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#### NOTICE.

The Society is not responsible for statements made or opinions expressed in the articles, criticisms and discussions published in these *Proceedings*.

#### ERRATA.

MR. CARVER'S PAPER "ON THE GRADUATION OF FREQUENCY DISTRIBUTIONS," pp. 52-72:

P.	55,	in	II,	line	3,	for	$\overline{r-1}$	read	$r-1^{2}$
				"	4,	"	$\overline{r-1}$	"	$\overline{r-1^{3}}$
				"	5,	"	$\overline{r-1}$	"	$\overline{r-1}^4$

P. 56, p. 58, p. 62. For v read v wherever the former occurs. P. 59, line 10, for  $v_n$  read  $v_n$ . VOLUME VI, PART I.

NUMBER 13.

# PROCEEDINGS

# NOVEMBER 21, 1919.

# THF EFFECT OF INFLATION ON THE BUSINESS OF INSURANCE.

## ADDRESS OF THE PRESIDENT, JOSEPH H. WOODWARD.

It is related of Dr. Johnson that, visiting one of the islands of the Hebrides and being told that twenty eggs might be had there for a penny, he observed: "Sir, I do not gather from this that eggs are plenty in your miserable island, but that pence are few." It is a matter of interesting conjecture whether, if Dr. Johnson should visit the United States today and find eggs retailing in some instances for as much as a dollar a dozen, he would attribute that phenomenon to the abundance of dollars or to the obstinacy of the American hen. However, it seems probable that the shrewd old philosopher would still be an adherent of the quantity theory of money.

A general statement of this theory in its modern form is that the total volume of money or credit in a country multiplied by its velocity of circulation is equivalent to the total volume of goods to be exchanged multiplied by the prices of those goods. Any increase, therefore, in the amount of the circulating media or in their velocity of circulation—the physical volume of the goods to be exchanged remaining constant—must result in an increase in price level.

In a paper on "Inflation" in the American Economic Review for June, 1918, Professor E. W. Kemmerer tells us that "inflation occurs when, at a given price level, a country's circulating media cash and deposit currency--increase relatively to trade needs." More generally, inflation implies a redundancy in the circulating media—a supply of money or credit in excess of the requirements of business or commerce. It does not necessarily imply that the

currency of a country is not on a gold basis, although, if such be the case, inflation is, *a fortiori*, likely to exist.

A condition of inflation, if it exists, must have important consequences for the business of insurance. It will be worth while, therefore, to review very briefly the general evidences of inflation at the present time and to consider some of the resulting effects which intimately concern us.

The index numbers of wholesale prices published by the Federal Bureau of Labor Statistics shows that such prices have, on the average, increased from 100 in 1913 to 219 in July, 1919, an increase of 119 per cent. The smallest increase is in metals and metal products, 58 per cent.—the largest in farm products, 146 per cent. The "cost of living" has lagged behind wholesale prices; the increase for the United States between July, 1914, and June, 1919, as reported by the Bureau, is from 100 to 175, or 75 per cent.

The records of the New York State Industrial Commission show that the average wage rate in manufacturing establishments in New York State has increased 88 per cent. between 1914 and August, 1919. Increases of wages among different groups of workers, however, have been very uneven and it is probable that for the country as a whole wages, including the wages of farm labor, have increased considerably less than 88 per cent. The wage rate among the industrial population appears to have kept pace fairly well with the rise in the cost of living—which latter quantity, because of the rapidly rising trend in wholesale prices, bids fair to go materially higher before a turning point is reached.

The next question is whether the present high prices are mainly due to an actual scarcity of commodities or whether the dominant factor is the depreciation of the purchasing power of money. Statistical information of two kinds is necessary in order to determine this. First we must have index numbers which measure the growth of trade needs. Such numbers must be based on physical quantities not involving monetary units—for example, the number of tons of pig iron, coal, copper, etc., produced, the number of bushels in the wheat and corn crops, the number of building permits issued, of tons of freight transported, and the like. Second, we need index numbers to determine the growth in the amount of money or credit currency available for the carrying on of business.

Professor Kemmerer has compiled index numbers showing that between 1913 and 1917 there was a growth in the physical volume of trade amounting to 21 per cent. He also presents index numbers showing that during the same period there was an increase in monetary circulation of 45 per cent., in the circulation of gold and gold certificates of 76 per cent., in cash reserves of 51 per cent., and in bank deposits of 68 per cent. Comparing these numbers with that of 21 per cent. for the growth in trade, the evidence for the existence of inflation may be taken to be sufficiently convincing.

Apart from the increase in the volume of circulating media other influences tending to inflation have been at work. During the period studied by Professor Kemmerer the federal reserve banking system was placed in operation. The most important single feature of this improvement in our national banking arrangements, from the standpoint of its effect on inflation, is that the proportion of the assets of banks required to be held as a cash reserve to meet demand liabilities is greatly diminished. A given amount of cash may thus support a greatly increased amount of credit. By this means the efficiency of the dollar is increased, which has an effect equivalent to increasing the number of dollars. Any improvement in banking practice which thus tends to make the dollar more efficient or more nimble tends to produce inflation.

The bearing of the national war-borrowing policy upon this question has received considerable attention. President Wilson, in his message to the special session of Congress in April, 1917, said:

"It is our duty, I most respectfully urge, to protect our people in so far as we may against the very serious hardships and evils which would be likely to arise out of the inflation which would be produced by vast loans."

Echoes have doubtless come to the ears of all of us of the economic controversy which has raged on the subject of the relative merits of taxation and borrowing as a means for filling the war chest. The present consensus of economic opinion as to the relationship between war loans and inflation is summarized by Professor J. H. Hollander in his recent book on *War Borrowing* in the following cautious words:

"To the extent that loans are made ultimately from uninvested capital, from current income, from liquidated investments, or from current or future savings there need be no inflation. To the extent that loans are made by banks for their own account by credit creation, or by individuals through bank loans in the nature of long time engagements rather than of installment purchases,—inflation may result." Again, there are a number of very difficult economic questions as to the influence of government price-fixing upon inflation. Obviously, price-fixed commodities tend to complicate the real meaning of index numbers. Until our knowledge in this field is more complete, however, little can be said beyond drawing attention to this aspect of the problem.

A general picture of a period of inflation shows: (1) an increase in wholesale prices; (2) an increase in retail prices lagging behind the increase in wholesale price; (3) an increase in wages lagging behind the increase in retail prices. Labor troubles are numerous, commercial failures relatively few, industrial and commercial profits high. In the investment markets bond prices tend to sag because the purchasing power of the money to be repaid by the borrower is decreasing. Indeed, during a period of rapidly rising prices investments with fixed maturities may in effect yield a negative rate of interest. In such a period, stocks and real estate drift toward higher levels because of the increasing value in dollars of the physical property. Being durable income bearers, however, the return from which is spread generally over long periods of time, they are subject to considerations which prevent a very rapid response to underlying economic conditions. Finally, these tendencies are obscured by speculative activities and by the condition of the money market so that the general situation is likely to be confusing.

Inflation has its value in time of war since it stimulates production and tends to check consumption, but these advantages are gained at the cost of grave injustice to certain economic groups and other social effects of an unhealthy nature.

When the tide turns and the forces of deflation commence to make themselves felt the cycle is reversed. We then look for falling commodity prices and wages, a rapid rise in commercial failures, an increase in unemployment, fewer labor troubles, and a decline in the prices of stocks and real estate as related to the prices of bonds and fixed term securities.

It is significant that the Federal Reserve Bank of New York has very recently established a higher rate of discount rates. The *Federal Reserve Bulletin* for November, 1919, says:

"The disappearance of the Treasury from the long term loan market and the rapid reduction in its requirements for short term accommodations foreshadows the approach of the time when the financial operations of the government will cease to be the important factor in shaping reserve bank policies and rates. A review of all the conditions in the banking situation has confirmed the board in the view that in the application of its discount policy an advance of rates should no longer be deferred."

That we shall ever again see commodity prices what they were in 1913, however, seems highly improbable. There are influences at work tending toward what might be termed a permanently inflated condition—if such a contradiction of terms is permissible. At any rate, a banking and fiscal policy sufficiently drastic to restore anything approaching previous conditions seems unthinkable.

It has been frequently pointed out that the business of insurance is not, strictly speaking, a productive enterprise, in that it does not add to the sum total of existing wealth. Fundamentally it is a contrivance for distributing wealth in such a way as to add to its total utility without increasing its aggregate amount. An insurance company does not sell goods; it sells a promise to pay money at a certain time and under certain conditions. It does not guarantee the purchasing power of that money at the time it is to be paid.

The most interesting fact with regard to the present situation in all branches of insurance is the recent rapid growth in premium income, a growth greatly in excess of the corresponding increase in our population and material resources. In life, fire, workmen's compensation, surety, and casualty lines generally, the situation is the same. The volume of business is greater than ever before. Life insurance companies are doing double the new business that they were a short time ago.

There is no evidence, however, that any larger percentage of the nation's savings is being diverted into insurance channels. The same percentage of incomes as was devoted to life insurance in 1913 when applied to the increased incomes of 1919 will account for nearly all of the increase in business. We are dealing, therefore, with a consequence of a high degree of inflation. If the present high commodity prices were due mainly to an actual scarcity of goods, wages and profits would not show the same tendency to increase step by step with prices and the percentage of the family income available for life insurance would be so diminished that less insurance rather than more would be written. Money devoted to the payment of a life insurance premium registers a preference for future goods over present goods, and in a time of great actual scarcity this preference would be reversed and the future sacrificed for the present.

Considering the reasons for the rapid increase in the volume of fire insurance it seems fairly clear that this cannot be attributed to a proportional increase in the actual physical amount of property requiring protection. It represents chiefly the increase in values brought about by inflation. During a period of rising prices the amounts of insurance carried tend to lag behind the value of the property requiring protection. Property owners, especially if their policies contain a coinsurance clause, must keep wide awake lest they be caught in a condition of under-insurance. In such a period, therefore, the moral hazard should, generally speaking, be good and the incendiary fire loss relatively low. When the tide turns and values fall in proportion to existing lines of insurance the moral hazard increases and the necessity for greater underwriting caution arises.

In workmen's compensation insurance, the continued activity in general lines of industry, the substantial increase in the wage rate and the relatively small amount of unemployment have contributed to produce a volume of business far surpassing all previous records. In automobile and miscellaneous lines of insurance there has been a tremendous growth, and it is safe to say that practically no branch of insurance has failed to respond to the economic conditions.

The situation in plate glass insurance is of special interest. A plate glass policy provides—not that a specified sum shall be paid for the breakage of the insured plate—but that the company must replace the broken plate with a plate of similar quality and value or pay the actual cash value at the time of breakage. Such a policy, therefore, in effect does guarantee the purchasing power of money. What has been the result? Mr. Fred S. Garrison says:

"Owing to the conditions brought about by the war the price of glass increased so rapidly that it was practically impossible to keep the rates abreast of current prices. . . . The price of glass during the last three years increased 200 per cent. in some cities and the increase in the premium rates was intended to at least partially meet this increased cost."

We have seen that, on the whole, the effect of inflation upon the premium accounts of the companies is of an apparently cheerful nature. Let us now turn to the other side of the account and consider its effect upon the beneficiaries of the policy contracts. Where, as in fire insurance or accident insurance, the premium payments and the corresponding loss payments both take place within a relatively short period of time there is no great disparity between the true value of the consideration and the true value of the benefit. But where, as in life insurance, the premium payments may extend over many years, the fluctuating purchasing power of money is obviously an important consideration.

Many beneficiaries are today receiving insurance money which has lost over forty per cent. of its purchasing power as compared to the money received by the company as premiums. There can be no better example of the evil social effects of inflation than this. In effect, over forty per cent. of the vast accumulations of the life insurance companies of this country-the property of the policyholders held for the protection of families left helpless through the death of the bread winner-has, if present conditions prove permanent, been confiscated and devoted to paying the cost of the war. No scheme of deliberate taxation could conceivably be as drastic as this. The injustice of it all is none the less cruel for being unintentional and the fault of no one in particular. Again, consider the situation of annuitants and of the beneficiaries under long term awards under workmen's compensation acts. An income probably all too meager for its purpose at the time it was entered upon has now become woefully inadequate. These are facts which should not be overlooked.

What has been the effect of inflation upon the investments of insurance companies? The most important class of investment is bonds. The holder of a bond is a creditor as distinguished from a property owner. If the purchasing power of a dollar declines between the time he lends his money and the time it is repaid to him he has no redress. In extreme cases the loss of purchasing power during the term of an investment may exceed the entire amount of interest received. The only way in which a company might have protected itself against the effects of inflation would have been to invest part of its assets in stocks and in real estate. A good many fire and casualty companies have considerable holdings of stocks but, unfortunately, these are mostly railroad stocks which fail to respond to the increased values of the properties whose ownership they represent for the reason that it is highly unlikely that the government will ever permit the stockholders to profit to any extent through such increases in the value of their properties. Real estate holdings of insurance companies are inconsiderable and represent chiefly buildings acquired for the company's own occupancy. A dozen years ago, the late Professor Lester W. Zartman, with a fine disregard for prevailing opinion, advocated the purchase of real estate by life insurance companies as an investment, citing the success of the French companies in this field. The legislative policy in this country, however, has been to prohibit life insurance companies from investing in stocks or in real estate beyond the requirements of the company for its own occupancy: a company could not hedge against the effects of an impending inflation even had it been foreseen. One of the incidental benefits of the present situation is that companies now find themselves in a position where they can dispose of properties acquired years ago under foreclosure on most satisfactory terms. Although the fire and casualty companies have been relatively unhampered by legislative restrictions only a very few have so divided their holdings between bonds and stocks as to receive some advantage from the effects of inflation upon investments.

It is a trite saying that America is now the world's great creditor nation. Has this any meaning for insurance companies? During the period of England's economic and financial supremacy British insurance companies were liberal investors in American securities. This was true independent of whether or not the company was admitted to transact business in the United States. The present exceptional state of affairs in the foreign exchange market makes first class investments in the allied nations most attractive. But our statutes prohibit such investments on the part of American companies unless they are admitted to transact business in the countries in question. It must be confessed, however, that it does not seem likely that many of our companies will desire to make investments of this kind, helpful as that action might be to the promotion of trade relations.

Finally, some comment may be made on the situation as regards the expense accounts of the companies. In discussing the rate situation for 1918, the London *Times*, speaking of the British fire companies says:

"The fact that a general advance has hitherto not been considered necessary in the face of higher expenses is probably due to the great increase in the volume of insurance caused by the rise in prices. . . It may be assumed that the bulk of this increase was caused by the higher values of the property insured. Office expenses have naturally not been increased to the same extent, and many insurance companies have, therefore, in spite of actually higher working expenses, been able to show a slightly lower ratio."

The agent or broker whose remuneration consists of commissions has seen his income, by reason of the increased volume of business written, keep reasonable pace with the rising cost of living. As an economic class he has not been discriminated against. Not so, however, with the army of clerks and stenographers without whose constant daily toil the vast and intricate machinery of modern insurance would cease to function. Increases and special allowances they have had, to be sure, but not enough to keep step with the soaring cost of the necessities of life.

Several plans for stabilizing the purchasing power of a dollar have been brought forward by economists—notably by Professor Irving Fisher. It is not my purpose to attempt to describe these plans. The main object of these remarks is to urge that, in the absence of any such stabilizing influence, we should train ourselves to think in terms of a fluctuating instead of a constant unit of exchange.

Summing up, the main points which it is hoped have been developed are as follows:

1. There exists at the present time a high degree of currency inflation.

2. This has important consequences for the business of insurance.

3. It explains the growth cf premium income.

4. It has had, if it proves permanent, the indirect effect of confiscating over forty per cent. of the assets of the companies to help pay the cost of the war.

5. It has worked serious injustice to many beneficiaries.

6. The problem of inflation must be carefully studied and thoroughly understood if the companies are to play their part intelligently in the era of reconstruction.

## UPON COMBINING COMPENSATION EXPERIENCE FROM SEVERAL STATES.

WINFIELD W. GREENE.

The essentials of compensation insurance experience for ratemaking purposes are, for each classification or group of classifications, homogeneity as to process and hazard and an exposure broad enough to warrant dependable results.

For many classifications, divergencies in methods of operation, in general working conditions and, indeed, in interpreting the manual considerably impair the value of a "country-wide" experience. On the other hand equitable underwriting presently requires several hundred classifications, a majority of which cannot be rated properly upon the experience of a *single* state even where a skillful use is made of the experience of classification groups.

There is hardly reason to doubt that for many years to come experience from contiguous states will have to be combined, or in trade parlance "reduced" to the "level" of the "basic state." Accordingly the determination of a sound and convenient method for this combination is vital to compensation rate-making.

PRINCIPAL REDUCTION METHODS HITHERTO EMPLOYED.

1. Flat "Law Differential." \*—In the beginnings of American compensation rate making it was customary to apply a single factor to the total losses of each classification in the experience of a given state to reduce such losses to the basic level, which was invariably taken to be that of the original Massachusetts Act. This factor ("law differential") was determined by applying the benefit schedule of the Act of the "additional" † state to an assumed distribution of accidents according to nature and extent of injury and comparing the resultant theoretic cost with the figures similarly com-

\*See I. M. Rubinow, "Scientific Compensation Rates," *Proceedings*, Volume I, Number 1, page 10, also G. F. Michelbacher, "The Theory of Law Differentials," *Proceedings*, Volume III, Number 8, page 195.

t For purposes of this paper, "additional" state means a state other than the "basic" state, contributing to the experience reviewed. puted upon basis of the benefits of the original Massachusetts Act. Obviously, the use of the law differential, although justifiable as a pioneer expedient, wrought inequity as between classifications owing to the variance of the frequency distribution of accidents by nature and extent of injury. Moreover, this theoretical factor ignored the variability of the accident rate, as well as of interpretation and enforcement of the act, and accordingly not even an equitable differentiation between the rates of the several states was assured unless the indicated differential was corrected by a comparison of "expected" and actual losses. There are well known instances where this test was not made.\*

2. Pennsylvania 1918 Method.<sup>†</sup>—This method, employed in the Pennsylvania rate revision of 1918, was resultant not only of the resourcefulness of the principal authors of the revision but also of the evolution since 1914 of prevailing actuarial theory. It represented a tremendous advance over the flat law differential method. Especially note-worthy was the more equitable discrimination between the pure premiums of individual classifications due to the reduction being made not by total, but by partial losses, that is, separately for "D. & P. T. D." (death and permanent total dis-

\* A striking example of the unreliable results which may proceed from a strictly theoretical calculation of a law differential was revealed when in the summer of 1918 the writer had occasion to test the New Jersey law differential through a comparison of Massachusetts and New Jersey pure premiums. From the experience before the Augmented Standing Committee when reviewing rates in 1917 all classifications showing an exposure of at least one-half million dollars payroll in both New Jersey and Massachusetts were selected. The Massachusetts pure premiums were applied to the New Jersey payrolls resulting in projected losses of \$939,113. The actual New Jersey losses for the same classifications were \$596,742. The indicated differential, i.e., ratio of New Jersey cost to Massachusetts, was accordingly 64 per cent. This is the "direct" experience differential as later defined in this paper. The inverse experience differential indicated by the same data was 69 per cent. In the 1917 rate revision the New Jersey law differential was taken to be 98 per cent. with a correction amounting to an increase of 15 per cent. in reduced losses for the absence of administrative claim supervision in New Jersey prior to 1916. The "net" differential for purposes of the revision was, therefore, taken to be about 85 per cent. as compared with the correct differential of about 67 per cent.

<sup>†</sup>See E. H. Downey and G. C. Kelly, "Revision of Compensation Insurance Rates, 1918," *Proceedings*, Volume V, Number 12, page 243. At this writing the author is not advised as to the actuarial methods employed in the Pennsylvania 1919 Revision. ability), "all other" (permanent partial, temporary and indeterminate disability) and "medical" losses respectively. The Pennsylvania 1918 method comprised in substance the following:

(a) The death and permanent total disability losses were determined for purposes of the combined experience by applying the average cost per case in the basic state (Pennsylvania) experience to the total number of D. & P. T. D. cases in the entire experience reviewed. This procedure had the merit of simplicity, but it did not regard the variance between states in ratio of reported deaths and permanent total disabilities to payroll. Later on we shall see that this variance is sometimes substantial.

(b) The "medical" and "all other" losses in the experience of the "additional" states were, before being combined with the basic losses, multiplied by "experience" reduction factors determined in the following manner:

Certain classifications having a substantial exposure both in the basic and in the additional state were selected. To the classification payrolls of the basic state were applied the corresponding pure premiums of the additional state and the total actual losses of the basic state divided by the total expected losses thus projected. The resulting ratio was termed the "direct" experience differential. The "inverse" differential was the result of the inverse process, namely, application of the basic pure premiums to the payrolls of the additional state and comparison of the resultant expected losses with the actual losses of the additional state. The mean of the direct and inverse reduction factors was generally selected as the factor to be employed.

This procedure was admittedly cumbersome in application\* and included explicitly at least no provision for comparing the level of the "combined" pure premiums with that of the pure premiums of the basic state. When losses are reduced by the mean of the direct and inverse experience reduction factors it is not certain that the expected losses upon basis of the combined pure premiums will fall as close to the original losses as is desirable.

#### DERIVATION OF THE "REDUCTION FACTOR."

The foregoing discussion brings out the following as the essentials of any method of reducing to the level of the basic state the experience of additional states:

\*See E. H. Downey and G. C. Kelly, "Revision of Compensation Insurance Rates, 1918," Proceedings, Volume V, Number 12, page 256. (a) The level of cost of the basic state should not be disturbed, that is, the combined pure premiums when applied to the payrolls in the experience of the basic state should reproduce quite closely the aggregate actual losses in such experience.

(b) A proper relativity between the rates for different classifications should be achieved.

(c) The reduction method should not involve a prohibitive amount of labor, either in preliminary work or in actual reduction.

At this date it is perhaps superfluous to urge that the reduction be made separately for each "nature of injury" or that wherever possible the use of strictly theoretic factors be avoided.

Accordingly choice of a reduction method appears to narrow down to so answering the following questions as to satisfy the foregoing criteria.

(a) For a given nature of injury shall the reduction be by number of accidents or by losses?

(b) Shall the reduction factors be determined once for the entire manual or separately for each of several schedules or other significant subdivisions?

(c) By what method or methods shall we calculate the reduction factors?

If we predicate our rating formula upon preservation of the basic level of cost, an interesting derivation is suggested, as follows:

Let us suppose that we have estimated or "guessed at" a factor (R) for reducing Massachusetts losses to the New Jersey basis; that employing this factor we have combined the Massachusetts experience with the New Jersey experience; and that we have tested the resulting "combined pure premiums" by applying them to the New Jersey payrolls, and comparing the expected losses thus projected with the actual New Jersey losses.

Suppose further that we find our expected New Jersey losses (upon basis of combined pure premiums) to differ from the actual New Jersey losses by (D) (where (D) is the *ratio* of the difference in question to the actual losses). Obviously we wish to determine that reduction factor (let us call it (E)) which will produce expected losses *exactly equal* to the actual.

We may express the existing and the desired situations respectively by means of the following equations:  $\frac{\text{Expected New Jersey Losses (basis of } R)}{\text{Actual New Jersey Losses}} = 1 + D,$ 

 $\frac{\text{Expected New Jersey Losses (basis of } E)}{\text{Actual New Jersey Losses}} = 1.$ 

If we divide each side of the first equation by the corresponding side of the second we arrive at the following proportion:

(1)  $\frac{\text{Expected New Jersey Losses (basis of } R)}{\text{Expected New Jersey Losses (basis of } E)} = \frac{1+D}{1}.$ 

Before we may solve the foregoing for (E), the reduction factor which will preserve the basic level of cost, we must analyze the left side. In order to do this we must employ a few symbols. It is quite convenient to designate the New Jersey payrolls for each of the several classifications as respectively,  $J_1$ ,  $J_2$ , etc., and the New Jersey pure premiums for each of the classifications as respectively  $j_1$ ,  $j_2$ , etc., and to employ an analogous notation for the Massachusetts payrolls and pure premiums. For classification (n) the New Jersey losses may be written  $J_n j_n$  and for the same classification Massachusetts losses may be written  $M_n m_n$ ,—since losses = payroll  $\times$  pure premium.

Now the combined pure premium (New Jersey basis), using (R) as reduction factor, for classification (n) is the sum of two quantities, namely, New Jersey losses and the Massachusetts losses modified by (R),—divided by the sum of the respective New Jersey and Massachusetts payrolls; which in the simple notation we have adopted may be written as

$$\frac{J_n j_n + RM_n m_n}{J_n + M_n}$$

and the expected losses for the same classification may be written

$$J_n \times \frac{J_n j_n + R M_n m_n}{J_n + M_n}.$$

Since the total expected losses for all classifications is the sum of a series of values similarly obtained, we may if we let  $\Sigma$  indicate summation, write total expected New Jersey losses, where (R) is employed to reduce Massachusetts losses, as follows:

$$\Sigma\left(J\frac{Jj+RMm}{J+M}\right).$$

The expected New Jersey losses where (E) is employed in place of (R) will obviously be an analogous function, so equation (1) may be rewritten as follows:

(2) 
$$\frac{\Sigma\left(J\frac{Jj+RMm}{J+M}\right)}{\Sigma\left(J\frac{Jj+EMm}{J+M}\right)} = \frac{(1+D)}{1}.$$

Replacing the left side of (2) by an approximation \*

$$\frac{\Sigma(Jj) + R\Sigma(Mm)}{\Sigma(Jj) + E\Sigma(Mm)} = 1 + D.$$

Whence

$$\frac{\Sigma(Jj) + R\Sigma(Mm)}{1+D} = \Sigma(Jj) + E\Sigma(Mm).$$

Whence

\* This approximation consists in regarding J/(J + M) as constant for purposes of this equation, in other words, assuming that the ratio of New Jersey payroll to combined payroll is constant. Obviously such an assumption would lead to serious error if there were a wide range in the ratio of combined losses, basis of (R) to combined losses, basis of (E). A simple investigation indicates that the value of this ratio ranges between unity and R/E. It is the narrowness of this range which apparently accounts for the closeness of the approximation.

It is not difficult to derive an expression for the *exact value* of (E) (reduction factor such that the basic level of cost will not be disturbed). If the equation immediately proceeding (1) be rewritten in our notation it takes the following form:

$$\frac{\Sigma\left(J\frac{Jj+EMm}{J+M}\right)}{\Sigma(Jj)}=1,$$

whence

$$E \Sigma \left( \frac{JMm}{J+M} \right) = \Sigma(Jj) - \Sigma \left( \frac{JJj}{J+M} \right),$$

whence, by simple algebra

$$E = \frac{\Sigma \left(\frac{JM}{J+M}j\right)}{\Sigma \left(\frac{JM}{J+M}m\right)}.$$

---

The verbal interpretation of the foregoing formula is that instead of weighting the respective pure premiums of Massachusetts and New Jersey by the payrolls of either one or the other state in order to determine the reduction factor, we should employ as weights a function of both the re-

$$E = \frac{\frac{\Sigma(Jj) + R\Sigma(Mm)}{1+D} - \Sigma(Jj)}{\Sigma(Mm)},$$
$$E = \frac{R - D\frac{\Sigma(Jj)}{\Sigma(Mm)}}{1+D}$$

(3) or

(4) 
$$E = \frac{R - D \frac{\text{Total New Jersey Losses}}{\text{Total Massachusetts Losses}}}{1 + D}$$

Formula (3) may be rewritten in general terms if we let (B) and (b) designate respectively payroll and pure premium of the "Basic" state and (A) and (a) payroll and pure premium of the "additional" state, as follows:

(5) 
$$E = \frac{R - D \frac{\Sigma(Bb)}{\Sigma(Aa)}}{1 + D}$$

We made no restriction whatever as to the accuracy of (R), which suggests that we may minimize labor by combining losses in the first instance without reduction, that is, by taking (R) as unity, whereupon formula (5) may be rewritten

(6) 
$$E = \frac{1 - D \frac{\text{Total Losses for Basic State}}{\text{Total Losses for Additional State}}}{1 + D}$$

spective state payrolls, namely their product divided by their sum. The labor involved in applying this formula is about equivalent to that required by the "direct and inverse" method, substantially more than attends the approximation formula (6) which appears to yield sufficiently accurate results, according to the tests thus far made.

A study of the formula for the exact value of (E) indicates that if we assume, as we did in arriving at the approximation formula, that J/(J + M) is constant for all classifications we arrive at the formula for the inverse experience reduction factor. This assumption is not safe owing to the wide range in the ratio of the New Jersey classification pure premium to the Massachusetts classification pure premium.

It may be of interest to note that each term in the numerator of the above formula for the true value of (E) is one half of the harmonic mean of the corresponding terms in the numerators of the formulæ for the direct and inverse reduction factors, respectively. Thus far we have been unable to make any practical use of this relation.

In the foregoing formula (1+D) is the ratio of the expected losses for the basic state to the actual losses for that state, where the expected losses are obtained by applying to the basic state payrolls the pure premiums derived from a combination of the experience of the two states without modifying the losses of the additional state.

#### Illustration of the Reduction Formula.

The convenience of the procedure implied by formula (6) may be demonstrated by some examples. Tables (1), (2) and (3) illustrate this method as applied to several important related classifications in the Trucking Schedule.

Referring first to Table (1) it will be noted that column one represents New York and New Jersey payrolls combined in thousands of dollars. Column two shows the New Jersey payroll in thousands separately. Columns three, four and five exhibit respectively the "All Other" losses for New York, New Jersey and for the two states combined. Column six is the "combined" pure premium and column seven the expected losses, namely the result of applying the combined pure premiums to the New Jersey payrolls. At the foot of the table is exhibited the computation of the value of (E). Employing formula (6) results in an indication of .549 which is applied to the New York losses in column three to obtain the reduced New York losses in column eight.

The calculation in Table (2) is analogous in all respects to that in Table (1) resulting in a factor of .627 to be applied to the Massachusetts "All Other" losses. In the last column of Table (2) is shown the reduced Massachusetts "All Other" losses.

Table (3) represents a test of the pure premiums obtained by combining the reduced losses for Massachusetts and New York with the actual New Jersey losses and dividing by the combined payrolls for the three states. The expected losses obtained by this procedure exceed the actual New Jersey losses for the same classifications by 1.2 per cent. When we consider that our formula for the reduction factor is an approximation and that we are operating upon figures for only four classifications, the deviation of expected from actual losses seems satisfactorily small.\*

\* If in Table (4) New York instead of New Jersey be regarded as the basic state, formula (6) gives a result of 2.499 which is almost exactly the reciprocal of .400 (the reduction factor as computed). Similarly if we reverse the calculation of Table  $(\mathcal{E})$  and consider Massachusetts as the basic

We submit also an analogous set of examples in Tables (4), (5) and (6). The explanations applicable to Tables (1), (2) and (3) apply to Tables (4), (5) and (6). In this case the deviation of expected from actual losses is slightly less than 1 per cent. (See Table (6)).

PRACTICAL APPLICATION OF THE REDUCTION FORMULA.\*

Formula (6) is so devised as to automatically satisfy the first criterion of the rating method as hereinbefore named, i.e., (a) preservation of the basic level of cost.

The formula may be interpreted either in terms of pure premiums or of rate of accidents per unit of payroll so we are now free to determine a method of applying the formula which will best satisfy the other two criteria, namely (b) a proper relativity between the rates for different classifications and (c) convenience in operation.

The attainment of a proper relativity between rates cannot be

state we obtain a factor of 1.696 which is very close to the reciprocal of the factor for reducing Massachusetts losses to the New Jersey basis.

This would be expected from an inspection of the exact formula for the value of (E) (see footnote page 15). With respect to any given pair of states we weight the pure premiums with the same set of factors, regardless of which state is regarded as the basic state. However, New York-New Jersey weights are not the same as New York-Massachusetts weights and consequently the Massachusetts-New York reduction factor may not be consistent with the indication of a comparison of the Massachusetts-New Jersey and New York-New Jersey factors.

The foregoing suggests that where a considerable volume of experience is reduced to a given basis, the problem of "projecting" the combined pure premiums to any other basis is a separate one for each additional state.

\* It is yet too early to predict exactly what methods will eventually be found the best in computing experience differentials. Already as the result of experimentation upon the part of the Actuarial Committee of the National Council considerable advance has been made beyond the point of progress indicated by this paper. Mr. Mowbray recommends that instead of employing formula (6) in the first instance, the first approximation to the reduction factor be obtained by comparison of average pure premiums. The factor resulting from this comparison, which, by the way, involves little labor, may be tested in the manner herein illustrated and formula (6) applied as a corrective.

I believe that Mr. Perkins made to the writer substantially the same suggestion as that of Mr. Mowbray.

Mr. Mowbray has also developed an interesting and convenient variation of the exact formula (see footnote on page 15) which I hope he will bring to the attention of the Society. entirely proved or disproved as respects all classifications, since we have no exact measure of the true (a priori) pure premiums of those classifications which have not within themselves a dependable exposure. However, we should employ a method which in reason may be expected to produce equitable results and which actually does produce results which are confirmed by trained judgment. It will help if the basic level of cost is maintained, not merely for the entire manual, but also for significant subdivisions. If the experience of the basic state be thrown into classification groups severally comprising a dependable exposure and related operative processes (not necessarily identical in the degree of hazard) the "fit" of the losses expected (upon basis of the combined pure premiums) to the actual losses should be reasonably close.

The foregoing indicates the desirability of determining experience reduction factors separately by schedules or other groups of related classifications, at least as respects "All Other" and "Medical" losses. The advisability of such procedure is confirmed by the variation in the value of (E) which we encounter as we pass from one schedule to another.\* For instance, for several important class-

\* One of the members of the Society raised the question as to whether the value of (E) is materially affected by the relative size of the respective payrolls in the basic and additional states; that is, more specifically, whether the value of (E) as obtained by formula (5) depends as much upon the difference between states in benefits, in administration of the act, and in accident frequency as it does upon the comparative exposure in the two states.

It appears that the value of (E) depends almost entirely upon relative pure premium level and very little upon the relative extent of exposure. If in table (4) the New York payrolls and losses are multiplied by ten and no change is made in the volume of New Jersey payrolls and losses, the value of (E) according to approximation formula (5) becomes .390. On the other hand, if the New York payrolls and losses are divided by three, in other words if the New York pure premiums remain constant while the New York volume be arbitrarily reduced to a parity with that of New Jersey, the value of (E) according to formula (5) becomes .408. Neither of these values is far off from the figure of .400 actually indicated by table (4).

Ideally, perhaps, we should employ for reduction purposes a factor reflecting the functional relation between the benefit schedules, administrative systems and accident frequencies of the two states. This functional relation might reasonably be expected to vary from schedule to schedule. Its absolute value can probably never be computed. The test of formula (5) just referred to seems to encourage the view that (E) is an approximation to this ideal factor. ifications in the logging and wood schedule, we find the value of (E) (for reducing New York "All Other" losses to New Jersey basis) to be .400 (see Table (4)) while for the most important classifications in the trucking schedule the corresponding value of (E) was .549 (see Table (1)).

In determining a procedure for reducing death and permanent total disability losses we are confronted by the fact that the number of accidents resulting in death or permanent total disability are comparatively few; while variation in extent of dependency causes such a serious irregularity in cost per case as to make the indications of actual pure premiums quite misleading from the standpoint of expected losses.

Pennsylvania established a valuable precedent in combining deaths and permanent total disabilities by number, ignoring actual losses in the individual case and making the reduced losses equal to the product of the total number of cases and the average cost per case in the basic state.

As previously stated, the Pennsylvania 1918 procedure ignored variation from state to state in frequency of "D. & P. T. D." cases per unit of payroll. This variation in "D. & P. T. D." frequency should not be ignored. The writer has made a computation, too lengthy to be reproduced here, determining the value of (E) (see formula (5)) for reducing New York "D. & P. T. D." cases by number to the New Jersey basis. The calculation was based upon New York Schedule "Z" policy year 1916 and New Jersey Schedule "Z" policy year 1916 and New Jersey Schedule "Z" policy year 1917 and embraced the experience of those classifications (to the number of 100) having the most substantial volume of premium exposure in both states. The value of (E) was found to be .72.\* The "D. & P. T. D." accident rates indicated by combining New York and New Jersey experience without reduction resulted in expected deaths which exceeded the actual New Jersey deaths by slightly more than 28 per cent.

A logical procedure would seem to be to modify the Pennsylvania practice by introducing the formula we have developed (for-

Another point which may merit further investigation is that the true value of (E) approaches that of the "direct" factor as a limit, where the pure premiums of both states remain constant and the payrolls and losses of the "additional" state are both increased in the same proportion.

\* This wide departure from unity may partly be accounted for by the fact that the New York data were accumulated a year earlier than were the New Jersey data. mula (5)),—in other words, to reduce the *number* of deaths and permanent total disabilities in the same way that we reduced the *losses* for the other elements of cost, and to the reduced *number* of cases apply the average "D. & P.T.D." value in the experience of the basic state.

Formula (5) is much easier to apply than is the "direct and inverse" method of computing reduction factors. Moreover it is much easier to check. A glance at Tables (1), (2), (4) and (5) indicates that most of the work can be checked by addition of columns and cross-footing of totals. Determination of the combined pure premiums and of the expected losses has to be checked item by item, but as a rule any serious error will be found if this check is confined to a careful inspection.

In view of the convenience of the formula there is no reason why in applying it we may not utilize the experience of enough classifications to comprise 80 per cent. or 90 per cent. of the entire losses of the "basic" state and of the "additional" state respectively. In selecting these classifications the selection may be made independently for each state without reference to whether a given classification has exposure in both states. The most satisfactory criterion in selecting which classifications to use is premium rather than either payroll or losses as a broad payroll exposure means little in extremely non-hazardous classifications and selection upon basis of volume of losses will tend toward misleading results.

For the convenience of the reader we summarize our suggestions as to the reduction method.

(a) Split experience of basic state into a number of subdivisions, such that each subdivision contains a substantial premium exposure in classifications which are related in process.

(b) Medical Losses: Determine separate value of (E) for "Medical" losses for each "additional" state and for each subdivision of the manual.

(c) All other Losses: Same procedure as for "Medical" losses.\*

\* In the above we have not dicussed the possibility of making the reduction for "all other" losses on the basis of accident frequencies rather than pure premiums. We believe that if such a procedure were to be adopted it would be necessary to first investigate the question of whether "all other" accidents can be combined by number by simple addition or whether it would be necessary to compute the value of (E) between states upon the basis of accident frequency. Table (7) appended to this paper indicates that for certain of the largest classifications the "direct" factor for reduc(d) D. & P.T.D. Losses: For purposes of reduction consider number of cases instead of actual losses. Determine for each "additional" state the reduction factor (E) upon basis of frequency of "D. & P.T.D." cases either for the entire volume of experience or separately for each of several subdivisions of the manual, if the exposure is sufficient in volume.

(e) When the experience of the several states has been combined, the combined pure premiums should be tested separately for each significant subdivision of the manual by comparing the expected losses with the actual losses.

#### SOME GENERAL REMARKS.

This paper would from a practical standpoint be incomplete withcut any comment upon the extent to which it is desirable to combine compensation experience from different states, or sections of the country.

It is, we believe, generally admitted that the pure premium level of each state should be determined from its own experience,—at least in all cases where there exists within the state a substantial premium volume. This limits the function of "additional" experience to assistance in the determination of a proper relativity between rates.

However, unless classification experience is thrown into groups comprising fairly similar processes, we shall find ourselves, even when the experience of the entire United States is combined, unable to determine a proper relation between the rates of the respective classifications. If such group experience is considered, we find it is possible to attempt a direct statistical approximation to the rates for the most important classifications of a given jurisdiction without going further than neighboring states for additional experience.

Speaking generally, owing to variation in processes and in working conditions from one section to another, the more limited the geographical spread of the experience the better, provided an adequate premium exposure is developed. Exceptions to this principle would be indicated for industries or occupations known to conform to standard regardless of location (as for example, because of unity

ing New York and Pennsylvania "all other" accidents to the New Jersey basis, is .890. The data employed in this calculation are taken from Schedule Z of the several states for the following policy years: New York 1915, Pennsylvania 1916, and New Jersey 1916. of management) also for those classifications or groups for which no dependable exposure will be forthcoming unless for the entire country.

State, sectional or national experience should, then, be utilized, according to the respective requirements of each situation. Such a course will commend itself far better to the judgment of intelligent employers than will the indiscriminate use of a country-wide combination of experience for all classifications.

The problem of compensation insurance rate-making is a national one, but business sense indicates that there is no magic in mere breadth of exposure. Our viewpoint should be national, but the experience used to make rates should be that portion of the available data which may logically be expected to measure most closely the expected losses within a given area.

If our problem is national we should then maintain our classifications upon a substantially uniform basis. There are cases which justify inconsistency as between the classifications employed in different states, but from an ultimate standpoint these cases should prove few in number. We recognize the substantial use which must be made of experience gathered from broad geographical areas, or from the country at large,—and such broad volumes of experience cannot be presented conveniently, much less intelligently, unless there is general standardization in classification wordings and code numbers.

The present manual is marred by numerous redundancies, inconsistencies and ambiguities in classification wording. Let us immediately "trim out" this dead wood and the useless underbrush, taking care, however, not to bark any live trees, and taking pains to set out new trees where there is room for them.

TADL	4E4 J.	

# CALCULATION OF REDUCTION FACTOR-N. Y. TO N. J .-- ALL OTHER (CERTAIN SPECIFIED CLASSIFICATIONS).

Classification.	Code.	Payroll in Thousands.			Losses.		Combined P. P.	Expected Losses.	Reduced N.Y. Losses.
		Combined.	N. J.	N. Y.	N. J.	Combined.	((5)+()).	<b>((2)</b> ×(6)).	((3)×.549).
Drivers N. O. C. Truckmen—general (discontinued) Trucking—light (discontinued) Chauffeurs N. O. C	7,205 7,208 7,211 7,380	$(1) \\ 33,927 \\ 6,721 \\ 3,175 \\ 16,372 \\ \end{cases}$	(2)7,0751,1277025,273	(3) 154,519 79,462 25,914 52,951	(4) 23,270 8,080 5,590 11,502	(5) 177,789 87,542 31,504 64,453	(6) .524 1.303 .992 .394	(7) 37,075 14,681 6,962 20,777	(8) 84,831 43,625 14,227 29,070
		60,195	<u> </u>	312,846	48,442	361,288		79,495	171,753

$$E = \frac{1 - D \frac{\Sigma \text{ N. J. Losses}}{\Sigma \text{ N. Y. Losses}}}{1 + D},$$

where 
$$(1 + D) = \frac{\text{Total Col. (7)}}{\text{Total Col. (4)}} = 1.641.$$

$$E = \frac{1 - .641 \times .155}{1.641} = .549.$$

#### TABLE 2.

CALCULATION OF REDUCTION FACTOR-MASS. TO N. J.-ALL OTHER (CERTAIN SPECIFIED CLASSIFICATIONS).

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Classification.	Code.	Payroll.				Losses.		Comb. P. P.	Ex. Losses.	Red. Mass. Losses.	
		Mass.	N. J.	Comb.	Mass.	N. J.	Comb.	((6)÷(3)).	<b>((2)</b> ×(7)).	((4)×.627).	
Drivers N. O. C.	7,205	$(1) \\ 25,004$	(2) 7,075	(3) 32,079	(4) 131,995	(5) 23,270	(6) 155,265	(7) .484	(8) 34,243	(9) 82,761	
tinued)	7,208	7,557	1,127	8,684	86,182	8,080	94,262	1.086	12,239	54,036	
tinued) Chauffeurs N. O. C.	7,211 7,380	11,320	702 5,273	702 16,593	47,295	5,590 11,502	5,590 58,797	.796 .354	5,590 18,666	29,654	
		43,881	14,177	58,058	265,472	48,442	313,914		70,738	166,451	

$$E = \frac{1 - D \frac{\Sigma \text{ N. J. Losses}}{\Sigma \text{ Mass. Losses}}}{1 + D},$$

where 
$$(1 + D) = \frac{\text{Total Col. (8)}}{\text{Total Col. (5)}} = 1.46$$
,  
 $E = \frac{1 - .46 \frac{48442}{265472}}{1.46} = .627$ .

FROM SEVERAL STATES.

#### TABLE 3.

NEW YORK, MASSACHUSETTS, NEW JERSEY (CERTAIN SPECIFIED CLASSIFICATIONS). TEST OF COMBINED PURE PREMIUMS.

Classification.	Code.	Payroll in	Thousands.		Reduced	Combined. P. P.	Expected Losses.		
		N. J.	Combined.	N. Y.	Mass.	N. J.	Combined.	((6)÷(2)).	((1)×(7)).
Drivers N. O. C. Truckmen—general (discontinued) Trucking—light (discontinued) Chauffeurs N. O. C.	7,205 7,208 7,211 7,380	$\begin{array}{c cccc} (1) \\ 7,205 & 7,075 \\ 7,208 & 1,127 \\ 7,211 & 702 \\ 7,380 & 5,273 \end{array}$	$(2) \\58,931 \\14,278 \\3,175 \\27.692$	$(3) \\ 84,831 \\ 43,625 \\ 14,227 \\ 29,070$	(4)82,76154,036	$(5) \\ 23,270 \\ 8,080 \\ 5,590 \\ 11,502$	(6) 190,862 105,741 19,817 70,226	(7) .324 .740 .624 .254	(8) 22,923 8,340 4,380 13,393
		14,177	104,076	171,753	166,451	48,442	386,646		49,036

 $\frac{\text{Projected Losses}}{\text{Actual Losses}} = \frac{49036}{48442} = 1.012.$ 

Combined.

#### TABLE 4.

#### CALCULATION OF REDUCTION FACTOR-N. Y. TO N. J.-ALL OTHER (CERTAIN SPECIFIED CLASSIFICATIONS).

	Code.	Payr	oll in Thouse	ands.		Losses.		Combined	Expected	Reduced
Classification.		N. Y <sup>9</sup>	N. J.	Combined $((1) + (2))$ .	N <b>.</b> J.	N. Y.	Combined $((4)+(5))$ .	P. P. (6)÷(3).	Losses $(1) \times (7)$ .	Losses (5)×.400.
Logging and lumbering Saw mills Sash, door and blind mfg Planing and moulding mills. Box mfg.—wood, mfg. shooks from sawed lumber and	2,702 2,710 2,730 2,731	(1) 1,426.0 870.0 1,226.0 2,721.0	(2) 254.6 223.5 715.6 535.0	(3) 1,680.6 1,093.5 1,941.6 3,256.0	(4) 1,749 1,859 3,393 5,378	(5) 40,642 29,053 19,891 36,284	(6) 42,391 30,912 23,284 41,662	$(7) \\ 2.522 \\ 2.826 \\ 1.199 \\ 1.279$	(8) 6,421 6,316 8,580 6,843	(9) 16,257 11,621 7,956 14,514
assembling Carpentry—shop only	2,760 2,803	1,231.0 2,055.0	392.4 718.9	1,623.4 2,773.9	1,814 5,588	$15,193 \\ 35,845$	17,007 41,433	$1.048 \\ 1.493$	4,112 10,733	6,077 14,338
		9,529.0	2,840.0	12,369.0	19,781	176,908	196,689		43,005	70,763

$$E = \frac{1 - D \frac{\Sigma \text{ N. J. Losses}}{\Sigma \text{ N. Y. Losses}}}{1 + D},$$
  
where  $(1 + D) = \frac{\text{Total Col. (8)}}{\text{Total Col. (4)}} = 2.174,$   
$$E = \frac{1 - 1.174 \cdot \frac{19781}{176908}}{-2.174} = .400.$$

FROM SEVERAL STATES.

TABLE	5.
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# CALCULATION OF REDUCTION FACTOR-MASS. TO N. J. -ALL OTHER (CERTAIN SPECIFIED CLASSIFICATIONS).

	Code.		Payroll.			Losses.		Comb. P. P.	Expected	Red. Mass.
Classification.		Mass.	N. J.	Comb.	Mass.	N. <b>J.</b>	Comb.	(6)÷(3).	(2)×(7).	(4) ×.592.
Logging and lumbering Saw mills Sash, door and blind mfg Planing and moulding mills. Box mfg.—wood, mfg. shooks from sawed lumber and	2,702 2,710 2,730 2,731	(1)686.2601.2774.51,602.9	(2) 254.6 223.5 715.6 535.0	(3) 940.8 824.8 1,490.0 2,137.9	$(4) \\11,714 \\6,535 \\6,115 \\44,612$	(5) 1,749 1,859 3,393 5,378	(6) 13,463 8,394 9,508 49,990	(7) 1.431 1.018 .638 2.338	(8) 3,643 2,275 4,566 12,508	(9) 6,935 3,869 3,620 26,410
assembling Carpentry—shop only	$2,760 \\ 2,803$	4,591.1 2,030.6	392.4 718.9	4,983.5 2,749.5	45,039 9,040	1,814 5,588	46,853 14,628	$\begin{array}{c} .940\\ .532\end{array}$	$3,689 \\ 3,825$	26,660 5,351
		10,286.5	2,840.0	13,126.5	123,055	19,781	142,836		30,506	72,845

$$E = \frac{1 - .542 \times \frac{10001}{123055}}{11.542} = .592.$$

TABLE	6.
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NEW YORK, MASSACHUSETTS, NEW JERSEY (CERTAIN SPECIFIED CLASSIFICATIONS). TEST OF COMBINED PURE PREMIUMS.

			Reduced Losses.				Pa	Combined	Expected		
Classification.	Code.	N. Y.	Mass.	N. J.	Total.	N. Y.	Mass.	N. J.	Total.	$((5) \div (8)).$	((7)×(9)).
Logging and lumbering Saw mills Sash, door and blind mfg Planing and moulding mills Box mfg.—wood, mfg. shooks	2,702 2,710 2,730 2,731	$(1) \\16,257 \\11,621 \\7,956 \\14,514$	(2) 6,935 3,809 3,620 26,410	(3) 1,749 1,359 3,393 5,378	$\begin{array}{r} (4)\\ 24,941\\ 17,349\\ 14,969\\ 46,302 \end{array}$	(5) 1,426 870 1,226 2,721	(6) 686.2 601.2 774.5 1,602.9	$(7) \\ 254.6 \\ 223.5 \\ 715.6 \\ 535.0$	(8) 2,366.8 1,694.7 2,716.1 4,858.9	(9) 1.053 1.023 .551 .953	(10) 2,681 2,286 3,943 5,099
from sawed lumber and as- sembling	2,760 2,803	6,077 14,338	26,660 5,351	1,814 5,588	$34,551 \\ 25,277$	$1,231 \\ 2,055$	4,591.1 2,030.6	392.4 718.9	6,214.5 4,804.5	$.556 \\ .525$	2,182 3,774
		70,763	72,845	19,781	163,389	9,529	10,286.5	2,840.0	22,655.5		19,965

 $\frac{\text{Projected Losses}}{\text{Actual Losses}} = \frac{\text{Total Col. (10)}}{\text{Total Col. (3)}} = 1.0093.$ 

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#### TABLE 7.

D	DIRECT REDUCTION FACTOR - { New York 1915 and Pent	nsylvar 916	ia 1916	to New	}-Basis	ALL OTH	er Acciden	r Frequency.	
	Classification.	Code.	"Other"* Payroll in	"Other" * Po Temp. an minate D	erm. Partial, d Indeter- isabilities.	N. J. 1916 Payroll in	N. J. 1916 Perm. Partial Temp. and	"Other" * Acci- dent Rate Applied to N. J.	
			Thousands.	(Number.)	(Rate.)	I HOURAHOR.	Disabilities.	$((6) \times (5)).$	
	(1) Wool spinning and weaving Silk mfg	(2) 2,286 2,303 2,412	$(3) \\18,826 \\27,537 \\6,622$	(4) 433 213 162	$ \begin{array}{r} (5)\\ 2.300\\ .774\\ 2.477 \end{array} $	(6) 6,876 12,726 4,556	(7) 84 91	(8) 158.1 98.5	
	Finishing of textiles—new goods Tanning. Iron and steel works.	2,413 2,623 3,030	5,456 2,908	$     \begin{array}{r}       103 \\       223 \\       253     \end{array} $	2.477 4.087 .870	4,550 2,741 561	140 77 23	$112.8 \\ 112.0 \\ 4.9$	

16.691

20.116

59,947

991

3.081

1.112

1,379

3,337

125

1,976

4.504

10,458

551

6.662

12.616

6.855

5.567

70

30

184

406

131.6

69.5

58.2

308.8

27 29.47,789 2593.325885 6,885 274 5,281 210.23.980 21154.5Millwright works 3,724 4,818 2224.6081.18269 9.266 327 3.5293.12361 110.21,439 112 133.2916 9,9019.2522,336 460 28956.919.693 41 74.5 5,183 13,724 589 4.292 1.735 55 Plumbing. 2354.2 3.554507 14.264380 1,393 106 192.3Carpentry. 5.401 7,695 1.06213.80243.23,334 3049.117 473 29 5,490 320 3.368 880 17 29.6Painting and decorating-interior. 9.501 23 26.72432362.14611.32181.2 212 49 5,324 3.9822.040272.8 3,012 4,847212Drivers and helpers. 7,205 53.5045.62980.2 6,064 796 13.127611 54 2,545 2359.232 212  $\mathbf{23}$ 19.5Chauffeurs and helpers. 7,380 18,487 844 4.5652,292109 104.621.6 Coal merchants. 8,220 1,390 131 9.42522913 8,380 762 3.886 1.809 74 70.3 Auto. livery. 19,609 346.966 18,714 74,285 2,419 2,719.5

\* "Other" means Pennsylvania 1916 and New York 1915 combined.

Foundries-iron.

The "direct" experience factor for reducing N. Y. and Pa. "all other" accidents to the N. J. basis (by number)

$$= \frac{\text{Actual N. J. Accidents}}{\text{Expected N. J. Accidents}} = \frac{2419}{2719.5} = .890.$$

COMBINING COMPENSATION EXPERIENCE

#### AIRCRAFT INSURANCE.

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#### WALTER G. COWLES.

I would ordinarily approach the discussion of any subject before an actuarial society with considerable diffidence because I am not an actuary. Fortunately, however, the subject assigned to me requires for its discussion rather more words than figures, and on that basis perhaps I can get along with it.

The consideration of aircraft insurance in casualty lines, to which these remarks are limited, naturally begins with an inquiry respecting the field for such insurance. At the present moment the field appears to be very limited, perhaps too limited to permit an actual application of the fundamental principles of insurance. At this moment it may be broadly stated that the aircraft insurance fields is limited to the heavier-than-air machines, of which class of machines a relatively small number is now available for private or commercial use, and of that small number only a portion is employed for what I may call legitimate purposes to distinguish their use from exhibition and sport purposes. The lighter-than-air machines have not yet been developed to a point where they are used to any extent for private or commercial purposes, and up to the present time have not been considered as within the field of aircraft insurance. The reasons for this condition are many, but prominent among them are the difficulty and expense of equipping and maintaining a lighter-than-air machine. Serious accidents in various parts of the world have demonstrated not only the unreliability but the grave danger attendant upon the use of lighter-than-air machines with inflammable gas as the means for overcoming the force of gravity. Until rather recently no gas suitable for this purpose has been discovered which was not both explosive and dangerous. Helium gas was rather accidentally developed during the war and applied to a limited extent to the lighter-than-air machines. The application was limited because of the difficulty in obtaining the gas, as well as its great expense. The cost of properly supplying a reasonable-sized dirigible with helium gas runs far into the thousands of dollars and, of course, there is a constant loss of gas, so that the up-keep of such a machine for gas alone is almost, if not quite, prohibitive for private or commercial purposes. So far as I know, no dirigible or other form of balloon has ever been offered for casualty insurance in this country, and under present conditions it is to be hoped that they will not be offered because, for reasons which I will attempt to explain later, it might become necessary to undertake the risk, and it would surely be a risk attendant with most unusual danger, not only to the occupants of the machine itself, but to innocent and unsuspecting people on the ground and in the buildings over which it might move. There is some promise held out that these lighter-than-air machines will sooner or later be developed to the point of practicability for private and commercial use. I certainly hope they will be, for, if they can be rescued from their present unusual hazards, a great field of usefulness can be found for them and they have in many respects an advantage over the other class of aircraft.

For the purposes of this paper I shall limit my comment to the heavier-than-air machines, to which I believe the casualty insurance experience in this country has so far been limited.

Speaking broadly, the field for aircraft insurance is yet to be developed. In fact, the aircraft themselves are yet to be manufactured and sold. Soon after the close of the war a limited number of aircraft were made available to private purchasers. I think the first movement in this direction was when the Canadian government sold its entire stock of aircraft used for training purposes. These machines were of a somewhat similar type and are generally known as the Canadian-Curtiss machines. They are, in fact, about the same type of machines as were used in the United States for training purposes during the war. They are a two-place machine with dual controls designed for carrying an instructor with his pupil, the pupil gradually assuming control as the process of instruction continued. Several hundred of these machines were made available for private purchase through the Canadian sale, and later limited quantities were sold in the United States. The Canadian offerings were rather rapidly absorbed by private purchasers and rather generally devoted to exhibition work and short passenger flights. Young aviators with more or less experience
during the war bought up these machines and established themselves in various communities or praveled about the country making money out of them as best they could. Few of them succeeded in making their enterprises profitable. A very few of these machines were used in a limited way for purely private purposes and commercial work. Their carrying capacity was rather small and, therefore, their use for the transportation of merchandise was necessarily very limited, while their use for advertising purposes was considerably greater. The various types of machines developed during the war are not as a rule available for private or commercial use, although in some notable instances changes have been made in some of the larger machines in an effort to adapt them to commercial use, which effort, however, has met with very little success. Such war machines as were developed, through changes, for carrying loads have largely been employed by the United States government for mail delivery, and a few have reached private purchasers.

After the armistice was signel there was a decided halt in the production of aircraft. A very large number of machines had been manufactured under the impetus of war and the armistice caught the manufacturers and the government with a large number of machines in various stages of construction as well as a large number of machines actually completed. With so many machines in sight and with the known fast that in some instances at least they were offered for sale at prices far below the cost of manufacture, the few concerns in this country which had qualified as successful manufacturers of aircraft found little or no encouragement for the production of machines suitable for the private and commercial use in which the field for insurance lies. In the last few months this situation has changed slightly because manufacturers are now developing new models, advertising them either as accomplished facts or as prospects and in some instances actually selling them. Nevertheless the field at the moment is extremely limited and the available aircraft are very largely used in enterprises of a character not likely to continue, as well as in sports, races, exhibitions, thrilling adventures and hair-breadth escapes. These uses do not furnish an attractive field for insurance; therefore, it may be stated that the field for aircraft insurance at the present time lies largely in the realm of conjecture.

Seventy-five years ago or so a railroad train was as much of a 3

curiosity as an aircraft is today. In those days small model trains running on circular tracks were exhibited at country fairs, and a small admission fee was charged to see the side show. Railroads, however, possess no opportunities for sport uses. The development of railroads for commercial use was unhindered by any misapplication to pure sport uses. We have never had any railroad races, nor have we had hair-breadth railroad escapes which were staged intentionally, unless we enter the field of moving pictures. The railroad, however, has become an absolute public necessity and important feature in our lives.

Forty years or more later the trolley car was developed. I can well remember that some thirty-five years ago I rode upon the first trolley car I had ever seen, and I believe at this moment it was the first trolley line ever run in this country. That line was on 15th Street in Denver. The motive power was electricity. The wire was placed below the ground and electrical contact was obtained by running a trolley through a slot in the roadway, similar to those used by New York cars today. It was the habit of those days, as I personally observed, to refuse to pay fare on one of these cars until it reached the point at which the passenger expected to alight because as a general rule it did not reach that point. Something was happening all the time, and, judging by the experiences of that particular line, there would never be such a thing as a successful trolley system in the country.

Following this, notably in New York City, came the cable trolleys, and we all know the endless trouble encountered by that particular form of transportation which led to their final abandonment. Notwithstanding these discouragements the trolley system has survived, and while it, like the railroad system, is having its full share of financial difficulties, it has become a necessity in our lives and none of us would care to dispense with it. The trolley, like the railroad, was not adaptable to sport purposes and, therefore, its development was not delayed by misapplication.

Then came the automobile and the history of its development is so recent that comment seems unnecessary. I recall that some twenty years ago I was a member of a small party of automobilists which undertook a "club run" from Hartford to New Britain, a distance of nine miles. The only public garage proprietor in the city at that time offered to send his repair men with a car loaded with tools and appliances to help out any cripples which might be picked up by the wayside. The repair car broke down during the trip. The other cars reached their destination in safety.

For the first time we found a means of transportation by land which could be devoted to sport purposes, and it was promptly so devoted, and to an extent the development of the automobile was delayed by its misapplication. A speed craze took hold of the people. Automobile racing, exhibitions and tricks became prominent in the early days of that means of transportation, and for a time their prominence promised to over-shadow the really serious personal and commercial use to which an automibile could be put. But the automobile survived. In its early days it was cordially hated by a vast majority of the people, particularly in rural communities, and today it is found in almost countless numbers in all communities. It has come to be a necessity and the people at large probably feel that they cannot dispense with its use.

In the automobile as a means of transportation we find something which more closely approximates the aircraft than in any other present form of transportation, particularly by land. The all important question from the insurance standpoint is, will the history of the railroads, the trolleys and the automobiles be repeated in the future history of the aircraft? To that question no positive answer can be made at present. Like the automobile in its early days, the aircraft of today is very largely devoted to pure sport purposes, and its commercial development has been scarcely undertaken. It was many years after the private and pleasure automobile was well established that attention was seriously given to the development of the commercial side of this means of transportation. The automobile survived its purely personal and sport use. It survived the cordial dislike of a large majority of the population and has developed into a commercial necessity. Will the aircraft do the same thing? We may reason toward an answer by examining some of the claims which can be made on behalf of aircraft as a means of transportation, as well as the obstacles, in comparison with other means of transportation now available.

Prominent among those claims is the matter of speed. The speed which has been obtained in aircraft is already phenomenal, and the possible speed of the future is beyond conjecture, but speed is not the only consideration. If a man under urgent business requirements can actually fly from Chicago to New York in eight or ten hours when transportation by train would require more than twice that time, that looks attractive on its face, and it looks as though aircraft might be developed as a means for rapid transportation, but we must go to step further and consider the fact that a trip from New York to Chicago in a given number of hours is only a part of the story. The railroad stations in New York and Chicago are accessible, and when a passenger arrives at a railroad station there are convenient means of local transportation by use of which the traveler can reach his actual destination speedily. It is not so with the aircraft at present. If a man in the business center of Chicago desires to travel by aircraft to New York, he must first journey to an outlying field which must necessarily be in the suburbs and not necessarily within convenient reach by means of short local travel. Therefore, he spends a fair portion of the time apparently saved in his trip in getting to a starting place. Then when he arrives at New York, the same situation is encountered. Perhaps he may land at Mineola or somewhere on Long Island, and actually require an hour or more to travel from that place to his actual destination in the down town business district of New York City. In this aspect the allurements of the aircraft lose some of their force because the time actually saved, even if the trip be accomplished without mishap, is much less than it appears to be on the face of the record, all of which goes to show that before the aircraft can be recognized as a suitable and necessary means for rapid transportation, landing facilities must be provided with means for rapid transportation to business centers in the various cities of the country. Up to the present moment no substantial progress has been made in that direction and all of this militates against the development of the aircraft and, consequently, against the development of the field for aircraft insurance.

The dangers of aircraft transportation have in the past deterred —and will in the future deter—a great many people from accepting that means of travel. These dangers are probably very largely exaggerated. The railroads, the trolleys and the automobiles have left behind them in the course of their development a long trail of dead and injured, and the fact that aircraft transportation is dangerous will not probably of itself seriously delay the development of aircraft as a means of transportation if other obstacles are removed.

Drawing my figures from a publication which happens to be

before me at the moment, it is claimed that during the war there were 20,142 men trained for aviation in this country. They were trained upon fields more or less congested and with machines more or less deficient. It is claimed that there were 869,831 flying hours involved in this training, and there were 298 fatalities. If these figures are correct, even under the unusual conditions attendant upon war training and the unusual hazards due to an undeveloped machine, there was only one fatality in nearly 3,000 hours of flight, and 3,000 hours of flight under favorable conditions and at a fairly moderate speed would take an aviator seven or eight times around the world if such a thing were practically possible. There are reasons for believing that fatal accident frequency in private and commercial use would be much lower than the frequency recorded during the period of war training when all surrounding conditions are considered.

I understand upon the figures compiled by the United States Air Service covering a period of six months duriny the war only about  $2\frac{1}{2}$  per cent. of all the accidents, both fatal and non-fatal, were due to failure in the plane construction or its parts. The same tabulation shows that in the event of injury where a machine carries a pilot and one or more passengers, the pilot is the most likely to escape.

In the consideration of accident frequency in aeroplanes for the purpose of reaching rate results we have proceeded upon the theory that the proportion of fatal injuries to total number of injuries would be very much larger than it is in the ordinary casualty lines. This theory has been particularly applied to workmen's compensation. Whether it will prove true in practice or not remains to be seen, but it seems rather reasonable to assume in the absence of reliable data that in the distribution of accidents as to results, we shall find cases involving tota' and permanent disability in far greater proportion than similar results will be noted in other lines.

Another theory has been employed in developing compensation rates particularly, and that is that a larger proportion of aircraft pilots will be found in the event of fatal injuries to be without dependents than is found in the ordinary compensation lines. This is conjecture almost entirely. So far as I know there is no data of any moment which would serve to either prove or disprove this theory, but it has been used almost from necessity in order to produce an aircraft rate, particularly for compensation, which was not on its face prohibitive and would not serve to obstruct the progress of this new means of transportation.

Perhaps we may conclude that the dangers attendant upon transportation by means of aircraft will not of themselves prevent its development to a point which will furnish a real insurance field. At least that seems to be a reasonable conclusion.

The next feature which apparently weighs against the growth of the aircraft as a means of transportation is its instability and unreliability, both of which for our purposes mean about the same thing. In this respect perhaps it does not differ from the automobile in its earlier history, or even from the railroads or trolleys. Stability and dependability are matters of development, and having faith, as we must, in the inventive genius of our people, we may with reason conclude that these conditions will be materially improved, if not largely removed, by early development. However, the present alleged instability of the aircraft is not abundantly supported by evidence. Our government has been using aircraft in its mail service. It is stated that out of about 1,250 mail delivery trips actually projected, 1,200 were actually made, while the failures were only about 50. This is a most general and inexact statement but will answer present purposes. Of the contemplated mileage for these trips it is claimed that practically 98 per cent. was actually flown.

The item of cost is of course a very important factor in considering the question of development, but in its present aspect it has a very marked similarity to earlier questions respecting the automobile. Aircraft, so far as they are available, can be purchased at almost any price which a person is willing to pay. I believe a dependable one-place machine for purely private use can be had for \$2,000 or perhaps less. I am not now considering second-hand machines which can be bought still cheaper. From that minimum point the price may increase almost without limit. It is unnecessary to give much attention to the embellishments of aircraft for purely ornamental or fanciful purposes in considering cost, but it is important to know how far the item of cost will deter the managers of commercial enterprises from undertaking the aircraft as one of their means of doing business, and by this I mean an aircraft of a type which will carry a reasonable quantity of merchandise. A heavier-than-air machine which will carry as much as a ton of merchandise aside from the pilot, crew and other necessary load would be a large and expensive machine. All of the elements of construction, as well as all of the elements of power, would be very expensive. I do not really know what such a machine would cost at the presert time, but I think the cost would exceed \$25,000. Here the lighter-than-air machine would have many advantages because construction, outside of the gas supply, would probably be less expensive. Therefore, when the gas supply problem is settled, if it ever is, the field for the lighter-than-air machine is probably found in the transportation of dead weights where actual sustained speed is not so important.

We know very little at present about the cost of maintenance and repair, although we have a general understanding that it is pretty large. An engine used in an aircraft is capable of perhaps 100 hours of service, although it is customarily removed and overhauled after a very much shorter period of service.

We know very little about the cost of fuel. Some rather reckless statements have been made respecting fuel cost as well as the cost of repairs and allowances for depreciation. I regard none of these statements as dependable, but the sum total of the whole situation appears to be that the initial cost as well as the cost of maintenance and use is at the present time nearly, if not quite, prohibitive, and unless this obstacle can be reasonably reduced, the development of the aircraft, for commercial purposes at least, will be slow. However, we are reminded of the apparently unanswerable objections of not more than ten years ago respecting the automobile and how successfully the claims respecting excessive cost, not only as to the original purchase price, but as to maintenance and use, have The economy of transportation by automobile been dealt with. truck has been adequately demonstrated, as is evidenced by the constantly growing use of these vehicles. Will the same thing happen with respect to aircraft capable of carrying heavy loads? Τ confess at once I do not know the answer, but it is safe for present purposes to say that those who have the development of the aircraft in charge have a far greater problem to deal with in the matter of initial cost and subsequent expense than those who had to do with the development of the automobile, even in its earlier years.

We might go on almost indefinitely considering the probabilities of the future development of the aircraft and the resulting development of a field for insurance, but enough has been said to fairly establish the claim that we have not reached the point of development yet, nor do we see in the near future the promise of a development likely to result in the early establishment of a field for casualty insurance presenting a sufficient volume to permit the application of fundamental insurance principles.

Having reached that point, the next question is, why should aircraft insurance be undertaken by casualty companies? Here we encounter an entirely different line of reasoning. We all know that in spite of all delays and hindrances there are a large number of aircraft in operation in various parts of the country. A very large portion of these machines is owned by the government and operated either by the army or navy, or in the mail service. These operations obviously do not come within the field of insurance. After all, however, there are some left. There are such things in use as private and commercial aircraft. Their use in many instances involves the employment of pilots and others who in the course of their duties as employees are required to fly. The compensation laws in most of our states require insurance or security for the compensation obligation. If the owners of aircraft in civil life have employees, the law in a great many instances at least requires them to obtain insurance. There are many reasons for claiming that insurance companies professing to write the compensation lines would fail in their duty if they did not devise means for providing insurance in that line which the law requires. Therefore, perhaps the first reason why aircraft insurance has been undertaken is that it is the duty of insurance companies to provide it, or devise means through which it can be secured. These considerations apply to workmen's compensation insurance only, but a company undertaking this line would naturally conclude that there should go with it such other lines, within its corporate powers, as would serve to increase premium receipts and to an extent improve distribution in a limited field. The only casualty company definitely announcing an aircraft program, so far as I know, has included in that program, with workmen's compensation, public liability and property damage, as well as individual accident insurance for passengers and others exposed to the hazard of flying.

Passing the compensation line for the present, I may say that the public liability and property damage lines are in some respects similar to the same lines now undertaken by many casualty companies upon automobiles. They differ, however, in one essential particular, which is, that the public liability policies do not cover the passenger hazard. So far as I know, there is no present provision made upon the liability basis for the passenger hazard by any of the American companies. That is taken care of so far as is possible by offering personal accident insurance which can be obtained in the form of daily tickets, trip tickets or annual contracts under the conditions imposed by the company writing them. This provision does not take care of the legal liability of the owner of the aircraft, but if we consider the theory of assumed hazard, which is so clearly chargeable to the passenger, and assume that accident insurance in a definite amount is furnished by or through the owner for the benefit of the passenger with a possible agreement, which would be legal in some instances, that the passenger in the event of injury would accept the provisions of the individual accident policy in lieu of all other claims, we approach, at least, a public liability protection for passengers.

You will observe also that in my enumeration of lines I have omitted collision as ordinarily written upon automobiles. So far as I know, casualty companies have not undertaken this risk, although I believe the fire companies have undertaken if to a limited extent. Every landing of an aircraft, whether forced or intended, is a collision, and all resulting damage to the craft itself would constitute a collision claim. It might be claimed that this could be excluded from a collision policy, but effort in that direction indicates that an attempt to exclude it would exclude so much as to make the collision policy of very little value. If a collision policy is to be written at all, it ought to cover the damage due to landings where the damage is more than casual, and yet for contract purposes it is hard to draw the line.

The public liability and property damage are written together, never separately. The combined basis rate at present all over the country is \$125 for each aircraft, of which \$50 is assigned to public liability and \$75 to property damage. The policy limits for public liability are customarily \$5,000/10,000 and policy limit for property damage is \$1,000. This basis rate applies to ordinary flying, or what we might call straight-away work. It is the rule of the company writing such business that if the aircraft insured is used for exhibition, trick or stunt flying, demonstration or instruction, the basis rate shall be increased 60 per cent. There exists within my knowledge no actuarial reason either for the basis or its increase. It is a pure matter of conjecture. From such limited experience as has been obtained during the few months in which this line has been written by one company, the public liability rate appears to be too low, while the property damage rate appears to be sufficient. The relation between these rates seems disproportionate in view of the relation between the limits expressed in the policies, but the theory was that frequent property damage would be produced by forced or intentional landings damaging crops, trees, buildings and animals, while injuries to persons would be less frequent. I believe the experience to date has been exactly the reverse. A number of public personal injury claims have developed and very few property damage claims.

I shall refer to the individual accident feature very briefly because its details do not come under my personal observation. A daily ticket policy is issued which becomes applicable at whatever hour the flight is started during a given day and continues until four o'clock A. M. the following day. This ticket policy is for the principal sum of \$5,000, with the usual indemnities for dismemberment and loss of sight, and also for disabilities temporary in character. Weekly indemnities, however, apply only where the holder of the ticket is a man. Similar tickets are issued to women with the weekly indemnities eliminated and the premium cost of the ticket is \$5.00 for men and \$4.00 for women. This ticket policy plan has been developed so that we may issue a similar contract to cover a trip of whatever duration, including a round trip, if that is desired, and these we call trip ticket policies. The rates depend upon the length and character of the trip and at present are largely matters of negotiation in individual cases. There are also means provided for obtaining an annual personal accident policy carrying a rider permitting flight in aircraft, and the charge for this rider is \$50 for each \$1,000 of the principal sum.

Matters of life insurance are not within the particular observation of this Society, but I may mention in passing that life insurance with an aircraft permit may also be obtained. It is issued in one-year non-renewable term form only, and the extra premium rate per \$1,000 of insurance in addition to the term rate is for a passenger \$50 and for a pilot \$90.

It may be said generally that all the foregoing rates have been reached without substantial actuarial data except in so far as the obtainable experience used in the computation of the compensation rate has assisted in the determination of the personal accident and life rates.

We may now consider briefly such experience as we have, which has been largely obtained from the Government and particularly through the War Department, which kindly gave our actuaries personal access to its records. In an effort to adapt the available experience to the necessities of rate computation we were obliged to establish several more or less theoretical hypotheses:

1. In the event of injury to a pilot, whether fatal or not, the compensation would be maximum because of the high wage rate.

2. We had some very dependable data upon aircraft accidents generally in which accidents due to stunting, collisions in the air, collisions on the ground and straight flying were separated and the injuries were classified according to their kind. That is, fatal or non-fatal. Since our first effort was to establish a basis rate for straight flying we excluded accidents due to stunting from the computation.

3. Since the conditions at the training fields presented serious features of congestion with resulting collisions in the air, we assumed that these conditions would not exist in private flying to the same extent and, therefore, adopted the hypothesis that one half of the accidents due to collision should be excluded in our computation.

4. The number of fatalities resulting in compensation payment to dependents was treated upon pure hypothesis. In ordinary compensation lines out of 100,000 industrial accidents 932 would be fatal and of that number 705 would be settled on the basis of full dependency, 32 on the basis of partial dependency and 195 on the basis of no dependents. Considering the age, environments and general characteristics of the aviators developed during the war and assuming that many of these aviators would find their place in private and commercial work in times of peace we took considerable liberty with this distribution by degree of dependency. We produced our rates upon the theory that instead of 705 cases of full dependency there would be but 352, which was intended to be 50 per cent., and the remaining 353 were treated as further cases involving no dependents and, therefore, added to the 195 cases of that character found in the general experience. It occurs to me now that this hypothesis may be somewhat violent, particularly bearing in mind the unusua, marriage opportunities which are presented to many young aviators if current reports are to be believed. At any rate, whether right or wrong, present rate procedure is upon that basis.

5. The elements of exposure also ought to be treated upon theory rather than data. We had the government records, and from all we could gather the annual exposure of an aviator could be reasonably placed at 200 hours actually in the air. For the private use it seemed necessary to at least double this exposure.

6. On the medical aid feature, we assume medical payment in each case.

A tabulation of the experience in the government schools in this country showed that the total number of deaths per 100,000 flying hours, excluding stunting, passengers, passengers during stunting, and one-half of the collision cases, was 23. Upon the same tabulation the total number of non-fatal injuries per 100,000 flying hours with the same exclusion was 14. While we accepted the fatal results as shown by this tabulation with considerable confidence. the non-fatal results were not equally convincing because we felt pretty certain that many injuries of a non-fatal kind never found their way into the reports and, consequently, were not represented in the War Department data. This is but natural, as field commanders striving for records would naturally withhold all reports of injuries considered by them trivial and unnecessary. Perhaps we would not consider the same injuries trivial. We considered it safe and necessary to increase the non-fatal results from 14 to 28, and these elements were used as the basis for the computation, adding of course a medical charge for the sum of the two elements of both fatal and non-fatal injuries. That is, a medical charge in 51 cases for every 100,000 hours of flight. This resulted in the determination of an expected accident frequently per year per aviator upon a basis of 400 flying hours. The fatal frequency was .092. The non-fatal frequency .112, and the medical frequency was again the sum of these two elements, or .204.

I will not undertake to follow this branch of the actuarial computation any further, because, if I do, I will soon be beyond my depth. It will be so much easier for any of you to apply these fundamental data to the requirements of the compensation law in any state that I leave that part of it to you.

There is one other feature in the rate making which ought to be mentioned, and that is the expense loading. We start with the proposition that the rate per aviator, which is necessarily per capita under this method of premium computation, constitutes a high premium unit, and on the general theory affecting the expense loading that has a bearing upon the elements of that loading. The expense loading finally adopted for use throughout the country was 35 per cent. As premium computation was not on the basis of wages, there was no audit, and as the premium unit was high, some of the elements of expense became lower in proportion for reasons which will be obvious to you. The division of this loading was as follows:

Acquisition	$17\frac{1}{2}\%$
Administration, excluding audit	4_
Inspection	3
Investigation and adjustment of claims	5
Taxes, licenses and fees	4
Profit	11
Total	35%

This theory of expense loading was accepted in all states having power of approval of rates except New York state, where the standard expense loading was required.

The Workmen's Compensation classifications adopted and approved very generally through the country are as follows:

"Aircraft Operation—commercial or private, excluding demonstration, testing, instruction, public exhibition, trick or stunt flying 7400

"Aircraft Operation—demonstrating, testing, instruction, public exhibition, trick or stunt flying 7401

"Note.—The premium named in connection with the two preceding classifications apply to each employee who is permitted or required to be upon aircraft while under their own power, but upon written notice to the Company the employer may substitute one employee for another without additional charge. During the policy period the employer may add other employees or may cancel from the policy employees previously covered, both upon a short rate basis. In no event shall the premium for the entire policy be reduced below the minimum premium herein provided."

The rate for classification No. 7401 is uniformly 160 per cent. of the rate for classification No. 7400. The minimum premium is uniformly the annual premium for one aviator.

Rates have been computed for practically all the compensation states and filed and approved where required in most of them. 1

The rates for each of the states as computed for each of the classifications are as follows:

State	7400	7401
California	\$340	\$544
Colorado	195	312
Connecticut	340	544
Delaware	220	352
Idaho	365	584
Illinois	240	384
Indiana	240	384
Iowa	290	464
Kansas	260	416
Kentucky	250	400
Louisiana	290	464
Maine	240	384
Massachusetts	270	432
Maryland	275	440
Michigan	265	424
Minnesota	285	456
Missouri	280	448
Montana	285	456
Nebraska	315	504
New Hampshire	225	360
New Jersey	225	360
New Mexico	235	376
New York	365	584
Oklahoma	410	656
Pennsylvania	230	368
Rhode Island	215	344
South Dakota	200	320
Tennessee	275	<b>44</b> 0
Texas	310	496
Utah	375	600
Vermont	220	352
Virginia	195	312
Wisconsin	295	472

There are probably other reasons why aircraft insurance should be undertaken in this country without awaiting the full development of the field. In this paper an attempt has been made to view the prospects of the near future in a very conservative way which might be adjudged by some as pessimistic. Notwithstanding all the difficulties suggested and many others likely to be encountered, aircraft of all kinds will be used in the future to a greater or less extent, and an early development of sound under-

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writing theories and practices, as well as an early purchase (and I use that word advisedly) of a substantial amount of aircraft experience for future guidance may be regarded as almost necessary. It really matters very little if the field in the near future is to be restricted or if the final development of the aircraft stops at a point short of making it a necessity in our personal and commercial lives. The aircraft has come to stay beyond any question, and its future depends very largely upon the preparations made for its acceptance and regulation. I wish to comment on these features briefly.

Suitable landing fields properly constructed and guarded must be established at points reasonably accessible to the business centers The proper construction and arrangement of the of our cities. landing places is a subject worthy of very careful consideration. The aircraft still remains more or less of a curiosity to the public at large. The landing of an aircraft attracts a crowd and very few people in that crowd realize the dangers involved when the aviator undertakes to resume his flight by setting his machinery in motion. On landing fields the public must be properly segregated and protected by reasonable enclosures, and the field itself must be kept clear. Regulations respecting landing where that is attempted by more than one machine must be carefully worked out. An aircraft occupies a good deal of space on the ground, even if it is a comparatively small machine, and the element of space occupation will sometimes form the basis of differential, particularly in public liability and property damage rate-making. The establishment of these fields, while largely dependent upon private enterprise, must be reasonably controlled by well-considered legislative enactment.

In matters of flight there are several things to be considered. An aviator who flies over my house is guilty of trespass. The old common-law maxim. "He who owns the ground owns also to the stars" makes a land owner the proprietor of the air above his land, and in that air a passing aviator is a trespasser. When fights are taken over populous centers, dangers of unnecessary magnitude are created. They involve unsuspecting people on the streets and in the buildings, any one of who'n may be injured by some mishap, or the dropping of some article in, or some part of, the machine. In the continental countries and in England there are known such things as "air lanes." That is, routes of travel are laid out to a certain extent at least, and while I am not familiar with the requirements I have an idea that regard is had in the establishment of these routes for the proper protection of dense centers of population where the hazard of injury increases with density. There is really no reason why an aircraft in flight except for exhibition or advertising purposes should pass over the center of a city. It can easily pass around it and as landing places are necessarily in suburbs and less populous centers, this exposure could be materially reduced by wise legislation.

There are many other points along these lines which might be mentioned, but I will include only one which to my mind is of the utmost importance.

Given the best aircraft in the world, the safety of its flight depends very largely upon the personal skill and fitness of the pilot in charge. The element of personal fitness enters very largely into the consideration of the aircraft risk from an insurance standpoint, and before a reasonable field for insurance can be developed upon a suitable basis there must be legal control of this situation which is very exact and very effective in its nature. Whether this control is to be undertaken by the Federal Government or by states is a question now under discussion and upon which opinions differ, but in either event there should be a control and it should be real and not theoretical. At present there is no control whatever. The Federal Government has some sort of a licensing system and one or more private organizations pretend to issue licenses certifying to the qualifications of an aviator. Neither of these arrangements is of any avail because it is not based upon the necessary requirements, nor is the aviator sufficiently under observation to make those licenses effective. The thing required above all other things is to provide by law that no person shall operate an aircraft either for himself or for others until he is duly licensed for that purpose, and the process of licensing should involve most rigid physical, mental and moral examination to determine the absolute fitness of the individual who is to be entrusted with a task which immediately becomes tremendously perilous, if he is not fit. A single examination, however careful, with a resulting license is not sufficient, however. The evidence seems to be that a pilot who is fit for that work today may be unfit six months or less in the future. There are conditions found in constant flying calculated to produce physical or mental changes which render a man who was once fit quite

unfit to continue his work. As a result licenses should be issued for a short term, certainly not more than one year, and preferably for a lesser term, and the holder of such a license should present himself at the end of each term fcr reexamination, which should be equally exact and careful and upon which his ability to continue as a licensed aviator should depend. Viewing the whole situation, I regard the personal qualifications of the aviator as of the utmost importance.

We may assume freely that air raft will be improved, that they will be rendered more stable, more dependable, and less difficult of operation. Perhaps they will be much less expensive in original cost and subsequent up-keep in the near future, but all this will be of little avail unless the personal fitness of the pilot, whether he be an employee or an owner, is made the subject of constant, careful, rigid supervision under the operation of well considered and fully enforced laws enacted either by the Congress of the United States or by legislatures of the several states.

Any extended discussion of possible differentials in aircraft rate making would require me to assume powers of prophecy which I do not possess. It is fairly safe, however, to predict that none of the special requirements respecting landing facilities, lanes of flight, or the personality of the aviator will ever enter into rate differential practice. On the other hand it seems rather probable that as time passes and our knowledge increases we shall find many occasions for introducing differential features in rate making depending upon construction, arrangement and equipment of the individual aircraft which is the basis for the rate. This statement from its nature excludes differential possibilities as respects workmen's compensation. We already have one differential based upon the use of the aircraft which applies to public liability, property damage and compensation as well. It is not impossible that differentials because of use will be further elaborated as the various uses to which aircraft may be put are developed. At present, however, it seems rather likely that differential efforts will be directed toward those rates which are based upon the aircraft itself. By this I mean the public liability and property damage rates in our case, and the same considerations would apply to the fire hazard and the collision hazard in so far as those are undertaken. The superiority of one form of construction over another or one method of equipment over another is a matter still in the field of discussion. There are

#### AIRCRAFT INSURANCE.

many varieties of wings and bodies. There are many differing arrangements for engines, not only as to number but as to location and power. Methods of control differ somewhat, particularly as between the light and the heavy machines. General methods of operation, including sparking devices, gasoline feed and things of that character are still matters of controversy, but out of them will probably grow at least a limited and perhaps an extended system of differentials which in due time must have actuarial attention. I think the discussion of this feature in the aircraft insurance rates of the future cannot be profitably extended at this time.

Our former allies, as well as our former enemies on the other side of the water, are far ahead of us in the development of the aircraft, and in the development of the necessary insurance plans to go with it. It is freely stated that England is to be the aircraft center of the world, and that from England will come the insurance plans and provisions in the various lines required and without which aircraft projects of whatever nature cannot succeed. I think at least the United States ought to strive to divide this honor with our former ally. I think we ought to make it our business as representatives of American Insurance to see that the United States remains on the map in the matter of aircraft insurance, as well as aircraft development. The heavier-than-air machine was born in the United States, developed to a certain point but ignored as a factor of any value by the people at large. Other countries took up the project which we neglected, and we have suffered much in consequence. If reconstruction is ever accomplished, if we ever come back to normal times and to a normal method of living, there will come a period of sharp competition during which recourse must be had to every possible method for maintaining our position in our own markets and in the markets of the world. In this the aircraft will most surely play its part and a very important part too. The fact that we here in the United States are far behind England and all other countries in the development of this most helpful competitive means should not deter us as representatives of insurance interests from laying a sound foundation and establishing a useful practice for aircraft insurance notwithstanding present discouragements, notwithstanding a limited field and notwithstanding the lack of substantial hope for the immediate future.

These thoughts I commend to you for your earnest attention because through you many of the plans for the insurance of air-

craft must be developed and your neglect or failure to give them your very best attention in these very early days and in the face of every discouragement will militate very largely against the insurance interests of our country as well as against the commercial interests with which our insurance is so intimately associated. We must have the aircraft. It must be developed and improved. Ιt must be cheapened in cost and up-keep. It must be dependable. It must be practical. It must do its part in the annihilation of space, a part now so amply played in the transmission of words by telegraph either of the old kind or of the more modern sort. Chicago can order goods from New York by telegraph in a few minutes, but New York cannot deliver goods to Chicago with sufficient promptness to meet the requirements of the future by the means now at hand. The railroads are largely impotent. The steamships are not always available. The automobile truck has its limitations and certainly the aircraft has its place. We must not forget these things. We must work in anticipation of the future. We must work for the supremacy of the United States of America in all things respecting her commerce and those plans for commerce which experience has demonstrated as feasible and which probably will soon be regarded as necessary.

## ON THE GRADUATION OF FREQUENCY DISTRIBUTIONS.

#### BY

### H. C. CARVER.

The graduation of frequency distributions may not improperly be referred to as that branch of actuarial and statistical theory which is most neglected.

Elderton's "Frequency Curves and Correlation," which is recommended by the Educational Committee of this Society and is unquestionably the text best known to the English speaking actuaries, presents the Pearsonian methods which have dominated to a marked degree the English school of biometricians.

Pearson's method is empirical and is based upon the assumption that the differential equation of a unimodal distribution is of the form

$$\frac{dy}{dx} = \frac{y(a-x)}{f(x)} \; .$$

The following phenomena of such distributions suggest this equation:

(a) At the mode (x=a) the derivative of the curve is necessarily zero. The factor (a-x) takes this fact into consideration.

(b) At the extremes of the distribution there is generally high contact, that is, the slope of the curve tends to approach zero as y likewise diminishes in value.

(c) The balance of the differential equation for any distribution may be represented by f(x) appearing in the denominator. We assume that this function may be expanded in the power series  $b_0 + b_1 x + b_2 x^2 + b_3 x^3 + \cdots$ , which is generally so rapidly convergent that the terms which involve the third and higher powers of x may be neglected.

We thus arrive at

$$\frac{1}{y} \cdot \frac{dy}{dx} = \frac{a-x}{b_0 + b_1 x + b_2 x^2}$$

as the differential equation of unimodal distributions in general.

The integration of this equation may produce various types of

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frequency curves, depending upon the inter-related values of the constants  $b_0$ ,  $b_1$  and  $b_2$ . Thus we may have as solutions

1.  $y = \kappa e^{\frac{-(x-b)^2}{2\sigma^2}}$  if  $b_1 = b_2 = 0$ . 2.  $y = \kappa \left(1 + \frac{x}{\alpha}\right)^{\gamma a} e^{-\gamma x}$  if  $b_2 = 0$   $b_1 \neq 0$ . 3.  $y = \kappa \left(1 + \frac{x}{\alpha_1}\right)^{m_1} \left(1 + \frac{x}{\alpha_2}\right)^{m_2}$  if the roots of  $b_0 + b_1 x + b_2 x^2 = 0$  are real.

4. 
$$y = \kappa \left(1 + \frac{x^2}{\alpha^2}\right)^{m_1} e^{m_2 \tan^{-1} \frac{x}{\alpha}}$$
  
if the roots of  $b_0 + b_1 x + b_2 x^2 = 0$  are complex.

The above curves, with modifications, make up Pearson's system which, according to Mr. Elderton's recent supplement, comprises twelve distinct functions.

Although the practical suffic ency of Pearson's method leaves but little to be desired, still it is a highly unfortunate fact that a graduation involving such procedure can only be effected at the expense of a vast amount of labor. Orly those who have completed a graduation of the transcendental type four (which is the one most frequently met in practice) will fully appreciate the truth of the preceding statement.

The purpose of this paper is to point out, and illustrate with examples, that if we slightly modify Pearson's hypothesis so that it will permit treatment by the finite, rather than the infinitesimal, calculus, we may eliminate a great deal of theoretical and laborious procedure, and what is equally, if not more important, treat all distributions which belong to Pearson's system (and certain others) by a single method regardless of "type."

#### SECTION II.

The reasoning which prompted Pearson to choose his differential equation also suggests

$$\frac{\Delta y_x}{\Delta x} = \frac{y_x(a-x)}{b_0 + b_1 x + b_2 x^2}$$

as the difference equation of a unimodal distribution, since if there be a maximum there must also be a value of x = a for which  $\Delta y_x = 0$ , and moreover, at the extremes where  $y_x = 0$  (to quote Elderton) "the finite difference between two successive ordinates must be zero, or there will not be contact."

By arbitrarily allowing  $\Delta x$  to represent the difference in magnitudes of two successive classes, this element may be considered equal to unity for the particular distribution being graduated, and thus eliminated from further consideration.

It follows that our difference equation may now be written as

$$\frac{y_{x+1}}{y_x} = 1 + \frac{a-x}{b_0 + b_1 x + b_2 x^2} = \frac{x^2 + c_1 x + c_2}{x^2 + c_3 x + c_4}$$

It is important to note here that a knowledge of the values of the constants in the differential equation

$$\frac{1}{y} \cdot \frac{dy}{dx} = \frac{a-x}{b_0 + b_1 x + b_2 x^2}$$

for a particular distribution does not permit a calculation of the ordinates of the distribution until the equation has been integrated, producing a solution of the form  $y = \kappa f(x)$ . Our case is, however, essentially different, for as soon as  $c_1$ ,  $c_2$ ,  $c_3$  and  $c_4$  are known, the computed values of  $y_{x_{\pm 1}}/y_x$  (corresponding to the  $l_{x_{\pm 1}}/l_x$  or  $p_x$  in actuarial theory) absolutely determine without any integration the shape of the frequency curve. The condition that the sum of the graduated ordinates must equal that of the ungraduated ordinates will enable us to arrive at the proper radix.

Consequently, variations in type, an outgrowth of integration, will in no way concern us.

There remains but the problem of determining the constants for a particular distribution.

### SECTION III.

Although it is possible to proceed, using the calculus of finite differences, along lines parallelling Elderton's, yet the constants may be determined more easily as follows:

We obtain by clearing our difference equation of fractions

$$c_1xy_x + c_2y_x - c_3xy_{x+1} - c_4y_{x+1} = x^2y_{x+1} - x^2y_x.$$

If we multiply this through by  $x^n$ , and sum with respect to x between the limits x=r and x=s-1, we have, giving n successively the values 0, 1, 2 and 3,

I. 
$$\begin{cases} c_1 \Sigma x y_x + c_2 \Sigma y_x - c_3 \Sigma x y_{z+1} - c_4 \Sigma y_{z+1} &= \Sigma x^2 y_{z+1} - \Sigma x^2 y_z \\ c_1 \Sigma x^2 y_x + c_2 \Sigma x y_z - c_3 \Sigma x^2 y_{z+1} - c_4 \Sigma x y_{z+1} &= \Sigma x^3 y_{z+1} - \Sigma x^3 y_z \\ c_1 \Sigma x^3 y_x + c_2 \Sigma x^2 y_z - c_3 \Sigma x^3 y_{z+1} - c_4 \Sigma x^2 y_{z+1} &= \Sigma x^4 y_{z+1} - \Sigma x^4 y_z \\ c_1 \Sigma x^4 y_x + c_2 \Sigma x^3 y_x - c_3 \Sigma x^4 y_{z+1} - c_4 \Sigma x^3 y_{z+1} &= \Sigma x^5 y_{z+1} - \Sigma x^5 y_z \end{cases}$$
where  $\Sigma$  means  $\sum_{x=r}^{x=s-1}$ .

If we desire to graduate that portion of a distribution lying between x=r and x=s, we must first calculate from the known ungraduated frequencies  $f_r$ ,  $f_{r+1} \cdots f_{s-1}$ ,  $f_s$  the numerical values of x=s-1x=r  $x^n f_x$  and  $\sum_{x=r}^{x=s-1} x^n f_{x+1}$ , corresponding to the  $\sum_{x=r}^{x=s-1} x^n y_x$  and  $\sum_{x=r}^{x=s-1} x^n y_{z+1}$  of equations I. Imposing the usual condition that the corresponding moments of the graduated and ungraduated frequencies must be identical, we obtain the numerical values of the coefficients of equations I. A simultaneous solution then yields the desired values of  $c_1$ ,  $c_2$ ,  $c_3$  and  $c_4$ .

In the above the limits of summation are, as stated, x = r and x = s - 1. Clearly we could not sum to x = s, since such procedure would require a knowledge of the value of  $f_{s+1}$ , which is contrary to our assumption that the ungraduated frequencies from  $f_r$  to  $f_s$ , only, are known.

Although the values of  $\sum x^n f_{s+1}$  can be computed in the same way as those of  $\sum x^n f_s$ , yet this would be practically a duplication of work, since we may easily show that

$$\sum_{r}^{s-1} x^{n} f_{s+1} = \overline{s-1}^{n} f_{s} - \overline{r-1}^{n} f_{r} + \sum_{r}^{s-1} x^{n} f_{z} - {}_{n} C_{1} \sum_{r}^{s-1} x^{n-1} f_{z} + {}_{n} C_{2} \sum_{r}^{s-1} x^{n-2} f_{z} - \text{etc.}$$

In other words

$$\text{II.} \begin{cases} \Sigma \quad f_{x+1} = \int_{s} f_{s} - \int_{r} f_{x} + \Sigma \quad f_{x}, \\ \Sigma x \, f_{x+1} = \overline{s-1} \, f_{s} - \overline{r-1} f_{r} + \Sigma x \, f_{x} - \Sigma \quad f_{x}, \\ \Sigma x^{2} f_{x+1} = \overline{s-1} \, f_{s} - \overline{r-1} f_{r} + \Sigma x^{2} f_{x} - 2\Sigma \, x f_{x} + \Sigma \quad f_{x}, \\ \Sigma x^{3} f_{x+1} = \overline{s-1} \, f_{s} - \overline{r-1} f_{r} + \Sigma x^{3} f_{x} - 3\Sigma x^{2} f_{x} + 3\Sigma x f_{x} - \Sigma f_{x}, \\ \Sigma x^{4} f_{x+1} = \overline{s-1} \, f_{s} - \overline{r-1} f_{r} + \Sigma x^{4} f_{x} - 4\Sigma x^{3} f_{x} + 6\Sigma x^{2} f_{x} \\ \Sigma x^{4} f_{x+1} = \overline{s-1} \, f_{s} - \overline{r-1} f_{r} + \Sigma x^{4} f_{x} - 4\Sigma x^{3} f_{x} + 6\Sigma x^{2} f_{x} \\ - 4\Sigma x f_{x} + \Sigma f_{x}, \\ \Sigma x^{5} f_{x+1} - \Sigma x^{5} f_{x} = \overline{s-1} \, f_{s} - \overline{r-1} \, f_{r} - 5\Sigma x^{4} f_{x} + 10\Sigma x^{3} f_{x} \\ - 10\Sigma x^{2} f_{x} + 5\Sigma x f_{x} - \Sigma f_{x}. \end{cases}$$

Formulae I and II enable us to graduate a section or "stump" of a distribution and are therefore more powerful than formulae that presuppose a complete distribution—that is, assume  $y_r = y_s = 0$ .

If we restrict ourselves likewise, and in the usual manner reduce the moments  $\Sigma x^n f_x$  to unit frequency, we have, denoting

$$\begin{aligned} \frac{\sum x^n f_x}{\sum f_x} & \text{by } v_n' \\ v_1'c_1 + c_2 & -(v_1'-1)c_3 - c_4 = -2v_1' + 1, \\ v_2'c_1 + v_1'c_2 - (v_2'-2v_1'+1)c_3 - (v_1'-1)c_4 \\ & = -3v_2' + 3v_1' - 1, \\ v_3'c_1 + v_2'c_2 - (v_3'-3v_2'+3v_1'-1)c_3 - (v_2'-2v_1'+1)c_4 \\ & = -4v_3' + 6v_2' - 4v_1' + 1, \\ v_4'c_1 + v_3'c_2 - (v_4'-4v_3'+6v_2'-4v_1'+1)c_3 \\ & -(v_3'-3v_2'+3v_1'-1)c_4 = -5v_4' + 10v_3' - 10v_2' + 5v_1' - 1. \end{aligned}$$

Lastly, if the moments  $v_n'$  be transferred to the mean by means of the relations

$$\begin{aligned} v_1 &= 0 \\ v_2 &= v_2' - (v_1')^2, \\ v_3 &= v_3' - 3v_2'v_1' + 2(v')^3, \\ v_4 &= v_4' - 4v_3'v_1' + 6v_2'(v_1')^2 - 3(v_1')^4, \end{aligned}$$

equations I become

$$III. \begin{cases} c_2 + c_3 - c_4 = 1, \\ v_2 c_1 - (v_2 + 1) c_3 + c_4 = -3v_2 - 1, \\ v_3 c_1 + v_2 c_2 - (v_3 - 3v_2 - 1) c_3 - (v_2 + 1) c_4 \\ = -4v_3 + 6v_2 + 1, \\ v_4 c_1 + v_3 c_2 - (v_4 - 4v_3 + 6v_2 + 1) c_3 - (v_3 - 3v_2 - 1) c_4 \\ = -5v_4 + 10v_3 - 10v_2 - 1. \end{cases}$$

Solving III we have

IV 
$$\begin{cases} c_1 = \left(\frac{\nu_3}{\nu_2} - 1\right)\delta - 1, \\ c_2 = \nu_2(1+2\delta), \\ c_3 = \left(\frac{\nu_3}{\nu_2} + 1\right)\delta + 3, \\ c_4 = c_1 + c_2 + 3 + 2\delta = c_2 + c_3 - 1, \end{cases}$$

where we let

$$\beta_1 = \frac{\nu_3^2}{\nu_2^3},$$

$$\beta_2 = \frac{\nu_4}{\nu_2^2},$$

$$\delta = \frac{\beta_2 + 3 - \frac{1}{\nu_2}}{2\beta_2 - 3\beta_1 - 6 + \frac{1}{\nu_2}}.$$

It is interesting to compare these results with Pearson's.

If we change our difference equation

$$\frac{y_{x+1}}{y_x} = \frac{x^2 + c_1 x + c_2}{x^2 + c_3 x + c_4}$$

back to the form

$$\frac{\Delta y_x}{y_x} = \frac{a-x}{b_0+b_1x+b_2x^2},$$

corresponding to Pearson's

$$\frac{1}{y}\frac{dy}{dx} = \frac{a-x}{a-b_1x+b_2x^2}$$

we have, since

$$a = \frac{c_2 - c_4}{c_3 - c_1}, \qquad b_0 = \frac{c_4}{c_3 - c_1}, \\ b_1 = \frac{c_3}{c_3 - c_1}, \qquad b_2 = \frac{1}{c_3 - c_1},$$

the following comparison:

TABLE I.

Finite Constants.	Const.	Pearson's Values.
$\boxed{\frac{-\frac{\nu_3}{\nu_2}\left(\beta_2+3-\frac{1}{\nu_2}\right)}{2\left(5\beta_2-6\beta_1-9+\frac{1}{\nu_2}\right)}-\frac{1}{2}}$	a	$\frac{-\frac{\nu_3}{\nu_2}(\beta_2+3)}{2(5\beta_2-6\beta_1-9)}$
$\left -a+\frac{\nu_{2}\left(4\beta_{2}-3\beta_{1}-\frac{1}{\nu_{2}}\right)}{2\left(5\beta_{2}-6\beta_{1}-9+\frac{1}{\nu_{2}}\right)}\right $	bo	$\frac{\nu_2(4\beta_2 - 3\beta_1)}{2(5\beta_2 - 6\beta_1 - 9)}$
$b_2 - a$	<i>b</i> 1	- a
$-\frac{\left(3\beta_{1}-2\beta_{2}+6\ -\frac{1}{\nu_{2}}\right)}{2\left(5\beta_{2}-6\beta_{1}-9\ +\frac{1}{\nu_{2}}\right)}$	b2	$-\frac{(3\beta_1-2\beta_2+6)}{2(5\beta_2-6\beta_1-9)}$

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#### SECTION IV.

The following problems will serve to illustrate various applications of the proposed method to statistical problems.

## Example I.

The distribution of deaths due to old age in the U. S. Registration Area for the year 1910 is shown in Table II:

Age Intervals.	Deaths Ungraduated.	x.	$\frac{y_{x+1}}{y_x}$ .	y'_z.	Deaths $y_{\pm}$ Graduated.
45 55 55 65 75 75 80 95 95 100 110	189 519 1,379 2,475 3,716 3,116 1,587 443 173*	$\begin{array}{r} -7.056 \\ -6.056 \\ -5.056 \\ -4.056 \\ -2.056 \\ -2.056 \\ -1.056 \\ -9.056 \\ -9.44 \\ 1.944 \\ 2.944 \\ 3.944 \\ 4.944 \\ 5.944 \end{array}$	$\begin{array}{c} 8.18444\\ 6.82875\\ 5.32671\\ 3.93885\\ 2.80070\\ 1.93457\\ 1.30420\\ .85728\\ .54555\\ .33085\\ .18502\\ .08792\\ .02531\end{array}$	$\begin{array}{r} 100\\818\\5,589\\29,777\\117,262\\328,416\\635,344\\828,618\\710,359\\387,534\\128,216\\23,723\\2,086\\2,086\\53\end{array}$	$\begin{array}{r} & 4\\ & 24\\ & 127\\ & 499\\ 1,396\\ 2,701\\ & 3,523\\ & 3,020\\ & 1,648\\ & 545\\ & 101\\ & 9\end{array}$
Total	13,597			3,197,895	13,597

TABLE II.

\* Deaths 100 and over. In calculating moments treated as class 100-.

Taking the middle of class 80— as origin we have

$\Sigma f_x = 13,597,$ $\Sigma x f_x = 765,$ $\Sigma x^2 f_x = 31,905,$ $\Sigma x^3 f_x = -771,$ $\Sigma x^4 f_x = 223.641.$	$v_1' = .056262,$ $v_2' = 2.34647,$ $v_3' =056704,$ $v_4' = 16.4478,$	$v_2 = 2.34320,$ $v_3 =45240,$ $v_4 = 16.5051,$ $\beta_1 = .0159,$ $\beta_2 = 3.0058.$
,	$c_1 = -18.041,$ $c_2 = 69.284,$ $c_3 = 14.526,$ $c_4 = 82.810.$	F2

Using these constants, the value of  $y_{x+1}/y_x$ , shown in Table II were calculated. An arbitrary radix of 100 at class 45— produces a total frequency of 3,197,895; hence each frequency,  $y_x'$ , must be

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multiplied by the decimal equivalent of  $\frac{13,597}{3,197,895}$ . The final graduation, as shown in the last column, results.

Let us now consider the problem of calculating the number of deaths at each age, instead of within quinquennial groups.

Although an interpolation formula might be used, yet it is preferable to modify the original moments so that both the graduation and interpolation may be performed simultaneously. This may be done as follows:

Taking  $\Delta_x$  as one year, it follows that the corresponding moments  $v_n$  may be obtained by multiplying the previously calculated ones by 5<sup>n</sup>. This will, however, not alter the values of  $\beta_1$  or  $\beta_2$ .

The new difference equation referred to the mean age of 82.28 as origin, becomes

$$\frac{y_{x+1}}{y_x} = \frac{x^2 + 618.46x - 36871}{x^2 - 8x - 36880}.$$

The results of this graduation are as follows:

Age,	¥∉.	Age.	y <sub>z</sub> .	Age.	1'=-	Age.	y <sub>x</sub> .	Age.	y <sub>x</sub> .
52	1	64	46	76	437	88	557	100	42
53	1	65	60	77	539	89	503	101	30
54	1	66	78	78	537	90	446	102	20
55	2	67	100	79	629	91	387	103	13
56	3	68	127	80	634	92	330	104	9
57	5	69	158	81	690	93	275	105	5
58	7	70	193	82	705	94	225	106	3
59	10	71	234	83	708	95	180	<b>107</b>	<b>2</b>
60	13	72	279	84	699	96	141	<b>*</b> 108	1
61	19	73	328	85	679	97	108	109	1
62	26	74	380	86	647	98	81	[	
63	35	75	433	87	606	99	59	Total	13,597
L		1		L	l				13157

TABLE III.

The results of the graduation, as shown graphically in Plate I, are entirely satisfactory.

A very important point which is always involved when the frequencies are associated with graduated variates, may be brought to light by comparing the grouped frequencies of Table III with the graduated frequencies of Table II. Column 5 of Table IV shows the group totals of Table III while 6 is merely the final column of Table II. The discrepancies between grouped results are marked, and are due to the fact that we have been treating as ordinates these frequencies that in reality should be represented by areas. Thus, the frequency of class 80— should be represented by the area under



Plate I.

the curve from age 80 to age 85, instead of by the ordinate at age 821%.

In general we may state that a distribution of graduated variates should be represented by areas under a curve, while a distribution of integral variates should be considered as proportional to ordinates of a curve.

Since approximately

$$\int_{x+\frac{1}{2}}^{x+\frac{1}{2}} y dx = \frac{1}{24} \left[ y_{x-1} + 22y_x + y_{x+1} \right]$$

we may revise the computations of Table II as follows:

In the computing areas,  $\alpha_x$ , the factor  $\frac{1}{24}$  may be neglected, since the fraction  $\frac{13,597}{76,749,327}$  automatically introduces it.

Columns 4 and 5 are now practically identical. The differences, which are slight when compared to the total frequency, may be attributed to the following causes:

	(1)	(2)	(3)	(4).	(5)	(6)
Ages.	$\frac{y_{x+1}}{y_x}$ .	¥.	$y'_{x+1} + 22y'_{x} + y'_{x+1}$	a <sub>x</sub> .	Grouped Fre- quencies from Table III	yx.
45	$\begin{array}{r} 8.18444\\ 6.82875\\ 5.32671\\ 3.93885\\ 2.80070\\ 1.93457\\ 1.30420\\ .85728\\ .54555\\ .33085\\ .18502\\ .08792\\ .02531 \end{array}$	$\begin{array}{r} 100\\818\\5,589\\29,777\\117,262\\328,416\\635,344\\828,618\\710,359\\387,534\\128,216\\23,723\\2,086\end{array}$	$\begin{array}{r} 3,018\\ 23,635\\ 153,553\\ 777,945\\ 2,937,957\\ 7,977,758\\ 15,134,602\\ 19,575,299\\ 16,844,050\\ 9,364,323\\ 3,232,009\\ 652,208\\ 69,638\end{array}$	$\begin{array}{r} 1\\ 4\\ 27\\ 138\\ 520\\ 1,413\\ 2,681\\ 3,468\\ 2,984\\ 1,659\\ 573\\ 116\\ 112\\ \end{array}$	$\begin{array}{r} & 3\\ & 27\\ & 139\\ & 523\\ 1,414\\ 2,675\\ 3,466\\ 2,992\\ 1,663\\ & 569\\ & 114\\ & 12\end{array}$	$\begin{array}{r} 4\\ 24\\ 127\\ 499\\ 1,396\\ 2,701\\ 3,523\\ 3,020\\ 1,648\\ 545\\ 101\\ 9\end{array}$
110-		53	76.749.327	13 597	13 597	13.957

TABLE IV.

1. No quadrature formula was used in the calculation of the frequencies of Table III. If there be many classes, that is, if the class interval is small as compared with the visible range, the error involved by treating the areas as ordinates is slight. Thus, we treat the number of persons dying, as per a mortality table, as an ordinate (which practically assumes a uniform distribution of deaths throughout the year) without introducing an appreciable error. On the other hand, if our tables were based on a quinquennial, rather than an annual, basis, such an hypothesis would introduce a very considerable error, such as we just noted in comparing columns 5 and 6 of Table IV.

2. The quadrature formula use 1, though practically sufficient, is only approximate. Better ones, involving however a greater amount of labor, could be used if necessary; for example

 $\int_{x-\frac{1}{2}}^{x+\frac{1}{2}} y dx = \frac{1}{5769} \left\{ 5178y_x + 308(y_{x-1} + y_{x+1}) - 17(y_{x-2} + y_{x+2}) \right\}$ 

is somewhat better.

3. In changing from a quinquennial to an annual basis, the moment  $v_n$  should, strictly speaking, be modified. Sheppard's adjustments will, in general, slightly improve results, although their tendency in this case would be to "over adjust."

On the whole, if a quadrature formula must be used, the one we made use of is practically sufficient, and the modification of moments, moreover, may be entirely eliminated.

## Example II.

Wage.	Ungraduated.	Gradu- ated.	Wage.	Ungrad- uated.	Grad- uated.	Wage.	Ungrad- uated.	Grad- uated.
0 . 1- 2-	(Under 5) 43	2 4 8	18– 19– 20–	$     182 \\     97 \\     94   $	$220 \\ 199 \\ 178$	36 37 38	(35–40) 68	10 9 7
3- 4- 5-	59	16     28     47	21 - 22 - 23 - 23 - 23 - 23 - 23 - 23 -	$     \begin{array}{r}       341 \\       77 \\       65     \end{array} $	157 137 118	39- 40- 41-	(40–50) 9	6 5 41
6- 7- 8-	84 84 05	71 101	24- 25- 26	384 23	$\frac{101}{85}$	42- 43-	(50-60)	3
9 10	160 207	168 200	20-27-28-	$\begin{array}{c} 21 \\ 60 \\ 6 \end{array}$	60 50	44- 45- 46-	2 (60–)	$\begin{array}{c} 2\\ 2\\ 1\end{array}$
11- 12- 13-	$286 \\ 311 \\ 288$	$\begin{array}{c} 227 \\ 248 \\ 260 \end{array}$	29- 30- 31-	$\begin{array}{c} 20\\ 121\\ 8\end{array}$	42 34 28	47 48 49	2	1
14- 15-	332 220	$265 \\ 262 \\ 252 \\ 252 \\ 352 $	32- 33	7		Total	4,138	4,138
17-	218	238	34- 35-	4	13			

WAGE DISTRIBUTION, ALL COMP. CLASSIFICATIONS, 1916.

Plate II.



Mean is .493 interval from central ordinate of class 16-.

### Example III.

Central Age of Group.	Ungraduated Exposed to Risk.	Elderton's Graduation.	Present Graduation.	Elderton's $\frac{d^2}{y}$ .	Present Grad. $\frac{d^2}{\tilde{y}}$ .
17	34	44	44	2.27	2.27
$\tilde{22}$	145	$1\bar{3}\bar{7}$	$1\tilde{42}$	.47	.06
$\bar{27}$	156	149	151	.33	.17
32	145	142	$\overline{142}$	.06	.06
37	123	127	126	.13	.07
42	103	108	106	.23	.08
47	86	88	87	.05	.01
52	71	69	68	.06	.13
57	55	51	50	.31	.50
62	37	36	36	.03	.03
67	21	<b>24</b>	23	.38	.17
72	13	14	14	.07	.07
77	7	7	7		
82	3	3	3		
87	1	. 1	1		
Total	1,000	1,000	1,000	$\chi^2 = 4.39$	$\chi^2 = 3.62$

GRADUATION OF TYPE I DISTRIBUTION IN ELDERTON.

Since there is not high contact for this distribution at the  $y_r$  end, we cannot properly assume  $y_{r-1} = 0$ . We should use, therefore, equations I and II.

Taking our provisional origin at class 37 we obtain r - 1 = -5,  $f_r = 34$ , s - 1 = 9,  $f_s = 1$ ,  $\Sigma f_x = 999$ ,  $\Sigma x f_x = 165$ ,  $\Sigma x^2 f_x = 7593$ ,  $\Sigma x^3 f_x = 18,135$  and  $\Sigma x^4 f_x = 174,309$ .

In solving simultaneous equations of this type it is advisable to divide each equation through by the coefficient  $c_1$  and then eliminate this unknown from the set by subtraction. This process should be repeated for  $c_2$  and  $c_3$ .

The solution is

 $c_1 = -5.180514, c_3 = -8.163185, c_2 = -42.734192, c_4 = -50.510486.$ 

If we use  $\chi^2$  as the criterion for the goodness of fit, it is seen that a comparison somewhat favors the method of the difference equation.

Had we treated  $y_s$  as  $y_{11} = 0$ , the results would have been practically the same: the graduated frequencies for classes 17 and 18 would have been, to the nearest integers 45 and 141 instead of 44 and 142, all others remaining unchanged.

#### Example IV.

## Example IV. Distribution of Deaths of Males in the O. R. S. for the Years 1909, 1910 and 1911.

The recorded deaths, as shown in Plate III, together with the estimated population as of July, 1910, were used in the construction of the U. S. Life Table, smoothing being done by grouping the frequencies within quinquennial intervals and redistributing with the aid of fifth-degree osculatory interpolation.

A glance at Plate III clearly indicates that we are dealing with



a compound frequency distribution. We may assume that there exists a distribution of deaths due to causes that produce the recorded deaths at the higher ages, Series  $\alpha$ , and another which is responsible for additional deaths at the earlier ages, Series  $\beta$ . Without attempting to philosophize, I may point out that the range of his curve, ages 11 to 60 odd, may reflect on industrial and social conditions.

In our attempt to smooth these statistics, we shall further assume that all deaths after the age of 62 may be taken to belong to Series  $\alpha$ . This is, of course, rather arbitrary. A glance at Plate III shows that the end of Series  $\beta$  is somewhere between 50 and

## TABLE V.

Age Last	Ungraduated			
Birthday.	Deaths,	Total.	Series a.	Series <b>β</b> .
15	1.679	1.928.25	708.10	1.220.15
6	1.995	2.202.18	747.97	1,454.21
Ť	2.579	2,461.75	790 16	1.671.59
	2,990	2 707 14	834 81	1,872,33
i i	3,338	2 038 58	882.04	2 056 54
20	3 420	2,300.00	032.04	2,000.04
20	3 645	2 260 02	084 87	2 376 11
	3 062	2 559 70	1 040 77	2,570.11
4	2,271	2 729 01	1,000,80	2,011.00
o d	2,011	2 200 26	1 169 90	2,002.12
4	3,900	3,099.00	1,102.39	2,100.91
	4,170	4,000.40	1,228.44	2,820.79
p p	3,094	4,200.10	1,298.20	2,901.91
	4,100	4,334.03	1,3/1.98	2,902.07
l 8	4,000	4,459.20	1,449.84	3,009.42
9	3,920	4,574.58	1,532.03	3,042.55
30	4,998	4,681.17	1,618.75	3,062.42
	3,112 .	4,779.64	1,710.21	3,009.43
2	4,719	4,870.02	1,806.62	3,004.00
3	4,407	4,954.74	1,908.19	3,040.55
4	4,700	5,032.63	2,015.12	3,017.51
5	0,050	5,104.90	2,127.62	2,977.34
6	4,932	5,172.39	2,245.89	2,926.50
7	4,835	5,235.58	2,370.12	2,865.46
8	5,873	5,295.23	2,500.50	2,794.73
9	5,091	5,351.99	2,637.18	2,714.81
40	6,929	5,406.56	2,780.32	2,626.24
	4,505	5,459.60	2,930.03	2,529.57
2	5,848	5,511.77	3,086.42	2,425.35
3	5,182	5,503.73	3,249.54	2,314.19
4	4,809	5,616.10	3,419.41	2,196.69
5	6,801	5,669.50	3,596.00	2,073.50
6	4,937	5,724.52	3,779.22	1,945.30
1 7	5,332	5,781.69	3,968.91	1,812.78
8	6,077	5,841.53	4,164.85	1,676.68
9	5,/00	0,904.51	4,300.72	1,557.79
50	(,090	0,9/1.03	4,0/4.10	1,390.93
	5,205	0,041.47	4,780.48	1,254.99
	0,401	0,110,12	5,003.19	1,112.93
3	5,904	0,195.23	5,225.47	9/1.70
4	0,150	0,278.98	5,440.30	832.02
D C	0,810	0,007.04	0,010.19 E 00E 47	090.70
	0,304	0,401.02	0,090.47	000.00
	0,000	0,009.08	0,118.90	440.02
ð	6 994	6 772 07	0,009.00	020.04
9	0,224	0,113.01	0,000.00	194 71
	8,004 6 177	0,889.39	0,104.00	124.11
	0,111	7 159 44	0,904.77	49.00
4	7,100	1,100.44	1,100.04	
	7,204	1,321.00	7 484 08	
4	7,241	7,484.90	7,404.90	1
Ð	9,000	1,022.17	1,022.17	1

DISTRIBUTION OF DEATHS OF MALES IN THE O. R. S. FOR THE YEARS 1909, 1910, 1911.

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## TABLE V.—(Continued.)

Age Last	Ungraduated	Graduated Deaths.			
Birthday.	Deaths.	Total.	Series a.	Berles <b>\$</b> .	
6	7.072	7.736.19	7.736.19		
7	7,504	7.823.85	7.823.85	1	
8	7,902	7,881.95	7.881.95	İ	
9	7,436	7.907.41	7,907.41		
70	8,767	7.897.28	7.897.28		
1	6,861	7.848.88	7.848.88		
<b>2</b>	7,769	7,759.92	7,759.92		
3	7,659	7,628.61	7.628.61		
4	7,224	7,453.79	7,453.79		
5	7,911	7.235.06	7.235.06		
6	7,001	6.972.91	6.972.91		
7	6,427	6,668.83	6,668.83		
8	6,469	6,325.33	6.325.38		
9	5,814	5,946.27	5.946.27		
80	5,777	5,536.33	5,536.33		
1	4,750	5,101.48	5,101.48		
<b>2</b>	4,667	4,648.60	4.648.60		
3	4,319	4,185.37	4.185.37	l i	
4	3 911	3,719.96	3,712.96		
5	3,417	3,260.79	3.260.79		
6	2,925	2.816.12	2,816.12		
7	2,379	2,393.67	2,393.67		
8	1,972	2,000.25	2,000.25		
9	1,588	1,641.39	1.641.39		
90	1,360	1,321.10	1,321.10		
· 1	972	1,041.67	1,041.67		
2	741	803.663	803.663		
3	549	609.950	609.950		
4	378	445.970	445.970		
5	284	320.028	320.028		
6	188	223.679	223.679		
7	155	152.127	152.127		
8	91	100.597	100.597		
9	81	64.6394	64.6394		
100	49	40.3431	40.3431		
1	25	24.4539	24.4539		
2	22	14.3984	14.3984		
3	17	8.23918	8.23918		
4	12	4.58610	4.58610		
5	10	2.48616	2.48616		
6	6	1.31478	1.31478		
7	3	.679630	.679630		
8	5	.344192	.344192		
9	3	.171226	.171226		
110	5	.0839097	.0839097		

#### DISTRIBUTION OF DEATHS OF MALES IN THE O. R. S. FOR THE YEARS 1909, 1910, 1911.

70, assuming that the balance of the distribution belongs to a single curve. Since the ordinates at 62 and 63 appear to be closer to this curve than the others, because of the well-known systematic errors in statements regarding ages, this limiting section was chosen. I have found that it is possible to choose any point between 50 and 70, which is approximately on Series  $\alpha$ ; what is gained or lost on one series is made up on the other.

Taking the number of deaths at age 62-63 as  $f_r$ , and choosing age 94- as one provisional origin, we obtain by means of equations I and II the following difference equation

$$\frac{y_{x+1}}{y_x} = \frac{x^2 - 30.616x + 589.440}{x^2 - 21.439x + 821.405}.$$

The result of the graduation is the portion of Series  $\alpha$  falling after age 62.

By calculating values of  $y_x/y_{r+1}$  for ages less than 62, the remainder of Series  $\alpha$  is easily obtained. Taking the provisional origin at age 35—, the difference equation of the rough residual Series  $\beta$  must now be taken as

$$\frac{y_{x+1}}{y_x} = \frac{(x+c_1)(x-26)}{x^6 + c_2 x + c_3}$$

in order to effect a union of the two curves at the proper point. Where systematic errors are not present, the data is generally able to provide this point of union itself, but in problems where such large variations occur (the last three terms of the rough residual series are -332, +1,739 and -788) this must be provided for by the introduction of the proper factor. Incidentally, we are able to proceed now with but three moments instead of four. The elimination of this higher moment,  $\Sigma x^4 f_x$ , with its high probable error, is somewhat in our favor.

We proceed as follows:

$$\frac{y_{x+1}}{y_x} = \frac{x^2 - 26x + c_1(x - 26)}{x^2 + c_2 x + c_3},$$

$$c_{1}(\Sigma xy_{x} - 26\Sigma y_{x}) - c_{2}\Sigma xy_{x+1} - c_{3}\Sigma y_{x+1} = \Sigma x^{2}y_{x} + 26\Sigma y_{x},$$

$$c_{1}(\Sigma x^{2}y_{x} - 26\Sigma xy_{x}) - c_{2}\Sigma x^{2}y_{x+1} - c_{3}\Sigma xy_{x+1} = \Sigma x^{3}y_{x} + 26\Sigma xy_{x},$$

$$c_{1}(\Sigma x^{3}y_{x} - 26\Sigma x^{2}y_{x}) - c_{2}\Sigma x^{3}y_{x+1} - c_{3}\Sigma x^{2}y_{x+1} = \Sigma x^{4}y_{x} + 26\Sigma x^{2}y_{x},$$

# GRADUATION OF FREQUENCY DISTRIBUTIONS.

### TABLE VI.

### REGRADUATION OF THE U. S. LIFE TABLE FOR MALES IN THE O. R. S. BY THE METHOD OF COMPOUND CURVES.

Age	Fisher's Graduation- 10 Curves	Life Table	Present Graduation—	Graduated Deaths.		15.
	(Modified Radix).	Ungraduated.	2 Curves.	Total d <sub>z</sub> .	Series a.	Series <b>\$</b> .
Age 20 12 34 56 78 90 12 78 90 12 78 90 12 78 90 78 78 90 77 78 90 77 78 90 77 78 90 77 78 90 78 78 78 78 78 78 78 78 78 78	Graduation- 10 Curves (Modified Radix). 78,792 78,445 78,082 77,704 77,313 76,906 76,484 76,046 75,590 75,116 74,627 74,619 73,592 73,045 72,477 71,646 71,280 70,653 70,006 69,340 68,652 67,944 67,216 66,464 65,689 64,891 64,065 63,208	Life Table Ungraduated. 78,792 78,396 77,974 77,543 77,110 76,675 76,237 75,794 75,339 74,867 74,867 74,378 73,872 73,344 72,792 72,215 71,614 70,988 70,341 69,676 68,995 68,297 67,583 66,850 66,850 66,096 65,319 64,518 63,689 62,833	Present Graduation- 2 Curves. 78,792 78,395 77,987 77,568 77,138 76,696 76,294 75,774 75,294 74,201 74,294 73,773 73,237 72,686 67,2119 71,535 70,316 69,679 69,023 68,347 67,648 66,928 66,184 65,415 64,619 63,796 63,796	Total $d_{\pm}$ . 3,967 4,079 4,189 4,305 4,422 4,544 4,671 4,800 4,933 5,071 5,359 5,511 5,671 5,835 6,005 6,183 6,369 6,562 6,766 6,980 7,205 7,441 7,692 7,955 8,233 8,529 8,841	$\begin{array}{r} \text{Series a.} \\ \hline 209 \\ 232 \\ 257 \\ 286 \\ 317 \\ 352 \\ 391 \\ 435 \\ 483 \\ 537 \\ 596 \\ 662 \\ 736 \\ 818 \\ 909 \\ 1,010 \\ 1,122 \\ 1,246 \\ 1,383 \\ 1,535 \\ 1,703 \\ 1,889 \\ 2,094 \\ 2,321 \\ 5,385 \\ 2,843 \\ 3,144 \\ 3,472 \end{array}$	Berles β. 3,758 3,847 3,932 4,019 4,105 4,192 4,280 4,365 4,450 4,534 4,617 4,697 4,775 4,853 4,995 5,061 5,123 5,179 5,231 5,277 5,316 5,347 5,385 5,389 5,385 5,369
78901234567896123456789	63,208 62,322 61,400 60,443 59,441 58,397 57,306 56,161 54,962 53,706 52,394 51,016 49,581 48,086 46,528 44,913 43,243 41,524 39,756 37,946 36,102 34,229 32,333	62,833 61,951 61,046 60,118 59,167 58,189 57,170 56,099 54,970 53,773 52,505 51,173 49,787 48,343 46,842 45,285 43,669 41,993 40,264 38,490 36,676 34,824 32,938	62,943 62,059 61,142 60,189 59,200 58,171 57,100 55,986 54,826 53,617 52,358 51,046 49,679 48,257 46,778 45,241 43,647 41,995 40,289 38,530 36,722 34,869 32,977	8,841 9,173 9,524 9,896 10,288 10,704 11,143 11,604 12,087 12,593 13,120 13,663 14,224 14,793 15,368 15,943 16,512 17,064 17,592 18,083 18,528 18,918 19,238	3,472 3,832 4,224 4,651 5,113 5,614 6,734 7,354 8,015 8,715 9,453 10,226 11,030 12,709 13,569 14,429 15,278 16,886 17,614 18,266	5,369 5,341 5,300 5,245 5,175 5,090 4,870 4,733 4,578 4,473 4,578 4,210 3,998 3,763 3,234 2,943 2,635 2,314 1,642 1,304 972
# TABLE VI.--(Concluded.)

Age.	Fisher's Graduation- 10 Curves (Modified Radix).	Life Table Ungraduated.	Present	Graduated Deaths.		
			Graduatio:) 2 Curves.	$Total d_x.$	Series a.	Series ß.
$\begin{array}{c} 701234567898123456789900123456789900123456789900123456789900000000000000000000000000000000000$	Radix). 30,425 28,516 26,609 24,711 22,838 20,996 19,197 17,452 15,766 14,157 12,620 11,168 9,808 8,550 7,389 6,331 5,374 4,517 3,756 3,092 2,515 2,022 1,605 1,253 9,64 730 541 393 280 193 129 83 51 30 17 9 9 4 1	$\begin{array}{c} 31,023\\29,087\\27,134\\25,165\\23,188\\21,213\\19,246\\17,311\\15,438\\13,648\\11,942\\10,322\\8,804\\7,413\\6,165\\5,059\\4,093\\3,263\\2,562\\1,978\\1,502\\1,121\\4,17\\289\\196\\130\\84\\53\\33\\19\\111\\6\\3\\3\\2\\1\end{array}$	$\begin{array}{c} 31,055\\ 29,105\\ 29,105\\ 27,139\\ 25,165\\ 23,188\\ 21,210\\ 19,248\\ 17,320\\ 15,443\\ 10,301\\ 1,918\\ 10,301\\ 1,918\\ 10,301\\ 8,800\\ 7,424\\ 6,182\\ 5,076\\ 4,103\\ 3,273\\ 2,567\\ 1,980\\ 1,501\\ 1,117\\ 815\\ 585\\ 412\\ 284\\ 192\\ 127\\ 833\\ 53\\ 33\\ 20\\ 12\\ 7\\ 4\\ 2\\ 1\\ 1\end{array}$	$\begin{array}{c} 19,485\\ 19,653\\ 19,743\\ 19,769\\ 19,781\\ 19,621\\ 19,283\\ 18,761\\ 19,283\\ 18,761\\ 18,060\\ 17,191\\ 16,169\\ 15,015\\ 13,757\\ 12,425\\ 11,057\\ 9,684\\ 8,343\\ 7,064\\ 5,873\\ 4,792\\ 3,835\\ 3,007\\ 2,310\\ 1,737\\ 1,278\\ 920\\ 647\\ 446\\ 300\\ 198\\ 127\\ 80\\ 50\\ 30\\ 18\\ 10\\ 6\\ 3\\ 2\\ 1\end{array}$	a. 18,827 19,276 19,276 19,769 19,769 19,781 19,621 19,283 18,761 18,060 17,191 16,169 15,015 13,757 12,425 11,057 9,684 8,343 7,064 5,873 4,792 3,835 3,007 2,310 1,737 1,278 920 647 446 300 198 127 80 50 30 18 10 6 3 2 1	β. 658 377 147

REGRADUATION OF THE U. S. LIFE TABLE FOR MALES IN THE O. R. S. BY THE METHOD OF COMPOUND CUEVES.

The difference equation,

$$\frac{y_{x+1}}{y_x} = \frac{x^2 - .56149x - 661.40128}{x^2 - 3.14933x - 672.89232}$$

is the result of a simultaneous solution.

The lack of red tape involved resulting through application of the finite calculus is brought out by the above. GRADUATION OF FREQUENCY DISTRIBUTIONS.

I regret that I cannot agree with Mr. Fisher's "Note on the Construction of Mortality Tables," *Proc.*, Vol. IV, to the extent that it is possible to construct mortality tables from only records of deaths.

If we add the graduated deaths of Table V backwards, we will produce a series that approximates the  $l_x$  column of a mortality table. I believe this sort of thing could be done for a community which enjoyed a stationary population, and also not affected by immigration or emigration, but only in such an event.

However, we can graduate the populations as we just did the deaths and compute values of  $q_x$  by means of the formula

$$q_z = \frac{d_x}{L_x + \frac{1}{2}d_x}.$$

In order to bring out the fact that a graduation of the  $d_x$  column may be performed by breaking it up into but two curves, Table VI and Plate IV are added—showing the results obtained by the pro-



Plate IV.

posed method compared to the actual values as shown in the Life Tables prepared by Professor Glover and the regraduated values as computed by Mr. Fisher by means of ten compound curves.

# SECTION V.

In conclusion I wish to bring out certain points bearing upon the systems devised by Pearson and Charlier which are, unfortunately and incorrectly, considered by many to be radically different, both as regards philosophic basis and effectiveness. If we integrate Pearson's differential equation in the modified form

$$\frac{1}{y}, \frac{dy}{dx} = \frac{a-x}{b_0}$$

we obtain as a solution the Gaussian or normal curve of error

$$y = \varphi_x = \frac{1}{\sigma \sqrt{2\pi}} e^{-\frac{(x-b)^2}{\sigma 2^2}}.$$

This curve, obviously symmetrical, graduates with a considerable degree of satisfaction, many distributions possessing but slight skewness.

To take care of skew distributions a function f(x) is introduced in the differential equation, as before stated, giving

$$\frac{1}{y} \cdot \frac{dy}{dx} = \frac{a-x}{b_0 \cdot f(x)} \text{ or }$$

$$\frac{1}{y} \cdot \frac{dy}{dx} = \frac{a-x}{b_0 + b_1 x - b_2 x^2 + b_3 x^3 + \cdots}.$$

Charlier's Type A curve is given, on the other hand, as

$$y = A_0 \varphi_{(x)} + A_3 \varphi_{(x)}^{\text{III}} + A_4 \varphi_{(x)}^{\text{IV}} + A_5 \varphi_{(x)}^{\text{V}} + \cdots,$$

where  $\phi(x)$  is the same symmetric function that we obtained above from Pearson's differential equation

$$\frac{1}{y}\cdot\frac{dy}{dx}=\frac{a-x}{b_0}.$$

The type A curve is identically equivalent to

$$y = \phi_{(x)} \{ 1 + a_3 [(x-b)^3 - 3c(x-b)] + a_4 [(x-b)^4 - 6c(x-b)^2 + 3c^2] + \cdots \},\$$

which may in turn be written as

$$y = \phi_{(x)}f(x) = \phi_{(x)}[b_0 + b_1x + b_2x^2 + b_3x^3 + \cdots].$$

In effect, then, the basis of Pearson's system, and Charlier's Type A curve is the same symmetrical function  $\phi_{(x)}$ . Skewness is taken care of in *each* case by the introduction of an UNKNOWN function f(x) which is represented as the converging power series  $b_0 + b_1 x + b_2 x^2 + \cdots$ . In one case this is introduced in the differential equation of the graduating curve—in the other, in the curve itself.

The basis of Charlier's Type B curve

$$y = B_0 \psi(x) + B_1 \Delta \psi(x) + B_2 \Delta^2 \psi(x) + \cdots$$

is

$$\psi(x) = \frac{e^{-m}m^x}{|x|},$$

whose difference equation, from a fixed origin is

$$\frac{y_x}{y_{x+1}} = \frac{x+1}{m} \qquad \text{or} \qquad \frac{\Delta y_x}{y_{x+1}} = \frac{(m-1)-x}{m}.$$

this is of the type

$$\frac{\Delta y_x}{y_{x+1}}=\frac{a-x}{b_0},$$

which is quite similar to the corresponding difference equation of this paper.

Again, we might generalize the above by introducing a function f(x) in the difference equation, giving

$$\frac{\Delta y_x}{y_{x+1}} = \frac{a-x}{b_0+b_1x+b_2x^2+b_3x^3+\cdots}.$$

Neglecting the terms involving the third and higher powers of x we have our difference equation

$$\frac{y_{x+1}}{y_x} = \frac{x^2 + c_1 x + c_2}{x^2 + c_3 x + c_4}.$$

Therefore we have in effect modified the basic curve  $y = \psi(x)$ by introducing a function f(x) in the difference equation. Charlier's Type B curve introduces f(x) in the curve (or rather series) itself since the Type B curve can be written as

$$y = \psi(x)f(x) = \psi(x) [b_0 + b_1x + b_2x^2 + b_3x^3 + \cdots].$$

# LEGAL NOTES.

## BY

# RICHARD FONDILLER

# (OF THE NEW YORK BAR).

# ACCIDENT AND HEALTH.

SOLELY THROUGH EXTERNAL, VIOLENT OR ACCIDENTAL MEANS: ----(Aetna Life Ins. Co. vs. Ryan, U. S. Circuit Court of Appeals, 255 Fed. Rep. 483.) The deceased had an accident policy in the defendant company. The beneficiary had recovered a judgment against the defendant upon the theory that the insured had sustained injuries effected solely through external, violent, or accidental means.

Upon appeal from the judgment, the court found that the evidence tending to prove the accident, if any, was inadmissible upon technical grounds. However, if it were admissible, and the accident had been proved beyond doubt, the defendant could not recover. It was clearly established not only that the deceased was suffering from advanced arteriosclerosis, but also from two other serious diseas is. The court reversed the judgment and restated the principle you rning this class of cases as follows:

"The burden of proof rested on the plaintiff to establish the fact that the insured sustained an accident and that there could be no recovery upon the policy of insurance unless that accident was the sole cause of his death, as the policy insured him against a death 'resulting, directly and independently of all other causes, from bodily injuries effected solely through external, violent and accidental means.' The cases establish the principle that, if death results from disease or a bodily infirmity, there can be no recovery under such a policy whether the insured suffered an accident or not. And they also show that there can be no recovery if the insured sustained an accident but at the time it happened was afflicted with a pre-existing disease, but his death was caused because the accident aggravated the effects of the disease or the disease aggravated the effects of the accident." BREACH OF WARRANTY: --- (Campbell vs. Maryland Casualty Co., U. S. Circuit Court of Appeals, 255 Fed. Rep. 437.) The plaintiff's accident policy provided an indemnity "if such injuries shall, independently and exclusively of all other causes, continuously and wholly disable and prevent the insured from performing any and every kind of duty pertaining to his occupation." The policy had been renewed and the renewal receipt continued the policy in force on condition the warranties were true. The 'plaintiff entered a claim for total disability on account of an injury to his lip, and the defendant contested the claim on the ground that the injury was not the sole cause of disability.

From a careful study of the evidence of the medical experts, the court concluded the insured's lip was in a cancerous condition, which had been undeniably treated for several months prior to the date of the policy. The policy included a copy of the application and provided that the statements made in the application were warranted to be true. The insured warranted in his application that he had not received medical attention within the last two years, and the court held that the breach of this warranty was sufficient to defeat the claim.

The policy contained the following provision:

"An agent has no authority to change this policy, or to waive any of its provisions, nor shall notice to any agent or knowledge of his or any other person be held to effect a waiver or change in this contract, or any part of it. No change whatever in this policy, and no waiver of its provisions, shall be valid unless an indorsement is added hereto, signed by the president or secretary of the company, expressing such change or waiver. In any matter relating to this insurance no person, unless duly authorized in writing, shall be deemed the agent of this company."

The insured testified he had told the defendant's general agent prior to the issuance of the policy that his lip had been under treatment; further, that he had repeated these remarks to the general agent's employee when the renewal receipt was delivered.

The following extract from the court's opinion is decisive:

"The above quoted provision negatived the existence of authority in either of those persons to change the policy, or to waive any of its provisions, and stipulated against notice to them having the effect of a waiver or change in the contract. Embodied in that provision was the stipulation that: "'No change whatever in this policy, and no waiver of its provisions, shall be valid unless an indorsement is added hereto, signed by the president or secretary of the company, expressing such change or waiver.'

"There was no such indorsement. The defendant, like any other principal, could limit the authority of its agents, and thus bind all parties dealt with to whom such limitation was disclosed. An insurer cannot be deemed to have waived a breach of a warranty contained in its policy, because its agent had notice or knowledge of the breach, where the policy expressly withheld from such agent authority to change the policy, or to waive any of its provisions, and provided that notice to such agent or knowledge of his should not be held to effect a waiver of the contract or any part of it."

TOTAL DISABILITY:---(United States Casualty Co. vs. Perryman, Supreme Court of Alabama, 82 S. Rep. 462.) The plaintiff's accident policy contained the following clauses:

"(a) Continuous disablement and inability from date of accident to perform any and every business duty or occupation—hereinafter called total disablement.

"(b) Continuous disablement and inability (either from date of accident or immediately following a period of total disablement) to perform one or more but not all of the material duties of business or occupation—hereinafter called partial disablement."

The plaintiff received an accidental injury, but unaware that it was serious, went to his office and performed part of his duties as a salesman. He was later compelled to desist from working. The court construes clause (b) above to mean that no indemnity is payable for total disability if it follows a period of partial disability, because the total disability must run continuously from the date of accident. After a consideration of the medical evidence, the court finds that the insured made an error in judgment in attempting to work and that there was a condition of total disability existing continuously. Quoting from the opinion:

"The meaning of provisions (a) and (b) of the policy is not that the injury or accident which shall entitle the insured to be paid as for a total disability shall be such as to render it physically impossible for him to perform or discharge any of the duties of his business or employment. Total disability may exist though it is physically possible for insured to perform occasional acts as part of his employment or business. It is not necessary that the injury or accident shall be such as to make it absolutely necessary that insured stay in his room, home or hospital during the entire period for which he claims total disability. . . ."

"The fact that insured received wages from his employer during the period of time for which he claimed total disability did not of itself preclude his right to recover as for such total disability. If the accident and injury insured gainst was such as to entitle the insured to recover as for total disability, it was no concern of the insurance company that the employer of the insured continued to pay a part or the whole of the wages due the insured during the period of total disability. Of course, the policy could have provided that the insured should not be entitled to receive or recover from the insurance company except what he lost in the way of wages, or salary, during the periods of disability, but this policy did not so provide. . . ."

"It appears that two separate notices were given the insurance company by the insured, and that no objection was then made as to the sufficiency of either; but the company declined to recognize liability as for any amount. That is, there was ample evidence to carry these questions to the jury, and they were properly submitted. As we have before stated, the fact that the first notice and claim as for loss was for a much shorter period of total and partial disability than the last was not conclusive against the right to recover as for the period specified in the last claim. There was no element of estoppel. The insurance company did not act upon the first claim to its detriment or injury. It seems to have denied all liability. If it had accepted the first claim and settled therefor, then that might have precluded the plaintiff from claiming as for a total disability thereafter; but it is not shown that the insurance company took any action on this claim further than to ignore it and deny all liability.

"We find no error in this record prejudicial to the defendant company, and hence the judgment appealed from in favor of the plaintiff must be affirmed."

DISEASE: ---- (Clarke vs. New Amsterdam Casualty Co., Supreme Court of California, 179 Pac. Rep. 195.) The insured's policy was payable in the event of "loss of life . . . from bodily injuries, . . . which independently of all other causes are effected solely and exclusively by accidental means. . . . Nor shall the company be liable for any loss caused or contributed to by illness or disease." The insured was struck by an automobile across the stomach and was seriously injured about the head. The injury to his stomach resulted in an operation for appendicitis being performed. A few days later he died of heart disease. The defendant company denied liability and suit was brought by the plaintiff (beneficiary).

Quoting from the opinion:

"The court below instructed the jury that if disease plays a part in the death of an assured person after an accident, it is essential to recovery that such disease was due to the accident. . . . The jurors were also given the following instructions:

"'Under the terms of this policy plaintiff cannot recover for the death of James T. Clarke, unless that death was caused by accidental means, and solely and exclusively by such means, independently of other causes. . . If you shall find that death was caused in part by heart disease, and that this heart disease was not in fact caused by this accident, your verdict must be for the defendant. . . If you shall be in doubt whether this accident caused either appendicitis or the heart disease, your verdict must be for the defendant.'

"These instructions substantially stated the rule governing such cases, and therefore the problem before us is whether or not there is substantial evidence to support the verdict in view of the court's charge."

The court after analyzing the evidence concludes that both the appendicitis and heart disease were induced by the accident. It finds that the jury was amply justified in holding that the proximate cause of the insured's death was concussion of the brain due to the accident. The judgment in favor of the plaintiff was affirmed.

SUICIDE:---(Scales vs. National Life & Accident Ins. So., Supreme Court of Missouri, 212 S. W. Rep. 8.) It was admitted that the insured committed suicide by drinking poison, and this suit was brought by the beneficiary of his accident policy to recover the face amount. The policy provided for the face amount to be payable in the event of death by accident, and one-fifth of the face amount in the event of death from poison or disease. There was no evidence as to whether the insured was sane or insane at the time. The famous Missouri suicide law reads as follows:

"In all suits upon policies of insurance on life hereafter issued by any company doing business in this state, to a citizen of this state, it shall be no defense that the insured committed suicide, unless it shall be shown to the sutisfaction of the court or jury trying the cause, that the insured contemplated suicide at the time he made his application for the policy, and any stipulation in the policy to the contrary shall be void."

This statute was held to apply in the case of Logan vs. Fidelity & Casualty Co., 47 S. W. Rep. 948, which was decided by this court. In explanation of the Logan case, the court wrote in its opinion in this case: "It was agreed by the parties in the Logan case that the insured came to his death from 'external, violent and accidental means." It was also conceded that he committed suicide. In other words, it was conceded that it was a death by accident. The court here correctly held that an accidental death by suicide was covered by the accident policy, and that the statute applied and took away the defense of suicide. It did not hold or intimate that a suicide by a sane person was an accident or was covered by an accident policy."

The court restates the following well-established legal propositions, which had been affirmed by the United States Supreme Court:

"A policy of insurance against death by accident covers a death by suicide by a person who is at the time insane. In other words, death by suicide of an insane person is death by accident. . . Intentional self-destruction by a sane man is not an accident. . . On the question as to whether the insured was sane or insane at the time of committing suicide, the presumption is in favor of his sanity and the burden of proof is upon the one affirming the contrary."

The court concludes that the insured was of sound mind when he committed suicide. The court held that only one-fifth of the amount of the policy was payable. The following extracts from the opinion are given, in which the court attempts to limit the effect of the Logan case.

"The vital point in the Scales case is whether, under the statute, a policy of insurance against death by accident makes the company liable in case of the death of the insured by suicide while sane... The plain truth is that courts and counsel in all those cases (quoting several Missouri cases) proceeded on the theory that, under the Logan case, suicide by a sane person was an accident covered under an accident policy, an assumption absolutely without any foundation, as we have seen.

"Counsel for the beneficiary say:

"'This court, the Supreme Court of the United States, and our Courts of Appeals have held unequivocally and emphatically that the statute applies to policies such as the one in suit, and the courts' construction thereof has become a part of every policy since written.' "In answer to that assertion we say that this court has never

"In answer to that assertion we say that this court has never held that a suicide by a sane person was an accident covered by the accident clause of a policy. If our Courts of Appeals and the Supreme Court of the United States have been led to assume that the Logan Case so decided, we are not bound by their assumption. In the construction of a Missouri statute, where no federal question arises, this court is not bound by an opinion of the Supreme Court of the United States.

# LEGAL NOTES.

"During all these years since the decision of the Logan Case no one who has taken out an accident policy in this state has had any right to suppose that this court would, under any circumstances, go beyond the Logan Case in the construction of our statute."

SUICIDE:—(Wilkinson vs. Standard Accident Ins. Co., Supreme Court of California, 180 Pac. Rep. 607.) This suit was upon an accident policy, and the jury's verdict was that the insured had met death through accident and not by suicide. The court found sufficient evidence to sustain the jury's verdict, which it declined to disturb. There is a statutory presumption that a person is innocent of crime until the contrary is shown and therefore the court held as a matter of law that in the case at bar the presumption is against suicide and in favor of accident.

In his application, the deceased stated that he was a member of a firm, but in reality was an officer of a corporation of the same name. The defendant claimed that this misstatement avoided the policy, which was denied by the court because this policy did not contain any such provision.

On the question of authority of the defendant's Pacific Coast superintendent to waive proofs of loss, the court held that he was clothed with full authority by virtue of his broad powers generally. In affirming judgment for the plaintiff, the court wrote on the subject of proof of loss:

"Nor do we think that there is any merit in the argument that the averment in the complaint with reference to loss under the policy is insufficient. The allegation upon this subject recites that plaintiff gave to defendant complete oral proof of the facts and circumstances surrounding the death of insured, and that, though requested, defendant refused to furnish to plaintiff the blank form of proofs, and denied all liability upon the policy, and informed plaintiff that it was useless for her to make proof of loss. Such denial of liability constitutes a waiver of the condition requiring proof of loss."

# WORKMEN'S COMPENSATION.

PERMANENT TOTAL DISABILITY :---(Wabash Ry. Co. vs. Industrial Commission, Supreme Court of Illinois, 121 N. E. Rep. 569.) The claimant (plaintiff) was employed as a night watchman by the defendant railroad. Prior to entering this employment, he had lost his left arm. He suffered an injury arising out of and in the course of his employment, making it necessary to amputate his left leg. In affirming an award of compensation for permanent total disability, the court stated:

"The principal contention made by the defendant is that the circuit court erred in holding that it was liable to pay compensation for a total and permanent disability. The basis of this contention is that the loss of one leg does not constitute total disability. The plaintiff, Williams, contends, on the other hand, that the loss of his left leg, combined with the previous loss of his left arm, constitutes total permanent disability, and that the judgment of the circuit court is correct. This precise question has not arisen before in this state. It has arisen in other jurisdictions under compensation acts similar to our act. In Massachusetts and New York it has been held that under such circumstances the disability occasioned is total and permanent."...

"We are disposed to follow the reasoning of the Massachusetts court construing a statute quite similar to ours, and hold that this act applies where the loss of one of the members mentioned occurred previous to the employment, and the loss of the other occurred as the result of an injury arising out of and in the course of the employment. This, in our opinion, is the fair intent and meaning of the act. When Williams was employed by plaintiff in error, he had lost his left arm, and his capacity for work was to that extent impaired. He was employed to do work which could be performed by a man having but one arm, and he was paid upon that basis. By the loss of his leg such capacity as he had for work was entirely destroyed, and under the provisions of the act he was entitled to compensation for total permanent disability. Such a construction of the act works no hardship upon defendant. Williams was employed and paid as a man of limited capacity, and the compensation which defendant is required to pay is based upon the wages it was paying him as a man of limited capacity."

CONSTITUTIONALITY: --- (Middleton vs. Texas Power & Light Co., United States Supreme Court, 39 S. C. Rep. 227.) The plaintiff (Middleton) was injured in the course of his employment, refused to accept the compensation offered him under the Texas Workmen's Compensation Act, and sued his employer for damages. The employer set up the defense that it carried compensation insurance as required by the act, of which the employee had notice before bringing suit at common law. The plaintiff attacked the constitutionality of the Texas Act, but it was finally held valid by the Supreme Court of Texas. The plaintiff appealed the case to the United States Supreme Court.

Several extracts from the decision of the country's highest court

are given, since the judicial status of workmen's compensation laws generally are reviewed. The court affirmed the decision of the state court holding the act constitutional, also that plaintiff had no right of action and must accept compensation.

The first paragraph below is from the act.

"'The provisions of this act shall not apply to actions to recover damages for the personal injuries or for death resulting from personal injuries sustained by domestic servants, farm laborers, nor to the employees of any person, firm or corporation operating any railway as a common carrier, nor to laborers engaged in working for a cotton gin, nor to employees of any person, firm or corporation having in his or their employ not more than five employees.'

"Following the order adopted in the argument of plaintiff, we deal first with the contention that the act amounts to a denial of the equal protection of the laws. This is based in part upon the classification resulting from the provisions of the section just quoted, it being said that employees of the excepted classes are left entitled to certain privileges which by the act are denied to employees of the non-excepted classes, without reasonable basis for the distinction.

"Of course plaintiff, not being an employee in any of the excepted classes, can not be heard to assert any grievance they might have by reason of being excluded from the operation of the act. . . . But plaintiff sets up a grievance as a member of a class to which the act is made to apply.

"However, we are clear that the classification cannot be held to be arbitrary and unreasonable. The Supreme Court of Texas in sustaining it said:

"'Employees of railroads, those employers having less than five employees, domestic servants, farm laborers and gin laborers are excluded from the operation of the act, but this was doubtless for reasons that the Legislature deemed sufficient. The nature of these several employments, the existence of other laws governing liability for injuries to railroad employees, known experience as to the hazards and extent of accidental injuries to farm hands, gin hands and domestic servants, were all matters no doubt considered by the Legislature in exempting them from the operation of the act. Distinctions in these and other respects between them and employees engaged in other industrial pursuits may, we think, be readily suggested. We are not justified in saying that the classification was purely arbitrary.'

"There is a strong presumption that a Legislature understands and correctly appreciates the needs of its own people, that its laws are directed to problems made manifest by experience, and that its discriminations are based upon adequate grounds. The equal protection clause does not require that state laws shall cover the entire field of proper legislation in a single enactment. . . .

"The burden being upon him who attacks a law for unconstitutionality, the courts need not be ingenious in searching for grounds of distinction to sustain a classification that may be subjected to criticism. But in this case adequate grounds are easily discerned. As to the exclusion of railroad employees, the existence of the Federal Employers' Liability Act of April 22, 1908, applying exclusively as to employees of common carriers by rail injured while employed in interstate commerce, establishing liability for negligence and exempting from liability in the absence of negligence in all cases within its reach, and the difficulty that so often arises in determining in particular instances whether the employee was employed in interstate commerce at the time of the injury (quoting cases), reasonably may have led the Legislature to the view that it would be unwise to attempt to apply the new system to railroad employees, in whatever kind of commerce employed, and that they might better be left to common-law actions with statutory modifications already in force. . . .

"The exclusion of farm laborers and domestic servants from the compulsory scheme of the New York Workmen's Compensation Act was sustained in New York Central R. R. Co. vs. White, 243 U. S. 188, upon the ground that the Legislature reasonably might consider that the risks inherent in those occupations were exceptionally patent, simple and familiar. The same result has been reached by the state courts generally. Similar reasoning may be applied to cotton gin laborers in Texas; indeed, it was applied to them by the Supreme Court of that state, as we have seen. And the exclusion of domestic servants, farm laborers, casual employees, and railroad employees engaged in interstate commerce was sustained in Mathison vs. Minneapolis Street Ry. Co., 148 N. W. 71.

"The exclusion of employees where not more than four or five are under a single employer is common in legislation of this character, and evidently permissible upon the ground that the conditions of the industry are different and the hazards fewer, simpler, and more easily avoided where so few are employed together; the Legislature, of course, being the proper judges to determine precisely where the line should be drawn. Classification on this basis was upheld in Jeffrey Mfg. Co. vs. Blagg, 235 U. S. 571, and has been sustained repeatedly by the state courts.

"The discrimination that results from the operation of the act as between the employees of different employers engaged in the same kind of work, where one employer becomes a subscriber and another does not, furnishes no ground of constitutional attack upon the theory that there is a denial of the equal protection of the laws. That the acceptance of such a system may be made optional is too plain for question; and it necessarily follows that differences arising from the fact that all of those to whom the option is open do not accept it must be regarded as the natural and inevitable result of a free choice, and not as a legislative discrimination. They stand upon the same fundamental basis as other differences in the conditions of employment arising from the variant exercise by employers and employees of their right to agree upon the terms of employment.

"In recent years many of the states have passed elective workmen's compensation laws not differing essentially from the one here in question, and they have been sustained by well-considered opinions of the state courts of last resort against attacks based upon all kinds of constitutional objections, including alleged denial of the equal protection of the laws; usually, however, from the standpoint of the employer (quoting cases).

"Stress is laid upon the point that the Texas act, while optional to the employer, is compulsory as to the employee of a subscribing employer... It is fair to assume that all who remain in the employ of a subscribing employer, with notice that he has provided for payment of compensation by an authorized insurance company, will be bound by the provisions of the act.

"But a moment's reflection will show the impossibility of giving an option both to the employer and to the employee and enabling them to exercise it in diverse ways. The provisions of the act show that the legislative purpose is that it shall take effect only upon acceptance by both employer and employee. The former accepts by becoming a subscriber; the latter by remaining in the service of the employer after notice of such acceptance. And we see in this no ground for holding that there is a denial of the equal protection of the laws as between employer and employee. They stand in different relations to the common undertaking, and it was permissible to recognize this in determining how they should accept or reject the new system. . . . These and other considerations that might be suggested fully justified the legislative body of the state in determining that acceptance of the new system should rest upon the initiative of the employer, and that any particular employee who with notice of the employer's acceptance dissented from the resulting arrangement should be required to exercise his option by withdrawing from the employment. The relation of employer and employee being a voluntary relation, it was well within the power of the state to permit employers to accept or reject the new plan of compensation, each for himself, as a part of the terms of employment; and in doing this there was no denial to employees of the equal protection of the laws within the meaning of the Fourteenth Amendment. This disposes of all contentions made under the equal protection clause. . . .

"The law of master and servant, as a body of rules of conduct, is subject to change by legislation in the public interest. The definition of negligence, contributory negligence, and assumption of risk, the effect to be given to them, the rule of respondeat superior,

#### LEGAL NOTES.

the imposition of liability without fault, and the exemption from liability in spite of fault—all these, as rules of conduct, are subject to legislative modification. And a plan imposing upon the employer responsibility for making compensation for disabling or fatal injuries irrespective of the question of fault, and requiring the employee to assume all risk of damages over and above the statutory schedule, when established as a reasonable substitute for the legal measure of duty and responsibility previously existing, may be made compulsory upon employees as well as employers."

REMARRIAGE:—(Wangler Boiler & S. M. W. Co. vs. Industrial Commission, Supreme Court of Illinois, 122 N. E. Rep. 366.) The employer (defendant) had been paying compensation to the widow of one of its employees, his only dependent. The employer declined to pay her any compensation after her remarriage, since she was no longer dependent. As will be seen by the following extracts from the opinion, the court holds that the widow's compensation is not terminated by her remarriage, in the absence of express legislative enactment.

"Defendant, unless it is within section 3 (section 128) of the act, had the right to elect whether it would operate under the act. By operating under the act it became freed from the common-law or statutory liability for damages for injuries arising out of and in the course of the employment of its employees. The right to damages for death or injury of an employee, at common law or under the Personal Injuries Act, was a vested right. . . .

"Compensation under the act in question is analogous to and is to take the place of damages at common law and under the statute. While the right to compensation is not a subject of bequest of the beneficiary, but continues in the dependents of the beneficiary only in the manner provided by said act, yet such right to compensation, when determined according to law, is no less a vested right, and one that can be affected only by the act of the Legislature that gave it. . .

"The Workmen's Compensation Act contains no provision for the extinguishment of compensation where the widow of the deceased employee remarries, and we can see no reason, on principle, for reading such a provision into the act. We do not adopt the view of the counsel for defendant that the basis of the act is merely that of providing support through a 'period of adjustment,' but, as its title indicates, the act is based on the idea of compensation for death or injury arising out and in the course of the employment. The act is also based on the broad economic theory that such death or injury is an incident of industrial activity and production, and that compensation therefor is properly chargeable as a part of the cost of such activity and production. "The Legislature has the power to place limitations upon the rights of beneficiaries; but courts have no power to put a limitation upon a right legally given by the Legislature, unless by a fair construction of the act it can be said that such limitation was in furtherance of legislative intent. . . If an act on her part does not increase his liability, then obviously it is of no concern to him, as his liability has been fixed by law. There appears to be no more reason, in the absence of legislative provision therefore, for holding that remarriage of the widow would extinguish her compensation, than to hold that such result would follow in case she were to receive a legacy, or by her wits acquire a competency, within the period for which compensation is to be paid."

INTERSTATE COMMERCE:—(Callahan vs. Boston & M. R. R., Supreme Court of New Hampshire, 106 Atl. Rep. 37.) The defendant railroad was engaged in interstate and intrastate commerce and employed the plaintiff as a locomotive engineer. He received orders to assist in the transportation of an interstate train (which he carried out) and at the same time to return to a junction, where he was to receive further instructions. Upon his return trip to the junction, he was injured and he brought suit under the Federal Employers' Liability Act. From a judgment in plaintiff's favor, the defendant appealed upon the theory that plaintiff was not engaged in interstate commerce at the time of the accident. The court affirmed the judgment, and wrote:

"The question presented is whether the evidence warranted a finding that the plaintiff, at the time of the accident, was engaged in interstate commerce within the meaning of the Federal Employers' Liability Act, as construed by the Supreme Court of the United States. Counsel do not differ materially as to the test to be applied. If the act the servant was performing at the time of the accident was incident to interstate work, or if it was incident to a whole day's work which was partly interstate and partly intrastate, he is within the provisions of the act."

CIRCUMSTANTIAL EVIDENCE:--(Flucker vs. Carnegie Steel Co., Supreme Court of Pennsylvania, 106 Atl. Rep. 192.) The deceased employee worked from 6 P.M. to 6 A.M. at two pumping stations, separated by a small ravine, over which ran a railway trestle and a footbridge. On the day of the accident, he reported for work on time, then went home at 8 P.M. and remained there for two hours and left to return to work. He was not supposed to go home during working hours. The next morning his body was found in the ravine between the trestle and footbridge. The court upheld an award of compensation to the dependents of the employee. This case well illustrates the liberal tendencies of the courts, in not requiring formal affirmative proof to establish liability in workmen's compensation cases. Extracts from the opinion follow:

"The underlying findings in the present case, considering the circumstances, are reasonably full and explicit; and they by no means call for the conclusion, reached by the court below, that claimant's husband had abandoned his work for the night when he went to his house. On the contrary, the express finding of the referee is that Flucker subsequently 'left his home to go back to his place of work'; and other findings upon the record suggest that, considering the hour of departure from his residence, he must have reached defendant's plant in ample time to resume his usual occupation during his regular working hours. . . .

"We may add that, while the present conclusion, as to the manner of death, rests upon circumstantial evidence, there having been no eyewitnesses to the actual occurrence, yet this is by no means unusual. As recently stated by us, 'there were no eyewitnesses to the accident; but that situation is present in many cases where verdicts for the plaintiff have been affirmed.'"...

"Where no facts appear indicating anything to the contrary, it may be presumed logically that an employee at his regular place of service, during his usual working hours, is there in discharge of some duty incident to his employment; and, when the dead body of an employee is found on the premises of his employer, at or near his regular place of service, under circumstances fairly indicating an accidental death which probably occurred during the usual working hours of the deceased, the inference may fairly be drawn, in the absence of evidence to the contrary, that the employee was injured in the course of his employment. Such is the case at bar.

"Of course, the burden is always upon a claimant to prove his case, and the tribunal charged with the duty of finding the facts must weigh and consider all attending circumstances, in order to determine how far they should prevail against presumptions arising out of other facts favoring the claimant; but, when this coursehas been pursued, a controlling finding that an employee was killed in a particular manner, reasonably indicated by the circumstances shown in the underlying findings, cannot properly be held to be without support upon the record."

 a state of collapse, when he stated "he got hurt." He developed pneumonia and peritonitis, dying in a few days. There was some evidence from marks upon his body, indicating he may have met with an accident. The defendant claimed that death was due to natural causes, the deceased there having pneumonia.

The compensation law provides that the decision of the chairman of the Industrial Accident Commission shall be final as to all questions of fact. The court consequently accepted the commissioner's statement of the facts in the following discussion:

"" "The commissioner permitted witnesses to rehearse the story of the accident as told by the deceased. This was hearsay testimony, plainly inadmissible. But the allowance of hearsay evidence by the commissioner does not require this court to reverse his decree, unless such decree was in whole, or in part, based upon such incompetent testimony.

"Were the court convinced that hearsay influenced the decree, it would be required to sustain the appeal. We perceive, however, no sufficient reason for questioning the commissioner's statement that he made his finding of fact 'wholly disregarding the hearsay evidence."...

"There must be some competent evidence. It may be 'slender.' It must be evidence, however, and not speculation, surmise, or conjecture. While no general rule can be established applicable to all cases, certain principles are clear:

"If there is direct testimony which, standing alone and uncontradicted, would justify the decree, there is some evidence, notwithstanding its contradiction by other evidence of much greater weight.

"If the case must be proved wholly or in part circumstantially, and there is a dispute as to what the circumstances are, the determination of such dispute by the commissioner is final. It is for the trier of facts, who sees and hears witnesses, to weigh their testimony and without appeal to determine their trustworthiness.

"But the inferences which the commissioner draws from proved or admitted circumstances must needs be weighed and tested by this court. Otherwise it cannot determine whether the decree is based on evidence or conjecture.

"In other words, the court will review the commissioner's reasoning, but will not, in the absence of fraud, review his findings as to the credibility and weight of restimony."

The court affirmed the award of compensation, after an exhaustive review of the decisions of other jurisdictions. Some further extracts from the opinion follow: "Evidence that an existing disorder reaches the point of disablement during employment, of course, does not prove accidental or other injury arising out of such employment. It is sufficient however (assuming other elements proved), if by weakening resistence or otherwise an accident so influences the progress of an existing disease as to cause death or disablement."...

"The deceased might have left the foundry in the night in pursuit of his own affairs, received an injury, and found his way back. He might have been injured in the foundry while doing something for his own personal pleasure, entirely independent of his employment. These unsupported hypotheses are so improbable as to be almost negligible. From all the circumstances, the commissioner drew the inference that Mailman's injury was received while employed at the defendant's foundry and arose out of such employment. This inference is neither unnatural nor irrational.".

"When the employee dies at his post of duty, a presumption may reasonably be entertained that he was then performing his duty and engaged in the work for which he was employed, from which a causal relation between his employment and the accident may be inferred. The authorities with substantial uniformity support this conclusion."

MARITIME EMPLOYEE:---(Stewart vs. Knickerbocker Ice Co., Court of Appeals of New York, 123 N. E. Rep. 382.) An employce was injured while at maritime work and was awarded compensation by the New York State Industrial Commission. The defendant employer contested the award, citing the decision of the United States Supreme Court in Southern Pacific Co. vs. Jensen. (See Proceedings, IV, 351.)

The court calls attention to the closely divided vote in the Jensen case, tracing the course of that case in the state and federal courts. The effect of the Jensen decision was to deprive all state compensation acts of jurisdiction in maritime cases, which were held to be under exclusive federal control. The New York court holds, however, that in view of subsequent federal legislation, the state compensation act is valid in maritime cases, confirms the award and concludes its opinion as follows:

"The enactment by the states of Workmen's Compensation Acts has become very general. Public sentiment has justified and demanded the enactment of these statutes, as offering speedy and simple relief to injured workmen and their dependents, and as being a positive and decided step in the interest of industrial welfare and of better relation between employers and employes. In recognition of this widespread public sentiment, and realizing it is desirable that the states should be given power to enact and administer such statutes as these, the Congress, since the decision of the Jensen Case, has very materially modified the federal statute under which it was held that our decision in the latter case could not stand. It has amended this statute, so that it now saves from the jurisdiction of the federal courts 'to suitors in all cases the right of a common-law remedy when the common law is competent to give it, and to claimants the rights and remedies under the Workmen's Compensation Law of any state.'

"In view of the close division of opinion amongst the learned justices of the United States Supreme Court, involved in the decision of the Jensen Case, and in view of the concession made in the prevailing opinion that it was difficult to determine just how far the jurisdiction of the federal courts in maritime matters might be limited or affected by such legislation, we think that we are justified in assuming that the Congress has acted within its powers under the Constitution when, after due consideration, it has confided to the states the power to enact and enforce Workmen's Compensation Acts in respect of injuries received in the course of maritime employment. We think that it would be altogether an unjustifiable concession of lack of state jurisdiction in this field of compensation to injured workmen or their dependents, if, after this amendment by the Congress, we should hold that our statute was unconstitutional."

# MISCELLANEOUS.

AUTOMOBILE THEFT INSURANCE:—(O'Connor vs. Maryland Motor Car Ins. Co., Supreme Court of Illinois, 122 N. E. Rep. 489.) The plaintiff held a theft insurance policy in the defendant company covering his automobile. The automobile was stolen and the following day the plaintiff orally informed the agent of the loss and on the same day sent a letter to the agent with the facts. The next day the plaintiff called at the agent's office and offered to submit sworn proofs of loss, but the agent informed him that no additional proof was required because the plaintiff's letter had been received.

Several days later plaintiff tought another automobile. The policy provided that the defendant company could, at its option, replace the property within thirty days after it had received sworn proof of loss, which latter the court held was waived by the company through the acts of its agent. The policy also provided that there could be no abandonment of the property to the company and that losses were payable sixty days after the receipt of proofs. The stolen automobile was located more than sixty days after the agent had received the plaintiff's letter. The company thereupon refused to pay the loss, upon the ground that the stolen car had been recovered and that there could be no abandonment of the car. The plaintiff refused to accept the stolen car because it now belonged to the company and brought suit for the face of the policy.

The judgment was in favor of the plaintiff. It was held the option to replace the property within thirty days was waived by the acts of the company's agent. After notice had been given to the agent, sixty days had expired before the automobile had been found, under which circumstances the policy intended the loss to be payable. The abandonment clause was interpreted to mean that the owner could not abandon the property before the expiration of sixty days.

WAIVER IN PUBLIC LIABILITY INSURANCE:---(Syracuse Lighting Co. vs. Maryland Casualty Co., Court of Appeals of New York, 122 N. E. Rep. 723.) The defendant (casualty company) issued a public liability policy to the Electric Light & Power Company. While the policy was in force, the administratrix of one Hughes brought suit for damages on account of the latter's death, which suit was defended by the casualty company. Before the trial, the power company was merged with the lighting company (plaintiff herein) under the statute governing such procedure. The defendant was unsuccessful on appeal from the judgment recovered by the administratrix, and the lighting company was ultimately compelled to pay the judgment of \$10,534 in full, after suit had been brought against it which the casualty company refused to defend on the ground that it had only engaged to indemnify the power company.

The lighting company promptly proved to the defendant that the judgment had been satisfied and requested the defendant to refund the indemnity of \$5,000 provided in the policy issued to the power company. The defendant, through the manager of its claim division, declined to honor the claim, but declared its willingness in subsequent letters to the plaintiff to be convinced of its legal liability, which correspondence extended considerably beyond thirty days. The defendant's first contention was that it had no contractual relation with the plaintiff. Plaintiff then brought suit, whereupon the defendant secondly claimed (as a further defense) that the plaintiff's action was barred because the policy required suit to be brought within thirty days after the judgment had been satisfied. As to defendant's first contention, the policy provided that the written consent of the defendant company was required to effect an assignment of interest. While no such assignment was made, the court held that the statute authorizing the merger acted to protect the claims of creditors of the power company by making the lighting company liable therefor and that consequently the latter became subrogated to the rights of the power company.

Concerning the defendant's second contention, the court found that the correspondence constituted a waiver and said:

"To determine that defendant had not waived the provision of the policy as to the limitation of time and was not estopped from asserting the same as a defense would impute to it a fraudulent intent to lull the plaintiff into inactivity, induce it to continue negotiations until after the expiration of the 30 days, and thereby secure the opportunity to later interpose a defense which it considered impregnable. The conduct of defendant was such as to permit the trial justice to find that defendant, with full knowledge of all the facts and of its rights under the policy contract prepared by it, particularly the provision therein limiting the time within which an action against it should be commenced, did not intend to refuse to pay plaintiff the indemnity provided for in the policy or to urge any defense to an action to recover the same, save only the one stated by it, the non-existence of any contractual relation with plaintiff or a right in plaintiff to make a claim against it by reason of such policy, and to abandon its right to urge the particular defense of limitation of time, now sought to be enforced. The finding that such waiver was made estops defendant from now asserting the defense of limitation of time."

In affirming the judgment for \$5,000 in favor of the plaintiff, the court disposed of the last contention of the defendant in the following language:

"Counsel for defendant also urged that under paragraph 10 of the conditions annexed to the policy no waiver or estoppel could arise. The first part of that paragraph relates to the lack of power of an agent to waive any part of the contract. The second part reads:

"'No change whatever in this policy nor waiver of any its provisions shall be valid unless an endorsement is added hereto, signed by the president or secretary of the company at its home office, expressing such waiver or change.'

"The waiver or estoppel found in this case is not based upon any transaction with an agent of defendant, but rather with dealings

directly between plaintiff and defendant. The first letter of plaintiff . . . was addressed to the company at its home office in Baltimore, Md. The reply to the same was upon the letter paper of the defendant inscribed 'Maryland Casualty Company' and signed ... 'Manager Claim Division,' as was likewise every letter written by defendant to plaintiff relating to the question in difference. We may presume that the letter addressed to defendant was by proper authority delivered to the manager of the claim division for consideration and action; that such manager was empowered by virtue of his position or office and within the apparent scope of his authority to directly act upon the claim made by plaintiff and to allow or reject the same. If such power was delegated to him, he was not inhibited by the language of the condition quoted from waiving such condition, even though a specific mode of waiver was provided. If, on the other hand, his position was one of recommendation only, and the question was a payment of \$5,000 and interest or a litigation over the same, the presumption continues that his acts relating thereto were communicated to and approved by the officers of the defendant. The entire transaction between the parties was conducted at the home office of defendant. The plaintiff was justified in a belief that defendant would deal fairly and honestly with it, and we may presume from the facts in this case that defendant's intention was to so treat with plaintiff rather than, to commit an injustice or fraud, and to waive the provision of the policy as to limitation of time, which it was at liberty to do."

FIDELITY RENEWAL:--(Green vs. Interstate Casualty Co., U. S. Circuit Court of Appeals, 256 Fed. Rep. 81.) The defendant company issued a fidelity bond to a bank covering the bank cashier (McKinzie) by which it agreed

"'to make good and reimburse to the obligee, to the extent of ten thousand dollars, any and all pecuniary loss sustained by the obligee of money, securities, or other personal property in the possession of the principal, or for the possession of which he is responsible, by any act of dishonesty on the part of the principal in the discharge of the duties of his office or position as set forth in said statement referred to, amounting to larceny or embezzlement, and which shall have been committed during the continuance of this bond, or any renewal thereof, and discovered during said continuance, or within' a time specified."

**Prior** to the issuance of the bond, the bank warranted the truth of all statements and also of all subsequent statements in connection with the renewal of the bond. The bond was renewed several years by a continuation certificate; prior to the issuance of each certificate the president of the bank signed a statement to the effect that the cashier was not in default at the date of signature.

There was abundant evidence to prove that while the cashier was not in default at the date of the issuance of the fidelity bond, he had been in default at the time of each renewal. In holding that the defendant was only liable for the shortage accrued during the term of the original bond, the court stated:

"By the terms of each of the continuation certificates the obligation it evidenced was 'subject to all the covenants and conditions of said original bond heretofore issued, dating from the 1st day of October, 1910.' This resulted in making the covenants and conditions of the original bond parts of the renewal agreements as effectually as if they had been copied in the continuation certificates. It follows that each continuation certificate is to be regarded as containing the provision warranting the truth of the statement referred to in the original bond and of any subsequent statement or statements. That included a warranty of the truth of the statement made prior to and in contemplation of the issue of each continuation certificate. Each of these subsequent statements was false in its assertion, with reference to McKinzie, that 'he is not now in default.'

"The bank had notice from the terms of the original bond that it was issued in reliance upon statements made in its behalf to the surety company, and that, in the ordinary course, renewals, which the terms of the bond showed were in contemplation, might also be based upon further statements to be made on behalf of the bank. In view of these circumstances, and of the additional one that each continuation certificate expressly made the obligation it evidenced subject to the covenants and conditions of the original bond, one of the provisions of which was a warranty of the truth of the statement specifically referred to in the bond and of any subsequent statement, there is no room for holding the surety company bound by a continuation certificate issued on the faith of a statement which was warranted to be true, but was false in a respect material to the obligation which the surety company conditionally incurred."

NOTICE IN INDEMNITY INSURANCE:---(Haas Tobacco Co. vs. American Fidelity Co., Court of Appeals of New York, 123 N. E. Rep. 755.) The defendant issued to plaintiff a policy of automobile insurance, which required immediate written notice. One of plaintiff's automobiles hit a boy, who went away as if uninjured. An account of the accident having appeared in the newspaper, the plaintiff's manager questioned the driver of the automobile, who stated that the accident was not serious. The plaintiff made no

#### LEGAL NOTES.

further investigation, although it had been placed on notice. The defendant was informed of the accident about ten days later and denied liability because immediate notice had not been given. The boy secured a judgment against the plaintiff, upon which the latter brought suit to recover the amount of the judgment from the defendant herein.

The Court of Appeals affirmed the decision of the lower court dismissing the complaint. It appears that the court insists upon the fulfillment of the condition of immediate notice and distinguishes this case from the contemporaneus case of Melcher vs. Ocean Accident & Guarantee Corp., 123 N. E. Rep. 81, as follows:

"The Melcher case held that under a policy requiring immediate notice to the insurer of accidents insured against, the condition does not apply to every trivial occurrence, even though it may prove afterward to result in serious injury. If no apparent harm came from the mishap and there was no reasonable ground for believing at the time that bodily injury would follow, there was no duty upon the insured to notify the insurer. We held that a recovery was permissible."

"The circumstances in the present case require a different result. A boy struck the machine and was knocked down. True, the driver, who represented the plaintiff, believed he was only slightly hurt, for he walked away, and, in his opinion the accident didn't amount to much. But no investigation was made. There was no assurance by the person struck that he was uninjured. There was no opportunity by later observations of determining that he was not in fact injured. The plaintiff relied wholly upon the driver's opinion, an opinion which as subsequent events showed was a mistaken one.

"The ruling in the Melcher Case is not to be extended. Under the peculiar circumstances there disclosed, and in view of the full investigation made, it might fairly be said that a reasonable man was justified in believing the occurrence so trivial that no report was required. But where, as here, a boy is knocked down in the street, and at least slightly injured, the insured may not, without any investigation whatever, rely solely upon his own opinion or upon the opinion of his driver that because he went away the injury was too trivial to require attention."

# Abstract of the Discussion of the Papers Read at the Previous Meeting.

# WORK OF THE STATISTICS BRANCE, UNITED STATES ARMY-RALPH H. BLANCHARD.

## VOL. V, P/GE 274.

#### WRITTEN DISCUSSION.

#### MR. EDWIN W. KOPF:

Mr. Blanchard's paper is informing, because he has given in compact form the principal tables and plates which show the Army activities in the war with Germany. It may be of interest to our. members to know that, in addition to the data and diagrams given in this paper, there is also available for distribution a 154-page statistical summary entitled "The War with Germany."\* This document, compiled under the direction of Colonel Ayres, contains statistical materials which give a birds-eye view of American participation in the war. Both the paper by Mr. Blanchard and the booklet by Colonel Ayres are of interest to our members technically. They point this lesson to casualty statisticians and actuaries: we have been so accustomed to viewing statistics only as a base for the projection of experience, and for the description of mass phenomena more or less in the historical past, that we have lost sight of the uses of simple, although crude, statistical tables and diagrams in current administrative control work. Mr. Blanchard indicates in his opening paragraphs that very little historical material was available "to furnish a suitable basis for predicting the future." On the other hand, he emphasizes that there was needed, "a system of current information which would present a complete, vivid and compact picture of the progress and status of Army activities."

Do not the examples of non-mathematical, tabular and graphical practice, which Mr. Blanchard has selected with such good taste, suggest that we could apply the conceptions and methods of the statistics branch of the general staff to the current administrative statistics of insurance? Instead cf waiting until after the close of policy years, or until long after the annual statement has gone to press, could we not apply in insurance administration the prin-

\* "The War with Germany," by Leonard P. Ayres, Colonel, General Staff. Second edition, Govt. Printing Office, Washington, August, 1919.

ciples of collecting and graphically illustrating the statistics of events a few hours, or at the most a few days, after they have transpired? Would not the attractive display of salient, current statistics appeal with great force to the non-statistical and nonactuarial executives of insurance organizations?

If nearly all of the principal facts of the war with Germany can be concentrated into a small booklet by means of simple tables and informing graphs, could not the current tendencies of an insurance organization be illustrated in even smaller compass? Mr. Blanchard has shown how the Army used the most elementary statistical technique to "accelerate lagging or urgently needed work and . . . to indicate trends and relationships." Surely, there are practical business problems in insurance, other than those of rating and valuation, where the application of simple statistical technique to current facts and figures would insure greater efficiency and, consequently, better service for policyholders. It may be of interest to say that Colonel Ayres, before the war, was chairman of an interassociation committee on graphic statistics. It was the aim of this committee to outline standards of graphic procedure which would illuminate the figures ordinarily used by business executives. Now that the war is over, it is to be hoped that Colonel Ayres, Mr. Blanchard and their associates will continue the work of this committee so that American business, including insurance, may receive the benefits of "graphic control" which were afforded the General Staff of the Army.

Mr. Blanchard makes another point which is full of meaning for the practical insurance man. He mentions the lecture service of the statistics branch which kept the War Department executives, Congressional Committees and other groups constantly informed of current tendencies by means of wall charts, graphs, tables, etc. Ι should like to see Mr. Blanchard in his reply to this discussion go into a little more detail on the workmanship of the methods used to enlighten executives, especially the system of typewriting tables on one side of a two-sheet folder and presenting the illustrative graph on the opposite, facing side, etc. There were other practical points in connection with this general information service of the Statistics Branch which would be of value to insurance people in connection with the conduct of weekly, monthly, and other executive conferences. It would be of interest also if Mr. Blanchard would indicate in his reply the practical clerical methods used in drawing the graphs, bar diagrams and spot maps quickly. I noted in some of Colonel Ayres's charts that typewriting was used a good I know we shall all be glad to learn how these maps and deal. charts can be put together quickly and inexpensively, so that current facts can be given to executives very soon after the last figures have been put into tables.

# MR. HARRY LUBIN:

This paper on the "Work of the Statistics Branch, United States Army," although deviating from the usual topics of the *Proceedings*, is very timely and instructive and is especially interesting because it gratifies our natural desire to learn whether the statistician, as such, did his share behind the man behind the gun.

That he could be useful to the War Department we had not the slightest doubt. Statistics, if not a science, is at least a method by which the trained statistician can forecast the future by means of the past. The economist, the social scientist, the biologist, the modern leader in finance and industry, have resorted to statistics as their basis for their studies and as their guide in their inquiry into human affairs and their undertakings. An insurance company, for instance, has learned through experience that it could no more do without a statistical department than without a claim department or insurance agents.

The present paper well illustrates what statistics can do for the War Department, for in the last analysis, even the winning of a battle is a matter of chance and of probability. The number of combatants taking part, the amount of ammunition used, etc., are not its only determinants, and a properly organized and equipped statistical department would reduce to a minimum the uncertainties of factors like "surprise," "morale," and others which are weighty in deciding a victory.

It is therefore to be regretted that the need of a modern statistical service was not felt until recently, in an emergency at a time when events moved fast, when reflection had to give place to quick action and no extra time could be devoted to real preparation. But the encouraging sign of the times is that the chief executives of the Army thought it was advisable, indeed necessary, in this unparalleled struggle of balanced belligerents to turn to the statistician as their aid and guide in their military operations. And in spite of the difficulties mentioned, in face of the handicaps that there were no records to go by, no models to follow, the predominating feeling awakened by a careful perusal of the paper is an appreciation that the experts were equal to the task they were called upon to perform.

The diagrams exhibited here are only a small proportion of the whole, yet they deal with a variety of subjects of great importance and interest. They initiate us into the doings of the Army and give us a brief sketch of the history and progress of the War. The graphics used are well suited for the data at hand. They are clear, easy of comprehension, and tell the whole story at a glance. To the busy general, we can well imagine they were just what he needed. Without wasting any of his precious time, he had the whole picture of the campaign at his disposal. Without wading into a labyrinth of figures, he could learn at a glance what strength of divisions was available, number of troops embarked, number 7

discharged, number arrived from overseas, carrying capacity of troop transports, cumulative number of planes delivered and "floated" per month, beds in base hospitals, deaths from disease, submarines sunk, merchant tonnage sunk, etc.,—a veritable clearing house of important military statistical information epitomized and visualized. Such information to the chief executives of the Army must be of inestimable value in directing their campaign.

The criticism we would like to make of this paper is not of commission but of omission. The points we would like to raise are, first, that little of the so-called advanced statistics has been presented; the diagrams shown are mainly expository, there is very little of comparative statistics and nothing analytical or interpretative. Have the quantitative data, with their corresponding graphics, been presented to the military executives, to take or leave at their will, without any analysis or interpretation of them by the chief statistician?

Second, since the attempt to co-ordinate our activities with the efforts of the Allies was largely responsible for a centralized statistical system, it would be very interesting indeed to see some tables showing the activities, military operations and results of the Allies as compared with our own, whereby we could judge where we excelled or fell short of the mark. Especially helpful to us would have been such relative tables regarding cases of influenza and pneumonia. They would throw light on the question whether under-nourishment and fatigue were the most responsible factors in these diseases, as our armies were, supposedly, the better supplied with food, and fresher, surely, while they were trained in this country.

We appreciate that these were probably not available to Mr. Blanchard when his paper was prepared, but we sincerely hope that, if not in our *Proceedings*, at least elsewhere such data may be published for the information of the public and advancement in the application of statistical research.

Much progress has been made in many branches of statistics, like social statistics, registration statistics, and insurance statistics, and we shall therefore look forward to a great future in the development in military statistics.

#### EMMA C. MAYCRINK:

This paper brings before us a recent statistical accomplishment of exceptional interest. The tables which Mr. Blanchard has selected from the series of reports which were sent to various departments of the United States government during the war emphasize the importance of that branch of the army by which the movements of various parts of the gigantic war machine were synchronized and controlled. They also afford an interesting study of graphic methods as a means of statistical presentation. Mere columns of figures enumerating men or materials would have been deadly monotonous, requiring considerable effort to grasp the important details; a variety of diagrams served the purpose of arresting attention and vizualizing comparative results and significant trends.

Eminent statisticians warn us against the use of pictograms to present statistical data and this warning was apparently heeded by the government statisticians. Stress should also be laid, however, upon care in the choice of diagrams to illustrate the facts. If it is not possible to grasp the salient features at a glance the diagram becomes a puzzle picture and its purpose is defeated. Diagrams which are simplest in form are the most effective. For example, Plate I shows by means of heavy horizontal bars the relative strength of fifteen divisions in camps of the United States as compared with one another and with the total authorized strength. A table giving the actual numbers making up these divisions accompanies the chart, so that a more detailed study may be made if desired. In comparing quantities, a chart of this form is clear and is easily comprehended by any one.

In Plate III two graphs are plotted in the same chart showing discharges vs. arrivals from overseas by weeks. The graph is the most satisfactory method of reporting progress where time is necessarily one of the variables.

Plate VI gives the quantity production of De Havilland 4 Planes. Here we have again a time chart. Two graphs show clearly the relation of planes delivered and "floated" in the last part of the year 1918. The cumulative graph is placed below, giving the total output of the year.

In Plate XII the horizontal bars are used to show the surplus amount of clothing in the United States as at September 30, 1919 and the number of years this stock would maintain 500,000 men. The form of this chart is good with the exception of the figures placed at the right of the heavy bars. These figures could have been shown in a column at the left instead of at the right, thus avoiding any uncertainty as to the length of the bars.

The same fault is found in Flate XIV which illustrates transatlantic tonnage under army control by month and type. The figures at the right and the lines connecting the cross hatching are confusing. In fact, this is an example of a diagram in which too many details are given. The result is almost an optical illusion.

The other diagrams evidence care in preparation and are commendable both in point of utility and as a precedent for future use in presenting statistical reports of complex and highly organized enterprises.

#### MR. L. W. HATCH:

It has become a somewhat trite observation that in this last great war science played a far greater rôle than in any previous war. The way in which scientific men in nearly all lines were mobilized for service was a striking feature in all the countries involved. The services rendered by such men were not spectacular nor have they been much featured by publicity, but they were none the less important and useful.

Among the scientific professions much called upon for war work were the two represented in our membership and for that reason the paper by Mr. Blanchard, although treating of a subject rather outside the field of greatest natural interest to this society, was nevertheless not out of place, and it was certainly not lacking in general interest.

Except for two pages briefly outlining the circumstances under which the work was established and its general character the paper consists of a series of diagrams illustrative of the material furnished currently to the army authorities by the Statistics Branch. These diagrams are essentially narrative records of army activities or conditions and hardly call for discussion of their subject matter therefore. Consideration of the technique of the diagrams is in order, however. Concerning that there is occasion for little comment except commendation. No difficult technical problems of construction were indeed presented by the material to be graphically portrayed, all but one of the diagrams utilizing only simple bar or curve forms. If any question as to methods were to be raised the following which concern only minor points suggest themselves to the present writer.

In Plate III there is an undesirable difference in the plotting of the two curves, owing to the points on one being located upon the vertical lines of the cross sections while those on the other are located midway between those lines. There is nothing to suggest that this was necessitated by the nature of the data (though that may have been so) and the result is that the really accurate points on the curve are not comparable for the same date. In Plate VI the designation of the curves in the upper portion of the table by connecting the designating word to the curve with an arrow is hardly so effective as printing same along the curve as in the lower part of the plate, or as a separate "legend" like those in other plates, would be. Plate XVI is not immediately clear as to what it actually signifies. At first sight indeed it seems misleading by suggesting direct comparisons of quantities where such are impossible. This results from plotting two curves representing different things and drawn to different scales on the same cross section plate. As a matter of fact the only comparable elements in the two are directions and degrees of change in the two items set forth and these might have been more clearly and accurately displayed by a different method, that is, by reducing the figures to one common scale by means of index numbers and by using a plate with logarithmic horizontal rulings.

On the other hand, there is one point of technique which may

well be singled out for special commendation aside from the general commendation above. That is the way in which the diagrams are accompanied by or contain in themselves the actual data which they portray. In this respect these diagrams exemplify a sound general rule for all statistical diagrams and charts.

The present writer is moved to cite one fact noted by Mr. Blanchard as a text for one more remark not concerning his paper but concerning a too prevalent characteristic of statistical work in general. He points out that the work which he describes had to be started with "no ground work on which to build," owing to utter lack of any previous statistical work of the kind. How often it is that some emergency situation which makes evident the value of accumulated statistical records at the same time reveals just such a dearth of material, with the result that the new need can be met only with very limited and inadequate statistical evidence as compared with what would be available if only intelligent planning and continuous accumulation of such evidence in the past had laid the necessary foundation for the future. The moral of this is that spasmodic and piecemeal development of statistics, which has perhaps characterized statistical work more in this country than in some others, must give way to continuous and systematic development of work in each line, if statistical work is to attain the highest degree of scrvice. For the attainment of such indispensable current building for the future there is required of the statistician not only cultivation of his own prevision of future needs and values but also, what is much harder, cultivation of prevision in the so-called "practical man" who, especially when it comes to statistics, commonly knows what he wants after he wants it, but all too seldom knows what he is going to want before he wants it.

# AUTHOR'S REVIEW OF DISCUSSIONS.

## MR. RALPH H. BLANCHARD:

Mr. Kopf suggests that the statistical methods which have been used by the Army might be applied to current insurance problems. I believe that much of value could be done along these lines. Over a year ago, Mr. Frederick Richardson, addressing the Insurance Society of New York said: "... I am inclined to the opinion that it would be advisable ... to set up a department of values to gather statistical information bearing upon all changes in what might be termed the raw materials of the insurance business. Index figures could be worked out for a number of important phases of fire, accident and marine insurance which would be invaluable to underwriters in attempting to appraise the clanging hazards of the immediate future. Our ordinary statistical work in casualty insurance is of little use in this regard, being too belated; but admirable enough ultimately as a basis for final analysis. ... From day to day circumstances and conditions are a tering the terms of the problem."

Statistical work in insurance is largely directed toward the ascertainment of losses and expenses incurred in the past, while underwriters are concerned with present and future rates. Unquestionably statistics of past disbursements are the best guide to probable future disbursements, but they can be relied upon only to the extent that future conditions affecting losses and expenses are equivalent to those under which the statistics were produced. There is a need for further figures which will measure changes in underlying conditions and which may be used to modify the indications of accumulated insurance experience.

The development of an adequate method for the determination of such figures calls for considerable experimentation. First, a careful study is needed of relations between insurance experience and general economic conditions. Indices of these latter are numerous and are found in food prices, stock market prices, bank clearings, building activity, foreign exchange, strikes, etc. The difficult problems are to determine whether a changed condition in any one of these points to effective changes in insurance conditions and, if so, what the probable effect will be.

Recently an attempt has been made to relate the volume of life insurance to the general level of prices.\* It is evident that a relation between the two phenomena has been established and it seems not improbable that the relation is causal. If careful analysis should show this to be the case and if, by further analysis, a suitable basis for the predication of price levels should be achieved, there would be created an index of immense value to the life insurance executive.

The calculation of index numbers accurately reflecting specific economic conditions has been the subject of much thought and a great deal has been accomplished. In addition to perfecting these figures, it remains for the insurance statistician to construct "master" index numbers for each line of insurance which will measure the combined effect of underlying economic phenomena on the insurance business.

It is suggested that I explain the methods used by the Statistics Branch in preparing its reports. I shall use as an example the shipping report or "Weekly Report on Tonnage."

The raw material came to the Statistics Branch in the form of periodical (usually daily) reports from the operating branches of the army and from other organizations concerned with army shipping. This material was combined and analyzed, and each Thursday a photostated report of approximately thirty pages was issued.

\*Address by Philip Burnet, pußlished in Weekly Underwriter, Nov. 15, 1919.

 $\dagger$  A monthly report was also issued in which statistics covering the entire period of the war were presented and which contained records of less current interest.

The first three days of the week were given over to analysis and arrangement of material, using information which, in most cases, was up-to-date as of Monday. The greater part of this work consisted in the calculation of figures for the extension of standardized graphs and tables to cover current development, although it was attempted to include in each weekly report topics of special but not continuing interest. On Wednesday and Thursday figures and directions were ready for the drafting room where a trained force prepared tables and diagrams. Much time was saved by making use of those already constructed; adding to them whenever possible, instead of preparing new ones.

From the drafting room the material went to the photostat department where it was photostated and bound for distribution to the army executives, who thus had placed before them a report sufficiently up-to-date to serve as a check on accomplishment and as a basis for effective action.

These reports contained two parts; a three- or four-page "text summary" which stated concisely the particularly important developments of the week, and the more complete tabular and diagrammatic section. An executive with past facts in mind could inform himself on the more important matters by a glance at the text summary. If he desired to make a careful study of the situation he could turn to the body of the report.

The lecture service of the Statistics Branch continued up to the time of the Armistice. The lectures on shipping were given weekly and were attended by the Secretary of War, the Chief of Staff, and the heads of governmental activities which were particularly related to shipping problems. Diagrams were presented on bristol board, about two by three feet in dimensions. These were made the basis of a talk by the chief of the Shipping Section. During and after the lecture there was opportunity for questions and general discussion.

Reference has been made to the absence of coöperative or otherwise highly developed statistics. This was due partially to the fact that the Statistics Branch was in full operation for scarcely more than a year and partially to the necessity for preserving simplicity, clarity, and direct relation to operating problems.

For a summary of the information collected I second Mr. Kopf's reference to "The War with Germany."

# CASUALTY INSURANCE FOR AUTOMOBILE OWNERS-G. F. MICHELBACHER.

## VOL. V, PAGE 213.

#### WRITTEN DISCUSSION.

#### MR. SAMUEL DEUTSCHBERGER:

Mr. Michelbacher has furnished a comprehensive survey of conference forms and underwriting practices with an explanation of rate-making methods useful not only to the student but also so interestingly and lucidly written it may be read to advantage by automobile owners and others who may have an interest in the subject. My comments are few and they are principally confined to references which perhaps emphasize, as outlined by Mr. Michelbacher, the difficulties confronting the underwriters in their rating work.

In classifying pleasure automobiles for liability insurance, speed and weight were recognized as important elements. It seemed quite logical therefore to use the horsepower of the machine as the basis for such classification, the higher ratings being applied to the highpower cars. Quite recently, this system was abandoned for a classification depending upon manufacturers' list prices. In effect, the new classification still results in fixing the higher rates upon high-power cars and lower rates upon the low-power cars, and although the discarded Horse-power Classification seems to have reflected more accurately than the newer classification is simple and therefore to be preferred, more especially in view of the fact that the fire and marine companies had already adopted the same basis for grouping automobiles for the purpose of insuring them against the fire, transportation and theft hazards.

Incidentally, the new classification frankly imposes here and there the heavier premium charge on the more expensive cars even though no greater physical hazard may be involved. This is possibly justified on the theory that accidents are likely to result in larger claims and verdicts where people of wealth are concerned than would be the case on identical accidents involving persons of moderate means.

When the underwriter has disposed of his liability rating problems, he has virtually performed the greater part of the task required in fixing the Property Damage rates as the hazards to be considered seem to be the same in the one case as in the other.
### DISCUSSION.

Both in the old and in the newer classification scheme, the Property Damage rates follow closely the rates for Public Liability, the Property Damage rates being naturally much less than the Public Liability rates. The standard limits for liability insurance are \$5,000 for injury sustained by one person and \$10,000 as respects injuries sustained by more than one person in one accident as compared with the standard limit of \$1,000 for Property Damage insurance. That serious consequences may follow damage to property may be gathered from an incident cited in an interesting primer prepared by one of the dcans of the business—an automobile skidding into a fire plug with sufficient force to break it, the ensuing flood causing property damage amounting to \$100,000.

When the old rating scheme was in vogue, collision rates for Pleasure and Commercial Cars were based upon list prices, no differential being used in N. Y. State. With the present classification for liability and property damage, the old list price classification was retained for collision rates with a differential, however, in favor of the country districts. This differential perhaps may be productive of discussion regarding the relative hazards of city and country, the question having once been raised that in the matter of collision insurance, the dangers arising from lack of control of automobiles on unfrequented poor country roads fully offset the hazards due to congestion on good roads.

Perhaps, after all, the chief obstacle to making a scientifically perfect rating schedule for automobiles is the fact that the automobile won't stay in one spot. When it does, the insurance companies have chalked up another loss. The automobile not only refuses to stay in one spot but it wanders into all sorts of unexpected and unsuspected places, more or less frequently meeting with accidents while thus wandering. This does not affect the pure premium for the whole country but when territorial differentials are sought, it complicates the problem.

Mr. Michelbacher outlines the zoning scheme based upon the measurement of the hazards of environment and he points out the unsatisfactory situation produced by drawing sharp lines of demarcation with consequent abrupt changes in rates. Equally as unsatisfactory or perhaps more difficult of solution is the problem created by the establishment of zones near congested centers. All automobiles in such zones are rated upon the assumption that they are likely to be exposed to the hazards of the congested section although there can be no question that a substantial number of such automobiles are applied to a routine use which does not expose them to these hazards. In connection with the zone rating scheme, an interesting question was raised by a farmers' association regarding the zone rates on farm trucks. The trucks were maintained in a zone adjacent to New York City, a differential in rate being applied to the zone because of its proximity to that greatest of all congested centers. The farmers confessed that their trucks brought their farm produce to the city markets, but they pointed out that farmers' trucks are kept or loaded at the farms and then taken to the most available market in the night or early morning hours when the roadways are more or less deserted and that the element of congestion hardly applied to farmers' trucks. Thev also drew attention to the fact that farmers located further away from the city markets received a lower rating by reason of being in a different zone, notwithstanding that their trucks traversed the same roads and were exposed to such greater hazard as might be involved in the greater mileage exposure. The farmers' contentions were recognized by the underwriters and we may at any time expect an application from the joy-riding automobilists who traverse the same roads at the same hours for special concessions in their liability and collision insurance.

In closing, I would suggest that Mr. Michelbacher supplement his excellent paper with one which goes more deeply into the scientific and technical aspects of automobile rate-making.

### ORAL DISCUSSION.

#### MR. HARDY:

Mr. President, Ladies and Gentlemen: I feel in a sense that I appear before you in possibly false colors, because, while a member of the Society, I am not an actuary, and while I learn many things from your discussions, I should hardly venture to discuss anything myself. Mr. Woodward, however, has helped me out by writing me this note: "I thought it would be a fine thing if you would favor us with a few words on fire insurance for automobile owners, by way of a discussion of Mr. Michelbacher's paper." And therefore you will have to blame the retiring president if what I say does not fit in with your Proceedings.

When I start on a matter, I usually find that while I am not able to produce anything which helps the other fellow, I do learn something myself. And as I searched for something to say on this paper, I thought I might bring together a very nice set of quotations bearing on the subject. But then, I thought you might take exception as to its propriety. Possibly you might make the same criticism that the elderly lady made after seeing a performance of Hamlet. "As a play," she said, "it was very entertaining, but it seemed to be made up principally of quotations." Therefore, feeling that I ought to abandon that, I thought of a verse of Kipling's, which quite happily helped me along. That verse, as you recall, runs:

"When 'Omer smote 'is bloomin' lyre,

He'd 'eard men sing by land and sea;

#### DISCUSSION.

An' what he thought 'e might require, 'E went and took-the same as me!''

So I have gone and "took" what I require—the same as he.

In 1896, there was in England a trial of mechanically-driven devices. That was 23 years ago this month. The trial was from London to Brighton, and prior to that month and year no mechanically-propelled device could pass along a street or roadway without someone walking in front of it. When I came across that, I wondered that some of our friends who want to reduce the unemployment situation hadn't discovered what a fine thing it would be to pass a law requiring every automobile owner to have someone run in front of his machine. And when you come to consider the number of machines, why, that would absorb a good part of our population. At that time, however, in 1896, forty machines entered the trial. Four of them finished, and the highest horse-power developed by any of them was eight horse-power.

I feel that I ought to pause at this point in my remarks and make some comparison which would set before you in vivid form the number of machines which are now being made annually. It is customary, of course, to do this by placing the articles end to end and informing the audience that if so placed they would reach at least to the moon, if not to a more distant planet.

None of these forms of illustration as to the marvellous growth of this device appeal to me, but I recall that about a quarter of a century ago I read an article about a device, the watch, written many years before by an English  $\epsilon$  conomist,—a device that is celebrated in the Mother Goose Nursery Jingle which runs as follows:

> "Old King Cole was a merry old soul, And a merry old soul was he; He called for his pipe and he called for his bowl, And he called for his Waterbury."

Now this economist remarked on the fact that the English Waterbury, the cost of which, when translated into American dollars and cents, that is, from shillings and pence, amounted to a dollar and eighteen cents, was now produced for such a small sum of money that it was within the reach of the meanest of Her Majesty's subjects; and the automobile, it seems to me, is about reaching that point.

The original rate for fire and transportation was three per cent. This excluded fire originating within the car. Later, or in the early part of 1905, this restrictive clause was eliminated from the policy and the coverage extended to include fire arising within the car. This gave a complete fire coverage. Of course, the present fire form, the ordinary fire form, like the ordinary insurance form for buildings or property, limits the liability of the company to the actual cash value of the property at the time of the car's destruction, said value being subject to depreciation and in any event not to exceed the actual cost of repairing or replacing. In those days it is worthy to note that the big problem was the fire problem. To-day that has entirely passed away, and I believe the dominating problem is the theft problem, the inability of certain people to distinguish between the machine that they do not own and the one that somebody else owns. In other words, the theft hazard is now the controlling thing, and the fire hazard, so far as it exists, is probably as well controlled as any hazard can be.

Now when this device was first put on the market, it presented the underwriter with two problems. In the first place, it was a new form of device, that is, the engine itself was a new type of motor power, and secondly, it used a fuel which the underwriter was just learning how to control. And when you united those two things together, you produced a fire hazard that in those early days was of serious moment. But every new device presents hazards.

When electricity was first put on the market, it was recognized instantly by the underwriters to be a dangerous fire hazard. The first attitude of the electric light people was: "That is not our business." They saw, however, and very shortly, that that attitude would not do—that if they wanted to sell that product which they were making, called electricity, the only way to do it was to cooperate with the underwriter and produce an equipment so safe in manner that the fire hazard would be eliminated. And so they combined and have worked together ever since, and very little danger now arises from that source.

The automobile manufacturer found himself confronted with the same problem. He wanted a product that would be safe and reliable: he was not interested in the fire end as an insurance matter. He was only interested in the fact that he wanted a safe device, because that was the device that he could sell. So he continued to improve his machine and to do everything in his power, until he has produced the exceptionally safe device that we have now.

I have discovered by talking with automobile men that while the fire end of the automobile insurance is not important to them, so far as the risk is concerned, it is an eminently desirable end from an insurance point of view. It is required that before insuring an automobile for such things as collision damage, or other things, that first it should have fire insurance, and then the other things may be added thereto. And that is the present method. This has resulted in fire insurance companies themselves writing scarcely any direct fire insurance on automobiles. That has almost entirely passed away. What a man wants is the broader cover which he gets under his automobile policy and where he gets both transportation and fire and can have the other things added as he may deem necessary.

I wrote to Baltimore, Chicago, New York, Philadelphia and

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Pittsburgh, to find out what rates they would promulgate on a nonfireproof garage of large capacity, and I found that the rates averaged something like \$2.25 on the building and \$3.00 on the contents. In this connection, it is interesting to note that the fire risk in Class A, cars \$3,500 and upward, is written for seventy-five cents; while, if you pass up to the cars \$799 and under, the rate is one dollar.

So far as the machine is concerned, I may say that no attention is paid to the type of machine or the price, or anything of that kind. Whether the garage, that is, the capacity, is used for large trucks or small machines, may make a difference in the rates, but I think the tendency now is to omit the capacity and build a schedule on the hazard.

It took some time to develop safe storage capacity, but there the underwriter had some experience, because he drew on the experience of the Middle West, where gasoline had commenced to be used for lighting purposes. The desire is that the price should be as moderate as possible. That means standard conditions, as far as they can be secured, because owners try to keep the storage places in a standard manner.

## MR. MOORE:

Liability Statisticians and Automobile Underwriters are not in an unanimous agreement on the new method of rating Private Pleasure automobiles. The Statisticians have contended that the original horse-power basis of rating private pleasure automobiles was as equitable and satisfactory as could be determined in the nature of the business and this method should have been maintained.

I have been interested to learn that fire insurance companies have • rated automobiles on list price groupings and that was probably one of the reasons that lead the Underwriter to change the base. No matter what proposition is put forward there are always arguments for and against any method as to the correctness in the fundamentals of Automobile underwriting. I have listened with interest to Underwriters and Statisticians, and am still to be convinced that either one of the methods is absolutely correct. No one has been able to suggest a better, practical working basis and the new list price grouping has not as yet been in effect a sufficient time to be able to foretell the results thereunder. Statisticians of Casualty companies are very much interested to know what the results will be. Some believe that under this method rates will prove inadequate while others contend that rates are more than adequate, depending of course upon the level of rates for each group and territory.

Another interesting point to be considered in automobile underwriting is the analysis of accidents in the public liability field. Considerable pressure is being brought to bear from all sources upon

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Underwriters to furnish data in connection with accident prevention campaigns. The truth of the matter is that few, if any, companies are keeping an analysis of automobile accidents. At a recent meeting of the National Workmen's Compensation Service Bureau it was suggested that it might be well to analyze automobile accidents both from the standpoint of accident prevention and as a possible means of determining the new basis of rating. If the various states favor such laws as are proposed for the State of Massachusetts, providing for compulsory insurance of automobiles and for a stated amount of compensation for accidents, it will be necessary to make an analysis of accidents in order to calculate rates.

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## THE REVISION OF PENNSYLVANIA COMPENSATION INSURANCE RATES, 1918-E. H. DOWNEY AND G. C. KELLY.

## **VOL. V, PAGE 243.**

#### WRITTEN DISCUSSION.

### WILLIAM LESLIE:

It is impossible to cover the subject matter of this paper thoroughly in a brief discussion. Describing as it does the principles employed in a rate revision, it opens up for possible review a host of matters which, of themselves, are of sufficient importance to have been heretofore made the subject of papers by members of the Society.

As respects the paper in its entirety, I feel that we are much indebted to the authors, not only because of the thoroughness and nicety of presentation of a big and complex subject, but also because of the historical significance of the event recorded and the consequent value of the paper as an historical document. We are still feeling our way in compensation rate making and written records of the important steps toward our ultimate goal are not only of immediate practical value but are of untold future value as a source of education for studer ts and associates. There is nothing which so brings home the theories and problems discussed at our meetings as their application in an actual rate revision. It does not fall to the lot of all members (whether that lot be considered good or bad) to participate in rate revisions. Yet, with such a paper available, it is possible for each to have a rate revision of his own, conducted in a comfortable morris chair with only one essential missing, viz., "atmosphere."

It is doubtless a fact that much of the diffidence among underwriters about accepting "innovations" suggested by actuaries arises out of uncertainty as to their practical value and the result of their application. The happy feature of the Pennsylvania Rate Revision of 1918 was the fact that a wealth of new ideas had been expounded from time to time, which despite the expounding remained but ideas, and Pennsylvania seized upon the opportunity to give practical effect to many of these, thereby affording an actual test of their value. Irrespective of how opinions may differ respecting the manner in which these principles have stood the test, it is now a recognized fact that trying out a new principle does not necessarily mean certain ruin and chaos. Underwriters are not today in quite the same frame of mind they were prior to the Pennsylvania rate revision of 1918 and for that matter neither are we actuaries.

The indirect result of this revision has been the formation of the National Council on Workmen's Compensation Insurance. The direct result of the organization of the Council has been the stimulation of the desire among those members closely affiliated with the work of the Council to do a better and more scientific job, in connection with the general revision of rates now being undertaken, than any heretofore put out. The results of such endeavors can only be for the good of the compensation business and the advancement of casualty actuarial science.

I am not going to review or discuss any of the eight important innovations described by the authors. The events recorded have been under trial for nearly a year and a discussion at this time should be in the light of the practical test to which they have been submitted. I know that the authors have abandoned some of the principles in the Pennsylvania rate revision of 1919 (e. g., the graded expense loading) and that others have been modified, refined or carried further. It would be fruitful for the authors to relate what changes the test of practical application have made in their opinions on these matters.

Before concluding the discussion, however, I must mention my inability to agree with the full conclusion of the authors respecting simplification of actuarial procedure. The last sentence of the paper reads:

<sup>7</sup> If the whole attempt to approximate current cost were frankly abandoned and rates based directly upon pure premium experience for, say the five years next preceding each annual revision, modified only for differences in compensation benefits—it is almost certain that rates would be more stable and the long term results more satisfactory to all concerned."

The only "long term" element I see in that statement is the period of five years, the experience of which is used. Rate revisions annually are, in my judgment, a crying evil and I fail to see any advantage in an annual revision based on unweighted averages of the five preceding years as against less frequent revisions based upon weighted averages of the same time, the weights being determined by experience differentials. So far as objection is raised to the use of theoretical and unmeasurable factors, I am heartily in accord, but beyond that I am not in agreement with the suggestion of the authors.

#### MR. GEORGE D. MOORE:

The work accomplished by the Pennsylvania Rating Board in connection with the rate revision of 1918 is admirable. The statistical investigations and the results which have been arrived at through these investigations form the ground work of the principles which will be laid down in the future for the standardization of rate making; and the only criticism that can be made of the work outlined in this paper is one which could naturally be made of any rate revision undertaken for any given state, namely, that in some respects it does not consider the problem of a rate revision for the country as a whole; and it will be my present purpose to suggest methods which to my mind will lend themselves to nation-wide use.

It should be borne in mind that the statistical work in any rate revision is enormous and the combination of experience, although simplified in every possible way, necessarily takes time. Therefore, the thought of simplicity should run through any discussion of method.

A set of basic pure premiums formulated from data collected form every compensation state would, it is true, reflect the average classification experience for the entire nation, but it is doubtful if this experience could be projected into conditions inherent in industry in any one section of the country. Upon this premise it would seem wise to sub-divide the basic pure premiums into three or four groups representative of East, Middle West, South and Pacific Coast, bearing in mind that the pure premium for any specified industries could be compared for any given section of the country at will.

The next point to consider is the quantity of the data entering into the combination. The first consideration, of course, should be given to Schedule Z experience and to this should be added the experience of non-schedule Z states in which the range of industry is varied and the experience is fairly indicative. At this point the element of time should be considered and not too many states combined at the outset so that the work would be impeded. As time goes on the experience of the remaining states could undoubtedly be added thus increasing the reliability of the basic pure premiums.

It has been ably demonstrated in the paper under discussion that the method of combination by partial pure premiums is undoubtedly superior to any other method, and with this point in mind let us consider how we shall arrive at these basic partial pure premiums, and how we shall project them into any given state for rate making purposes.

## (a) Death and Permanent Total Disability.

In the combination of experience by classifications the number of death and permanent total disability cases should be shown separately and the accident rate for such cases per unit of payroll should be determined by classifications. In the projection of experience the average cost of a death and permanent total disability case should be determined either by actual experience or by actuarial valuation and the values applied to the determined rate. Whether the combination of death with permanent total disability cases is preferable to that of the separation between the two is still a matter of conjecture. An investigation of the death and permanent total disability cases undertaken in the recent Pennsylvania Rate Revision resulted in dividing the classifications into three or four groups of trades according to the predominance of men or women and the extent of dependency, and then utilizing the average cost for such cases determined from actual experience. This refinement is one which could undoubtedly be utilized in a large state but in the experience of a small state would have but little value.

## (b) Major Permanent Disability Cases.

It is a notable fact that irregular variations in rates and abnormal results under experience rating have been due mainly to the inclusion of major dismemberment cases with temporary and permanent disability cases in rate making and in the factors used in experience rating. With this in mind the Committee on Uniform Schedules "W" and "Z" last year proposed a change in the form of Schedule "Z" providing for the inclusion of major permanent disability cases. This, of course, will necessitate a definition of major permanent partial disability cases and to that end I favor the adoption of the monetary unit for such cases where there is a loss of an arm, a foot, or an eye, etc., for there is a great danger of complicating the work of reporting Schedule "Z" which is already involved and thus slowing up the final results.

In order that the determination of this portion of the pure premium may be carried to its logical conclusion an individual report would of necessity have to accompany each case included in Schedule "Z" so that the nature of the disability might be determined. With such data the same method might be applied as that used for death and permanent disability cases. However, for rate making purposes during this year major permanent disability cases, as well as all other dismemberment and permanent partial cases, will of necessity have to be included in a section with the temporary total disability cases.

# (c) Temporary Total Disability.

It might be well again to suggest the thought that was current at the time of the Pennsylvania rate revision, namely, that of the exclusion, for combination purposes, of the experience of any classification which is extensive enough in any given state to establish its own rate. This would, of course, exclude such classifications as the textile and boot and shoe industry in Massachusetts, the steel industry in Pennsylvania as well as possibly the cement industry in that state, and the pottery industry in New Jersey. The elimination of this experience for me general combination will tend to make the basic experience for such classes indicative of conditions in states where the volume is small—therefore fairly general, while the experience for those classes in the states mentioned above should of its own weight determine the pure premiums in these states.

It is generally conceded that the method of combining experience for this section should be that of experience differentials and in order to use the method of experience differentials, on account of the work involved, the number of classifications must be limited; and another very potent requirement is that the experience should be fairly homogeneous and adequate. Many suggestions have been offered and several papers have been written to determine the adequacy of payroll exposure. This problem, however, is as yet unsolved. In Pennsylvania, under its recent revision, a million dollars of payroll was used as a criterion for the states of Pennsylvania, Massachusetts and New York, while \$500,000 was used for New Jersey experience. In the recent rate revision of New Jersey, for instance, the criterion of a minimum of \$7,000 of incurred losses in a classification was used. Some method should be devised which would fix the minimum of experience to be used for combination. There should be chosen as large a number of classifications as are representative, using the determined criterion in all of the states whose experience is to be utilized for combination purposes. The inclusion of a classification which is inherent in one state only will tend to destroy the experience as a whole and this should be avoided as has already been stated. The next point to consider is the possibility of forming three or four sub-groups of these classifications which shall represent, as closely as possible, the seriousness and nature of accidents,-the point being that certain classifications possess inherent potential ability to produce dismemberments whereas in others fatalities and permanent total cases predominate. It is readily understood that a flat differential would not work justice in both instances. If it is possible experience differentials should be obtained by these three or four groups for each state entering into the experience.

One interesting point in the use of experience differentials should be brought out, namely, that it is possible, by means of experience differentials, to utilize the experience of two years of issue combined, for the purpose of combination, without detriment to the result.

At the present stage of development it has been deemed advisable by most Actuaries and Statisticians to limit the experience to two years of issue, namely 1916 and 1917, and by means of the additive feature and the fact that many classifications are analogous it is possible to arrive at a larger group of classifications and a more adequate exposure. It is necessary to reduce all of the experience to that of one year of issue for it is frequently necessary to project rates into states having no experience whatever or where the experience is so limited as to be without value and this must be done by means of theoretically calculated law differentials.

The question of what method of experience differentials will least disturb the relativity of pure premiums by classifications and yet produce adequate rates without injustice presents itself. It might

#### DISCUSSION.

be well at this time to critically analyze the method proposed by Mr. Kelly in his paper, namely that of simple average for the ratios of the pure premiums by classifications. This method has since been simplified and used by Dr. Downey in the recent Pennsylvania revision as the averages of the pure premiums for the state under combination. A test of this method, however, applied to similar groups of classifications I feel sure would not be nearly as accurate as that proposed recently by Mr. Greene,\* which is an improvement upon the old method of cross multiplication.

Taking 82 representative classifications where the payrolls amount to more than \$1,000,000 in the states of Pennsylvania and New York the following is shown:

The so-called Direct Method produces:

$$\frac{28,598\times760,769}{647,685}$$
 = .488,

and the Inverse Method produces

$$\frac{14,784\times760,769}{1,367,230} = .480.$$

The ratio of the average weighted Pure Premiums is

$$\frac{647,685}{572,193} \div \frac{1,367,230}{760,768} = .59.$$

The ratio of the sum of all the pure premiums in both States produces .502 and using Mr. Greene's formula

$$1 + D = \frac{942,844}{647,685} = 1.455. \quad D = .455.$$
$$E = \frac{1 - .455 \frac{647,685}{1,367,230}}{1.455} = .54.$$

Mr. Greene's formula which really is predicated upon a method of correcting the first approximation to the law differential, assuming the first approximation to be unity, can be applied state by state in reducing the experience to a common level. The factors which

\* Mr. Greene's formula

$$E = \frac{1 - D \frac{\text{Losses Basic State}}{\text{Losses State to be Reduced}}}{1 + D}$$

$$1 + D = \frac{\text{Losses based upon Combined Pure Premiums}}{\text{Losses Basic State}}$$

where the combined pure premiums are obtained by the ratio of added Payrolls to Added Losses.

#### DISCUSSION.

have been arrived at for each state in three or four groups should then be applied to every classification in these states except those which have been arbitrarily removed and a basic pure premium determined. After the basic pure premiums have been determined the next problem is to project them into the state for which rates are to be made. Here again Mr. Greene's formula should be applied together with suitable tests as to the relativity between the total projected losses and the actual losses in the given state and if necessary a correction factor should be applied to all classifications. For those states where there is no experience or the experience is inadequate the projection should be made on an actuarial basis using theoretical law differentials by parts.

#### (d) Medical.

The critical analysis of this portion of the differential leads to the belief that it is unnecessary to make a separation of representative classifications into groups for the determination of the factor, this being an unnecessary refinement.

Time and space forbid the various tests that have been made to substantiate or disapprove the rate portions of the above theories. It is a fascinating subject and one well worth the attention of any Statistician.

#### ORAL DISCUSSION.

### MR. W. W. GREENE:

As Mr. Woodward has said, the subject of the paper which I shall read to-day fits in very well with the discussion of the paper upon the Pennsylvania rate revision.

There is one phase of the Pennsylvania 1918 revision, and for that matter of the Pennsylvania revision just concluded, which I believe is worthy of extended discussion, although this phase is not enumerated by Messrs. Downey and Kelly as one of the most important innovations introduced.

I refer to the revision of manual classifications including the elimination of some and rewording of others so that the total number has been quite substantially reduced.

The arrangement of classifications in the manual, whether alphabetical or by groups, is after all only a detail although it may be of considerable practical importance. What deserves our most serious consideration is the elimination and consolidation of classifications. I direct attention to this matter without any intent to criticize adversely what Pennsylvania did, but rather to point out some dangers which attend lack of standardization in the system of classifications.

It seems to me that in general the determination of classification wording should be viewed as a national problem; and in the long run, our statistical difficulties will be great unless almost all classifications, although not necessarily universally applicable, have been determined with nation wide conditions fully in mind. If each state is to erect its own system of classifications, the number of classifications may for each state be fewer than would otherwise be possible. Yet if the combination of experience from several states is to be continued, enormous statistical difficulties will result from multiplicity in the total number of classifications and inconsistency in their scope.

In fact, I do not believe that experience from different states can be combined upon a rational basis unless for the most part classifications are well standardized throughout the several jurisdictions concerned.

Undoubtedly, we are all of us interested in having no larger a number of classifications than is actually necessary in order to equitably conduct our business. From time to time industrial processes within the respective classifications change materially. This consideration and the more thorough mastery of the problem of grouping classifications which we should hope for as time goes on both indicate the desirability of retaining classifications as separate entities wherever there is substantial likelihood that they may at any time cover essentially different processes.

I am not convinced that reduction of the number of classifications is an end of great importance, although, of course, it is *per se* desirable. I do know that classifications can be much easier "scrambled" than "unscrambled" and that this latter job is something which we should avoid at all hazards.

The work done in Peunsylvania has a great value irrespective of the specific results achieved in that it has put up to the business squarely the problem of eliminating duplications and unnecessary classifications in such a manner as to still permit of general standardization in classifications and code numbers.

## W. A. SCHAEFER:

Speaking entirely from the standpoint of an underwriter and solicitor, I believe that the elimination of classifications from the manual can be, and indeed has already been, carried too far.

Once a classification of even limited use has been removed, the agent and underwriter must resort to reasoning by analogy in order to classify the hazard no longer precisely described in the manual. Reasoning by analogy is inherently faulty, for it is quite dependent upon judgment. Consequently the risks precisely within the eliminated classification are now scattered as the judgment of the brokers and underwriters may dictate. Thus, not only is injustice done to the specific risks but the dependability of the classifications to which the risks have been assigned, has been impaired.

The "machine shop" classification is a particularly good example of a classification whose dependability has been impaired in the writer's estimation. Almost invariably where machine tools are used and no specific classification exists—the risk is placed under this classification. It matters not if the principal product consists of large-size pumps or steam engines nor whether the general hazard is comparable to the manufacturing of mining or milling machinery.

At the other end of the scale, I have seen risks classified under the machine shop classification which were closely related in hazard to the manufacturing of valves or carburetors.

If more classifications existed covering machine shop operations, preferably differentiated (in the writer's opinion) by the average weight of the product, the underwriting of risks with machining operations could be carried on with greater precision. And what is true of this great group of risks is true of many others.

After a classification has been taken from the manual, it is exceedingly difficult to eradicate the injustice done—at a later date. Whereas, if classifications are retained even though they are seldom used, we can always combine results statistically.

I realize that many actuaries cavor the elimination of classifications and oppose the erection of new classifications. It should be realized, however, that primarily the existence of classifications is an underwriting matter.

Several years ago I discussed with one of our members the thenpending suggestion before the Wisconsin Compensation Rating and Inspection Bureau to devise a weight-element in the application of the machine shop classification. This member insisted that experience rating would smooth out any inconsistencies in the placing of widely variant hazards in the machine shop classification. But experience rating is intended to work out only small changes in hazard—not fundamental differences. Why try to determine atomic weights by making comparison with the bulk of the moon? Obviously the idea of the actuary referred to would, if logically applied, result in the elimination of every classification covering a machine tool hazard except the "Machine shop—no foundry" classification.

Be slow about eliminating classifications! If they are in the manual, they are in for some good reason and that reason should be searched for with great diligence before a classification is thrown out as unnecessary.

# REVIEWS OF BOOKS AND PUBLICATIONS.

- Report of Commission on Public Welfare, Connecticut. 1919, pp. 136.
- Report of the Pennsylvania Commission on Old Age Pensions. March, 1919, pp. 293.
- Report of the Health Insurance Commission of the State of Illinois. May 1, 1919, pp. 647.
- Report of the Special Commission on Social Insurance, Wisconsin. January 1, 1919, pp. 85.
- Report of the Social Insurance Commission of the State of California. March, 1919, pp. 132.
- Health, Health Insurance, Old Age Pensions-Report, Recommendations, Dissenting Opinions by the Ohio Health and Old Age Insurance Commission. February, 1919, pp. 448.

I. REVIEW FROM STANDPOINT OF HEALTH INSURANCE.

Neither the report of the California Social Insurance Commission nor the report of the Wisconsin Special Committee on Social Insurance adds appreciably to information on Health Insurance. In California the majority of the commission favored a compulsory law providing medical benefits and indemnity of two-thirds of wages for a period of not over twenty-six weeks. It was recommended that insurance be permitted in mutual organizations and that a State fund be created, and that the administration of the law be vested in the Industrial Accident Commission. Costs were to be shared equally by employers and employed. One member of the commission presented a dissenting recommendation calling for flat premiums, flat benefits, and exclusively governmental insurance. In addition to these recommendations, the report contains a valuable statement by Dr. Woods Hutchinson, in favor of the panel system of employing physicians, useful digests of the text of the British law and of three reports on its operation, and a reprint of the "California Survey" from the report of the former commission.

The Wisconsin report does little more than record the opinion of its legislative committee that compulsory health insurance is not desirable, that preventive measures should be extended, that the climate of Wisconsin is admirable and that the people of that State are decidedly thrifty. One suspects that these opinions were held by the committee prior to the investigation. Official endorsements of health insurance by labor and medicine in Wisconsin are repudiated as not representative of the "rank and file" of employees and physicians. One member of the committee, in a minority report, strongly favors the enactment of a compulsory law.

The Illinois report in its presentation of the problem, and in its useful, though limited, statistical studies is a real contribution to the subject of health insurance. It is well written, shows a grasp of the question and indicates thoroughgoing familiarity with the existing information and with its virtues and limitations. The majority conclusion is adverse to the adoption of compulsory health insurance and favorable to immediate and extended application of preventive measures. A minority report urges a compulsory law. Appended to the report is a series of valuable special reports on various aspects of health insurance.

While not so complete nor so well arranged as the Illinois report, that of the Ohio Commission is valuable. The majority of the commission favored adoption of a compulsory law but again there was a vigorous dissenting opinion. Particularly interesting to students of the problem is the study of disability data from selected benefit associations by Dr. H. W. Kuhn.

It is noticeable that there is a general tendency on the part of investigators to regard health insurance and preventive work as necessarily alternatives. Commissions favoring prevention point to the great advantages to be gained from active health measures and to the large cost of insurance. They fail to realize that the cost of insurance will be cut down in the measure that prevention is effective.

Exception may also be taken to the failure to qualify statements of cost of health insurance by reference to present costs of illness. It is true that these latter costs are considered in most reports, but there has been little attempt to arrive at the *net additional cost* which health insurance would involve. Health insurance would lead in large measure to a redistribution of present costs as well as to an imposition of new ones.

As was the case in workmen's compensation, no adequate statistics on health insurance can be produced unless a law is enacted and experience under it recorded. The reports of the various commissions could have been made much more useful had graphic methods of presentation been employed for the presentation of significant facts and relations. One searches in vain for a diagram. The statistics which are presented are arranged in many cases in discrete fashion and confuse rather than illuminate the text. There is throughout little evidence of a sense of concrete, convincing arrangement.

## RALPH H. BLANCHARD.

## II. REVIEW FROM STANDPOINT OF OLD AGE PENSIONS.

Report of the Pennsylvania Commission on Old Age Pensions.— This report covers a study of the old age problem as it exists in Pennsylvania and also presents a discussion of the various systems adopted by other states and countries for relieving the distress which accompanies old age disability.

Commissions appointed to investigate various phases of social insurance turn out publications which are usually similar in respect of the material included and the manner in which it is handled. This document differs from the usual run of such reports in at least one important omission. It contains no recommendation either of a positive or negative kind respecting legislation. In justice it should be pointed out that the commission was not required to suggest any specific remedial legislation, but merely to "look into the general subject of old age pensions, and to investigate the various systems provided for this purpose in other nations and states, together with all facts relating thereto, especially as bearing upon the industrial and other conditions prevailing in Pennsylvania, and with a view to their practical adaptability here."

The tenor of the descriptive analyses of the various tables showing facts about the aged in poorhouses, old folks' homes and among the general population, points to the very general and eminently safe conclusion that Pennsylvania has an old age problem and further, that the problem is largely native rather than imported. It is shown that, outside of those cared for by public or private relief, 43 per cent. of the population of the state, aged 50 and over is dependent upon earnings for support and only 38 per cent. possess any personal property.

The railroads and certain other industries are especially conducive to premature old age with resulting hardships in most cases on account of a forced change of occupation with a decline in wages. The principal cause of dependency among the aged is disability from disease or accident which prevents the aged worker, who is dependent upon his earning's, from following a gainful pursuit. The existing means of systematically providing for old age pensions or annuities are limited to those adopted by the railroads, about twenty industrial establishments and the first and second class cities, all of which combined, carry only about 10,000 pensioners on their rolls. Not only are these insufficient but "they can never be expected to meet the situation to any extent."

The Commission makes no claim of having exhausted the possibilities of research and study along these lines and, in fact, offers suggestions for further investigations which it states should be made before any legislation is proposed. In connection with the very able resumé of arguments for and against the various recognized systems of providing for old age, this frank statement is made: "It was the purpose of the Commission to present this solely from the students' attitude, as the Commission itself, because of the lack of time and the disputed and contradictory facts, is, as yet, unable to decide upon the merits or demerits of any of the schemes presented, and as to their applicability in Pennsylvania."

Incorporated in the report are interesting tables showing the details of the private and public pension systems in existence in Pennsylvania and a brief presentation of the means employed in other states and countries of providing for old age. It is regrettable that war conditions made it difficult to obtain first-hand information concerning the latter, but the material which has been gleaned from other publications is conveniently set forth and should be of value to those who desire information on this subject but lack of time to consult the original sources.

Report of the Ohio Health and Gld Age Insurance Commission.— Part III of this report deals with old age and old age pensions. The 84 pages devoted to these subjects treat mostly with Ohio conditions and are based upon both census data and original investigations. In common with other similar reports there is also contained a discussion of the merits of insurance and pensions, respectively, for providing for old age and an outline of various European systems.

Four specific studies were under aken to obtain information con-

cerning the condition of the aged in Ohio, as respects the extent and cause of their dependency and means and sufficiency of their care. These are quoted from the report as they indicate both the sources and the character of the data procured:

"A study of the problem of old employees in industry to determine to what extent changes in industry are supplanting older employees."

"A study of county infirmaries to determine the present status of public care of the aged (forty-five infirmaries were inspected)."

"A study of private old folks' homes to learn the extent and method of care (twenty-eight homes were inspected)."

"A field survey of representative urban districts to learn the economic status of the aged people in their own homes."

From an analysis of the figures of the 1900 and 1910 census on the age distribution of persons employed in the different occupations and on home ownership, three significant conclusions are drawn:

1. The proportion of people 65 years of age and over is increasing and in 1918 was 5.8 per cent. of the population.

2. Home ownership is decreasing.

3. The proportion of aged persons gainfully employed is decreasing.

From the study of public and private institutions and the field investigations, it was found that the present methods of care are wholly inadequate as well as demoralizing, being primarily in the nature of charity, either from the public or from relatives and friends. The underlying causes of dependency among the aged constituted an important part of the studies and surveys. The leading cause among those cared for in county infirmaries and private homes was found to be disease or accident, with intemperance, misfortune, improvidence and low wages generally following in importance in the order named.

After examining critically the three main systems usually followed in providing for old age (voluntary insurance, compulsory insurance and non-contributory old-age pensions) the majority of the Commission recommends a system of old age pensions as the proper means to employ in Ohio. It is suggested that the state provide, out of funds from general taxation, a pension of not more than \$5.00 per week to all persons over 65 years of age. If the person possesses an income, the pension and income combined are not to exceed \$350.00 annually. Ways are mentioned for safeguarding the state against an infux of aged persons from other states who might be attracted by the possibility of becoming a beneficiary of the state of Ohio upon attaining the retiring age. A plan of voluntary insurance is recommended as an adjunct to the pension system in order to aid and encourage individual supplementary provision for old age.

No information is given as to the reason for a \$5.00 maximum in the recommendation, but by inference it may be presumed that the Commission considered that a larger amount would pervert the intent of the system. Considerable stress is laid upon the fact that by granting larger weekly payments to those who, upon attaining age 65, defer their pensions and by providing for the purchase of voluntary insurance, the system will promote thrift and will not be detrimental to the self-reliance and independence of the individual. Presumably, therefore, \$5.00 per week is selected as that amount which will keep body and soul together, if need be, but will not permit of that degree of ease and comfort, necessary to induce an able bodied man to retire at age 65 or cause an otherwise thrifty and frugal individual to become shiftless and wasteful.

The determination of this maximum may, however, have been influenced by the estimates of cost which show that at \$3.00 per week, the annual cost to the state of such a system, including expenses of administration, would be between \$12,200,000 and \$12,980,000, and at \$5.00 per week between \$20,000,000 and \$21,300,000.

A minority report is also presented in which one member of the six on the Commission disagrees with the conclusion of the majority respecting the superiority of non-contributory pensions over insurance. He states that adequate consideration has not been given to the subject and that further study of the experience of foreign countries should be undertaken before any legislative program is suggested.

The report contains an appendix nineteen pages of which are given over to a fairly complete description of old age pensions in the British Empire, which includes the systems in the United Kingdom, New Zealand and Australia.

WILLIAM LESLIE.

# Second Annual Report of the Workmen's Compensation Board of the Province of British Columbia for the Year Ending December 31, 1918. Pp. 48.

In 1916 British Columbia established an Accident Fund to be administered by a Workmen's Compensation Board and to which all employers of the province must contribute. The second annual report of the Board discusses five phases of its work in connection with the administration of the Fund.

(a) Financial.--All industries covered by the Act are divided into sixteen classes, those of essentially the same hazard being classed together. Each class has been assigned a basic rate, such rates being so proportioned as to measure the relative hazards of the various classes. In case the hazard within a class is not uniform, different basic rates are given to industries within the class. Since a separate fund is maintained for medical aid the basic rates must represent ex-medical hazards. Each class has its own accident fund, from which all compensation payments to its industries are made. When the fund of a class becomes depleted, assessments are made upon the employers of that class, the amount being determined by applying the basic rate to one fourth the estimated annual payroll of the employer. At the end of the year when payroll audits are made, the amounts of payments are adjusted. Assessments are made only when necessary to replenish the fund, and the number made during a year thus far has varied one to four for the various classes. Thus the value of the basic rate of a class does not determine the cost of compensation to its industries, but rather the number of assessments that are made during the year, which depends upon the actual cost of accidents occurring within the class. An employer who does not pay his assessments promptly is charged a 5 per cent. penalty for the first month or fraction thereof, and 1 per cent. per month thereafter.

A Medical Aid Department is maintained to provide medical attention. One cent per day is payable to this fund by each workman, and the employer, unless he maintains approved hospital arrangements for his men, must make up any further amount necessary to furnish adequate medical service, assessment for such cost being made upon industries in general, and not upon classes.

The Board has so managed the Fund that the expense of administration has amounted to only 4.84 per cent. of the total amount

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collected from employers. However, the law states that the salaries of members of the Board shall be paid out of the Consolidated Revenue Fund, and the Lieutenart-Governor in Council may annually direct the payment of a sum not exceeding \$50,000, to assist in defraying the expense of administration. Apparently no such payment was made during 1918, and only \$10,000 during 1917. A reserve has been set aside, to meet payments of all pensions to dependents or to permanently injured workmen, interest having been computed at 5 per cent. It would appear from the statements made that no reserve has been set up for indeterminate or temporary cases.

No system of merit rating has yet been adopted, due to the lack of sufficient experience, but the Board hopes to make some such system effective in the near future. The plan to be adopted has not yet been determined, but that set forth in the 1917 report of the Board indicates that experience, not schedule rating, is contemplated.

(b) Claims.—During 1918 there were presented to the Board 22,498 claims, 240 of which were fatal and 12,631 of which were non-compensable, the time lost being not more than 3 days. Many of the workmen receiving minor dismemberments were able to return to work without suffering any immediate decrease in earning capacity. Although the law states that compensation in such cases shall be based upon loss in earning capacity, the Board recognized that such a loss, though not yet apparent, would ultimately result, and in making awards, estimated the probable future loss in earning capacity due to the injury.

(c) Medical Division.—It was estimated that over 7 per cent. of the cases reported eventually showed infection, and often serious results followed which might have been prevented by proper care at the time of the injury. As a result, the Board has established certain regulations calling for a first-aid equipment in all establishments, the minimum requirement varying with the number of men employed. This, together with a campaign of education among the workmen, it is felt, has given distinctly beneficial results.

(d) Accident Prevention.—During 1918 extensive safety regulations were passed, requiring various guards for machinery, floor openings, stairways, elevators, etc. The penalty for contravening any of the regulations is \$50, and a plant refusing to install any required safeguards is shut down until the requirements are met. It is estimated that the safety regulations together with the general campaign for safety education and the coöperation of both employers and workmen, has resulted in some of the largest plants in a decrease of from 20 to 50 per cent. in number of accidents.

(e) Statistical.-The report gives extensive statistical tables, but they are based on accidents closed during 1918, without regard to the date of the accident. Thus the report includes some accidents which occurred during 1917, and does not include all accidents which occurred in 1918. It is difficult to understand the value of statistics compiled in this way, when the law has not been in effect long enough to make such statistics representative of a true accident distribution. The statement is made that it is impossible to forecast the cost of many accidents and if the cost of indeterminate cases were estimated and included in the statistics, the results would be inaccurate and misleading. Although this is true, it is also true that the present statistics do not represent an accurate distribution of either accidents or costs. It would seem that sufficiently accurate estimates of the cost of indeterminate cases might be made so that the deductions from statistics so compiled would not go far astray. On the present basis it is impossible to make any deductions.

Table A shows amounts paid for temporary, permanent and fatal injuries in each industry, with the following totals:

1	No. of Claims.	Amount of Award.
Temporary total	8841	\$456,902.00
Permanent partial	. 522	204,491.00
Fatal	. 111	387,678.00
Burial	. 152	11,249.00
		\$1,060,320.00

Table B analyzes the temporary total disabilities showing for each industry total wage lost, average duration of disability, average daily wage, sex, conjugal state, average age, nationality and number of cases in which other benefits were received. Table B2 is a summary of Table B and shows a total wage loss of \$944,723. Of the 8,841 cases, 4,765 were married, 3,818 single and the conjugal condition of the other 258 was unknown.

Table C shows the amount paid for each kind of benefit classified by cause of accidents instead of industry.

Table D classifies the temporary total disability accidents by nature and location of injury.

Table E classifies permanent partial disability cases by nature of injury showing the class in which the injuries occurred and the average cost.

Following the tables are three charts showing graphically the industries responsible for 8,841 temporary total disabilities; causes of such injuries; and the causes of 240 permanent partial disabilities.

The report concludes by setting forth the need for adequate health insurance legislation, as disclosed in the work of the Board among workmen and their families.

## OLIVE E. OUTWATER.

# Fourth Annual Report of the Industrial Accident Board of Montana, for the Twelve Months Ending June 30, 1919. Pp. 438.

In the State of Montana this Act became effective July 1, 1915, as to the Compensation provisions. The report under review is for the 12 months ending June 30, 1919.

One of the innovations is the introduction of a poem, "The Shade's Lament," which faces page 7 of the Report and relates the experience of one who lost out because he did not believe in safety first. On page 17 there is an interesting contribution to the historical aspect of compensation laws. This may not be so well known but that a quotation therefrom will prove of interest to many. It reads as follows:

"The first authentic Compensation Law that we have been able to discover should be credited to ancient Lombardy through the medium of the edict of King Rotharius, dated A. D. 643. This proclamation provided compensation for those who might be injured in fights or brawls or physical encounters of any kind, and as translated reads as follows:

"'If anybody of another the great toe from the foot severs, he pays solidi sixteen.

"'If the second toe from the foot he severs, he pays solidi six.

"'If the third toe he severs, he pays solidi three.

"'If the fifth toe he severs, he pays solidi two.

"Upon all these damages or injuries above described, which among men occur, therefore, this payment have we placed.

"'That the Faida (feud or vendetta); that is the hatred, after receiving the above described payment may cease, and, moreover, it is desired may not be required."

"The edict provides a similar schedule for the loss of fingers, eyes, arms and legs, etc. As a solidi equalled about five dollars in 9 American money, it is evident that King Rotharius was modest in his compensation award. However, as it will be noted, the compensation provided by King Rotharius for the loss of the great toe in its entirety was sixteen solidi, or eighty dollars, while our law provides, for a similar loss, compensation for thirty weeks at twelve dollars and fifty cents per week, or three hundred and seventy-five dollars, which by comparison possibly only represents the fair increase in values since the days of King Rotharius."

While nearly all court decisions involve a statement of the purpose of Workmen's Compensation laws, a restatement of the case, especially by the highest court in any State, is always of value, and for that reason the statement in the case of Shea vs. North Butte Mining Company, decided March 8, 1919, is worthy of quotation. The decision was rendered by Chief Justice Brantly and reads as follows:

"The causes, from an historical point of view, impelling the enactment of Workmen's Compensation Laws and the object to be served by them, have heretofore been stated somewhat at length by this court. Hence it is not necessary to restate them. It is sufficient for the present purpose to call to mind that the object sought was to substitute for the imperfect and economically wasteful common law system by private action by the injured employee for damages for negligent fault on the part of the employer, which while attended with great delay and waste, compensated those employees only who were able to establish the proximate connection between the fault and the injury, a system by which every employee in a hazardous industry might receive compensation for any injury suffered by him, arising out of and during the course of the employment, whether the employer should be at fault or not, except only when the injury should be caused by the wilful act of the employee. In other words the theory of such legislation is that loss occasioned by reason of the injury of the employee shall not be borne by the employee alone, as it was under the common law system, but directly by the industry itself and indirectly by the public, just as is the deterioration of the buildings, machinery and other appliances necessary to enable the employer to carry on the particular industry."

On pages 50 to 60 inclusive there are set forth the three insurance plans in force in the State. We note each of these briefly:

Employers' Self Insurance—Plan One.—Since the Act became effective, July 1, 1915, or during a period of four years, 98 employers elected this method, of which number 64 qualified and these 64 had 40,000 employees on their staff. The financial results of the four years were: Total sums paid under the Act, \$1,389,721.86. This included \$809,027 in lump sum death settlements and \$38,105 in burial expenses.

Casualty Company Insurance—Plan Two.—This plan deals with the purchase of insurance from companies and the records show that 2,370 employers used this plan in the four-year period. The report states that the sums paid during the four-year period amounted to \$327,436.25. Without quoting the premiums paid in that time the business would appear to have been profitable to the companies.

State Fund Insurance—Plan Three.—Some 15,000 employers are insured in the State Fund, these including evidently a very high proportion of the employers who employ but few hands. The compensation paid in the four-year period was \$164,835.26, and the Fund closed this four-year period with a substantial balance on hand.

The total number of accidents reported for the four-year period was 26,421. Of this number 688 were fatal accidents, 609 permanent partial disabilities, and 25,081 temporary total disabilities. Of this large number exceeding 25,000, only about one-fourth, or 6,493, received compensation. The remaining 18,588 returned to work before the expiration of the waiting period of two weeks.

An excellent tabulation of the four years' accident record is presented on page 65.

The report claims, and it is apparently substantiated, that the low cost and the increasingly lower cost is due to the development of "safety first" provisions. The work in this respect is most excellently set forth in the report, not merely from the point of view of what the Commission itself has done, but also as to the cooperation of many of the employers.

On page 102 there is a complete statistical exhibit of the fatal accident record for the four-year period. This is especially valuable because it sets forth the manner of settlement. We note briefly some of the figures:

Total number of fatal accidents	688
Claims filed	372
Rejected	15
No claim	316
Pending for settlement	79
Settled by monthly payments	64
Lump sum payments .,,	214

This shows a conviction on the part of the Commission that the lump sum settlement is preferable to the monthly payment plan in most cases.

A feature of the report which seems to be a contribution to the subject is a statement of the problem of the crippled workman. In the pages beginning at 104 there is set forth the provision which is being made or the work undertaken to put the injured workman back in some form of productive employment, the basic thesis being that this is better for the workman and far better for the State.

In the four-year period 6,000 cases have come before the Commission for adjustment, and all of these have been settled without an appeal to the courts. This shows an exceedingly smooth working of the Act, but more than that it is highly complimentary to the administrative body.

Our attention was directed to the administrative expenses which seem to be remarkably low, but there would not seem to be any denying the printed statistics, and whatever else Montana may complain of it cannot complain of that part of the Industrial Accident Board's cost chargeable to the Workmen's Compensation Act.

The report is complete as to the minute statistical exhibit of the results of the Act, the tables being given not only for the past year but for the four past years, so that with this report before him one gets a very clear idea of the operation of the Act in Montana for four years.

E. M. HARDY.

# Report of Industrial Commission of the State of California-1919. 167 pp.

The report, which covers the operations of the Commission from July 1, 1918, to June 30, 1919, is in two sections. The first section deals with the activities of the various departments, among which may be mentioned the Medical and the Permanent Disability Rating Departments, and the Department of Safety.

For the first time the Commission speaks of a Department of Rehabilitation. This new department came into existence in 1919 as a result of the passage of a law for the industrial re-education of those permanently disabled in work accidents in the State of California. To create a fund to cover the cost of re-education, the law provides that the employer or his insurance carrier shall pay into

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the Treasury of the State of California the sum of \$350 in every case of fatal injury where the deceased leaves no dependents. This is known as the Industrial Rehabilitation Fund. In anticipation of such a law being passed, or what is more likely, because in advocating the law it needed facts to assure its passage, the Commission undertook in July, 1918, a survey of all the serious permanent injuries which had occurred in the State between January 1, 1914, and June 30, 1918. The report of this survey, published in January, 1919, shows that the "typical" average workman so injured is 37.8 years of age with a permanent disability rating of 34.75 per cent., which entitles him to a weekly compensation of \$13.55 for 139 weeks; that after losing practically a year he is now employed at \$16.60 a week, but feels doubtful of being able to hold down his job, and that before being injured he had earned \$22.34 a week, which was then equivalent to the present purchasing power of \$28.00.

It is gratifying to learn that the Commission, through its Department of Rehabilitation, is already training a number of cases. On July 1, 1919, the Commission had twenty cases undergoing courses in re-education, and by this time there must be considerably more than twenty. There should be nothing but words of commendation for this phase of the work of the Commission. It demonstrates that the Commission is not content merely to administer the law, but that in its concern for the welfare of the workers who come under its jurisdiction it goes beyond the indemnification of injuries and seeks in every way to so ameliorate and improve the condition of handicapped workmen that they may again resume their former place in the industrial world.

The description of the work of the other departments indicates a vigorous and impartial administration of the California Act, particularly as respects the safeguar ling of machinery in places of employment.

The second and principal section of the report is a statistical analysis of the accidents which occurred during calendar year 1918.

Those who have had occasion to refer to previous reports of the Commission will find little change and some deterioration in the methods of presenting the mass of statistical material compiled from the Commission's records.

As far back as 1915, Mr. J. H. Woodward, in reviewing the 1914 report of the Commission, pointed out that the data presented, while interesting, were not only of no practical value in solving compensation problems owing to the entire absence of information regarding exposure, but also likely to mislead inexperienced or hasty readers. The same criticism holds true of all reports issued since 1914, and particularly of the 1919 report.

The desirability of exposure data is recognized. On page 40 of the report preceding the one under discussion will be found a statement to the effect that the statistical department was at that time without figures as to the number of workers engaged in industries in the State and consequently was unable to explain the reason for the increase in the number of accidents over the prior year. With the problem of obtaining exposure figures hardly susceptible of solution under the present plan of collecting accident information, it seems that some of the extensive tables of the report might well be dispensed with, as they are valueless unless related to some measure of exposure.

For example, of the 125 pages devoted to the statistical section of the report, over 50 pages are given over to tables showing a distribution of injuries by manual classifications. Aside from the question of lack of value for the casualty statistician and actuary in rate making, and the misleading character of the information, there are several features of this exhibit which should be corrected immediately if the tables are to be retained.

In the first place, the phraseology of the manual classifications is given in full. When it is considered that the first few words of each classification fully identify the industry and that the remaining words are only for the guidance of the agent in the proper classification and underwriting of risks, it seems absurd to include the complete phraseology in the tables. For example, classification No. 5208 contains about 55 words. The first three words "Concrete Work-buildings" are completely descriptive of the classification for all practical purposes. For the technical man who is in possession of manuals and manual classification codes, it would be a simple matter to distinguish this particular classification from other concrete work classification by means of the code number which is given in the table. The opinion is ventured that with the phraseology of the classifications abbreviated to the few necessary identifying words only about 40 per cent. of the space devoted to these tables would be necessary. This would be in line with the desire of the Commission to cut down the space to a minimum. It

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would also help the much-harassed reader in locating his classification without wading through a mass of verbiage.

The Commission publishes the tables apparently for the purpose of enabling each industry to ascertain the number of accidents reported and other information with reference to compensation and medical payments. If this is the sole purpose of the exhibit, its value is questionable. The information with reference to number of accidents has no value in itself and may be absolutely misleading. Thus, of two industries one has a record of 2,007 temporary injuries during 1918; the other has a record of 28 temporary injuries for the same period. To the uninitiated, it might appear that the first industry represents 70 times the hazard as regards temporary injuries as does the second industry. The fact is, however, that the first industry is gold mining-a most important industry in California in which there is a considerable exposure. The second industry is incandescent lamp manufacturing, in which the exposure measured in terms of employes or payroll is comparatively small. The monetary values in the exhibit likewise have no significance as absolute quantities. They are only useful in obtaining the ratio and averages for each industry and are of no particular value in comparing conditions as between industries.

Another disadvantage of the present make-up of the tables is the illogical order in which the classifications are listed. As at present arranged the only way to find a classification is to begin with the first one and to seek through the pages of the exhibit until the particular one is located. An alphabetical arrangement would be of great aid. It should be noted further that the use of the manual classifications has the effect of breaking up the various industries into subdivisions which have no significance in a statistical report of this character. Thus, there are four or five classifications for the packing house industry. An attempt to subdivide an industry so small as this one in California produces ridiculous results. Furthermore, the Commission has made no effort to assemble the experience in groups or any large subdivisions of industry. It merely presents a mass of data analyzed to the *n*th degree.

The construction of the tables in general is faulty in many respects. In the first place, they are not numbered, which makes it necessary to give the entire title and the page number in order to refer to them. Neither are they indexed properly. A person seeking for certain information must search through the entire report and read or examine all of it to find some bit of information in which he is interested. In a number of instances text is interposed between the title and the table itself, varying from three lines to half a page.

The table of the average wages of those fatally injured in 1918, on page 59, furnishes a fair example of the general faulty construction of the tables in the report. To bring out the points more clearly, the table is given here in full:

### AVERAGE WAGE OF THOSE FATALLY INJURED IN 1918.

The average wages of those fatally injured in 1918 for each main industry, compared with the previous average for years 1916, 1917 and 1918, appear in the following table.

The average wage of those fatally injured was \$25.01.

Average Wage.	1916.	1917.	1918.
Average wage for agriculture	\$14.00 18.80 18.60 21.70 14.70 21.60	\$19.09 18.85 20.89 22.92 26.38 27.69	\$19.73 27.99 24.97 25.65 18.31 25.84
ties	19.70	23.45	24.97

In the first place, the title is wrong. It states that the wages are of those injured in 1918, whereas it actually gives the wages for three years; in the second place, four lines of text are interposed which had better have been left out altogether. The language is bad. Meant to simplify and explain, the text is put in such English that it is made to appear that wages of those injured in 1918 are compared with the wages of those injured in the same year. The last sentence shows that the average wage of those injured was \$25.01, but it fails to state for what year. This is left to the imagination of the reader. Of course, the proper place for the average wage for all industries is immediately following the last line in the table, and since 1916 and 1917 wages are compared with those of 1918, it follows that such averages should be given for each year. The average wage for all industries is much more significant than the several averages for the various divisions of industry and the reader should not be left in the air, so to speak, with the vague and incomplete statement given in the text. The first column of the

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table giving the industry is headed "Average wage." Of course, the proper heading for this column is "Industry," as the title indicates that the monetary values in the table stand for average wages. Another peculiarity will be noted. The words "Average wage" are unnecessarily repeated for each industry.

The explanatory text, aside from presenting the subject matter in an improper manner, is couched in such language that the statements are often illogical and incoherent.

A striking but withal a typical example, a perfect epitome of all the shortcomings of the statistical portion of the report, is afforded by the fourth paragraph on page 64, which is quoted herewith:

"So from these figures it would seem that, with the exception of shipyards, hazards to farm laborers and operators in sawmills seem to be on a par during the year 1918."

The paragraph is patently a summing up of preceding statements. The reader, however, has no recollection of any mention of shipyards. Consequently the interpolation of the unintelligible and gratuitous reference to shipyards puzzles him. A re-reading of the preceding paragraphs fails to elicit any information in regards to shipyards. By this time the reader, if he is of the inquiring and analytical type of mind, is determined to find out for himself what it is all about. A partial answer is found in the paragraph following the one quoted, where it is stated that shipyards reported 233 permanent injuries. But why this singling out of shipyards, sawmills and farm labor for special mention? Perplexed, the reader has recourse to the table itself for a possible explanation. After a fruitless effort to find shipyards it may or may not dawn upon him to look for boat building. It is granted that he should be credited with sufficient intelligence and acquaintance with the subject to associate shipyards with boat building. He refers to boat building and finds three boat building classifications with a total record of 258 permanent injuries, one of which was responsible for the 233 cases mentioned in the text. But upon what grounds were the other two classifications not deemed to be shipyards? This question remains unanswered. The reader next discerns for himself what should have been pointed out in the text that boat building was responsible for the greatest number of permanent injuries and that farm labor and sawmills, each with 96 cases, rank next in point of number. With this information he is finally able to formulate some notion of the meaning which was intended to be conveyed by the paragraph. Using the original language as much as possible it might be stated thus: It will be seen that farm labor and sawmill operations were equally hazardous and, with the exception of shipyards, seemingly the most hazardous industries in 1918.

Whether or not the author's meaning has been correctly interpreted by the reconstructed paragraph is not germane to the subject. Whichever way it is viewed, it will be conceded that the reader is offered erroneous conclusions in regard to hazardousness of certain industries. Three factors which should have been considered before making comparisons of this sort were ignored. In the first place, the comparison is based on absolute magnitude of quantity without reference to the number of employees exposed in each of the industries considered. In the second place, the permanent injuries are made the sole criterion of hazard, no consideration being given in this comparison to deaths and temporary injuries which might far outweigh the permanent injuries in importance. Lastly, the question of severity of the permanent injuries is disregarded. As likely as not the farm laborers may have sustained mostly the loss of fingers and toes, whereas among the sawmill workers the loss of hands and arms may have predominated.

Examples bearing out these criticisms might be multiplied, but enough has been presented to indicate the necessity for a thorough reconsideration by the Industrial Commission of its method of analyzing and presenting statistics. The statistician should strive for accuracy in his materials and in his methods of presenting them. He should compile statistics which are valuable and not waste time on information that has no practical value or significance. His conclusions should be presented in a logical way and concisely. A statistical report should be readable, easily understood by the readers for whom it is intended, and it should never be possible to misinterpret what is presented. And above all, the language should be simple, direct and in good form. To quote Mr. L. W. Hatch in his recent discussion on a paper in our *Proceedings*:

"These shortcomings of language may perhaps be regarded by some as not of major importance. Nevertheless, of all the sciences, statistics should aim at the highest standards of clear and accurate expression and to maintain such should be the constant endeavor of our Society."

## MARCUS MELTZER.

# CURRENT' NOTES.

# THE NATIONAL COUNCIL ON WORKMEN'S COMPENSATION INSURANCE.

Ratemaking in the field of workmen's compensation insurance has passed through a good many phases in this country, the trend being toward a greater degree of supervision by government. There are signs which indicate that standard rating methods and uniformity of actuarial technique in this branch of casualty insurance are possible of early achievement.

It has for some time been recognized that the future of the business depends rather importantly upon the need for divorcing from each other those problems which are competitive and those which are strictly scientific-such for instance as the making of basic rates. During the first years of workmen's compensation in the United States rates were made from data obtained and controlled by the stock casualty companies. Soon, however, the rates began to be subject to state supervision and the insurance departments took a hand in the gathering and publication of such data. Rate revisions which have taken place from time to time have been participated in by all classes of carriers, stock, mutual and State fund, with the insurance departments keeping in close touch-usually as ex-officio members of rating committees and conferences. These informal and occasional assemblies finally assumed the form of permanent standing committees. One development of these was known as the National Council of Workmen's Compensation Insurance. It consisted of three technical committees (one for underwriting, one for actuarial and one for engineering functions), and an advisory committee of the managers of the several boards and bureaus having local authority to maintain and apply rates in the field. The National Council, as thus constituted, was a loose organization and convened infrequently so that its efforts to act as a clearing house through which to control and standardize proposals emanating from the various local bureaus were only partially successful.

Early in 1919 plans for a general revision of rates based on

countrywide experience were being discussed. Out of the discussion developed a plan for making the National Council a working organization with permanent quarters and a statistical department of its own. To insure continuity of membership it was arranged that carriers should not become members as such but only through their affiliation with boards and bureaus having to do with the application of rates. Three technical committees were provided for as under the previous National Council. The Committee of Managers and a Governing Committee completed the organization plan and a general manager was provided to give effect to the scheme.

At this writing the organization of the staff of the new National Council is halted by sheer lack of physical quarters due to the congested condition of the business section of New York City. Nevertheless an important rate revision is going on under its auspices with a staff of experienced actuarial assistants employed by special arrangement with the National Workmen's Compensation Service Bureau. The actuarial and statistical work is being conducted under the direction of the Actuarial Committee of the Council, comprising Messrs. A. H. Mowbray, G. D. Moore, E. Scheitlin, S. B. Perkins, S. B. Black and W. H. Burhop, all of whom are members of this Society. The actuarial technique of the forthcoming revision will be of particular interest to the Society. It is to be hoped that these actuaries will contribute to an early number of *Proceedings*, the results of their respective endeavors in this highly important work.

# UNIFORM STATISTICS FOR AUTOMOBILE CASUALTY INSURANCE.

The National Workmen's Compensation Service Bureau (15 Park Row, New York City), in line with its program of standardizing the statistical information which its members compile and which is used as the basis for ratemaking, has recently published a statistical plan for automobile casualty insurance. The present plan is a revision of a plan originally put into effect by the Bureau on January 1, 1917. It has been adopted not only by the Bureau but also by the National Automobile Underwriters Conference (Fire and Marine Companies) and the National Automobile Bureau (non-Bureau Stock Casualty Companies).

The plan is too lengthy to reproduce; however, the introduction, in which the history of the plan and a statement of its purpose are
given is brief, and because of its general interest to students of casualty insurance, this is given below in full:

The history of the development of automobile insurance has been one of rapid growth. In the beginning there was, of course, no great amount of statistical information available upon which to base rates and the judgment of underwriters was depended upon to a large degree for a correct measurement of hazards. The fact that in the end experience is absolutely necessary to the scientific development of rates was recognized however. With the introduction of the new line of business casualty statistical departments were called upon to keep a record of automobile experience. It was an entirely new field and unfortunately there was no concerted action to produce uniformity in methods of classification and tabulation. The underwriters soon discovered this fact. Experience when submitted for the purpose of rate making could not be used to the greatest advantage because of the varying conditions under which it had been compiled. The work of combining experience returns was both difficult and conclusing. The remedy for this state of affairs was obvious; a concerted effort was needed to place automobile insurance statistics upon a standardized basis. The demand for uniformity originated with the underwriters because they were first to discover the need for large volumes of comparable data.

Some time ago the Automobile Underwriting Committee of the Bureau prepared an extensive statement of the exact details of automobile experience which should be available to that committee for rate making. This statement was issued to all company statisticians in the form of a call for experience. As this call had been drawn by a central committee and issued by a central bureau, its requirements could not adequately be met except by standard data compiled in a uniform manner. This call brought home to the statisticians the necessity for uniformity, and the Statistical Committee of the Bureau set itself the task of developing a comprehensive plan for the tabulation and compilation of automobile statistics. The committee was aided in this work by having previously prepared a similar plan for workmen's compensation experience. Considerable time was spent with the Automobile Underwriting Committee in reducing the required experience to a minimum; an attempt was made to anticipate the various lines of research study which are incidental to the scientific application of experience to the rate making problem; and then with a definite objective in view the statisticians proceeded to develop the technical details necessary to the production of a thoroughly workable plan.

About this time the reorganization of the Bureau took place and the so-called Statistical Committee was placed by the Central Statistical Committee upon which all company statisticians and actuaries serve. The Central Statistical Committee recognizing the importance of automobile experience created a special sub-committee on automobile statistics to continue the preparation of the proposed uniform plan and to carry the work to completion. The Statistical Sub-committee then took up the tentative plan which had been handed down by the Statistical Committee and proceeded carefully to review it and to prepare an amended plan for presentation to the Central Statistical Committee for ratification. This amended plan was finally ratified by the Central Statistical Committee in October, 1916, for use by Bureau companies beginning with the 1917 year of issue.

The fact that the plan was in the process of development for one year, during which it was subjected to the criticism of many different minds guarantees its completeness and adaptability to the statistical procedure of all casualty companies. That questions will present themselves with reference to the details of the plan is admitted. As a matter of fact the Sub-committee will continue its jurisdiction over the plan for the purpose of formulating rules for new problems as they arise. We invite inquiries concerning the plan in all its details and the Actuarial Department of the Bureau will gladly give attention to problems incidental to the application of the plan to the work of any company which may desire to follow it in compiling its automobile experience.

Mention should be made here of the fact that the National Automobile Underwriters Conference (Fire Companies) has been consulted with reference to that section of the plan which relates particularly to Collision Coverage, a form of coverage written by both fire and casualty companies, with the result that we have been able to agree upon a uniform method of reporting this experience. The National Automobile Bureau of Chicago has also agreed to use the same uniform method beginning January 1, 1920.

The object of the plan is primarily to secure the statistical basis for scientific automobile rates. For this purpose a great volume of dependable data is necessary and the plan has been so constructed that these data will be uniformly accumulated in each company office. A combination of experience returns collected under standard rules of procedure and reported to the Bureau in a uniform manner will be comparatively simple. The result of such combination of experience will furnish automobile underwriters with a reliable guide to the rate making problem in all its various phases.

#### THE TREND OF COMPULSORY AUTOMOBILE INSURANCE.

If legislative activity is truly indicative of public sentiment, then compulsory automobile insurance laws will be on the statutes of all states within the next few years. In one state alone, six bills purporting to make automobile insurance mandatory were introduced during the same session of its legislature. In other states, investigations have been ordered to establish the advisability and practicability of requiring such insurance. Nor is this activity confined to one section of the country. Connecticut and Idaho, Texas and New Jersey, now have such laws in force, and New York, Massachusetts, Illinois, etc., have had, or now have pending, bills making automobile insurance a prerequisite to obtaining an automobile license.

Whether this simultaneous action of the states is prompted by the success of the workmen's compensation laws or by the everincreasing number of automobiles cannot be determined. But certain it is that the constantly growing list of automobile fatalities and the great economic loss sustained by the public through insolvent and impecunious automobile owners are very potent factors in the creation of this sentiment which seeks expression in remedial legislation.

There are to-day six million automobiles in operation throughout the United States. Of that huge fleet of "potential instruments of injury" only about 15 per cent. are insured. If the loss ratio of the uninsured automobiles is as great as that of the insured automobiles, the former inflict an annual loss of \$15,000,000. No figures have been compiled to indicate what portion of this colossal loss is compensated. But it may be safely assumed from the alarming increase in bankruptcy cases that at least 60 per cent. of such loss is expressed in uncollectible judgments. Investigation would disclose that the greater part of insured automobiles are owned by men who are financially able to pay any reasonable loss and therefore not in urgent need of insurance but who through business sagacity deem it advisable to transfer this burden to insurance companies. On the other hand it would be found that a high percentage of uninsured automobiles are owned and operated by impecunious and irresponsible owners who either cannot afford insurance or who, being "judgment-proof," desire no insurance. If the law permits the injury of human beings and the destruction of property with impunity, why seek protection? With the phenomenal expansion of the automobile industry and the annual acceleration of production, this class of owners will be increased to such an extent that within the next five years annual unsatisfied losses will. if not checked, reach a staggering amount.

That compulsory automobile insurance will tend to greatly ameliorate existing conditions is indisputable. Its great analogy, workmen's compensation insurance, has clearly demonstrated that. And the rapid succession with which the various states have adopted such leaves no doubt as to the feasibility of public liability insurance. But for the existence of compulsory employers insurance, losses reaching into hundreds of millions annually would be uncompensated. There should be little surprise, therefore, at this almost concerted attempt of the states to eradicate an evil which not only creates irreparable damage but also leaves its victims destitute of financial means.

Edmund S. Cogswell is now General Manager of the National Association of Mutual Casualty Companies.

John M. Bessey, whose position Mr. Cogswell takes, is now General Manager of the Employers' Mutual Insurance Company of New York.

George D. Moore has been appointed Actuary of the Royal Indemnity Company.

Eckford C. DeKay has left the New York Insurance Department and is now Vice-President of T. G. R. Pierson & Co., Inc.

Barrett N. Coates is now Actuary of the Western States Life Insurance Company, San Francisco, California.

S. Bruce Black now has the title of Vice-President and Actuary of the Liberty Mutual Insurance Company.

Bruce D. Mudgett is now connected with the school of business of the University of Minnesota at Minneapolis.

Louis H. Mueller is now Statistican of the State Compensation Insurance Fund of California.

W. H. Burhop, formerly Secretary and Member of the Wisconsin Compensation Insurance Board is now Assistant Secretary and Actuary of the Employers Mutual Liability Insurance Company of Wausau, Wisconsin.

A. L. Kirkpatrick has left the actuarial department of the National Workmen's Compensation Service Bureau and is now in the statistical department of the Globe Indemnity Company.

H. C. Carver has returned to the University of Michigan, where he is Assistant Professor of Mathematics and Insurance. As a result of his experiences in home office statistical work he plans to

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inaugurate a practical course in office routine as part of the training of actuarial students interested in casualty insurance.

Frank R. Mullaney is now Assistant Secretary, as well as Actuary of the American Mutual Liability Insurance Company of Boston.

Walter A. Schaefer is connected with the insurance firm of Schenck & Schenck, Jersey City, N. J.

H. E. Ryan is the General Manager of the National Council of Workmen's Compensation Insurance, the newly organized national rate-making body for workmen's compensation insurance.

James W. Glover, of the University of Michigan, served as Acting President of the Teachers Insurance and Annuity Association, New York City, during the month of September, 1919, in the absence of Dr. Pritchett, the president. Dr. Glover is a member of the Board of Trustees

The Travelers Insurance Company has recently announced several promotions which will interest members of the Society. Everett S. Fallow becomes Actuary of the Accident Department, Sanford B. Perkins Actuary of the Compensation and Liability Department, and Harry V. Waite Statistican of the Compensation and Liability Department.

# HONOR ROLL.

The following members of the Society have been in the military or naval service of the United States.

Amerine, W. M.	First Lieutenant, U. S. A.
Baridon, F. E	U. S. A.
Blanchard, R. H	Captain, U. S. A.
Brockway, U. H	Captain, U. S. A.
Case, Gordon	First Lieutenant, U. S. A.
Coates, B. N.	U. S. A.
Craig, A. H	Lieutenant, U. S. A.
DeKay, E. C	Lieutenant Commander, U. S. N.
Dorweiler, Paul	Captain, U. S. A.
Egbert, L. D	U. S. A.
Feder, M	Captain, U. S. A.
Graham, T. B.	Captain, U. S. A.
Hess, H	Sergeant, U. S. A.
Kirkpatrick, A. L.	Second Lieutenant, U. S. A.
McManus, R. J.	Yeoman, 1st Class, U. S. N.
Miller, T. W.	Sergeant, U. S. A.
Milligan, S	Second Lieutenant, U. S. A.
Mueller, L. H.	Second Lieutenant, U. S. A.
Tilson, Howard	Captain, U. S. A.
Waite, A. W.	Second Lieutenant, U. S. A.
Wolfe, S. H	Colonel, U. S. A.

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# Fellows.

Those marke	ed (†) were Charter Members at date of organization,
November 7, 19	14.
Those marked	d (*) have been admitted as Fellows upon examination by
the Society.	
Date Admitte	ed
t	Amerine, W. M., Actuary, Georgia Casualty Co.,
	Macon, Ga.
t	Benjamin, Roland, Comptroller, Fidelity & Deposit
4	Black S Bruce Vice President and Actuary Liberty
1	Mutual Ins. Cc., 185 Devonshire St., Boston,
Apr 20 1917	Blanchard Balnh H Instructor in Insurance
mp1. 20, 1011	School of Business Columbia University New
•	York.
May 19, 1915	Bradhaw, Thomas, Commissioner of Finance and
<i></i>	City Treasurer, Toronto, Canada.
ŧ	Breiby, William, Partner in firm of Fackler & Fack-
,	ler, Consulting Actuaries, 35 Nassau St., New
*0 1 01 1018	York.
*Oct. 31, 1917	Brockway, U. Hayden, Travelers Ins. Co., Hartford,
1	
Ť ·	Brodin, Richard, Actuary, United Life and Acci-
0 4 00 1015	dent Ins. Co., Concord, N. H.
Oct. 22, 1915	Brown, Herbert D., Chief of U.S. Efficiency Bureau,
0 4 00 1015	Wasnington, D. C.
Oct. 22, 1915	Brown, William H., Second Vice-President and Sec-
	retary, Columbian National Life Ins. Co., Boston,
L	Mass.
I ·	Duck, George B., Actuary, Teachers' Retirement
	Nom York
Mar. 96 1016	New LOCK.
may 20, 1910	Ducklin, walter S., President, Liberty Mutual Ins.
L '	Dudleng W A Semi-turbut of Cl.
f	monoial Travelary Mutual Assidant Arm. Thi
	N Y
Apr. 20, 1917	Burbon W H. Asst Secv and Actuary Employees
	Mutual Liability Ins. Co., Wasau, Wis.

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Feb. 91, 1915	Burns, F. Highlands, First, Vice-President, Mary-
	land Casualty Co., Baltimore, Md.
t	Cammack, Edmund E., Associate Actuary, Aetna
t	Carpenter, Raymond V., Assistant Actuary, Metro-
*Nov.21,1919	Carver, Harry C., Assistant Professor of Mathe- matics and Insurance, University of Michigan,
Feb. 19, 1915	Ann Arbor, Mich. Case, Gordon, Office of F. J. Haight, Consulting Actuary, Hume-Mansur Bldg., Indianapolis, In-
Feb. 25, 1916	Close, Charles L., Manager, Bureau of Safety, U. S. Steel Corporation, 71 Broadway, New York.
*Nov.15,1918	Coates, Barrett N., Actuary, Western States Life Ins. Co. San Francisco. Cal
Oct. 27, 1916	Cogswell, Edmund S., General Manager, National Association of Mutual Casualty Companies, 233 Broadway, New York
t	Cole, Richard H., Secretary, Connecticut General
Feb. 19, 1915	Collins, Henry, Assistant Manager, Ocean Accident
t	Conway, Charles T., Vice-President, Liberty Mu-
t	Copeland, John A., Consulting Actuary, 1709 Third
t	Cowles, W. G., Vice-President, Travelers Ins. Co.,
t	Craig, Arthur H., Fredk. C. Smith Co., 1 Liberty St., New York.
t	Craig, James D., Assistant Actuary, Metropolitan Life Ins. Co., 1 Madison Ave., New York.
†	Craig, James M., Actuary, Metropolitan Life Ins. Co., 1 Madison Ave., New York.
May 26, 1916	Crum, Frederick S., Assistant Statistician, Pruden- tial Ins. Co., Newark, N. J.
Nov. 15, 1918	Davis, Mervyn, Assistant Actuary, Equitable Life Assurance Society, 120 Broadway, New York.
t	Dawson, Alfred B., Miles M. Dawson & Son, 141 Broadway, New York.
t	Dawson, Miles M., Counsellor at Law and Consult- ing Actuary 141 Broadway New York
†	De Kay, Eckford C., Vice-President, T. G. R. Pier- son & Co. Insurance Brokers 15 William St
	New York.
t	Dearth, Elmer H., President, General Casualty & Surety Co., 114 Woodward Ave., Detroit, Mich.

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May 19, 1915	Deutschberger, Samuel, Chief Examiner, Under- writers' Association Bureau, New York Ins. Dept.
	165 Broadway, New York.
t	Downey, E. H., Special Deputy, Insurance Depart-
•	ment, Harrisburg, Pa.
ŧ	Dublin, Louis I., Statistician, Metropolitan Life
	Ins. Co., 1 Madison Ave., New York.
May 19, 1915	Dunlap, Earl O., Metropolitan Life Ins. Co., 1
	Madison Ave., New York.
Ť	Egbert, Lester D., Office of Willcox, Peck, Brown
	& Urospy, Insurance Brokers, 3 S. William St.,
+	INEW LORK. Ensteen Seul Le Lare Cel
1	Factor David Parks Consulting Actuany 25 Neg
I	son St New York
+	Fackler Edward E Consulting Actuary 35 Nassau
1	St. New York
+	Fallow, Everett S., Actuary, Accident Dept.,
,	Travelers Ins. Co., Hartford, Conn.
t	Farrer, Henry, Actuary, Hartford Accident & In-
•	demnity Co., Hartford, Conn.
Feb. 25, 1916	Fay, Albert H. Statistician, U. S. Bureau of Mines,
	Washington, D. C.
Feb. 19, 1915	Fellows, C. W., Manager, State Compensation Ins.
	Fund, 525 Market St., San Francisco, Cal.
1	Fitch, Frank M., Auditor, Hartford Steam Boiler
<b>W-1</b> 10 1012	Inspection & Ins. Co., Hartford, Conn.
reb. 19, 1915	Dea Meinea Long
1	Des Mondiet Ti Aggigtant Segnetary Travelors
i	Ins Co Hartford Conn
Feb. 15, 1915	Fondiller, Richard, Supt., Bureau of Records &
, , , , , , , , , , , , , , , , , , , ,	Accounts, Group Ins. Dept., Equitable Life As-
	surance Society, 120 Broadway, New York.
t	Forbes, Charles S., Consulting Actuary, 68 William
_	St., New York.
May 26, 1916	Frankel, Lee K., Third Vice-President, Metropolitan
	Life Ins. Co., 1 Madison Ave., New York.
	Franklin, C. H., 825 West 7th St., Plainfield, N. J.
Feb. 25, 1916	Froggatt, Joseph, Fresident, Joseph Froggatt & Co.,
Т	Insurance Accountants, 25 Church St., New 10rk.
T	William St. New York
Feb 19 1915	Garrison Fred S Assistant Secretary Travelors
2 00. 10, 1010	Indemnity Co Hartford Conn
ŧ	Gaty. Theodore E., Vice-President and Secretary.
I	Fidelity & Cascalty Co., 92 Liberty St., New
	York.

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May 19, 1915	Glover, James W., Professor of Mathematics and In-
	surance. University of Michigan, 620 Oxford
	Road, Ann Arbor, Mich.
ł	Goodwin, Edward S., Goodwin-Beach & Co., Bank-
I	ers. 36 Pearl St., Hartford, Conn.
÷	Gould William H Consulting Actuary 256 Broad-
ſ	way New York
Oct 22 1915	Graham George Vice-President and Actuary Mis-
000.00, 1010	souri State Life Ing Co. St Louis Mo.
Oct 22 1915	Graham T Bartrand Matropolitan Life Ins. Co.
000.00, 1010	I Madicon Ave New York
Ļ	Graham William I Third Vice-President Equi-
1	toble Life Assurance Society 120 Broadway New
	Vork
L	Grandfald Pohent E. Secretary Industrial Acci-
1	dont Board State House Boston Mass
+	Groone Winfield W Special Deputy Commissioner
I	of Banking and Ingurance 571 Broad St New-
	orb N T
T	Hamilton B C L Comptrollor Hartford Acci
<b>I</b> .	dont & Indomnity Co. Hartford Conn
1	Hammond H Pierson Assistant Actuary Life
ſ	Dont Travelars Inc. Co. Hartford Conn.
T	Hangan Carl M. Someters American Be Incurance
l	Co Huntingdon Po
Oct 97 1016	Handy Edward B. Aggistant Managan New York
	Fire Tra Frehance 192 William St. New York
Oct 99 1015	Hetch Loopard W Chief Statistician State Indus
000.00, 1910	trial Commission Albany N V
Nov 91 1010	Handorson Bohort Actuary Fauitable Life Acour
100.01, 1919	ana Society 120 Breadway New York
Act 99 1015	Here Herbert Joseph Frograft & Co. Incurance
006. 22, 1910	Accountants 25 Church St. Now York
1	Hillen Dehent T. Dregident Fidelity & Convolty
T	Co. 09 Liberty St. New York
Nov 15 1019	Hingdolo F W Socretary Worlsman's Company
100.10, 1910	tion Board Vancourar B. C. Canada
Oct 99 1015	Hodgling L. C. Socretary Magonic Destection
000. 22, 1910	Agan Worcester Mass
Ŧ	Hoffman Frederick L. Whird Vice Dresident on J
I	Statistician Dandontial Inc. Co. Normal N. J.
Oct 99 1015	Holland Charles H Dresident and Concred Mar
000.22, 1915	agor Doval Indomnity Co. 94 William St. Norr
	Vorb
Nov 91 1010	LUIK. Healwheith Carl Furnant II & Deresson of I.
1104.21, 1918	Statistica Washington D. C. S. Bureau of Labor
T	Bushes Charles Anditas and Astrony M. N.
Ţ	Ing Dont 165 Propagator N= N-1
	ins. Dept., 100 Broadway, New York.

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MEMBERSHIP OF THE SOCIETY.

t	Hunt, Burritt A., Actuary, Casualty Dept. Aetna
t	Hunter, Arthur, Chief Actuary, New York Life
Feb. 25, 1916	Jackson, Charles W., Actuary, Postal Life Ins. Co., 511 Fifth Ave. New York
May 19, 1915	Johnson, William C., Vice-President, Masonic Pro-
May 23, 1919	Kelley, Gregory C., General Manager, Pennsylvania Compensation Rating & Inspection Bureau, 507
Ť	King, Walter I., Secretary, Group Insurance Dept., Connecticut General Life Ins. Co., Hartford, Conn
*Nov.21,1919	Kirkpatrick, A. L., Globe Indemnity Co., 45 Wil- liam St. New York
t	Kopf, Edwin W., Assistant Statistician, Metropoli- tan Life Ins. Co. 1 Medison Ave. New York
Feb. 19, 1915	Laird, John M., Actuary, Connecticut General Life
Feb. 19, 1915	Landis, Abb, Consulting Actuary, 1107 Independent
t	Law, Frank E., 322 Claremont Ave., Montclair, N. J.
May 19, 1915	Lawson, F. W., U. S. Manager, London Guarantee & Accident Co., Ltd., 134 So. La Salle St., Chi-
- †	Leal, J. R., Interstate Life and Accident Co., Chat-
t	Leslie, William, Actuary, New York Ins. Dept., 165 Broadway, New York
Feb. 19, 1915	Lubin, Harry, State Industrial Commission, 411 Fifth Ave. New York
†	Luckett, D. G., General Manager and Secretary, United States Casualty Co., 80 Maiden Lane, New York
May 23, 1919	McDougal, Alfred, Accident Manager, Phoenix As- surance Company, Phoenix House, King William St. F. C. Londou, England
*Oct.31,1917	McManus, Robert J., Travelers Ins. Co., Hartford,
Feb. 19, 1915	Maddrill, James D., Supervisor of Training, Fed- eral Board for Vccational Education, 997 Monad- nock Bldg. San Francisco. Colif.
t	Magoun, William N., General Manager, Massachu- setts Rating & Inspection Bureau, 88 Broad St., Boston, Mass.

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May 19, 1915	Maycrink, Emma C., Auditor, Compensation In- spection Rating Board, 135 William St., New York
Feb. 19, 1915	Mead, Franklin B., Secretary and Actuary, Lincoln National Life Inc. Co. Fort Wayne, Ind.
Apr. 20, 1917	Meltzer, Marcus, Statistician, National Workmen's Compensation Service Bureau, 13 Park Row, Now York
t	Michelbacher, G. F., Actuary, National Workmen's Compensation Service Bureau, 13 Park Row, New York
t	Miller, David W., 354 New York Ave., Brooklyn, N Y
†	Milligan, Samuel, Metropolitan Life Ins. Co., 1 Madison Ave., New York.
t	Mitchell, James F., First Asst., U. S. Manager, Gen- eral Accident Fire and Life Assur. Corp., Fourth and Walnut Sts., Philadelphia, Pa.
t	Moir, Henry, Second Vice-President and Actuary, Home Life Ins. Co. 256 Breadway, N. Y.
Ŧ	Moore, George D., Actuary, Royal Indemnity Co.,
May 19, 1915	Morris, Edward B., Actuary, Life Dept., Travelers
Nov.21,1919	Morrison, Charles E., Vice-President and General Manager, Utilities Mutual Ins. Co., 5 Nassau St., New York
†	Morrison, James, Chief Accountant, Royal Indem- nity Co. 84 William St. New York
t	Mowbray, Albert H., Actuary, State Industrial Com- mission 411 Fifth Ava. New York
May 20, 1918	Mudgett, Bruce D., University of Minnesota, Minne-
+	Mullaney, Frank R., Actuary and Asst. Secy., Amer- ican Mutual Liability Ins. Co., 245 State St., Boston Mass
†	Nicholas, Lewis A., Statistician, Fidelity & Cas-
t	Olifiers, Edward, Actuary, A Sul America, Rio-de-
t	Orr, Robert K., President, Michigan Employers
t	Otis, Stanley L., Secretary, Insurance Federation of the State of New York, 80 Maiden Lane, New York.
*Nov.21,1919	Outwater, Olive E., National Workmen's Compensa-

tion Service Bureau, 13 Park Row, New York.

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t	Pallay, Julius J., Statistician, London Guarantee & Accident Co., Ltd., 134 So. La Salle St., Chi-
May 26, 1916	cago, Ill. Parker, Jr., John M., Secretary, Accident and Li- ability Department, Aetna Life Ins. Co., Hart-
Nov. 15, 1918	ford, Conn. Perry, W. T., Manager for Canada, Ocean Acci- dent and Guarantee Corporation, Toronto, Can-
t	ada. Reiter, Charles G., Assistant Actuary, Metropolitan
t	Remington, Charles H., Assistant Treasurer, Aetna
May 23, 1919	Richardson, Frederick, U. S. Manager, General Accident Fire and Life Assur. Corp., Fourth and Walnut Sts. Philadelphia Pa
Feb. 19, 1915	Rolph, Mrs. Dorothy M., Deputy Commissioner and Actuary Colorado Ins. Deputy Deputy Color
· † ·	Rubinow, I. M., 550 Riverside Drive, New York. Ryan, Harwood E., General Manager, National Council on Workmen's Compensation Insurance, 128 William New York
t	Saxton, Arthur F., Chief Examiner of Casualty Companies, New York Ins. Dept., 165 Broadway, New York
† †	Scattergood, Claude E., 56 Beaver St., New York. Scheitlin, E., Statistician, Globe Indemnity Co., 45 William St. New York
t	Senior, Leon S., Manager and Secretary, Compensa- tion Inspection Rating Board, 135 William St., Now York
t	Smiley, J. W., Actuary and Chief Accountant to the West Virginia State Compensation Commis-
Apr. 20, 1917	sioner, Charleston, W. Va. Smith, Charles G., Actuary, New York Ins. Dept.,
Feb. 19, 1915	Stone, John T., President, Maryland Casualty Co.,
Feb. 25, 1916	Strong, Wendell M., Associate Actuary, Mutual Life
Oct. 22, 1915	Strong, William Richard, 39 Streatham High Road,
t	Sullivan, Robert J., Secretary, Liability Depart-
May 19, 1915	Thiselton, Herbert C., General Manager, London Guarantee and Accident Co. Ltd. 20, 21 and 20
1	Lincoln's Inn Fields, London, W. C. 2, England. Thompson, John S., Assistant Actuary, Mutual Life Ins. Co., 32 Nassau St., New York.

+	Train, John L., Secretary and General Manager, Utica Mutual Ins. Co., 239 Genesee St., Utica,
*Nov.21,1919	New York. Van Tuyl, Hiram O., Examiner, New York Ins. Dept 165 Broadway, New York
May 23, 1919	Welch, Archibald A., Vice-President, Phoenix Mu-
t	tual Life Ins. Co., Hartford, Conn. Whitney, Albert W., General Manager, National Workmen's Compensation Service Bureau, 13
t	Park Row, New York. Wolfe, Lee J., Consulting Actuary, 165 Broadway, New York.
t	Wolfe, S. Herbert, Consulting Actuary, 165 Broad-
· †	way, New York. Woodward, Joseph H., Associate Actuary, Guardian Life Ins. Co. 50 Union Square New York
t	Young, William, Actuary, New York Life Ins. Co., 346 Broadway, New York.

#### ASSOCIATES.

Those marked (\*) have been enrolled as Associates upon examination by the Society.

Those marked (1) have passed Part I of the Fellowship Examination. Date Enrolled

#### Date Enrolled

*Nov. 15, 1918	Ackerman, Saul B., Assistant Actuary, State
	Industrial Commission, 411 Fifth Ave., New York.
Nov. 15, 1918	Ankers, Robert E., Actuary, Virginia Ins. Dept.,
	Richmond, Va.
<sup>(1)</sup> *Oct. 27, 1916	Baridon, Felix E., Travelers Insurance Co.,
	Hartford, Conn.
*Oct. 22,1915	Baxter, Don A., Deputy Ins. Commissioner,
	Michigan Ins. Dept., Lansing, Mich.
<b>*O</b> ct. 27, 1916	Bernstein, Abraham, 200 Fifth Ave., New York.
*Oct. 31,1917	Bessey, John M., General Manager, Employers
	Mutual Ins. Co., 61 Broadway, New York.
*Oct. 22,1916	Brann, Ralph M., Supt. Compensation Dept.,
	London & Lancashire Indemnity Company of
	America, 57 William St., New York.
Nov. 15, 1918	Brooks, LeRoy, Statistician, U. S. Fidelity &
	Guaranty Company, Baltimore, Md.
*Nov. 15, 1918	Brunnquell, H. G., Associate Actuary, Wiscon-
	sin Ins. Dept., Madison, Wis.

*Oct. 22, 1915	Buffler, Louis, Employers Mutual Ins. Co., 61 Broadway, New York
*Nov. 15, 1918	Dorweiler, Paul, Aetna Life Insurance Co.,
NT. 18 1010	Hartford, Conn.
Nov. 15, 1918	Egli, W. H., Statistician, Zurich General Acci-
	dent & Liability Ins. Co., 431 Insurance Ex-
*Nov 15 1010	change, Unicago, III.
1107.15,1510	Elston, James S., Assistant Actuary, Life Dept.,
*Oct 22 1015	Fodor Morey Assistant Examinar New York
000. 00, 1010	Ine Dent 165 Breadway New York
May 23 1919	Fletcher Nicholas Sacratary Workmon's Com
114 NO, 1010	pensation Ecord Winning Manitoba Canada
Nov. 21, 1919	Havdon George F General Manager Wiscon-
	sin Compensation Rating & Inspection Bureau
	373 Broadway, Milwaukee, Wis.
May 23, 1919	Hoage, Robert J., Chief Statistician, U. S. Em-
	ployees Compensation Commission, Washing-
	ton, D. C.
*Oct. 31, 1917	Jackson, Edward T., Statistician, Maryland
43°° • • • • • •	Casualty Co., Baltimore, Md.
*Nov. 21, 1919	Jones, Loring D., Claim Auditor, State Ins.
*0.1 01 101W	Fund, 411 Fifth Ave., New York.
*Oct. 31, 1917	nonsation Insurance Fund Donver Colo
*Oct 22 1915	Levy S Leon War Trade Board Washington
000. 20, 1010	D. C.
(1)*Oct. 27, 1916	McClure, Laurence H., Colt's Patent Fire Arms
·	Mfg. Co., Hartford, Conn.
*Oct. 22,1915	McGuire, Vincent G., Group Ins. Dept., Equi-
	table Life Assurance Society, 120 Broadway,
(1)*0.4 AN 1010	New York.
WFOct. 27, 1916	Miller, Illiold W., Iravelers Ins. Co., Hartlord,
*Oct 31 1917	Montgomery Victor Actuary California Inc.
000.01,1011	Dent San Francisco Cal
*Nov. 21, 1919	Mothersill, E. V., Actuary, Standard Accident
,	Ins. Co., Detroit, Mich.
*Oct. 31, 1917	Mueller, Louis H., Statistician, State Compen-
	sation Insurance Fund, 525 Market St., San
#0 1 00 Jozz	Francisco, Cal.
<b>*</b> Oct. 22, 1915	Muller, Fritz, New York Life Ins. Co., 346
(1)*A. ON 1010	Broadway, New York. Nowell William Chief States Englisher Chief
	Incurance Fund 411 Fifth Are Now Value
May 23 1919	Otto Walter E. Treasurer and Actuary Michi-
	gan Mutual Liability Co., Detroit. Mich.

Nov. 21, 1919	Perkins, Sanford B., Actuary, Compensation & Liability Dept., Travelers Ins. Co., Hartford,
*Nov. 15, 1918	Conn. Raywid, Joseph, Statistician, International Fire & Marine Ins. Corp., 3 S. William St., New York
*Nov. 21, 1919	Robbins, Rainard B., Instructor, Mathematics and Insurance, University of Michigan, 1113 Ferdon Road, Ann Arbor, Mich.
<b>*N</b> ov. 15, 1918	Schaefer, Walter A., Schenck and Schenck, In- surance Brokers, 1 Exchange Place, Jersey City, N. J.
*Nov. 15, 1918	Spencer, Harold S., Aetna Life Insurance Co., Hartford, Conn.
Nov. 15, 1918	Sibley, John L., Statistician, United States Cas- ualty Co., 80 Maiden Lane, New York.
Nov. 15, 1918	Sullivan, Oscar M., Chief Statistician, Minne- sota Dept. of Labor, Old Capitol, St. Paul, Minn.
Sept. 17, 1919	Tarbell, Thomas F., Actuary, Conn. Ins. Dept., Hartford, Conn.
*Oct. 22,1915	Tilson, Howard, Captain, Ordnance Dept., Frankford Arsenal, Philadelphia, Pa.
*Nov. 21, 1919	Trench, Frederick H., Utica Mutual Ins. Co., 239 Genesse St., Utica, New York.
*Nov. 21. 1919	Voogt, Walter G., State Compensation Ins. Fund, 525 Market St., San Francisco, Cal.
(1)*Oct. 27, 1916	Waite, Alan W., Aetna Life Ins. Co., Hartford, Conn.
<sup>(1)</sup> *Oct. 27, 1916	Waite, Harry V., Statistician, Compensation & Liability Dept., Travelers Ins. Co., Hartford, Conn.
May 23, 1919	Warren, Charles S., Chief Statistician, Ocean Accident & Guarantee Corp., 59 John St., New York.
Nov. 15, 1918	Wilkinson, Albert E., Statistician, Standard Accident Ins. Co., Detroit, Mich.
Sept. 17, 1919	Williams, John F., Actuary, Tennessee Ins. Dept., Nashville, Tenn.
*Oct. 22, 1915	Williamson, W. R., Assistant Actuary, Life Dent. Travelers Ins. Co. Hartford Conp.
*Oct. 22, 1915	Wood, Donald M., of Childs, Young & Wood, Insurance Exchange, Chicago, Ill.
*Oct. 22, 1915	Woodman, Charles E., Chief Accountant, Ocean Accident & Guarantee Corp., 59 John St., New York.

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\*Nov. 21, 1919 Young, Charles N., Acting Supt. Schedule Rating Dept., National Workmen's Compensation Service Bureau, 13 Park Row, New York.

	Fellows.	Associates.	Total.
Membership, May 23, 1919 By withdrawal	145 2	$45 \\ 1$	190 3
	143	44	187
Additions: By election, Sept. 17, 1919 By election, Nov. 21, 1919 By examination		2 2 6	2 5 10
Transfers from Associate to Fellow	150	54 4	204 4
Membership, November 21, 1919	150	50	200

SCHEDULE OF MEMBERS HIP, NOVEMBER 21, 1919.

### Abstract from the Minutes of the Sixth Annual Meeting, November 21, 1919.

The sixth annual and thirteenth regular meeting of the Casualty Actuarial and Statistical Society of America was held at the Hotel Pennsylvania, New York, on November 21, 1919.

President Woodward called the meeting to order at 10:30 A.M. The roll was called, showing the following thirty-seven Fellows and ten Associates present:

#### FELLOWS.

BLANCHARD BUDLONG BURHOP CAMMACK CRAIG, J. D. DEKAY DEARTH DEUTSCHBERGER DUBLIN FLYNN FONDILLER COULD	GRAHAM, T. B. GRAHAM, W. J. GREENE HARDY JACKSON, C. W. KING KIRKPATRICK LESLIE LUBIN MCMANUS MAYCRINCK MELTZED	MOORE MOWBRAY NICHOLAS OTIS OUTWATER - PALLAY SCHEITLIN SENIOR SMITH VAN TUYL WOLFE, S. H.
GOULD	MAYCRINCK Meltzer Mulligan	WOODWARD

#### ASSOCIATES.

ACKERMAN	RAYWID	WARREN
Egli	SCHAEFER	WOODMAN
McGuire	Spencer	YOUNG, C. N.
NEWELL		-

The President's address was presented.

The minutes of the meeting held May 23, 1919, were approved as printed in the *Proceedings*.

The report of the Council was read and, upon motion, adopted by the Society. The Council also reported that the plan to hold the May, 1920, meeting in Chicago had been tabled.

The Council recommended the following three men for election to Fellowship in the Society, without examination, under the terms of Article III of the Constitution:

Henderson, Robert, Actuary, Equitable Life Assurance Society, New York.

Hookstadt, Carl, Expert U. S. Bureau of Labor Statistics, Washington, D. C. Morrison, Charles E., Vice-President and General Manager, Utilities Mutual Insurance Company, New York.

After ballot, these nominees were declared duly elected Fellows. The Council reported that the following had been enrolled, without examination, as Associates:

HAYDON, G.	F.	TARBELL, T. F.
PERKINS, S.	В.	WILLIAMS, J. F.

The Council reported that the following Associates had passed the necessary examinations and had been admitted as Fellows:

CARVER, H. C.	OUTWATER,	0.	Ε.	(Miss).
KIRKPATRICK, A. L.	VAN TUYL,	Н.	0.	

The Council also reported that the following candidates had passed the necessary examinations and had been enrolled as Associates:

Jones, L. D.	TRENCH, F. H.
Mothersill, R. V.	Voogt, W. G.
Robbins, R. B.	YOUNG, C. N.

The report of the Secretary-Treasurer, a summary of which follows, was read and accepted:

"At the organization of the Society, November 7, 1914, there were ninety-seven Fellows enrolled as charter members. Including those becoming members to day, there are one hundred and fifty Fellows and fifty Associates, a total of two hundred members. The membership of the Society has more than doubled during its first five years.

"During the last fiscal year, November, 1918-November, 1919, Volume V of the *Proceedings* has been issued. This volume consists of Numbers 11 and 12, which are the products of the two meetings held by the Society. One thousand copies of each number have been printed. The growth of the *Proceedings* is shown in the following table:

Volume.	Numbers.	Pa zes.	Papers.	Discussions.
I II IV V	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	381 521 328 466 394	16 30 14 11 10	5 7 31 32 16

"Volume V, bound in buckram, has been furnished gratis to members in addition to Numbers 11 and 12."

The Auditing Committee (Mr. Charles Hughes, Chairman) reported that the books of the Secretary-Treasurer had been audited and his accounts verified.

The Chairman of the Educational Committee, Mr. Albert H.

Mowbray, read its report, which recommended a revision of the examination syllabus, effective in 1921. The Society voted to refer the report back to the Council with power to act.

The Examination Committee (Mr. G. F. Michelbacher, Chairman), submitted a report, of which the following is a summary:

Éxaminations were held on May 7 and 8, 1919, throughout the United States. The following passed the examinations:

### Associateship—Part III ARNOLD, J. A. EDGERLY, L. (Miss) BAGLEY, R. E. ROBBINS, R. B. COOPER, H. F. (Miss) YOUNG, C. N.

Associateship—Part IV

EVANS, W. E. Jones, L. D. Mothersill, R. V. Robbins, R. B. TRENCH, F. H. VOOGT, W. G. YOUNG, C. N.

Fellowship—Part I

CARVER, H. C. KIRKPATRICK, A. L. OUTWATER, O. E. (Miss) MUELLER, L. H.

. . .

Fellowship-Part II

CARVER, H. C. KIRKPATRICK, A. L. OUTWATER, O. E. (Miss) VAN TUYL, H. O.

A vote of thanks was extended to the Editor for the efficient manner in which he had performed his duties.

The annual elections were then held, and the officers and members of the Council, as stated below, were elected in the following order:

President	Benedict D. Flynn
Vice-President	George D. Moore
Vice-President	William Leslie
Secretary-Treasurer	Richard Fondiller
Editor	G. F. Michelbacher
Librarian	Louis I. Dublin
Member of Council (term to expire	No-
vember, 1921)	Ralph H. Blanchard
Member of Council (term to expire	No-
vember, 1921)	W. W. Greene
Member of Council (term to expire	No-
vember, 1920)	S. Herbert Wolfe
Recess was taken until 2:15 P.M.	
The papers printed in this number	were read or presented and

The papers printed in this number were read or presented and those read at the last meeting of the Society were then discussed. Upon motion, the meeting adjourned at 5:15 P.M.

#### CONSTITUTION.

#### (As Amended May 20, 1918.)

ARTICLE I.—Name. This organization shall be called THE CASUALTY ACTUARIAL AND STATISTICAL SOCIETY OF AMERICA.

ARTICLE II.—Object. The object of the Society shall be the promotion of actuarial and statistical science as applied to the problems of casualty and social insurance by means of personal intercourse, the presentation and discussion of appropriate papers, the collection of a library and such other means as may be found desirable.

The Society shall take no partisan attitude, by resolution or otherwise, upon any question relating to casualty or social insurance.

ARTICLE III.—Membership. The membership of the Society shall be composed of two classes, Fellows and Associates. Fellows only shall be eligible to office or have the right to vote.

The Fellows of the Society shell be the present members and those who may be duly admitted to Fellowship as hereinafter provided. Any Associate of the Society may apply to the Council for admission to Fellowship. If his or her application shall be approved by the Council with not more than one negative vote he or she shall become a Fellow on passing such final examination as the Council may prescribe. Otherwise no one shall be admitted as a Fellow unless recommended by a duly called meeting of the Council with not more than one negative vote followed by a ballot of the Society with not more than four negative votes and not less than twenty affirmative votes.

Any person may, upon nomination to the Council by two Fellows of the Society and approval by the Council of such nomination with not more than one negative vote, become enrolled as an Associate of the Society provided that he shall pass such examination as the Council may prescribe. Such examination may be waived in the case of a candidate who for a pericd of not less than two years has been in responsible charge of the statistical or actuarial department of a casualty insurance organization or has had such other practical experience in casualty or social insurance as in the opinion of the Council renders him qualified for Associateship.

ARTICLE IV.—Officers and Council. The officers of the Society shall be a President, two Vice-Presidents, a Secretary-Treasurer, an Editor, and a Librarian. The officers with ex-Presidents, ex-Vice-Presidents and four other Fellows shall constitute the Council.

ARTICLE V.—Election of Officers and Council. The officers shall be elected by a majority ballot at the annual meeting for the term of one year and two members of the Council shall, in a similar manner, be annually elected to serve for two years. The President and Vice-Presidents shall not be eligible for the same office for more than two consecutive years nor shall any retiring member of the Council be eligible for re-election at the same meeting.

ARTICLE VI.—Duties of Officers and Council. The duties of the officers shall be such as usually appertain to their respective offices or may be specified in the by-laws. The duties of the Council shall be to pass upon candidates for membership, to decide upon papers offered for reading at the meetings, to supervise the examination of candidates and prescribe fees therefor, to call meetings, and, in general, through the appointment of committees and otherwise, to manage the affairs of the Society.

ARTICLE VII.—*Meetings.* There shall be an annual meeting of the Society on such date in the month of November as may be fixed by the Council in each year, but other meetings may be called by the Council from time to time and shall be called by the President at any time upon the written request of ten Fellows. At least two weeks notice of all meetings shall be given by the Secretary.

ARTICLE VIII.—Quorum. A majority, or seven members, of the Council shall constitute a quorum. Twenty Fellows of the Society shall constitute a quorum.

ARTICLE IX.—*Éxpulsion or Suspension of Members.* Except for non-payment of dues no member of the Society shall be expelled or suspended save upon action by the Council with not more than one negative vote followed by a two-thirds ballot of the Fellows present and voting at a meeting of the Society.

ARTICLE X.—Amendments. This constitution may be amended by an affirmative vote of two-thirds of the Fellows present at any meeting held at least one month after notice of such proposed amendment shall have been sent to each Fellow by the Secretary.

#### BY-LAWS.

#### (As Amended October 27, 1916.)

ARTICLE I.—Order of Business. At a meeting of the Society the following order of business shall be observed unless the Society votes otherwise for the time being:

- 1. Calling of the roll.
- 2. Address or remarks by the President.
- 3. Minutes of the last meeting.
- 4. Report by the Council on business transacted by it since the last meeting of the Society.
- 5. New membership.
- 6. Reports of officers and committees.
- 7. Election of officers and Council (at annual meetings only).
- 8. Unfinished business.
- 9. New business.
- 10. Reading of papers.

11. Discussion of papers.

ARTICLE II.—Council Meetings. Meetings of the Council shall

be called whenever the President or three members of the Council so request, but not without sending notice to each member of the Council seven or more days before the time appointed. Such notice shall state the objects intended to be brought before the meeting, and should other matter be passed upon, any member of the Council shall have the right to re-open the question at the next meeting.

ARTICLE III.—Duties of Officers. The President, or, in his absence, one of the Vice-Presidents, shall preside at meetings of the Society and of the Council. At the Society meetings the presiding officer shall vote only in case of a tie, but at the Council meetings he may vote in all cases.

The Secretary-Treasurer shall keep a full and accurate record of the proceedings at the meetings of the Society and of the Council, send out calls for the said meetings, and, with the approval of the President and Council, carry on the correspondence of the Society. Subject to the direction of the Council, he shall have immediate charge of the office and archives of the Society.

The Secretary-Treasurer shall also send out calls for annual dues and acknowledge receipt of same; pay all bills approved by the President for expenditures authorized by the Council of the Society; keep a detailed account of all receipts and expenditures, and present an abstract of the same at the annual meetings, after it has been audited by a committee of the Council.

The Editor shall, under the general supervision of the Council, have charge of all matters connected with editing and printing the Society's publications. The *Proceedings* shall contain only the proceedings of the meetings, original papers or reviews written by members, discussions on said papers and other matter expressly authorized by the Council.

The Librarian shall, under the general supervision of the Council, have charge of the books, pamphlets, manuscripts and other literary or scientific material collected by the Society.

ARTICLE IV.—Dues. The dues shall be ten dollars for Fellows and five dollars for Associates payable upon entrance and at each annual meeting thereafter, except in the case of Fellows not residing in the United States, Canada, or Mexico, who shall pay five dollars at the times stated.

It shall be the duty of the Secretary-Treasurer to notify by mail any Fellow or Associate whose dues may be six months in arrears, and to accompany such notice by a copy of this article. If such Fellow or Associate shall fail to pay his dues within three months from the date of mailing such notice, his name shall be stricken from the rolls, and he shall thereupon cease to be a Fellow or Associate of the Society. He may, however, be reinstated by vote of the Council, and upon payment of arrears of dues.

ARTICLE V.—Amendments. These by-laws may be amended by an affirmative vote of two-thirds of the Fellows present at any meeting held at least one month after notice of the proposed amendment shall have been sent to each Fellow by the Secretary.

#### RULES REGARDING EXAMINATIONS FOR ADMISSION TO THE SOCIETY.

#### (As Amended May 20, 1918.)

The Council adopted the following rules providing for the examination system of the Society:

1. Examinations will be held on the first Wednesday and Thursday during the month of May in each year in such cities as will be convenient for three or more candidates.

2. Application for admission to examination should be made on the Society's blank form, which may be obtained from the Secretary-Treasurer. No applications will be considered unless received before the fifteenth day of March preceding the dates of examination.

3. A fee of \$5.00 will be charged for admission to examination. This fee is the same whether the candidate sits for one or two parts and is payable for each year in which the candidate presents himself. Examination fees are payable to the Secretary-Treasurer and must be in his hands before the fifteenth day of March preceding the dates of examination.

4. The examination for Associateship consists of four parts. Not more than two parts can be taken in the same year and no credit will be given for the passing of any part unless all previous parts have been passed during the same or previous years. If a candidate takes two parts in the same year and passes in one and fails in the other, he will be given credit for the part passed.

5. In the case of applicants not less than thirty years of age, who have had not less than five years' experience in actuarial or statistical work in insurance offices, the Council may, upon receipt of satisfactory evidence of general education, waive the passing of Parts I, II and III of the Associateship examination. Such applicants may thereupon become Associates by passing Part IV of the Associateship examination.

6. Admission to Fellowship examinations is granted only to those who are Associates of the Society. The examination for Fellowship is divided into two parts. No candidate will be permitted to present himself for Part II unless he has previously passed in Part I or takes Parts I and II in the same year. If a candidate takes both parts in the same year and passes in one and fails in the other, he will be given credit for the part passed.

7. As an alternative to the passing of Part II of the Fellowship examination, a candidate may elect to present an original thesis on an approved subject relating to casualty or social insurance. Candidates electing this alternative should communicate with the Secretary-Treasurer as to the approval of the subject chosen. All theses must be in the hands of the Secretary-Treasurer before the first Thursday in May of the year in which they are to be considered. Where Part I of the Fellowship examination is not taken during the same year, no examination fee will be required in connection with the presentation of a thesis. All theses submitted are, if accepted, to be the property of the Society and may, with the approval of the Council, be printed in the *Proceedings*.

8. In Part II of the Fellowship examination the papers will be so arranged that it will be necessary for the candidate to write on only three of the four prescribed topics in order to obtain full credit.

9. Special attention is called to the following important exception to the above rules effective as respects the year 1920. Examinations will be regularly held in May, 1920, but in the case of candidates for Associateship presenting themselves at that time the passing of Parts I and II will be waived and the candidates will be required to take Parts III and IV only. Commencing with 1921, candidates for Associateship will be expected to pass in all four Parts of the Syllabus.

#### SYLLABUS OF EXAMINATIONS.

#### For Enrollment as Associate.

#### Part I:

- 1. Elementary algebra up to and including the binomial theorem.
- 2. Elementary plane trigonometry including the use of logarithms.
- 3. Elementary plane analytical geometry.
- 4. Double entry bookkeeping.

#### Part II:

- 1. Advanced algebra.
- 2. Elementary differential and integral calculus.
- 3. Elementary calculus of finite differences.
- 4. Theory of probability and least squares.

#### Part III:

- 1. Compound interest and annuities-certain.
- 2. Theory of statistics.
- 3. Elements of the theory of life annuities and assurances, including the calculation of premiums and reserves for the simpler forms of policy.
- 4. Elements of economics.

#### Part IV:

- 1. Practical problems in statistics.
- 2. Policy forms and underwriting practice in casualty insurance, viz.: Personal accident, health, liability, workmen's compensation, fidelity, surety, plate glass, steam boiler, burglary, fly wheel, automobile, workmen's collective, credit.

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#### RULES REGARDING EXAMINATIONS FOR ADMISSION.

- 3. Practical problems in insurance accounting and statistics, including the preparation of annual statements.
- 4. Insurance law, including the more important statutes of the United States and Canada relating to casualty insurance.

#### For Admission as Fellow.

Part I:

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- 1. Calculation of premiums and reserves for accident, sickness, workmen's compensation and other branches of casualty insurance.
- 2. Inspection of risks; adjustment and settlement of claims.
- 3. Investments of insurance companies.
- 4. Current problems in workmen's compensation and other branches of casualty insurance.

Part II:

- 1. Principles and history of social insurance.
- 2. Compilation and use of census or other government statistics relating to population, mortality, invalidity, sickness, unemployment, old age and allied matters.
- 3. Systems of invalidity, old age and unemployment insurance.
- 4. Calculation of premiums for and valuation of pension funds.

VOLUME VI, PART II.

NUMBER 14.

# PROCEEDINGS

# MAY 23, 1920.

# THE EFFECT OF THE WAR UPON THE DEVELOPMENT OF SOCIAL INSURANCE IN THIS COUNTRY.

#### Address of the President, B. D. Flynn.

One of the principal objects of this Society is the promotion of actuarial and statistical science as applied to the problems of social insurance. In workmen's compensation, one of the important forms of social insurance which has been generally adopted in this country, members have contributed most valuable service in applying scientific principles to the solution of the many intricate problems of that form of protection. In any future development of other forms of social insurance-as, for instance, workmen's sickness insurance or unemployment insurance-the actuary and the statistician must be prepared to compile any data which may be available in making estimates of cost, and to work out upon a sound basis proper solutions of the new problems which will arise. Further, it is hoped that members, because of their valuable knowledge of underlying insurance principles, will have an opportunity to assist in framing the general plans for providing these insurance benefits. I do not mean to convey the impression that certain forms of social insurance, such as compulsory workmen's sickness insurance, will eventually be adopted in this country. There is a strong difference of opinion-first, as to the necessity for handling this country's problem in this way and, second, as to the means by which insurance benefits should be provided for its working classes. Whatever our opinions with regard to the matter may be, we should, as persons who may be called upon to play an important and useful part in the working out of insurance costs and plans, keep in touch with developments which may have an effect upon the whole movement. Thinking along these lines, it has occurred to me that it would be interesting and profitable for us to review today the important changes which have occurred in the financial and economic condition of the wage earner since the beginning of the World War-and which are attributable to it

—and the effect which these changes have had upon the development of the social insurance movement in this country. The changes in wage level, cost of living, hours or labor, working conditions, later on the development of the idea of thrift through Liberty Loan and Thrift Stamp campaigns, and last but not least, the advent of prohibition, have all been important factors. It is practically impossible to measure exactly the effect of these changes in conditions, but it should be profitable to review them, to rate their importance so far as possible, and to draw our own conclusions as to their probable effect.

Before taking up this study, let us review briefly the nature of social insurance, its scope and the various means proposed for providing it. Social insurance has as its object the relief of the working classes and their dependents from loss due to accident, sickness, invalidity, old age and unemployment. As one writer has put it, it is a means of securing "the solidarity of the working classes by systems of insurance, against overwhelming disaster." Some writers consider it as the means by which the community can meet its obligation to better the condition of the wage earning class by providing relief against the human misfortunes referred to.

Dr. Rubinow, in his book "Social Insurance," restricts the beneficiary class (presumably of the compulsory form of insurance) to those who are not financially able to pay for commercial insurance. Although other writers do not confine the class so closely, it is apparent that they consider the beneficiaries to be members of a wage earning class who are not able because of inadequate wages to help themselves by means of insurance or in other ways against human misfortunes and weaknesses.

Social insurance benefits may be provided by the compulsory method or by voluntary means. The compulsory form of insurance would be put into effect by means of a federal or state act —as, for instance, the acts providing compensation of workmen for industrial accidents. Many advocates of the compulsory form believe that such a plan can be worked out satisfactorily only by means of a monopolistic governmental agency while others believe that to provide the protection as in workmen's compensation, by competitive insurance carriers of various kinds—such as state funds, mutual organizations or commercial insurance companies would be the most efficient method of providing this protection. The voluntary means for providing social insurance depends upon the voluntary effort of the worker himself, or of his employer, or of both jointly. The benefits are obtained through associations financed by the employee, the employer, or both jointly, by means of fraternal orders, labor organizations or commercial insurance carriers.

How has the financial and economic condition of the wage earning class of this country changel since the commencement of the World War? Wages have increased greatly-and so has the cost of living. It is not necessary to utilize the large volume of reliable statistics which is available to support this statement. The cost of the necessities of life have increased but the pay of the wage earning class, particularly the unskilled labor, has kept pace fairly well with this abnormal increase. A comparison of index numbers showing the course of average weekly earnings in New York State factories with the course of retail food prices in the United States from June 1914 to the present day, shows that although food prices have been generally in advance of the average weekly earnings during the past few years, the situation has changed in the past eight or nine months. Weekly earnings are now in advance of retail food price figures. A comparison of index numbers for relative earnings per hour in eleven prominent industries during the war period, or through 1919, with those for the cost of living for a corresponding period shows that in six of the eleven, earnings had increased more rapidly than the cost of living. Because of the more rabid increase in the rate of wage during the past eight or nine months, it is probable that today in a large number of these industries the increase in earnings per hour would be greater than the increase in the cost of living. These statistics which seem to be the best available, may not prove conclusively our assertion with regard to the race between the worker's earnings and his cost of living. Statistics published periodically by the United States Department of Labor, however, show that with the exception of a few cases in the income group of less than \$900 per annum in certain sections of the country, there is a comfortable surplus shown in the family budget of all income groups over total yearly expenses. If further evidence is necessary, we can turn to the retail merchant of necessities or luxuries who can give testimony that the wage earner during the past few years has been his best customer. It seems to be a safe conclusion, therefore, that the financial condition of the wage-earning class has improved greatly since the beginning of the World War. He has enjoyed general prosperity as compared with his financial condition prior to three or four years ago.

Coincident with the improved financial condition of the wage earner, there has been a marked improvement in his hours of work and working conditions. During the war period, because of the pressure for production and the consequent demand for labor, overtime work was done in many industries. The eighthour day movement made rapid progress, however, so that it is now established in practically all branches of industry as the basic working period. The observance of the Saturday half-holiday has further reduced the 48-hour week to 44 hours. Shop conditions of workers have also been improved. The prosperity which has come to employers has enabled them to put back into the plants part of their extra profits for improvement of working conditions.

Unemployment due to the scarcity of work has been reduced to a minimum. An examination of employment conditions in the United States in the period March to June 1919 showed a marked falling off in the labor surplus. The demand for labor, particularly unskilled workers, was never so great as at present. The ease with which older men have obtained work has effected another feature of the whole problem to the extent of decreasing somewhat the need for old age pensions. Men who five or ten years ago were, because of scarcity of work, dependents and subjects for old age pension help are at present earning good wages upon work which is not too heavy for their reduced strength.

Thrift, which may be considered as an offset to the necessity for compulsory social insurance, has been materially developed since the beginning of the war. The Liberty Loan and Thrift Stamp campaigns which went into the factories and other work places stimulated and developed the idea of saving. It is difficult to show in a convincing way the growth of the habit of thrift. Reports of enormous increases in savings bank deposits are not conclusive. With the budget of the average worker showing a surplus, however, he has been a more willing listener to the savings plans of employers and of savings organizations, with the result that a larger percentage of wage earners have saved and a larger part of their earnings have gone into savings accounts.

The effect which the coming of prohibition has and will have

upon the economic condition of the wage earner is an interesting speculation. In those states which adopted prohibition several years ago the general testimony of employers was that the condition of the worker was greatly improved-he kept himself and his family in better condition, worked steadier and therefore earned and saved more money. It is probably too early to look for the effects of National Prohibition. There have been statements by various employers, however, that they have already begun to see the good effects not only in the steadiness of certain elements of their working forces but also in the improved home conditions of these employees. On the other hand, there is a feeling current that the inability of certain classes of workers to obtain their beer or wine has left them in a restless frame of mind. It is felt by many employers that part of the general unrest among the working classes in this country today is due to the changed conditions brought about by prohibition. Inrest undoubtedly has the effect of causing the worker to shift from one position to another, to listen with an attentive ear to the agitator and produces a willingness to go on strike, the net result being to lower the general economic condition of this class. Considered from all angles, however, it seems safe to assert that the prohibition of strong drink is having a good influence and will be an important factor in improving the economic condition of the wage earning class.

To sum up, we can safely say that the financial and economic condition of the wage earner has improved greatly in the past few years. Wages have increased and in spite of the great rise in the cost of living, the result has been a condition approaching prosperity for the working classes. Hours of labor have been shortened, working conditions have been improved and there is practically no labor surplus. Thrift has been encouraged and developed. Finally, prohibition has begun to have its effect in helping to lift the wage earner to a higher economic status.

It would appear that this change in the wage earner's condition has had two important effects upon the development of the social insurance movement in this country. First, it has lessoned the need for the *compulsory* form of social insurance and, second, it has greatly developed *voluntary* methods of providing the protection. With regard to the first effect, the fact must be admitted that changed conditions have greatly lessoned the number of people in this country who require assistance in this form. There are, it is true, certain classes of workers whose earnings have not increased sufficiently to meet increased living costs—as, for instance, teachers, some salaried workers and certain small divisions of the wage earning class. There is also a small class of individuals who are still in the condition of poverty or near-poverty. It must be, however, that the last mentioned either are not able to earn or have no wage earner upon whom they can depend. Considering the wage earning or small salary classes as a whole, however, the statement can safely be made that the part who are in need of compulsory social insurance benefits at this time is comparatively small.

Unemployment insurance, disregarding the needs of striking workmen, is almost unnecessary at this time. The necessity for old age help is lightened to some extent by the employment at good wages of many more old age workers. If one should read any one of half a dozen volumes upon the subject of social insurance, I am certain that he would agree that the class for which social insurance benefits of a compulsory character are urged does not contemplate one whose economic and financial condition is that of the wage earner today. Those for whom social insurance benefits are urged by these writers now exist only in a comparativelyly small class whose condition would more nearly need charity or other voluntary financial assistance. If we accept Dr. Rubinow's designation of those who should be the beneficiaries of compulsory social insurance as the working class which cannot afford commercial insurance, we must admit that there are comparatively few at the present time in this division.

In this connection it should be noted that the state workmen's health insurance bill, known as the Davenport Bill, which was passed two years ago by the Senate of New York State but defeated in the House, was when introduced at the last session of the New York Legislature accompanied by a statement that the proponent did not intend to urge its passage at this time. It may be that the Association for American Labor Legislation which prepared the bill felt that in view of the present changed conditions of the wage earner, this was not the proper time to urge legislation of this character.

The second, and perhaps most interesting, effect of the changed conditions is shown in the great increase in the effectiveness and diversity of the methods by which the worker can obtain protection by voluntary means. The workman has had the money to pay for his insurance and the employer, who has likewise enjoyed prosperity during these years, has been willing to help or in many cases completely finance the cost. The influenza pandemic and other developments have shown to the worker the great necessity for protection in event of sickness or death. Industrial insurance companies—both life and accident— report enormous increases in the amount of insurance issued to industrial workers. A large volume of ordinary insurance has been sold also to workmen who prior to a few years ago purchased industrial insurance. Employees mutual benefit associations conducted in connection with industrial establishments have been reorganized and membership greatly increased. Moreover, many new beneficial associations of this character have been started.

There is a further most interesting and significant development during the past few years of the voluntary means of providing social insurance benefits-namely, Group insurance. This form of protection as related to Life insurance is ordinarily paid for entirely by the employer and provides protection for the dependents of his employees. The general prosperity of the employer has given him the means and his desire to better his relations with his employee has given him the inclination to provide this protection. Group insurance, which did not gain much headway before 1915, has grown at a rabid rate, practically doubling in volume during the year 1919. At the end of that year the total volume of insurance in force amounted to \$1,084,515,433, insuring approximately 1,350,000 employees. Production is going ahead in 1920 even faster than during 1919. At the rate at which the idea is being adopted by employers throughout the country, it is not unreasonable to suppose that within two years, if general industrial conditions do not change greatly, five million employees will be provided protection by this means. Considering the comparatively short period of its growth, the results in Group Life insurance are impressive. They mark an important and possibly significant development of the voluntary means of providing one form of social insurance benefit.

Group Accident and Health 'nsurance, although it has been developed to its present form only within the past year, is already growing rapidly. This form of protection is ordinarily paid for partly by the employer and partly by the employee. By means of it the employee receives indemnity in case of sickness or accidental injuries which are not provided for under the compensation act. With workmen's compensation and group accident and health insurance, the worker is protected against loss of time due to either accident or sickness of any kind. It is believed by underwriters that in this form of protection a practical plan for providing accident and health benefits suited to the workman's needs has been obtained. Probably not more than 200,000 employees are protected at the present time, but as the education of the employer and the employee to the advantages of blanket insurance of this kind progresses, it is clear that it will take an important place as one of the means for obtaining voluntarily social insurance benefits.

There has not been a great increase in the number of industrial corporations which have installed old age pension plans, as one might expect offhand, as an accompaniment of the general prosperity of the employer in recent years. This may be due in part to the fact that the older men prefer to continue to work at good wages rather than to retire. There have been new plans installed, however, particularly in the case of large corporations, so that some progress has been made in this branch of social insurance.

The foregoing remarks are intended simply as a review of the effects upon the development of social insurance of the changed conditions of the wage earning class since the commencement of the war. It is not claimed that present conditions are an index of a permanent condition. It has been shown, I believe, that the need for compulsory social insurance has been lessened and the voluntary means has been greatly developed in the past few years Whether or not conditions will continue so that the foundation for the solution of the social insurance problem in this country by voluntary means will be laid, is an interesting question. We know that the recent past has been a period of inflation. There is a period of deflation and readjustment to come-in fact, it has already begun. How the financial and economic condition of the wage earning class will change during this period of deflation, no one can tell. Most students are of the opinion, I believe, that the permanent status of the wage earning class in this country after readjustment will be a vast improvement over that of pre-war days. It is the personal opinion of the writer that the development of the voluntary means of providing insurance for the workman resulting from the changed conditions of the past few years will have a permanent effect upon the social insurance movement in this country and will postpone the day when social insurance of a compulsory character will be considered as necessary by the wage earning class, the employer, or the public in general.
# AN ANALYSIS OF HEALTH CLAIMS BY DISEASE.

#### BY

#### ROBERT J. MCMANUS.

The conservation of the public health is the subject of much discussion at the present time. The economic loss due to illness has been calculated from various sources of information and the most efficient means of providing a renedy, whether in the form of prevention campaigns or systems of insurance, is widely debated. On the assumption that it would be interesting to learn what forms of illness are responsible for loss payments in the Health Insurance business the present analysis of The Travelers Insurance Company's paid claims was undertaken.

The tabulation is entirely confined to claims presented by what are considered the best risks under the commercial form, the clerical, professional and commercial occupations in the preferred, extra preferred and selected ordinary rates and white males only are considered. The total of policy years 1914, 1915 and 1916 representing illness contracted during the calendar years 1914 to 1917, inclusive, is the basis of the analysis. The well known factors, such as careful selection of risks, policy limit, cancellation clause, refusal of renewal, which make the facts drawn from statistics of carriers so difficult of application to morbidity in general, are of course present in this data and in some instances are very apparent. Nevertheless, a condition of sickness being duly established and in accordance with the practice of the business certified by an attending physician, the results afford an interesting exhibit of the frequency and severity of different diseases.

The policies which are involved in the analysis cover all diseases and provide a limit of fifty-two weeks indemnity. On claims where payment was made for both house confinement and non-house confinement the periods of disability are combined which brings the data to a basis of disability from sickness while totally incapacitated from work. A separation is made by age periods and tables are compiled for combinations of the various diseases in groups relating to the different systems of the body together with complete exhibits subdivided to specific diseases. Table I presents the number of claims and per cent.; Table II shows the days of disability and the per cent. and Table III gives the average number of days disability per claim for the various systems of the body and are summaries of the detailed data in Table VI.

Referring to Table I, All Ages, the predominance of Influenza among ailments encountered in this kind of business is immediately noticed. This disease stands first contributing 27.88 per cent. of all cases. If we combine it with throat affections and respiratory diseases we have 50.09 per cent of all cases. One half of all claims presented are thus accounted for at once. As most of us know from experience the period of disability caused by Influenza usually is not great and this particular tabulation gives an average of 11.4 days per claim, but it should be remembered that the period under observation does not include the extremely virulent and costly epidemic of 1918-1919. This comparatively short disability period causes Influenza to take third place in severity measured by days as shown in Table II and a combination with throat and lung affections produces 32.07 per cent. of all disability. It will be noted in Table I that the distribution of cases of Influenza is fairly constant throughout the different age groups.

Diseases of the Digestive System are second in rank by occurrence and this position is maintained excepting for the age group 25 to 29 where throat affections which rank third rise slightly above it. The number of claims for Diseases of the Throat are most frequent in the early ages holding second place in the group 25-29 and steadily decreasing beyond age 29.

General Diseases are above the average up to Age 24 then dropping below and remaining to Age 40 where an increase is noted which can be traced to Myalgias and Rheumatic conditions.

Respiratory Diseases are fifth in order and up to Age 40 are below the average, but from that point are constantly over average.

The non-venereal diseases of the Genito-Urinary System and the diseases of the Circulatory System are more frequent in the older ages.

In Table II which presents the days of disability and per cent., we find that Digestive System ailments are in first place in the All Ages column and alternate between first and second place throughout the age groups. The very large proportion from this cause for Age 19 and Under can be traced to Appendicitis cases con-

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tributing 20.89 per cent. and an Ischio-Rectal Abscess claim causing 13.66 per cent. of all disability.

Next in order are the General Diseases and these ailments move up to first place from Age 25 to 34 where tuberculosis of the lungs, malignant tumors, and myalgias show a marked increase. The largest number of cases of tuberculosis of the lungs found in any age group is fifteen in Age 25-29 group.

Influenza steadily holds third place in amount of disability contributed and there is no great change between age periods.

Diseases of the Nervous System hold fourth place for All Ages and in the age distribution steadily ascend from 3.68 per cent. at Ages 20-24 to 15.41 per cent. at 40-44 followed by a decrease to 13.19 per cent. during the next five years and then again mounting to reach 17.11 per cent. for Ages 55-60.

Respiratory Diseases follow ranking fifth, and appear to be more severe in the Ages beyond 35.

Throat affections are of next in portance and it will be seen that the younger ages are over average conforming with the comparatively greater incidence for those ages shown in Table I.

Skin Diseases rank seventh with age groups 20-24 and 45-49 the largest contributors.

The first seven Disease groupings are responsible for 91.89 per cent. of all cases and 89.55 per cent. of all disability.

Table III presents the average length of period of disability in days per claim. The ratios for all Diseases clearly indicates a steady increase of the disability period with age. It will be noted that the diseases which cause the longest disability are least frequently encountered. Thus, the Circulatory System furnishes about one per cent. of all claims but causes a sixty day disability period. Nervous System ranks seventh in number but averages 50.6 days per claim. Genito-Urinary (Non-Venereal) ninth in number, 33.1 days; Venereal Diseases, thirteenth in number, 25.9 days. The data is undoubtedly affected at this point by the operation of the cancellation clause and the failure of policyholders to present claims for disability due to Venereal Disease.

Tables IV and V are exhibits of the summarized data by State Groups and Table VII shows the same information in detail. The subdivision consists of Group 1—New England, New York, New Jersey and Pennsylvania; Group 2—the north central states; Group 3—a belt of states across the center of the country from the Atlantic to the Kansas-Colorado boundary; Group 4—the South; Group 5—the far West. The following is a list of the states comprising each group.

Group 1	Groùp 2	Group 3
Maine	Ohio	Delaware
New Hampshire	Indiana	Maryland
Vermont	Michigan	District of Columbia
Massachusetts	Illinois	Virginia
Rhode Island	Wisconsin	West Virginia
Connecticut	Iowa	North Carolina
New York	Minnesota	Tennessee
New Jersey	Nebraska	Kentucky
Pennsylvania	North Dakota	Missouri
	South Dakota	Kansas
Group	4	Group 5
South Ca	rolina	Montana
Georgia		Wyoming
Florida		Colorado
Alabama		New Mexico
Mississip	pi	Arizona
Louisian	- a	Utah
Texas		Idaho
Oklahom	8	Nevada
Arkansas	5	Washington
		Oregon
		California

The outstanding features of Table IV which shows the number of claims are the wide departures from average in groups 3 and 4. The ever present and dominating Influenza leads as usual with the exception of Group 4 (the South) where claims for disease of the Digestive System are found to be more frequent and it will be noted that their percentage 23.90 is greater than in any other group. This increase is spread fairly evenly over most of the discases in the group with a few exceptional increases such as Auto-Intoxication having 5.91 per cent. as compared with an average of 1.47 per cent.; and Hemorrhoids, 3.02 per cent.—average, 1.43 per cent.

The Influenza ratio in the Southern states group is lower than in any other and the same is true for Respiratory Diseases and Throat Affections, but on the other hand there is an increase in Digestive Diseases and also in General Diseases. Among the latter

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# TABLE I.

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#### NUMBER OF CLAIMS AND PER CENT. FOR DISEASE GROUPS BY AGE PERIODS.

	A11 A	All Ages. 19 an Unde		19 and 20-24.		25-29.		30-34.		35-39.		40-44.		45-49.		50	⊢54.	55	-60.	
	No. Claime.	\$	No. Ciaims.	%	No. Claima.	%	No. Cialms.	8.	No. Claims.	%.	No. Claima.	%	No. Claima.	%.	No. Claims,	%	No. Claims.	%	No. Clafma.	%
Influenza Other general diseases. Nervons system Circulatory system Bigestive system Genito-urinary (non-venereal). Skin Genito-urinary (venereal) Eye Ear Throat Nose.	$\begin{array}{c} 3,105\\ 1,377\\ 509\\ 976\\ 1,912\\ 251\\ 837\\ 23\\ 124\\ 125\\ 1,498\\ 276\\ \end{array}$	$\begin{array}{c} 27.88\\ 12.37\\ 4.74\\ .94\\ 8.76\\ 17.17\\ 2.25\\ 7.52\\ .21\\ 1.11\\ 1.12\\ 13.45\\ 2.48 \end{array}$	$     18 \\     10 \\     -3 \\     14 \\     1 \\     1 \\     12 \\     2     $	$\begin{array}{r} 28.13 \\ 15.62 \\ \\ 4.69 \\ 21.88 \\ 1.56 \\ 1.56 \\ 1.56 \\ 1.56 \\ 1.56 \\ 1.56 \\ 1.56 \\ 1.56 \\ 3.13 \end{array}$	$217 \\ 111 \\ 19 \\ 7 \\ 69 \\ 159 \\ 18 \\ 69 \\ 2 \\ 12 \\ 13 \\ 130 \\ 21$	$\begin{array}{r} 25.62\\ 13.11\\ 2.24\\ .82\\ 8.15\\ 18.76\\ 2.13\\ 8.15\\ .24\\ 1.42\\ 1.53\\ 15.35\\ 2.48\end{array}$	$515 \\ 216 \\ 62 \\ 10 \\ 143 \\ 332 \\ 41 \\ 140 \\ 12 \\ 19 \\ 27 \\ 342 \\ 60$	26.84 11.26 3.23 7.45 17.29 2.13 7.29 63 .99 1.41 17.83 3.13	$592 \\ 242 \\ 95 \\ 10 \\ 146 \\ 398 \\ 22 \\ 136 \\ 3 \\ 27 \\ 22 \\ 308 \\ 58 \\ 58 \\$	$\begin{array}{r} 28.75\\ 11.75\\ 4.61\\ .49\\ 7.09\\ 19.33\\ 1.07\\ 6.61\\ .15\\ 1.31\\ 1.07\\ 14.96\\ 2.81\\ \end{array}$	$583 \\ 247 \\ 90 \\ 18 \\ 175 \\ 337 \\ 46 \\ 174 \\ 3 \\ 26 \\ 25 \\ 295 \\ 41 \\$	$\begin{array}{r} 28.30\\11.99\\4.37\\8.50\\16.36\\2.23\\8.45\\.15\\1.26\\1.21\\14.32\\1.99\end{array}$	$\begin{array}{r} 472\\ 224\\ 116\\ 16\\ 180\\ 272\\ 45\\ 133\\ 1\\ 211\\ 15\\ 206\\ 40\\ \end{array}$	$\begin{array}{c} 27.11\\ 12.87\\ 6.66\\ .92\\ 10.34\\ 15.62\\ 2.58\\ 7.64\\ .06\\ 1.21\\ .86\\ 11.83\\ 2.30\\ \end{array}$	$\begin{array}{r} 402 \\ 189 \\ 74 \\ 17 \\ 123 \\ 216 \\ 40 \\ 103 \\ 1 \\ 9 \\ 13 \\ 145 \\ 34 \end{array}$	$\begin{array}{c} 29.43 \\ 13.85 \\ 5.42 \\ 1.24 \\ 9.00 \\ 15.81 \\ 2.93 \\ 7.54 \\ .07 \\ .66 \\ .95 \\ 10.61 \\ 2.49 \end{array}$	$     \begin{array}{r}       198 \\       100 \\       45 \\       20 \\       102 \\       128 \\       27 \\       58 \\       - \\       8 \\       7 \\       44 \\       14     \end{array} $	$\begin{array}{r} 26.37\\ 13.31\\ 6.00\\ 2.66\\ 13.58\\ 17.04\\ 3.60\\ 7.72\\ -\\ 1.07\\ .93\\ 5.86\\ 1.86\end{array}$	$   \begin{array}{r}     108 \\     38 \\     27 \\     7 \\     35 \\     56 \\     11 \\     23 \\     -1 \\     2 \\     16 \\     6   \end{array} $	32.73 11.51 8.18 2.12 10.61 16.97 3.33 6.97 .30 .61 4.85 1.82

# TABLE II.

# DAYS OF DISABILITY AND PER CENT. FOR DISEASE GROUPS BY AGE PERIODS.

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	All A	ges.	19 an	d Under.	20-	24.	25-	-29.	30-	-34.	35-	-39	40-	-44	45-	49.	50-	-54.	55-	-60.
	Days Disab.	%.	Days Disa.	%.	Days Disab.	%.	Days Disab.	%.	Days Disab.	%.	Days Disab.	%.	Days Disab,	%.	Days Dísab,	%.	Days Disab.	%.	Days Disab	%.
Influenza Other general	35,262	15.36	180	15.66	2,085	15.72	5,218	15.23	6,157	16.52	6,345	15.15	5,895	15.19	5,016	16.15	2,718	12.28	1,648	17.36
diseases Nervous system Circulatory	45,376 26,726	19.81 11.65	183	15.93	2,365 488	17.84 3.68	8,081 2,380	23.60 6.95	8,934 3,646	23.97 9.78	7,343 4,892	$17.53 \\ 11.68$	7,457 5,977	19.23 15.41	5,751 4,095	18.52 13.19	3,446 3,624	$\begin{array}{c} 15.56 \\ 16.36 \end{array}$	1,816 1,624	19.13 17.11
system Respiratory	6,308	2.75	—	—	457	3.44	236	.69	226	.61	583	1.39	1,022	2.63	786	2.53	2,196	9.92	802	8.45
system Digestive system. Genito-urinary	21,625 46,288	9.43 20.19	27 504	$2.35 \\ 43.87$	$1,352 \\ 3,122$	$\begin{array}{c} 10.19\\ 23.54 \end{array}$	2,940 7,358	$8.58 \\ 21.48$	3,002 7,965	8.05 21.37	4,781 8,828	$\begin{array}{c} 11.41 \\ 21.06 \end{array}$	4,119 6,814	$\begin{array}{c} 10.62 \\ 17.56 \end{array}$	2,290 6,195	7.37 19.95	2,519 3,922	$11.38 \\ 17.71$	595 1,580	$\begin{array}{c} 6.27\\ 16.64\end{array}$
(non-venereal). Skin.	8,316 13,377	3.63 5.83	17 6	$1.48 \\ .52$	398 972	3.00 7.33	1,118 1,610	3.26 4.70	606 1,745	$1.63 \\ 4.68$	1,696 2,667	4.05 6.37	$1,200 \\ 2,302$	$3.09 \\ 5.93$	1,710 2,306	5.51 7.42	$1,118 \\ 1,242$	$5.05 \\ 5.61$	453 527	4.77 5.55
(venereal)	595	.26	63 14	5.48	38	.29	330	.96	80	.21	70	.17	8	.02	6	.02			-	
Ear	2,343	1.02 7.28	$10 \\ 135$	.87 11.75	$164 \\ 1.169$	1.24 8.82	458 3.443	1.34 10.05	401 518 3.103	1.29	449 353 3.146	1.07 .84 7.51	$\frac{234}{383}$ 2.721	.00 .99 7.01	138 184 1.970	.44 .59 6.34	243 734	$     \begin{array}{r}       .55 \\       1.10 \\       3.32     \end{array} $	$     \begin{array}{r}       5 \\       30 \\       270     \end{array} $	.06 .32 2.84
Nose	4,386	1.91	10	.87	359	2.71	749	2.19	807	2.17	740	1.77	667	1.72	611	1.97	301	1.36	142	1.50

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#### TABLE III.

			_							
	All Agea.	19 and Under.	20-24.	25-23.	30-34.	35-39,	40-44.	45-49.	50-54.	55-80.
Influenza	11.4	10.0	9.6	10.1	10.4	10.9	12.5	12.5	13.7	15.3
diseases	33.0	18.3	21.3	37.4	36.9	29.7	33.3	30.4	34.5	47.8
Circulatory system	60.1	_	25.7 65.3	38.4 23.6	$\frac{38.4}{22.6}$	54.4 32.4	63.9	55.3 46.2	80.5 109.8	114.6
System	22.2	9.0	19.6	20,6	20.6	27.3	22.9	18.6	24.7	17.0
Genito-urinary	24.2	17 0	19.0	22,2	20.0	20.2	20.1	28.1	30.0	28.4
Skin	16.0	6.0	14.1	11.5	127.5 12.8	30.9 15.3	17.3	$\frac{42.8}{22.4}$	21.4	41.2 22.9
(venereal)	25.9	63.0	19.0	27.5	26.7	23.3	8.0	6.0	-	_
Eye Ear	$16.3 \\ 18.7$	$14.0 \\ 10.0$	$24.3 \\ 12.6$	$17.5 \\ 17.0$	$\frac{17.8}{23.5}$	$17.3 \\ 14.1$	$\frac{11.1}{25.5}$	15.3 $14.2$	$\begin{array}{c} 9.6\\34.7\end{array}$	6.0 15.0
Throat	$11.1 \\ 15.9$	$11.3 \\ 5.0$	9.0	$\begin{array}{c} 10.1 \\ 12.5 \end{array}$	$10.1\\13.9$	10.7 $18.0$	$\begin{array}{c} 13.2 \\ 16.7 \end{array}$	$\begin{array}{c} 13.6\\ 18.0 \end{array}$	$16.7 \\ 21.5$	$\begin{array}{c} 16.9 \\ 23.7 \end{array}$
All diseases	20.6	18.0	15.7	17.3	18.1	20.3	22.3	22.7	29.5	28.8

DAYS OF DISABILITY PER CLAIM FOI: DISEASE GROUPS BY AGE PERIODS.

Malaria claims are an important factor and an increase is also shown for Typhoid. The largest percentage for Malaria appears in the Central states where 5.93 per cent. of all claims is for that disease as compared with 1.62 per cent. in All Groups. In the Southern states it furnishes 5.36 per cent. Typhoid Fever contributed 1.20 per cent. of all claims in the Central states and 1.51 per cent in the Southern states as compared with the average of 0.83 per cent. in the total experience. There is, therefore, a noticeable decrease in diseases of a respiratory nature and an increase in general diseases, particularly Malaria, and disturbances of the digestive system in the Southern states and we notice this transition gradually taking form through the Central states as compared with the closer adherence to average conditions exhibited by the other groups.

	All G	roups.	Grou	ıp 1.	Group 2.		Group 3.		Group 4.		Grou	1p 5.
	No. Olaims.	%.	No. Claims.	%.	No. Claims.	%.	No. Claims.	%.	No, Claims.	%.	No. Claims.	%.
Influenza	3.105	27.88	1.623	28.50	806	30.03	330	24.74	164	22.53	182	26.11
Other general diseases	1.377	12.37	631	11.09	295	10.99	227	17.02	135	18.55	89	12.77
Nervous system	528	4.74	289	5.08	109	4.06	62	4.65	29	3.99	39	5.59
Circulatory system	105	.94	63	1.11	17	.63	13	.97	6	.82	6	.86
Respiratory system	976	8.76	556	9.76	248	9.24	84	6,30	28	3.84	60	8.61
Digestive system	1,912	17.17	900	15.81	459	17.10	255	19.12	174	23.90	124	17.79
Genito-urinary (non-venereal)	251	2.25	114	2.00	50	1.86	46	3.45	19	2.61	22	3.16
Skin	837	7.52	457	8.02	180	6.71	91	6.82	64	8,79	45	6.46
Genito-urinary (venereal)	23	.21	8	.14	3	.11	5	.37	6	.83	1	.14
Eye	124	1.11	54	.95	36	1.34	13	.97	14	1.92	7	1,00
Ear	125	1.12	69	1.21	30	1.12	11	.82	6	.82	9	1.29
Throat	1,498	13.45	776	13.63	389	14.50	167	12.52	69	9.48	97	13.92
Nose	276	2.48	154	2.70	62	2.31	30	2.25	14	1,92	16	2.30

# TABLE IV.

# NUMBER OF CLAIMS AND PER CENT. FOR DISEASE GROUPS BY STATE LOCATION.

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ANALYSIS OF HEALTH CLAIMS BY DISEASE.

			_	
p 3.	Grou	up 4.	Gro	1p 5.
%.	Days Disab.	%.	Days Disab.	%.
15.00	1,578	11.91	1,798	13.4
22.20	3,005	22.69	2,999	22.4'
8.50	1,842	13.90	1,517	11.3
2.62	212	1.60	123	.9
7.30	699	5.28	1.046	7.8
22.48	3,157	23.83	2,466	18.4
4.81	451	3.41	<b>´982</b>	7.3
5.70	842	6.36	876	6.5
.75	165	1.25	8	.0
.83	348	2.63	137	1.0
.76	105	.79	213	1.6
7.18	661	4.99	943	7.0
1.87	180	1.36	239	1.7
			1	

#### TABLE V.

#### DAYS OF DISABILITY AND PER CENT. FOR DISEASE GROUPS BY STATE LOCATION.

Days

Disab.

19,316

25,372

15,796

4,550

12,26223,889

4,073

7,362

1,357

9,101

2,311

156

804

Group 1.

%.

15.29

20.08

12.50

3.60

9.70

18.91

3.23

5.83

.12

.64

1.07

7.20

1.83

Group 2.

8,877 17.15

8,535 16.50

5,479 10.58

5,820 11.25

2,893

82

530

482

4,218

1,196

776 1.50

%.

5.59

.16

.93

1.02

8.15

2.31

Days

Disab.

Group 3.

Days

Disab.

3,693

5,465

2,092

647

1,798

5,535

1,185

1,404

184

204

186

1,768

460

All Groups.

%.

15.36

19.81

11.65

2.75

9.43

20.19

3.63

5.83

.26

.88

1.02

7.28

1.91

Days

Disab.

 $35,262 \\ 45,376$ 

26,726 6,208 21,625

46,288

8,316

13,377

2,023 2,343

16,691

4,386

595

Influenza.

Nervous system

Circulatory system

Respiratory system

Digestive system .....

Genito-urinary (venereal)

Eye..... Ear

Throat.....

5

18 õ

ANALYSIS OF

HEALTH CLAIMS

BY DISEASE

#### TABLE VI.

	All	Ages.	19 and	Under.	20-	-24.
	No. Claime.	Daya Disab.	No. Claims,	Days Disab.	No. Claims.	Days Disab.
(1) Influenza (2) Malaria	3,105 180	35,262 2,838	18 1	180 8	217 25	$\substack{2,085\\237}$
<ul> <li>(4) "acute articular</li> <li>(5) Typhoid fever</li></ul>	160 92 82 33 41 55 11	5,358 5,358 5,348 1,108 799 895 8,110 301	2 3 1	83 34 11	6 7 12 8 3 3	116 277 155 117 70 589
(12) Scarlet fever. (13) Tumors, benign	12 18 48 17	636 1,000 2,246	1	16	2 3	86 123
<ul> <li>(15) Anæma.</li> <li>(16) Myalgias.</li> <li>(17) Chickenpox.</li> <li>(18) Smallpox.</li> <li>(19) Syphilis.</li> </ul>	$\begin{array}{r} 6\\239\\12\\15\\5\end{array}$	608 3,873 203 348 666	1	30	6 1 3	88 18 38
<ul> <li>(20) Diabetes</li> <li>(21) Dengue</li> <li>(22) Minor ailments</li> <li>(23) Unclassified</li> <li>General diseases</li> </ul>	$15 \\ 9 \\ 139 \\ 161 \\ 4,461$	$1,264 \\ 135 \\ 2,902 \\ 5,520 \\ 80,295$	1 28	1 363	$1 \\ 16 \\ 12 \\ 326$	$4 \\ 37 \\ 222 \\ 164 \\ 4,426$
<ul> <li>(40) Neuritis.</li> <li>(41) Neurasthenia</li> <li>(42) Paralysis.</li> <li>(43) Cerebral apoplexy.</li> <li>(44) Meningitis.</li> <li>(45) Locomotor ataxia.</li> <li>(46) Paresis.</li> <li>(47) Insanity.</li> <li>(48) Herpes zoster.</li> <li>Dis. of nervous system.</li> </ul>	$228 \\ 215 \\ 10 \\ 12 \\ 5 \\ 1 \\ 3 \\ 16 \\ 38 \\ 528$	6,900 11,437 1,546 1,365 281 19 571 3,814 793 26,726			- 6 12 1	89 354 45 488
<ul> <li>(60) Pericarditis, acute</li></ul>	$2 \\ 7 \\ 39 \\ 6 \\ 2 \\ 9 \\ 10 \\ 2^{\circ}$	$122 \\ 369 \\ 3,819 \\ 552 \\ 162 \\ 104 \\ 321 \\ 263 \\ 506 \\ 506 \\ 102 \\ 10$			3	312
(69) Tachycardia. Dis. of circulatory system	105	6 <b>,30</b> 8			7	457
<ul> <li>(80) Bronchitis, acute.</li> <li>(81) Pleurisy.</li> <li>(82) Pneumonia, lobar.</li> <li>(83) Pneumonia, broncho.</li> </ul>	579 114 130 53	8,931 4,215 5,477 1,807	3	27	42 11 5 2	679 485 112 28

	26	j-29.	3	0-34.	3	5-39.	4	0-44.	4	5-49.	50	)-54.	55	-60.
	No. Ciaima	Days Disab.	No. Clatura.	Days Disab.	No. Claims.	Days Disab.	No. Claime.	Days Disab.	No. Claims.	Days Disab.	No. Claima.	Days Disab.	No. Claims.	Days Disab.
(1) (2) (2)	$515 \\ 32 \\ 1$	5,218 428 16	592 37	6,157 717 180	583 37	6,345 531	472 17	5,895 216	402 24	5,016 459	198 7	$2,718 \\ 242$	108	1,648
(3) (4) (5)	$25 \\ 16 \\ 12$	1,052 918	22 16	639 845	27	947 1,036	20 12	1,276 1,404	22	608 522	17	451 209	5 1	269 54
(0) (7)	13 7 14	112 112	10 6 4	79 83	10	255 70 164	10	173		371 165	1	19	2	13
(9) (10)	$15 \\ 15 \\ 1$	2,953 22	9 3	1,835 99	8	1,068 75	9	903	6	317	3 2	371 84	$\begin{array}{c} 2\\ 1\end{array}$	74 21
(11) (12) (12)	152	14     225     110		188 117	12	21	52	340 77	2	182	1 2 5	60 107	1	12
(13) (14) (15)	2	42	$\begin{vmatrix} 3\\ 2 \end{vmatrix}$	1,353 255	12 5 1	285 280	4	128	3	114 31	J	107	2	366
(16) (17) (18)	22 4 4	342 64 109	35 4 2	523 90 39	49 2 1	706 17 18	5) 1	730 38	40 1 3	712 14 76	26	446	11	326
(19) (20) (21)	1 1 1	8 98 5	1	46 69	12	28 14	34	612 98 10	3	90	4	582	1	364
(22) (23)	$23 \\ 20 \\ 726$	324 648 13,227	$27 \\ 29 \\ 831$	651 858 15,051	$\begin{array}{c} 1\widetilde{6} \\ 28 \\ 828 \end{array}$	634 872 13,648	19 24 693	293 893 13,331	19 29 586	404 1,314 10,649	12 13 297	290 538 6,136	7 5 146	84 232 3,464
(40) (41) (42)	22 31	535 1,297	36 41 2	785 1,435 273	43 35	905 2,558	57 45 2	$1,420 \\ 2,590 \\ 612$	$     \begin{array}{c}       34 \\       26 \\       2     \end{array} $	1,666 1,499 112	21 16 1	1,199 1,147 154	9 9 2	301 557 350
(43) (44) (45)	1	91 10	1 1	39 67	1	63	8	666 67	2	. 83	2	207	$\frac{3}{1}$	279 84
(46) (47) (48)	1 $6$ $62$	364 74 2,380	$2 \\ 2 \\ 10 \\ 95$	389 469 189 3,646	7 4 90	1,288 78 4,892	1 1 5 116	182 364 76 5,977	$2 \\ 8 \\ 74$	482 253 4,095	$3 \\ 2 \\ 45$	847 70 3,624	3 27	53 1,624
(60) (61) (62) (63)	3 1	139 31	1	94	6 2	368 46	1 6	$\begin{array}{c} 155\\ 481 \end{array}$	1 1 7	35 62 294	1 12 4	87 1,500 506	2 3	13 739
(64) (65) (66) (67)	2	20	1 1	38 7	$1 \\ 2 \\ 2$	32 27 55	4 1	$231 \\ 15$	2 3	162 145	1 1 1	72 10 21	1	15
(68) (69)	4	46	7	87	5	55	4	140	3	88	- 00	0.100	1	35
(00)	10	236	10	226	111	583 9.040	10	1,022	17	780	20 50	⊿,190 270	- 7	802 975
(80) (81) (82) (83)	$     \begin{array}{r}       79 \\       14 \\       20 \\       5     \end{array}   $	1,046 806 795 126	$     \begin{array}{r}       91 \\       20 \\       16 \\       4     \end{array} $	1,244 689 556 414	$     \begin{array}{c}       111 \\       23 \\       22 \\       8     \end{array}   $	2,046 798 1,166 330	98 20 33 14	1,409 697 1,422 383	10 11 10 10	1,170 227 421 316	9 9 21 6	$975 \\ 367 \\ 908 \\ 140$	20 6 3 4	275 146 97 70

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# TABLE VI (Continued).

	All	Ages.	19 snd	Under.	20	-24.
	No. Claims.	Days Disab.	No. Clatms.	Days Disab,	No. Claims.	Days Disub.
(84) Cold	85 9 6	587 519 89			9	48
system	976	21,625	3	27	69	1,362
(100) Appendicitis (101) Indigestion (102) Hemorrhoids	$393 \\ 252 \\ 159$	$14,161 \\ 3,179 \\ 3,462$	6 1	$\begin{array}{c} 240 \\ 2 \end{array}$	$41 \\ 35 \\ 4$	$1,357 \\ 284 \\ 64$
(103) Gastritis (104) Fistula-in-ano (105) Auto intoxication	$\begin{array}{c}155\\41\\164\end{array}$	$2,975 \\ 910 \\ 2.657$	1	5 21	15     2     8	247 50 183
(106) Ulcerated teeth	43	473			5	100
(108) Enteritis (109) Cholecystitis	$188 \\ 47 \\ 50$	2,277 1,326 1,025	1	5	15 2	121 69
(111) Ulcer, gastric	30 23	1,365 1,275			- 4	02
(113) Jaundice, acute catarrhal. (114) Cirrhosis of liver	55 4	1,345	1	12	8	161
(115) Ischio-rectal abcess (116) Cholelithiasis	42 36	$1,549 \\ 1.858$	1	157	2	102
(117) Ptomaine poisoning (118) Peritonitis	$104 \\ 5$	$1,265 \\ 223$	1	5	8	38
(119) Hernia (120) Intestinal stasis	105 13	4,052 388	1	57	10	365
Dis. of digestive system	1,912	46,288	14	504	159	3,122
<ul> <li>(130) Orchitis.</li> <li>(131) Cystitis.</li> <li>(132) Nephritis, acute.</li> <li>(133) Nephritis, abronia</li> </ul>	$14 \\ 46 \\ 36 \\ 25$	$250 \\ 1,295 \\ 1,522 \\ 1,782 $			5 3 2	92 86 22
(134) Prostatitis (135) Epididymitis	18 6	591 112			. 1	$   \begin{array}{c}     24 \\     56 \\     02   \end{array} $
(137) Varicocele	14 75 6	306 1,936 278	1	17	$\frac{2}{2}$	23 77 18
Dis. of genito-urinary system (non-venereal)	251	8,316	1	17	18	398
(150) Abcess	$254 \\ 179$	3,715 2,715	1	6	20 10	207 76
(152) Eczema (153) Ingrown nail	45 10	955 68			4 2	59 7
(154) Furuncles (155) Cellulitis (156) Erysipelas	117 21 35	1,545 269 706			$1\tilde{3}$ 2	120 19
(157) Infection Dis. of skin and cellu-	176	3,404		ł	18	484
lar tissue	837	13,377	1	6	69	972

	2	529.	3	0-34.	3	5-39.	4	0~44.	4	5-49.	50	)-54.	5	5-60.
	No. Clatma.	Days Disab.	No. Clatma.	Days Disab.	No. Claims.	Days Disab.	No. Čiaius,	Days Disab.	No. Clatms.	Days Disab.	No. Claims.	Days Disab.	No. Claims.	Days Disab.
(84) (85) (86)	$egin{array}{c} 21 \\ 2 \\ 2 \end{array}$	$     \begin{array}{r}       107 \\       24 \\       36     \end{array} $	14 1	95 4		34 389 18	14	139 9	$     \begin{array}{c}       13 \\       2 \\       1     \end{array} $	70 62 24	4 2 1	87 35 7	2	7
	143	2,940	146	3,002	175	4,781	180	4,119	123	2,290	102	2,519	35	595
(100) (101) (102) (103) (104)	$     \begin{array}{r}       103 \\       48 \\       21 \\       22 \\       7 \\       04     \end{array} $	$\begin{array}{r} 3,378 \\ 563 \\ 238 \\ 550 \\ 120 \\ 200 \end{array}$	$   \begin{array}{r}     76 \\     47 \\     33 \\     48 \\     5 \\     41   \end{array} $	2,562 520 593 768 100	$ \begin{array}{c} 67 \\ 42 \\ 36 \\ 19 \\ 10 \\ 05 \end{array} $	2,342 616 1,011 328 323	57 30 24 25 3	2,295 404 477 488 39 492	$\begin{array}{c} 27 \\ 27 \\ 23 \\ 14 \\ 11 \\ \end{array}$	$1,274 \\ 436 \\ 557 \\ 305 \\ 208 \\ 208 \\ 100 \\ 10$	$     \begin{array}{c}       12 \\       14 \\       12 \\       8 \\       3 \\       10 \\     \end{array} $	$ \begin{array}{c} 600 \\ 182 \\ 437 \\ 259 \\ 70 \\ 100 \end{array} $	4 8 6 3	$     \begin{array}{r}       113 \\       172 \\       85 \\       25     \end{array} $
(105) (106)	24 5	299	10	<sup>491</sup> 120	25	399	7	103	4	391	10	139	9 3	332
(107) (108) (109) (110) (111) (112) (113)	35 4 4 3 7	506 89 45 159 147	$     \begin{array}{r}       38 \\       10 \\       10 \\       6 \\       5 \\       13     \end{array} $	381 168 175 280 208 248	2 34 8 10 5 3 8	$     \begin{array}{r}       119 \\       510 \\       251 \\       239 \\       239 \\       197 \\       236 \\       \end{array} $	$     \begin{array}{c}       1 \\       29 \\       9 \\       9 \\       8 \\       4 \\       4 \\       5 \\     \end{array} $	$     \begin{array}{r}       14 \\       348 \\       259 \\       244 \\       238 \\       236 \\       207 \\       \end{array} $	13 7 8 6 8 5	85 271 184 144 376 101	18 7 4 5 2 5	$272 \\ 219 \\ 41 \\ 210 \\ 200 \\ 121$	$5 \\ 2 \\ 1 \\ 1 \\ 3$	49 35 95 58 112
$(114) \\ (115) \\ (116) \\ (117) \\ (118) \\ (119) \\ (120) $	6 3 16 24	60 132 177 850	$9 \\ 2 \\ 22 \\ 19 \\ 4$	$\begin{array}{c} 262 \\ 66 \\ 233 \\ 716 \\ 74 \end{array}$	1 10 11 21 1 14 3	$52 \\ 517 \\ 630 \\ 200 \\ 49 \\ 450 \\ 46$	$     \begin{array}{r}       7 \\       5 \\       11 \\       2 \\       12 \\       2     \end{array} $	178 180 83 90 449 80	$     \begin{array}{c}       1 \\       8 \\       4 \\       15 \\       13 \\       3     \end{array} $	245 356 99 387 641 63	2 1 5 7 1 9	$93 \\ 19 \\ 394 \\ 89 \\ 14 \\ 427 \\ 125 \\ $	4 3 1 3	255 53 70 97
(120)	332	7,358	<b>39</b> 8	7,965	337	8,828	272	6,814	216	6,195	128	3,922	56	1,580
$(130) \\ (131) \\ (132) \\ (133) \\ (134) \\ (134)$	4 10 9 3	95 255 461 71	$     \begin{array}{c}       2 \\       5 \\       3 \\       1 \\       1     \end{array} $	$     \begin{array}{c}       27 \\       125 \\       130 \\       9 \\       21     \end{array} $	8 6 3 3	166 539 91 118	$     \begin{array}{c}       1 \\       7 \\       6 \\       4 \\       3     \end{array} $	$14 \\ 182 \\ 140 \\ 262 \\ 93$		384 93 843 43	$     \begin{array}{c}       1 \\       7 \\       4 \\       4 \\       2     \end{array} $	8 97 132 474 77	1 1 2 2	14 5 104 144
(135) (136)	2	43	1	65			2	41	1	25	2	26	2	53
(137) (138) (139)	5 7 1	92 73 28	8 1	201 28	17 2	108 547 104	19 2	344 118	13	316	7	304	3	133
	41	1,118	22	606	46	1,696	45	1,200	40	1,710	27	1,118	11	453
(150) (151) (152) (153)	$     \begin{array}{r}       40 \\       28 \\       6 \\       3     \end{array}   $	421 336 80 27		$     \begin{array}{r}       605 \\       291 \\       168 \\       17     \end{array}   $	59 41 10 1	866 603 224 7	$     \begin{array}{r}       40 \\       26 \\       11 \\       1     \end{array} $	$463 \\ 472 \\ 257 \\ 2$	$25 \\ 28 \\ 3 \\ 1$	$765 \\ 529 \\ 114 \\ 8$	$\begin{array}{c} 12\\16\\4 \end{array}$	$340 \\ 279 \\ 40$	$\begin{array}{c} 6 \\ 5 \\ 1 \end{array}$	42 129 13
(150) (154) (155)	$\frac{28}{2}$	309 28	16	210 116	$1\overline{8}$	255 $22$	18	$16\overline{6} \\ 49$	$1\overline{3}$	211 7	9 2	$\begin{array}{c} 231 \\ 28 \end{array}$	2	43
(156) (157)	$\overline{1}$ 32	$\overline{10}$ 399	1 27	$\frac{18}{320}$	7 36	$\begin{array}{r}1\overline{07}\\583\end{array}$	$\frac{7}{27}$	130 763	$1\overline{0}$ 21	188 484	$\overline{6}$ 9	$1\overline{\underline{69}}\\155$	3 6	84 216
	140	1,610	136	1,745	174	2,667	133	2,302	103	2,306	58	1,242	23	527

	Ali	Ages.	19 and	Under.	20	-24.
· .	No. Claima.	Days Disab.	No. Clafma.	Days Dissb.	No. Claima	Days Dissb.
(170) Heat prostration	21	343			2	24
(180) Gonorrhea (181) Epididymitis (182) Chancroid (183) Synhilis	16 6 1	416 130 49	1	63	2	38
Venereal diseases	23	595	1	63	2	38
(190) Conjunctivitis (191) Chalazion (192) Cornea, ulcer of (193) Iridocvelitis	65 12 10 1	$776 \\ 224 \\ 166 \\ 27$	1	14	7	117
(194) Iritis (195) Keratitis (196) Ontic peuritis	$1\overline{7}$ 7	482 167			2 1	$153 \\ 2$
(197) Retinitis	5 7 124	$125 \\ 56 \\ 2,023$	1	14	$1\\1\\12$	$\begin{array}{c} 16\\ 4\\ 292 \end{array}$
(210) Otitis media (211) Mastoiditis (212) Furuncles of ext. canal Dis, of the ear	$110\\11\\4\\125$	$1,813 \\ 504 \\ 26 \\ 2.343$	1	10 10	10 1 2 13	133 17 14 164
<ul> <li>(220) Tonsillitis</li> <li>(221) Laryngitis</li> <li>(222) Quinsy.</li> <li>(223) Pharyngitis</li> <li>(224) Hyper-tonsils</li> <li>Dis. of the throat</li> </ul>	1,103 107 125 88 75 1,498	$11,841 \\ 1,505 \\ 1,754 \\ 765 \\ 826 \\ 16,691$	10 1 1 12	125 7 3 135	100 4 13 5 8 130	916 23 125 46 59 1,169
<ul> <li>(230) Sinusitis, frontal</li> <li>(231) Sinusitis, ethmoidal</li> <li>(232) Sinusitis, maxillary</li> <li>(233) Rhinitis</li> <li>(234) Hypertrophied turbinates</li> <li>(235) Polypi</li> <li>(236) Deviated septum</li> <li>Dis of the pase</li> </ul>	67 32 46 26 42 9 54 276	1,418 616 766 294 503 169 620 4 386	1	3 7 10	2 4 3 2 6 4 21	143     80     26     9     56     45     359
All diseases	11,137	229,316	64	1,149	847	13,261

·	25	-29.	30	-34.	35	-39.	40	-44.	45	-49.	5	0-54.	5	5-60.
	No. Claims.	Days Disab.	No. Claims.	Days Disab.	No. Claims.	Days Disab.	No. Claima	Days Disab.	No. Claima.	Daya Diaab.	No. Clatma.	Daya Disab.	No. Clatms.	Days Disab.
(170)	5	72	3	40	2	40	3	21	5	118	1	28		
(180) (181) (182)	8 4	238 92	2	31 49	3	70	1	8	1	6				
(183)	12	330	3	80	3	70	1	8	1	6				1
(190) (191) (192) (192)	11 1 2	123 11 28	13 3 2	99 133 55	14 2 3	237 23 50	10 $4$ $2$	89 49 21	5 1	53 12	<b>4</b> 1	44 2	1	6
(195) (194) (195) (196)	2 1	78 25	4 3	78 63	3 1	54 49	1 1	$^{26}_{-28}$	3	73	2	20		
(197) (198)	1 1 19	49 18 332	2 27	53 481	$\begin{array}{c}1\\1\\26\end{array}$	7 2 449	3 21	21 234	9	138	1 8	11 77	1	6
(21 <b>0</b> ) (211) (212)	$25 \\ 2$	323 135	18 2 2	393 113 12	25	353	13 2	321 62	12 1	174 10	4 3	76 167	2	30
	27	458	22	518	25	353	15	383	13	184	7	243	2	30
(220) (221) (222) (223) (224)	252 21 34 14 21	2,377 174 466 152 274	242 9 22 18 17	2,286 158 353 123 183	219 22 22 21 11	2,334 241 283 186 102	143 26 17 10	1,877 399 215 102 128	$     \begin{array}{r}       102 \\       15 \\       11 \\       10 \\       7     \end{array} $	1,412 186 214 92 66	$     \begin{array}{c}       24 \\       9 \\       4 \\       6 \\       1     \end{array} $	298 317 65 40 14	11 2 3	216 33 21
(==+)	342	3,443	308	3,103	295	3,146	206	2,721	145	1,970	44	734	16	270
(230) (231) (232) (222)	16 4 7	233 93 60	18 8 4	290 184 62	7 7 6	$256 \\ 93 \\ 168 \\ 17$	11 4 10	242 122 124 25	$10 \\ 2 \\ 12 \\ 1$	$173 \\ 28 \\ 260 \\ 14$	$1 \\ 2 \\ 4 \\ 1$	18 12 66	2 1	63 4
(234) (235) (236)	12 12 9 60	113 109 749	8 1 15 58	73 73 142 807	9 2 8 41	111 35 60 740	2 2 8 40		$     \begin{array}{c}       1 \\       5 \\       34     \end{array}   $	30 69 37 611		89 42 46 301	1 1 6	13 56 142
	1,919	34,253	2,059	37,270	2,060	41,893	1 741	38,799	1,366	31,058	751	22,140	330	9,493

#### TABLE VII.

# NUMBER OF CLAIMS AND DAYS OF DISABILITY FOR DISEASES BY STATE LOCATION.

	All G	roups.	Gro	up 1.	Gro	up 2.	Grou	ıp 3,	Grou	ıp 4.	Grou	ıp 5.
	No. Claims.	Days Disab.	No. Claims.	Days Disab.	No. Claims.	Days Disab.	No. Claims.	Daya Disab.	No. Claims.	Days Disab.	No. Claims.	Days Disab.
(1) Influenza	3,105	35,262	1,623	19,316	806	8,877	330	3,693	164	1,578	182	1,798
(2) Malaria	180	2.838	42	800	15	346	79	1,059	39	547	5	86
(3) Rheumatism. chronic	6	308	4	229	1	14			1	65		
(4) Rheumatism, acute articular	160	5,358	77	2,323	42	1,515	17	568	11	327	13	625
(5) Typhoid fever	92	5,348	45	3,059	17	878	16	838	11	406	3	167
(6) Mumps	82	1,108	28	371	27	348	12	190	5	55	10	144
(7) Measles	- 33	799	23	641	4	66	1	7	<b>2</b>	13	3	72
(8) Diptheria	41	895	10	306	15	301	5	65	8	158	3	65
(9) Tuberculosis of lungs	55	8,110	32	4,973	9	1,479	3	321	6	725	5	612
(10) Whooping cough	11	301	5	180	3	68	1	21	2	32		
(11) Gout.	12	567	8	342			2	189			2	36
(12) Scarlet fever	18	636	13	442	4	151				_	1	43
(13) Tumors, benign	48	1,000	28	721	11	117	4	120	1	2	4	40
(14) Tumors, malignant	17	2,246	10	2,020	2	119	2	44	3	63		
(15) Anæmia	6	608	4	297			1	31			1	280
(16) Myalgias	239	3,873	124	2,106	53	-999	31	429	10	105	21	234
(17) Chickenpox	12	203	6	116	5	77			1	10		
(18) Smallpox	15	348	<b>2</b>	41	10	233	1	35	2	39		
(19) Syphilis	5	666	3	627			1	8	1	31		
(20) Diabetes	15	1,264	6	702	2	65	7	497	-			
(21) Dengue	9	135	2	61	1	37			6	37		
(22) Minor ailments.	139	2,902	<b>63</b> .	1,501	26	548	24	432	16	293	10	128
(23) Unclassified	161	5,520	88	3,378	39	1,000	17	592	9	83	8	467
General diseases	4,461	80,295	2,246	44,552	1,092	17,238	554	9,139	298	4,569	271	4,797
(10) Nousitie		6 000	191	1 165	47	1 994	34	558	12	327	14	326
(40) INCUTINES	240	11 427	121	7 712	28	1 862	21	1 038	7	287	18	537
(41) Iveurasinenia	213	11,401	101	611,13	00	1,004	<u> </u>	1,000			10	001

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ANALYSIS OF HEALTH CLAIMS BY DISEASE.

# ANALYSIS OF HEALTH: CLAIMS BY DISEASE.

193

# TABLE VII (Continued).

NUMBER OF CLAIMS AND DAYS OF DISABILITY FOR DISEASES BY STATE LOCATION.

	All C	roups.	Gro	yup 1.	Gre	oup 2.	Grou	ıp 3.	Grou	1p 4.	Gro	1p 5.
	No. Ciaims.	Days Disab.	No. Ciaims.	Days Disab.	No. Claims.	Days Disab.	No. Claims.	Days Disab.	No. Claims.	Days Disab.	No. Claims.	Days Disab.
(42) Paralysis	10 12 5	$1,546 \\ 1,365 \\ 281$	3 8 9	344 943 133	3	679 148	$\frac{1}{2}$	45 44	1 1	$245 \\ 28$	$2 \\ 1$	233 350
(45) Locomotor ataxia		19 571	2	1 010	3	571	0	900	1	19		
(47) Instituty (48) Herpes zoster Dis. of nervous system	38 528	5,814 793 26,726	$\frac{17}{289}$	1,812 386 15,796	4 11 109	286 5,479	$\begin{array}{c} 2\\ 2\\ 62\end{array}$	000 19 2,092	3 4 29	905 31 1,842	4 39	71 1,517
<ul> <li>(60) Pericarditis, acute.</li> <li>(61) Endocarditis, acute.</li> <li>(62) Heart disease, organic.</li> <li>(63) Anging pasteria</li> </ul>	2 7 39 6	$122 \\ 369 \\ 3,819 \\ 552$	$     \begin{array}{c}       1 \\       4 \\       29 \\       3     \end{array} $	87 230 3,164 194	132	44 102 356	1 1 4 1	35 93 345	1 2	2 188	1	22
<ul> <li>(64) Aneurism.</li> <li>(65) Embolism and thrombosis.</li> <li>(66) Phlebitis</li> </ul>	2 2 9	$162 \\ 104 \\ 321$	$\begin{array}{c} 1 \\ 2 \\ 7 \end{array}$	112 104 272	ĩ	50	1	11			1	38
<ul> <li>(67) Varicosities</li> <li>(68) Adenitis</li> <li>(69) Tachycardia</li> </ul>	10 28	263 596	3 13	152 235	2 8	15 209	2 3	42 121	3	22	$\frac{3}{1}$	54 9
(80) Bronchitis acute	105 579	6,308 8,931	$\frac{63}{347}$	4,550 5,491	17 132	776 2.008	13 42	647 527	6 15	212 414	6 43	123 491
<ul> <li>(81) Pleurisy</li> <li>(82) Pneumonia, lobar</li> <li>(83) Pneumonia, hobar</li> </ul>	114     130     53	4,215 5,477 1 807	65 62 29	2,694 2,403 844	36 36 15	1,031 1,841 743	10 17 5	359 719 75	2 6	96 169	1 9 4	$35 \\ 345 \\ 145 \\$
(84) Cold	85 9	587 519 89		338 456 36		142 6 49	6 3 1	57 57 4	5	20	3	30
Dis. of respiratory system	976	21,625	556	12,262	248	5,820	84	1,798	28	699	60	1,046

	AH G	roups.	Gre	oup 1.	Gre	oup 2.	Grou	ap 3.	Orou	1p 4.	Grou	up 5.
	No. Claims,	Days Disab.	No. Ciaims.	Days Disab.	No. Claims,	Days Disab.	No. Claims.	Days Disab.	No. Cialms.	Days Disab.	No. Claims.	Days Disab.
(100) Appendicitis	393	14.161	184	6.724	103	3.573	46	1.924	28	932	32	1.008
(101) Indigestion	252	3.179	113	1.650	72	902	33	342	21	208	13	77
(102) Hemorrhoids	159	3.462	71	1,494	32	927	23	498	22	392	11	151
(103) Gastritis	155	2.975	79	1,869	37	635	23	302	8	84	8	85
(104) Fistula-in-ano	41	<b>´910</b>	18	349	12	317	7	175	3	34	1	35
(105) Auto intoxication	164	2.657	64	1,132	30	539	16	449	43	438	11	99
(106) Ulcerated teeth	43	<b>´473</b>	20	249	12	138	5	34	2	19	4	33
(107) Cholera morbus	3	133	<b>2</b>	120			1	13				1
(108) Enteritis	188	2,277	88	1,123	42	538	35	310	14	245	9	61
(109) Cholecystitis	47	1,326	28	730	9	294	3	58	4	153	3	91
(110) Colitis	50	1,025	17	461	15	367	11	123	7	74		
(111) Ulcer, gastric	30	1,365	12	658	7	246	5	137	3	142	3	182
(112) Ulcer, duodenal	23	1,275	12	765	6	226	4	216			1	68
(113) Jaundice, acute catarrhal	55	1,345	28	716	15	· 420	6	125	3	45	3	39
(114) Cirrhosis of liver	4	390	4	390			}					
(115) Ischio-rectal abcess	42	1,549	20	921	9	333	5	123	3	68	5	104
(116) Cholelithiasis	36	1,858	22	1,201	11	537	1	20	•		2	100
(117) Ptomaine poisoning	104	1,265	47	568	20	257	19	229	6	72	12	139
(118) Peritonitis	5	223	3	131	2	92	(					1 1
(119) Hernia	105	4,052	61	2,317	23	886	10	419	6	248	5	182
(120) Intestinal stasis	13	<b>388</b> '	7	321	2	14	2	38	1	3	1	12
Dis. of digestive system	1,912	46,288	900	23,889	459	11,241	255	5,535	174	3,157	124	2,466
(190) O-1 :::				40		80						
(130) Orenitis	14	250	4	43	4	12	4	86		00	Z	49
(131) Uysuus	46	1,295	20	605	10	413	8 N	104	3	88	5	85
(132) Nephritis, acute	36	1,522	16	614	10	323	2	25	5	56	3	504
(133) Nephritis, chronic	25	1,783	13	1,251	5	215		317				
(134) Prostatitis	18	291	10	403	2	84	3	64			3	40

# TABLE VII (Continued). NUMBER OF CLAIMS AND DAYS OF DISABILITY FOR DISEASES BY STATE LOCATION.

ANALYSIS OF HEALTH CLAIMS

BΥ

DISEASE.

	All G	roups.	Gro	oup 1.	Gro	up 2.	Grou	ip 3.	Grou	1 <b>p 4</b> .	Gro	1p 5.
	No. Claims.	Days Disab.	No. Claims.	Days Disab.	No. Claims.	Days Disab.	No. Claims.	Days Disab.	No. Claims.	Days Disab.	No. Claims.	Days Disab.
(135) Epididymitis. (136) Hydrocele. (137) Varicocele. (138) Nephrolithiasis. (139) Pyelits. Dis. of genito-urinary system (non-wenereel)	6 11 14 75 6 251	112 243 306 1,936 278 8 316	3 5 36 2	56 125 56 886 34	1 2 1 13 2 50	225821240177	1 4 12 1	21 60 143 337 28	1 4 6	13 86 208	8 1 22	265 39
<ul> <li>(150) Abcess.</li> <li>(151) Carbuncles.</li> <li>(152) Eczema.</li> <li>(153) Ingrown nail.</li> <li>(154) Furuncles.</li> <li>(155) Cellulitis.</li> <li>(156) Erysipelas.</li> <li>(157) Infection.</li> <li>Dis. of skin and cellular tissue.</li> </ul>	254 179 45 10 117 21 35 176 837	3,715 2,715 955 53 1,545 269 706 3,404 13,377	114 132 103 16 8 74 19 15 90 457	4,073 2,075 1,670 303 54 989 214 302 1,755 7,362	50 64 29 17 1 20 8 41 180	1,023 895 437 378 6 259 199 719 2,893	40 24 20 4 13 2 4 24 91	1,185 191 221 90 197 55 79 571 1.404	19 19 4 1 7 6 8 64	431 249 233 29 8 61 109 154 842	$     \begin{array}{r}       22 \\       15 \\       8 \\       4 \\       3 \\       2 \\       13 \\       45 \\     \end{array} $	982 305 154 150 39 17 205 876
<ul> <li>(170) Heat prostration</li></ul>	21 16 6 1 23	343 416 130 49 595	8 7 1 8	136 142 14	9 1 2 3	174 41 41 82	35	19 184 184	1 2 3 1 6	14 41 75 49	1	8
(190) Conjunctivitis. (191) Chalazion	65 12 10	776 224 166	33 2 3	402 119 37	17 7 1	181 77 12	6 1 3	68 10 48	5 1 3	100 35 16 69	4 1	90 2

# NUMBER OF CLAIMS AND DAYS OF DISABILITY FOR DISEASES BY STATE LOCATION.

ANALYSIS OF HEALTH CLAIMS BY DISEASE.

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#### TABLE VII (Concluded).

NUMBER OF CLAIMS AND DAYS OF DISABILITY FOR DISEASES BY STATE LOCATION.

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	All C	lroups.	Gr	oup 1.	Group 2.		Group 3.		Group 4.		Grou	1p 5.
	No. Claims.	Days Disab.	No. Claims.	Days Disab.	No. Claims.	Days Disab.	No. Claima.	Days Disab.	No. Claims.	Days Disab.	No. Claims.	Days Disab.
(193) Iridocyclitis (194) Iritis (195) Keratitis (195) Optic neuritis	1 17 7	27 482 167	1 4 5	27 70 99	9	193	1	42	$\frac{2}{2}$	153 68	1	24
(197) Retinitis (198) Hordeolum Dis. of the eye	5 7 124	• 125 56 2,023	$\begin{array}{c} 2\\ 4\\ 54 \end{array}$	$23 \\ 27 \\ 804$	1 1 36	49 18 530	1 1 13	32 $4$ $204$	1 14	7 <b>3</b> 48	1 7	21 137
(210) Otitis media (211) Mastoiditis (212) Furuncles of ext. canal	110 11 4	$1,813 \\ 504 \\ 26$	59 6 4	$1,100 \\ 231 \\ 26$	30	482	9 2	101 85	5 1	42 63	$\frac{7}{2}$	88 125
(220) Tonsillitis	125 1,103 107	2,343 11,841 1,505	69 576 66	$ \begin{array}{r} 1,357\\6,291\\1.124\end{array} $	$\begin{array}{c c} 30\\279\\24\end{array}$	482 2,994 212	11 126 8	186 1,370 69	6 53 3	105 529 26	9 69 6	$213 \\ 657 \\ 74$
(222) Quinsy (223) Pharyngitis (224) Hyper-tonsils Dis. of the throat	125 88 75 1,498	1,754 765 826 16,691	59 49 26 776	944 449 293 9,101	$ \begin{array}{c c} 42 \\ 22 \\ 22 \\ 389 \end{array} $	549 185 278 4,218	11 8 14 167	125 73 131 1,768	5 4 4 69	51 15 40 661	8 5 9 97	85 43 84 943
(230) Sinusitis, frontal (231) Sinusitis, ethmoidal (232) Sinusitis, maxillary	67 32 46 26	1,418 616 766 294	38 14 30 14	651 202 480 152	16 10 6 7	517 211 138 117	7 5 2 2	134 124 36 4	2 2 2 1	61 21 13 7	4 1 6 2	55 58 99 14
(235) Polypi (235) Deviated septum 	$     \begin{array}{c c}       42 \\       9 \\       54 \\       276     \end{array} $	503 169 620 4,386	$19 \\ 4 \\ 35 \\ 154$	$ \begin{array}{c c} 286 \\ 105 \\ 435 \\ 2,311 \end{array} $	$     \begin{array}{c}       12 \\       1 \\       10 \\       62     \end{array} $	117 7 89 1,196	$     \begin{array}{c}       6 \\       1 \\       7 \\       30     \end{array} $	67 14 81 460	3 2 2 14	22 41 15 180	2 1 16	$ \begin{array}{c} 11\\ 2\\ 239\end{array} $
All diseases	11,137	229,316	5,694	126,349	2,684	51,754	1,334	24,621	728	13,245	697	13,347

ANALYSIS OF HEALTH CLAIMS BY DISEASE.

# Notes on Poisson's Expensional and Charlier's Curves.

BY:

A. H. MOWBRAY.

In his paper on Graduation of Frequency Distributions (*Proc.*, VI, p. 52 et seq., at p. 72) Professor Carver gives the formula for Charlier's Type B curve, stating that the basis is

$$\psi(x) = \frac{e^{-m}m^x}{|x|}.$$

This last function is known as Poisson's Exponential Expansion or (the term is due to Bortkewitsch) "The Law of Small Numbers" and through it we can see something of the relationship between the Pearson and Charlier Systems of Frequency Curves, on the one hand, as well as Professor Carver's method of graduation, and on the other the Theory of Probabilities as it is usually taught. I believe this relationship is sufficiently interesting to our members to justify calling it to their attention in these notes.

We are all, of course, familiar with the elementary proposition in the theory of probabilities that the probabilities of the respective possible results in a series of n thials of any subject whose individual probability is p are given by the successive terms in the expansion of the binomial  $(p+q)^n$ .

Performing the expansion and considering as the general term the (x+1)th term we get the term

$$(p+q)^{n} = p^{n} + np^{n-1}q + \frac{n(n-1)}{2}p^{n-2}q^{2} + \cdots + \frac{n(n-1)(n-2)\cdots(n-x+1)}{x!}p^{n-x}q^{x}, \cdots$$
(1)

If in the above we let n q = m we may write

$$(p+q)^{n} = p^{n} + mp^{n-1} + \frac{1\left(1-\frac{1}{n}\right)}{2}p^{n-2}m^{2} + \cdots + \frac{1\left(1-\frac{1}{n}\right)\left(1-\frac{2}{n}\right)\cdots\left(1-\frac{x+1}{n}\right)}{x!}p^{n-x}m^{x}, \cdots$$

$$= p^{n} + mp^{n-1} + \frac{m}{2} \cdot 1 \cdot \left(1-\frac{1}{n}\right)p^{n-2} + \cdots$$
(2)

$$= p + mp^{-1} + \frac{1}{2} \cdot 1 \cdot \left(1 - \frac{1}{n}\right) p^{n-2} + \cdots$$

$$+ \frac{m^{z}}{x!} \cdot 1 \cdot \left(1 - \frac{1}{n}\right) \left(1 - \frac{2}{n}\right) \cdots \left(1 - \frac{x+1}{n}\right) p^{n-z}, \cdots$$
(3)

We may now let q=0 while *m* remains finite, i.e.,  $n=\infty$ . Under these conditions, the factor  $m^{x}/x!$  in the general term remains finite and the several factors [1-(1/n)], [1-(2/n)]...[1-(x+1/n)] approach unity. There remains for consideration  $p^{n-x}$ , which we may transform as follows:

$$p^{n-x} = (1-q)^{n-x} = \left(1-\frac{m}{n}\right)^{n-x} = \left(1-\frac{m}{n}\right)^n \left(1-\frac{m}{n}\right)^{-x}.$$

Passing to the limit when  $n = \infty$  the first factor becomes  $e^{-m}$  and the second unity.

Hence we find as the limit of the general term when  $n = \infty$  but nq remains finite  $e^{-m}(m^x/x!)$  and

$$\lim_{\substack{n \ge 0 \\ q = 0 \\ q \text{ fulle}}} (p+q)^n = e^{-m} \left( 1 + m + \frac{m^2}{2} + \frac{m^3}{3!} + \dots + \frac{m^x}{x!} \right).$$

It will be noted that the expression in parentheses is the expansion of  $e^m$  which must be so since  $(p+q)^n \equiv 1$ .

This representation of  $(p+q)^n$  was first discovered by Poisson. Hence its name.

Although the formula is rigid only in the limit, it gives a fair approximation when q is relatively large. In general, in the type of probabilities we deal with, q is small, and even n q is small. It is because of its application in such cases that it was called the "Law of Small" numbers.

Tables of the value of this function according to the values of m and x are tabulated for values of m by intervals of 0.1 up to

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m = 15 in "Tables for Statisticians and Biometricians" edited by Professor Karl Pearson. As a means of graduating actual frequencies the formula is, however, of little value, as the function is not continuous in this form and in practice perturbing influences prevent natural events accurately following the Bernoullian law represented by the binomial expansion.

It can be shown that the so-called normal error curve is the limiting form of the same binomial expansion when p and q are nearly equal and  $n = \infty$ . One demonstration of this will be found, for example, in Bowley's "Elements of statistics."

Since the Charlier Type A curve is, as Professor Carver has pointed out, reducible to the form

$$y = \phi^{(x)} f^{(x)} = \phi^{(x)} (b_0 + b_1 x + b_2 x^2 + b_3 x^3 + \ldots).$$

Where

$$\varphi(x) = \frac{1}{\sigma \sqrt{2\pi}} e^{-\frac{(x-b)^2}{\sigma^2}}$$

(the normal curve) it would seem that it should be found best fitted to graduate frequencies developed from large probabilities where p is nearly equal to q and that the relative size of the coefficients  $b_1, b_2$ , etc., to  $b_0$  are determined by the amount of perturbation of the basic probability. This must be so, since if they all vanish but  $b_0$  the curve reduces to the normal curve multiplied by a constant, which is, of course, a function of the scale of the y coordinates.

On the other hand, Charlier's Type B curve is based on Poisson's Exponential, which approximates the probability binomial when q is small. It would therefore seen that this curve would be most useful in graduating frequencies arising from events with low probabilities, the kind we have most need to deal with.

Since this curve can be reduced to the form

$$y = \psi(x)f(x) = \psi(x)[b_0 + b_1x + b_2x^2 + b_3x^3 + \cdots]$$

it would again seem that the size of the coefficients  $b_1$ ,  $b_2$ ,  $b_3$ , etc., relative to  $b_0$  are dependent upon and may serve as a measure of the perturbation of the basic probability in this type of cases.

# 200 POISSON'S EXPONENTIAL AND CHARLIER'S CURVES.

It would appear these relationships should be of value to us in rescarches as to stability of statistical series and the nature of disturbing forces which affect their value for rate making. I hope to find an opportunity in the near future to look into this further and present some tests along these lines to the Society.

# THE TECHNIQUE OF RATE MAKING AS ILLUSTRATED BY THE 1920 NATIONAL REVISION OF WORKMEN'S COMPENSATION INSURANCE RATES.

#### ΒY

#### G. F. MICHELBACHER.

To one who has never taken active part in such proceedings, a revision of rates means probably little more than a new manual with various innovations in classifications, rules and rates. From this point of view a revision is simple; the manual suddenly appears as a completed product, there follows a short period of adjustment to changes in rates and methods of underwriting and then the order of things runs on as usual. The new manual is only an incident and is accepted more cr less as a matter of course, as a necessary development in the tusiness. To a person in this position a manual is apparently created over night, or possibly in the short space of time it takes a committee to make certain fundamental decisions without which it would be impossible to have a revision at all.

Such, however, is not the case. The production of a manual is a huge task requiring months of preparation by the individual insurance carriers and by the organization prosecuting the work, elaborate machinery for assembling and compiling statistics, numerous committee meetings for the determination of actuarial, underwriting and engineering principles and a large staff trained in the minutiae. The beginnings of a revision are to be found in the offices of the insurance carriers where the necessary statistical data are brought together from original sources. The final publication of the manual can come only after these raw statistics have been filed with some central organization, audited, combined with similar figures filed by other carriers and subjected to actuarial and statistical processes by means of which they are converted into compact form for the use of the technical committees which translate them into rates.

It is for the purpose of outlining the rate making process in its various details that this paper is presented. The several steps in a rate revision will be described and the reader will be taken through the procedure from beginning to end. In order that the paper may deal with particulars instead of with generalities, the recently completed 1920 national revision of workmen's compensation rates has been selected as an example, and the data, methods and machinery discussed will be those employed in this revision. The procedure of this revision is typical and differs only in detail from that which might be adopted for any revision of rates. Fundamentally, all revisions requiring extensive use of statistics must proceed along similar lines and in accordance with the same general principles. The present paper will, therefore, enable persons experienced in the methods used in other lines of insurance to compare such methods with those which have been established after years of experimentation in the field of workmen's compensation insurance. The 1920 national revision represents the latest development in rate making in this field.

#### THE MACHINERY.

The 1920 national revision of workmen's compensation rates was conducted under the auspices of the National Council on Workmen's Compensation Insurance. It is proper, therefore, to preface this paper with a brief outline of the purposes of the Council, its organization and the machinery by means of which it performs its rate making functions.

The Council is a federation of rate making boards and bureaus with offices in New York City.\* Its fundamental objects are "to coöperate with rating organizations and public officials in all states in the determination of equitable premium rates for workmen's compensation insurance, and to promote a true public understanding concerning the establishment of such rates."

To further the accomplishment of these objects, the constitution provided, among other things, that the Council shall

- "1. Collect and compile experience for rate making purposes.
- "2. Establish classifications for rate making, and rules and procedure governing the application of same.

\* The present membership comprises the following organizations: Independent rating bureaus of the states of Alabama, California, Delaware, Massachusetts, New Jersey, New York, Pennsylvania, Tennessee, Virginia and Wisconsin; the National Association of Mutual Casualty Companies and the National Workmen's Compensation Service Bureau.

- "3. Establish basic pure premiums and formulate fundamental general principles applicable to all states for translating such pure premiums into rates.
- "4. Establish rating plans for the purpose of modifying manual rates on individual risks.\*

The general administrative and financial affairs of the Council are under the supervision and direction of two committees, the Governing Committee and the Committee of Managers. Upon the Governing Committee are six insurance carriers, membership being equally divided between "participating" and "non-participating" carriers.<sup>†</sup> This committee appoints the General Manager and has control over the finances of the Council. The second administrative committee is made up of the General Manager of the Council and the Managers of the affiliated boards and bureaus. This committee elects the members of the various technical committees, designates the chairmen of these committees, passes upon applications for membership in the Council and assists the Council in an advisory capacity.

The technical work of the Council is in charge of committees of insurance carriers. Each committee is equally representative of participating and of non-participating insurance and the chairman is, in each case, a representative of a state insurance department supervising workmen's compensation rates.

In recognition of the fact that workmen's compensation insurance for coal mines presents peculiar problems requiring special knowledge, a section has been formed for dealing with technical problems in this field. This section has its central committee known as the Coal Mine Committee and two sub-committees, the Actuarial Sub-committee, whose function it is to consider the actuarial phases of the subject; and the Engineering Sub-committee which deals with engineering and inspection problems.

\* The term "risk" used in this connection includes the operations of an assured which are the subject of insurance. Thus, a manufacturing plant, a chain of stores, a garage, the construction of a dam, the operations of a brick-mason, a mine, a quarry, etc., may each constitute a "risk" for insurance purposes.

<sup>†</sup> The constitution of the Council lefines "participating" and "nonparticipating" carriers as follows: "Participating carriers' are defined as stock corporations issuing dividend policies, mutual corporations, state funds, and reciprocal interinsurers. 'Non-participating carriers' are stock corporations issuing non-dividend policies." There is a similar organization of technical committees for dealing with the general rate making problem. A central committee, known as the General Rating Committee, is in charge. It is the duty of this committee "to prepare a manual of classifications and rules, to establish basic pure premiums and subsequent amendments in such manual and basic pure premiums, and to approve rating plans determined upon by the Actuarial and Engineering Committees." In this work the General Rating Committee is assisted by the Actuarial Committee which has jurisdiction over actuarial and statistical problems and over the plan of experience rating, and by the Engineering Committee which deals with engineering problems and more particularly with the schedule rating plan.

The Council proper is in charge of a staff of officers headed by Harwood E. Ryan as General Manager. It is equipped to perform actuarial, engineering and statistical work and serves as the agency by means of which the decisions of the various technical committees are put into proper form for practical application.

The Council has no absolute power over rates and rating plans. The results which it produces are advisory only; the member boards and bureaus may accept or reject them. It does, however, exercise considerable influence and its recommendations carry much weight because of the completeness of its statistical data and the reputation and ability of the members of its technical committees.

The most important feature of the Council's work is its function as a clearing house for the member boards and bureaus. Each member is obligated to file with the Council proposed changes in rules, classifications, rates and rating plans. The Council analyzes these propositions, checks them against the available statistical data in its files, subjects them to actuarial, engineering and underwriting tests, secures a decision from the proper technical committee and then reports this decision to the proposing member and to every other member as well. Through this procedure each member keeps in touch with developments in other jurisdictions and at the same time receives the benefit of the statistical experience and the advice and recommendations of the technical committees of the Council. Thus, even though the conclusions of the Council are only advisory, they are nevertheless most important factors in promoting uniformity in underwriting, actuarial, statistical and engineering procedure in all sections of the country.

#### THE PROBLEM.

Before considering the technique of a rate revision, it is essential to examine the nature of the problem requiring solution. This problem is the production of the manual, a book containing rules of underwriting procedure, a schedule of classifications describing the various risks to be rated, and rates applicable to the classifications.

In workmen's compensation insurance there are approximately 1,000 classifications. For the most part each classification represents an entire industry or business, as, for example, bakeries, landscape gardening, mining, department stores. But this is not necessarily so. Some classifications still follow occupations, such as carpentry, locksmithing, plastering; others represent processes, such as wood-turning, rolling raills, rubber reclaiming.

Classifications should meet certain general qualifications.\* They should be clearly phrased so that their scope may be readily understood by everyone who uses them. They should represent units for which accurate payroll and loss records can be kept. There should be no possibility of manipulation, either for the purpose of misapplication in classifying risks or of "jugging" payroll from one classification to another carrying a lower rate. The statistician in the home office of the insurance carrier should be able to allocate the payrolls, premiums, and losses to the classification to which they belong. I There should be as few classifications as possible since accurate rates cannot be established if the total experience is distributed among many classifications. The best results will be achieved if there is a reasonable concentration of experience in important classifications which actually represent distinct industrial units.

\* See paper by E. H. Downey entitled "The Classification of Industries for Workmen's Compensation Insurance," *Proceedings C. A. S. S. A.*, Vol. II, pp. 10-24.

t Cases are on record where unintentional errors in charging pay-rolls or losses to classifications have had  $\varepsilon$  serious influence upon the experience which is used as the basis for rate making. Take, for example, the case of "Blasting." It is customary to require a separation of payroll for blasting wherever it is found. This payroll is usually estimated or taken at an arbitrary amount, it being difficult to obtain an accurate statement; the losses, however, are clearly indicated from accident reports and are properly charged. The result probably is an experience indication that is excessive; the losses are correct but the payroll exposure is too low because it is not accurately determined. The present classification system is an inheritance from the days of employers' liability insurance. During each revision many changes are made. For example, in the 1920 revision there were 1,319 classifications at the beginning of the work. Of these, 466 classifications were eliminated. On the other hand, 100 new classifications were erected. The total number remaining in the manual at the completion of the revision was thus reduced to 953.

It cannot be urged that the classification system is scientifically satisfactory, but it is difficult to improve it by making radical changes. Just as, in some forms of insurance, there are old policy contracts which retain their original phraseology, entirely different from present day language,\* so the classifications as they stand have a certain value because long practice has given them the weight of precedent and interpretation.

The rules, likewise, are the result of gradual development and experiment. In each revision they are subjected to thorough overhauling in order that they may be kept abreast of the times. Radical changes have to be avoided, however, because the underwriting procedure covered by the rules has become more or less firmly established in practice and violent adjustments or amendments would undoubtedly react seriously upon the business. For example, in the latest revision, there were only three such changes of any consequence. One of these provides for the inclusion of bonuses as part of the payroll upon which premiums are computed. This was adopted in recognition of the fact that bonuses are practically universally considered as wages for the purpose of determining the amount of compensation benefits. Another involves an addition to the so-called "payroll" rules which govern the sub-division of risks into constituent manual classifications. Formerly, when several operations were involved in a risk, all of which were specifically classified in the manual, it was not permissible to use the individual manual classifications for parts of the risk on the same floor of a building. Under the rule as amended, a "division of payroll" may be made in these cases provided each operation is in a separate department surrounded by structural partitions, and has no interchange of labor with other departments. The third change involves the erection of a new rule governing the writing of business upon a monthly, quarterly, or semi-annual premium collection basis; certain percentages of the annual premium are established

\* For example, the marine insurance contract.

as the amounts to be deposited with the insurance carrier in these several cases.

The real crux of a revision, however, and the phase which will receive attention in this paper, is the problem of establishing rates. In a thoroughgoing revision, such as the present, the old rates are discarded completely and new rates are produced from fundamental data. This work requires extensive preparation and the greatest part of the time is consumed in that way. To fully appreciate a revision, therefore, it is necessary to know what the manual rate represents, how it may be analyzed, upon what it is based and what processes are essential to its determination.

The rate is the price of insurance per \$100 of payroll exposure.\* The manual rate is an average rate applicable to all risks within the classification to which it relates but it is not necessarily the final rate charged. It is, however, the starting point, the modifications produced by the systems of merit rating (schedule or experience rating)† being subtracted from, or added to it, depending upon whether the individual risk is better or worse than the average of its type.

The rate must be adequate to cover the losses arising out of accidents in the industry represented by the classification and also the expenses incurred by the insurance carrier in administering the insurance. The *pure premium* is that part of the rate which represents the loss cost per unit of exposure. The *loading* is the part which provides for the various items of expense. The best indication upon which to base the pure premium is actual experience assembled from the records of insurance carriers. The expense loading must be established with proper regard for the prevailing methods of doing business and for the actual expense requirements of individual carriers.

\* Payroll has been taken as a basis for premium calculation because the state workmen's compensation laws hase compensation payments upon the wages of workmen who are injured, and also because it is the measure of the number and working time of employees most readily furnished by employers.

t Schedule rating is a method of rating physical hazards. The schedule is a list of hazards with debits and credits therefor and is applied by inspectors who make actual surveys of individual risks. Experience rating measures both physical and moral hazards. It involves the use of the past loss history of the individual risk and a comparison of this with the general experience of the classification.

It is obvious, when experience is made to serve as a basis for pure premium determination, that the values selected with reference to such experience will represent the conditions and requirements of the past.\* There may, therefore, be some discrepancy between the pure premium based upon experience and the pure premium which will be adequate to meet the conditions of the future period for which the rate is contemplated. Items affecting this change, such as wage level, employment or unemployment, industrial conditions, immigration and emigration, amendments to the workmen's compensation law, changes in the interpretation of the workmen's compensation law or in the procedure of the board or commission supervising and administering the law, merit rating, accident frequency and severity, etc., are usually measured collectively or individually by a factor or by factors which are applied to the pure premium established upon past experience. By this process the pure premium is increased or decreased, depending upon whether the conditions effecting the change have resulted in a higher or lower level of cost for the period during which the rates will be applied than that for the period represented by the available experience.

The pure premium for a classification based upon experience after analysis and comparison with the experience of other classifications, may be termed the *selected* pure premium<sup>†</sup> and the pure premium which is correct for the future may be designated the *final* pure premium.

In practice, complications are found. The classifications in a given state having adequate experience upon which to establish pure premiums are comparatively few in number. Where the state experience is inadequate for rate making purposes it is necessary to combine the experience of several states or possibly to combine the experience of all states in order to obtain an experience which will produce a dependable indication. There must, therefore, be regional pure premiums applicable to a number of contiguous states and national pure premiums applicable to all states except those with sufficient local experience to determine their own rates. In the 1920 national rate revision the experience of all states was

\* In workmen's compensation insurance, classification experience "lags" approximately two years behind the present. This is due to the "policy year" method of accounting which will be described later.

† The pure premium taken direct from the experience without modification is known as the *indicated* pure premium or the *experience* pure premium. available. It was converted to a common level and was presented by states and by regions as well as for the country as a whole. The General Rating Committee in establishing pure premiums started with the country-wide experience and made exceptions for regions and states wherever necessary.

#### THE DATA.

We come next to the consideration of the data available for a rate revision. In workmen's compensation insurance the major part of the experience utilized for rate making is in the form of special exhibits compiled by insurance carriers which are known as schedules " $\mathbb{Z}$ " and "W."

Schedule "Z" is a record, by manual classifications, of the experience of an individual state. The policies written in a given calendar year are reported upon as a single experience group. Thus, the payrolls and premiuris of policies written during calendar year 1920 and all losses arising out of these policies constitute the experience for policy year 1920.\* Since the policies are customarily written for a period of twelve months, it follows that policy year 1920 will not be complete until December 31, 1921, when the last policy expires. In fact, the experience will not be available in *final* form until some time later, for the payrolls of each individual risk must be audited, the premiums adjusted accordingly and all the injuries resulting from accidents chargeable to the 1920 policies must be definitely determined and compensated before the ultimate cost of insurance can be known. The record of policy year 1920, for instance, continues to develop for a number of subsequent calendar years and it often requires a long period, depending upon the provisions of the state workmen's compensation law, to determine its ultimate status.

The first approximation to the final result may be obtained, however, not long after the expiration of the last policy issued in 1920, provided sufficient time is permitted to elapse to enable the carriers to secure audits of payrolls and reports of all claims chargeable to the account. In this event the losses actually paid may be

\* Also termed 1920 "year of issue" or "year of risk" (inaccurately).

† In New York certain payments continue during the lifetime of the beneficiary. The account for any year will, therefore, remain open until the death of the last beneficiary entitled to receive compensation on account of accidents chargeable to policies issued in that year. ascertained with exactness; but the liability for future payments must be estimated. Schedule "Z" for 1920 may, therefore, be originally reported in calendar year 1922. It cannot, under present conditions, be reported earlier. It is this method of accounting that is responsible for the "lag" of the available experience behind the current rates.

Schedule "Z" for a given state is reported in several parts. In 1919 there were four parts. Part I was a record by classifications of the payrolls, premiums and losses of a single policy year. The sample form of the 1919 Part I blank reproduced as Exhibit I is more or less self-explanatory, but one or two comments may serve to clear up doubtful points.

It will be noted that payrolls and premiums are reported separately for policies including medical aid and for policies excluding medical aid. It is customary in many states to provide a form of contract under the terms of which the insurance carrier reduces the premium by a stipulated amount, the policy holder, for this consideration, assuming the responsibility of providing medical, surgical and hospital treatment for his injured employees. This arrangement is designed particularly to meet the convenience of policy holders who have installed hospitals in their plants. In these cases the entire payroll will be reported but the premium and the losses will be incomplete. The purpose of reporting the payrolls and premiums for such contracts as separate items is to permit a modification of the experience to take account of its incompleteness.\*

Attention should also be directed to the analysis of losses. Accidents are classified by nature of injury into five classes as follows:

- 1. Death Cases.
- Cases resulting in permanent total disability, i.e., absolute incapacity for work, as for example, accidents involving the loss of both arms, both legs, both eyes, insanity, total paralysis, etc.
   \* Take for example the following situation:

Kind of Polley.	Payroll.	Medical Losses.	Total Incurred Losses.
Policies including med. aid	\$10,000,000	\$5,000	\$250,000
" excluding " "	1,000,000	0	20,000

It may be assumed that the medical experience of policies excluding medical aid will be the same as for policies including medical aid. The indicated medical pure premium for policies including medical aid is .05 (\$5,000 divided by 100,000). Applying this to the payroll excluding medical aid, we obtain expected medical losses of \$500. These are assumed

- 3. Cases resulting in permanent partial disability,\* as for example, injuries involving the loss of one hand, one eye, one leg, or any other disability permanent in character which does not totally incapacitate the injured worker.
- 4. Indeterminate cases, i.e., cases in which the exact nature of the disability is not ascertainable at the time the report is prepared. The number of these cases will decrease in subsequent reports as information is obtained which will permit the carrier to allocate them to one of the other groups.
- 5. Temporary disability cases, i.e., cases involving loss of time in excess of the waiting period specified in the state workmen's compensation law, which are known not to involve any permanent injury.

All indemnity losses, whether paid or "outstanding," arising out of each of these classifications of injury are reported in the proper loss column: the number of cases is also given. All medical losses are reported in one classification, irrespective of the kind of accident. The first approximation to the selected pure premium is the

to be the medical losses which would have been incurred had the \$1,000,000 payroll been written with full aid coverage; \$500 is, therefore, a measure of the deficiency in the loss experience. The total experience on a correct basis may, therefore, be written as follows:

Payroll.	Medical Losses.	Total Incurred Losses.
\$11,000,000	\$5,500	\$270,500

\* In the 1920 schedule "Z" this class fication will be sub-divided, "major" permanent partial disability cases being reported in one classification, "minor" permanent partial disability cases in another. For this purpose "major" permanent partial disability will include the following cases:

- "(a) Every permanent injury, not constituting permanent total disability, which involves the loss of sight of an eye or the loss of a hand, foot, arm, or leg:
  - (b) Every permanent injury involving the impairment to the extent of 50 per cent. or more of a hanc, foot, arm or leg:
  - (c) Any permanent injury, whether enumerated above or not, which is compensated on the basis of 25 per cent. or more of permanent total disability (or 25 per cent. or more of the full-benefit for permanent total disability allowed under the act applicable thereto)."

t It will be noted upon reference to the blank in Exhibit I that three columns are provided for losses, one for "paid" losses, a second, for "outstanding" losses and a third, for total losses. The first two columns need not be used; they are provided for the convenience of certain carriers in preparing the schedule. experience indication, that is, the ratio of the actual incurred losses to each \$100 of payroll exposure.\*

The remaining parts of the 1919 Schedule "Z" were individual reports of certain cases included in part I concerning which special additional information was required. Individual reports of death, permanent total disability and indeterminate cases were made. The cause of accident, nature of injury, number of dependents, nature and extent of dependency and other items were given, thus facilitating the audit of the schedule and the correction of estimated losses and assisting in the allocation of these "serious" cases to the appropriate classifications. The individual reports also served a valuable purpose in enabling the rate making committee to graduate the pure premiums for the more serious types of injury and to spread the cost so that it was properly distributed to the individual classifications.

Whereas Schedule "Z" presents experience by policy years and for individual classifications, Schedule "W" presents it by calendar years and for all classifications combined. Schedule "W" is an underwriting "gain and loss" exhibit—it contains not only a record of premiums and losses but also a statement of expenses so that the carrier and the supervising authority may determine whether the established rates were adequate in their provision for both losses and expenses. The value of Schedule "W" lies in its indication of the latest loss experience; inasmuch as it is on a calendar year basis it is always one year closer to the present than is Schedule "Z." Its use for this purpose, however, must be attended with many reservations owing to the considerable element of judgment and estimate involved in its preparation.

The real use of Schedule "W" is for the determination of the expense loading. The exhibit presents a detailed analysis of expenses and taxes, so that each item may be evaluated in terms of percentage of gross premium income.

\*For example, referring to Exhibit I, the "indicated" pure premiums are as follows:

Death $$66,907 \div 346,150$ = \$ .193
Permanent Total=\$ 0
Permanent Partial \$142,703 ÷ 346,150 = \$ .412
Temporary Total \$99,254 ÷ 346,150 = \$ .287
Indeterminate
Medical \$66,477 $\div$ 327,520 $\times \frac{346,150}{327,520}$ =\$ .215
Total $\ldots = \$1.107$
## THE TECHNIQUE OF BATE MAKING.

# PART 1 NEW YORK SCHEDULE Z-1919 POLICY YEAR 1916 3632 CLASSIFICATION EXPERIENCE

(CARD NO.)

Insurer\_ All carriers combined.

Manual classification

Machine Shops - without foundry.

		Man	ual Rate
	COVERAGE	EINRNED PAYROLL (Dollars only)	EARNED PREMIUM (Dollars only)
~	Excluding medical	1,863,000	16,237
8	Including medical	32,752,000	358,429
с	Total	34,615,000	374,666

### LOSS EXHIBIT

	NATURE OF INJURY	NO. OF CLAIMS (1)	PAID (Dollium only) [2]	OUTSTANDING (Dollars only) (3)	TOTAL INCURRED (Dollare only) (4)
a	Death	16			66,907
E	Permanent total disability				
F	Permanent partial disability (Dismemberment, loss of use, etc.)	269			142,703
G	Temporary disability (Total and partial)	1767			99,254
н	Indeterminate				
_J	Medical				66,477
— к	Total	2052			375,341

4-17-19-52,000 (14-4155)

EXHIBI'T I.

In addition to these particular schedules, each revision brings forth requests for special exhibits of data required for the solution of peculiar problems. In the 1920 revision, for example, three special calls were issued. The first was for wage data for calendar years 1917 and 1919. This was used to test the effect of wage fluctuation upon the cost of compensation and also for the purpose of determining the effect of amendments to the workmen's compensation laws of the several states. The second was a special call for premium and loss data for use in projecting the experience for policy years 1916, 1917, 1918 and 1919 to an approximately ultimate basis. This study was made in connection with the projection of rates, the purpose being to ascertain the trend of cost in order that the committee might predict the cost of calendar years 1920 and 1921-the period for which rates were established. The last was a call for special information concerning the relative cost of medical aid in 1917 and 1919. This information was used to determine the increase in medical cost over this period.

# PRELIMINARY WORK.

In a manual revision the order of events preliminary to the actual determination of pure premiums involves the following steps. The first step is the determination of the exact scope of the experience to be used. An outline of the desired data is prepared and submitted to the individual carriers who compile from their records the necessary information and file it with the central organization. These reports are then audited, after which the experience is assembled and reduced to convenient form for the use of the rate making committees.

In the 1920 national revision of workmen's compensation rates the process was shortened by reason of the fact that Schedule "Z" data previously had been assembled by the several state insurance departments and rating bureaus and the experience was thus available for immediate compilation in proper form for rate making. The Actuarial Committee, therefore, proceeded without delay to formulate a number of rulings to govern the staff of the Council in this important preliminary work.

Mr. Mowbray, in his paper, discusses the actuarial problems of the revision and the methods adopted for their solution. I, therefore, shall merely state the conclusions of the committee and describe the procedure by means of which they were given practical application. 1. It was decided to use the available experience of all carriers for each workmen's compensation state for policy years 1916 and 1917. The 1916 experience represented the second reporting for that year and was, therefore, practically altogether matured. The 1917 experience was necessarily taken from the first report. Both experiences were made up as of December 31, 1918, and were reported in calendar year 1919. As the revision was inaugurated in November, 1919, this was the latest experience then available.

2. It is obvious that these experiences by states and policy years could not be simply added together without adjustment. They represented varying wage levels, widely different conditions surrounding the production of accidents, and as many standards of indemnification as there were benefit schedules in the workmen's compensation laws effective in the United States during calendar years 1916, 1917 and 1918. The committee recognized this fact by a decision to take the experience of a single state for one year of issue as representing a common 'evel to which the experiences of other states and years of issue might be converted and combined. For this purpose, New York Schedule "Z" for 1917 was selected as the basis of reference.

3. The next decisions had to do with the process of converting the experience to the common level:

(a) There were six loss divisions in the original Schedule "Z" data, namely:

- 1. Death.
- 2. Permanent total disability.
- 3. Permanent partial disability
- 4. Temporary total disability.
- 5. Indeterminate disability.
- 6. Medical.

These were grouped into three divisions as follows:

- 1. "D. & P. T. D."-i.e., death and permanent total disability losses.
- 2. "All Other Indemnity"—i.e., permanent partial disability, temporary total disability and indeterminate disability losses.
- 3. "Medical "-i.e., medical losses.

(b) Two distinct methods of conversion were selected for these loss divisions:

1. It was decided to convert the "D. & P. T. D." division on a numerical basis; that is to say, to obtain the converted losses by

counting the number of cases for each classification for all states and years of issue, and by multiplying this by an average value per case determined from New York Schedule "Z" for 1917.

2. For converting the "All Other Indemnity" and "Medical" loss divisions an "experience differential" method was adopted; the converted losses to be obtained by the application of a conversion factor to the actual state losses for 1916 and 1917. The committee adopted Greene's formula\* for the purpose of developing conversion factors for these divisions. This formula in the form in which it was used may be written as follows:

Conversion Factor = 
$$\frac{R - D \frac{\text{Losses for N. Y. Schedule "Z"-1917}}{\text{Losses for Additional Statet}}$$
where
$$Aucrage Pure Prem for N. Y. Schedule "Z" - 1917$$

 $R = \frac{\text{Average Pure Prem. for N. Y. Schedule "Z"-1917.}}{\text{Average Pure Prem. for Additional State}}$ 

$$1 + D = \frac{\text{Expected Losses for N. Y. Schedule "Z"}}{\text{Actual Losses for N. Y. Schedule "Z"-1917}}$$

It will be noted that a first approximation to the conversion factor is the simple ratio of average pure premiums for the two experiences under comparison.<sup>‡</sup>

3. Recognizing the fact that the proposed analysis of the total pure premium into three divisions threw into the "All Other Indemnity" division two important classes of losses, those arising out of permanent partial disability and out of temporary total disability accidents, and that for this reason absolutely correct results for individual classifications were not to be obtained in the process of conversion if a single factor for "All Other Indemnity" was used for all classifications, the committee erected three groups of classifications and calculated conversion factors for each group. These groups are described as follows:

\*See paper by Mr. Greene entitled "Upon Combining Compensation Experience from Several States," pages 10-30 inclusive, Volume VI, Part I, Proceedings C. A. S. S. A.

t The "additional state" experience is that to be converted to the basic level, e.g., Connecticut experience for 1916 and 1917-Michigan experience for 1916 and 1917, etc.

‡ An analysis of Greene's formula developing this relationship will be found in Mr. Mowbray's paper. (a) Classifications involving essentially contracting and building operations including excavation and other heavy outdoor work.

In these, the "All Other Indemnity" division will be created by injuries which are generally severe, such as those resulting from fractures, sprains and bruises.

The nature of the operations performed is the basis of classification rather than the relative proportion of permanent partial disability and of temporary total disability losses.

(b) Classifications characterized by a marked dismemberment hazard.

In these, the "All Other Indemnity" losses will be unequally distributed, the larger percentage being created by permanent partial injuries.

(c) All classifications not covered by groups 1 and 2.

It was assumed that the ratios of permanent partial disability losses to temporary total disability losses in all classifications in each of these groups were sufficiently uniform to obviate violent inaccuracies arising from the use of an average differential for the "All Other Indemnity" division.\*

4. The committee decided to group the experience of individual classifications according to the "Groups" and "Schedules" of the "Manual Classifications Code." The code is an arrangement of the manual classifications designed particularly to assist the underwriter in rate making. Classifications presenting similar hazard characteristics are thrown together into groups. These groups in turn are associated in schedules. For example, group 102—"Baking" includes the following four classifications:

2000-Bakeries

2001-Cracker Manufacturing

\*Strictly speaking the losses for each kind of injury should be converted independently, as there is likely to be a different cost relationship as between states for each class. The points raised in connection with the "All Other Indemnity" division are that the ratio of the two important loss elements making up the division is not constant for all classifications and that the use of one conversion factor, rather than two separate conversion factors, would produce inaccurate results particularly if an attempt were made to apply a single factor to all classifications. 2002-Macaroni Manufacturing

2016-Breakfast Food Manufacturing-prepared foods-excluding oatmeal and corn milling.

This group is one of thirteen groups making up Schedule 5-"Food and Tobacco."

The use of the code has the advantage of associating analogous experiences in homogeneous groups and of so arranging the work of revision that classifications which should be considered together for rate making, come up automatically in the proper order.

5. Finally, it was decided to present the classification, group and schedule experiences for each of the following regional sections and also for the country as a whole:

## Eastern

Connecticut, Maine, Maryland, Massachusetts, New Jersey, New York, Pennsylvania, Rhode Island, Vermont.

Central

Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Nebraska, South Dakota, Wisconsin.

Western

California, Colorado, Montana, New Mexico, Utah.

Southern

Kentucky, Louisiana, Oklahoma, Texas.

The purpose of presenting the data in this manner was to afford the General Rating Committee an opportunity to study the experience not only by states, but also by sections of the country, thus simplifying the establishment of exceptions to the national pure premiums wherever the experience of individual states or regions warranted such treatment.

The first step in the execution of the program outlined by the Actuarial Committee was the calculation of conversion factors. For this purpose the blank reproduced as Exhibit II was prepared.

Twenty classifications in each of the three conversion groups were selected as a basis for the calculations. In this process it was necessary to exercise considerable care in order that the classifications selected might be typical and at the same time represent a sufficient volume of the total experience to produce dependable results. Lists were prepared of the seventy-five classifications in

#### CALCULATION OF CONVERSION FACTORS

ADDITIONAL STATE Illinois

THE TECHNIQUE OF RATE MAKING.

		ACTUAL	EXPERIE	INCE		CALC	ULATION (	OF FACT	OR		TEST OF	PACTOR	·
CATION GODE NO.	NEW YORK	Illinois	Illinoia	LOS NEW YORK	SE5 Illinoia	CONVERTED -11110018 LOSSES	COMBINED LOSSES	PURE	EXPECTED NEW YORK LOSSES	CONVERTED LOSSES	COMBINED LOBBEB	PURE PRENIUN	EXPECTED NEW YORK LOISES
		1916 & 1917	(97476) (2) + (3)		1915 & 1917	(1838)×(0)	(8) + (7)	(8) + (4)	(p) × (2)	( 1814)× (*)	(5) + (11)	(12) + (4)	(12) × (2)
(1)	(2)	(3)	(4)	(5)	(a)	(7)	(a)	(0)	(10)	(11)	[12]	.15)	(14)
5643	61,020	97,765	158,785	52,318	57,529	105,738	158,056	•995	60,716	104,358	156,676	.987	60,227
5642	32,190	60,029	92,219	42,613	53,6 <b>8</b> 0	98,664	141,277	1.532	49,315	97,376	139,989	1,518	48,864
5602	63, <i>2</i> 10	57,527	120,737	51,391	27,060	49,736	101,127	•838	52,970	49,087	100,478	• 832	52,591
5022	51,120	32,835	83,955	98,900	27,180	49,957	148,857	1.773	90,636	49,305	148,205	1.765	90,227
5204	19,240	31,365	50,605	57,121	28,011	51.484	108,605	2.146	41,289	50,812	107,933	2.133	41,039
3724	41,020	27,488	68,508	25,591	16,047	29,494	55,085	<b>a</b> 804	32,980	29,109	54,700	•798	32, <b>734</b>
5401	49,730	25,614	75,344	135,368	51,610	94.859	230,225	3.056	151,975	93,621	328, 987	3.039	151,129
5502	20,050	22,054	42,104	12,206	7,718	14,186	26,392	.627	12,571	14,000	26,206	•622	12,471
6042	62,460	18,692	81,152	76.652	9,079	16,697	95, 339	1.159	71,829	16,469	93,121	1.147	71,640
5 500	9,780	15,614	25,394	13,260	8, 119	14,923	28,183	1.110	10,856	14,728	27,988	1.102	10,778
5209	15, 560	15.574	31,134	11,556	6,912	12,704	24,260	.779	12,121	12,538	24,094	•774	12,043
6300	9,740	7,378	17,118	18,739	6,519	11, 982	30,721	1.795	17,483	11,825	30,564	1.785	17,386
5 54 <sup>1</sup> 5	7,660	6,710	14,370	32,327	6,865	12,618	44,945	3.128	23, 960	12,453	44,780	3.116	23,869
7 531	58, 320	5,371	43.691	32,669	5,390	9,907	42,576	.974	37,324	9,777	42,446	.972	37,247
6041	17,690	5,123	22,813	14,178	1,538	2,827	17,005	•745	13,179	2,790	16,968	.744	13.161
6227	8,150	4,231	12,381	6,996	2,046	3,761	10,757	.869	7,082	3,711	10,707	.865	7,050
6220	6,830	3,709	10,639	10,997	5,371	9,872	20,869	1.980	13,523	9,743	20,740	1.968	13,441
6321	5,640	2,450	8,090	8,117	1,238	2,275	10,392	1.285	7,247	2,246	10,363	1.281	7,225
5541	580	3.865	4,445	4,735	6,268	11,521	16,256	3.657	2,121	11,370	16,105	3.623	2,101
6003	8,260	1,652	9,912	15,652	2, 383	4,380	20,032	2.021	16,693	4,323	19,975	2.015	16,644
TOTAL	, 528, 250	445,046.	973,296	721,384	330,563	607,575	1,328, 959		725,869	599,641	1,321,025		721,869
		$\mathbf{E} = \frac{1.3}{.7}$	66 - 1.838; 43	l+D ≠	725869 ¥21384	1.006; D =	.006; E	1.838	3006 (72 1.006	2 <u>1384</u> ) 2055 <u>3</u> - 1			

each group which had the largest payroll and loss exposure in New York Schedule "Z" for 1917. Classifications peculiar to New York, that is, those representing industries which might produce unique experience were then eliminated. Similar lists were prepared for each state from the combined experience for policy years 1916 and 1917. These lists were then compared and the twenty classifications common to both lists for each conversion group were taken as a basis for the calculations. In some states, where the available exposure was too small to provide a satisfactory basis, the groups were consolidated.\* In two cases even this procedure did not produce enough volume to insure dependable results and the state experience was not converted at all.<sup>+</sup> Wherever possible group 1 was maintained because, particularly in the western states‡ the classifications comprising the group (mining, oil production, etc.) are unique and it was desired to convert the losses on the most consistent basis that could be obtained.

	Grou	1 <b>P I</b> .	Grou	p II.	Grou	p III.
State.	All Other.	Med.	All Other.	Međ.	All Other.	Med.
New York 1916 Connecticut Maine	$\begin{array}{c} 1.022 \\ 2.902 \\ 3.326 \\ 1.509 \end{array}$	.827 .780 1.460	$1.254 \\ 2.919 \\ 2.527 \\ 1.950$	.936 .904 1.173 1.000	1.302 1.928 2.113	.866 .588 1.552
Massachusetts New Jersey Pennsylvania Bhode Island	$   \begin{array}{r}     1.503 \\     2.525 \\     3.714 \\     2.894   \end{array} $	$   \begin{array}{r} .904 \\     1.742 \\     2.148 \\     1.043 \\   \end{array} $	$   \begin{array}{r}     1.850 \\     2.543 \\     3.372 \\     2.894   \end{array} $	1.639 1.662 1.043	$   \begin{array}{r}     1.003 \\     2.089 \\     3.109 \\     2.894   \end{array} $	$\begin{array}{r} .984 \\ 1.465 \\ 1.715 \\ 1.043 \end{array}$
Vermont Maryland Illinois	2.718 3.493 1.814	$1.438 \\ 1.302 \\ .760$	$\begin{array}{c} 2.718 \\ 3.042 \\ 1.712 \end{array}$	$1.438 \\ 1.273 \\ .855$	$\begin{array}{r} 2.718 \\ 3.522 \\ 2.040 \end{array}$	1.438 1.214 .723
Indiana Iowa Kansas Michigan	$1.682 \\ 2.334 \\ 1.294 \\ 2.204$	$\begin{array}{r} .944 \\ 1.156 \\ 1.479 \\ 1.158 \end{array}$	$     1.754 \\     1.873 \\     1.337 \\     2.193   $	$1.075 \\ .955 \\ 1.700 \\ 1.143$	$\begin{array}{r} 1.767 \\ 2.692 \\ 1.337 \\ 2.783 \end{array}$	$1.039 \\ .983 \\ 1.700 \\ 1.116$
Minnesota Nebraska Wisconsin	$1.442 \\ 1.743 \\ 1.535 \\ 835$	.740 .795 .589 360	$   \begin{array}{r}     1.605 \\     1.589 \\     1.799 \\     1.355   \end{array} $	.844 .651 .819 540	$1.846 \\ 1.589 \\ 1.806 \\ 1.433$	.756 .651 .704 477
Colorado Montana Utah Kentucky	2.837 3.675 3.222 1.210	1.593 1.322 1.002 .841	$     \begin{array}{r}       3.300 \\       3.675 \\       3.222 \\       1.541     \end{array} $	1.090 1.322 1.002 .796	3.300 3.675 3.222 1.836	$1.090 \\ 1.322 \\ 1.002 \\ .761$
Louisiana Oklahoma Texas	$\begin{array}{c} 1.652 \\ 2.514 \\ 2.047 \end{array}$	.726 1.136 1.124	$     \begin{array}{r}       1.939 \\       2.098 \\       1.255     \end{array}   $	.774 .708 .746	$\begin{array}{c} 2.539 \\ 2.098 \\ 1.768 \end{array}$	.770 .708 .783

The conversion factors for the several states are presented in the following table:

\* This was true of the experience for the states of Montana, Rhode Island, Utah and Vermont.

+ New Mexico and South Dakota.

t Colorado, Kansas, Nebraska and Oklahoma.

The next step was the selection of average "D. & P. T. D." values from New York Schedule "Z" for 1917. As a basis for this work the committee had an exhibit presenting the following information for each schedule of the Manual Classifications Code:

- (a) Number of "D. & P. T. D." cases.\*
- (b) Total incurred "D. & P. T. D." losses.\*
- (c) Average cost per case.

The exposure in many schedules being inadequate, an attempt was made to group schedules according to predominant characteristics affecting the cost of death and permanent total disability. Such factors as the employment of women and children or single men, the probable number of dependents and the degree of dependency, the average age of injured employees and similar factors were considered. The experience was then assembled according to this tentative grouping and the average value of "D. & P. T. D." cases obtained for each group. To this point the grouping was based entirely upon a priori considerations. A comparison was then made of the group average value with the average value for the individual schedule, exceptions being established where the value for the schedule was out of line and where the exposure was broad enough to produce a reliable indication. As a result, seven groups of schedules were selected with average values as follows:

I	-\$3500.00.— Agriculture Wood Contracting, not erection Care, custody and maintenance Miscellaneous occupations	
11	-\$3500.00 Food and tobacco Textiles Clothing Laundries Leather	
III—	Faper goods Fine machines and instruments Commercial enterprises Clerical and professional -\$4400.00.— Rubber, composition, bone, etc. Paper and pulp	

\* New York Schedule "Z" for 1917,

Printing Metal forming Machine shops Vehicles Stone products Clay products Glass and glass products Chemicals Miscellaneous manufacturing IV-\$5300.00.-Mining Metallurgy Quarrying, stone crushing, etc. Erection-metal Erection---not metal Ship building Railroad Operation Public utilities-not railroad operation Garage and trucking VI-\$1900.00.-Vessel operation VIII-\$2300.00. Stevedoring and freight handling

Finally the committee tested these values to ascertain how closely they reproduced the total incurred "D. & P. T. D." losses of New York Schedule "Z" for 1917. The comparison being found satisfactory the selected values were adopted as a basis for conversion.

The final step preliminary to the determination of pure premiums was the conversion of the state experiences to the common level. For this work the blank reproduced as Exhibit III was used. This blank calls for the combination of the payrolls and actual losses for each state for policy years 1916 and 1917.\* It also requires the combination of the loss elements entering into the "All Other Indemnity" division. These combinations were made on intermediate cards which were designed in the same form as the Schedule "Z" blank. The original Schedule "Z" figures for the two policy years were combined and entered on these cards after which the necessary information for the working sheet was

\* New York is an exception because the selection of Schedule "Z" for 1917 as representative of the common level made it necessary to deal separately with the experience for 1916.

MATIONAL COUNCIL ON W	IORICMEN'S C	DRIPENSATION INSURANCE								1	CLASS : _							SCHEDULE &	CHOUP HO 1.8-	461
WORKINEN'S CO	MPENSATION	EXPERIENCE 919							`			<u> 3632 - 1</u>	achin	e Sho	p - no re	unary		CONTLASION		
						ACTL	AL LO	SSES					CON	VERTE	D LOSSES	(NEW YOR	( 1917 BAS/S)			
STATE,	YEAR	PAYROLL (IN HUNDREDS)		DEATH	PEI	ATOTAL	ÁLL	OTHER	HEDICAL	TOTAL		ATH& PERM.TOT	AL.		ALL OTHER		MEDICA		TOTAL	
			NO, CASES	AMOUNT	NO, CASES	AMOUNT	10. CASI 3	ANOUNT	AMOUNT	ANOUN!	NO, CASES	ABOURT	P. P.	NO. CASES	AMOUR?	2.2	AlaQuet 7		AMOUNT	P. P.
I NEW YORK	1917	202390	9	44800			1178	233651	78672	357123	9	39600	.13	1178	233651	.77	78672	. 26	351923	1.16
2 NEW YORK	1916	346150	16	66907			2036	241957	70266	379130	16	70400	.20	2036	303414	.88	65769	.19	439565	1.27
3 CONNECTICU	T 1916-17	103650	6	11017			490	28739	32157	71913	6	26400	.26	490	83689	. 81	29070	.28	139359	. 1.85
4 MAINE	1916-17	25260	2	3035				11291	7185	21511	2	6800	.85		28532	1.13	8426	.33	45760	1.81
5 MARYLAND	1918-17	27595	3	9898			54	8442	5635	23975	3	13200	. 48	54	25681	.93	7178	.26	46054	1.67
6 MASS.	1916-17	381694	18	34845	1	4000	-	137469	89155	265469	19	88600	. 22		254318	.67	97179	. 26	435097	1.16
7 NEW JERSE	1918-17	803966	4	8149	1	4000	855	83387	47202	142738	Б	22000	.07	855	212053	.70	77364	. 26	811417	1.08
8 PENN	1916-17	754410	31	72153	3	11025	2691	167837	119458	370473	34	149600	.20	2691	565946	,75	198539	.26	914085	1.21
S RHODE ISLAN	1916-17	39843	1	265			94	4298	6483	11046	1	4400	.11	94	12438	.31	6762		23600	. 59
10 VERMONT	1916-17	31989	2	4633	L		94	9146	4.622	18401	2	8800	. 28	.94	24859	.78	6646	. 21	40305	1.27
11 EASTERN	STATES	2316947	92	255702	5	19025	7492	926217	460835	1661779	97	426800	.19	7492	1744781	.75	575602	.25	2747183	1.19
12 ILLINOIS	1918-17	243550	6	20537	1	5370	1825	123014	75439	224360	7	30800	.13	1825	193480	,79	64500	. 27	288780	1.19
13 INDIANA	1916-17	76571	3	4729			460	36770	21155	62654	3	13200	.17	460	64495		22742	.30	100437	1.31
14 IOWA	1916-17	21422	4	7406			110	5969	5299	18674	-4	17600	.82	110	11180	. 52	5273	.25	34053	1.59
15 KANSAS	1916-17	<b>3942</b>					31	2872	1047	3919				31	3840	. 98	1780	. 45	5620	1.47
16 MICHIGAN	1916-17	126261	7	11047			402	51711	31769	94627	7	30800	. 24	482	113462	. 90	<u>3631</u> 2	. 29	180514	1.43
H MINNESOTA	1916-17	83997					142	16120	9486	25606				142	25873	.76	8006	.24	83879	1.00
18 NEBRASKA	1916-17	5955					45	3546	2740	6286				45	5635	. 95	1784	.30	7419	1.25
19 SO. DAKOTA	1917	164				·		-												
20 WISCONSIN	1918-17	154153	1	3000			1143	67503	46121	116624	1	4400	.03	1143	121438	. 79	37778	.25	163611	1.07
21 CENTRAL	STATES	665851	21	46719	1	5370	4238	307505	193056	552650	22	96800	.15	4238	539343	.81	178170	.27	814313	1.23
22 CALIFORNIA	1916-17	97382	4	10727	1	4159		56505	46008	117399	5	22000	.23	T	76564	.79	25258	.26	123822	1,28
23 COLORADO	1918-17	20448					75	5244	7112	12356				75	17305	.85	7752	.36	25057	1.23
24 HONTANA	1916-17	963					2	25	· 186	211				2	92	.10	246	. 26	338	.36
25 HEW MEXICO	1917	35																		
26 UTAH-	1917	1816			1	1	13	910	827	1737				13	2982	1.62	829	.46	3761	2.08
27 TOTA	STATES	120609	4	10727	1	4159	90	62684	54133	131703	5	22000	.19	90	96893	.80	4085	.28	152978	1.27
28 KENTUCHT	1916-17	11964	1	4075			69	4560	4306	12941	1	4400	.37	69	7027	. 59	3428	. 29	14865	1.25
29 LOUISIANA	1918-17	8531			1		96	3794	3623	7417				96	7550	.89	2804	, 32	10354	1.21
30 OXLAHOMA	1918-17	4895			1	1	42	5022	2775	7797				42	10536	2.15	1965	.40	12501	2.55
JITEXAS	1918-17	16654	1	5400	1	1	110	6619	5036	17055	1	4400	.26	110	8307	.50	3757	. 23	16464	, 99
32 101	STATES	42044	2	9475	1		317	19995	15740	45210	2	8800	.21	317	33420	<b>*80</b>	11964	.28	64174	1.29
33 GRAND 1	TOTAL	3145451	119	322623	7	28554	12137	1316401	723772	2391350	126	554400	.18	1213	2414437	.77	799811	.25	3768648	1.20
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THE TECHNIQUE OF RATE MAKING.

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EXHIBIT III.

noted in a column especially designed for this purpose. The adjustment of medical losses in classifications for which "ex-medical" policies were reported was also made on this preliminary card. The total of the combined experience of each state was then balanced against the totals of the two individual years, thus verifying the work to this point.

The data for columns 3 to 9 inclusive of the working sheet were then posted from the intermediate state card, the work being so arranged that each clerk had a certain group of working sheets for which she was responsible. The code numbers in the upper right hand corner of the working sheet had been previously inserted and a list of conversion factors prepared. The work of conversion, that is, of applying the conversion factors to the state losses was carried on at night by a special crew so that the working sheets might be used to the maximum advantage. Thus, as rapidly as the actual losses were entered in the day time they were converted at night, both jobs going forward simultaneously. The night crew also calculated pure premiums wherever necessary and obtained territorial and country-wide totals of payroll and converted losses. Later, when the day force had completed its work of entering the raw state experience, it checked the calculations of the night force.

As soon as the working sheets for individual classifications were completed, the work of grouping classifications was started. The grouping was of two kinds. First, there was the throwing together of the experiences of classifications which were essentially cross references. As a basis for this work a special committee of underwriters had previously reviewed the Manual Classifications Code and had indicated certain combinations. These, as has been stated, were really the bringing together of experiences which were similar. For example, prior to the present revision there were several classifications in the manual for various forms of millwright work, such as:

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3720-Conveyors-Coal and Ash-installation, etc.
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· 3722-Acetylene Gas Machines-installation.
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3723-Refrigerating Machinery-installation.

- 3727—Engines—installation. 3729—Pumps—installation.

3732—Leather Belting—installation and repair.

3734-Automatic Stokers-installation.

۲	NORKMEN'S COM	PENSATION PLED IN 1	EUPERENCE.		1	achin	e Sho	p - no fe	oundry					CODE NO	36	52	
			···			CON	VERTE	D LOSSES	(NEW YOR)	K 1917 BASIS)							
	STATE	YEAR	PATROLL (IN HUNDREDS)		EATH & PERM.TOTA	11		ALL OTHER		MEDICA	L	TOTAL		SCHEDULE & GRO	WP HQ	<u>. 0~5</u>	ю.
				NO. CASES	TRUOMA	P.P.	NO, CASES	AMOUNT	P. P.	AMPUNI	P. P	ANDUNT	R.R.	CONVERSION GR	×**•0		
1	NEW YORK	1917	. 302390	9	39600	.13	1178	233651	.77	78672	,26	351923	1.16	1919 00470	110		_
.5	NEW YORK	1916	346150	16	70400	.20	2036	303414	.88	65769	.19	439568	1.27	PURE PREMA		ю	
1	CONNECTICUT	1918-17	103650	6	26400	.26	490	83889		29070	. 28	139359	1.35	1.1.1.1.1.1.1			ئـــــ
4	MAINE	1916-17	25260	2	8800	.35		28532	1.15	8428	.53	45760	1.81				
5	MARYLAND	1916-17	27595	3	13200	, 48	64	25681	. 93	7178	. 26	46054	1.67	AD07 (7=13)	of Rating Con	PREMI	ун ун
6	MASS.	1916-17	381694	19	83600	, 22		254318	,67	97179	.26	435097	1.15	STATES	T.D. OTHE	NE DA-	1014
1	NEW JERSEY	1916-17	203966	Б	22000	.07	855	212053	.70	77364	. 26	311417	1.03	MATTORIAL			
ð	PENN.	1916-17	754410	34	149600	.20	2691	565946	.75	198539	,26	914085	1.21		EXCEPTI	)NS	
9	THODE ISLAND	1916-17	39843	1	4400	.11	94	12438	.31	6768	.17	23600	.59			11	
10	VERMONT	1916-17	81989	2	8800	28	94	24859	,78	6646	.21	40305	1.27				
	TOTAL BARTERN	TATES	2316947	97	426800	.19	7492	1744781	.75	575602	.25	2747183	1.19			$\left  \right $	
12	ILLINOIS	1916-17	243550	7	30800	.13	1825	193480	.79	64500	. 27	288780	1.19				{
13	INDIANA	1916-17	76571	3	13200	,17	460	64495	.84	22742	.30	100437	1.31	<b>   </b>		+	
ц	AWO	1916-17	21482	4	17600	.82	110	11180	.52	5273	.25	34053	1.59	<b></b>			
15	KANSAS	1916-17	3942				31	3840	. 98	1780	.45	5620	1.43	íí	. i.	ii	نـــــا
16	MICHIGAN	1918-17	126261	7	30800	.24	482	113402	. 90	86312	.29	180514	1.43			1 1	1
17	MINNESOTA	1918-17	33997				142	25873	.76	8006	.24	33879	1.00				
18	NEBRASKA	1916-17	6955				45	5635	.95	1784	.50	7419	1.25		NOTE		
19	SO. DAKOTA	1917	164		· ·									The above	e is a key cl	ssilceli	-
20	WISCONSIN	1915-17	154153	1	4400	.03	1143	121438	.79	87778	.25	163611	1.07	the	following c	asses. Asses	° 1
21	CENTRAL	STATES	665851	22	96800	.15	4238	639343	.81	178170	. 27	614313	1.23				- [
22	CALIFORNIA	1916-17	97382	5	22000	.23	1	76564	.79	25258	. 26	123822	1.28				
23	COLORADO	1916-17	20448				75	17305	.85	7752	.58	25057	1.23				
24	MONTANA	1918-17	963			_	2	92	.10	246	.26	338	.36				
25	NEW MEXICO	1917	. 35														
26	UTAH .	1917	1816				13	2932	1.62	829	.46	3761	2.08				
27	TOTAL	STATES	120609	5	22000	.19	90	96893	.80	4085	.28	152978	1.27				
28	KENTUCKY	1916.17	11964	1	4400	.37	69	7027	.59	3428	.29	14955	1.25			-	1
29	LOUISIANA	1916 17	8531				96	7550	.89	2804	, 32	10354	1.21				
30	OKLAHOMA	1916-17	4895				42	10536	2.15	1965	.40	12501	2.55				
31	TEXAS	19:8.17	16654	1	4400	.26	110	8307	.50	3757	. 23	16464	.99				1
32	TOTA SOUTHERN	STATES	42044	2	8800	.21	317	33420	.80	11954	,28	54174	1,29				
43	GRAND T	OTAL	3145451	126	554400	.18	1213	2414437	.77	799811	.25	3768648	1.20	L			

THE TECHNIQUE OF RATE MAKING.

EXHIBIT IV.

These, in reality, were no more than cross references to the key classification, 3724—Millwright Work. The experiences, therefore, were thrown together and grouped with that of 3724. For the purpose of this grouping the regular working sheet was used, proper note being made of the individual experiences going into the combination.

The second combination involved the determination of the experience for each group of the Manual Classifications Code. For this purpose a working sheet, identical in form with that for individual classifications but of a different color, was prepared. The working sheets for the individual classes in each group were assembled and a group working sheet properly designated was attached to each set, after which the necessary consolidations were made, entered on the group sheet and checked. Finally, the group working sheets were assembled by schedules and combined.

It was then necessary to reproduce the experience data in convenient form for use by the General Rating Committee. Much thought was given to this phase of the arrangements inasmuch as proper presentation of the data is an important factor in determining the speed of a revision and the accuracy and convenience of the work. After a careful canvass of the various methods or reproduction it was decided to photograph the exhibits. For this purpose a special form was prepared on onion skin paper with rulings and column headings printed on the reverse side. The experiences were typed on these forms from the working sheets, a carbon being used to throw the figures on the back of the sheet thus making a clear impression through the paper. Plates were then prepared from these copies by a photographic process, after which the sheets for the use of the Committee were printed.\* Samples of the sheets in the form presented to the Committee are reproduced in Exhibits IV, V and VI.

The experience in Exhibit IV is for classification 3632—"Machine Shops—no foundry" which is in group 461—schedule 18 and falls in the second conversion group. The blank in this case was white. The 1919 converted pure premium noted in the upper right-hand margin is an approximation to the old pure premium in the manual in effect immediately prior to the revision. The arrangement under the heading "Adopted Pure Premium"

\* This work was done for the Council by the National Process Co. of New York City.

	<b>)</b> i	YEAR	( IN HUNDREDS )	L'	VEAIN & PERMIOR	AL		ALL OTHER	· · ·	MEDICA	۱. I	TOTAL		COMPLED IN 1919
				NO, CASES	THUOMA	**	MO. CASES	AMOUNT	PP	ANOUNI	₽ ₽	#MOUNT	P P	
1	NEW YORK	1917	323920	9	<b>296</b> 00	.12	1228	244142	.75	82218	.25	365960	1.12	
2	NEW YORK	1916	358710	16	70400	.20	2069	310552	,87	67889	.19	448841	1.26	SCHEDULE 18
3	CONVECTICUT	1916.17	122428	7	20800	.25	537	87952	.72	32892	.27	151644	1.24	Machine Shops
	MAINE	1916-17	26028	2	8800	.34		28706	1.10	8511	.33	46017	1.77	
5	MARYLAND	1916-17	28276	3	13200	. 47	56	25724	. 91	7245	.26	46169	1.64	
6	MASS.	1916-17	491930	24	105600	.21		281111	.57	110633	.22	497344	1.00	GROTTP 463
1	NEW JERSEY	1916-17	333483	5	22000	.07	928	235092	.70	87514	.26	344606	1.03	Machine Shop -
B	PENN.	1916-17	804640	36	158400	.20	2865	609269	.76	213068	.26	980737	1,22	no foundry
9	RHODE ISLAND	1916-17	52445	1	4400	.08	163	17882	.34	10569	.20	32851	.62	
10	VERMONT	1916.17	31989	2	8800	.28	94	24859	.78	6646	.21	40305	1.27	
u	TOTA: BASTERN	L STATES	2573849	105	462000	.18	7940	1865289	.72	627185	.24	2954474	1.14	
12	ILLINOIS	1916-17	254871	7	30800	.12	1886	199999	.78	66814	.26	297613	1,16	
13	INDIANA	1916-17	91850	4	17600	.19	523	68342	.74	25281	.28	111223	1.21	
14	IOWÁ-	1918-17	25788	4	17600	.68	125	13087	.51	6175	.24	36862	1.43	
15	KANSAS	1918-17	3942				31	3840	.97	1780	.45	5620	1.42	
16	MICHIGAN	1918-17	135836	.7	30800	.23	509	115535	.85	38703	.28	185038	1.36	
17	MINNESOTA	1916-17	36745				152	26261	ΫŹ	8449	.23	34730	. 95	
18	NEBRASKA	1916-17	5955				45	5635	.95	1784	.30	742.9	1.25	NOTE
619	SO DAKOTA	1917	-									-	-	Includes
20	WISCONSIN	1916-17	179237	1	4400	.02	1346	141665	.79	42658	.24	188723	1.05	
21	TOTAL CENTRAL S	TATES	734224	23	101200	.14	4617	574384	.78	191644	.26	867228	1.18	3281-Safe
Z2	CALIFORNIA	1916-17	117201	5	22000	.19		92499	.79	29145	,25	143644	1,23	3522-Acetvlene
23	CÓLORADO	1916-J7	20451				75	17305	.85	7752	.38	25057	1.23	3583-Automatic
24	MONTANA	1916-17	963				2	92	.10	246	.26	338	.36	3608-Engine
25	NEW MEXICO	1917	-									-	-	3632-Machine
26	UTAH	1917	1816				13	2932	1.61	829	.46	3761	2,07	8637-Washing
27	TOTAL WESTERN S	STATES	140431	5_	22000	,16	90	112828	.80	37972	.27	172800	1.23	3639-Projectile
28	KENTUCKY	19[6-17	12690	1	4400	.35	70	7119	. 56	3483	.27	15002	1.18	
29	CUISIANA	1925-17	8539	·			96	7550	.88	2806	.33	10356	1.21	
30	OKLAHOMA	1916-17	4956				42	10536	2.13	1965	.40	12501	2,53	
31	TEXAS .	1916-17	17053	1	4400	.26	114	8420	49	3863	.23	16683	. 98	
32	TOTAL SOUTHERN	STATES	43238	2	8800	.20	322	33625	.78	12117	,28	54542	1,26	
37	GRAND TO	TAL	3491742	135	594000	.17	12969	2586126	.74	868918	.25	4049044	1.16	L

THE TECHNIQUE OF RATE MAKING.

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EXHIBIT V.

was provided for the use of the General Rating Committee. In this space the committee entered the selected pure premiums. If one set of pure premiums was adopted for the entire country it was entered in the first set of squares opposite the word "National." If exceptions were established they were noted under the caption "Exceptions," the state or region in question being written in the square at the left-hand side. The note in the lower right-hand margin was used to indicate the identity of discontinued and cross reference classifications, the experience of which had been included. In the case of classification 3632 there were no such inclusions.

Exhibit V gives the sheet for group 461 "Machine Shops—no foundry." It was reproduced on yellow paper. The data here are for the group of classifications noted in the box in the lower righthand margin. In addition to classification 3632 the group includes eight related classifications.

Exhibit VI presents the experience for schedule 18 "Machine Shops." This is in the same form as the group and classification sheet and gives a summary of the experience for the seven groups comprising the schedule. It was reproduced on blue paper.

An idea of the extent of the data available to the General Rating Committee upon the completion of this preliminary work may be obtained from Exhibits VII and VIII. Exhibit VII gives the total experience by states. Exhibit VIII presents the same experience by schedules. The total payroll, it will be noted, was close to \$12,000,000,000 and the converted losses were approximately \$115,000,000, a truly imposing volume of experience, the largest, in fact, ever available for a revision of workmen's compensation rates.

# ESTABLISHMENT OF BASIC PURE PREMIUMS.\*

With the preliminary work out of the way we can next consider the first phase of the revision proper, namely, the establishment of basic pure premiums. This involves the determination of national, regional, and state pure premiums upon the basis of the converted experience. These pure premiums have no significance in themselves; they must be reconverted to the level of the state experiences before they can be used for rate making purposes. They are, however, an important link in the procedure because they are the starting point from which state rates are eventually developed.

\* The basic pure premium is the selected pure premium on the New York 1917 level.

1	PIAIE	YEAR	(IN HUNDREDS)	L .	DEATH& PERN.TOT	AL	l	ALL OTHER		MEDICA		TOTAL		EXPERIENCE COMPLED IN 1919
<sup>.</sup>				NO. CASES	AMOUNT	P.P.	HO. CASES	AHOUNT	P. P.	ABOUNT	P. P.	THUOMA	P. P.	
1	NEW YORK	1917	632320	19	83600	.13	2394	456073	.72	160227	.26	699900	1.11	
2	NEW YORK	1916	651310	27	118800	.18	3583	526661	.81	146256	.28	791717	1.22	Summary
	CONNECTICUT	1916-17	405378	11	48400	,12	1572	256070	.63	80020	.20	384490	.95	
. 4	MAINE	1916-17	62453	2	8800	.14		50188	.81	15161	.24	74149	1.19	
5	MARYLAND	1918-17	41598	3	1,3200	.32	135	41278	.99	11275	.27	65753	1,58	SCHEDUILE 18
6	MASS.	1916-17	1332229	<b>4</b> 3·	189200	.14		794213	.60	276087	.21	1259500	•95	
7	NEW JERSEY	1916-17	728173	19	83600	,11	2072	532932	.73	178788	.25	795320	1.09	Machine Shops
1	PENN.	1915-17	1279680	56	246400	.19	5140	1101717	.86	354636	.28	1702753	1.33	
	RHODE ISLAND	1916-17	82827	1	4400	.05	317	59654	.72	18814	.23	82868	1,00	
10	VERMONT	1916-17	37093	3	13200	.35	118	25517	.69	8466	.23	47183	1.27	
11	TOTAL EASTERN	STATES	5253061	184	809600	.15	15326	3844308	. 73	1249730	.24	5903633	1.12	
12	ILLINOIS	1916-17	589023	22	96800	.16	<b>3850</b>	424282	.72	127448	: 22	648530	1.10	
13	INDIANA	1916-17	191042	7	20800	,16	1064	154131	.81	53800	.28	238731	1,25	
14	j0wa	1916-17	57991	6	26 400	.46	251	41212	.71	14548	.25	62160	1.42	
15	KANSAS	1916-17	5698				49	5995	1.05	26 21	.46	8616	1.51	
16	MICHIGAN	1916-17	274411	8	35200	.13	1055	205938	.75	70857	.26	311995	1.14	
!?	HINHESOTA	1015.17	71214	. 4	<b>1</b> 7600	, źĐ	375	66869	, 93	18721	.26	102690	1.44	
18	NEBRASKA	1916-17	7907				56	7123	. 90	2247	. 28	9370	1,18	NOTE
19	SO DAKOTA	1917	ť						•					Treluion
20	WISCONSIN	1916-17	214500	3	13200	.06	1596	163222	,76	51935	.24	228357	1.06	Incingan
21	CENTRAL 1	TATES	1411781	50	220000	.16	8296	1068272	.76	342177	.24	1630449	1.16	452-Heavy Shops
22	CALIFORNIA	1918.17	215080	6	26400	.12		169321	.79	60903	. 28	256624	1.19	453-With
23	COLORADO	1916-17	27672	2	8800	.82	123	31881	1,15	10901	.39	51582	1.86	Foundry
24	MONTANA	1916-17	3956				11	1518	.38	810	.21	2328	,59	461-Without
8	NEW MEXICO	1917	-											Foundry
26	HATU	1917	4202				32	5177	1.23	1775	.42	6952	1.65	462-Special
27	TOTAL WESTERN	STATES	250910	8	35200	.14	166	207897	.83	74389	.30	317486	1.27	Mach'y.
28	KENTUCKY	1916-17	17895	1	4400	.25	95	8616	.48	4810	. 27	17826	1.00	471-Misc.
29	LOUISIANA	1916-17	11876	1	4400	.37	137	8909	.75	3593	.30	16902	1.42	Products
30	OKLAHOMA	1916-17	8126	1			58	12601	1,55	3017	.87	15618	1.92	
31	TEXAS	1916-17	34363	3	15200	.38	426	23956	.70	9395	.27	46551	1.35	
37		STATES	72260	5	22000	.30	716	54082	.75	20815	.29	96897	1.34	
33	GRAND T	OTAL	6988012	247	1086800	.16	2450	5174554	.74	1687111	.24	7948465	1.14	

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# EXHIBIT VI.

The problem may be stated in simple terms. Here we have experience which is in such form that the losses for all states and policy years are expressed in terms of a common denominator; it may be assumed that the converted national experience is merely a magnified New York Schedule "Z" for 1917. This experience is presented by states, regions and for the country as a whole and it is analyzed to show not only the total indicated pure premiums but also the indications for each of the pure premium divisions. It is obvious that if there is great uniformity in the experience of the several states and regions, the national indications may be taken as representative of the cost of workmen's compensation insurance in all states. Where there is no uniformity and the experience is broad enough to give dependable results for individual states, the experience being on a comparable basis, the states and regions requiring individual consideration can be singled out by inspection, and proper exceptional pure premiums created.

The aim should be to follow the converted experience as closely as possible, using it in mass where permissible, but always watching for variations indicating regional or state conditions representing actual differences in cost. The test of the accuracy of the work is primarily whether the selected pure premiums actually reproduce the converted losses. The results, from the standpoint of the individual state, will be satisfactory only if, in addition, every important classification which produces sufficient local experience to indicate the state pure premium is accorded exceptional treatment.

With this plan of procedure in mind the reader will appreciate that the establishment for 1,000 classifications of basic pure premiums, with the necessary exceptions for states and regions, is by no means a task that can be disposed of in a short time. In the 1920 revision over two solid months were consumed by this phase of the work.

At this point it may be wise to offer a word of warning in connection with the use of experience for pure premium determination. In workmen's compensation insurance it is impossible to develop rates by rule and solely in accordance with mathematical principles. Such methods may come in time but at present rate making in this field involves the use of a large element of judgment in addition to statistics, although statistics always provide the best basis for rate making. The statistics in themselves do not provide the solution. The correct interpretation of the available

							CONVE	RTED LOS	SES (#	EW YORK 1917 BASIS)			
	STATE	YEAR	(IN HUNDREDS)	0	EATH & PERH. TOTAL		>	ALL OTHER		HERICAL		TOTAL	
		<u> </u>		NO CASES	AMOUNT		NO CASES	AMOUNT		AHOUNT	P.P.	ANOUNT	
	NEW YORK	1917	1.568,148,4	720	2929300	.19	37669	7667941	.49	1953439	.12	12550680	.80
2	NEW YORK	1916	1,414,574,5	871	3600700	. 25	43473	6999727	•50	1774727	.12	12375154	.87
	CONNECTICUT	1916-17	387,053,7	196	821500	.21	11869	2049766	•53	530269	.14	3401535	.88
	MAINE	1916-17	159,771,1	96	389400	.24		984558	.62	256021	.16	1629979	1.02
5	MARYLAND	1916-17	171,425,4	181	545500	.32	4851	1276151	.74	286332	.17	2107983	1.23
6	MASS.	1916-17	1,619,792,9	818	3459400	.21		8028617	.50	2066249	.13	13554466	.84
	NEW JERSEY	1916-17	762,655,2	431	1838700	.24	17874	4485139	.59	1181704	.15	7505543	.98
	PENN.	1916-17	2,266,387,8	1618	7030400	.31	59530	13822484	.61	3493450	.15	24346334	1.07
9	RHODE ISLAND	1916-17	125,660,2	51	202000	.16	2911	650837	.52	170895	.14	1024732	.82
10	VERMONT	1916-17	43, 384, 7	51	216300	.50	1731	351310	.81	94238	.22	661848	1.53
<u> </u>	EASTERN	L STATES	8,518,853,9	4983	21034200	. 25	179908	46316730	.54	11807324	.14	79158254	.93
12	ILLINOIS	1916-17	743,715,6	435	1838500	.25	34661	4254287	.57	1038764	.14	7131551	.96
13	INDIANA	1916-17	273,031,4	175	780800	.29	10866	1533826	.56	423401	.16	2738027	1.01
	IOWA	1916-17	142, 291, 7	127	530000	.37	4044	829549	.58	202323	.14	1561872	1.09
15	KANSAS	1916-17	37,354,6	52	250400	.67	2182	384244	1.03	73116	.20	707760	1.90
16	MICHIGAN	1916.17	398,758,5	264	1147100	. 29	13049	2664706	.67	659109	.17	4470915	1.13
	MINHESOTA	1916-17	212,898,6	182	817000	.38	7642	1183662	.56	271358	.13	2272020	1.07
18	NEDRASKA	1916-17	58, 320, 6	57	231000	.40	2055	290708	.50	70271	.12	591979	1.02
19	SO DANDTA	1917										;	-
20	WISCONSIN	1916-17	<b>305,5</b> 60,9	249	1034400	.34	18276	2131638	.70	541494	.18	3707532	1.22
21	TOTAL CENTRAL 1	TATES	8,171,931,8	1541	6629200	.31	92775	13272620	.61	3279836	.15	23181656	1.07
22	CALIFORNIA	1916-17	726,378,9	501	2085600	.29		3656030	.50	947662	.13	6689292	.92
-23	COLORADO	1916-17	100,488,6	131	622300	.62	2296	757333	.75	165836	.17	1545469	1.54
. 24	MONTANA	1916-17	32,512,4	19	80900	.25	827	294716	.91	46754	.14	422370	1.30
25	NEW MEXICO	1917											-
26	UTAH	1917	30,483,4	26	118900	.39	941	241525	.79	40866	.13	401291	1.31
27	TOTAL WESTERN S	TATES	889,863,3	677	2907700	.33	4064	4949604	.56	1201118	.13	9058422	1.02
28	KENTUCKY	1916-17	75,025,7	73	328600	.44	3196	429082	.57	105307	.14	862989	1.15
29	LOUISIANA	1916-17	55,355,0	91	338400	.61	4366	405984	.73	96238	.17	840622	1.51
30	OKLAHOMA	1916-17	78,458,1	108	496800	,63	2763	791274	1,01	188154	.24	1476228	1.88
-31	TEXAS	1916-17	165,312,2	164	702900	.43	12927	1235118	.75	289015	.17	2227033	1.35
32	SOUTHERN	STATES	374,151,0	486	1866700	.50	23252	2861458	.76	678714	.18	5406872	1.44
ม	GRAND TO	TAL	11,954,800,0	7637	32437800	. 27	299999	67400412	.57	16966992	.14	116805204	.98

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THE TECHNIQUE OF RATE MAKING.

EXHIBIT VII.

experience and its use for rate making involves a knowledge of the way the business is underwritten and administered, an intimate acquaintance with industrial processes, particularly from the standpoint of accident production, and, above all, an appreciation of the weaknesses inherent in the data themselves. Underwriters usually are responsible for the establishment of pure premiums, but they find it necessary to keep in close touch with actuaries, statisticians, and safety engineers. In fact, the best results are obtained by rate making committees upon which all these professions are represented.

It is impossible, in a paper of this length to describe the many interesting questions which present themselves during a rate revision. One must live with the problem to learn its many variations. It will be possible, however, to discuss the selection of pure premiums for several typical classifications and in this way to convey to the reader an idea of the procedure followed in establishing pure premiums under various conditions.

1. The simplest case is where the experience is reasonably uniform by states and regions and represents a sufficient volume for the entire country to produce a true indication for each pure premium element. A classification of this type is 3632—"Machine Shops—no foundry," the experience of which is reproduced in exhibit IV. For this classification the national indications were adopted without modification and no exceptions were established. The selected pure premiums thus correspond to the indicated pure premiums, namely:

D. & P. T. D.	All Other Indemnity.	Medical.	Total.
\$.18	\$.17	\$.25	\$1.20
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2. A second case of common occurrence is where there are several classifications so related from the standpoint of hazard that the combined experience of the group is representative. A group of this description may constitute one of the groups of the Manual Classifications Code or it may be made up by associating classifications within a single code group or from several different code groups. In these cases the group experience may be uniform by states and may aggregate a dependable volume for the United States thus enabling the committee to establish the country-wide indications for all states and for all classifications in the group. The group experience is then the basis for rate making, it being used as the experience of a single classifications.

	1				CONVE	RTED LOSS	ES (N	EW YORK 1917 BASIS)			
SCHEDULE	PATROLL (HEHUNDALPS)		EATH& PERMITOTAL			ALL OTHER	、	HEDICAL		TOTAL	
			TRUDING IN	**	NO. CASES	AMOUNT	**	NUCOUNT	P.P	Alettuart	
1 Agriculture	100.477.8	111	388500	.39	1995	756514	.75	172893	.17	1317907	1.31
2 Mining	82 389 3	331	1754300	2.13	3429	1121256	1,36	218823	.27	3094379	3.76
3 Metallurgy	67,260,1	145	768500	1,14	3630	776812	1,16	194419	.29	1739731	2.58
4 Quarrying	59,586,2	207	1097100	1.84	3914	1090793	1.83	216940	<b>"</b> 36	2404833	4.03
5 Pood	503,725,6	311	1088500	.22	15022	3061044	.61	839535	.17	4989079	1.00
6 Textiles	857,477,1	204	714000	.08	8402	2847202	.33	737140	.09	4298342	-50
7 Clothing	606,890,2	50	175000	.05	6839	758558	.12	303194	.05	1236752	.20
8 Laundries	58,795.0	17	59500	.10	1324	396348	.67	80145	.14	535993	.91
9 Leather	342,164,5	80	280000	.08	3931	1246127	.36	831266	.10	1857898	-54
20 2-22-5	101 610 0		100000		0070	707.040		202400	-	1100440	
10 Rubber	1 101,010,0	40	189200	•13	2209	761846	•71	191400	•13	1104448	1.03
11 Paper & Pulp	88,001,9	94	413500	• • • ""	2601	798876	. 90	200695	•20	1640171	1.00
12 Paper Goods	87,861,8	00	TTPPOO	•19	2830	<b>P</b> 4000A	.01	100074	•13	622183	• 40
13 Printing	266,948,4	44	193600	•07	3469	900171	.34	222679	•08	1816450	•49
14 Wood	416,254,0	427	1494500	•36	27400	4964772	1.19	1061660	.26	7520882	1.81
17 Metal Forming	777,796,7	387	1702800	.22	35520	7022644	•90	2044430	•26	10769874	1.38
18 Machine Shops	698,801,2	247	1086800	.16	24504	5174554	•74	1687111	•24	7948465	1.14
19 Fine Machines	208,517,7	88	115500	•06	3084	690694	•33	216903	•10	1023097	•49
20 Vehicles	210 208 1	70	\$08000	.16	6528	1441559	-69	441843	.27	2190902	1.05
21 Stone Product	83,286.7	64	281600	.34	2811	678406	-81	143162	17	1103168	1.32
22 Clay Products	54 958 9	43	189200	.84	1690	351545	-64	72035	13	612780	1.11
25 GLASS	105,563,2	21	92400	.09	2853	485412	-46	165962	.16	743774	.71
24 Chemioals	207 579 4	296	1302400	63	7425	1713397	.85	444621	. 21	3460418	1.67
25 Misel, Mfg.	60,489,0	19	83600	.14	1358	231482	.38	70005	.12	385087	.64
26 Contracting*	287 796 0	674	8819000	77	13067	3763017	1.31	810761	.28	6792778	2.36
27 Frection	768 349 1	1267	6714700	.87	35032	10413497	1.36	2020765	.26	19148962	2.49
28 Shinhuilding	63 349 7	88	466400	.74	2491	747119	1.18	169511	27	1383030	2.10
29 Vessel Opera-	28,252,5	129	245100	.87	1078	238526	.84	44232	16	527858	1.87
- tion											[ ]
80 Stevedoring	46.658.4	119	273700	.58	11008	1715616	3.68	228783	.49	2218099	4.75
31 R.R. Operation	60 992 3	133	704900	1.16	1340	612654	.84	124393	20	1341947	2.20
32 Trucking	443 285 7	659	2899600	.65	20113	3920223	-88	987724	22	7807547	1.75
33 Public Ŭtil.	78,300.6	201	1065300	1.36	2429	618656	.79	183527	.23	1867483	2.38
34 Commercial	1.285.659.9	640	2240000	17	29816	5220226	41	1486011	.12	8946237	.70
35 Clerical	2 332 710 3	115	402500	.02	2852	736292	-03	216518	.01	1355310	.06
36 Care, Custody	473 888.1	312	1092000	23	7078	1530736	.32	398223	.08	3020559	.63
37 Miscellaneous	38,245,5	63	220500	.58	852	214233	<b>5</b> 6	43603	.ii	478336	1.25
	11 054 900 0	7697	89497000	07	200000	67400479	ÊT	16066009		336005904	00
TOTEL	111,304,000,0	1031	0~1000	4.67	C22233	01400412	•07	<b>T030033</b> 2	14	110005204	•90

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...... 1010 A case in point is group 161 of the Manual Classifications Code which comprises the following classifications:

2501—Clothing Manufacturing 2502—Fur Goods Manufacturing 2503—Dressmaking 2520—Collar and Cuff Manufacturing 2521—Shirt Manufacturing 4416—Rubber Garments Manufacturing—no rubber mill.

The regional and country-wide indications for this group are presented in the following table:

		I	ndicated Pu	ire Premiums.	
Region.	Payroll Exposure.	D. & P.T. D.	A. O.	Medical.	Total.
Eastern Central Western Southern U. S. A	\$400,818,500 40,140,800 7,142,300 4,583,800 452,685,400	\$.02 .05 0 0 .02	\$.11 .10 .09 .08 .11	\$.05 ,03 .03 .03 .05	\$.18 .18 .12 .11 .18

It will be noted that if account is taken of the limited exposure in the western and southern regions and the fact that no "D. & P. T. D." losses appear in either experience, the indications of the total pure premiums and also of the partial pure premiums are fairly uniform. In this case the national indications were adopted for all states and for the six classifications in the group.

3. The next type includes cases of classification and group experiences which have developed unique indications in individual states and regions requiring the establishment of exceptions. Such a case is that of classification 1321—"Oil Producing—operation of oil leases, etc." It is apparent from a consideration of the nature of the operations falling under this classification that a single set of pure premiums for the United States would not measure the varying conditions found in individual states in which this industry is important. This is fully borne out by a review of the experience for the more representative states which is presented in the following table:

#### THE TECHNIQUE OF RATE MAKING.

		]	Indicated Pu	ire Premiums	,
Region.	Payroll Exposure.	D. & P. T. D.	A. O.	Medical.	Total.
Pennsylvania California Oklahoma Texas U. S. A	\$5,172,000 7,709,100 9.298,200 4,628,400 30,872,500	\$1.14 .41 .29 1.15 .81	\$1.78 .39 1.07 1.23 1.03	\$.27 .14 .29 .44 .26	\$3.19 .94 1.65 2.82 2.10

In this case exceptions were established for the states of Pennsylvania, California, Oklahoma and Texas based upon the local experience in each state.

4. There are many cases, however, where the experience of a single classification or even the experience of a homogeneous group is inadequate. These are the cases presenting difficulties. No practical criteria have been developed which may be applied to the payroll or losses for the purpose of measuring the adequacy of experience for rate making purposes. Judgment is still an important factor. It is evident that the losses which occur with the greatest frequency require the least exposure to produce a dependable indication, and that those which occur infrequently cannot be measured except by large volumes of data. In general, losses furnish the most reliable guide to a dependable experience and the volume necessary to provide a reliable rate making basis varies from the "Medical" division, for which the least exposure is required, to the "D. & P. T. D." division, where the experience indication is only conclusive if the exposure is large.

Two cases will illustrate these points. Take, for example, classification 3075—" Coppersmithing—shop only." For this classification the total payroll for the United States was \$1,554,300 and the indicated pure premiums were as follows:

D. & P. T. D.	All Other Indemnity.	Medical.	Total.
0	\$.48	\$.26	\$.74

The experience obviously was so limited that there was no basis for establishing exceptions for individual states or regions. As a matter of fact the country-wide experience itself was incomplete, as evidenced by the absence of death and permanent total disability losses. In this case the committee accepted the indications of the experience for the "All Other" and "Medical" pure premiums and supplied the "D. & P. T. D." pure premium by adopting \$.12, the indication for a number of related groups in schedule 17. The second example is that of classification 5103--- "Door, Window Frame, or Sash--erection and repair--metal or metal covered." The experience for this classification for the United States on a payroll exposure of \$2,722,100 indicated the following pure premiums:

D. & P. T. D.	All Other Indemnity.	Medical.	Total.
\$1.95	\$1.58	\$.36	\$3.89

The committee, after a careful review, decided that the "D. & P. T. D." indication was abnormal. It was willing, however, to accept the "All Other" and "Medical" indications as correct. The problem was to find a "D. & P. T. D." pure premium which might be used for the classification. The "D. & P. T. D." indication of group 664—"Ornamental and Architectural Metal Work Within Buildings," the group in which classification 5103 falls was selected, the adopted pure premiums being as follows:

D. & P. T. D.	All Other Indemnity.	Medical.	Total.
\$1.23	\$1.58	\$.36	\$3.17

5. Finally, there are cases where there is some experience but it is of such small volume as to be of no value whatever for rate making, or where there is no available experience at all. These will arise where the classification has not been in effect long enough to permit the accumulation of a representative experience, where the classification is newly erected, or where an existing classification is radically amended, thus making it impossible to use the experience accumulated under the old wording for the purpose of establishing pure premiums for the new classification. Such cases are treated in several ways:

(a) They may be found to represent substantially the same hazards as classifications for which experience is available in sufficient volume for rate making purposes, in which event the pure premiums of the analogous classification may be adopted.

(b) They may be compared with some classification for which experience is available and a factor of relationship established which will permit the derivation of pure premiums from those established for the related classification.

(c) The pure premiums may be established entirely upon judgment.

(d) The existing pure premiums may be continued.

Several cases typical of this class may be described as follows: (a) Prior to the revision there was a single classification in the manual for "Fertilizer Manufacturing." This was classification 4580-" Fertilizer Manufacturing-no phosphate companies." It was found in practice that this classification, which carried a substantial rate, did not properly reflect the hazards of certain concerns, which buy ingredients and manufacture fertilizer by the simple process of mixing these materials by hand and putting them into sacks or other containers. During the revision it was decided to eliminate classification 4580 and to erect two classifications in its place, one of which was particularly designed to fit the type of risk just described and which was expressed in the following language: "Fertilizer Dry Mixing Plants-excluding the manufacture or handling of acid, bone and rock crushing, and the preparation of tankage-not available for division of payroll."\* The new classification could not be compared with classification 4580 and the experience for classification 4580 was, therefore, of no value in determining pure premiums for it. This being the case the committee sought some analogy which would enable it to determine pure premiums. The new classification for this purpose was related to classification 4581-" Phosphate works-no mining": and the following pure premiums-previously adopted for classification 4581-were established:

D. & P. T. D.	All Other Indemnity.	•	Medical.	Total.
\$.51	\$.56		\$.25	\$1.32

(b) A similar case is that of a new classification described as follows: "Cord and Twine Manufacturing—not from manila, hemp, sisal or jute—including the manufacture of cotton rope or cord." In the absence of experience this classification was deemed to represent the same hazards as classification 2222—"Cotton Spinning and Weaving" and the pure premiums of classification 2222 were, therefore, adopted.

(c) The next example is the case of classification 4923--- "Photographic Supplies Manufacturing." For this classification the national experience was deemed to be entirely out of line and was,

\* The "not available for division of payroll" clause means that the classification cannot be used unless it expresses the complete operations of the risk. It therefore, cannot be used to cover the mixing operations of a fertilizer manufacturing risk which manufactures fertilizers from raw materials.

therefore, discarded. In the absence of a better indication the old pure premium of \$.48 was continued and arbitrarily divided as follows:

D. & P. T. D.	All Other Indemnity.	Medical.	Total.
\$.12	<b>\$.24</b>	\$.12	\$.48

(d) During the revision the "steel making" classifications were radically amended. Prior to the revision the classifications had included the steel making processes and had specifically excluded rolling mill and forging operations for which separate classifications and lower rates were provided. It was found that this division of the industry was impracticable and the new classifications, therefore, include rolling mill and forging operations. For example, classification 3000-"Steel Work-open hearth, bessemer, and crucible, or open hearth and bessemer, casting ingots, and puddling and blooming mill operations" was eliminated and the following classification erected in its place: 3002 "Steel Making-open hearth furnaces including bessemer, with blooming mills or forging and rolling mills-excluding blast furnace operation and coke manufacturing." Naturally the experience of classification 3000 could not be used to obtain pure premiums for the new classification. An investigation was made to determine the relative proportions of "steel making" and "rolling mill" operations which would fall under the new classification and the pure premiums were obtained by using the experience of 3000 as well as the experience of 3018-"Iron and Steel Rolling Mills-n. o. c .- with or without puddling furnaces," a weight of two being assigned to the latter experience as compared with the weight of one to the experience for classification 3000, these being the proportions of payroll for the two operations assumed to be included under the new classification.

After all the pure premiums were established the General Rating Committee carefully reviewed them for the purpose of detecting inconsistencies, particularly in the "D. & P. T. D." division. The "D. & P. T. D." division requires the broadest exposure for a dependable indication and, in the absence of sufficient experience, the pure premiums in many cases had been selected with reference to the group or schedule indication—in other words a large element of judgment had been employed. Inasmuch as each classification had been taken up in the order in which it appeared in the Manual

Classifications Code there was a possibility that classifications representing the same "D. & P. T. D." hazards but having a limited experience might have received different treatment merely because they were not all considered at the same time. For the purpose of making this final survey two lists of the selected pure premiums were prepared. One presented the pure premiums for each classification and was arranged according to the groupings of the Manual Classifications Code. The other also presented the selected pure premiums but in a special arrangement in which all classifications having the same "D. & P. T. D." pure premiums were thrown into a single group. These lists were carefully reviewed, and some inconsistencies were located although not so many as were anticipated. In several cases groups were combined and pure premium variations of \$.01, \$.02, \$.03, \$.04 or \$.05 eliminated. In other cases corrections were made for individual classifications, for the purpose of truing up the results.

After this final review of the pire premiums, a test was made to ascertain how closely the committee had followed the converted experience. This test was made by extending the payrolls at the established pure premiums, exceptions being taken into consideration, and comparing the expected losses obtained in this manner with the converted losses. The comparison was made by groups and schedules and for all schedules combined. The total expected losses were within  $\frac{1}{10}$  of 1 per cent. of the actual converted losses and the results for individual groups and schedules compared favorably and were within reasonable limits, thus indicating that the national pure premiums had been selected with care and with proper regard for the experience indications.

# DETERMINATION OF STATE PURE PREMIUMS.

We have gone through the process of bringing all experience to a common level for the purpose of finding the necessary volume for establishing a relationship of hazard between classifications and have obtained an expression of this relationship in terms of basic pure premiums. We are now confronted with the problem of retracing our steps. This means the breaking up of the national experience and the translation of the basic pure premiums so that they may be expressed in terms of state level rather than of basic level. We must secure for each state a set of pure premiums which in the aggregate will reproduce the experience of the state and which we may later project into gross rates for the several manual classifications. The experience of each state is the sole criterion for the determination of its own level of rates.

The first step in this procedure involves nothing more than the reversal of the conversion process. Instead of attempting to bring the experience to a common level we now have to translate pure premiums established on the converted experience back to the level of the individual state. For example, let us take the problem of bringing the national basic pure premiums to a level represented by the Connecticut Schedule "Z" data for policy years 1916 and 1917 combined.

It has been demonstrated that the established basic pure premiums reproduce the converted losses which, according to our hypothesis, are representative of New York Schedule "Z" for 1917. These basic pure premiums must, therefore, correspond to the experience for New York Schedule "Z" for 1917. We have a set of factors for the "All Other Indemnity" and "Medical" loss divisions by means of which Connecticut losses for policy years 1916 and 1917 were converted to the basic level. As a first approximation to the translation factors we may assume the reciprocals of these conversion factors.\*

For the translation of the "D. & P. T. D." element, it is necessary to make a comparison of average values taken from the Connecticut Schedule "Z" experience for 1916-1917 with the corresponding values which were used in the conversion process. The ratios of these values constitute the translation factors for this element.

The factors having been obtained the actual translation of the basic pure premiums is accomplished by the simple process of applying the factors to the basic pure premiums. Thus, assuming a simple hypothetical case, let us say that the national basic pure premiums for a certain classification are as follows:

D. & P. T. D	\$1.00
All Other	1.50
Medical	.50

and that the translation factors applicable to this particular classification are as follows:

\* This is only an approximation as Mr. Greene points out in his paper.

D. & P. T. D	.75
All Other	1.00
Medical	1.10

Expressed in simple terms, the "D. & P. T. D." factor means that in the particular state for which the translation is to be made, the death cost for this classification is 75 per cent. of the cost as measured by New York Schedule "Z" for 1917. A similar interpretation applies to the remaining translation factors. The translated pure premiums are obtained by applying the factors to the basic pure premiums as follows:

	Basic Pure Premium.		Translation Factor.	D	State Pure Premium.
D. & P. T. D	\$1.00	X	.75	=	\$.75
All Other	1.50	×	1.00	=	1.50
Medical		X	1.10	==	, .55
	\$3.00				\$2.80

In this procedure care must be exercised to see that all the exceptions for the state under consideration are recognized and properly treated. If the exception is based upon regional experience, the pure premiums, which will be expressed in terms of the basic level, must be translated. If the exception is based entirely upon local experience, the indications of the local experience, without translation, may be accepted as the selected state pure premiums. A copy of the blank used in the translation process is reproduced in Exhibit IX.\*

\* It will be noted on this blank that the term "projection" is applied to the process of obtaining state pure premiums from basic pure premiums Thus, the factors are referred to as "projection factors," the state pure premiums (columns 13 to 16 inclusive) as "projected state pure premiums," etc. It was originally planned to refer to this process as "projection." Later, when the writer undertook to prepare this paper, it struck him as more logical to reserve the term "projection" for the final step in the rate making procedure, namely—the determination of gross rates from the selected state pure premiums. A new term "translation" was therefore established for the process of going over from the basic pure premiums to the state pure premiums.

If this new term is accepted, the rate making process may be broken up into four phases, as follows:

- 1. Conversion of state experience to the basic level.
- 2. Selection of basic pure premiums.
- 3. Translation of basic pure premiums to the state level.
- 4. Projection of state pure premiums into final rates.

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THE TECHNIQUE OF BATE MAKING.

After a complete list of selected state pure premiums is available a test is made to ascertain how nearly the state losses for policy years 1916 and 1917 have been reproduced. This test requires the extension of the payroll for each classification by means of the selected state partial pure premiums. The expected losses produced in this manner are then compared with the actual state losses. If the work has been properly done the expected losses for each division thereof will closely correspond to the actual state losses. If this relationship does not hold an analysis must be made to ascertain wherein the process has failed to reproduce the original state experience. Additional cases requiring exceptional treatment may be discovered, in which case the translated national pure premiums must be modified in whole or in part to make them follow more closely the indications of the state experience. Or it may develop that the translation factors require correction, in which case a slight change one way or the other will bring about the desired balance of expected and state losses. At any rate, a balance or a reasonable approximation thereto is obtained before the set of selected pure premiums is definitely adopted as a basis for the determination of gross state rates.

### PROJECTION OF RATES.

We have now reached the final stage of the revision, namely the establishment of gross or manual rates. As a starting point we have the selected pure premiums for each state which, in the aggregate, reproduce the actual state experience for policy years 1916 and 1917 combined. Our problem now is to project these pure premiums to meet the cost conditions of the future period for which the rates are intended, thus producing final pure premiums. After this we can obtain gross rates by the simple process of applying the expense loading and adding to the result one cent, as provision for the catastrophe hazard.\*

As developed by the Actuarial Committee in the 1920 revision, the process of projection assumed two phases. First, the 1916– 1917 pure premiums were brought to the present cost level (represented by the experience of policy year 1919). They were then modified to meet the requirements of the future. This involves correcting the pure premiums so far as possible in the light of the

\* In addition, as will be explained later, a loading for schedule rating is applied for classifications subject to schedule rating.

most recent statistical data available and then projecting them into the future to the level of cost which is expected for the period during which the rates will be in effect.

As a basis for bringing the selected state pure premiums up to date the committee used loss ratio experience for policy year 1919.\* The actual loss ratio for policy year 1919 is not definitely known because the ultimate experience for that year is not yet available. A close approximation was obtained, however, by studying separately the premium and loss developments of previous policy years and projecting the incomplete premiums and losses of 1919 to an ultimate basis by means of appropriate factors.† A loss ratio was then obtained for policy years 1916-1917 by using 1919 manual rates, with a suitable modification for merit rating, to develop premiums on the 1916-1917 payrolls (thus putting both loss ratios on the same rate basis) and relating the premiums thus obtained to the actual incurred losses of that period. A comparison of these loss ratios is, in fact, equivalent to a comparison of average pure premiums and reflects the influence of every factor affecting the cost of workmen's compensation during the intervening period. (From 1916-17 to 1919.)

Such a comparison measures collectively such factors as changes in wage level, amendments to the benefit schedules, greater liberality on the part of administrative claim bodies in interpreting workmen's compensation laws, a possible tendency on the part of claimants to malinger and to present fraudulent claims, the influence of immigration and emigration, variations in accident frequency and severity rates or in employment and unemployment, and, in fact, any and all influences acting upon the cost. The result, known as the projection factor, does not provide a separate measure of each of these items but, as it is based upon actual experience, it represents the net effect of all causes acting upon the pure premium

\* The loss ratio is the ratio of incurred losses to premiums. Thus assuming an expense loading of 38 per cent., the normal loss ratio is 62 per cent. If the rates are exactly correct the loss ratio will be normal thus indicating that the pure premium has been entirely consumed. If the experience has been better than expected the loss ratio will be lower than normal, thus indicating a saving because of failure to use entirely the provision for losses. If the loss ratio is higher than normal, the actual experience has been worse than expected.

<sup>+</sup>See Mr. Mowbray's paper for an explanation of this process from the actuarial point of view.

cost. Inasmuch as policy year 1919 has not yet expired, it may be assumed that the application of the projection factor to the 1916-1917 pure premiums will bring them to a level entirely representative of present-day conditions.

The next problem is to look ahead for changes in cost which can be anticipated and measured. There are many tendencies at work which may possibly result in decided changes in cost in the future but, for the most part, these cannot be measured statistically; conjecture must be resorted to if they are to be considered at all. We have learned from years of experience that estimates in such cases are as likely as not to be entirely contrary to the final result. Hence, early in the 1920 revision it was decided to avoid conjecture and to introduce only such factors as could be statistically developed and defended. A prediction with reference to the future trend of wages, industrial conditions, accident frequency and severity rates, and other individual factors of similar character, was not attempted. This leaves only one factor which can be considered in this category, namely, the effect of changes in statutory compensation benefits.

Enough experience has now developed so that we know with reasonable exactness what change in cost an amendment to the workmen's compensation law will carry with it. If the waiting period is reduced or the percentage of wages, which is the basis of compensation payments, is increased or any one of numerous changes in benefits is made, we can foretell almost with certainty just what the result will be when measured in terms of cost.

For the purpose of calculating the effect of amendments a new accident distribution was developed and applied in the 1920 revision. For convenience this has been termed the "American Accident Distribution,"\* and, as its name implies, it is based entirely upon American accident data obtained from Schedule "Z" and from other sources. The table is a sample distribution of accidents taken from all industries. These accidents are arranged according to nature of injury in the following general divisions:

Kind of Injury.	Number of Cases
Death	. 776
Permanent Total Disability	. 63
Permanent Partial Disability	. 3,855
Temporary Total Disability	. 95,306
Total	. 100,000

\* Work of Miss Olive E. Outwater, a Fellow of this Society.

Each division is further subdivided—the "Death" cases by nature and extent of dependency, the "Temporary Total Disability" cases by duration of disability, etc. This standard distribution is used to measure the effect of amendments by the simple process of ascertaining how much the old and the amended benefits will cost for the 100,000 accidents and taking the ratio of the two results. The results can be obtained separately for the three pure premium elements by making appropriate comparisons.

The application of the projection and amendment factors converts the selected 1916-1917 pure premiums into final pure premiums and we are now ready to produce gross rates.

In this final step three factors were used:

1. Catastrophe\* loading. In establishing basic pure premiums all catastrophic losses were eliminated except where they were normally incidental to the industry, as for example, in mining, celluloid manufacturing, starch manufacturing (dry process), etc. There is no provision, therefore, in the pure premiums for ordinary classifications for the catastrophe hazard. It is known, however, that catastrophies occur even in low-rated industries as witness the recent falling of a dirigible into a bank building in Chicago, the Triangle fire in the clothing industry in New York, etc. The frequency of these accidents cannot be accurately foretold; furthermore, they fall at random affecting certain classifications this year, others next year and failing to produce sufficient experience to enable the rate maker to measure the cost for individual classifica-The fairest method, therefore, is to charge all industries tions. alike with a contribution toward these losses. One cent for each \$100 of insured payroll in all states was estimated as adequate to create a fund to cover the catastrophe losses. This charge is assessed by making a flat addition of one cent to each gross rate.

2. Loading for schedule rating. In the past there have been loadings for both plans of merit rating in recognition of the fact that these plans in actual practice have failed to produce sufficient debits to offset the credits and thus have tended to make inadequate the premium level as measured in terms of manual rates.<sup>†</sup> In the 1920 revision it was decided to provide for the deficiency due to

\*A catastrophe is an accident involving five or more death or permanent total disability cases.

t The manual rate is the average rate for all risks and consequently it must on the average be collected.

experience rating in the experience rating plan itself thus rendering unnecessary a specific loading in the manual rates. However, it was impracticable at the time to make any adjustment in the schedule rating plan and the Actuarial Committee decided to introduce a factor to take account of the fact that the schedule rating plan does not in practice produce a balanced result. This factor is applied only to the rates for classifications which are subject to schedule rating.

3. Expense loading. This covers the expense portion of the premium and is applied as a percentage of the gross rate. A standard loading of 38 per cent. was  $\varepsilon$  dopted, made up as follows:

1	Per Cent.
Acquisition cost	17.5
Administration	8.0
Inspection and Accident Prevention	2.0
Claim Adjustment	7.0
Taxes-state	2.0
Taxes-federal and miscellaneous	1.5
	38.0

This loading was established for universal application in all states having a state tax of 2 per cent. with the proviso that, in cases where the state tax varies from 2 per cent. (the usual tax requirement) an adjustment should be made. Thus, in Maryland the normal tax is  $1\frac{1}{2}$  and there is a special tax for the maintenance of the Industrial Accident Board which amounts to an additional  $1\frac{1}{2}$ per cent., thus bringing the total tax to 3 per cent. For Maryland, therefore, the expense loading is 39 per cent. On the other hand, in a state such as Illinois the loaling is 38 per cent. because there are no abnormal state taxes.

We now have all the materials necessary to the construction of gross rates. The procedure by means of which these are assembled for this purpose may be illustrated by an example. Let us continue the determination of gross rates for the classification used to illustrate the translation process, the figures for which are given on page 241.

Pure Prem- lum Ele- ment.	Selected State Pure Premium (1916-17.)		Projection Factor (1919).		Amendment Factor (1920-1).		Final Pure Premium,
D. & P. T. I	)\$ .75	Х	.95	X	1.00	=	.712
A. O Indem	nity. 1.50	X	.95	×	1.50	=	2.137
Medical		×	.95	Х	1.10		.574
Total .	2.80						3,423

Assuming that the classification in question is subject to schedule rating and that the factor for schedule rating is 1.05 we next apply this loading as follows:

 $1.05 \times 3.423 = 3.594.$ 

The gross rate is then obtained by the following calculation:

Rate = Final P. P. (loaded for schedule rating) + .38 Rate, Rate (1 - .38) = Final P. P. (loaded for schedule rating),

Rate 
$$=\frac{3.594}{.62}=5.80.$$

With the catastrophe leading this becomes 5.81 (5.80 + 5.01).

In conclusion, a word concerning the form of the manual resulting from the 1920 revision. The manual is in two parts:

1. The manual proper, in which items of general application to all states are presented. This contains fundamental rules of underwriting and an alphabetical arrangement of classifications with corresponding code numbers.

2. State rate sheets which present items of local interest. These contain exceptions to the general rules of underwriting, special classifications applicable only to the local jurisdiction, and rates. The rate sheet is a list of code numbers in numerical order with corresponding state rates and minimum premiums.\*

Thus, the manual for an individual state is a combination of the universal basic manual and the exception and rate sheets for the local jurisdiction. Rates are obtained by first consulting the manual proper, locating in the alphabetical arrangement the classification for which the rate is desired, noting the code number and

\*The minimum premium is "an expression of the lowest premium amount for which a single risk can be written and carried for any period not exceeding one year." It is intended to provide

First: For the minimum cost of issuing and administering a policy of insurance, and

Second: For the losses produced by the lowest exposure which any insurance carrier wishes to assume, namely, the exposure of one employee for the full period of one year.

The formula by which the minimum premium is obtained is as follows:

Minimum premium equals \$8 plus ten times the manual rate.

\$8 is the policy charge for the first item; ten times the manual rate is equivalent to the premium on a payroll exposure of \$1000, the assumed payroll of one employee for one year. It is provided that the lowest minimum recognized shall be \$10.
then referring to the state rate sheet where the code number is to be found in its proper numerical order with the rate opposite it.

#### CONCLUSION.

It is difficult to summarize a paper of this character: the detailed description of the rate making process must be covered in its entirety, if the reader wishes to understand the subject. It is hoped that it will be of value as a record of the 1920 rate revision, primarily from the standpoint of students, who have not had the advantage of close association with the work and thus have been denied the opportunity to examine Schedule "Z" and the other materials used for rate making in this field and the processes by means of which these materials are transformed into manual rates.

The statement has been made that the 1920 revision represents the latest development in rate making in workmen's compensation insurance. The work throughout was highly constructive. The volume of workmen's compensation insurance data is the largest ever compiled for rate making and the methods employed have produced greater accuracy both in the aggregate rate level of each state and in the distribution of the total cost to individual industries. The revision does not, however, represent the ultimate development: even at this moment, before the results are in actual application, changes in procedure are being proposed. It is my personal opinion that the future will bring many innovations. There is plenty of room for improvement, particularly in the way of simplification. Present-day rate making procedure, as must be evident to any one who has carefully read this paper, is in serious danger of being overbalanced by sheer weight of complexity. The ultimate rate making process should be designed to produce the best results with the least expenditure of effort. It is in this direction that future progress should be made.

# THE ACTUARIAL PROBLEMS OF THE 1920 NATIONAL REVISION OF WORKMEN'S COMPENSATION INSUR-ANCE RATES AND THE SOLUTIONS DEVELOPED BY THE ACTUARIAL COMMITTEE OF THE NATIONAL COUNCIL.

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#### A. H. MOWBRAY.

In accordance with the growing tendency toward greater recognition of the value of actuarial work in casualty insurance, a more important part of the work of the 1920 revision of the workmen's compensation rate manual under the auspices of the National Council on Workmen's Compensation Insurance was assigned to the actuarial profession as represented by the Actuarial Committee of the Council than in any previous revision. While the complete report of that revision will undoubtedly show this and record at least the decisions of the committee on the more important questions presented to it, it seems appropriate that our *Proceedings* should early contain a quite full record of this work, including a resumé of the committee's reasons for its decisions.

The carrying into effect of the committee's decisions was in the hands of a special staff under the direction of Mr. G. F. Michelbacher, Actuary of the National Workmen's Compensation Service Bureau, who was retained by the Council under a special arrangement for this purpose. His paper on "The Technique of Rate Making," appearing in this number of the *Proceedings*, which should be read in connection with this paper to get a true conception of the work of the Actuarial Committee and its relation to the whole revision, gives adequate description of this interesting work, leaving me free to devote this paper exclusively to a discussion of the work of the Actuarial Committee proper, itself an ample field.

The work of the Actuarial Committee during this revision fell naturally into two parts. The first was, on account of its nature, necessarily preliminary to the work of the General Rating Committee and dealt with the problems connected with the compilation of data and its presentation to the General Rating Committee in suitable form for its work. The second was supplementary to the work of the General Rating Committee and dealt with the problem of converting pure premiums prepared by the General Rating Committee into gross rates for actual application in the writing of insurance. The Actuarial Committee's work was, as usual, advisory in character, the executive decisions of the Council in this respect resting with the General Rating Committee, but its decisions here noted when reported from time to time to the General Rating Committee received in every instance its approval. The two parts into which the work of the Actuarial Committee fell were not wholly independent, for the final result desired must always be kept in mind throughout the course of any such work, even in its most preliminary stages.

OBJECTS TO BE ATTAINED IN REVISING THE MANUAL.

Early in the work of the Council a joint meeting of the Actuarial and General Rating Committees was held, and there was a general agreement that the final desiderata were:

1. Right rates in each state. Rates accurately measuring the compensation insurance cost of its industries under its law and industrial conditions, or in other words conforming to the closest reasonable degree with its own experience.

2. A basic manual in substance as well as in form.

This latter result requires:

(a) Uniform classifications.

(b) Some logical relationship between the rates for each state and a basic set of key rates.

The matter of uniform classifications was hardly within the province of the Actuarial Committee, this being generally considered as more properly an underwriting problem. It was however within the province of the Actuarial Committee to develop the nature of the logical relationship between state rates and the basic key rates, and the procedure necessary actually to put that relationship into practice that right rates for the several states as above defined would result. In the final analysis, this was the actuarial problem of the 1920 revision of which the detailed problems here discussed were but subordinate elements.

# NATURE OF THE RATING PROBLEM.

It has been for some time more or less generally recognized that there are two phases of the problem of establishing workmen's compensation insurance rates for a given jurisdiction. First, it is necessary to establish a proper relativity between the rates for the several manual classifications and, second, to establish a general level upon which all of the rates in the jurisdiction are to be pitched.

The needed level is indicated by the local experience after proper correction has been made for changes in the law, either by specific enactment, judicial decision or administrative procedure between the period for which the experience has been developed, and that to which the new rates will be applied, and for such other developments as can be properly traced.

The relativity between classifications is a function of the scale of benefits in the particular jurisdiction as the law of that jurisdiction (whatever its apparent intent may be) is there actually administered.\*

#### THE DEFECT OF FORMER DIFFERENTIAL METHODS.

The great defect of the flat law differential system heretofore in use; was that it failed to recognize this. Although concealed in the procedure and not, perhaps, always clearly recognized, that system established one fixed and invariable relationship between the rates for the several classifications in the different jurisdictions, based on the law and practice of the state adopted as the basis and gave effect to the variation in statutory provision only in a change of the general level of rates from jurisdiction to jurisdiction. This of itself tends to the necessity of exceptional state rates, for if the relation, say in Massachusetts between the costs for machine shop operation and boat building is as 1 to 2 and the flat differential is used upon Massachusetts costs as a base then everywhere the relation in rates will be as 1 to 2 while the law of New York may be such that the true relative costs are as 1 to 3. Then

\* It is often found that the benefits awarded under the compensation acts are quite different from those apparently indicated in the law. For example it has been held in Massachusetts that an injured workman is totally disabled until work can be found for him that he can do. It is not enough that other men in his physical condition have found work and are working.

† See Proc., Vol. I, p. 10; Vol. III, p. 10.

one or both rates in New York must be erroneous and if the classifications are important in New York the local experience will show the error and a correct rate will be made which is not constructed according to the usual rule, being designated as a "New York exception" rate. Before the 1920 revision began actuarial opinion was fairly unanimous that the old single law differential system must soon be abandoned and a new method found.

It is proper at this point to call attention to the fact that, between the time of the manual revision under the auspices of the Augmental Standing Committee in 1917\* and the undertaking of this work by the National Council, substantial progress had been made in dealing with the actuarial problems of manual making. Early in 1918, when it was thought the manual might be further revised during that year, the Actuarial Committee of the old informal National Council had given serious consideration to the problems just referred to, and expressed its judgment on several matters. The conclusions of that committee, whose personnel overlapped to some extent the personnel of the National Council committee as now constituted, were tested out and used or modified in two rate revisions in Pennsylvania and one in New Jersey prior to the National Council's undertaking this work, and the Actuarial Committee had the benefit of these discussions and subsequent experiments in which its members had participated for its guidance. Needless to say, they were of great help to the committee.

The proposal to use experience differentials rather than theoretically calculated differentials was first advanced during the work of the Augmented Standing Committee, although not adopted at that time, but further discussion since that time has shown that, while experience is the "acid test," flat experience differentials (*i.e.*, developed by comparison of the relative average total net costs for each state without analysis according to kind of injury or by industry groups) have the same tendency to distort the relationship between classifications as do theoretical flat differentials. The average relation between state rate levels will be maintained which did not necessarily follow when theoretically calculated differentials were used, but the distortion remains if the experience differential is applied uniformly to the pure premiums of the basic state.

\*See "Report of Augmented Stanling Committee" published by the National Workmen's Compensation Service Bureau.

### THE REMEDY PROPOSED.

To avoid this, the suggestion was first presented to the Actuarial Committee of the former National Council that the differentials be calculated by partial or sectional pure premiums, setting up in this way the relative value of the different parts of the several compensation acts according to the type of injury rather than the relative value of the acts as a whole and thus giving due weight to variations in benefits for different types of injury as affecting the relative costs in different industries. Indeed this idea also was presented to the Augmented Standing Committee in 1917, though it was not given much consideration at that time. That this was feasible had been demonstrated by the work in the Pennsylvania and New Jersey revisions above referred to.\* It is natural, therefore, to find that the Actuarial Committee presented this proposal to the General Rating Committee at its first joint meeting with that committee when the foundation for the future work was laid. The proposal was accepted. In this way, it was considered possible to provide right rates in the several states and at the same time maintain a basic manual, that is to say to establish a set of key pure premiums for the several classifications and divisions of loss cost which could be developed into correct total pure premiums and gross rates for the classification and state by the application of suitable factors to each of the partial pure premiums, as for death benefits, for permanent disability compensation, for temporary disability compensation, for medical and hospital services.

## WHAT DATA SHOULD BE USED?

The first problem presented to the committee was the determination of what data should be used in the preparation of the new manual, first, the states whose experience should be considered and, second, the years of issue in such states. The committee had before it a record of the states for which experience was available and of the policy years available for each such state. It was the view of the committee that the experience of all states available should be combined and used. While it was desirable to broaden the experience to the greatest possible degree, no material damage

\*See Proc., Vol. V, p. 256, "Revision of Compensation Insurance Rates 1918," by Messrs. Downey and Kelly, and Proo., Vol. VI, p. 10, "Upon Combining Compensation Experience from Several States," by W. W. Greene; also discussion of these papers. would have been done from this point of view had the experience of some states been omitted, as the (remaining) volume of data collected from the leading industrial states was so substantial that the addition of experience from several smaller states did not give any great extension to the breadth of basis for ratemaking. On the other hand, however, the manual was to be a national one, and recognition was given the fact that local authorities would have greater confidence in its applicability to their industries and locality if they knew that their own experience had entered into its formation. It was necessary for the committee, having made this decision, so to plan the remaining work that no distortion of relationships between classifications on the level of rates in the several states would result from these combinations. The means taken by the committee to this end are dealt with a little later in this paper.

Prior to the organization of the National Council in its present form, the Actuarial Committee of the former National Council had discussed at considerable length the question of what experience should be used in a manual revision and had reached the conclusion that on account of changing economic and industrial conditions most, if not all, of the data prior to the last two policy years reported upon in Schedule "Z" would be obsolete and to a certain extent misleading in its indications. Accordingly it had recommended that in any general rate revision only the experience of the last two available years of issue be considered. In the present work, the volume of data in the '16 and '17 years of issue being so extensive, the Actuarial Committee accepted this conclusion without having to expend a great deal of time on discussion of this phase of the problem.

# THE STANDARD OF REFERENCE, OF BENEFIT SCALE TO BE USED FOR THE BASIC MANUAL.

The second problem before the committee was the standard of reference which should be used to form the basis of the key set of pure premiums. Its decision on this question was to use the experience of the state of New York on the issues of 1917 as a basis. The Actuarial Committee of the old National Council had also discussed this problem at some length and had considered the advisability of a hypothetical composite law which would include the most prominent characteristics of several of the laws, but obviously,

while such a law would have been an advantage as a basis if theoretically calculated differentials were to be used, either for total or partial pure premiums, it was impossible to combine with such a basis a system of experience differentials. That committee felt at that time that experience differentials were much to be preferred and, therefore, the law of an actual state was desirable. Naturally, its preference would be a representative law under which a large volume of business had been transacted. The old Massachusetts law upon which basic pure premiums had been set in earlier revisions\* was considered inappropriate, because of the peculiar method of compensating permanent partial disability under the Massachusetts law found in but a very few of the other laws. It was also pointed out that there were advantages in choosing a law which was of relatively high cost rather than one of low cost, as the resultant multipliers in the former case would tend to produce reductions, in passing from it to other states, rather than increases; the psychological effect locally being that much better as a rate higher than that for the basic state creates an initial impression of adverse discrimination that has its subconscious effect even after the misapprehension has been corrected by proof submitted to the public and authorities that no injustice has been done. Giving due consideration to all of these factors, the committee reached the conclusion above noted-that the New York law and the issues of 1917 should furnish the basic standard of reference.

### SUBDIVISION OF THE PURE PREMIUM.<sup>†</sup>

The third important problem before the committee was how the total premium should be broken up for the purpose of passing from key rates on the New York basis to rates for another state having the proper relativity between classifications for that state into partial pure premiums. This was the subject of extended discussion. It was clearly evident that the types of benefits under the several acts with respect to death cases varied so considerably that the pure premium for death benefits should be one of the elements, though later, as a matter of convenience and because of their infrequent occurrence and similarity of cost, permanent total disability costs

\* This choice was then dictated by the fact that it was the first state for which a well authenticated volume of data was collected, not from any theory of its desirability as a standard.

† This term throughout refers to net loss per \$100 of payroll covered.

were included with death costs. It was likewise easily agreed that pure premium for medical berefits should also be considered a separate element. It was generally felt that the remainder of the total pure premium ought to be broken into at least two parts, one covering cost of indemnity for permanent partial disability of serious character and the other covering cost of indemnity for temporary disability and permanent partial disability of minor extent. But here a serious practical difficulty was encountered.

The Schedule "Z" returns available to the committee analyzed the loss cost in the several states generally into death, permanent total disability, permanent partial disability. temporary and medical costs, but detailed schedules of the individual cases entering into the total classification costs for permanent partial disability were not available for further analysis. This form of return was used in most states, but the Massachusetts data was reported in accordance with the peculiar provisions of that law, by kind of benefit rather than by nature of injury so that it was not possible to analyze the Massachusetts data with any accuracy by nature of injury further than into three elements, death and permanent total, medical and all other. The Pennsylvania data also were not quite comparable with those of most of the other states. The terms of the Pennsylvania Compensation Act are such that only the major permanent partial disabilities are specifically compensated, and, therefore, the Pennsylvania permanent partial disability data included only such cases. On the other hand, under the New York law, and that of most other states, both major and minor permanent cases are specifically compensated, and the returns under the New York and other Schedules "Z" included as permanent partial disability both types of injuries. Therefore, the Pennsylvania data were not really comparable with other states though apparently so, and, while they might have been brought to a common level by experience differentials the committee was very doubtful whether under the circumstances the data combined in this way would be any more valuable than where the "all other" data were consolidated before conversion. The committee was therefore, confronted with the virtual certainty that, if a further analysis were made the Massachusetts data would have to be excluded and, probably, also the Pennsylvania data. The committee accordingly reached the conclusion that it would be better to make no analysis of this item than to reject the experience of two such important

states, and decided that at this time the pure premiums should only be broken into the three elements, death and permanent total, medical and "all other."

In accordance with the provisions of the Constitution of the National Council and with the general intent respecting its work, the committee's work was conducted in the open and representatives of certain Rating Boards and others interested were present during a part or all of its sessions, especially during discussions of the method of conversion. The representative of one local Bureau did seriously challenge the soundness of the committee's conclusions with regard to the division of the pure premium, and in view of that challenge, the committee reconsidered the matter and went over the whole problem again with great care, going so far as to test, upon the basis of New York, Pennsylvania and New Jersey experience, the effect upon the "all other" converted losses of dividing them into "permanent partial" and "temporary" and separately converting and combining those two elements and then adding the combined results together. As compared with converting by a single factor, the results showed so little variation that the committee was satisfied of the wisdom of its first decision and placed itself on record with its reasons by adopting a resolution embodying the following points:

1. Since it is necessary that the final pure premiums underlying the rates in any state should reflect the actual losses of that state, the final losses for the state must be determined by its own experience.

2. As a necessary corollary to this proposition, the combination of the experience of several states is solely for the purpose of eliminating the accidental fluctuation due to limited data and producing a smoother and more accurate graduation. If the relation between the pure premiums for the several classifications.

3. Past experience has indicated clearly that the old system of flat law differentials does not produce proper results and that much better results are obtained by combining the experience separately for different types of benefits as to which either the frequency of occurrence or, more particularly, the character of benefits in the laws of the several states as they are administered are considerably divergent. It is recognized that a logical carrying out of this proposition calls for a separation of the pure premium for purposes of this combination into death, permanent total, permanent partial, temporary and medical.

4. It was found, in view of the way the data have been collected in some of the more important states, notably Massachusetts, and the difference in the way certain minor permanent disabilities were compensated under the laws of some states, notably Pennsylvania, it would be very difficult, if not impossible, to utilize the experience of all states on this basis. It would be possible, however, to utilize all of the experience if, in making the combination, permanent partial disability losses and temporary losses were treated as a single element of the pure premium.

5. The committee did not feel justified in taking this action without test and, while the time was not available to make a thoroughly exhaustive test, the committee did make a test which it felt was very rigid, using a combination of the Pennsylvania, New York and New Jersey experience for certain classifications, first separating the permanent partial losses from the temporary losses and combining each separately, and taking the sum of the pure premiums as the pure premium for the combined element and then combining the data for permanent partial and temporary together before working out conversion factors and combining the data from the three states in this way. When the graduations of the total pure premiums for temporary total and permanent partial by the two methods were compared, it was found that the results showed little variation. Further discussion developed that this was a logical result, since possible errors in conversion are minimized in the process of combination.

#### CONVERSION BY GROUPS CONSIDERED ADVISABLE.

The committee recognized that whatever difficulty might be involved in its treating the "all other" in one item would arise from the fact that permanent partial disabilities are compensated in the different states on a more variable basis than temporary disabilities, and it, therefore, felt that the possible error of the use of a single "all other" conversion factor would be minimized if, instead of making the conversion factor for bringing the data of any state to the common level the same for all classifications, the classifications be divided into groups with some regard for the probable extent of permanent partial disability cases. The first effort was to set up four groups:

- 1. Classifications involving heavy outdoor work.
- 2. Manufacturing classifications where there were high dismemberment probabilities.
- 3. Other manufacturing classifications.
- 4. General commercial industry.

A study of conversion factors was made as between New York, Massachusetts and New Jersey on the basis of these groups, and it

was found that the results did vary enough for some states to justify resorting to this method. It was found, however, that the differences between the factors produced for the commercial and the light manufacturing were so slight as to warrant combining these two groups, and this was done, reducing the number from four to three. At this point a conference was held with the General Rating Committee and joint sub-committees were appointed to go over the manual and assign each of the several classifications to its appropriate group upon the above basis.

In order to minimize the amount of mechanical work involved in converting and combining experience, the committee considered whether it was necessary to use all classifications or whether a limited number would be sufficient, and after some test reached the conclusion that, if a sufficient number of representative classifications were used, the work could safely be so cut down. Accordingly, it adopted the policy of using twenty classifications in each group for conversion purposes, although in some states the number was restricted to less than twenty because the volume of data on some classifications was so small that distorting variations might be introduced if they were given an influence in this matter.

# THE CONVERSION FORMULA.

The next problem before the committee was the formula or method that should be used in making the conversion of the experience to the common level for purposes of combination. Here it had the advantage of the work that had gone before it. When the prospective revision of the manual in 1918 was considered by the National Reference Committee, the Actuarial Committee had carefully considered this problem and had recommended the use of the partial-pure-premium method, with experience differentials for purposes of conversion. The method suggested at that time was the application to the payrolls in one state of the pure premiums in another and the comparison of the actual losses with the expected losses as so projected. As a check upon errors which might be introduced by classifications having a small exposure, it was proposed at that time that the reverse process be also used and that the final result be determined by considering the mean of the indicated results of the two processes. This was tried out for the medical and "all other" sections of the premiums in the 1918 revision in Pennsylvania, as has been indicated to this Society in the paper by Dr. Downey and Mr. Kelly dealing with this work.\*

In that revision, as is also indicated in that paper, the previous recommendation was departed from to the extent that the "death" and "permanent total disability" experience was combined on the basis of a count of the number of cases and the application of an average cost. This was done because it was found the pure premiums showed such wide and peculiar variations on account of the infrequency of fatal accidents and the variation in their cost that a strict following of the recommendation would have led to confusing results. In the 1919 Pennsylvania revision a further step was taken and the average cost of D. & P. T. D. was graduated by classifications after a study of the cost of the individual cases which arose. This was on account of the fact that certain industries employ predominantly women so that when death cases occur there is much more than the normal proportion of no-dependency cases. Others, while employing chiefly men use a migratory class of laborers who likewise, in the large proportion of cases, have no dependents. A test of this was made on the more extended data available at this time and the conclusion reached that there was enough variation in the average cost of fatal accidents in different industries to call for such an analysis and it was made for each state by dividing the classification into two to six groups depending upon the volume of data available and its indications and using one average value for each group rather than a single value for the whole experience of the state.

It was the first judgment of the Actuarial Committee that for the purpose of rate-making all that should be necessary on the part of the General Rating Committee would be the indication of the number of such death or permanent total cases to be expected in the given classification, per unit of exposure (that is a tabulation of pay roll exposure and number of occurrences only), and that this number could then be converted into pure premiums for each state by the application thereto of an appropriate average value. It was felt, however, that this task would be confusing to the General Rating Committee which in all the other work would be thinking in terms of partial premiums and that they would be able to determine results better if this element also were presented to them in the form of pure premiums, and it was, therefore, decided that, in

\* Proc. C. A. S. S. A., Vol. V, p. 256.

presenting the experience on the New York 1917 basis, the number of cases would be multiplied by the average New York cost (for groups of industries as above noted) and presented to them in the form of pure premiums. It was decided that for other states the basis pure premiums selected as for New York should be made into state pure premiums by applying the factor of relativity between New York average cost per case and local state average for the same group of classifications. It must be fairly apparent that this brings about the same result as though the committee had selected a probability of death occurrence which was to be translated into terms of premium by multiplying by the average cost per case.

For example, let us assume that the average D. & P. T. D. cost in a certain classification was in New York \$4,000 per case and in Massachusetts \$3,000 per case and also that the composite experience showed \$40,000,000 of pay roll exposure and 10 deaths or permanent total cases with a cost in the New York basis (as used) of \$40,000. The committee would have an indicated D. & P. T. D. pure premium of \$0.10 and we may assume would adopt this. Then since the average cost per case in Massachusetts is  $\frac{3}{4}$  that in New York its pure premium would be \$0.075. The indicated probability of death per \$100 of payroll exposure is 10 in 400,000 such units or .000025 and if this be converted to New York pure premiums by multiplying by \$4,000 and to Massachusetts pure premiums by multiplying by \$3,000 we again have as the pure premiums \$0.10 and \$0.075 respectively.

Having thus disposed of the conversion formula as affecting "death" and "permanent total disability" cases, the committee passed on to the conversion of "medical" and "all other." Mr. Greene's paper appearing in *Proceedings*, Vol. VI, p. 10, was available to the committee. A test was made of his conversion formula  $(6)^*$  on page 16 and it was found that the formula was not quite so accurate as Mr. Greene had in the first instance hoped. A study by the committee of the several formulæ resulted in one of the members presenting to the committee a rather full memorandum dealing with the general relationships of the several formulæ which had been used for the purpose, showing that they were all approximations on the basis of different assumptions to the accurate formula

\* 
$$E = \frac{1 - D \frac{\text{Total Losses for Basic State}}{\text{Total Losses for Additional State}}}{1 + D}$$

$$E = \frac{\Sigma\left(\frac{JM}{J+M} \cdot j\right)}{\Sigma\left(\frac{JM}{J+M} \cdot m\right)}$$

given in the footnote on page 15 of Mr. Greene's paper. (It will be understood that by " accurate" formula is meant the one which so combines the data that when the pure premiums derived from the combination are applied to the payrolls for the basic state the total expected losses as produced exactly equal the actual incurred.) The memorandum also developed a method of applying that formula which was quite as simple as that for the formula Mr. Greene had used. It was, however, pointed out that, since the formula reproduced the losses of the basic state with absolute accuracy, it was dangerous to use in connection with the developing of conversion factors by a selected number of classifications when all classifications were not used, for it is within the range of possibility that there might be one or more classifications selected among the group for conversion purposes whose experience was such that it would distort the true indications and this distortion would not be brought out by the application of an exact formula. On the other hand, an approximate formula which is reasonably accurate when the classifications used for the conversion purpose are fairly homogeneous will show by the amount of error in reproduction whether or not there is such homogeneity. This is an important advantage in practical work as we later found in a few cases. Generally, however, the data originally selected to develop the conversion factors was sufficiently homogeneous and representative, so that review was not necessary.

The memorandum presented is too lengthy to reproduce here in full, but the comparisons are well worth recording in this paper. With a slight change in notation which is probably obvious, Mr. Greene's accurate formula appearing in the footnote above referred to is:

$$*E = C_j^m = \frac{\Sigma \frac{JM}{J+M} \cdot j}{\Sigma \frac{JM}{J+M} \cdot m}.$$
 (1)

\* Read  $C_j^m$  as conversion factor Massachusetts to New Jersey. Otherwise the notation is as used by Mr. Greene. M and J represent Massa-

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By dividing both numerator and denominator of the numerator fractions by M and of the denominator fractions by J, this formula takes the form:

$$C_{J}^{m} = \frac{\Sigma \frac{Jj}{\frac{J}{M}+1}}{\Sigma \frac{Mm}{\frac{M}{J}+1}} = \frac{\Sigma \frac{L_{j}}{\frac{J}{M}+1}}{\Sigma \frac{L_{m}}{\frac{M}{J}+1}}.$$
 (1a)

This is the form in which it is easiest of application, if it is found desirable to use this form.

The earliest approximation, the one suggested by the actuarial committee in 1918 of the old National Reference Committee, takes the form:

$$C_{j}^{m} = \frac{\Sigma J j}{\Sigma J m} = \frac{\Sigma L_{j}}{\Sigma J m},$$
(2)

0ľ

$$C_j^m = \frac{\Sigma M j}{\Sigma M m} = \frac{\Sigma M j}{\Sigma L_m}.$$

When applied in the two separate ways and when the mean of the two results is taken as the true indication, the form is:

$$C_{j}^{m} = \frac{1}{2} \left( \frac{\Sigma J j}{\Sigma J m} + \frac{\Sigma M j}{\Sigma M m} \right).$$
 (2a)

A comparison of this with the accurate formula indicates that the assumption underlying this approximation is that for each classification the proportion of payroll for the two states has a constant ratio (i.e., M/(J+M) or J/(J+M) is the same for all classifications so that it may be taken outside the sign of summation and cancelled from numerator and denominator). This formula, therefore, is quite inaccurate, since this assumption is very far from being realized in practice and since the work rests entirely upon the least dependable or most variable element involved, the local pure premium. This is also the most laborious of the several approximate formulæ.

chusetts and New Jersey payrolls respectively, m and j the local pure premiums and  $L_m$  and  $L_j$  the respective incurred losses.

Probably the next formula in order of development was:

$$C_j^m = \frac{\Sigma j}{\Sigma m}.$$
 (3)

This is the comparison of the unweighted arithmetic mean of the local pure premiums. This assumes that the ratio JM/(J+M) is a constant. Here again the work rests upon the most undependable element, viz., the local pure premiums, and it is obvious that the assumption is not realized in practice with any greater closeness than the assumption underlying the earlier approximate formula. It will be apparent from the form of the formula that it is, however, relatively easy of application if all the local pure premiums are worked out. But if not then it is very laborious since these must be worked out for the purpose.

The next approximation considered was the ratio of the average pure premiums for each state. Mathematically expressed it is as follows:

$$C_j^m = \frac{\sum L_j / \sum J}{\sum L_m / \sum M}.$$
 (4)

This is the comparison of the two average pure premiums on total experience used for each state.

Dividing the denominator of both numerator and denominator fractions by  $(\Sigma J + \Sigma M)$  and writing for  $L_i$  and  $L_m$  their equivalents  $J_j$  and Mm we get as the form.

$$C_{j}^{m} = \frac{\sum Jj \left| \frac{\sum J}{\sum J + \sum M} \right|}{\sum Mm \left| \frac{\sum M}{\sum J + \sum M} \right|}$$

$$= \frac{\sum Jj \cdot \left( \frac{\sum M}{\sum J + \sum M} \right)}{\sum Mm \cdot \left( \frac{\sum J}{\sum J + \sum M} \right)}.$$
(4a)

This last expression shows the relation of this formula to the accurate formula. The assumption here is that we may use, where the payroll enters the formula, the mean of the payroll for the several classifications in each state in lieu of the precise payroll. The

result of this is to give within each state uniform weight to the losses in each classification, whereas in the preceding formula uniform weight is given to the pure premiums in each classification. Therefore, this formula will be more stable in practice than the preceding one. Since, as noted, the conversion factor here is merely the ratio of the two average pure premiums and is derived by adding the losses in each of the states and the payrolls in each state, forming the state average pure premium in each case and taking the quotient it is very simple of application.

The latest approximation is that developed by Mr. Greene and takes the following form:

$$C_{j}^{m} = 1 - \frac{D \frac{\Sigma L_{j}}{\Sigma L_{m}}}{1+D} \quad \text{where} \quad (1+D) = \frac{\Sigma \left(J \frac{L_{j} + L_{m}}{j+M}\right)}{\Sigma L_{j}}.$$
 (5)

The relation to the accurate formula is not so simple nor so easily shown as in the other approximate formulæ, and it is not necessary to reproduce it here since it is fully explained in Mr. Greene's paper already cited.

Prior to the presentation of these comparisons, the committee had made several trials with Mr. Greene's formula and had tested out its accuracy. It observed that the work of testing-out this or any approximate formula was in itself the preliminary step for a second application of this formula (i.e., it was the calculation of 1+D). It also noted that where on first application the losses in the basic state were not reproduced the second application produced a result that was accurate within as narrow limits as could possibly be desired. The double application of Mr. Greene's formula, however, involves a large amount of work, and, realizing that there was no restriction upon the accuracy of "R" in his formula

$$E = \frac{R - D\frac{\Sigma(Bb)}{\Sigma(Aa)}}{1 + D}$$

the committee determined to try the use of this formula as a secondary or closer approximation upon one of the others as a first approximate and it found, by test, that formula (4) in the above study and comparison, namely, the ratio of the group pure premiums, was not only easiest of application but most accurate in itself.

The committee, therefore, resolved to make the conversion by the successive use of these two approximate formulæ, provided that the test-out of the results of applying the first (which, as I have already pointed out, constituted the first step in the application of Mr. Greene's formula) indicated that the factor so produced required correction. The assumption involved in the first approximation put enough strain on the formula to develop, by an inaccuracy in reproducing the basic losses, the presence of a disturbing classification and enabled the committee to go over again, where necessary, the classifications chosen for conversion purposes, and the two formulæ in successive application gave a highly accurate result. In actual application this method of working proved very satisfactory. Mr. Michelbacher, in his paper, reproduces the working sheets that were used, so that it is not necessary to exhibit them here, and reference is made to his paper for that purpose. These formulæ were used for the purpose of conversion and combination with respect to the "medical" and "all other" elements.

It will be noted that the experience of two years of account was used for each state, and a strict following through of the theory of the committee would call for the separate conversion to the New York level of the experience of each year of account. This, however, would greatly add to the labor of compiling the statistics, and, unless there was an important ariendment to the Compensation Act between the central dates of the issues of 1916 and the issues of 1917, or some very substantial change in industrial conditions between the period covered by the two years of account, there would not be a serious difference in the relativity between the several classifications for the partial pure premiums in the two years. Under such circumstances, substantially as good results could be obtained in conversion by adding together the experience of the two years of account and then making the conversion at one time. This being so much simpler and easier in application, the committee decided upon this procedure

With the determination of this question, the preliminary work of the committee was completed and the committee was ready to pass on to the second group of problems for its consideration, viz., the projection of pure premiums selected by the General Rating

Committee on the basis of New York 1917 issues of experience to state gross rates.

As soon as the partial pure premiums, as reviewed by the General Rating Committee, became available it was necessary to have developed the procedure by which those pure premiums on the level of issues of 1917 for New York were to be converted into gross rates for the several states, in order that the work of developing the gross rates might proceed with expedition. The Actuarial Committee, therefore, continued its work and undertook this second phase of its problems—the determination from the basic pure premiums of state gross rates, which involved two steps:

- 1. The determination of state pure premiums at approximately current level and
- 2. The determination of the loading necessary to cover taxes and expenses, including service and other expenses.

The determination of state pure premiums at approximately the current level is again divisible into two separate items, (a) the translation or reconversion of the basic pure premiums into state pure premiums at the level of past experience and (b) the projection of graduated state pure premiums of the experience period to the level of cost of the present date.

# TRANSLATION FROM BASIC PURE PREMIUMS TO STATE PURE PREMIUMS.

The first step in this process has been foreshadowed in the description of the process of converting the experience to a common level, particularly in the statement of the committee quoted above relative to the subdivision of the pure premiums for purposes of combination. This first step would naturally be the reconversion of the pure premiums from those selected by the general rating committee on the basis of 1917 issues, under the New York Act, to the basic of the 1916–1917 issues for the particular state for which the gross rate is to be made. The conversion process is, necessarily, of the same nature as the conversion process when the experience of the state in question was brought to the level of the New York Act, although in this case the states are reversed, and now the New York experience is brought to the level of the state in question.

It was the committee's first judgment that for the purpose of this conversion the experience of the local state for the year of issue 1917 only should be used, but, on consideration of the matter, it was felt that a better result would be obtained if, instead of merely the one year the experience of two years of issue were used.

The committee made this decision because the method later described in this record was found for projecting from the 1917 issue level to the 1919 issue level and it was realized after a little reflection that that method was not restricted to the case of passing from the level of the actual year of issue in one state to the later level, but was equally applicable for passing from any experience period for which payrolls and losses are available to the later issues. It was therefore not necessary to pass to the issues of 1917 for the local state but was sufficient to pass to the combined issues of 1916 and 1917 and this could be done by using the reciprocal of the original conversion factors since the same two sets of conditions were being compared though in the reverse ways.\* Thus the large labor of computing several new sets of conversion factors was avoided. It was not, however, possible further to reduce the labor and apply the projection method direct to the selected pure premiums (New York basis) as this method determines level only and it is necessary to reconvert to the local state basis to give effect to the relativity between classifications determined by its own conditions.

At this point it should be stated that it was recommended to the General Rating Committee, and approved by them, that, after the selection of the pure premiums upon the standard basis, and their translation to the level of another state, the result be reviewed in comparison with the local experience and special consideration be given those classifications where the local experience was sufficiently broad to be really indicative, with the intention of making rates by way of exception on the basis of local experience wherever that experience seemed to warrant and the rate produced by the usual process was considered out of line with the indications of the local experience. Cases where this was necessary were relatively few.

\* It was stated that the conversion factors reproduced with high accuracy in the expected losses of the basic State the aggregate actual losses regraduated by classifications. In reversing the process by applying the reciprocals rather than recomputing new factors from basic pure premiums to state pure premiums a slight discrepancy was sometimes found due to the fact that by the inclusion of the data if many states the weights of the various classifications in the experience of the basic states were changed. The discrepancies found were slight and the committee felt since it was due to the use of reciprocals of the original factors as approximations to the true factors correction could properly be made by a flat factor.

# STATE PURE PREMIUMS BASED ON STATE EXPERIENCE REGARD-UATED BY COMPARISON WITH NATIONAL EXPERIENCE.

The net result of the conversion and combination of the experience data in accordance with the rulings laid down by the actuarial committee, the review of the total experience by the General Rating Committee and its reconversion and check with the original local data produces at this point for each state a series of pure premiums upon the level indicated by the experience with the combined 1916 and 1917 issues within that state, graduated in their relation among the several classifications by comparison with and recheck against the experience of the country as a whole, but giving essential weight to the local experience in the classifications where the greatest amount of exposure was produced locally, i.e., to the classifications of greatest local importance.

So far we have conformed to the desiderata set out at the opening of this paper, viz., a basis for right rates in each state and a basic manual in substance as well as form, the latter being represented by uniform classifications and a logical relationship between the rates for each state and a basic set of key rates. But we have not yet passed beyond the period which developed the experience.

The remaining problem then is that of passing from the pure premiums on the level of the combined issues of 1916 and 1917 to pure premiums of essentially the present date.

# PROJECTION TO PRESENT CONDITIONS.

A comparatively brief review of industrial conditions of the time covered by the policy issues of 1916 and 1917 with a like survey of the present industrial conditions will very readily indicate that they are not precisely the same. In former rate revisions we have faced similar difficulties. Indeed, as the work has heretofore been conducted there has always been a lag between the development of experience and the making of rates, a lag inherent in the methods heretofore in use in compiling experience and other statistical data. (Parenthetically it may be remarked the National Council has been asked to study and develop new methods to avoid this lag.) In former rate revisions prognostications for the future were made on the basis of observed tendencies here and abroad in the history of compensation insurance.\* These were admittedly on a hypo-

\* For example factors were introduced to reflect increasing cost with age

thetical basis and rested primarily upon what has been before referred to in this Society as "subjective judgment." These judgments were sometimes correct enough on the phases of the rate problem considered, but, unfortunately, other phases were generally overlooked and sometimes as with the recent advance in wages their tendency was in the opposite direction to those allowed for. In any event, the judgments themselves have from time to time been subjected to rather drastic criticism. Although the matter was not made the subject of a definite resolution by either the Actuarial or the General Rating Committee, it was very generally understood that in the present rate revision such subjective judgment factors would not be used. Tendencies indicated by the experience and statistics of American compensation insurance would be considered on the basis of the indications but conjectural factors based on general reasoning by European analogy would not be introduced.

# CHANGE IN WAGE LEVELS.

It was recognized that among the conditions which had materially changed since the issues of 1917 was the level of wages in all industries, and the Actuarial Committee was requested by the General Rating Committee to undertake to measure this. Accordingly, a call was sent out to all companies asking for information as to wages of employees injured during the last half of the calendar year 1917 and the last half of the calendar year 1919, and upon the basis of these returns standard distributions of wages were constructed for several geographical regions of unlike conditions. The returns were called for by groups of classifications, in three groups corresponding to what were believed to be the high-paid, low-paid and intermediate industries. While the levels of wages in the three groups were different, the distributions were such that when the limits of the Compensation Act in New York in 1917, and as amended by the 1920 session of the Legislature, were considered, it was immaterial in practice whether one or another of the three groups or the composite of all the groups was used.

of act as had been found abroad, increasing accident frequency with increased industrial activity, etc. See Report Augmented Standing Committee already cited.

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#### INCREASE IN THE MEDICAL SERVICE COSTS.

It was also recognized that, along with the general increase in wages and living cost, the medical profession had been compelled to increase its charges and that this had resulted in a substantial increase in the costs of these benefits to the carriers. The committee, therefore, undertook an investigation to determine the extent of this, by calling upon the several carriers to report to it their number of accidents requiring medical treatment occurring during the last half of 1917 and the last half of 1919 and their expenditures for medical, hospital and like services for the same periods. On the basis of this information, average costs per case for each period were worked out, and it was found that in New York, for example, the cost had increased approximately 50 per cent. There was a substantial increase in all states but as with the wages it was not uniform for the entire country.

### OTHER CONDITIONS PRODUCED CHANGED COST.

It was also known that in New York, at least, there had been a material change in other conditions. This was due, in part, to a decision of the New York Courts construing one provision of the Compensation Act in a quite different manner from that which had been followed in making awards prior to that time. In addition to this, a governmental special investigation of the conduct of the Industrial Commission had brought about a considerable change in their manner of handling cases and their attitude toward carriers and claimants. Obviously, these must affect the costs of covering the compensation liability and should be taken into account in developing the rates.

# THE PROJECTION TO CURRENT LEVEL.

The committee, therefore, was confronted with the problem of working out a reasonable allowance for these items upon a basis of fact as represented in experience and without the use of more than a modicum of individual judgment. After a considerable study, the committee proposed that this problem be solved in the following manner for all states,\* namely that:

1. A loss ratio be worked out for the issues of 1919 for each state.

\* The committee's first investigation was based on New York data for the solution of the rather unique New York problem but as it developed and tested the method it was found of general applicability and provided on a statistical basis a solution for the problems which in other revisions gave rise to conjectural factors.

- 2. The 1916 and 1917 payrolls for a representative group of classifications in such state be multiplied by the manual rate at which the 1919 policies were issued, and the hypothetical premium income so developed be modified by such factor as may be found on experience to represent the actual effect of schedule and experience rating on the 1919 issues in such state.
- 3. By comparison of this with the combined actual losses on these classifications of the issues of 1916 and 1917 entering into ratemaking experience, a loss ratio be found.
- 4. A comparison of these two loss ratios\* be made which will be the measure of relativity between the pure premiums for combined 1916 and 1917 issues and the pure premuims for 1919 issues. This will be so because, while the comparison is between loss ratios, it is between loss ratios developed from a common premium level basis and, unless violently distorted by change in distribution of the business between the two years, will be the equivalent of a comparison between pure premiums themselves.

The standard form of Schedule W calls for the following data, as of December 31, 1919, by year of issue for each of the four or five preceding years: Earned Premiums: Losses Paid; Losses Incurred; Loss Ratio; and the Schedule is so drawn as to show these as originally reported at the end of the calendar year in which the policies were written, and at each subsequent December 31.<sup>†</sup>

	Calendar Year.				
Policies Issued.	1916.	1917.	1918.	1919.	Total.
in 1916 Earned Premiums Losses Paid Losses Incurred					
in 1917 Earned Premiums Losses Paid Losses Incurred					
in 1918 same data					
in 1919 same data					
Totals					

\* The actual loss ratio on 1919 issues above referred to and the hypothetical loss ratio developed by comparing the actual losses on combined 1916 and 1917 issues with the premium income which the payroll exposures would have developed at the 1919 going rates.

t The Schedule calls for a tabulation relative to the losses in the jurisdic-

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The preliminary investigations of the committee based on New York Schedule W returns indicated that the Losses Paid at the end of the calendar year in which the policies were issued bore a remarkably stable percentage relationship to the ultimate incurred losses on that same year of issue.\*

The committee was not satisfied to rest there, but searched further and made the comparison on a countrywide basis, from the returns in Schedule P of the Annual Statement as it is now prepared and Schedule O of the Statement as it was a few years ago. These ratios of Losses Paid at the end of the calendar year in which the policies were issued to the Ultimate Incurred Losses under such policies, showed a similar stability.

The Schedule W returns also show the Losses Paid on the issues of 1919 during the calendar year 1919, and we were thus able to project the Ultimate Incurred Losses upon these policies by dividing the Losses paid at the end of the calendar year by the percentage factor which, upon the average, they have been found to bear to the Ultimate Incurred Losses. Thus, we got a fairly dependable estimate of the Ultimate Incurred Losses on 1919 issues the numerator of the fraction which measures the loss ratio on the issues of 1919.

The committee recognized that, if a similar factor could be found to apply to the earned premiums of a given year of issue at the end of that calendar year, the denominator of the loss ratio fraction would be found, and the loss ratio on the 1919 year of issue thereby developed. There seemed to be a considerable degree of stability in the ratio between the earned premiums of a given year of issue at the end of that calendar year and the ultimate premiums on that year of issue; but this figure was confused somewhat by varying methods between companies in computing proportionate earned premiums and by varying practices as respects interim audits. It therefore seemed that if the data could be obtained, better results might be had by comparing the Net Premiums Written as recorded at the end of the year in which the policies were issued with tion made up substantially as follows though some items not used by the committee are omitted in this reproduction.

\* In the state of New York these percentages for a representative group of companies were on '16 Issues 13.9 per cent., on '17 Issues 14.2 per cent., on '18 Issues 13.7 per cent., Average of 3 years 13.8 per cent., and similar stability has been shown by the figures for other states on a much smaller volume of data after allowance has been calculated for the effect of intervening amendments. the ultimate premiums of the same year of issue, although these net premiums written were not shown in Schedule W.

From a study of Schedule P, in which the premiums were entered in this way, this conclusior seemed to be verified. The committee, therefore, selected a group of representative companies, having a substantial volume of business in New York, obtained by correspondence with the companies their net premiums written for the several years of 1916, 1917, 1918 and 1919, as recorded on their books at the end of the calendar year of issue, and compared the net premiums written with the ultimate earned premiums on the same year of issue, for years 1916, 1917 and 1918.

A similar study was made from Schedule P dealing with the same group of companies. While these figures do not show quite the stability of the losses paid to ultimate incurred losses, the committee felt the general trend, both as shown by the New York data and the countrywide data developed from Schedule P, was sufficiently dependable to project approximately the ultimate premium income on the 1919 New York issues and to develop the loss ratio required for this test.

This conclusion was reported to the General Rating Committee and, after extended debate and comparison of the loss ratio on 1919 issues developed in this way the loss ratio on the uncompleted year, as reported in Schedule W 1919, and the loss ratios of earlier years, as reported in successive returns of Schedule W, the general method received the approval of the General Rating Committee not only for New York, but for other states where as it was tried similar stable ratios were found to enable 1919 issue loss ratios to be projected with considerable confidence.\*

This investigation of the committee introduced something new into the ratemaking procedure hitherto in force, and laid the foundation for developing the experience of the past toward present conditions upon a statistical basis as contrasted with the unstable basis heretofore used in the rating conferences for this work. The committee was not able to project beyond the conditions of the issues of 1919, but it did feel that this method of projection was satisfactory, notwithstanding that on the average the issues of 1919 will not expire for several months yet.

\* In some of the states the problem was complicated by changes in manual rates having been made during 1919 or an amendment taking effect in that year but satisfactory bases were found for making adjustments to allow for these.

This method of projection, however, gave a composite factor, and, while it did involve all of the various elements tending to change the costs, it could only be applied to partial pure premiums as a flat factor.

The committee then gave consideration to the possibility of breaking up this total projection factor. After study by a subcommittee and consideration of its conclusions by the entire Actuarial Committee, a general conclusion was reached, as set forth in the following resolution:

*Resolved*, That the Actuarial Committee advise the General Rating Committee with reference to the projection factors as follows:

That as respects the subdivision of the total projection factor the committee reports:

(a) That it believes this question should be taken up separately for each state after the total projection factor for the state has been determined.\*

(b) That as regards New York the total factor should be subdivided as follows:

D. & P. T. D	1.00
Medical	1.07
All Other	Balance <sup>†</sup>

In support of the recommendation with reference to the subdivision of the total projection factor for New York, the committee made the following note:

1. The medical factor of 1.07 is determined by comparing the increase in the average cost of medical aid for the last six months of 1919 as related to the last six months of 1917 with the average wage increase for the same periods. The increase in the cost of medical aid is approximately 50 per cent. as compared with a wage increase of approximately 40 per cent., thus indicating the medical pure premium for 1917 should be increased approximately 7 per cent. to produce an adequate pure premium for 1919.<sup>‡</sup>

2. The justification for the decision to load the balance of the factor upon the all other pure premiums is found in the fact that

\* Generally as the work progressed the factors developed for the several states were such that the committee decided not to attempt analyzing them.

+ As it was worked out this proved to be 1.19.

<sup>+</sup> This study of medical cost was made for each state as a part of the projected study. In some cases a factor was recommended to be applied to the medical pure premiums because this study indicated a very slight increase and the committee had advices that larger medical changes were being approved or would be when the new rates became effective. the conditions which are held largely accountable for the increase in the cost of compensation for 1919 as compared with 1917, viz., the decision in the Phonville case and the change in procedure adopted by the Industrial Commission following the Connor investigation, are substantially, but not wholly, limited in effect to the cases comprising the all other indemnity division of the total pure premium. We believe the D. & P. T. D. costs have also felt some effect of this and have therefore recommended a factor of unity for this element notwithstanding the effect of the fixed limits on the higher wage basis would otherwise have tended to reduce the pure premiums.

It would make this paper quite too voluminous to indicate the conclusion as to subdivision of the projection factor for each state but I believe this record of treatment in New York is a sufficient indication of the general method followed by the committee. Further, the work of projection of gross rates for all the states is not completed at this writing. If this point is further developed before the close of the work I shall be glad to elaborate the statement when the paper is up for discussion at the next meeting of the Society.

# INVESTIGATION OF EFFECT OF WAGE INCREASE BY INDUSTRIES.

From the nature of the projection factor and its development, as above described, it will be apparent that this factor embodies within itself the composite effect of wage changes without change of limits in the Act, of changes in administrative procedure and construction and of any other like changes which may have occurred during the time interval bridged by this factor. It must be apparent from even a brief consideration, that the effect of fixed limits in any compensation act does not operate alike in all industries. In the industries having predominantly highly skilled and correspondingly well paid employees, the tendency is for the upper limit of the compensation act to reduce the effective ratio of compensation to wages, whereas the lower limit tends to increase that ratio in the industries characterized by unskilled and low-paid employees. An upward change in the general level of wages tends to make the upper limit more effective in the more highly skilled industries and to diminish the effect of the lower limit in the less skilled industries. It must, therefore, be apparent that when, as recently in the case of New York, the limits of the compensation act have remained unchanged and the general level of wages increased, the effect upon the pure premiums must vary by classifications.

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This was considered by the Actuarial Committee, and the wage distributions for three divisions of industries during the last part of 1917 and the last part of 1919 were applied in a theoretical calculation to the terms of the New York Act to determine the independent effect of the change in wage level. Contrary to the expectations of the committee, the net effect was found to be approximately the same for all three groups of industries for which the wage data had been collected.

A study of the plotted curves of the wage distributions convinced me\* that this result was due to the groups of industries for which the data had been collected not being sufficiently homogeneous. In response to request, certain of the companies furnished the necessary data to investigate the effect of the wage change by individual classifications and a considerable variation was found, but in the meantime the New York Legislature had amended the compensation act, increasing the limits; and, as will appear on reflection, the effect of such an amendment upon the compensation costs in the several classifications will be in direct opposition to the effect of the wage increases when the limits have remained fixed. Those industries receiving the greatest reduction in compensation costs by the operation of the old limits received the greatest increase by reason of the increase in limits, and vice versa. Our study proved this to be the case. This fact, and this alone, relieved us of the necessity of admitting a discrimination in the effect of wage changes by classification. In one way this was most fortunate as the labor involved in making the discrimination would have been very great.

### AMENDMENT TO COMPENSATION ACTS.

Reference has been made to amendments having been passed in New York at the Session of 1920. It is obvious that, these amendments having been passed after the latest date (December 31, 1919) to which any statistical data had been brought, factors to measure the effect of the amendments must be derived from theoretical calculations. If our projection factor had taken account of the effect of wage changes by classification, it would be necessary to measure

\* This supplementary study was made by Mr. Michelbacher and the writer and as it was earnestly desired to hasten the arrival at a definite conclusion was presented to the general rating committee without previous reference to the Actuarial Committee. the effect of amendments changing benefit limits by classifications but since the projection factor did not so discriminate and, as noted above, the discriminating effect of the wages was in the opposite direction to the effect of law changes, this work was avoided.

Early in the committee's deliberation, it was recognized that there would probably be amendments which could not be measured by statistical data and would have to be allowed for by theoretical calculation, and it was decided by the committee that this calculation should be made along the lines heretofore generally followed in calculation of differentials, except that the differentials should be calculated for partial pure premiums rather than en bloc.

# THE AMERICAN ACCIDENT TABLE.

For a considerable time prior to the sessions of the committee there had been more or less discussion of the adequacy of the Standard Accident Table for this work, and Mr. Michelbacher had suggested to Miss Olive E. Outwater, of the National Workmen's Compensation Service Bureau, the collection of American data and construction of an American table along the lines of the Standard Accident Table. This work was completed during the committee's sessions and brought to the attention of the committee. Through it, the table as prepared was promulgated for general criticism and corrections were made in it to mee' certain criticisms that had been received. The committee then  $\varepsilon$  dopted the American Accident Table for the calculation of theoretical differentials.

Generally speaking, recent amendments to the compensation acts of the several states have been increases in the maximum limit of compensation, either throughout the entire schedule or for certain types of benefits, and it is important, in measuring the effect of such changes, that recent wage distributions should be used. I have heretofore referred to the committee's collection of wagedistribution data, and the committee decided that the projection factor brought the experience up to approximately present-day conditions and that calculations of amendment factors should be made upon the basis of 1919 (last half of year) wage-distribution data, either for the state in question or, if that was not available, for a neighboring state of similar industrial characteristics and economic conditions.

#### OCCUPATIONAL DISEASE COVERAGE.

Among the 1920 amendments of the New York law was an amendment bringing occupational diseases under the compensation act, and the committee, after due consideration, adopted the report of a special sub-committee appointed to make an investigation into this question. This report was as follows:

"It is recommended that no special factor be used in the rates to measure the cost of occupational diseases.

"The special committee looked particularly into the question of securing additional information on the subject from the records of the Industrial Board of Massachusetts and the Industrial Accident Commission of California. It failed to find any new data of value. This would make it necessary to refer back to the original report on this subject made by Mr. Maddrill in 1915.

"However, the committee felt that there was no necessity for doing this and that a decision to refrain from an attempt to measure the cost of occupational diseases was entirely warranted by the following considerations:

"1. The element is not of great importance. The most radical measure of the cost of occupational diseases so far made, places the total cost of this element as approximately 2 per cent. of the cost of accidental injuries.

"2. The California and Massachusetts experience used in the present revision contains occupational disease cases as the laws of these states contain specific provisions covering the subject. Notwithstanding this fact, the experience of these states shows no radically different results than the experience of other states where the occupational disease hazard is not specifically covered by statute.

"3. A large proportion of so-called occupational disease cases have already been carried into the experience. Such cases as lead poisoning and anthrax have, in many jurisdictions, been classified as accidents and compensated under the terms of the workmen's compensation law provided they occurred under certain conditions." Proof of this is found in many individual death and permanent total disability cases, for which detailed reports are available.

"4. The distribution of occupational disease cases by classification is very unstable. In California, for example, the occupational diseases that did occur and were compensated in many cases were not covered by Mr. Maddrill's report. Many of them fell in classifications for which no specific loadings had been provided, thus producing inequities.

"5. A flat factor to apply to all rates could not be justified. Such treatment would involve discrimination as occupational dis-

\* This is particularly true of infectious diseases. The scratch or abrasion through which infection entered is usually considered an accident and the infection a secondary result. eases are particularly prevalent in certain industries and practically non-existent in others."

We have now disposed of the entire pure premium by states for the most recent law and at current level except for one element the question of catastrophe cost. This element has for some time past been covered by a flat loading of 1 cent on the gross rate in all states, and the committee having no further data on the subject than heretofore available has continued this loading.

#### EXPENSE LOADING.

Having disposed of all these matters, the committee next gave consideration to the development of the gross rate, which involved the question of loading for taxes and expenses and the correction, if any, for the effect of schedule and experience rating. The committee decided, as respects schedule rating, that there should be a loading factor of the amount that a proper investigation of conditions in each jurisdiction indicated was necessary on account of the operation of the plan in that jurisdiction tending to disturb the average rate level,\* to be used in the rates of classifications subject to the schedule.

As respects experience rating, the committee decided that there should be no loading in the premium to correct for a distorting effect of experience rating, but that the experience rating plan should be studied and adapted so as to produce a balance, or an approximate balance, in all cases. It felt that it is more possible to do so now than heretofore, because by discovery of the statistical method of developing the projection factor it was possible to bring up the experience of former years in the experience rating plan by a method which accurately corresponded to the way the data was handled in the rates so that the factors were based on the actual experience to which they were to be applied.<sup>†</sup>

As respects expense loadings, consideration was given to the methods heretofore in use of a graduated expense loading, by states,

\* The Schedule Rating Plan has not yet been brought under such statistical control that it can be made to recognize proper distinctions in the physical condition of individual plants and not disturb the average level of rates. Until that time it seems to be necessary to let it take its own course and correct the manual rates to allow for its effect.

+Study of the experience rating plan was an interesting part of the committee's work but must be left for later presentation.

having regard to the scale of benefits in that state. After careful consideration, the committee decided that with the exception of the tax item it would recommend a single loading for all states. This decision involves the discontinuance of the present practice of making a variation of the expense loading dependent upon the size of the state law differential. The committee's reasons for this action were as follows:

1. There is no necessary relationship between law differentials and the expenses of administration. In fact, cases have been found where the law of variation which has been used in the past has produced results exactly contrary to the actual expense requirements.

2. Factors, other than the level of benefits in the individual state, are just as important, and in some cases more important, in determining the expense requirements of the carriers. Some of these items may be enumerated as follows:

- (a) Geography of the state.
- (b) Dispersion of risks.
- (c) Distribution of risks by kind of industry.
- (d) Requirements of administrative claim bodies in handling claims.

These factors are important in determining the cost of field work for the purpose of accident prevention, the adjustment of claims, and the auditing of payrolls. Difficulties of transportation, the necessity for long trips, the impossibility of making convenient itineraries for field work, and the various requirements imposed upon the carriers by administrative bodies in the adjustment of claims, vary so considerably, and without any regard to the level of benefits, that the use of a scale of expense ratios based upon variations in benefit levels is impracticable and may produce illogical results. Furthermore, the larger part of the expense loading varies directly with the gross premium, limiting the possible variation of the expense loading to only a share of the total cost.

The committee derived a single tax and expense loading\* from

\* This standard loading corresponded accurately in its total and approximately in its analysis to the actual returns and was:

	Per Cent.
For Acquisition expense	17.5
" Home office administration	8.0
" Claim investigation	7.0
" Inspection and accident prevention	2.0
" Taxes State 2 per cent. Federal and c	ther
1 <sup>1</sup> / <sub>2</sub> per cent	3.5
-	38.0

the Schedule W returns, which this year, in contradistinction to other years, covered the entire country.

One exception was made to the recommendation of a flat tax and expense loading. The item of taxes other than federal taxes, including therein taxes or special charges for the maintenance of industrial commissions, is a matter within the control of the local legislatures, and the committee felt that it would be unwise, where the taxes were substantially above the average, to distribute this extra tax over the country, but that properly this tax should be assessed upon the premiums of the policy holders within the local jurisdiction. Accordingly, it was recommended that in those states where the tax rate, including special charges, exceeded the normal of 2 per cent. of the premiums, the loading for expenses and taxes should be increased above the standard loading by this amount. The actual standard loading, based upon Schedule W, was 38 per cent. of the gross premium, and the special additional items ran from 1 to 2 per cent., according to local provisions. This was the final decision necessary for the determination of the gross manual rates.

### CONCLUSION.

The committee's work covered such a wide field that it is not possible suitably to summarize this account of its work in a closing paragraph. In noting each decision I have tried to bring out its bearing on the work as a whole. Reviewing it from my personal point of view, it seems to me that probably the outstanding features of the committee's work were:

- 1. The change in method of combining experience and translating the selected basic pure premiums into state pure premiums.
- 2. The development of statistical projection from earlier years of issue to conditions of more recent date.

It seems to me that with this work the pioneer stage of compensation ratemaking may be considered to have drawn to its close, foundations for future rates having been laid in actuarial and statistical studies of experience data to replace in the largest possible degree the exercise of empirical personal judgment. Looking to the future, it seems to me that the problem for the actuary and sta-

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tistician is the development of labor-saving methods in carrying out the actual work and of methods for bringing attention more promptly to changes in conditions which call for revision of rates, thereby diminishing the lag which has heretofore, of necessity, existed between economic and industrial changes and the adjustment of compensation rates thereto. This last, more closely to follow the trend of experience, is our most important problem.
# LEGAL NOTES.

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RICHARD FONDILLER (OF THE NEW YORK BAR).

# ACCIDENT AND HEALTH.

UNDERWRITING CLASSIFICATION :--- (Warren vs. Globe Indemnity Co., Supreme Court of Wisconsin, 176 N.W. Rep. 73.) At the date of issue of the insured's accident policy for \$15,000 he was an advertising solictor and paid the premium for class 1, classification being "Office and Traveling." The insured paid an additional premium to provide for double indemnity in case he was killed on a private conveyance. The policy contained the usual prorating clause that in case the insured was injured while engaged in a more hazardous occupation than that in which he was classified, the liability would be limited to the amount purchased by the rates applicable to his new occupation.

During the first policy year, the insured became assistant to the president of a corporation manufacturing electric gear shifts to be installed in automobiles. He went to the office of the insuring company, where he informed two agents of the duties of his new position. The agents concluded that the insured's correct classification was "Assistant to President, Cutler-Hammer Mfg. Co., Office Duties and Traveling," and attached an indorsement to that effect, signed by the insured, to his policy.

His employers gave him an automobile equipped with the device, in which he traveled in order to interest automobile manufacturers. He was killed on one of these trips. The defendant company claimed that the insured had not made a complete disclosure to its agents of the real nature of his duties, which would have placed him in class 3 either as (a) "automobile dealer demonstrating" or (b) "salesman traveling, selling, operating, exhibiting, or setting up machinery or implements or automobiles." The company claimed that prorating should apply to the principal sum, also that there was no liability under the double liability clause because it would not have been written under a class 3 risk with a full knowledge of the facts.

It would appear, upon legal principles, that the defendant company was estopped by its agents' acts, from asserting that the insured had been wrongly classified. This estoppel would be effective to bind it as of the time of the insured's death, which occurred during the second policy year. During the trial, the jury was discharged from the determination of the questions of fact surrounding the disclosures by the insured to the defendants' agents, and by stipulation these were determined by the court. The court consequently did not consider the question of estoppel, but based its decision solely upon the facts, and placed itself in the position of an underwriter.

It affirmed the judgment for \$30,000, concluding its opinion as follows:

"A careful review of the evidence convinces us that the finding is in accordance with the great preponderance of the evidence. There is no classification set out in the manual of rates and classifications which accurately describes the work in which the insured was engaged. He certainly was not a dealer in automobiles. Neither was he a 'salesman, traveling, selling or operating, exhibiting or setting up machinery, or implements, or automobiles,' in the sense in which those terms are generally and ordinarily used. The classification in which he was placed by the defendant's agents more clearly and more accurately describes the deceased's occupation than any other classification appearing in the manual of rates and classification. An electric gear shift is not an automobile, and the insured was something more than a mere salesman. While, of course, a part of his duties was to make contracts for the manufacture and sale of the electric gear shift, he was also to introduce it to manufacturers, engineers, and others having to do with the manufacture of automobiles. He was not a mechanic, and at times at least had with him a man who understood the construction and mechanism of the device which he was introducing. He was paid a salary of \$12,000 per year. While some salesmen receive very large salaries, the amount paid him is somewhat indicative of the nature and importance of his work. The use of the device upon different makes of automobiles must necessarily have involved many mechanical and manufacturing problems. The electric gear shift was not a machine, an implement or an automobile. It was a device which might in the course of manufacture be installed in and made a part of an automobile. The insured fully and fairly stated the nature of his duties as an employe of the Cutler-Hammer Manufacturing Company and upon

such statement the agents of the defendant company correctly placed him in the classification 'Office Duties and Traveling.'

"The conclusion we have reached disposes of the other questions raised by the defendant. If he correctly stated his occupation and was correctly classified, there was no breach of the warranty, nor is there any basis for the claim that the prorate clause should be applied in this case, and the double liability rider was properly attached."

CANCELLATION: --- (Wolonter vs. United States Casualty Co., Supreme Court of Appeals of Virginia, 101 S.E. Rep. 58.) The accident policy held by the insured contained the following clause:

"The company may cancel this policy at any time by written notice delivered to the insured cr mailed to his latest address appearing on the company's record with its check for the unearned part, if any, of the premium, but such cancellation shall be without prejudice to any claim arising on account of disability commencing prior to the date on which the cancellation takes effect."

The insured took out an accident policy and also a health policy through an agent of the defendent company. In his application, he gave his address in care of his employer, Virginia Bridge Company. He had two claims under his health policy adjusted and paid at the agent's office. Prior to the settlement of the second claim, the insured's wife (plaintiff herein) notified the agent of their new home address, to which all future communications were to be addressed. Subsequently, the insured and his wife received written notice at their home to call for the adjustment of the second health claim.

The policies and all previous rnail had been addressed in care of the insured's employer. The defendant company mailed some blanks to the insured, addressed to the city of his residence, which were returned unclaimed by the post office. Thereupon the company wrote its agent to secure the correct address, which he did. The company, however, on February 8th mailed a notice of cancellation with a check for the uncarned premium, addressed to the city of his residence only. It was not received by the beneficiary until the thirteenth, when she was informed to go to the post office. The insured had received fatal injuries on the twelfth and died on the fourteenth.

The sole question was whether cancellation had taken place in accordance with the contract. There was contradictory evidence as to whether notice of change of address had been given; the jury decided that it had been given. The court goes even further and holds that proof of notice of change of address was not necessary, since the policy required that the notice of cancellation must be given to the insured's last address appearing on the company's record. This last address was in care of the insured's employer, but the notice of cancellation was addressed merely to the city.

The court upholds the general rule as to cancellation as follows:

"The contract was a valid contract, and the company had the right to cancel it in the manner therein provided. If the notice, properly addressed, was mailed to the assured at his latest address appearing on the company's record, accompanied by the company's check for the unearned premium, that was sufficient. The assured assumed the risk of the due receipt of the notice."

Under the facts in the case at bar, however, the court handed down judgment for the plaintiff, and distinguished it from the general rule in the following extract:

"The records of the company should have shown, but for the negligence of the company or its agents, upon which it cannot rely, that the words 'Care of Virginia Bridge Company,' were a part of the address of the assured. The notice of cancellation, however, did not conform to this address, and was for that reason insufficient. It was wholly immaterial whether the assured was still in the employment of the bridge company or not or whether a letter addressed to him in care of that company would have reached him or not; the contract of the parties stipulated how the notice was to be sent, and it was not so sent. In either view of the case, we are of opinion that the notice of cancellation was insufficient."

STATUTE OF LIMITATIONS:--(Midland Casualty Co. vs. Frame, Supreme Court of Colorado, 185 Pac. Rep. 656.) The plaintiff secured a judgment for \$2,000, the face of an accident policy containing the following clause:

"Legal proceedings for the recovery hereunder shall not be brought before the expiration of three months from the date of filing final proofs at the company's home office, nor brought at all unless begun within one year from the date specified herein for final proofs. If any limitation set forth herein is in conflict with the statutes of the state in which the insured resides, the said limitation is hereby amended to agree with the minimum period of limitation permitted by such statutes." The plaintiff did not begin her suit within one year, as required by the clause quoted above, and the defendant urged that she was barred by the limitation in that clause. The plaintiff replied that an accident policy is substantially a life insurance policy, hence came under the standard provision of the statute allowing a period of five years in which suit may be brought.

In a discussion of the amendments governing life insurance companies, the court shows that a clear distinction may be drawn between these laws and those relating to accident companies and that therefore accident insurance is not life insurance. Since the plaintiff began her suit after the time allowed by the policy, the court reversed the judgment and dismissed the action.

REPRESENTATIONS: -- (Ætna Life Ins. Co. vs. McCullagh, Court of Appeals of Kentucky, 215 S.W. Rep. 821.) The plaintiff's accident policy provided for a specified weekly indemnity payable so long as he was continuously and wholly disabled. Shortly after the delivery of the policy, the plaintiff met with a severe accidental injury. After he had filed proofs of claim and demanded payment, the defendant denied liability upon the grounds of four misrepresentations in the plaintiff's application for insurance.

The Kentucky statute declares:

"All statements or descriptions in any application for a policy of insurance shall be deemed and held representations, and not warranties; nor shall any misrepresentations, unless material or fraudulent, prevent a recovery on the policy."

The court adopts the following definition of representation, as one which has been generally used:

"A representation is an oral or written statement, which precedes the contract of insurance and becomes a part thereof, if so stipulated, made by the assured or his authorized agent to the insurer or its authorized agent, and relates to facts necessary to enable the insurer to determine whether it will accept the risk and at what premium. A representation is material when it communicates any fact important to the nature of the risk, that may be reasonably supposed to influence the judgment of the insurer in undertaking the risk or calculating the premium."

The first alleged misrepresentation was a statement by the insured that he had never been declined for life, health or accident insurance nor that, if a policy had been issued, it had ever been cancelled. The evidence showed than an accident policy had been issued to him by another company, which he declined to accept because that company had mailed a rider to its agent to attach to the policy after it had been issued but before delivery. The court held that this showed that the insured had not been declined and also that the cancellation was not by order of the company but by that of the insured.

The second misrepresentation concerned the amount of indemnity he had received three years previously from another company on an accident policy. The answer was "About \$50" and the evidence showed the correct amount was \$133.88. The answer had been given as the conclusion reached in a discussion between the insured and the agent, neither of whom had any memoranda to refresh his recollection. The court holds that the discussion indicated no desire on the part of the insured to deceive and, in fact, was such as to put the agent and through him, the defendant company, on notice that the insured may have received larger indemnities. Two agents of the defendant, while testifying, disagreed as to whether the amount of indemnity received was material to the risk and it was consequently decided by the jury in the negative.

The third misrepresentation was that his habits were temperate. There was much contradictory evidence on this point, except that for the two months preceding the application, the insured had not taken any drinks. The agent, who had known the insured for twenty years consequently answered the question in accordance with the insured's habits at the time of application, after the insured had reminded him of his past habits. The court interprets this question strictly, to mean what the habits of the insured were solely at the time. The following extract from the opinion bears upon this question:

"The authorities all hold to the doctrine that the principal is affected with constructive knowledge of all material facts of which his agent received actual notice, or acquires actual knowledge while acting in the course of his employment, and within the scope of his authority, although the agent does not in fact inform his principal thereof [quoting cases]. It is an equally well recognized doctrine that an agent who solicits insurance will be treated as the agent of the company, and not the insured, notwithstanding a provision in the policy that he is acting as the agent of the insured. And where, as was here done, the agent of the company undertakes to write into

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the application the answers of the applicant to the questions propounded to him, and makes false answers to such questions, or by misleading statements induces the applicant to make false answers, when the latter is acting in gool faith and without any intention to deceive, the company will be estopped to rely upon the answers to defeat the policy [quoting cases]. In such state of case it will be held by the courts either that the questions were not asked, or answered, or that the failure to answer them was waived, or that the answers so made by the agent are to be taken as true."

The last misrepresentation was that he had not received medical attention within the past five years, except for small local disorders. There was evidence tending to show that this was untrue, but since the jury found in favor of the insured, the court declined to disturb the jury's findings upon a question of fact.

The court held as a matter of law that the burden of proof was upon the defendant to establish its defense that the four misrepresentations were false and material. The jury's verdict as to all these were in favor of the plaint. The court affirmed the judgment for the plaintiff, concluding its opinion as follows:

"As the evidence in this case clearly shows that all the answers of the plaintiff to the questions contained in the application for the insurance granted by the policy sued on were either written or dictated by the defendant's agen', Banks, whose knowledge of the facts communicated by the answers, whether true or false, was equal to that of the plaintiff, and there being neither allegation nor proof of fraud or collusion between the agent and plaintiff, the doctrine of estoppel was properly applied by the jury as to all the grounds of defense pleaded in the answer, and as the verdict is supported by the evidence it should not be disturbed."

DISEASE: --- (Leland vs. Order of United Commercial Travelers of America, Supreme Judicial Court of Mass., 124 N. E. Rep. 517.) The insured's certificate provided for indemnity "against the results of bodily injury . . . effected through external, violent and accidental means, herein termed the accident, which shall be occasioned by the said accident alore and independent of all other causes" and also stipulated that benefits were not payable "unless external, violent and accidental means, producing bodily injury is the proximate, sole and only cause of the death, disability or loss." He was a commercial traveler and worked regularly until two days before his death. On the morning of his death, he was returning from the heater in his house to his room, when he had two falls resulting in slight abrasions. Liability having been denied by the defendant association, this action was brought by the beneficiary. The medical experts on both sides testified to an advanced diseased condition of both the heart and lungs, which would have resulted fatally within a short time. The plaintiff's experts, however, urged that the falls had aggravated the chronic existing diseases, thus bringing the case within the terms of the contract.

The court quotes the following extract as a precedent, from one of its own decisions (Freeman vs. Mercantile Accident Co., 30 N. E. 1013) which had been adopted throughout the country:

"Where different forces and conditions concur in producing a result, it is often difficult to determine which is properly to be considered the cause, and, in dealing with such cases, the maxim, 'Causa proxima non remota spectatur,' is applied. But this does not mean that the cause or condition which is nearest in time or space to the result is necessarily to be deemed the proximate cause. It means that the law will not go farther back in the line of causation than to find the active, efficient, procuring cause, of which the event under consideration is a natural and probable consequence, in view of the existing circumstances and conditions. The law does not consider the cause of causes beyond seeking the efficient predominant cause, which, following it no farther than those consequences that might have been anticipated as not unlikely to result from it, has produced the effect. An injury which might naturally produce death in a person of a certain temperament or state of health is the cause of his death, if he dies by reason of it, even if he would not have died if his temperament or previous health had been different; and this is so, as well when death comes through the medium of a disease directly induced by the injury, as when the injury immediately interrupts the vital processes."

The burden of proof was upon the plaintiff to show that the falls were the sole cause of death, and the most she had proved was that the falls, concurrently with the diseases, had resulted fatally. Since the falls alone could not have caused death, the court's judgment was in favor of the defendant, and wrote:

"The application of that principal of law to the case at bar is that, if the insured was suffering from a disease, which was accelerated and aggravated by the accident so as to be a cause cooperating with it to produce the fatal end, then there can be no recovery. Manifestly recovery is not barred merely because the insured is suffering from disease. One upon a bed of illness may meet death by an explosion or other accidental means." ACCIDENTAL MEANS:--(Martin vs. Interstate Business Men's Acc. Assn., Supreme Court of Iowa, 174 N. W. Rep. 577.) The deceased's policy provided for rayment in the event of death by accidental means. He was employed to sort oranges, which was his regular occupation, into those which were marketable or those not marketable. While so engaged, he ate three oranges to supplement a light breakfast. He was ill upon his return home from work and died from acute indigestion the next day.

The medical testimony established the fact that the oranges were the cause of the indigestion. The insured knew that some of the oranges were unmarketable and knowingly selected three for his own consumption. His choice was entirely voluntary, not accidental; the failure of the oranges to digest was accidental.

Holding that the plaintiff could not recover, the court concluded its opinion as follows:

"As said before, the defendant died from gastritis, which is caused by the failure of food to properly digest in the stomach. To come within the policy the injury to the stomach must be traceable to means which were purely accidental, and the disease must be a result of a direct injury to the organ affected thereby through accidental means. If we were to hold in this case that the plaintiff could recover, then, under a policy containing provisions such as this policy contains, it would follow that, whenever any one ate food that disagreed with him, or failed to properly digest, and acute indigestion followed, his beneficiary would be entitled to recover the amount provided in the certificate. This case is clearly distinguishable from those cases in which the company was held liable where one ate food containing ptomaine poison, without knowledge of the fact that it contained ptomaine poison, and death resulted, not from the failure of the food to digest, but from the effect of the poison."

ACCIDENTAL MEANS: --- (General Accident, Fire & Life Assurance Corp., vs. Hymes, Supreme Court of Oklahoma, 185 Pac. Rep. 1085.) The insured's accident policy contained a provision that in case of death resulting from an injury intentionally inflicted upon him, the liability would be reduced from the principal sum to one month's indemnity. The insured was shot dead by an intoxicated friend, while the latter was under the impression, in the darkness of the night, that he was shooting some one else. The jury decided that there was no intent to injure the insured on the part of the friend. In affirming the judgment for the principal sum in favor of the beneficiary, the court quoted with approval the following extract from the opinion in the case of Newsome vs. Travelers Ins. Co., 85 S.E. 1035:

"A provision contained in an accident insurance policy, . . . which excepts from operation of the policy injuries 'intentionally inflicted upon the insured by any other person'. . . contemplated injuries intended against the insured, and not injuries intended against another. Accordingly such exception will not relieve the insurer from liability for an injury to the insured inflicted by another person, where the other person, intending to injure some one other than the insured, mistook the insured for the person intended to be injured and intentionally inflicted upon him a bodily injury, while he was unaware of the intent to injure him, and had done nothing to bring about the injury."

# WORKMEN'S COMPENSATION.

OCCUPATIONAL DISEASE:—(Zajkowski vs. American Steel & Wire Co., U. S. Circuit Court of Appeals, Sixth Circuit, 258 Fed. Rep. 9.) The plaintiff had been in the defendant company's employ for several years, when his duties were changed to those of an operator of sheet steel rolls. The surface of the rolls was very bright, the work was done under powerful electric lights and without goggles to diminish the strain upon the plaintiff's eyes. The plaintiff's eyesight was destroyed by reason of these working conditions and he brought suit for damages at common law, alleging that no precautions were taken for his safety or well-being.

The court below dismissed the suit, but the Circuit Court of Appeals entered a reversal, upon the ground that

"The case set out in the petition falls well within principles of the common law. The general rule is that where an employer places and continues an employee for a substantial length of time in the regular performance of work and under conditions which, in the absence of preventive means and precautions, are calculated to engender in the employee a disorder of serious and injurious character regardless of the name by which the disease is known, it is the duty of the employer to warn and instruct the employee as to the dangers and to furnish him with reasonably effective means to avoid them and where as the direct result of failure to perform this duty an employee in the exercise of reasonable care suffers injury through a disorder so contracted, he is entitled to recover." The Ohio constitution provided:

"No right of action shall be taken away from any employee when the injury, disease or death arises from failure of the employer to comply with any lawful requirement for the protection of the lives, health and safety of employees."

In accordance therewith, a statute was enacted in Ohio to compel employers to provide means to prevent occupational diseases and imposing penalties for violation of the statute. The court held that this statute imposed a duty upon the employer, the breach of which gave the injured employee a right of action at common law, but none under the Compensation Act.

The court further held that the Ohio Compensation Act did not cover occupational disease, and quoted the following extract from an opinion of the Ohio Supreme Court (Industrial Commission vs. Brown, 110 N. E. 744) in construing that act:

"It is to be observed that the constitutional amendment differentiates between injuries and occupational disease. It clearly recognizes three distinct classes for which provision may be made: (1) Injuries resulting in death; (2) nonfatal injuries; and (3) occupational diseases—and all are to be limited to such as might be occasioned in due course of employment. The present law specifically provides for compensation for two of these classes only and significantly omits any provision for compensation for the third class. Were this claim one that had accrued under the new law, the court could only construe the passage in dispute, in the light of the Constitution, as wholly excluding any compensation for injury by disease, whether occupational or otherwise. The Legislature would have been within its constitutional rights had it included the third class, and its failure to do so, under the circumstances, makes of it a case of designed omission."

The defendant relied upon the case of American Woodenware Mfg. Co. vs. Schorling (*Proceedings*, IV, 355) which the court stated was not relevant, for that case was within the Compensation Act. Since the plaintiff alleged freedom from fault and negligence of the defendant, the court ordered a new trial to determine these issues under the act for the prevention of occupational diseases.

SELF-INSURANCE:— (Bank of Los Banos et al. vs. Industrial Accident Commission, Supreme Court of California, 183 Pac. Rep. 538. The Workmen's Compensation Act provides: "Every employer as defined in section seven hereof, except the state and all political subdivisions or institutions thereof, shall secure the payment of compensation in one or more of the following ways:

"1. By insuring and keeping insured against liability to pay compensation in one or more insurance carriers duly authorized to write compensation insurance in this state.

"2 By securing from the commission a certificate of consent to self-insure, which may be given upon his furnishing proof satisfactory to the commission of ability to carry his own insurance and pay any compensation that may become due to his employe. The commission may, in its discretion, require such employer to deposit with the state treasurer a bond or securities approved by the commission, in an amount to be determined by the commission. Such certificate may be revoked at any time for good cause shown."

The application of the bank and its associated corporations for permission to self-insure was granted by the commission on condition that they deposit twenty thousand dollars in Liberty Bonds. The financial statement filed by the petitioners showed that they had a surplus of many millions of dollars, and they urged that they consequently be allowed to become self-insurers without a deposit of bonds, other security or any surety bond. Such a requirement, they contended, amounted to an abuse of discretion on the part of the Commission:

The court followed the line of reasoning of the United States Supreme Court in the case of New York Central R. R. Co. vs. White, 243 U. S. 188. Section 50 of the New York Workmen's Compensation Law was construed in that case as follows:

"We conclude that the prescribed scheme of compulsory compensation is not repugnant to the provisions of the Fourteenth Amendment (of the U.S. Constitution) and are brought to consider, next, the manner in which the employer is required to secure payment of the compensation. By section 50, this may be done in one of three ways. (a) State insurance; (b) insurance with an authorized insurance corporation or association; or (c) by a deposit of securities. The record shows that the railroad company chose the third method, and, with the sanction of the commission, deposited securities to the amount of \$300,000, under section 50, and \$30,000 in cash as a deposit to secure prompt and convenient payment, under section 25, with an agreement to make a further deposit if required. This was accompanied with a reservation of all contentions as to the invalidity of the act, and had not the effect of preventing plaintiff in error from raising the questions we have discussed.

"The system of compulsory compensation having been found to be within the power of the state, it is within the limits of permissible regulation, in aid of the system, to require the employer to furnish satisfactory proof of his financial ability to pay the compensation, and to deposit a reasonable amount of securities for that purpose. The third clause of section 50 has not been, and presumably will not be, construct so as to give an unbridled discretion to the commission; nor is it to be presumed that solvent employers will be prevented from becoming self-insurers on reasonable terms. No question is made but that the terms imposed upon this railroad company were reasonable in view of the magnitude of its operations, the number of its employes, and the amount of its payroll (about \$50,000,000 annually); hence no criticism of the practical effect of the third clause is suggested."

The decision that self-insurers must deposit security was also handed down in the case of Industrial Commision of Utah vs. Daly Mining Co., reviewed in the *Proceedings*, V, 103. In that case, the Supreme Court of Utah also relied upon the case of New York Central R. R. Co. vs. White.

Holding that the above section of the California statute is practically identical with Section 50 of the New York Law, the court dismissed the petition to review the action of the Commission. The court ruled that the Commission could require a deposit from self-insurers, and that the sum demanded in the instant case was reasonable in view of the large rumber of employees of the petitioners and the probability of frequent injuries.

DISMEMBERMENT:--(Addison vs. W. E. Wood Co., Supreme Court of Michigan, 174 N. W. Rep. 149.) The plaintiff (employee) received an injury to his leg which arose out of and in the course of his employment. He was paid ten dollars per week during his temporary total disability of fifty-four weeks, together with all medical expenses, by the defendant insurance company. His foot was then amputated, upon which the defendant company maintained that its total liability was the statutory compensation of 125 weeks for loss of a foot, dating from the date of the injury. The Industrial Accident Board, however, awarded the employee, in addition to what he had been paid, 125 weeks at \$10 weekly, dating from the date of the amputation.

The award for temporary total disability was made under section 9 below, and that for amputation under section 10, which includes

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various subparagraphs specifying compensation periods for amputations.

"First, dealing in the matter of compensation with the subject of total incapacity, without particularizing as to the nature of the injury, the Legislature provided:

""Sec. 9. While the incapacity for work resulting from the injury is total, the employer shall pay, or cause to be paid as hereinafter provided, to the injured employee a weekly compensation equal to one-half his average weekly wages, but not more than ten dollars nor less than four dollars a week; and in no case shall the period covered by such compensation be greater than five hundred weeks, exceed four thousand dollars."

"'Then, passing to the subject of partial incapacity, it further provided:

""Sec. 10. While the incapacity for work resulting from the injury is partial, the employer shall pay, or cause to be paid as hereinafter provided, to the injured employee a weekly compensation equal to one-half the difference between his average weekly wages before the injury and the average weekly wages which he is able to earn thereafter, but not more than ten dollars a week; and in no case shall the period covered by such compensation be greater than three hundred weeks from the date of the injury. In cases included by the following schedule the disability in each case shall be deemed to continue for the period specified, and the compensation so paid for such injury shall be as specified therein.""

The court affirmed the award of the Industrial Accident Board, by adopting an extremely liberal view of the statute, and one which is not generally recognized. An extract from the opinion follows:

"It is manifest that plaintiff's condition before amputation of his foot entitled him to weekly compensation from the date of his injury for continuing total incapacity under section 9. During that time he had lost no member, and section 10 had no application. Upon the amputation of his foot by a physician of his own selection, Addison's theretofore indeterminate total incapacity, only cognizable under the general provisions of section 9, took definite classification under a specific provision of the succeeding section (10), which is devoted to partial incapacity and specified compensation for loss of named members; the maximum period mentioned in said section being 300 weeks. His disability before that time entitled him to weekly compensation for total incapacity resulting from the accident, to be 'computed from the date of his injury.' It was so computed and paid as required by sections 3 and 9, to the maximum amount of weekly compensation authorized by the act, until amputation took place. Not until then was the loss of his foot an element in the case. Defendants did not and could not pay him weekly compensation up to that time for the loss of a member which he had not lost. After such loss his disability from the accidental injury resulting in incapacity for work concededly continued, but from that time came squarely under the schedule of losses in section 10."

"In case of an injury resulting in serious facial or head disfigurement the commission may in its discretion, make such award or compensation as it may deem proper and equitable, in view of the nature of the disfigurement, but not to exceed three thousand five hundred dollars."

In this case and two others, awards were made for disfigurement under this amendment, which were affirmed by the New York Court of Appeals. In each case, as the result of an injury arising out of and in the course of his employment, the employee received a serious facial or head disfigurement. For such disfigurement, in each case an award was made in addition to the award for compensation during temporary total disability.

The employers attacked the constitutionality of this amendment, upon the ground that it deprived them of property without due process of law. The court held that the amendment was constitutional and affirmed the judgments. The state can take into consideration any physical impairment due to the injury, and make an award therefore, irrespective of its effect upon the earning power of the injured employee. The state had full authority to determine whether awards for disfigurements were to be paid in one sum or in installments, either with or without compensation for temporary total disability.

During the course of its opinion, the court indicated an extremely liberal interpretation of the spirit of workmen's compensation laws. It expressly stated that awards may be made, although there is no reduction in the employee's earning power. Extracts from the opinion are:

"The argument (of the employer) is that an award for disfigurement, made wholly independent of claimant's inability to work, is not based upon impairment of earning power; that only such impairment can justify imposing upon an employer without fault compulsory payment by way of compensation to an injured workman; and hence that the 'disfigurement clause' is not a reasonable exercise of the police power, but is arbitrary and oppressive...

"Even were impairment of earning power the sole justification for imposing compulsory payment of workmen's compensation upon the employer in such cases, it would be sufficient answer to the present contention to say that a serious disfigurement of the face or head reasonably may be regarded as having a direct relation to the injured person's earning power, irrespective of its effect upon his mere capacity for work....

"But we cannot concede that impairment of earning power is the sole ground upon which compulsory compensation to injured workmen legitimately may be based. Unquestionably it is a rational basis, and it is adopted for the generality of cases by the New York law. But the New York Court of Appeals has construed the 1916 amendment as permitting an allowance for facial or head disfigurement although it does not impair the claimant's earning capacity. . . . In view of this, and there being no specific finding of such impairment in these cases, it is proper to say that in our opinion the 'due process of law' clause of the Fourteenth Amendment of the United States Constitution does not require the states to base compulsory compensation solely upon loss of earning power."

INJURY ON WAY TO EMPLOYMENT:--- (Starr Piano Co. vs. Industrial Accident Commission, Supreme Court of California, 184 Pac. Rep. 860.) The employer rented a floor in an office building. The employee was injured by falling into an elevator shaft while attempting to operate the elevator to reach his employer's floor. The employer petitioned the court to set aside the award of compensation. The elevator was under the control of the owner of the building, but the employee was operating it after office hours with the former's knowledge and consent. The court ruled that an employee, to be covered, need not have reached his place of employment, but must be seeking access to the employer's premises. The preceding proposition is consistent, in the court's view, with the established rule that if an employee is injured while on his way to work, the injury is not sustained in the course of his employment and he is consequently not covered. In affirming the award, the court wrote:

"If the employer were the owner of the building and the employee were injured on the elevator or stairs in reaching his place of work on a certain floor, it cannot be doubted that compensation

is payable under the statute. The employee has reached the employer's premises and is using a means of access specially provided for that very purpose. It would seem to follow that if the employer did not own the building, but rented it all, compensation would still be payable, even though the employer did not operate or control the elevator, or have the control or care of the stairs, but such operation, control and care remained with the owner of the building. The operation, control and care of the elevator and stairs in such a case would seem to be a matter wholly between the employer and the owner of the building. It would not enter as between employer and employee and would be entirely extraneous to the employment. As to the employee it would be a matter of indifference whether the elevator or stairs necessary for access to the spot where he is to work are by the employer's lease operated and controlled by the latter or by the owner of the building, provided only that they are in fact furnished so that access by the employee may be had. There would seem to be no reason for allowing compensation where the employer controls the elevator for instance, and refusing it where he does not, when the fact as to who controls it is extraneous to the employment and the theory upon which compensation is now allowed under the Workmen's Compensation Act is not, as before, that the employer, either directly or through some agency or instrumentality under his control, has been guilty of some breach of duty toward the employee. So far as the employee is concerned, the elevator or stairs are a special means of access furnished him to get to his place of work, and, in effect, furnished him by his employer. By the lease the tenant has the right as an appurtenance of the premises leased to the use of the elevator or stairs for the purpose of access, and, so far as the tenant's employees are concerned, the elevator and the stairs are, in effect, a part of the employer's premises."

DEPENDENCY:—(Cronin's Case, Supreme Judicial Court of Massachusetts, 124 N. E. Rep. 669.) One Cronin died from an injury arising out of and in the course of employment. Compensation was awarded to his only dependant, a minor son, of ten dollars weekly for four hundred weeks. The son became eighteen years old about a year later and the insurance company requested the suspension of all payments for the reason that the son was now self-supporting.

The court held that the compensation must be paid in accordance with the award, even though the son had become self-supporting. Bott's Case, mentioned in the extract below, was reviewed in the *Proceedings*, V, 105.

"The only question is whether the insurer is entitled to be

relieved from the payments which it had agreed to make. The dependent at the time of the agreement was 'conclusively presumed to be wholly dependent for support' on the father. . . . Such dependency was created by the statute as of the time of the injury, and the amount payable, within defined limits, was controlled by the statute. . . Where dependency, as in this case, is not to be determined as a question of fact, but exists by virtue of the statute, it is not affected by the wealth or poverty of the dependent. Bott's Case, 119 N. E. 755. In Bott's Case, it was held that the remarriage of the dependent widow to one from whom she received ample support did not terminate her right of compensation. This is decisive. There is no distinction between a widow conclusively deemed to be dependent, and a son as to whom the same conclusive statutory presumption exists."

SUBROGATION :--- (Black vs. Chicago Great Western R. R. Co., Supreme Court of Iowa, 174 N. W. Rep. 774.) The Iowa Statute provides:

"Where an employee coming under the provisions of this act receives an injury for which compensation is payable under this act and which injury was caused under circumstances creating a legal liability in some person other than the employer, to pay damages in respect thereof:

"(a) Proceedings Against Both Parties. The employee or beneficiary may take proceedings both against that person to recover damages and against the employer for compensation, but the amount of the compensation to which he is entitled under this act shall be reduced by the amount of damages recovered.

"(b) Indemnity—Subrogation. If the employee or beneficiary in such case recovers compensation under this act, the employer by whom the compensation was paid or the party who has been called upon to pay the compensation, shall be entitled to indemnity from the person so liable to pay damages as aforesaid, and shall be subrogated to the rights of the employee to recover therefor."

The plaintiff (Black) while in the employ of a trucking company, was injured through the negligence of the defendant railroad. He received from his employer compensation of \$378 under the Workmen's Compensation Act. Thereafter he sued the defendant at common law for damages and secured a judgment of over \$7,000. Upon appeal, the defendant maintained that the plaintiff's employer, by paying him compensation, became completely subrogated to the plaintiff's right to sue and that consequently the plaintiff is not entitled to sue the defendant.

The court held that the acceptance of compensation by the em-

ployee did not have the effect of a full assignment of his right to sue to the employer, so that the latter could stand in the employee's shoes. The right to compensation arose out of the relationship of employer and employee; the right to sue arose out of the negligent act of the wrongdoer toward the injured party. The employer should be joined with the employee in bringing the suit, so that the former could be reimbursed only to the amount of compensation paid by him.

The court affirmed the judgment, and construed the above statute in the following extract:

"The amount of the recovery for tort (at common law) might be in a greater amount than the compensation fixed by the statute, since there may be other elements of damage allowed in an action for tort, as, for instance, pain and suffering, etc. It is true, as argued by defendant, that there may not be a double recovery by plaintiff by receiving compensation, and recovering damages, in the sense that plaintiff may receive both, for his own benefit. But he recovers full compensation in the action for damages, but the employer is subrogated to the rights of plaintiff to the extent of the amount of compensation paid by the employer, if, as in the instant case, the compensation is less than the damages recovered. He may recover both, but subject to the right of the employer to be indemnified for the amount paid. This is doubtless one object of the statute, to prevent a double recovery, and another purpose is to provide indemnity to the employer, and allow him to be subrogated to that extent. It may be that a proper construction of subdivision 'a' of the statute cited is that the amount of the compensation is to be reduced by the amount of damages recovered, in a case where the damages recovered are less than the compensation. In the instant case compensation was much less than the damages, so that paragraph 'b' of the statute applies. Under this last provision of the statute, the employer is entitled to be subrogated."

Two EMPLOYERS:—(King's Case, Supreme Judicial Court of Massachusetts, 125 N. E. Rep. 153.) King was employed by a printing company throughout the week. On Saturday nights, for the twelve months preceding his death, he had been employed by a newspaper company, from whom he received \$9.20 for each night's work. He received a fatal injury while employed by the newspaper company. The question for determination was whether compensation should be based upon the wage he received from the newspaper company or upon the wage (\$31.52) earned by a person in the same grade employed at the same work by the same employer.

The Industrial Accident Board awarded compensation upon the latter basis, amounting to ten dollars weekly for four hundred weeks. The court, however, reduced the compensation to \$6.13 (being two-thirds of \$9.20) for the same period of time. The court recognizes the sound underwriting principle that the payroll should be the measure of liability of the insurance company; claims should be settled in accordance with the premium collected upon the payroll, which in this case was not \$31.52 but only \$9.20. The Massachusetts act does not provide for compensation founded upon concurrent employment with two or more employers. During its opinion, the court wrote:

"Nor were the nature and terms of his employment of such a character as to render the computation of the compensation impracticable. He was regularly employed by the Newspaper Company, his wages were established, and for each Saturday night's work he received a fixed sum. The amount earned by an employee in a particular employment should govern in all cases, in computing the compensation to be paid under the Workmen's Compensation Act unless the computation becomes impracticable; and the wages which determine the compensation, with the exceptions referred to, are the wages earned in the employment where the injury happens. The cost of the insurance to the employer is determined by the wages of the employees received in this employment, and it is to be presumed that this is shown by the payroll."

STREET RISKS:—(Moran's Case, Supreme Judicial Court of Massachusetts, 125 N. E. Rep. 591.) The deceased was employed as a solicitor and collector by a life insurance company. Leaving his home one evening, he was fatally injured by a street car while running across the street to catch a car. He had received instructions from his superior to perform certain work that evening, which necessitated his traveling on the street cars. The question at issue was whether his injury was not due to street risks to which the traveling public are continuously exposed. If so, no compensation would be payable.

The court held that the injury arose in the course of the employment and affirmed the award of compensation. The court concluded its opinion as follows:

#### LEGAL NOTES.

"In the case at bar, the workman to do the work of his employment must continually stand in danger of receiving an injury from accidents resulting from exposure to whatever risks and hazards are commonly attendant on the use of public streets and conveyances; which risks to him are greater because more constant than those that are incidental to the occasional and casual use of such streets by persons who use them in the ordinary way. We are of opinion that the risk and hazard of the decedent's employment were not too remote in their causative relation to the employment."

# MISCELIANEOUS.

INTERNAL REVENUE: --- (Maryland Casualty Co. vs. United States, United States Supreme Court, 40 Sup. Ct. Rep. 155.) The United States collected from the claimant company an excise tax for 1909, 1910, 1911, 1912 and the first two months of 1913 and an income tax for the balance of that year. 'This suit was brought by claimant for payments which it asserts were unlawfully collected.

The Excise Tax Act of 1909 requires every insurance corporation "to pay anually a special excise tax with respect to the carrying on or doing business . . . equivalent to one per centum upon the entire net income . . . received by it from all sources during such year."

The Income Tax Act of 1913 provides that the tax shall be levied upon the "entire net income arising or accruing from all sources during the preceding calendar year," also defining gross income as that "received within the year from all sources." It is clear that under both Acts, Congress intended that the tax should be levied upon income "received" during the year.

The agency contracts allowed agents an extension of thirty days in which to remit, on the fifth day of each calendar month. Thus the premiums on November issues were not remitted to the home office of the company until January 5th, and likewise December issues until February 5th. The company's contention was that only premiums which had been paid to its treasurer within the calendar year could rightly be charged as net income "received by it . . . during each year." This construction would permit it to exclude from the gross income the ledger item "premiums in course of collection by agents, not reported December 31st" which ranged in the various years mentioned from half a million to a million dollars. While the amount, if deducted in one year, might appear in the following, yet the tax rate might be different. The government contended that the total written premiums were to be taxed, whether collected or not.

On this first question, the court held "that the claimant should have returned, not all premiums written by it, but all which were actually received by it during the year and that receipt by its agents was receipt by the company, within the meaning of the act of Congress."

Both the Excise and Income Tax Acts provide that "the net addition, if any, required by law to be made within the year to reserve funds" may be deducted from the gross income in order to arrive at the net income. The court aproved the company's practice of deducting from gross income the increase over the preceding year of "reserve for unearned premiums," "special reserve for unpaid liability losses," and "loss claims reserve." Concerning the last item, the court stated:

"This 'loss claims reserve' was intended to provide for the liquidation of claims for unsettled losses (other than those provided for by the reserve for liability losses) which had accrued at the end of the tax year for which the return was made and the reserve computed. The finding that the insurance department of Pennsylvania, pursuant to statute, has at all times since and including 1909 required claimant to keep on hand, as a condition of doing business in that state, 'assets as reserves sufficient to cover outstanding losses,' justifies the deduction of this reserve as one required by law to be maintained, and the holding that it should have been allowed for all of the years involved is approved."

The next question involved the interpretation of the term "reserve." The company claimed deductions from gross income of reserves for "unpaid taxes, salaries, brokerage and reinsurance due other companies," by reason of requirements of several insurance departments that it maintain assets as reserves to cover these items. The court did not approve these deductions, on the ground that the term "reserve" was used in its technical sense in the Excise and Income Tax Acts, while it was used in a non-technical sense in the insurance department rules. Furthermore, the court pointed out that these acts permit the deduction of these expenses from income if paid during the year. Quoting from the opinion:

"The term 'reserve' or 'reserves' has a special meaning in the law of insurance. While its scope varies under different laws, in general it means a sum of money, variously computed or estimated, which, with accretions from interest, is set aside—' reserved '—as a fund with which to mature or liquidate, either by payment or reinsurance with other companies, future unaccrued and contingent claims, and claims accrued, but contingent and indefinite as to amount or time of payment.

"In this case, as we have seen, the term includes 'unearned premium reserve' to meet future liabilities on policies, 'liability reserve' to satisfy claims, indefinite in amount and as to time of payment, but accrued on liability and workmen's compensation policies, and 'reserve for loss claims' accrued on policies other than those provided for in the 'liability reserve,' but it has nowhere been held that 'reserve' in this technical sense, must be maintained to provide for the ordinary running expenses of a business, definite in amount and which must be currently paid by every company from its income if its business is to continue, such as taxes, salaries, reinsurance, and unpaid brokerage."

During 1913 the unpaid liability loss reserve decreased by \$270,-000, which the government added to claimant's gross income for that year. The court held that it was not taxable as income, since the decrease had not been released for the general uses of the claimant (company). The court wrote in this connection:

"The findings of fact in this case, however, do not show that the diminution in the amount of required reserves was due to excessive reserves in prior years or to any other cause by which the free assets of the company were increased in the year 1913, and the following finding of facts makes strongly against such a conclusion:

"'The decrease in employers' liability loss reserve for 1913, designated as 'released reserve' did not in any respect affect or change claimant's gross income or disbursements, as shown by the state insurance reports.'

"It would not be difficult to suggest conditions under which the statutory permit to deduct net additions to reserve funds would result in double deduction in favor of an insurance company, but such deductions can be restored to income again only where it is clearly shown that subsequent business conditions have released the amount of them to the free beneficial use of the company in a real, and not in a mere bookkeeping sense. If this seemingly favorable treatment of insurance companies is to be otherwise corrected or changed, it is for Congress, and not for the courts, to amend the law.

"Since the findings of fact before us do not make the clear showing, which must be required, that the statutory deduction of net reserves in prior years was restored to the free use of the claimant in 1913, it should not have been charged as income with the decrease in that year." The statute provided that suit must be brought within two years from the time the cause of action accrued, and the court holds that this statute of limitations bars the claimant from any recovery for taxes illegally collected for the years 1909, 1910, 1911 and 1912. The time to sue was not extended by the action of the claimant in filing amended returns with the Commissioner of Internal Revenue, to whom the company failed to appeal for relief, although this was essential.

"To indemnify the assured for all loss by burglary occasioned by the abstraction of any of such property from the interior of any safe or vault described in the declarations and located in the assured's premises, by any person or persons making felonious entry into such safe or vault by actual force and violence of which force and violence there shall be visible marks made upon such safe or vault by tools, explosives, chemicals or electricity."

The policy also provided for no liability in the following event:

"Nor unless all vault, safe and chest doors are properly closed, and locked by a combination or time lock at the time of the loss or damage; nor if effected by opening the door of any vault, safe or chest by the use of a key or by the manipulation of any lock."

Burglars opened the outer door of the plaintiff's safe by manipulating the lock, which would have come within the exception of the policy quoted in the previous clause. The lock of the inner door, however, was broken by a hammer, of which there were visible marks, which would bring the case under the insuring clause.

The defendant company argued that it was not sufficient that there had been forcible entry through the inner door, that it was also required through the outer door. It quoted in authority of its position Blank vs. National Surety Co. (*Proceedings, IV, 363*), in which case there was no inner door in the safe but only wooden drawers broken. The court consequently distinguished the instant case from the Blank case, the facts and the policy being different.

The court felt that the evidence of force upon the inner door was sufficient to establish the liability of the insurer and handed down judgment for the plaintiff. The theory of the decision appears to be that since the plaintiff's claim did not clearly come under the exclusion, the defendant is liable, as is shown by the following extract from the opinion:

"The policy is not quite clear. The rule of construction favors the insured and resolves ambiguities against the insurer. It was proper, and not difficult, to write a policy making a forcibly entry through the outside door attended by visible marks a prerequisite of liability. If the insurance company intended to offer the plaintiff such a policy it could have made its meaning sufficiently clear by the use of a few apt words; and, wishing its liability thus limited, it should have done so."

# Abstract of the Discussion of the Papers Read at the Previous Meeting.

# UPON COMBINING COMPENSATION EXPERIENCE FROM SEVERAL STATES-WINFIELD W. GREENE.

#### VOL. VI, PAGE 10.

#### WRITTEN DISCUSSION.

#### MR. E. H. DOWNEY:

Mr. Greene's paper deals with the method of combining compensation pure premium experience had under different scales of benefits. As a contribution to the technique of experience differentials the paper is wholly admirable. Mr. Mowbray and others have discussed the technical aspects of this subject. What follows will relate to the fundamental fallacies of any method of experience law differentials.

The underlying thought of the experience differential is that the experience of a single jurisdiction of any considerable size is sufficient to indicate the general rate level for that jurisdiction, but that the experience of many states is necessary to establish the proper relationship between industry classification rates. The general rate level is a matter of total premium income; classification rates are a matter of premium distribution by industries. In the full-blown application of this method, the experience of Pennsylvania would determine that the aggregate rates for Pennsylvania shall be to the aggregate rates for New York (assuming the same industry distribution of insured payrolls) as .65 to 1.00; whereas the absolute Pennsylvania rate for any given classification will be determined, not by Pennsylvania experience, but by the combined experience of many states. Loss experience for this purpose is combined by means of conversion multipliers obtained by the now familiar methods of pure premium comparison. These conversion multipliers represent, not the actually experienced pure premium ratios of particular classification, but the weighted average (or aggregate) ratio for a large number of classifications.

The fundamental fallacy of this procedure resides in its underlying assumptions. The procedure will be valid only if, and insofar as, a uniform relationship between pure premiums can be predicated of the several classifications which are so treated as a unity for the purpose of deriving the conversion multiplier. It so happens,

#### DISCUSSION.

however, that the pure premium ratios as between any two jurisdictions are not the same for any two industries. Nor are these divergent ratios a matter of accident: they depend upon inherent causes which no mathematical jugglery can overcome. No two scales of benefits stand in constant relationship for the several degrees of injury and no two industries present the same severity distribution of injuries. As between New York and Pennsylvania, e.g., taking benefits and wages at the level of 1917, the conversion multipliers should be approximately as follows: For deaths 1.40, for permanent totals 4.00, for loss of arm 2.30, for loss of hand 2.20, for loss of eye 1.64, for loss of fingers 2.50, for temporary dis-

## TABLE I.

#### FREQUENCY DISTRIBUTION OF INJURIES.

		Pure Pre-	No. of Comp. Acci-	Number of Specified Injuries per 1,000 Comp. Accidents.				
Industry.	Payro'l (000 Pre- omit.ed). mium.				Ē	Loss of		
		dents	Death	Maj. Pe	Hand.	Foot.	Eye.	
1 2		3	4	5	6	7	8	9
All industries Anthracite mining Bituminous mining Quarrying All manufacturing Baking Blast furnaces Rolling mills Steel foundries Machine shops Planing mills Glass ware mfg CarpentryN.O.C. Concrete construction Iron erection Drivers	\$2,724,709 43,661 263,689 25,249 1,163,432 14,980 10,410 77,561 20,335 34,690 93,751 12,333 24,123 15,854 18,488 6,768 44,159	\$.73 2.76 1.83 2.00 .60 .71 1.64 83 1.20 .89 .67 1.00 28 1.62 1.50 3.30 .80	$\begin{array}{c} 88,234\\ 3,931\\ 17,778\\ 1,663\\ 38,840\\ 537\\ 612\\ 2,991\\ 1,047\\ 1,906\\ 3,507\\ 679\\ 428\\ 1,013\\ 1,034\\ 640\\ 2,139\end{array}$	$\begin{array}{c} 30 \\ 67 \\ 41 \\ 16 \\ 60 \\ 20 \\ 30 \\ 15 \\ 11 \\ 15 \\ 2 \\ 19 \\ 37 \\ 70 \\ 24 \end{array}$	$\begin{array}{r} 23\\ 24\\ 23\\ 39\\ 24\\ 40\\ 15\\ 18\\ 24\\ 16\\ 27\\ 25\\ 35\\ 12\\ \end{array}$	$\begin{array}{c} 7 \\ 5 \\ 6 \\ 10 \\ 33 \\ 5 \\ 6 \\ 6 \\ 3 \\ 8 \\ 20 \\ 7 \\ 8 \\ 6 \\ 14 \\ 4 \end{array}$	$\begin{array}{r} 3 & 6 & 6 \\ 10 & 2 & 5 \\ 3 & 4 & 2 & 1 \\ 1 & 2 & 6 & 6 \\ 7 & 2 \end{array}$	$\begin{array}{c} 12\\ 10\\ 10\\ 23\\ 12\\ 3\\ 5\\ 9\\ 13\\ 9\\ 17\\ 6\\ 16\\ 9\\ 12\\ 12\\ 4\\ \end{array}$

Pennsylvania Schedule Z, Policy Years 1916 and 1917.

abilities 1.50. Even these ratios vary with wage levels and consequently are not the same for the building trades as for candy making, nor are they the same for 1919 as for 1917. What makes these differences important from the present standpoint is the extremely variable severity distribution of injuries. Deaths range from one in fifteen compensable accidents for iron erection to one in four hundred for glassware manufacturing; major permanents are one-third the number of deaths in anthracite mining and five times the number of deaths in laundries; lost eyes are sixty per cent. of all major permanents in quarrying, and fifty to sixty per cent. in foundries and machine shops whereas lost hands are sixty to seventy per cent. of all major permanents in bakeries, laundries and printing establishments (See Table I). Minor permanents are an insignificant fraction of pure premium in blast furnaces, rolling mills, foundaries and machine shops but they play an important rôle in the losses of planing mills, paper box factories and sheet metal works.

The severity distribution of injuries being thus dissimilar, and the several scales of compensation disparite, it follows that no conversion multiplier which is true for planing mills can be true for machine shops and that no average conversion multiplier will hold good for any specific industry. The use of conversion multipliers, however derived, distorts the classification pure premiums for every state (See Table II). The error may be reduced by refined analysis but no refinement upon a wrong method can reach the fundamental source of error. If pure premiums be broken up into death and permanent total, major permanent, minor permanent, temporary and medical, the several fractional conversion multipliers will distort the classification experience less than the total multiplier, yet considerable distortion will remain, particularly in respect to death and permanent total disability benefits, major permanent disability benefits and medical benefits. The distortion is further reduced by computing separate conversion multipliers for broad industry divisions, but only at the cost of narrowing the basis of comparison and magnifying the influence of chance deviations. Obviously an experience differential derived from a very limited exposure is utterly unreliable. But the calculators of experience differentials must steer between Seylla and Charybdas: either their industry groups are a heterogeneous hodge-podge-like the "outdoor," "in-door" and "loft" industries of the National Council in the 1920 rate revision-or the statistical basis is too narrow to produce a dependable average. Really homogeneous industry groups are scarcely broader than individual classifications and a separate experience differential for each classification is a reductio ad absurdum. The attempt to enlarge the experience of a single state without altering its quality is analogous to the famous feat of the gentleman who lifted himself over the fence by his own bootstraps.

Mr. Greene's formula does not touch this fundamental defect of experience differentials. It is a method, simply, of correcting the aggregate, or average coversion multiplier for the state's experience as a whole, or for that segment of the state's experience which is treated as an entity for the purpose in hand. As such, the formula is equally applicable to total or fractional multipliers; it will reproduce the losses of the given state with equal fidelity whether taken *in toto*, or divided into partial pure premiums by severity of injury. What the method overlooks is that rates are

#### DISCUSSION.

made by classifications, and not for industry as a whole. It is not enough that the general level of rates shall correspond to a reasonable loss ratio; the rate for each industry must be, so far as possible, both reasonable and adequate. No method which produces unreasonable results for specific industries, however well balanced in the

# TABLE II.

COMPARISON OF PENNSYLVANIA PUEE PREMIUMS, SCHEDULE Z, POLICY YEARS 1916 AND 1917, WITH NATIONAL COUNCIL PURE PREMIUMS CONVERTED TO PENNSYLVANIA LEVEL OF BENEFITS.

	Раз	Toll.	"All o Pure Pi	Devia-	
Industry.	Penna. (000 onlitted).	Natl. Coun- cil (000 omitted).	Penna.	N. C. Con- verted to Penna.	tion in Per Cent. of Penna. P. P.
1	2	. 3	4	5	6
Quarries—N.O.C. Baking Wool spinning and weaving Fur hat mfg. Laundries—N.O.C. Planing mills Paper mfg.—N.O.C. Printing Blast furnaces. Steel foundries. Iron foundries. Machine shops. Cement mfg. Masonry—N.O.C. Drivers. Garages.	\$ 8,470 14,980 35,273 5,015 8,303 8,403 5,683 28,386 10,410 14,547 34,690 75,441 10,705 10,715 44,159 20,491	\$ 25,674 72,284 191,078 31,857 49,007 56,084 38,104 134,325 13,805 25,410 94,401 314,545 19,262 50,227 213,022 146,506	\$.70 .29 .13 .12 .35 .41 .20 .14 .32 .35 .29 .22 .27 .38 .27 .20	\$.62 .25 .11 .06 .20 .43 .28 .12 .43 .37 .28 .23 .31 .48 .26 .17	$\begin{array}{c} -10 \\ -17 \\ -15 \\ -50 \\ -43 \\ +05 \\ +40 \\ -14 \\ +33 \\ +06 \\ -03 \\ +05 \\ +15 \\ +26 \\ +04 \\ -15 \end{array}$

aggregate, will suffice for sound rate making. It is at precisely this point that the experience differential fails. The whole attempt to distinguish between general rate level and classification rates is fundamentally fallacious. The general rate level is produced by the classification rates and will be accurate just in so far as the classification rates are accurate.

The need of combining classification experience from different states arises only in respect to those classifications for which the experience of the given state is insufficient to afford a dependable rate indication. Such combination can proceed only upon the assumption that the industry covered by the classification is substantially homegeneous in the several states whose experience is to be combined—i. e., that the number and severity of injuries per million of payroll would be the same in all these states if the exposure were broad enough to produce a dependable average. If

this assumption be invalid, the combination is wholly illicit and no sleight of hand, whether by experience differentials or otherwise, will remedy the evil. Given, from Pennsylvania Schedule Z, \$10,-000,000 of payroll in Paper Mfg., with 21 deaths, 4 major permanents, and 360 temporary disabilities, the problem to be solved in rate projection is whether this number and this distribution of injuries per unit of exposure are normal to the industry. A convincing answer to this question can be obtained only by comparing the experience reported for Pennsylvania with the experience of the same industry in other states. Massachusetts experience is not appropriate for this purpose because paper making in Massachusetts and in Pennsylvania are quite dissimilar. The experience of New York and Wisconsin, on the other hand, is known to be fairly comparable with that of Pennsylvania. If, then, the combined experience of these three states for the policy years 1916 and 1917 shows \$40,000,000 of payroll, with 60 death, 50 major permanents and 1500 temporary compensatable disabilities, we have a reasonably adequate basis for the determination of the accident severity rate of that industry per million of payroll at the then wage level.

The next step is to pass from accident severity rates to pure Here nothing short of individual valuation of accipremiums. dents will serve the turn. An average value of death benefits will not answer, because the number of deaths in the Pennsylvania experience (21) is not sufficient to give a reliable average. To assume that the average cost of deaths in paper making is the same as for manufacturing industries as a whole, or is identical with the average for any other industry group, is to beg the very question at issue. It is only because Pennsylvania experience is deficient that it required to be supplemented by the experience of other states; this deficiency is not confined to fatality rates but extends as well, and even more emphatically, to the wage and dependency distribution. Whence it follows that a reasonable estimate of death pure premium can be obtained only by applying the Pennsylvania death benefits to individual death reports. Still less can permanent total and major permanent disability pure premiums be converted from one scale of benefits to another by any species of multiplier applied to monetary losses. Here again the very question to be solved is the frequency distribution of major permanents by part of body affected, and here also the only method of valuation which is even approximately accurate is to apply Pennsylvania benefits to the individual accidents as reported for each state. Minor permanents and temporaries can be valued en masse, but only when distributed into wage and duration groups for the specific industry, which also can be conveniently done only from cards punched from individual accident reports. Medical benefits, lastly, as between different jurisdictions, are affected by varying time and monetary limits which impinge unequally upon different industries. As between New York and Pennsylvania, e.g., the medical multiplier is not

the same in the building trades as for clothing manufacturing, nor is it the same for house carpentry and iron erection. The low limits of the Pennsylvania law affect most markedly the severe injuries and the ratio of Pennsylvania to New York benefits is inversely proportionate to the frequency of these injuries. For this reason a dependable translation of medical benefits necessitates a distribution of medical aid cases by monetary amounts, which in turn requires an individual card analysis. It is often the case, of course, as in the instance cited of Paper Mfg. in Pennsylvania, that the experience of the given state in the given industry is ample in respect to medical and temporary disability benefits and requires to be supplemented only in respect to death and permanent disability benefits. In such cases combined experience need be used only for the death and permanent disability pure premiums, which course. will notably lessen the labor of conversion. But wherever loss experience is to be combined at all, only individual valuation of claims will yield defensible results. If it be objured that the procedure will entail much labor, the answer is that Providence has provided no royal road to statistics.

If the foregoing contentions be sound, the experience differential is in the nature of a makeshift: an attempt to evade the necessity of statistical analysis and to substitute mathematical hocus-pocus for knowledge of facts. All this is not to be-little the efforts of those who have labored to perfect the mechanism of pure premium conversion. Much progress has been made since the first crude application of experience differentials by the Pennsylvania Bureau in 1918 and present methods represent an immence advance over the flat theoretical law differential of unhallowed memory. The time has come, however, after nine years' experience with compensation insurance, to develop an actual statistical basis for rate making.

#### MR. H. C. CARVER:

In a valuable contribution to our Society, Mr. Greene has called attention to the fact that conversion factors may quite readily be calculated by imposing the condition that the expected and actual losses, for representative classifications of the basis state must be equal.

Representing in general terms the payrolls and actual losses for the basis state by  $P_b$  and  $L_b$ , and by  $P_a$  and  $L_a$ , the corresponding items for the additional state, the above condition requires that

(1) 
$$\Sigma P_b \frac{L_b + EL_a}{P_a + P_b} = \Sigma L_b,$$

which can be reduced to

(2) 
$$\Sigma \frac{EL_a P_b}{P_a + P_b} = \Sigma \frac{L_b P_a}{P_a + P_b},$$

and if E can be considered a constant for the group of classifications to which  $\Sigma$  refers, we have

(3)  $E = \frac{\Sigma \frac{L_b P_a}{P_a + P_b}}{\Sigma \frac{L_a P_b}{P_a + P_b}}.$ 

Although a comparison of the actual and expected losses obtained by using Mr. Greene's method of approximating the value of E defined by equation (3) has appeared slightly unsatisfactory to Mr. Downey, I cannot but help believing that Mr. Greene's formula (2) can produce wonderfully satisfactory results if we do not impose the condition that E is a constant.

The results of Table I indicate that E is a function of the class hazard rather than a constant which, for a specified kind of injury, is common to any one broad group of industrial classifications.

TABLE	I,
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"ALL OTHER LOSSES."

Pure Premium Group.	Classifications in Groups.	Indicated N. Υ. p.p. Π <sub>δ</sub> .	E N.YBasic State PennaAddi- tional State.
1 2 3 4 5 6 7 8	$\begin{array}{c} 8028,\ 8000,\ 8016,\ 9071\\ 9050,\ 2623,\ 3808,\ 8003\\ 7205,\ 5380,\ 8380,\ 2121\\ 3632,\ 2000,\ 5183,\ 5602\\ 8222,\ 6042,\ 3864,\ 2803\\ 2730,\ 6220,\ 5500,\ 7219\\ 5022,\ 5160,\ 2760,\ 4234\\ 5401,\ 2702,\ 5204,\ 5545,\ 5474\\ \end{array}$	.0025 .2550 .5075 .75-1.00 1.00-1.25 1.25-1.50 1.50-2.00 over 2.00	$\begin{array}{r} 4.09\\ 3.20\\ 2.40\\ 3.34\\ 3.52\\ 3.63\\ 4.69\\ 4.50\end{array}$

The values of E were calculated by using formula (3).

It appears to me that the high values of  $\vec{E}$  for the low premium classifications can be accounted for by the fact that Pennsylvania does not provide for minor dismemberments in 306 C of the act.

Although we might assume that  $E = f(\Pi_b)$  for a limited region could be represented approximately by a parabola, better results can be arrived at, and more easily, by considering that the relation is linear for each of the regions  $\Pi_b = 0$  to .50, and .50 to 2.00, and therafter constant. Placing, therefore,

$$E = a + b \Pi_b,$$

equation (2) becomes

(4) 
$$a\Sigma \frac{L_a P_b}{P_a + P_b} + b\Sigma \frac{L_a L_b}{P_a + P_b} = \Sigma \frac{L_b P_a}{P_a + P_b}.$$

DISCUSSION.

Using the method of averages for the zone  $\Pi_b = 0$  to .50 we obtain from groups 1 and 2 of Table I the equations,

23463a + 5009b = 95855,

$$27780a + 10481b = 88808$$

and from the groups

7205, 3632, 2000, 6042, and

2730, 5022, 4234, 5401

the equations,

385280a + 100347b = 124101

251103a + 115535b = 53483.

From these we may deduce

TABLE II.

Пь.	E.	$\Pi_a = \frac{\Pi_b}{E}.$	п,.	E.	$\Pi_a = \frac{\Pi_b}{E}.$
$\begin{array}{c} 0 \\ 5 \\ 10 \\ 15 \\ 20 \\ 25 \\ 30 \\ 35 \\ 40 \\ 45 \end{array}$	5.2 5.0 4.7 4.4 3.9 3.6 3.3 8.1 2.8	$\begin{array}{c} .00\\ .01\\ .02\\ .03\\ .05\\ .06\\ .08\\ .10\\ .13\\ .16\end{array}$	.50 .60 .70 .80 .90 1.00 1.25 1.50 1.75 2.00 and over	2.7 2.9 3.0 3.1 3.2 3.3 3.6 3.9 4.2 4.5	.18 .21 .24 .26 .28 .30 .34 .38 .42 .44 and over

This table, based upon the experience of only a few classifications will enable one to read off the "expected" reduction factors from either  $\Pi_b$  or  $\Pi_a$ .

## EXAMPLE I.

From classification 8028, of Group III, we have,  $P_b = 323540$ ,  $P_a = 575140$ ,

$$L_b = 64773, \quad L_a = 28941,$$

 $\Pi_b = .20, \qquad \Pi_a = .50,$ 

and from Table II, we see that taking either  $\Pi_b$  or  $\Pi_a$  as a criterion

$$E = 4.2.$$

DISCUSSION.

EXAMPLE II.

Classification 5022, Group I.

 $P_b = 50770, P_a = 107150,$   $L_b = 98900, L_a = 40937,$  $\Pi_b = 1.95, \Pi_a = .38,$ 

Using  $\Pi_b$  and  $\Pi_a$ , in order, we have the two indicated values for E, 4.5 and 3.9 respectively. Weighting these according to payroll, i.e., 2 to 1, we have

E = 4.3.

## EXAMPLE III.

Classification 3631, Group II.

$$P_b = 14930, P_a = 143410,$$
  
 $L_b = 14482, L_a = 77579,$   
 $\Pi_b = .97, \Pi_a = .54;$ 

 $\therefore E$  is weighted between 3.3 and 4.5, i.e., 4.4.

Although a test over a large number of classifications shows that this modification of Mr. Greene's formula produces in the majority of cases smaller differences between the actual and expected losses, I believe its greatest value lies in its ability to project pure premiums.

Of course, discrepancies between values of E, as determined by  $\Pi_b$ and  $\Pi_a$  are bound to occur, due to a limited exposure, but by the use of weights whenever necessary, the total reduced losses from all states and therefore the basic pure premiums, ought to be very dependable for a large number of our classifications. Then, since values of

$$E = f(\Pi_b)$$

can be calculated from the classifications having the largest exposure, we may project the basic pure premiums, retaining a maximum amount of accuracy and dependability. Of course, in projection, values of E should be determined from a consideration of the basic pure premium only.

It seems to me that Mr. Greene's method of attack is exceedingly direct and logical, but that by giving E a little more freedom, better results can be obtained.

#### ORAL DISCUSSION.

### MR. H. E. RYAN:

Anything from the pen of Dr. Downey must be read with more than ordinary interest. Dr. Downey generally has something to say and he says it in such a manner that it can rarely be misunderstood. It has occurred to me on several occasions, in noting the apparent intolerance on Dr. Downey's part of methods which introduce the higher mathematics, that perhaps after all, the major difference between himself and those with whom he finds it difficult to be at peace may be due in large measure to the fact that Dr. Downey views things from the statistical rather than from the actuarial standpoint.

I must say that I am not inclined to be amused at Dr. Downey's newly-coined expression "mathematical hocus-pocus." It gives me very much the same feeling that the rather too frequent use of the word "conjectural" gives, when applied to estimates according to mathematical methods and reasoning of qualities which by their very nature must be estimated when the statistical material necessary for exact measurement is lacking. I equally condemn pure conjecture. When the actuary calculates the net premium for a joint and survivorship annuity, he might be accused of embarking upon the field of conjecture, and if the actual experience should not coincide with the assumptions underlying the calculation, I suppose he might even be accused of having employed "mathematical hocuspocus."

It seems a little unfair to criticize in such terms a genuine endeavor to reach, by mathematical reasoning, a solution to a problem for which there is no precise answer. Dr. Downey seems to find fault with us because we do not accomplish all of our results by the laborious processes of long-hand arithmetic. By the same token, it may be that he would have little faith in the calculated value of the net premium for say, a whole life policy, unless perchance it were arrived at by discounting, with mortality and interest, the successive annual claim payments and the corresponding premium contributions. This was the method in vogue before the invention of commutation columns, but now fortunately, by means of that very useful artifice, it is possible to produce the desired result with the minimum of mathematical labor.

There are, it is true, times when the use of actuarial short cuts tends to obscure the successive stages involved in obtaining a given result. For this reason, it is highly desirable that results reached by such means should be unscrambled and thoroughly explained. Is it fair, however, to intimate that actuarial short cuts obscure the results themselves? I am sure that to this proposition actuaries will not agree but they may have some difficulty in winning over to their point of view statisticians trained along traditional lines whose acquaintance with the actuarial method of analysis may not happen to be particularly close. Conjecture and mathematical hocus-pocus are not of the essence of actuarial science.

#### MR. S. B. PERKINS:

With regard to the criticism of Mr. Greene's paper, which has just been submitted (Discussion by Mr. Downey), it occurs to me that there is one fact which should be emphasized at this time. The point has been raised, and has been exceptionally well taken, that the distribution of accidents of a particular industry in a given state should be the basis of rate making for that classification and state.

The intimation is, however, that a single distribution of accidents is being used for all classifications in all states by the National Council. The fact is that, wherever a classification in any state has a sufficient amount of experience to be indicative, it is being rated on its own experience wherever that experience differs from the combined experience, and in this manner the accident distribution for that classification in the state in question is being given primary consideration. As a matter of fact, Mr. Greene's formula and method were originally devised, in my estimation, as a means of combining the experience for all states for those classifications which did not produce enough experience in any individual state to be indicative and has proved to be an admirable solution to that particular problem.

To carry out the idea of individual classification accident distribution to its logical conclusion, an accident distribution would have to be obtained from the experience of each classification for each state. It is obvious that, if for many classifications there has been too little experience accumulated to even be indicative in itself as a rate measure, it would be ridiculous to attempt to use it as a basis of an accident distribution. It occurs to me, therefore, that rates for the classifications and states for which the National Council has used accumulated experience on the assumption that one accident distribution holds for the whole country are more defensible and less fallacious than would be rates based upon accident distributions obtained from the inadequate experience of individual classifications and states.

#### AUTHOR'S REVIEW OF DISCUSSIONS.

#### MR. WINFIELD W. GREEENE:

Dr. Downey's criticism may be summarized as follows:

1. There is one proper way in which the compensation experience of several states for a given industry may be combined, and that is by actually revaluing each accident in terms of the benefit schedule of the basic act.

2. The method of experience differentials produces incorrect results for the following reasons:
(a) The frequency distribution of accidents according to their severity varies from classification to classification.

(b) The ratio between the respective costs of the benefit schedules of any two states varies according to the nature of the injury.

(c) Wage scales differ, not only by classification, but also by state, for the same classification.

(d) The combined effect of (a), (b) and (c) is to make a conversion factor determined for the entire manual, or for a group of related classifications, inapplicable to each of the individual classifications involved.

(e) The difficulty outlined in (d) cannot be overcome by computing many conversion factors for each of a considerable number of classification groups, because this latter course would cut down the statistical basis of the computation to a point where the result would be undependable.

Dr. Downey will admit, I believe, that a revaluation of the original accidents in terms of the basic act involves substantially more labor than that required by the experience differential method. He says, "if it be objured that this procedure will entail much labor, the answer is that Providence has provided no royal road for statistics."

If it is admitted that it is necessary to combine experience from several states for any purpose the amount of labor involved is a consideration. Those familiar with the recent work of the National Council must agree that even the method employed (experience differentials for "all other" and "medical" and combination of "D. & P. T. D." cases by number and average cost) requires quite as much of a burden of clerical labor as is tolerable. The revaluation method would require the determination of what might be termed accident tables, not a single standard table for all classifications, but one for each classification, or, at least, for each group of related classifications. In order to determine pure premiums upon the basis of the combined experience for each of, let us say, thirty states we would have to make 30,000 distinct applications of such an accident table to a given benefit schedule, assuming that a separate combination would be made for each of 1,000 classifications. If the number of accident tables could be cut down to 400, 12,000 calculations of this kind would be required.

Considering the preliminary labor of preparing the accident tables, which might be greater than that involved in their application, it would seem that Dr. Downey proposes a remedy hardly preferable to our present ills.

Now if the individual revaluation method is as laborious as I believe it to be, we should not consider the adoption of it for one moment if the present method produces results which are approximately correct. I say "approximately" because I believe absolute accuracy to be unattainable in the matter of compensation insurance rates. There are many things which may happen,—and some of them generally do,—which will result in disturbing that "relativity" between classification pure premiums which existed while the experience was being accumulated. Familiar past examples are the world conflict and entry of the United States therein.

Dr. Downey has enumerated several conditions which I admit tend toward inaccuracy in the experience differential method. Do these conditions tend to balance each other? Is the experience differential method reasonably accurate in spite of them?

My critic thinks not, and in support of his view submits his Table II entitled "A Comparison of Pennsylvania Pure Premiums --Schedule 'Z'--Policy Years 1916 and 1917---with National Council Pure Premiums Concerted to Pennsylvania Level of Benefits." The table in question shows for sixteen classifications the payroll for Pennsylvania and for the National Council experience, also the "all other" pure premium for Pennsylvania and "National Council Converted to Pennsylvania." The last column shows the deviation in percentage of the National Council converted pure premium from the Pennsylvania pure premium. These deviations run from 3 per cent. to 50 per cent. There are nine negative deviations and seven positive deviations.

It is not permissible to have as much as a 50 per cent. error in the "all other" pure premium, if it is really an error. However, before making final judgment as to the accuracy of the experience differential method, I would like to submit a modification of this same table (Table A.) In this I have shown, instead of payrolls, losses upon the Pennsylvania basis, both for Pennsylvania and the National Council. Further, I have rearranged the table to show the data for the classifications in descending order of Pennsylvania losses.

What a different light shines upon the subject as a result of the rearrangement, and the exhibition of losses instead of payrolls! The most striking thing is the consistency with which the deviation increases as the Pennsylvania losses decrease. For example, in the first five classifications, those having the largest Pennsylvania losses, the greatest deviation is 11 per cent. and the average deviation is 6 per cent. The average for the first three classifications, all having over \$100,000 Pennsylvania losses, is only 4 per cent.

In the next five classifications (having losses between \$39,000 and \$46,000) the average deviation is 17 per cent., while in the last group of six classifications (the losses vary from \$6,000 to \$34,000) the average deviation is 31 per cent.

A simple graduation of the last column using a moving average of three results as follows: 4, 6, 7, 11, 12, 14, 18, 19, 15, 17, 27, 30, 33, 38; with only one break in the curve and that a slight one. In other words, the deviation varies inversely with the volume of Pennsylvania losses.

This rearrangement of Dr. Downey's table can hardly be accepted as conclusive proof of the soundness of the National Council com-

bination of experience—but it is highly favorable to the very method which the Doctor indicts; for where the Pennsylvania experience is substantial, it confirms the national experience. It would seem to be a corollary that where the national experience is substantial and the Pennsylvania experience is insignificant the national experience is a more reliable approximation to the Pennsylvania pure premium than is the actual Pennsylvania experience.

### TABLE A.

COMPARISON OF PENNSYLVANIA PUFE PREMIUMS WITH NATIONAL COUNCIL PURE PREMIUMS (THE LATTIR CONVERTED TO PENNSYLVANIA LEVEL OF BENEFITS).

Losses * Penna		Penna	All Other Pure		% Deviation.	
Basis.		sis.	Premium.			
	Penna.	National.	Penna.	National.		
Machine shops	165,970	723,454	.22	.23	$ \begin{array}{c} +05 \\ -04 \\ -03 \\ -11 \\ +06 \end{array} \right\} \begin{array}{c} \text{Average} \\ =6\%, \\ \text{Maximum} \\ =11\% \end{array} $	
Drivers	119,229	553,857	.27	.26		
Iron foundries	100,601	264,323	.29	.28		
Quarries (N.O.C.).	59,290	159,179	.70	.62		
Steel foundries	50,915	94,017	.35	.37		
Wool spinning and weaving Baking Garages Masonry (N.O.C.). Printing	45,855 43,442 40,982 40,717 39,740	210,186 180,710 249,060 241,090 161,190	.13 .29 .20 .38 .14	.11 .25 .17 .48 .12	$ \begin{array}{c} -15 \\ -14 \\ -15 \\ +26 \\ -14 \end{array} \right  \begin{array}{c} \text{Average} \\ = 17\%, \\ \text{Maximum} \\ = 26\%, \end{array} $	
Planing mills	34,452	241,161	.41	.43	$ \begin{array}{c} +05 \\ +33 \\ -43 \\ +15 \\ +40 \\ -50 \end{array} \left  \begin{array}{c} \text{Average} \\ =31\%, \\ \text{Maximum} \\ =50\% \end{array} \right  $	
Blast furnaces	33,312	59,862	.32	.43		
Laundries (N.O.C.)	29,061	98,014	.35	.20		
Cement mfg	28,994	59,712	.27	.31		
Paper mfg. (N.O.C.)	11,366	106,691	.20	.28		
Fur hat mfg	6,018	19,114	.12	.06		

The above conclusion is confirmed by a comparison of New Jersey and national pure premiums for all classifications, which in the experience before the Council exhibited New Jersey losses of more than \$22,000 (New York basis). The results of this test appear in Table B. It should be born $\epsilon$  in mind that the pure premiums and losses in Table B are upon the New York basis (i.e., converted to New York level). This does not affect the significant feature of the table, which is the percentage of deviation of the national pure premium from the New Jersey pure premium (column 5).

As in the Pennsylvania class fications selected by Dr. Downey there is a clearly defined tendency for the deviation to increase as

<sup>1</sup> Derived from Dr. Downey's Table II. by applying pure premiums to payrolls.

# TABLE B.

# NEW JERSEY.

# COMPARISON OF NATIONAL AND STATE "ALL OTHER" PURE PREMIUMS. All Classes with More Than \$22,000 New Jersey Losses (N. Y. Basis). Note: Losses and P. P. are shown upon New York Basis.

		New J	ersey.	Nati	onal.		
Code No.	Classification.	Losses (in thou- sands). (1)	Pure Prem. (2)	Losses (in thou- san(s). (3)	Pure Pre- mium. (4)	% Dev trom N.	ation of Natl. J. Pure Prem.
3632	Machine shop-no						
0000	fdv	212	.70	2.414	.77	+10	1
7310	Stevedoring(N.O.C.)	152	3.57	1.597	4.19	+18	1
5401	Carpentry (N.O.C.)	101	2.25	1,738	2.75	+22	A
4524	Chemical mfg.						Average
	(N.O.C.)	91	1.26	314	1.16	-08	= 14%,
4420	Rubber tire mfg	89	1.04	241	.79	-24	}
3643	Electrical apparatus	87	.66	452	.57	-14	Maximum
7205	Drivers	82	.67	1,705	.80	+19	- 2407
3631	Machine shopfdy.	69	.94	803	1.08	+15	-21/0
5022	Masonry (N.O.C.).	66	1.92	890	1.77	-08	
6003	Pile driving	63	2.96	303	2.84	04	)
6861	Shinwrights	50	.85	163	1.00	+18	Y
5643	Carpentry-private.	49	1.06	900	.98	-07	
2000	Bakeries.	49	1.05	600	.83	-21	[
4410	Rubber goods						A
	(N.O.Č.)	48	.81	179	1.12	+38	Average
3633	Projectile shell or						=23%,
	case	46	1,64	310	1.00	39	}
6042	Road making	46	1.46	633	1.08	-26	Maximum
2413	Textiles—dyeing	45	.44	206	.51	+16	=30%
7380	Chauffeurs	43	.54	735	.61	+13	0070
5474	Painting-interior	10	0.04	400	0.00	1.05	Ì
9794	And exterior	40	2.34	480	2.92	+40	
3724		40	1.05	304	1.08	-29	,
2731	Planing mills	41	1.99	811	1.45	-27	۱ I
3607	Engine mfg	38	1.72	165	.98	-43	
5204	Concrete work	38	2.69	575	2.03	-24	Average
7219	Truckmen	36	1.32	892	1.73	+31	=28%,
3116	Tool mfg	36	1.10	348	.59	-46	
3808	Automobile mfg	35	.67	569	.63	-06	
5040	Iron work-erection	35	5.00	544	5.82	+16	Maximum
3100	Forging works	34	3.08	253	1.83	-41	=46%
1022	Quarries	34	2.75	555	2.10	-21	
4510	Acid mig. (N.O.C.).	33	1.90	120	1.50	- 24	'
3081	Foundries-iron	32	.68	818	.87	+28	
2623	Tanning	31	.65	343	.62	-05	Average
3030	Steel works	31	2.44	220	1.63	-34	= 24 %,
3241	Wire drawing	30	1.07	179	.87	-19	}
5642	Masonry-private	28	1.14	587	1.40	+23	Maximum
3881	Car mfg.—R.R	28	3.22	168	1.53	-52	= 52%
3089	Pipe mfg.—cast iron	27	1.08	60	1.16	+07	)

		New .	ersey.	Nati	onal,		
Code No.	. Classification.	Losses (in Thou- Sands). (1)	Pure Prem. (2)	Losses (in Thou- sands). (3)	Pure Prem. (4)	% Deviation of Natl. from N. J. Pure Prem. (5)	
$2121 \\ 5602$	Breweries Additions. altera-	27	.91	415	.84	-08	Average $=24\%$
4580	tions, etc Fertilizer mfg	$27 \\ 26$	.52 .93	356 109	.73 1.19	$^{+40}_{+28}$	Maximum =25%
5500	Paving (N.O.C.)	26 26	.83 1 25	332 291	.87	$+05 \\ -08$	
3620 2303	Boiler making Silk mfg	$\begin{array}{c} 20\\ 25\\ 24\end{array}$	1.46	376 123	1.55 .12	+06 +71	Average $=31\%$ ,
2803 3548	Carpentry—shop Printing machinery.	$\begin{array}{c} 24 \\ 24 \end{array}$	$1.79 \\ 1.29$	208 93	$\begin{array}{c} 1.28\\.70\end{array}$	$-29 \\ -46$	( ····
3400 5497	Metal goods (N.O.C.)	24	1.14	468	1.78	+56	Maximum
6106 3220	R.R. Construction	$24 \\ 23 \\ 22$	1.76 1.76	$260 \\ 266 \\ 137$	1.21 1.63	-32	=14%
4233	Paper board mfg	$\overline{22}$	1.19	<b>1</b> 19	1.08	-09	j

TABLE B-Continued.

the New Jersey loss exposure decreases. The following brings out this tendency:

	Deviation of National from New Jersey Pure Premium,			
Classifications.	Average.	Maximum,		
First 10	14%	24%		
Second 10	23%	39%		
Third 10	28%	46%		
Fourth 10	24%	52%		
Last 11	31%	74%		

The extent to which in practice it is found necessary to establish "state exceptions" is a rough indication of the degree to which the national pure premiums are satisfactory as a measure of relativity for classifications having a significant exposure within a single state. The facts upon this important point will soon be common knowledge.

The paper under discussion does not involve higher mathematics. The several formulæ presented were intended merely as practicable solutions of a practical problem. Mr. Mowbray's comparison of the several experience differential formulæ, which I understand he will embody in a paper to this Society, brings out the fact that the experience differential determined according to the theory laid down in my paper would be the ratio of the aggregate pure premium for the basic state to that of the other state were it not for differences between states in the distribution of payrolls according to classification. If I have correctly interpreted Mr. Carver's suggestion it is to make E a function of the pure premium; to determine E directly from the experience in case of a few classifications having a dependably broad exposure; and to derive E for the remaining classifications by interpolation. This interpolation could rest upon a variety of assumptions. The mathematical form of the assumption could be selected with reference to (a) conformity to the facts (b) convenience or operation.

Mr. Carver will I am sure agree that this procedure should not be adopted for practical use without further tests. If these tests yield satisfactory results the only objection I can forecast at this time is that we will not, as I see it now, be cutting down the labor incident to the combination of experience, and I think we do need to cut down on the work if it can be done without undue sacrifice of accuracy.

If Mr. Carver's method were followed, we might eliminate some of the labor by making only two subdivisions in the pure premium, death and permanent total (or major permanent) and "all other." It is possible that in combining "all other" and medical we would not materially alter the basic pure premiums.

It is to be hoped that Mr. Carver will utilize the National Council experience for the purpose of trying out his suggestion. He may find it necessary to adopt more than one mathematical law for the value of E in terms of pure premiums.

The writer would be glad if Mr. Carver or some other member of the Society would test the practicability of combining experience by simple addition without resort to factors of any kind, leaving all multiplicative operations to the second phase of rate-making, namely, projection.

Obviously if we do add the losses and payrolls respectively for all states, our results will be unintelligible owing to variability in the distribution of payrolls between states. It is, however, just as easy to add the number of accidents as it is to add losses. The figures handled are smaller and the computation and application of reduction factors would be avoided.

If we add for all states for a given classification the payroll, the number of deaths and major permanent disabilities, and the number of "all other" disabilities we could obtain pure premiums for any state by applying appropriate average values. (The average value for "all other" disabilities would include medical.)

Of course, accidents resulting in no payment or in medical only would be disregarded for purposes of the addition.

Great care would have to be exercised in determining the average values for death and major permanent, and "all other," injuries respectively. I am inclined to think that this problem could be met without serious difficulty by one of two expedients.

(a) Securing a dependable average by combining related classifications.

(b) Determining averages for classifications having a large exposure direct from their experience and deriving averages for other classifications by reference to the rate of accident per unit of payroll.

In any event we would be no worse off on the "death and major permanent" than we have been upon the "death and permanent total" heretofore. As for the "all other" average value, I believe the possibility that this average is a function of the accident rate is worthy of serious investigation.

I have phrased the above upon the assumption that before another national revision the available experience will segregate major permanent disabilities. If this turns out not to be the case the foregoing still applies *mutatis mutandis*.

It may be that refinements in compensation insurance statistics will have outlived their usefulness as soon as we have discovered the mathematical laws underlying the pure premium. If we can express the average cost per accident and hence the pure premium in terms of the accident rate per unit of payroll, we shall have but little interest in any statistics except payrolls, number of compensated accidents and aggregate losses. We should not forget that recently we decided that the time-honored division between paid and outstanding losses could after all be dispensed with.

Having determined your pure premiums from a consideration of the accident rate, and the relation of average accident cost thereto, you would quite likely find that your expected losses would not be identical with your actual state losses. I believe that the deviation between actual and expected losses for an entire state according to the method I have outlined would not be great and would be due either to variation between states in wages and in the true accident rate (man hour basis). This "slack" could be taken up as a flat percentage for the entire state, or by schedules, or groups of schedules.

# AIRCRAFT INSURANCE-WALTER G. COWLES.

#### VOL. VI, PAGE 31.

#### WRITTEN DISCUSSION.

### MR. A. MCDOUGALD:

I have read Mr. Cowles' paper with considerable interest, and particularly his pictures of the invention and development in America, as a means of transport, of the railroad train, trolley and automobile, the forerunners of aircraft. It is interesting, too, to note that the trolley, like the railroad, not being adaptable to purposes of sport, a development of these vehicles in the commerial sphere was not delayed by misapplication. Whilst as a matter of history this cannot be said of the automobile, there appears to be small chance (in England at least) of the hindrance of sport to the commercial advancement of aircraft. For this prospect we are probably indebted to the war as having ushered in a period of earnest striving and endeavor in the realm of recuperation, and to the post-bellum call for every available and effective means of transport in aid of recovery from the recent years of horror and deprivation.

Aircraft risks as the subject of insurance are new, and it must necessarily be some time before any dependable data can be collected on which to base equitable premium rates. In the meantime the arbitrary rates will be governed by considerations of analogy and argument and influenced possibly to some extent by competition. Repeated trial rates may be expected to approximate with increasing closeness to the ideal which can alone emerge as the passing years accumulate their experience data.

The author of the paper has performed his task so well as to leave small room for criticism, though superabundant space for discussion: these features I take to be characteristic of the author and of his subject respectively.

Viewing through the author's eyes the prospects of American aviation insurance, the impression conveyed by a perusal of the paper is that the author is well acquainted with the practical conditions of the problem, and that in the main, if not entirely, his forecast of the development of the insurance demand and supply may be relied upon. He writes: "Nor do we see in the near future the promise of a development likely to result in the early establishment of the field for casualty insurance presenting a sufficient volume to permit the application of fundamental insurance principles." If this be true for America, it strikes me as being somewhat pessimistic of application elsewhere. This brings me to a sudden halt at the standpoint of the author. He has attacked his subject with such vigor and success that I can but feebly attack him on one point, namely, his caption, "Aircraft Insurance," whereas he writes chiefly and so entertainingly or "Aircraft Insurance in America." If, however, I extend the title of his paper, I am poorly qualified to question his practical conclusion, that, of aircraft insurance in America, there is none—yet.

In these circumstances, and allowing the caption to stand, it occurs to me that it may be of passing interest to the members if I endeavor, as briefly as may be, to record something of the position of aircraft insurance on this side of the water.

Dealing first with the present position in the United Kingdom: in February of last year the British Government set up a department of Civil Aviation, and on the 1st May following, the official date of the opening of civil flying in England, a small government staff began to attack the multiplicity of problems and difficulties attending the transition period from war to peace, this work including (a) the framing of Air Navigation Regulations for the control of civil flying at home, as distinct from the International Air Convention governing the regulations for international flying, and (b) the fixing of air traffic routes, etc. The International air Convention was based in the main on the Air Navigation Regulations, and was signed in October last by eleven out of the thirteen nations which were parties to it, the United States and Japan not then being in a position to sign. It is expected that very shortly one code of rules for the air will obtain throughout the whole of the civilized portions of Europe. In the meantime, British commercial aircraft have already visited the principal cities of eight of the European Countries, namely, Amsterdam, Brussels, Christiania, Copenhagen, Lausanne, Madrid, Paris and Stockholm. Considerable progress, too, has been made with the reconnaissance and development of imperial air routes, including Cairo to Karachi, Cairo to the Cape and India to Australia.

A return shows that during the first six months of civil aviation the greater number of accidents occurred in getting off and landing. It would, therefore, appear that the proportion of accidents to flights made may be a truer guide to the underwriter than that for hours flown. A Communiqué issued by the British Air Ministry announces that returns voluntarily supplied by civil aerial transport firms in the United Kingdom for the eight months ending the 31st December last show that for Great Britain and on the Continental route 403 machines were in use, 35,330 flights were made and 8,368 machine hours were flown, the mileage totalling approximately 593,000. The number of passengers carried was 64,416 and the weight of goods carried amounted to 67,143 pounds.

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The following figures show the proportion of accidents over the whole period :---

No. of accidents resulting in death of one or more occupants of	
machines	4
No. of non-fatal accidents resulting in injury to occupants of ma-	
chine	8
No. of accidents resulting in death of third party (occupants of ma-	_
chine uninjured)	1
No. of accidents in which no one was killed or injured	5
Total accidents reported	18
Approximate number of machine miles flown per accident	32,900
Approximate number of machine flights per accident	1,960
Approximate number of machine hours flown per accident	465

The most common cause of accident was engine failure, of which there were six cases.

Experience has proved the necessity for the punctual report and investigation of accidents, as only by this means can weak points in administration, personnel and material be eliminated and the safety of the public proportionately increased.

A special branch of the Department of Civil Aviation is concerned with the building, inspection and licensing of aerodromes, and the licensing of pilots competent to control the machines, and of aerodrome officials qualified to pass machines as fit for flying. Every machine has to be registered and numbered in the same way as a motor car, and if flying for hire, must in addition be certified as "airworthy." Certified customs aerodromes have been constituted for dealing with regular traffic arriving by air from other countries.

One of the lessons learned during the war was the supreme necessity for rapid ground communication. A special branch of the Air Ministry has charge of this particular work and covers the requirements of both the civil and service sides. An important part of the work is in connection with wireless telegraphy and telephony and the development of aerial navigation by means of directional wireless. On the London-Paris air route a wireless liaison was early established, and machine and weather reports are successfully exchanged by numerous messages per diem. Meteorological reports are now transmitted almost entirely by wireless, and weather forecasts are distributed three times a day from the Air Ministry. A complete scheme of wireless organizations for the entire meterological service of England has now been prepared. This branch is also responsible for the supervision of the training and examination of the wireless personnel.

On the navigational side of the work experimental strip maps of certain routes have been prepared for all aerial purposes, and "flying directions" compiled containing information as to landing grounds, aerodromes, wireless and meterological data—the first of

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a comprehensive library of air maps and flying directions which it is hoped to produce for all the main routes. Charts and maps are also prepared and issued for all intended flights on new routes. Experimental lighthouses have been erected on land on the London-Paris route to assist such services as necessitate commercial night flying. A research branch of the Air Ministry has been established, and the government meterological office has been transferred to the Ministry. Endeavors are being made further to assist scientific research, and in addition to the ordinary routine work of the meterological office, special attention is being devoted to the requirements peculiar to flying. A system of weather maps is being produced at six-hour intervals from information supplied by a network of meterological stations, and reports and forecasts covering various aerial routes have been prepared and issued, together with maps showing the speed and direction of the upper wind over each.

The rigid airship has not been exploited in England to the same extent as the aeroplane, but the commercial possibilities of this type of aircraft in connection with long-distance flights are fully realized.

Some figures have been given showing the number of flights during the eight months ending December last, and the passengers carried. During that period four pilots were killed and six injured, and one passenger was killed and ten were injured.

The percentage of casualties was as follows:

Pilots killed per thousand flights male by pilots	.11
Pilots injured per ditto	.17
Pilots killed per 1,000 hours flown by pilots	.48
Pilots injured per ditto	.72
Pilots killed per 1,000 passengers carried	.016
Passengers injured per 1,000 passengers carried	.16
Passengers killed per 1,000 hours flown by passengers	.06
Passengers injured per 1,000 hours flown by passengers	.61

For these figures and a good deal of the foregoing information I am indebted to the courtesy of the Actuary of the British Air Ministry. In aircraft development we are probably in England about as far advanced relatively as was America twenty years ago in regard to the automobile. We have, however, travelled far enough along the road of progress to demonstrate that the possibilities of the future development of aircraft as a commercial proposition are very great. Once the postulates of reliability, safety, comfort and economy have been met, as they undoubtedly will be, civil aviation must play an increasingly important part in the development of civilization. These demands may and will doubtless be met in the comparatively near future by the combined forces of science and insurance. As these lines are being written, announcement is made of an invention involving a material saving of horse

power, weight and wing dimensions, whereby, without diminution of commercial capacity and usefulness, the dangers at present incident to getting off and landing may be considerably lessened, and insurance made *pro tanto* more attractive. Another invention of quite recent date enables a pilot to steer his chaft in a fog as unerringly as he might do in a clear atmosphere.

Under the stress of war the aeroplane was scientifically developed with great rapidity. The future relationship of the commercial to the service aircraft may develop into that of the mercantile marine of a country to its navy, and furnish a potential reserve of material value in any future crisis. If such a time of crisis should ever again loom up, the joint service and civil aviation forces of America and of the British Empire should surely suffice to settle the dispute in short order.

A particular word as to aviation insurance in England. Soon after the armistice, the leading insurance companies combined to form a pool to take care of aviation risks. A committee was formed, and with the advice and assistance on technical points of an aviation engineer, this committee fixed premium rates to the best of its judgment for (a) accident to the passenger, and (b) a comprehensive insurance, i.e., a policy covering practically all risks incident to the ownership and control of the machine. Each company issued its own policy in agreed common form, crediting the pool with the premium and charging there against all claims. The pool committee was in control of all claim settlements. Policies were issued up to specified limits and the balances between premiums and claims were proportioned periodically amongst the pool members according to their shares therein. Under this scheme policies could be issued by individual companies up to a limit of, approximately, £100,000 against liabilities to the public. The experience of the pool has been that the aggregate claims during the eight months ending December last were nearly 250 per cent. of the net earned premiums pooled. The total number of insured passengers carried was 3,600. These were all carried without any accident. There were only four accidents in all. In each instance the machine was wrecked. One case was that of a forced landing; another was the direct result of fog, and two were instances of engine trouble. In none of these four cases were any insured passengers aboard. The volume of insurance was, fortunately for the insurance companies, only of modest dimensions, so that each company in the result secured a valuable experience at a reasonably small cost. Hitherto premiums have generally been based on the intended number of flying hours, but this system has not proved satisfactory and rates are now being charged per flight, with differentiations for intended duration and distance.

Some demand for insurance has sprung up in Australia and is being met, and there is a strong probability of such an extension of commercial flying within the coming years between the far-flung countries of the British Empire as may exercise the mind and genius alike of the scientist and of the underwriter to the full.

The air lines of commerce between England and foreign countries are being laid down, and the insurance demand is imminent and must be met. Only to-day a 3-day-per-week service to and from Holland is announced, leaving: London at 10 a.m., arriving at Amsterdam just after mid-day. Other routes will quickly follow. It may not be so very long before the airship commercial service between England and America is in full swing, and its insurance requirements being met by a pool membership of American and British companies with the *Casualty Actuarial and Statistical Society of America* in charge of the accident statistics on the American side. Such a vision requires much less imagination than would have been necessary even three years ago to visualize to-day's status of commercial aviation. Mr. Cowles may yet be called upon for a further edition of his thought-provoking paper.

## MR. H. E. FEER:\*

When England issued the first policy on an airplane seven years ago, before the war, she had the privilege of being the first country to write this line of insurance. At that time the risks covered were principally so-called "school risks"; that is, insurance given against the accidental damage to which a machine is exposed if used by a pupil during his instruction. Later on, at the time just before the war, and during its first months, the insurance cover was extended to comprise also delivery flights; that is the flights of a newly bought machine from the seller to the purchaser. The premium for this latter insurance was fixed according to the miles flown, but most probably also varied according to the different routes. Yet, after a short time this development was entirely interrupted by the war, and it was only after the armistice that a resumption took place. Aviation insurance then began to make rapid progress, and there is no doubt that England possesses today the best developed market for this line. It is now possible to cover at London every kind of risk, pertaining to the crew as well as to the ship, and for both heavier and lighter than air machines. The competition in this business is very keen, and in an article of April 24th, 1920, the English magazine "The Policy" quotes: "Taking a general view of aviation insurance during the past year, one is struck with the extraordinary competition for so little an amount of business."

I do not wish to enter into a discussion of the situation in other European countries, such as France, Italy, Switzerland, etc., in all of which aviation insurance is engaged in only to a limited extent,

\* Mr. Feer, who was in this country at the time of the meeting representing a Scandinavian insurance pool, was invited by the President to present this statement to the Society. and I turn towards Scandinavia, which, for the purpose of my remarks, comprises Finland also. During the war Scandinavia had very little commercial flying. In 1919 this situation was somewhat changed, but I still doubt whether aviation in the northern countries is as much developed as in England, where today a widespread net of air lines is in operation. The Scandinavian insurance companies, however, realizing future possibilites, decided to carry aviation insurance from the very beginning along sound lines, and they therefore organized during 1919 a pool, the Scandinavian Pool for Aircraft Insurance, which is represented in the United States through my office. The pool comprises today about ninety companies, to which it prescribes a strict underwriting policy, in fixing forms, rates, rules for adjustment, etc. I believe I am safe in saying that probably no better organization of this kind exists today in the whole world.

Besides this underwriting organization, the pool provides also for a proper statistical institute, the "Aircraft Registry Inc." The purpose of this second organization consists of gathering and keeping in a proper way all statistics pertaining to aviation insurance and in making them available not only for the pool, but also for any other insurance company in the world.

As it is the particular object of your Society to analyze and study the making up of premiums and tariffs, I may now turn towards a short discussion of the tariffs of the Scandinavian pool. Of course it has to be considered from the very beginning that these tariffs are drawn up to fit entirely different conditions, and that American underwriters, in fixing their own rates, can in no way consider them as a precedent. However, they give a good insight into the lines along which the pool carries on its business and into the opinion of the Scandinavian companies about aviation insurance in general.

Actually there are two tariffs available, one of which applies to machines heavier than air; the second of which applies to machines lighter than air. I might say that the basis on which they were drawn up, was most probably the same as that of the American tariffs, namely, a certain number of governmental figures pertaining to military and naval flying and a great amount of guess work. In fact the pool itself does not consider them as tariffs in the usual sense of the word, but merely as a set of instructions, to be used by the central rating office in a general way, when fixing the rate for a special risk. I may here quote from the "General Conditions of the Pool":

"As aerial voyage risks are singularly unequal regarding the machine, the pilot, the rates, etc., and as the corresponding premium has to be changed very promptly, it has not been possible to work out any premium tariffs in the usual sense which could be used by the company without further reference. Until further notice the premium will be fixed for every single case by the department managements, for the guidance of which the pool management has fixed certain minimum premium rates."

The order of the two tariffs is as follows:

Tariff number one covers: accident, liability and so-called "transport" insurance; that is, insurance against all risks pertaining to the ship itself or to its cargo.

Tariff number two is less developed and provides, so far, for accident and liability insurance only.

Accident Insurance.—Accident insurance is issued either as a trip or as a period policy, and is given as a complimentary cover to a usual accident policy which has already been, or is still to be taken out. The applicant is subject to a medical examination. The highest amount of insurance granted is Kr. 100,000 and the minimum premium is fixed at Kr. 20. Beyond that amount the rates are graded according to the relation between the assured and the use made of the machine; they are different for private owners operating their own machines, for pupils and teachers of a flying school, for employees and workmen of an aircraft factory, and for third parties attending a flight as passengers. The rates are gensengers who pay the premium of their trip tickets according to the route then intended to fly; for instance, Stockholm-Copenhagen, Stockholm-Christiania, or Christiania-Goteborg, etc.

Liability Insurance.—The cover given under this line amounts to Kr. 50,000 for one person and Kr. 150,000, for one accident, together with Kr. 20,000, for property damage. The rate is different for private flying machines, for flying schools, for industrial demonstrating and delivery flying, and finally for commercial flying in general. All premiums are computed on a one year basis and the first hundred kroner of every plane are charged against the assured. This is a kind of exclusion of small losses, as it is practised by the American aircraft underwriter in the aircraft collision line. Other important features of the Scandinavian policy are the exclusion of all flights between one hour after sunset and one hour before sunrise; furthermore, the right of the company to cancel the policy within four days after any loss. The question of the qualification of the pilot bears a certain, although very limited, importance for this line, inasmuch as flights executed by non-certificated pilots are not covered by the insurance.

In this connection I may mention that the Scandinavian tariffs do not appear to provide for that line of business, which is probably the most interesting one for the present meeting, namely, compensation insurance. As you will have remarked, this cover is contained to a certain extent under the heading "Liability Insurance," but nowhere is it dealt with as a separate line of business, and I am at a loss to say exactly how far it comes under the scope of the activities of the pool. The reasons for such an apparent lack of an important line of the business may be different in each of the four Scandinavian countries, but most probably it has to be sought either in the absence of compensation laws at all or if there are any, in their limited application.

Transport Insurance.—As I have mentioned before, the Scandinavian pool includes under this heading all damage sustained by the ship itself or by the merchandise and other kinds of cargo transported in it. Consequently transport insurance covers the risks of landing, falling, striking against fast moving objects, collision, fire, explosion, lightning, and theft. Variation of the rate is made according to whether the machine is used for pleasure, for instruction, for demonstration, or for general business purposes.

I have intentionally abstained so far from reading any figures, either concerning rates of premiums. Of course such figures are contained in the tariffs, but as the amounts, terms, the currency and all other general items that they refer to, are entirely different from the American ones, I feel that their indication would be of very little interest. The knowledge of European rates is only of value for an American underwriter if he can compare them with his own, that means, if all pertaining points are brought on an identical basis. In our case, however, such a procedure is extremely difficult, and if I try to do it for a few rates, in spite of all obstacles, I am aware myself, more than anybody else, how limited the correctness of my figures is.

The first comparison I have made covers rates for personal accident. A private owner piloting his own plane pays under the tariff of one of the leading American companies \$15 on a principal sum of \$100. The same man while flying in Scandinavia would pay Kr. 12 on Kr. 1,000. If an owner is not piloting, but traveling in his own plane as a passenger, he pays in the United States \$8 on \$100, while in Scandinavia the rate is the same as mentioned above, namely, Kr. 12 on Kr. 1,000.

In property damage and liability insurance a comparison shows the following:

A sea plane used for pleasure pays for property damage the following in the U. S. and Scandinavia, respectively:

\$ 5.00 on a cover of \$ 100.00 Kr. 3.75 on a cover of Kr. 1,000.00

The liability rate on the same plane would be in the United States and Scandinavia, respectively:

> \$ 1.00 on a cover of \$ 100.00 Kr. 1.50 on a cover of Kr. 1,000.00

If the same plane is used for commercial purposes, the property damage rate is in the United States and Scandinavia, respectively:

> \$ 5.00 on a cover of \$ 100.00 Kr. 9.375 on a cover of Kr. 1,000.00

On liability insurance, the rates are respectively for the United States and Scandinavia:

\$ 1.00 on a cover of \$ 100.00 Kr. 3.75 on a cover of Kr. 1,000.00

If a *land plane* is used for pleasure, it pays for property damage in the United States and Scandinavia, respectively:

> \$ 5.00 on a cover of \$ 100.00 Kr. 7.50 on a cover of Kr. 1,000.00

For liability insurance:

\$ 1.50 on a cover of \$ 100.00 Kr. 4.50 on a cover of Kr. 1,000.00

Finally, the rates for a *land plane* used for commercial purposes, for property damage, for the United States and Scandinavia, are respectively:

\$ 5.00 on a cover of \$ 100.00 Kr. 15.00 on a cover of Kr. 1,000.00

and for liability insurance:

\$ 1.50 on a cover of \$ 100.00 Kr. 9.00 on a cover of Kr. 1,000.00

The most striking conclusion to be drawn from this comparison is doubtless the extremely low level of the European rates. The limited time does not allow me to discuss the reason for this fact, but for general information I may mention that this difference between European and American rates shows not only here but, as far as I know, in most lines of insurance. I may refer here to the general fire rates, which in Europe are always at least one fifth of those in the United States.

All of the foregoing remarks are based exclusively on information and documents, and not on personal investigation. Their value is, therefore, very limited and I myself am eager to amplify my knowledge of European aviation insurance by personal study. I hope to visit Europe this summer and to spend a good deal of my time on aviation insurance, and I trust, after my return in September, to be able to report more completely and more accurately on aviation insurance in Europe than I can at the present time.

### CONTRIBUTED BY INFORMATION DEPARTMENT, MANUFACTURERS AIRCRAFT ASSOCIATION.\*

1. Mr. Cowles points out that the field for aircraft insurance is limited. The uses of aircraft from the underwriters' point of view may be placed into two classes, governmental and civilian. It is

\* This memorandum was prepared and presented to the Society upon the invitation of the President.

with the civilian use of flying machines that we are most concerned, because federal agencies will either take care of their own insurance or be guided by the rules governing commercial aviation and its insurance. Though the development of commercial aviation dates only since the signing of the armistice, it is rapidly progressing past the point where the public considered the airplane or dirigible only a dangerous toy. People now take aviation seriously. They are being impressed daily with the idea that one day everybody will have an opportunity to fly. They naturally look to the insurance companies for protection. This is where the actuary enters. This is where the actuary looks to those engaged in commercial aviation for correct figures and statistics.

Commercial aviation is slowly but surely becoming an established fact. Transportation companies are being organized in every state in the Union. These companies, many of them at present only entering upon the capital-seeking stage, propose to carry passengers, freight, mail and express. They have charted routes between large cities. They have interested all the trade bodies along their aerial right of way. These chambers of commerce or boards of trade are in turn spurring on their municipal governments toward the establishment of municipal landing fields, air terminals whereon the planes may alight for passengers and freight and for fuel and supply.

A recent survey made by the Manufacturers Aircraft Association discloses that at least fifty aerial transportation companies are in process of organization. Some of them will never get beyond that point, it is true, but the others, if properly officered and financed, have wonderful opportunities for expansion.

Then there are industrial and engineering concerns which have been compelled to adopt airplanes to facilitate transportation on certain occasions. Trial of this new vehicle has frequently resulted in keeping a certain number of planes for the important duty of carrying company officials or papers, often supplies and payrolls. It would be impracticable at this writing to check up the number of private industrial organizations actually employing the airplane daily. There are, perhaps, a hundred. More important for our purpose, however, is the fact that the number is gradually increasing.

The companies using aircraft and trying to place it on a paying basis are increasing. There is a real tendency on the part of all manufacturing and operating companies, such as the passenger and freight carrying services, to practise straight flying, eliminating the element of risk attached to exhibition, stunt or trick performance.

Aircraft are being used for pleasure travel. While the newest commercial machines, produced by representative manufacturers of America, have not yet been placed in quantity production, there is every indication that, given the proper encouragement, quantity production will be possible. Mr. Cowles has ably discussed the handicaps that aviation must overcome before we reach this state. Chief among these are the expense, both initial and overhead, and the risk. Quantity production will reduce the expense. Aerial laws and increased efficiency in design and structural stability will go far toward reducing the disk. Of these two needs we will write at greater length after considering the lighter-than-air, or dirigible type of commercial aircraft.

2. Mr. Cowles sees danger in the use of inflammable gas in dirigibles. Lighter-than-air machines are not yet used to any extent commercially; that is, in America. Great Britain and Germany are leading the world at present in the use of dirigibles for the transportation of passengers and dreight. Both countries favor the dirigible for long distance flying as well as for carrying great loads. They believe that lighter-than-air craft are more practical and economical where long hauls and heavy loads are to be considered. Yet, neither Great Britain nor Cermany looks for a general employment of dirigibles within the next five years; this because of the prohibitive expense involved in construction of both machines. hangars and terminals. On the other hand, it is pointed out by airmen in all countries, that if the Government finds it profitable to employ dirigibles in time of war, their use commercially would create a valuable aerial reserve, one that could not be created over night.

The same care enters into the building of a dirigible that entails the production of a large steamship or man-of-war. It requires months to build dirigibles, even after the design has been proven feasible. It follows that much capital must be available to finance a dirigible transportation line.

Now, as to the fear of inflammable gases. The discovery of helium, a non-inflammable gas, in the latter months of the war, opened up a new field for the lighter-than-air machines. Helium, it is expected, can be manufactured in sufficient quantities and at a not unreasonable cost, providing factories are especially built. It is a by-product of natural gas. When we have facilities for the production of helium no longer will hydrogen be used either for reasons of economy or convenience. But on account of the great capital investment required no one looks for a general use of dirigibles within the next few years, though important plans are being completed for dirigible lines in this country to-day. It is therefore logical that we base our conclusions on the increasing popularity of the airplane, a motor-propelled body with wings.

3. Mr. Cowles believes that the field for aircraft insurance is yet to be developed. Mr. Cowles is of the opinion that the field for aircraft insurance is yet to be developed. We believe that he is correct in his opinion. But we would qualify his next statement to the effect that aircraft themselves "are yet to be manufactured and sold." This was doubtlessly true at the time of compiling the figures on which Mr. Cowles based his conclusions. But that was ten months ago. The war machine was then being sold for sport and passenger-carrying purposes, invariably to ex-service men who saw in it a medium for continuing the fascinating sport which took thousands of our young men into the Air Service during the war.

Finding that they could realize quicker and larger profits from exhibition flights rather than from straight commercial flying, the pilots owning their own machines for several months continued to impress upon the public consciousness the erroneous belief that the flying machine was a dangerous toy and the person who travels through the air a daring adventurer. But the last few months have brought about a change, as romantic as it is radical.

The designers and manufacturers, realizing that the war machine, built with the element of speed and maneuverability as prime essentials, did not combine stability and airworthiness required in a safe commercial machine, set about to design machines for civil and commercial use. And they are succeeding. Here in America several companies have brought out, since January last, machines that are as safe, all things considered, as any other vehicle on earth. That is, the machine itself is as safe. Planes do not fall to earth any more, nor do they tear apart in mid-air. Expert engineering based on the laws of physics has provided against this. Before the war a machine when completed was taken out to the flying field and the entire staff gathered about to see if it would actually fly. To-day all the experimenting is done with models. When the finished machine goes out of the shop, the pilot knows it will fly. It may possibly require certain improvements, but these are confined to details.

There are at least ten American commercial machines of radically different types on the market to-day—all built for straight flying, all, by actual test, both on the field and in the air, as safe as a motor car or other conveyance that travels faster than fifteen miles an hour along congested highways. While there are fewer than two hundred of these machines in commercial use to-day, there are more than that number of persons endeavoring to sell commercial airplanes and flying boats.

These American machines carry from one to ten passengers. Some of them are designed to carry 1,500 pounds of cargo, mail or freight. They are in operation to-day, on the aerial mail routes between New York and Chicago, or on the aerial freight routes along the Atlantic or Pacific Coast or in the Middle West.

Airplanes are being used to-day for actual transportation purposes. The next generation will know as much about airplanes and flying as we to-day know about the automobile. The hardest task before us is to prove that the airplane is really as safe as we know it to be. Twenty years ago there was the same general apprehension regarding automobiles and fifty years earlier railroad travel was considered as a hazardous, uncertain adventure.

The field for aircraft insurance is yet to be developed to be sure,

but if we do not attempt to do the thing over night and follow a plan dictated by ordinary business prudence the development should progress satisfactorily and certainly.

4. Mr. Cowles says: "Will the history of the railroads, trolleys and automobiles be repeated in the future history of aircraft?" The history of all transportation facilities is replete with scorn, doubt, wonder and then final acceptance on the part of the public. As Mr. Cowles states, we find something in the motor car more closely approximating aircraft than anything else. The motor car was at first used as a sport machine. The public at large feared and hated it, but years later came to accept it as a legitimate means of transportation. Present facts being more easily checked up than predictions of the future, what do we find to-day? Whenever a man considers flying, the first thought that strikes him is whether or not it is safe. He pauses to weigh his chances in the air, much as you and I in the early days of the motor car hesitated before climbing in alongside the driver of that old one-lunged red-devil.

To-day the deaths and injuries per mile via air are not only smaller but the percentage of contestants finishing is greater in the aerial races despite the unquestionable fact that conditions under which the two kinds of speed contests are conducted favor the motor car.

We venture to suggest, also, that the aerial races of to-day are real races, and not tours, and as such can no more be compared to commercial aviation than the speedway events of motordom can be used to prove the dangers of boulevard touring. Let us compare the conditions under which the air race and speedway competitions were held. Take the matter of distance. The New York-Toronto air race, held in the summer of 1919, covered 1,042 miles and the transcontinental air race later the same season 2,701 miles.

The longest motor contest of the year was the 500-mile race on the Indianapolis Speedway. The physical conditions of the course favored the motor car. The drivers on a bright clear day, after weeks of practice which had made them familiar with every wellpaced inch, circled a banked course which had been prepared for them at a cost of hundreds of thousands of dollars. In their kits were everything which their skilled mechanics required to insure perfect performance of man and machine.

Compare these conditions with those under which the transcontinental race between New York and San Francisco was held. The army fliers were required to make twenty stops on as many fields, no two landing places alike, and on all twenty fields practically a negligible sum of money expended. Many of the pilots had never flown cross-country before. Individual resourcefulness was put to the hardest test.

The following figures have been set down, computing the number of miles per fatality, considering the full distance, of course, for the machines which finished and half the distance as a general

average travelled by the machines which failed to complete the course.

Indianapolis Auto Race 1919:

Distance	500 miles
Highest speed	110 m.p.h.
Winning average	88 m.p.h.
Machines started	33
Machines finished	15 (45 per cent.)
Deaths	3 (4,000 machine
	miles per death)

New York-Toronto Aerial Race:

Distance	1,042	miles
Highest speed	135	m.p.h.
Winning average	128	ш.р. <b>b</b> .
Machines started	52	
Machines finished	30	(59 per cent.)
Deaths	0	(42,722 machine
		miles and no deaths)

New York-San Francisco Aerial Race:

Distance	2,710	miles
Highest speed	135	m.p.h.
Winning average	120	m.p.h.
Machines started	62	
Machines finished	31	(50 per cent.)
Deaths	7	(17,940 machine
		miles per death)

In the transcontinental air race, all other conditions forgotten for the moment, the number of entries and distance travelled gave ten times the opportunity for accidents and failures that the Indianapolis race gave. The speed figures show that the strain on airplane and engine are as great as that on racing car and motor.

The transcontinental air race served two purposes. (1) Educational, that is, showing the public the possibilities in aerial travel, and (2) experimental. It served to lay the first transcontinental aerial route in any way resembling the aerial highway of the future. The experiment of laying out a course across the United States with twenty stops at intervals of not more than 180 miles and then having the pilots find these spots by means of maps, compasses and general sense of direction was successful. When these fields are properly leveled off, connected up by emergency fields, and directional wireless and then flown over by pilots familiar with their every feature, aerial traffic will have entered into its own.

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Inasmuch as the belief has teen expressed that great danger attends dirigible flights, the following is offered:

The history of real airship (lighter-than-air craft) flying in the United States dates from early in 1917. There have been constructed since then approximately 60 gas-filled airships for use in the United States. Nearly all of them, however, were for Naval use, and were flown under war or training conditions. Pilots have taken chances with these ships that one could hardly expect them to take in peace times. Yet it is interesting to note the kind of accidents occurring and their causes.

(1) Fire. Three cases:

(a) Car caught fire on the ground from careless handling of gasoline. Instead of extinguishing the fire, the crew liberated the airship; and the fire spread to the envelope. No fatalities.

(b) Ship caught fire on the ground from unknown causes. No fatalities.

(c) Ship caught fire in the air, presumably due to a chance electric spark at the gas valve at the moment when gas was escaping. Two passengers saved by parachute. Three others killed.

Static electricity around the value is practically the only danger in connection with using hydrogen gas. This subject is being intensively studied and promises to eliminate such accidents in the future. Airship builders assert that all available figures prove that in the whole history of airship flying there have been only four disasters due to the ship catching fire in the air. It is considered possible that only one of these was caused by use of hydrogen gas.

(2) Damage in forced landings (not at regular flying fields). Ten cases on record. No fatalities.

(3) Damage due to wind. Two cases:

(a) Ship was landed and helc by ground crew without aid of hangar or mooring attachments. Later blown loose in wind storm and lost at sea.

(b) Ship was blown against hangar by strong gust of wind which ripped the envelope. No fatalities.

*Note*—Such accidents will be eliminated by efficient mooring and housing apparatus.

(4) Collision.

One case: A student pilot steered into a kite balloon which was anchored. No fatalities.

(5) Loss of control at sea. Rescue and salvage by steamship, involving damages to airship.

(a) Due to rudder failure. No fatalities.

(b) Due to engine failure. No fatalities.

Practically all airships now carry wireless, thereby making rescue as certain as that in the case of steamships, with the added advantage of more often being able to keep longer afloat and adrift in the air than in the case of vessels.

The following figures of dirigible balloon flights at the Goodyear

Balloon School and Naval Air Station at Akron, Ohio, may be of interest. They cover flying during the entire period of the war:

Number of dirigible flights	769
Number of passengers carried	2,711
Time in the air	632 hours
Approximate distance flown	25,280 miles

Those figures show the activities at only one air station.

As to the types of policies desirable for airships, aeronautical experts believe that fire, tornado or wind damage and travelers' accident tickets are most important.

It is considered most desirable to base a travelers' accident ticket on the length of time to be occupied in making the flight, such as making the premium so much per hour or fraction thereof.

So much for the safety of aerial travel. What are its needs at present?

5. Mr. Cowles asks if aircraft will be as economical to operate as the auto truck and motor car. The cost per mile of operating aircraft is somewhat more than that of any other vehicle. But when one considers that aircraft travel in a straight line this overhead is reduced considerably. In fact, there are persons who assert that given any known distance, the airplane can traverse it at less expense per pound load than any other vehicle, this due to the economy of the straight line. The question remains, will the airplane get its load there surely and safely?

Aviation makes such universal appeal that it is comparatively easy to raise capital by popular subscription for new aeronautical enterprises. One of the perils of the present situation lies in the fact that it is easy to capitalize this enthusiasm and public spirit, providing money for the development of aviation enterprises that are doomed to failure because a proper foundation has not been prepared.

It is hardly fair to assume that the airplane can get its load to a given destination swiftly and surely without outside aid. At the present time the right to fly over your property has not been definitely determined. No law has been passed establishing and limiting the liability of the operators of private aircraft. Suitable terminals, airports, landing fields or repair stations do not exist. Methods of signalling must be improved, and new methods adopted for flying in bad weather and navigating at night. There must be a vast amount of preparatory work before an aerial transport company can operate on a regular schedule.

Lives and money unnecessarily sacrificed in premature attempts to force the development of commercial aviation upon conditions wholly artificial, will tend to restrict a permanent and reasonable growth of aviation in America. One of the great handicaps of aeronautical development for many years has been a tendency to overstate and promise successes far beyond the actual power of possible achievement.

If we are going to successfully establish in the public mind through experience the truth that aviation is something more than the use of dangerous toys, we must recognize facts, face them and state them. Popular imagination starting with the true facts will provide all the stimulus required. Manufacturers and designers of aircraft are united in their opinion that something along these lines must occur if commercial aviation is to develop to the point of popularity and pecuniary success.

(a) The enactment of a federal code establishing control of the air and authority for the administration of such control; followed by concurrent legislation in all the several states providing "Rules of the Air Lanes," and inspection and licensing of machines and pilots.

(b) Establishment of aerial harbors for land and water craft, development of a system of meteorological and radio information for all aviators.

(c) Coördination in Washington of the various conflicting Government activities having to do with the purchase, operation or scientific development of aircraft.

(d) Adoption by the government of a constructive aeronautical policy which will make it possible for capital to remain in the business and thus insure maintenance of a basic aircraft industry for purposes of commercial development and national defense.

All of these present needs are imperative if aeronautics is to be worth the attention of insurance companies. Wise and just laws protecting aviators, property owners and passengers of aircraft will automatically form the basis for insurance rates. Until we have these laws, there is no telling just what irresponsible persons will do with flying craft. They may endanger themselves, their machines, their passengers or the property and property owners over which they attempt to fly. Aviation must be controlled by the government as far as inspection and licensing of aircraft and pilots are concerned. The government must see to it that aerial law is made uniform throughout the United States.

Then we will find the safety first program in operation, inventors encouraged to develop new and improved types of flying machines and the public less prone to doutt their practical value. Once remove this subconscious antagonism on the part of the general public and insurance companies will add aeronautical departments just as they were compelled to establish automotive branches a few years ago.

### MR. EDW. R. HARDY:

The President asked me to discuss the fire phase of Mr. Cowles' paper on Aircraft Insurance.

You will recall that when the Century Dictionary was first pub-23 lished, in its preface or introduction the editor stated that in many cases the origin of words could not be discovered. He added that the fullest search in many cases only led to what they must call a negative result, that is, the origin of the word must be put down as unknown. I am very sorry, but that is the report I must bring to you on the fire phase of the aircraft insurance. I have communicated with all those both here and abroad who were engaged in this form of insurance only to ascertain a negative result. There is no experience, which of course is what we ought to have, to make my remarks of any value. Like the editor of the Century Dictionary I can only report a negative result. So far as any experience in this form of loss is concerned, it is still to be experienced.

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### ON THE GRADUATION OF FREQUENCY DISTRIBUTIONS-H. C. CARVER.

### VOL. VI, PAGE 52.

#### WRITTEN DISCUSSION.

# MR. A. H. MOWBRAY:

Mr. Carver's very interesting paper begins with the observation that the graduation of frequency distributions is that branch of actuarial and statistical theory which has been most neglected—in America, at least. It is true that the graduation of frequency curves has not been given much study in America; although American actuaries have given very considerable attention to the correlative but more specialized work of graduation of mortality tables. In our casualty work, so far, we have had little occasion for the use of such graduations, but I believe that in the course of time the occasion for such work is apt to develop not infrequently.

In dealing with the Pearson system of curves, Mr. Carver raises no question as to their practical sufficiency, but calls attention to the vast amount of work involved in making such a graduation. From having undertaken one or two such graduations, I can testify that he does not overestimate the amount of work so required.

In Section II of his paper Mr. Carver very frankly admits his indebtedness to Prof. Pearson's original suggestion in his approach to the problem, which is indeed evident from the similarity of his basic equation to Prof. Pearson's. It is rather surprising to find that the finite difference equation works out a simpler method of graduation than is developed by the method based upon the infinitestimal calculus. I think it is a usual experience that finite difference formulæ are more complicated and solutions by this method apt to be more difficult.

While the simplicity of Mr. Carver's formula is a great advantage over Prof. Pearson's, it seems to me there are certain apparent advantages about the Pearson system which may, however, in the end prove not to be real advantages after all. The several distinct forms of Pearson's equations indicate a law of formation determined by the constants and a different law of formation in each case. Mr. Carver's formula is universal and he does not distinguish, in setting forth its forms, the different types of distributions. It must be true, however, that varying relations between his constants, similar to the varying relations between the constants in Prof. Pearson's basic equation, define the different types of curves quite as sharply as they are differentiated in the Pearson system, and it is perhaps to be regretted he has not dealt with this phase of the matter and the determination of characteristic points in the distribution in terms of the constants or moments.

A mathematical law of formation with certain constants to be determined from the characteristics of the particular material to be used is sometimes of substantial advantage, even though the law itself is somewhat complex. As an illustration of this, we may recall the long search for a law of mortality, and while a definite law has not been established, the approximations thereto developed by Makeham have been of very great value to actuaries. In Prof. Whitney's reasoning underlying the present experience rating plan, frequency curves were also made use of, assuming a certain law of formation of a curve, although for the purpose he had in hand it was not necessary to know the precise constants. Mr. Carver's proposals do not appear to lead to a law which may be used in this way. On the other hand, some of Prof. Pearson's formulæ are so complex that it hardly seems likely they would be of great use in a similar investigation of basic principles.

The equations between the constants developed in Section III by Mr. Carver are developed in accordance with what is known as the "method of moments." It occurs to me there may be a sufficient number of our members not familiar with this method that a brief word of explanation may be valuable. The name of the method is derived from the mechanical principle of moments and the fact that in calculating physical moments the force applied at a given point is multiplied into its lever arm. The abscissa of a given function may be considered as equivalent to the lever arm and the ordinate to the measure of force applied at that point. In accordance with this analogy, the first moment of a given function about a given point is taken as the sum of the products of the successive values of the function (the ordinate) and the first power of the variable (the abscissa). The second moment is the similar sum of the products of the function and the second power of its variable, and so on. The method of determining the constants of the formula by this means is by calculating the successive moments from the original data and from the formula to which the data are to be fitted and equating the successive moments in the two distributions. The moments calculated from the formula must of necessity be expressed in terms of its constants, and in this way enough simultancous equations are formed involving the constants of the formula to enable their determination.

There is an unfortunate printer's error in some of the group of equations (II). The exponent of the factor  $\overline{r-1}$  in the second term on the right of each of these equations should be the same as the exponent of the factors  $\overline{s-1}$  in the first term. The shortening of the work so indicated may perhaps be made more clear if the work which is actually to be undertaken were set forth in schematic

form. The following column heads would indicate how the work might be done:

(1) (2) (3) (4) (5)  $x f_x x f_x x^2 x^2 f_x$  etc.

The powers of the successive terms may be copied on the sheet from tables and then each term be multiplied by  $f_x$ , setting up the value in a machine and multiplying across the line before dropping to the next line. The totals then being summed, the formulæ here quoted may be applied to the total. It occurs to me that perhaps Mr. Carver may be able to suggest a summation method of determining the moments after the manner frequently used in fitting data to Pearson frequency curves.

There is also an unfortunate printer's error in equations on page 56, with the exception of Equation IV, which error likewise occurs in several places subsequently in the text, namely, the writing of v for v. The error is perhaps excusable in view of the similarity of the characters, but it is regrettable that it was not caught when the proof was read.

The comparison between the constants in Mr. Carver's graduation formula and Pearson's basic differential equation is very interesting and suggests that in this way Mr. Carver might be able to set forth the relations between the constants in his formula which will distinguish the different types of curves and perhaps indicate in terms of the constants, as is possible, with the Pearson system, the location of the mean and the mode and the measure of skewness, the characteristics above referred to.

The illustrations used seem well adapted to show the use to which the system may be put, but Example II seems to me ill chosen from another point of view. On examination of Chart II, it will be noted that the greatest maximum is at \$24; the next greatest at \$21, with other pronounced maxima at \$14, \$12 and \$30. The graduated curve does not show any such distinctive points. When we note that \$24 per week is the weekly wage corresponding to \$4 per day for a six-day week, that \$21 per week is the weekly wage corresponding to \$3.50 per day for a six-day week or \$3 for a sevenday week, that \$14 is the weekly wage corresponding to \$2 per day and seven days per week, that \$13 is the weekly wage corresponding to \$2 per day for a six-day week, and \$30 is the weekly wage corresponding to \$5 per day and a six-day week, we will appreciate that these are characteristic variations in the curve, and the general rule as to graduation that characteristic features are not to be graduated out ought generally to apply.

If by graduation of a series of figures the correlation in the variation of two variable attributes may be made more clear, then we are justified in graduating and destroying to some extent certain characteristic features, and even then the value of the correlation study is to that extent diminished. But unless the graduation can serve some useful purpose along these lines, I think the general opinion is that it is better to attempt no graduation. I happen to know that about a year ago the Actuarial Committee of the New Jersey Rating Board was working on a correlation problem along these lines (upon which, however, we did not get satisfactory results) and Mr. Carver made this graduation for us to assist in that work. I think it is a bit unfortunate that he has chosen it as an illustration of his method and I have criticized the graduation of these figures mainly to bring sharply to the attention of students first taking up this type of work the impropriety of so graduating statistical data. As Mr. Carver puts the graduation forward as an illustration of method rather than a result for use, the criticism does not apply with the same force.

Mr. Carver's Example IV, where one basic series is split into two others, is interesting and illuminating, and particularly his expression of views, in comparison with those held by Mr. Fisher, are also interesting. My own personal view does not agree entirely with either that expressed by Mr. Carver or Mr. Fisher. I am willing to grant that a mortality table might be constructed from the records of death only if all the deaths were properly assigned to causes and if the varying causes were found to have clustering points about certain ages and the frequency distribution of deaths from those causes around the clustering point could be fully worked out. The difficulty is that it is clearly impossible to work out a frequency curve for each particular cause of death and that variation in the judgment exercised in selecting the causes to be grouped may give entirely different age distributions of death entering into the several frequency curves. It would also appear that the relative scales of the subsidiary curves would depend on the age composition of the population contributing the deaths, and this would not be known. My view, therefore, is that while it might be possible so to construct tables, it is exceedingly dangerous to do so without much greater knowledge than I believe we now possess, and the danger is enhanced by the absence of a criterion by which to judge results when the table is done.

The comparisons in Section V of the paper between Charlier's Type A curve and Prof. Pearson's system and Charlier's Type B curve and Mr. Carver's are most interesting.

It is to be hoped that Mr. Carver's paper may lead some of our other members with a natural inclination for higher mathematics to give us further papers along these lines and thus in time develop a facility for handling the mathematical side of our statistical work by the most highly developed modern methods.

#### MR. R. HENDERSON:

Mr. Carver has rendered a very practical service to all of us by calling attention to the possibility of using a law of frequency dis-

tribution based on finite differences in place of Pearson's system of curves based on a differential equation. While many of us will continue to feel that Pearson's system is from the theoretical side more satisfactory than that proposed, we will all recognize that in practical application the final results are likely to be for all practical purposes identical. While Mr. Carver's formula presents advantages arising from the uniform ty of method applicable to all distributions, I cannot but think, however, that he feels somewhat too strongly the difficulty of applying the Pearson system.

In the monograph on Graduation published by the Actuarial Society as No. 4 of its series of actuarial studies the authors give a set of equations for determining the constants and an examination of these equations will show that the only point where difficulty arises in practical application is in connection with the constant k and here Mr. Carver's method of using an arbitrary constant and then applying whatever ratio is necessary to bring out the correct total is equally applicable.

It is unfortunate for the confort of the student who wishes to read this paper that the printer has apparently substituted the italic v for the Greek letter v over a considerable proportion of page 56 of the text. I also regret that the author found it convenient to designate by the letter  $\delta$  a function analogous to the reciprocal of the function designated by that letter in the Actuarial Society study.

The analogy between the difference equation of Mr. Carver and the differential equation of Pearson is to my mind more clearly brought out if the former is put in central form, thus

$$\frac{\delta y_x}{\mu y_x} = \frac{y_{x+\frac{1}{2}} - y_{x-\frac{1}{2}}}{\frac{1}{2}(y_{x+\frac{1}{2}} + y_{x-\frac{1}{2}})} = \frac{(c_1 - c_3)(x - \frac{1}{2}) + (c_2 - c_4)}{(x - \frac{1}{2})^2 + \frac{c_1 + c_3}{2}(x - \frac{1}{2}) + \frac{c_2 + c_4}{2}}$$
$$= \frac{-\frac{\nu_3}{\nu_2} - 2(5 - 6y)x}{\frac{1}{4}(8 - 9y) + \nu_2(4 - 3y) + \frac{\nu_3}{\nu_2}x + (2 - 3y)x^2},$$
ere

where

$$y = \frac{\beta_1 + 4 - \frac{1}{\nu_2}}{\beta_2 + 3 - \frac{1}{\nu_2}}.$$

Compare this with Pearson's equation in the form

$$\frac{1}{y_x}\frac{dy_x}{dx} = \frac{-\frac{\mu_3}{\mu_2} - 2(5-6y)x}{\mu_2(4-3y) + \frac{\mu_3}{\mu_2}x + (2-3y)x^2},$$

where

$$y = \frac{\beta_1 + 4}{\beta_2 + 3}.$$

The differences here reduce to

- (a) the use of uncorrected moments in one case and corrected moments in the other,
- (b) the subtraction in Carver's equation of  $1/\nu_2$  from  $\beta_1$  and  $\beta_2$  and
- (c) the extra term  $\frac{1}{4}(8-9\gamma)$  in the denominator.

In the case of a suggested general law of this kind a particular case already known always adds to the interest. Such a case is that where n individuals are taken at random from a large number N of whom pN possesses a certain attribute and  $y_x$  represents the relative probability that exactly x of the N will possess the attribute.

Then

$$\frac{y_{x+1}}{y_x} = \frac{(n-x)(pN-x)}{(1+x)\{(1-p)N-n+1+x\}},$$
  
$$\frac{\Delta y_x}{y_x} = \frac{(n+1)(pN+1) - (N+2)(1+x)}{(1+x)\{(1-p)N-n+1+x\}}.$$

The success achieved by Mr. Carver in the graduation of the United States Life Table for males is remarkable even without any allowance for the fact that only two frequency curves are used and much more so when that fact is taken into consideration. The faithfulness with which the graduated values of  $l_x$  follow the general trend of the ungraduated values is almost uncanny and the small absolute departures and frequent change of sign testify to the goodness of fit. Our only regret is that the author did not give us more details of the actual work so that the student might be better able to follow it.

### MR. MERVYN DAVIS:

Two standard plans for applying the method of moments to the graduation of frequency distributions have hitherto been generally recognized, these plans being based on the assumption that the frequency function either satisfies a fundamental differential equation or that it may be expressed as a function or series of known form. Mr. Carver's paper presents a third plan in which the frequency function is defined by a difference equation of the first order analagous to the fundamental differential equation of the Pearson types of frequency curve, the graduation being based on the central ordinates of the areas representing the actual distribution. The Society is, therefore, indebted to Mr. Carver for an interesting and instructive study in the method of movements while

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actuaries and statisticians in general are still further indebted to him for a method of graduating frequency distributions which should produce results approximating those obtained by Pearson's method but at the cost of considerably less labor.

It cannot be claimed, however, that Mr. Carver's method rests on so complete and logical a basis as Pearson's. In the first place the graduation is based not on the areas which naturally represent the frequency distribution but on the midordinates of those areas. And in the second place the integration of the difference equation will not in general determine a frequency function which will represent the distribution throughout the range covered; all that the difference equation will furnish being the values of certain equidistant ordinates, the curve being completed by drawing a series of parabolic curves through the extremities of these ordinates.

To illustrate this latter point it may be noted that Mr. Carver's difference equation may be written in the form

$$\frac{y_{x+1}}{y_x} = \frac{x^2 + c_1 x + c_2}{x^2 + c_3 x + c_1} = \frac{(x+\alpha)(x+\beta)}{(x+\gamma)(x+\delta)},$$

the integral of which is

$$y = K \frac{\Gamma(x+\alpha)\Gamma(x+\beta)}{\Gamma(x+\gamma)\Gamma(x+\delta)},$$

where

$$K = y_0 \cdot \frac{\Gamma(y)\Gamma(\delta)}{\Gamma(\alpha) \cdot \Gamma(\beta)}.$$

Now if  $\alpha$ ,  $\beta$ ,  $\gamma$ ,  $\delta$  are all imaginary, equations (2) will represent a true frequency curve extending to infinity in both directions and asymptotic to the axis provided  $c_3 > c_1$ : this will always be true in cases of high contact, for from equations IV,  $c_2$  being positive,  $1 + 2\delta$  must be and hence  $4 + 2\delta$  or  $c_3 - c_1$ . The values of y in this case are, therefore, completely defined by equation (2); the same remark holds in cases where such of these values as are real are also positive, the curve in such cases extending to infinity in the positive direction and terminating on the negative side where the abscissa taken negatively equals the numerically smallest of these values, y being infinite at that point if this value be found in the numerator and zero if taken from the denominator.

Where, however, any one of the quantities  $\alpha$ ,  $\beta$ ,  $\gamma$ ,  $\delta$  is real and negative the curve given by equation (2) no longer resembles a frequency curve. As an example, the difference equation of Professor Carver's example III, may be written

$$\frac{y_{x+1}}{y_x} = \frac{(x - 9.622)(x + 4.441)}{(x = 12.277)(x + 4.114)}$$

and the integral in the form of equation (2) gives infinite values

for y when x = n + .622, where n is any negative integer or positive integer not greater than 9, and zero values for y when x = m + .277, m being an integer not greater than 12.

It may be noted that no general expression can be found for the position of the mode which will have to be approximated either graphically or by interpolation.

In cases where there is not high contact at either end of the range the determination of the terminal areas will require special treatment. For not only are the quadrature formulæ quoted no longer available but allowance must be made for the fact that the area rests on a fractional, not a unit, length of the axis. The simplest method of estimating these areas would appear to consist in passing a parabolic curve through the points given by the succeeding or preceding ordinates and in determining the area required from the equation obtained.

It is somewhat remarkable that Mr. Carver implies, as he appears to have done in the examples presented, that the midordinates of ungraduated statistics may be taken as the average ordinates; the more so since he points out the necessity of applying a quadrature formulæ to the graduated ordinates. Such an assumption involves appreciable errors and it is therefore, desirable to devise adjustments to offset them.

The quadrature form quoted on page 61, is based on the assumption that y is a parabolic function of the fourth degree in n, i.e., that

$$y = a + bx + cx^2 + dx^3 + ex^4.$$

On the same assumption it may be readily shown that a formula giving midordinates in terms of areas is furnished by

$$y = Y - \frac{1}{24} (\Delta^2 - \Delta^3 + \frac{7}{80} \Delta^4) Y,$$

where

$$Y = \int_{x-\frac{1}{2}}^{x+\frac{1}{2}} y dx.$$

We thus have a formula for adjusting the ungraduated statistics in cases where there is high contact at each end of the range. At first sight it might seem that these adjustments would apply in all cases where there is high contact at the positive end. A little reflection, however, at once makes it evident that this is not so: for in such cases the initial area rests on only a fractional length of axis and until the graduation has been performed we have no way of determining at what point the curve starts.

Where, however, there is high contact at each end of the range, it will be simpler to apply the adjustments direct to the moments calculated from the adjusted figures. For in such cases from the equation:

$$\Sigma x^m \cdot \Delta^n f_x = \Sigma x^m (f_{x+n} - n \cdot f_{x+n-1} + nC_2 f_{x+n-2} \cdots)$$

by writing  $\sum x^m \cdot f_{x+r}$  in the form  $\sum (x+r-r)^m \cdot f_{x+r}$  and expanding, it may be shown that

$$\begin{split} \Sigma x^m \cdot \Delta^n f_x &= 0, \quad \text{where} \quad m < n, \\ \Sigma x^2 \cdot \Delta^2 f_x &= 2\Sigma f_x, \\ \Sigma x^3 \cdot \Delta^2 f_x &= 6\Sigma x f_x - 6\Sigma f_x, \\ \Sigma x^4 \cdot \Delta^2 f_x &= 12\Sigma x^2 \cdot f_x - 24\Sigma x \cdot f_x + 14\Sigma f_x, \\ \Sigma x^3 \cdot \Delta^3 f_x &= -6\Sigma f_x, \\ \Sigma x^4 \cdot \Delta^3 f_x &= -24\Sigma x \cdot f_x + 36\Sigma f_x, \\ \Sigma x^4 \cdot \Delta^4 f_x &= 24\Sigma f_x, \end{split}$$

the general equations being

$$\begin{split} \Sigma x^{n} \cdot \Delta^{n} f_{x} &= (-1)^{n} \cdot \underline{\left[n \ \Sigma f_{x}\right]} \\ \Sigma x^{n+1} \cdot \Delta^{n} f_{x} &= (-1)^{n} \underline{\left[n+1 \ \Sigma x \cdot f_{x}\right]} + (-1)^{n+1} \cdot \underline{\frac{1}{2}n} \underline{\left[n+1 \ \Sigma f_{x}\right]} \\ \Sigma x^{n+2} \Delta^{n} f_{x} &= (-1)^{n} \underline{\frac{1}{2}} \underline{\left[n+2 \ \Sigma x \cdot {}^{2} f_{x}\right]} + (-1)^{n+1} \cdot \underline{\frac{1}{2}n} \underline{\left[n+2 \ \Sigma x \cdot f_{x}\right]} \\ &+ (-1)^{n+2} \cdot \frac{n}{24} (3n+1) \underline{\left[n+2 \ \Sigma f_{x}\right]} \\ \end{split}$$

If then  $\mu$ 's represent the moments of the adjusted ordinates we have

$$\begin{split} \mu_{0}^{'} &= \nu_{0}^{'}, \\ \mu_{1}^{'} &= \nu_{1}^{'}, \\ \mu_{2}^{'} &= \nu_{2}^{'} - \frac{1}{12} \cdot \nu_{0}^{'}, \\ \mu_{3}^{'} &= \nu_{3}^{'} - \frac{1}{24} [(6\nu_{1}^{'} - 6\nu_{0}^{'}) + 6\nu_{0}^{'}] \\ &= \nu_{3}^{'} - \frac{1}{4}\nu_{1}^{'}, \\ \mu_{4}^{'} &= \nu_{4}^{'} - \frac{1}{24} [12\nu_{2}^{'} - 24\nu_{1}^{'} + 14\nu_{0}^{'} + 24\nu_{1}^{'} - 36\nu_{0}^{'} + \frac{7}{80} \cdot 24\nu_{0}^{'}] \\ &= \nu_{4}^{'} - \frac{\nu_{2}^{'}}{2} + \frac{7}{240}\nu_{0}^{'}, \end{split}$$

or, with unit total frequency, transferring the origin to the mean

$$\mu_{2} = \nu_{2} - \frac{1}{12},$$
  

$$\mu_{3} = \nu_{3},$$
  

$$\mu_{4} = \nu_{4} - \nu_{2} + \frac{7}{24},$$

These are Sheppard's adjustments so that it would appear that the errors introduced in the moments of the areas through considering these areas as concentrated along the central ordinates is equal to that produced in the areas of the central ordinates through taking these ordinates as equal to the average ordinates.

The presentation of the new method ends with an interesting example of its application to the graduation of a population table. The graduation of the deaths is given in full while it is stated that that of the number living may be made in the same way. A little further information on this latter point would be of interest, as also would be the completion of the illustration by the standard comparison of the actual and expected deaths. The weak point, if there be any, in the graduation of the death curve lies in the lack of any definite method, other than by inspection, of fixing the limiting point of the supplementary series  $\beta$  and the fact that series  $\alpha$  is necessarily determined from a consideration of only the data at the older ages. To describe the entire population, a further supplementary series would evidently be required to cover the infantile ages, though, speaking offhand, I am inclined to the opinion that the inclusion of the supplementary series  $\beta$  in the example given is probably made necessary by unduly high exposures at the younger ages due to immigration.

I am glad to note that Professor Carver repudiates the idea that it is possible to correctly construct mortality tables from a consideration of deaths only.

The last section shows the connection between the Pearson and Charlier systems. I am unable, however, to agree with the author that we can, from this comparison, arrive at any reliable conclusion as to the comparative effectiveness of the two systems; for when considering the first few terms of a series as representing that series it makes a vast difference whether the series in question is the numerator or denominator of a fraction. In this connection it may be noted that the Charlier series fails completely in cases of appreciable skewness.

### AUTHOR'S REVIEW OF DISCUSSIONS.

### MR. H. C. CARVER:

I desire to take advantage of this opportunity to thank the gentlemen who have so kindly and ably led this discussion. Time will not permit me to answer in detail all the points which have been raised, but I shall venture a few remarks which may assist some of our members who are working along mathematical statistical lines.

There are two general classes of frequency distributions, distributions of "graduated variates" and distributions of "integral variates." The frequencies of the former should logically be represented by areas under a curve, those of the latter by ordinates of a curve. It follows, then, that from a theoretical standpoint Pearson's system is better adapted to deal with distributions of the first class than the method suggested in the paper under review, but the reverse is true for distributions of the second class, which are far less frequently met in the actuarial field of statistics.

The error that Mr. Davis refers to when he notes that I implied
"that the midordinates of ungraduated statistics may be taken as average ordinates" is the same type of error that would be made if one attempted to graduate a distribution of integral variates by representing the frequencies by areas under a curve,-yet it may be noted that Pearson on page 401 of Vol. 186 of the Philosophical Transactions of the Royal Society of London has done this same thing, producing results thereby which seem to warrant the procedure. Furthermore, Charlier invariably treats the midordinates as average ordinates. A translation of a section of his "Uber Das Fehlergesetz" runs "we divide the errors into groups with constant dimension— $\alpha$ —and assume that all errors in such a group are of the same magnitude. The smaller we make the interval  $\alpha$ , the smaller becomes the error which results from this assumption." Τ had this in mind when I made the statement that midordinates could be substituted for areas provided "the class interval is small as compared with the visible range." Thus it would be folly to use a quadrature formula for the distribution of Table II, though advisable for Table III of the paper. Even in the latter case it might be dispensed with, without entailing any appreciable error, as a comparison of columns 5 and 6 of Table IV will show. Again, it should be noted that in example III no quadrature formula was used, yet despite this we obtained a fit which, using  $\chi^2$  as a criterion, is somewhat superior to Elderton's graduation which made use of a quadrature formula. To be frank, however, I can tell of other cases where the reverse is true—possibly that influenced my choice of this particular illustration. There can be no doubt but that many problems of large class dimension will be met where it will be necessary to apply a quadrature formula, and Mr. Davis' careful and excellent treatment of this phase must be given very thoughtful consideration.

As regards the graduation of enumerated populations concerning which a question is raised; we may proceed along two distinct lines. First, we may choose as an  $\alpha$  series all enumerations above age 70 and then graduate the residual series  $\beta$ , or secondly we may make use of the fact that the differences of the population frequencies may be graduated in the same manner as the recorded deaths and the results summed to produce the desired results. I do not want to go on record as believing that this is the proper method of constructing a mortality or life table. I do not believe it is-at least I know several better methods. The results were rather interesting, but from a theoretical standpoint it seems to me that such a method is but little more logical than ar attempt to construct a mortality table from a record of deaths alone, or, going that one better, by using enumerated populations only. If we can construct a table from death alone as in Proc., Vol. IV, and by dividing these deaths by qx, determine the unenumerated populations—why not the converse?

I am afraid that I cannot accept Mr. Davis' suggestion that im-

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migration may be responsible for series  $\beta$ . A graph of log  $q_x$  or log (colog  $p_x$ ) for almost any life table will reveal the presence of a similarly situated supplementary series—a frequency shaped distribution—which when applied to the stationary population yields a strikingly similar series of expected deaths. As a result of certain experiments, I am led to believe that the equation

## $\mu_x = ab^x + a$ frequency series $\beta$

affords about the best representation of the law of mortality above age 10; in other words, instead of modifying Gompertz's law by the introduction of a supplementary series in the  $l_x$  column it may be advisable to introduce the series in either of the functions  $\mu_x$ , log (colog  $p_x$ ), or log  $q_x$ .

As regards the question concerning the position of the mode for a distribution defined by our difference equation it is quite evident that if we write the equation as

$$\frac{\Delta y_x}{y_x} = \frac{a-x}{b_0 + b_1 x + b_2 x^2}$$

the mode must lie approximately at  $a + \frac{1}{2}$ , that is at

$$x = \frac{-\frac{\nu_3}{\nu_2}\left(\beta_2 + 3 - \frac{1}{\nu_2}\right)}{2\left(5\beta_2 - 6\beta_1 - 9 + \frac{1}{\nu_2}\right)}.$$

The calculation of the mode by this result and by Pearson's formula

$$x = \frac{-\frac{\nu_3}{\nu_2}(\beta_2 + 3)}{2(5\beta_2 - 6\beta_1 - 9)}$$

will in general produce practically the same result: therefore Pearson's measure for skewness, etc., may be considered to hold for the system determined by the difference equation.

I regret that I cannot agree at all with the statements made by Mr. Davis in his last paragraph. For one thing I believe that Charlier's method is the only method which rests on a sound philosophic basis. On the other hand, I believe that Pearson's system and the proposed method can graduate any distribution that Charlier's can, and in the problem of smoothing the stump of a distribution are more powerful than Charlier's. We must remember, however, that

(a) The two methods referred to are empirical; we assume that the series in the denominator of the differential or difference equations are convergent.

(b) The coefficients of additional terms which may be required are readily computed in Charlier's series independently of the coefficients of the other terms. This is a great advantage. In the proposed method additional terms can be computed only at the expense of much additional labor, whereas in Pearson's differential equation the addition of an added term cr so will render the resulting integral so complex that using it is almost out of the question. An objection to the use of additional terms is that by so doing higher moments with high probable errors are introduced. In this respect Pearson's method and the proposed are rather superior to Charlier's, since it is possible where additional terms are needed (that is where the number of classes is large, such as in graduating a mortality table) to break the distribution up into several series, from which the number of required equations may be obtained using a modification of the method of averages. In this way the number of required higher moments may be reduced.

The statement that Charlier's series fails completely to graduate in cases of appreciable skewness is an error. It frequently happens that the type A series,

$$A_0\varphi_{(x)} + A_3\varphi_{(x)}^{\text{III}} + A_4\varphi_{(x)}^{\text{IV}} + \cdots,$$

as generally understood, fails, but in those cases type B series can yield the desired results. The most important reason why series Afails frequently to be useful is that in calculating the graduated frequencies we are obliged to make use of an approximation. The true value for  $\phi_x$  in the type A series is

$$\frac{1}{\pi}\int_0^{\pi} e^{-\frac{\sigma^2 \cdot \sigma^2}{2}} \cos x \omega d\omega$$

instead of the generally accepted value

$$\frac{1}{\sigma \sqrt{2\pi}} e^{-\frac{x^2}{2\sigma^2}},$$

which is the value of first named function when the upper limit is assumed to be infinity instead of  $\pi$ . Even assuming that the functions are for all practical purposes interchangeable it does not follow that their derivatives also are. Thus, if two functions intersect at right angles, they will have the same value at that point, but their derivatives may be zero and infinity respectively. It is not difficult however, to obtain an expression for the errors involved by making these assumptions in Charlier's series.

Too much significance ought not be placed upon the relations between the constants of the difference and differential equations. It is true, as Mr. Mowbray suggests, that the interrelated values define different types of curves. Thus we have the general solution

$$y = y_0 \frac{\Gamma(x-\alpha)\Gamma(x-\beta)}{\Gamma(x-\gamma)\Gamma(x-\delta)},$$

which Mr. Davis points out, but this is only useful for practical purposes when the roots  $\alpha$ ,  $\beta$ ,  $\gamma$  and  $\delta$  are real quantities. If the roots are integers or are replaced by the nearest integers, we have a hypergeometric series of the form

$$y_0 \frac{|x+a|x+b}{|x+c|x+d}$$

and it can easily be seen that a parabola also satisfies the difference equation. Although our idea of a frequency distribution excludes the idea of the parabola, nevertheless the logarithms of the frequencies may satisfy this function, since this merely implies that the distribution is Gaussian.

Again, when  $b_2 = 0$ , i.e., when

$$3\beta_1 - 2\beta_2 + 6 - \frac{1}{\nu_2} = 0,$$

the difference equation satisfies a binomial series or even a straight line. It is because of this wide degree of freedom that Pearson's differential equation and our difference equation are so widely applicable.

The summation method that Mr. Mowbray desires may readily be obtained by substituting the results which Elderton obtains on page 21 of his "Frequency Curves and Correlation" in either equations II or IV appearing on pages 55 and 56 of the paper under discussion.

# REVIEWS OF BOOKS AND PUBLICATIONS.

Statistical Analysis of Workmen's Compensation Insurance in Pennsylvania from January 1, 1916 to December 1, 1918.
Compiled jointly by the Insurance Department of Pennsylvania and the Statistical Department of the Pennsylvania Compensation Rating and Inspection Bureau. Pp. 72.

The Statistical Analysis of Workmen's Compensation Insurance in Pennsylvania from January 1, 1916 to December 1, 1918 was compiled, according to its foreword, for the purpose of establishing compensation insurance rates in Pennsylvania based on Pennsylvania experience. It was, of course, necessary for all the states, upon first enacting compensation legislation, to draw upon available experience wherever found in order to establish rates and it is a natural development to find a demand arising for rates based upon state experience as soon as such experience furnishes a sufficiently broad exposure.

This report is of special interest, therefore, to actuaries in the compensation field, but it contains information which is equally interesting and equally valuable to others not directly associated with the problems of rate-making and not in touch with the most recent developments in the actuarial side of compensation. The present reviewer is of the latter class.

Aside from a brief foreword and a two page explanation of the tables, the report consists entirely of tabulated experience of workmen's compensation in Pennsylvania for the years 1916, 1917, 1918 —fourteen tables in all. The following represent the important departures from the customary analyses of workmen's compensation insurance experience in such reports:

- (1) A table of payrolls, losses and pure premiums for all industries of the classifications that produced a payroll during the two years 1916 and 1917 of \$500,000 or better (Table VI).
- (2) An analysis of dependency in fatal cases showing distribution of dependency, remarriage experience of widows, cost of benefits correlated with average weekly wage and number of dependents, and ages of dependent children at time of death of father (Tables VII to IX).

#### REVIEWS OF BOOKS AND PUBLICATIONS.

- (3) Accident rates and accident severity rates per \$1,000,000 payroll in principal industries (Table X).
- (4) A table showing the distribution of weekly wages in compensation cases for the years 1916, 1917 and 1918 and the ratio of weekly compensation to weekly wages in twelve principal industries (Table XII).
- (5) An analysis, by industry and by cause, of accidents causing two or more deaths (Table XIII).
- (6) A detailed analysis of causes of fatal and major permanent injuries (Table XIV).

The table of pure premiums referred to above has been used by the rate making committee in establishing rates for compensation insurance in Pennsylvania. The tables on dependency will probably be of main interest likewise to actuaries. The accident severity rates shown in Table X will attract much more general interest, for it is, as the report states, "the best single index of industrial hazard." Table XIV not only furnishes a valuable reference for schedule rating purposes but should have a much wider application in the allied field or safety engineering.

# BRUCE D. MUDGETT.

# The Annual Report of the New York Industrial Commission for Twelve Months Ended June 30, 1918. Pp. 261.

A review of the year's work as set forth in individual reports of some nine bureaus of the Industrial Commission is of departmental interest rather than of statistical value. The information issued by means of bulletins is not included in this report nor is there a list of these publications given.

In the report of the Bureau of Statistics and Information a plea is made by the Chief Statistician for better facilities to carry on the work of collecting and publishing the data contained in the bulletins particularly that of the *Labor Market Bulletin*. This recommendation will be earnestly seconded by those who recognize the usefulness of this work. The further recommendation as to the perfecting of the method of collection and tabulation of accident statistics should also be heartily endorsed. The Industrial Commission with its first hand information as to reports of accidents with the extent of injury and the compensable cases under the Workmen's Compensation Act should be able to record and present

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without undue loss of time or accuracy complete facts as to cases handled, thus establishing an invaluable basis for the measurement of the effectiveness of accident prevention and a general check of the experience which is reported by companies under Schedule Z to the Insurance Department.

The report of the chief investigator of the Bureau of Immigration calls attention to the low figures of the year 1918 which are paralleled only by those of 1862 during the Civil War when the number of arrivals fell to 100,000. Of the number of aliens admitted many were retained in this country under bonds who in times of peace would have been deported. The following excerpt from the report is not comforting. "We have therefore for the four years 1914-1918 the astounding total of 3,923 excludable aliens, who have been admitted and released. . . . Considering the fact that one-third of the total immigration remains in New York State for permanent residence and that a much greater proportion of the unfit is released in this than in any other state these figures are startling." A legislative investigation is recommended and suggestions made as to the amelioration of present conditions by making efforts to retain the better portion of the aliens. Attention is called to the 14,000,000 acres of uncultivated farms in the State which could be used to attract immigrants of agricultural countries by grants of land to be worked by them thus preventing, in a measure, emigration of what is, indeed, the better class to the mother countries. The colonization of employees of large industries such as the Endicott-Johnson model industrial town near Binghamton is cited as a scheme for meeting, not only the foreign labor problem, but that of labor turnover.

The statistics of inspection are given in 34 tables prepared by the Bureau of Statistics and Information. These tables give principally the results of mercantile, factory and home inspection for violations under the law covering employment of women and children.

In view of the recent amendment to the Workmen's Compensation Act to include occupational diseases Table 33 is of interest —it gives the cases reported to the Department of Labor under Section 65 of the law for the years ended August 31, 1917 and August 31, 1918—also figures for the years ended August 31, 1912–1918 inclusive. The cases are shown under the different kinds of disease or poisoning and are separated as to the industries. The following figures are taken from the last column showing the total cases with deaths resulting therefrom.

August 31 1012-August 31 1018 INC

000-0-, -0+0	
No. Cases.	No. of Deaths.
. 665	96
. 458	4
. 60	15
. 18	2
. 15	0
. 9	2
. 3	1
. 1	1
. 1,219	121
	No. Cases. . 665 . 458 . 60 . 18 . 15 . 9 . 3 . 1 . 1,219

The report of the State Insurance Fund showing the financial condition as of December 31, 1918, is given in detail and is clearly analyzed. A comparative statement of business for the six months ended December 31, 1914, and the twelve months of each of the following years to the date of the year of this report appears on page 155.

Other reports deal with employment, factory inspection and safety work. There is a consistent appeal from all bureaus for increased salary allowance and for additional help to maintain a force adequate for the carrying on of the work. One is struck with the picture of the overburdened and underpaid representatives of the Empire State eking out a harried existence in the struggle to safeguard the carefree workmen at his toil. Let us hope that before another accounting is made some of the profits of industry will have been diverted to the state and will afford means of providing for the supervision of the large industrial field comprehended under the labor laws of this state.

## EMMA C. MAYCRINK.

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# SELECT LIST OF RECENT LITERATURE ON CASUALTY AND SOCIAL INSURANCE.

#### PREPARED UNDER DIRECTION OF THE LIBRARIAN."

- A. CASUALTY INSURANCE.
  - 1. Aircraft insurance.
  - 2. Automobile insurance.
  - 3. Burglary and theft insurance.
  - 4. Credit insurance.

  - 5. Fidelity and surety insurance.
     6. Personal accident and health insurance.
  - 7. Strike insurance.
  - 8. Public liability.
- B. SOCIAL INSURANCE.
  - 1. Group insurance. 2. Health insurance.

  - 3. Maternity insurance.
  - 4. Pensions and relief funds.
  - 5. Unemployment insurance.
  - 6. Workmen's compensation.
  - 7. Other.
- C. INDUSTRIAL ACCIDENTS, DISEASES AND POISONS.
  - 1. Accidents.
  - 2. Diseases and poisons.
- D. MISCELLANEOUS, STATISTICS AND GENERAL THEORY.
  - Economics.
     Sociology.

  - 3. Statistics.
  - 4. Other.
- E. BIBLIOGRAPHICAL NOTES.

A. CASUALTY INSURANCE.

#### 1. Aircraft Insurance.

Cowles, W. G.

Objects of the Travelers Insurance Company in offering aircraft insurance. (Economic World, new series, Vol. 17, April 26, 1919, pp. 601-2.)

Vice-President Cowles on the true origination of aeroplane workmen's compensation rates. (Econ(mic World, new series, Vol. 17, June 21, 1919, pp. 885-6.) Economic World.

Aviation insurance association formed in Great Britain. (Economic World, new series, Vol. 17, April 5, 1919, p. 495.)

Officers of the British Royal Air Force on the fundamentals of aircraft (Economic World, new series, Vol. 17, May 10, 1919, insurance. pp. 670-3.

\* Acknowledgment is made of the assistance of Miss Dorothy E. Wiesner, Statistical Bureau, Metropolitan Life Insurance Company, in the preparation of this list.

Lewis, G. H.

Aviation and insurance. (Economic World, new series, Vol. 18, July 5, 1919, pp. 21-3.

Stamm, L. É.

Aviation and life insurance. (Economic World, new series, Vol. 17, May 3, 1919, pp. 633-5.)

Travelers Standard.

Aircraft insurance. (Travelers Standard, Vol. 7, September, 1919, pp. 180-3.)

#### 2. Automobile Insurance.

Economic World.

Outlook for automobile insurance in 1919. (Economic World, new series, Vol. 17, February 8, 1919, pp. 204-5.)

Hord, E. F.

History and organization of automobile insurance. 105 William Street, New York City. 1919, 29 pp.

Johnston, A.

Insurance that protects the car owner. (Country Life, Vol. 36, August, 1919, pp. 68–70.)

Post, J. A.

Automobile liability; how to deal with it: an accident guide for owners. insured and uninsured. New York, E. P. Dutton and Company, 1919, 45 pp.

Ryder, A.

Principles of automobile rate-making. Insurance Society of New York, 1919, 27 pp.

3. Burglary and Theft Insurance.

Economic World.

Present-day hazards in burglary insurance in Great Britain. (Economic World, new series, Vol. 19, March 20, 1920, pp. 419-22.)

Garrison, F. S.

Burglary insurance experience in the United States in 1917 and early 1918. (Economic World, new series, Vol. 16, November 9, 1919, p. 674.)

#### 4. Credit Insurance.

Economic World.

Insurance agents and the question of credit to customers. (Economic World, new series, Vol. 16, October 26, 1918, p. 600-1.)

Helburn, J. W.

Plan for a mutual insurance association for the insurance of foreign trade credits. (Economic World, new series, Vol. 18, August 2, 1919, pp. 165-6.) Hollis, W. S.

British insurance against bad debts abroad. (United States Commerce Reports, No. 231, October 2, 1919, pp. 18-21.)

What credit insurance can do for commerce. (United States Commerce Reports, No. 242, October 15, 1919, pp. 289-295.)

Marsh, A. R.

Future of credit insurance in foreign trade. (Economic World, new series, Vol. 17, June 28, 1919, p. 920.)

National City Bank.

Question whether credit insurance would pay for itself. (Americas, Vol. 5, May, 1919, pp. 21-4.)

Rubber Age and Tire News.

Insuring foreign credits against loss. (Rubber Age and Tire News. Vol. 6, November 10, 1919, pp. 115-6.)

Rumpe, A. G.

Increasing the insurance of the debtor. (National Association of Credit Men's Bulletin, Vol. 21, June, 1919, pp. 356-9.)

#### 5. Fidelity and Surety Insurance.

Ruffin, B. A.

Bank insurance in its various forms. (Economic World, new series, Vol. 17, March 29, 1919, pp. 453-4.)

6. Personal Accident and Health Insurance.

Bacon, F. H.

A treatise on the law of life and accident insurance, including benefit societies, and voluntary associations, St. Louis; F. H. Thomas Law Book Company, 1917. 2 Vol.

Childs, A. E.

Presidential address (reviewing the year 1918 in the casualty insurance field). A. E. Childs, President, Columbian National Life Insurance Company, Boston, 1919. 19 pp.

Duffus, W. M.

Special report 6: insurance by casualty companies and assessment associations. (Illinois Health Insurance Commission, Report, May 1, 1919, pp. 403-42.)

Economic World.

Accident insurance and miscellaneous insurances in Canada in 1918. (Economic World, new series, Vol. 17, April 19, 1919, p. 567.)

Literary Digest. Single-eyedness. (Literary Digest, Vol. 62, August 2, 1919, p. 370.) Ocean Accident and Guarantee Corporation.

Primer of accident and sickness insurance. New York City, 1919. 110 pp.

Richardson, F.

Twenty-five years of casualty insurance. New York, Insurance Society of New York, 1918. 16 pp.

7. Strike Insurance.

American Industries.

Strike insurance now available. (American Industries, Vol. 19, July, 1919, p. 35.)

Pendrey, E. Riot and civil commotion polic7. (Economic World, new series, Vol. 17, May 10, 1919, pp. 669-70.) Sherlock, C. C.

Liability of employers during strikes. (Machinery, Vol. 25, August, 1919, pp. 1157-8.)

8. Public Liability.

Economic World.

Liability and casualty insurances in the United States in 1918. (Economic World, new series, Vol. 18, July 12, 1919, p. 63.)

Fay, R. E.

Public liability insurance; its theory, forms, and practice. (Economic World, new series, Vol. 17, June 21-28, 1919, pp. 886-9; 921-4.)

B. SOCIAL INSURANCE.

1. Group Insurance.

Automotive Industries.

Employee group insurance. (Automotive Industries, Vol. 39, July 18, 1918, pp. 94.)

Bloomfield, Meyer.

Group insurance. (In his: Labor and Compensation. New York, Industrial Extension Institute, 1918, pp. 343-349.) Economic World.

Introduction of group life insurance in Great Britain. (Economic World, new series, Vol. 17, March 29, 1919, pp. 456-8.)

Factory.

One way to get men to stay. (Factory, Vol. 21, November, 1918, pp. 836-8.) Kimball, H. W.

Group insurance. (Industrial Management, Vol. 57, February, 1919, pp. 154-6.) McCormack, P. H.

Group insurance; with discussion. (Journal of the Institute of Actuaries, Vol. 51, October, 1919, pp. 313-37.)

Outerbridge, E. H.

Group insurance as an influence in promoting stability in labor groups. (Economic World, new series, Vol. 17, January 4, 1919, pp. 22-3.)

Pope, P. E.

Direct benefits of group insurance. (Safety Engineering, Vol. 39, March, 1920, pp. 127.)

Rice, E.

Group insurance for the industrial worker. (Industrial Management, Vol. 57, March, 1919, pp. 234-6.) Standard Oil Company.

Experience of the Standard Oil Company (New Jersey) with group insurance in 1918. (Economic World, new series, Vol. 17, May 31, 1919, p. 782.) Underwood, W. E.

Group insurance stabilizes labor. (Independent, Vol. 96, December 28, 1918, pp. 445-7.) Watson, Sir Alfred.

An English actuary's criticisms upon group life insurance. (Economic World, new series, Vol. 18, December 27, 1919, p. 603.)

#### 2. Health Insurance.

American Association for Labor Logislation.

Additional endorsements of health insurance. (American Labor Legislation Review, Vol. 9, March, 1919, pp. 173-8.)

American Labor Legislation Review for June, 1919. (Entire number devoted to subject of health insurance.)

Health insurance questions answered. (American Labor Legislation Review, Vol. 9, June, 1919, pp. 276-8.)

Why health insurance must be compulsory to be effective. (American Labor Legislation Review, Vol. 9, June, 1919, pp. 280-3.)

American Federation of Labor.

Health insurance. (American Federation of Labor. Report of Proceedings, 1919, pp. 144-5.) American Medical Association.

Attitude of American Medical Association towards health insurance. (Monthly Labor Review, Vol. 9, December, 1919, pp. 2009-10.) American Industries.

Compulsory sickness insurance a menace. (American Industries, Vol. 20, February, 1920, pp. 37-8.)

Andrews, J. B.

Health promotion through legislation for health insurance. American Labor Legislation Association. New York City, 1919. 10 pp.

Sickness problem and workmen's health insurance. (Pennsylvania Medical Journal Vol. 23, January, 1920, pp. 219-24.) Social insurance and child we fare. (American Child, Vol. 1, May, 1919, pp. 48–53.) The proposed health insurance legislation. (Pennsylvania Medical Journal, Vol. 23, January, 1920, pp. 193-7.) Babcock, C. D. First popular vote on compulsory health insurance. (Oregon Voter, Vol. 16, Jaunary 11, 1919, pp. 142-5.) Mystery and menace of compulsory health insurance in the United States. (Economic World, rew series, Vol. 17, April 5, 1919, pp. 489-90.) Bondfield, M. Some lessons of the British Health Insurance Act. (American Labor Legislation Review, Vol. 9, June, 1919, pp. 202-3.) Burnham, A. C. Community health units and health insurance. Medical Record, Vol. 97, January 17, 1920, pp. 103-5.) Butz, R. H. When insurance companies pay indemnity for disability. (American Industries, Vol. 18, December, 1917, p. 27.) Canada Labour Gazette. Opinion in the United States on state health insurance. (Canada Labour Gazette, Vol. 19, October, 1919, pp. 1190-1.) Cheney, H. Compulsory health insurance. (North American Review, Vol. 209, April, 1919, pp. 490-8.) Clark, F. H. Health insurance. (Southwest Journal of Medicine and Surgery. Vol. 27, September, 1919, pp. 207-12.) Commons, J. R. Health insurance plan as aid to labor. (Iron Trade Review, Vol. 63, November 28, 1918, p. 1243.) Reconstruction health program. (Survey, Vol. 42, September 6, 1919, pp. 798-801.) Commonwealth Club of California. Health insurance. October, 1913. San Francisco, Commonwealth Club of California. 72 pp. Connecticut. Social Insurance Commission. Report of Connecticut social insurance commission. (Monthly Labor Review, Vol. 9, August, 1919, pp. 526-9.) Curtis, W. G. Compulsory health insurance; a socialistic fallacy. (National Fraternal Congress of America Bulletin, February 20, 1920, pp. 1-3; 5-7.) Health conservation vs. a socialistic scheme of charity insurance; a national problem discussed with particular reference to the state of Ohio. (National Fraternal Congress of America Bulletin, Vol. 6, August, 1919, pp. 5-6.) Davin, J. P. Legislative history of compulsor, health insurance in the state of New York. (Medical Record, Vol. 97, January 17, 1920, pp. 105-6.) Devine, E. T. Will California lead? (Survey, Vol. 41, October 26, 1918, pp. 91-2.)

Economic World.

Committee of Wisconsin legislature reports unfavorably upon compulsory health insurance. (Economic World, new series, Vol. 17, February 22, 1919, pp. 277-8.)

Health and accident insurance premiums, new and renewed, by states in 1917. (Economic World, new series, Vol. 16, December 21, 1918, p. 891.)

New York physicians oppose compulsory health insurance system for the state. (Economic World, new series, Vol. 17, March 1, 1919,

p. 314.) Frankel, Lee K.

The sickness problem: Is sickness insurance the remedy? (Pennsyl-vania Medical Journal, Vol. 23, January, 1920, pp. 224-227.)

Goldwater, S. S.

Square look at compulsory insurance as proposed in New York State. (Medical Record, Vol. 95, March 8, 1919, pp. 414-6.) Great Britain. National Health Insurance.

Report on the administration of national health insurance. Part I. During the years 1914-1917. H. M. Stationery Office, 1917. 345 pp. (emd. 8890).

Harris, H. J.

British national health insurance system. 1911-1919. (Monthly Labor Review, Vol. 10, January, 1920, pp. 45-59.)

Special report 14: sickness insurance in Germany. (Illinois, Health Insurance Commission Report, May 1, 1919, pp. 586-99.)

Hoffman, F. L.

Critique of the first report of the New Jersey Commission on health insurance, old age insurance and pensions. (Economic World, new series, Vol. 18, August 9, 1919, pp. 201-3.)

Address on the methods and results of national health insurance in Great Britain. Preliminary Report. New York, B. H. Tyrrel Press, 1920, 72 pp.

Failure of British national health insurance from a medical standpoint. (Economic World, new series, Vol. 19, April 17, 1920, pp. 565-6.)

(Pennsylvania Medical Journal, Vol. 22, July, 1919, p. 664.) Howell, Thomas.

Health insurance and its relation to hospitals. (Modern Hospital, Vol. 11, December, 1918, pp. 466-8.)

Hutchinson, Woods. Medical administration of health insurance. (California. Social Insurance Commission, Report, March, 1919, pp. 28-35.)

Ketcham, D.

Health insurance. (American Political Science Review, Vol. 13, February, 1919, pp. 89-92.)

Lapp, J. A.

Cost of an adequate medical service under health insurance. With discussion. (Pennsylvania Medical Journal, Vol. 23, January, 1920, pp. 201-11.)

Health and old age insurance in Ohio. (American Labor Legislation Review, Vol. 9, March, 1919, pp. 47-58.)

Health insurance. (Monthly Labor Review, Vol. 9, September, 1919, pp. 938-45.)

Health insurance. (National Conference of Social Work, Chicago, Illinois. Proceedings, 1919, pp. 442-7.)

Health insurance and the hospitals. (Modern Hospital, Vol. 11, November, 1918, pp. 398-401.)

Health insurance as a means of providing medical care. With discussion. (National Conference of Social Work. Chicago, Illinois. Proceedings, 1919, pp. 190-5.)

Health insurance from its medical and hospital aspects. (American Journal of Public Health, Vol. 3, December, 1918, pp. 943-4.)

Lewinski-Corwin, E. H.

Medical aspects of health insurance administration. (Monthly Labor Review, Vol. 9, September, 1919, pp. 946-9.)

Lindsay, S. M.

Social insurance. (F. A. Cleveland and Joseph Schafer, editors. Democracy in reconstruction. New York, Houghton, Mifflin Company, 1919, pp. 263-89.)

### Macarthur, M.

American health insurance bill better than the British act; New York measure. (American Labor Legislation Review, Vol. 9, June, 1919, pp. 204-8.)

Mason, H. B.

Report of the Committee on Compulsory Health Insurance. (American Pharmaceutical Association Journal. Vol. 7, October, 1918, pp. (American 899-900.)

Merchant's Association of New York.

Merchant's Association of New York adopts report opposing compulsory industrial health insurance. (Economic World, new series, Vol. 19, March 20, 1920, pp. 417-9.)

National Association of Manufacturers. Commission on Industrial Betterment.

Special report on minimum wage and sickness insurance. New York City, 1918. 5 pp. National Civic Federation.

Adverse report of Committee of the National Civic Federation on immediate compulsory health legislation. (Economic World, new series, Vol. 19, February 14, 1920, pp. 239-40.)

If not compulsory insurance, what? (National Civic Federation Review, Vol. 4, June 5, 1919, pp. 1-2; 16-7.)

National Civic Federation. Committee on Constructive Plan. Social Insurance Department.

Refutation of false statements in propaganda for compulsory health insurance. New York, National Civic Federation, 1919. 43 pp.

National Women's Trade Union League.

Compulsory health insurance: National Women's Trade Union League states position at Philadelphia convention, June 7, 1919. (American Labor Legislation Review, Vol. 9, June, 1919, p. 249.)

New York League for Americanism.

Compulsory health insurance and labor: how the interests of the workers would be affected by this legislation. (Bulletin No. 9.) New York City, 1919. 16 pp. New York State Chamber of Commerce.

Adverse conclusions of the Chamber of Commerce of the State of New York regarding compulsory health insurance legislation. (Economic World, new series, Vol. 19, April 17, 1920, pp. 528-9.)

New York State Federation of Labor. Committee on Health.

Health insurance; advantages to industry, 3rd report, Utica, 1918. 15 pp.

New York State Medical Society.

Attitude of Medical Society of State of New York toward compulsory health insurance. (Monthly Labor Review, Vol. 10, January, 1920, рр. 255-8.)

Rejection of compulsory health insurance by the Medical Society of the State of New York. (Medical Record, Vol. 96, November 29, 1919, pp. 889-90.) Health and Old Age Insurance Commission.

Ohio.

Health insurance movement in the United States, by J. R. Commons and A. J. Altmeyer; Health insurance in Great Britain, by Edith Abbott; Sickness insurance in Germany, by H. J. Harris. (Ohio. Health and Old Age Insurance Commission. Health, health insurance, old age pensions, February, 1919, pp. 287-357.)

Ohio. Health and Old Age Insurance Commission.

History of health insurance. (Ohio. Health and Old Age Insurance Commission. Health, health insurance, old age pensions, February, 1919, pp. 176–84.)

Pennsylvania Health Insurance Commission.

Report of Pennsylvania health insurance commission. (Monthly Labor Review, Vol. 9, July, 1919, pp. 220-6.)

Ransom, J. E.

Sickness facts indicate urgent need of compulsory health insurance. (American Labor Legislation Review, Vol. 10, March, 1920, pp. 41-5.) Isadore. Stern,

Health Insurance. (Pennsylvania Medical Journal, Vol. 22, March, 1919, pp. 391-3.)

Stone, W. S.

Compulsory health insurance in New York opposed by Grand Chief Stone of the International Brotherhood of Locomotive Engineers. (Economic World, new series, Vol. 17, March 8, 1919, pp. 350-1.)

Compulsory health insurance legislation: its present status surveyed and labor's position outlined. (National Civic Federation Review, Vol. 4, February 15, 1919, pp. 5-8.)

Suffern, A. E.

Special report 11: establishment funds in Illinois. (Illinois. Health Insurance Commission Report, May 1, 1919, pp. 532-49.)

Survey.

Health insurance. (Survey, Vol. 41, March 22, 1919, pp. 895-6.) Tucker, G. E.

Compulsory health insurance. (American Industries, Vol. 19, January and February, 1919, pp. 19-20; 24-7.)

Tufts, J. H.

Why social workers should study the need of health insurance. (National Conference of Social Work. Chicago, Illinois. Proceedings, 1918, pp. 407-17.)

United States. Bureau of Labor Statistics.

Social insurance in Germany after the war. (Monthly Labor Review, Vol. 8, April, 1919, pp. 1168-71.)

Social insurance in Portugal. (Monthly Labor Review, Vol. 10, January, 1920, pp. 261-5.) Warren, B. S. and Edgar Sydenstricker.

Health insurance, the medical profession and the public health, including the results of a study of sickness expectancy. (United States Public Health Reports, Vol. 34, April 18, 1919, pp. 775-89.)

372

Wassam, C. W.

Health insurance. (National Efficiency Quarterly, Vol. 1, February, 1919, pp. 286-98.)

Whalen, C. J.

Health insurance. (Illinois Medical Journal, Vol. 35, January, 1919, pp. 1-3.)

Wisconsin. Special Commission on Social Insurance.

Employees mutual benefit association of T. M. E. R. & L. Company. (Wisconsin. Special Commission on Social Insurance. Report, January 1, 1919, p. 65-71.)

Wisconsin. Special Commission on Social Insurance. Report. January 1, 1919. Madison, Democrat Printing Company, 85 pp.

#### 3. Maternity Insurance.

American Medical Association.

Maternity benefit systems. (Journal of the American Medical Association, Vol. 74, February 28, 1920, p. 601.)

American Woolen Company.

Will pay maternity benefits. (Modern Medicine, Vol. 2, January, 1920, p. 42.)

Andrews, Irene O.

Maternity benefits and insurance. (New York, American Association for Labor Legislation, 1920. 4 pp.)

Economic World.

New governor of New York advocates state health and maternity insurance. (Economic World, new series, Vol. 17, January 11, 1919, pp. 61 - 2.)

War and trade union maternity benefits in Great Britain. (Economic World, new series, Vol. 16, December 28, 1918, pp. 926-7.)

Harris, H. J.

Maternity benefits in certain foreign countries. (United States. Children's Bureau. Legal series No. 3, 1919. 206 pp.)

Ohio. Health and Old Age Insurance Commission.

Maternity insurance in European countries. (Ohio. Health and Old Age Insurance Commission. Health, health insurance, old age pensions, February, 1919, pp. 185-91.) l States. Bureau of Labor Statistics.

United States.

New regulation of maternity insurance in Germany. (Monthly Labor Review, Vol. 10, February, 1920, pp. 536-8.)

Worcester, Alfred.

Maternity benefits. (Boston Medical and Surgical Journal, Vol. 182, January 29, 1920, pp. 121-3.)

#### 4. Pensions and Relief Funds.

American Association of University Professors.

Report of the committee on pensions and insurance of the American Association of University Professors. (School and Society, Vol. 9, March 8, 1919, pp. 299-308.)

Andrews, J. B.

Old age pensions for federal employes. (Survey, Vol. 44, May 22, 1920, p. 271.)

Canada Labour Gazette.

Mothers' allowances in relation to child labor. (Canada Labour Gazette, Vol. 19, June, 1919, pp. 713-5.)

Cattell, J. McK.

Carnegie pensions: History of the Carnegie Foundation and reports of the Committee on Pensions of the American Association of Univer-Garrison-on-Hudson, New York. Science Press, sity Professors. 1919. 253 pp.

Policies of the Carnegie Company. (School and Society, Vol. 9, January 4, 1919, pp. 10-23.) Devine, Edward T. and Lilian Brandt.

Disabled soldiers' and sailors' pensions and training. Carnegie Endow-ment for International Peace. Preliminary Economic Studies of the War. No. 12. New York, Oxford University Press, 1919. 471 pp.

Dougherty, H.

Notes on deposit pension schemes. London, Effingham Wilson, 1919. 16 pp.

Fitch, J. A.

For value received: a discussion of industrial pensions. New York, Survey Associates, 1918. 4 pp.

Furst, C.

Insurance and annuities for college teachers. (School and Society, Vol. 8, December 28, 1918, pp. 762-3.)

Great Britain. Local Government Board.

Old age pensions. (Great Britain. Local Government Board. 48th Annual Report, 1918-19. H. M. Stationery Office, 1919, pp. 93-7.) Hulbert, E. D.

Pensions and profit sharing. (American Bankers Association Journal, Vol. 12, September, 1919, pp. 131-4.)

Lane, W. D.

Westchester; what an American county can do. (Survey, Vol. 43, No-vember 22, 1919, pp. 140-3.)

Maylander, Alfred.

Compulsory old-age and invalidity insurance law of Italy. Labor Review, Vol. 9, December, 1919, pp. 2013-22.) (Monthly

Montegriffo, Helen.

County allowances as a paying investment; with discussion. (Minnesota. Board of Control and Child Welfare Boards. Proceedings, 1918, pp. 102-7.)

Pennsylvania. Commission on Old Age Pensions. Report of the Pennsylvania Commission on Old Age Pensions. Harrisburg, J. L. L. Kuhn, State Printer, 1919. 293 pp.

Ripley, C. M.

Mutual benefit association of the General Electric Company. (General Electric Review, Vol. 20, December, 1917, pp. 968-78.)

School and Society.

Carnegie Foundation. (School and Society, Vol. 10, September 13, 1919, pp. 325-6.)

Scott, E. L.

Texas law granting pensions to widowed mothers; critical review. (Texas State Conference of Social Welfare. Proceedings, 1919, January, 1918, pp. 23-4.)

Shaw, A. W.

Profitable pension plans. (In his: Management and executive control. 1919, pp. 211-21.)

Swain, J. and others.

Report on pensions. (National Education Association. Proceedings. 1918, pp. 757-61.)

Teachers Insurance Annuity Association of America.

Insurance and annuities for college teachers, 1919. 23 pp.

Tewksbury, W. J.

Helping workers to help themselves. (Factory, Vol. 23, August, 1919, pp. 276-7.)

374

Thompson, L. A.

Laws relation to mothers' pensions in the United States, Canada, Den-mark and New Zealand. (United States. Childrens' Bureau. Legal series, No. 4. Publication No. 63, 1919. 316 pp.)

United States. Bureau of Labor Statistics. Disability funds, pensions, and group insurance. (United States. Bureau of Labor Statistics. Bulletin 250, Miscellaneous series, 1919, pp. 110-2.)

Old age pensions in Uruguay. (Monthly Labor Review, Vol. 9, September, 1919, pp. 957-8.)

Operation of laborers' and peasants' retirement fund in France, January 1, 1915, to December 31, 1916. Tables. (Monthly Labor Re-view, Vol. 8, June, 1919, p. 1843.) United States Steel and Carnegie Pension Fund.

Treasurer's and Manager's 8th Annual Report for the year ending De-cember 31, 1918. Pittsburgh, 1919. 8 pp.

Walker, N. J.

Mothers' pensions in relation to juvenile delinquency. (Juvenile Court Record, Vol. 18, June, 1919, pp. 7-10.)

#### 5. Unemoloyment.

American Federation of Labor.

Health insurance: insurance against unemployment. (American Federation of Labor. Report of the Proceedings, 1918, pp. 282-3.)

Economic World.

British trade union opposition to the further extension of compulsory unemployment insurance. (Economic World, new series, Vol. 16, December 14, 1918, pp. 854-5.)

Great Britain. Ministry of Labor.

Final report of the Committee of Inquiry into the scheme of out-of-work donation. Cmd. 305. H. M. Stationery Office, 1919. 18 pp.

Minutes of evidence taken before the Committee of Inquiry into the scheme of out-of-work donation. Cmd. 407. H. M. Stationery Office, 1919. 202 pp.

Jackson, C.

Insurance against unemployment. (Fortnightly Review, Vol. 113, February and March, 1920, pp. 306-15; 478-87.)

Kirkwood, J. C.

Unemployment pay in Great Britain. (American Industries, Vol. 20, September, 1919, pp. 28-9.)

Lawrence, A. S.

Prevention of unemployment. (In: Labour party. Labour women on international legislation, 1919, pp. 12-6.)

Lescohier, D. D.

Occupational idleness and the idle; mitigation of occupational idleness; unemployment insurance. (In his: Labor Market, 1919, pp. 68-110; 122-38, 307-9.)

MacLean, H. C.

Italian government unemployment relief measures. '(United States. Commerce Reports, No. 290, December 11, 1919, pp. 1440-5.)

New measures adopted by Italy against unemployment. (United States. Commerce Reports, No. 304, December 29, 1919, pp. 1765-9.)

Marriott, J. A. R.

Right to idle. (Nineteenth Century, Vol. 85, May, 1919, pp. 862-75.)

Maylander, Alfred.

Unemployment and unemployment relief in Germany during the first four months of 1919. (Monthly Labor Review, Vol. 9, September, 1919, pp. 775-83.)

New Zealand Employers' Federation.

Proposals for unemployment relief. (New Zealand Employers' Federation. Industrial Bulletin, Vol. 5, 1919, pp. 11-12.)

Smelser, D. P.

Unemployment and American Trade Unions. Baltimore, Johns Hopkins Press, 1919. 154 pp.

Stone, N. I.

Buying unemployment insurance cheap. (Survey, Vol. 41, December 28, 1918, pp. 399-400.)

Survey.

Insurance and doles. (Survey, Vol. 42, May 10, 1919, p. 249.) United States. Bureau of Labor Statistics.

Belgium unemployment benefits. (Monthly Labor Review, Vol. 9, August, 1919, pp. 530-2.)

New German scheme for compulsory unemployment insurance. (Monthly Labor Review, Vol. 8, February, 1919, pp. 562-3.)

Unemployment and unemployment relief in Germany and Austria. (Monthly Labor Review, Vol. 10, February, 1920, pp. 472-7.)

6. Workmen's Compensation.

Browne, O. G.

Self-insurance for workmen's compensation. (Electric Railway Journal, Vol. 53, June 14, 1919, pp. 1176-7.)

Carpenter, J. A.

State industrial insurance in Nevada. (Engineering and Mining Journal, Vol. 107, June 7, 1919, p. 985-8.)

Clark, L. D.

Scope and operation of the workmen's compensation laws of the United States. (Monthly Labor Review, Vol. 10, April, 1920, pp. 844-862.) Conyngton, M. K.

Compensation laws are vindicated; investigation by government representative in Connecticut, Ohio, and Pennsylvania. (Iron Trade Review, Vol. 63, September 26, 1918, p. 714-5.)

Effect of workmen's compensation in diminishing the necessity of industrial employment of women and children. 1918. (United States. Bureau of Labor Statistics. Bulletin, No. 217, pp. 1-170.)

Economic World.

Extension to agricultural workers of compulsory accident insurance in (Economic World, new series, Vol. 16, November 16, 1918, Italy. p. 709.)

Frincke, M. C. Jr.

What the term "medical service" in workmen's compensation laws includes. (Monthly Labor Review, Vol. 9, July, 1919, pp. 187-205.) Hookstadt, Carl.

Comparison of compensation laws in the United States, including 1919 legislation. (Monthly Labor Review, Vol. 10, January, 1920, pp. 230-47.)

Medical benefits and the medical profession under workmen's compensation laws. (Monthly Labor Review, Vol. 8, May, 1919, pp. 1265-87.)

Shall the ambitious cripple suffer loss of workmen's compensation benefits? (American Labor Legislation Review, Vol. 9, March, 1919, pp. 137 - 41.

Howell, Thomas.

Workmen's compensation, health insurance and hospital. (Modern Hospital, Vol. 11, November, 1918, pp. 414-6.)

Little, R. M.

Who shall bear the extraordinary compensation cost of total disability caused by successive injuries? (American Labor Legislation Review, Vol. 9, March, 1919, pp. 141-9)

Marsh, A. R.

Profitableness of British employers' liability insurance. (Economic World, new series, Vol. 16, September 28, 1918, p. 884.)

Workmen's compensation in relation to rising wages and living costs. (Economic World, new series, Vol. 16, September 28, 1918, p. 452.) Meeker, Royal.

Lacks in workmen's compensation. (American Labor Legislation Review, Vol. 9, March, 1919, pp. 35-46.)

Mitchell, John.

Defects in compensation law. (Eulletin of New York State Industrial Commission, Vol. 5, October, 1919, pp. 2-5.) National Workmen's Compensation Service Bureau.

Revision of the statistical plan of the National Workmen's Compen-sation Service Bureau. (Economic World, new series, Vol. 17, Jan-uary 11, 1919, pp. 59-61.) Pillsbury, A. J.

Adventure in state insurance. (American Economic Review, Vol. 9, December, 1919, pp. 681-92.)

Reiley, A. D.

Insurance company in industrial hygiene. (American Journal of Public Health, Vol. 10, February, 1920, pp. 160-3.)

Stoddard, C. F.

Hernia as a factor in workmen's compensation awards. (Monthly Labor Review, Vol. 7, November, 1918, pp. 1371-90.) United States. Bureau of Labor Statictics.

Workmen's compensation legislation of the United States and foreign countries, 1917 and 1918. (United States. Bureau of Labor Sta-tistics. Bulletin, No. 243, 1918, pp. 1-102.)

Wadsworth, A. B.

Development of the State Departments of Health in relation to health insurance and industrial hygiene. Bibliography. (American Journal of Public Health, Vol. 10, Jaruary, 1920, pp. 52-8.)

#### 7. Other.

American Association for Labor Legislation.

Next steps in social insurance in the United States. (American Labor Legislation Review, Vol. 9, March, 1919, pp. 107-14.)

Bloomfield, Meyer.

Industrial and social insurance. (In his: Labor and Compensation, 1918, pp. 350-8.)

Brosmith, William.

Difference in principle between casualty and life insurance contracts. (Economic World, new series, Vol. 18, December 20, 1919, pp. 561-4.) California. Social Insurance Commission,

Report of the California Social Insurance Commission, March, 1919. Ŝacramento, California State Printing Office, 1919. 132 pp.

Domestic Engineering. Master plumbers' mutual liability insurance plan successful. (Domestic Engineering, Vol. 90, January 10, 1920, pp. 74-6.) Huebner, S. S.

Insurance for druggists. (American Pharmaceutical Association Journal, Vol 8, October, 1919, pp. 832-7.) 25

Lindsay, S. M.

Next steps in social insurance in the United States. (American Labor Legislation Review, Vol. 9, March, 1919, pp. 107-14.)

Schneider, A. J.

Cincinnati Planer Company's first year's experience. (American Machinery, Vol. 50, March 27, 1919, p. 580.)

United States. Bureau of Labor Statistics.

Proposed changes in the German invalidity and survivors' insurance system. (Monthly Labor Review, Vol. 8, January, 1919, pp. 285-8.)

C. INDUSTRIAL ACCIDENTS, DISEASES AND POISONS.

1. Industrial Accidents.

Automotive Industries.

Accidents in Cadillac plants lessened. (Automotive Industries, Vol. 39, October 17, 1918, pp. 673-4.)

Chaney, L. W.

"Engineering revision" as seen by safety committee. (Monthly Labor Review, Vol. 7, December, 1918, pp. 1483-99.)

Influence of the war on accident rates in machine building. (Monthly Labor Review, Vol. 8, April, 1919, pp. 958-68.)

Pre-war and war-time accident rates in the iron and steel industry. Monthly Labor Review, Vol. 9, November, 1919, pp. 1555-9.)

Davis, E. M.

Statistics in accident prevention. (Electrical World, Vol. 73, March 8, 1919, pp. 476-7.) Dawson, M. M.

State accident insurance in America a demonstrated success. (American Labor Legislation Review, March, 1920, pp. 8-14.)

Fay, A. H.

Accidents at metallurgical works in the United States during the calendar year 1917. (United States. Bureau of Mines. Technical paper 215, pp. 1-21.)

Coal-mine fatalities in the United States, 1918. (United States. Bureau of Mines, 1919, pp. 1-61.)

Coke-oven accidents in the United States during the calendar year, 1918. (United States. Bureau of Mines. Technical paper 239, 1919, pp. 1-23.)

Mine accidents; English speaking versus non-English-speaking employees. (Engineering and Mining Journal, Vol. 108, November 1, 1919, pp. 726-9.)

Quarry accidents in the United States during calendar year 1917. (United States. Bureau of Mines. Technical paper 213, 1919, pp. 1-60.)

Hoeveler, J. A.

Electrical hazards. Some accidents caused by electricity in Wisconsin since 1915, their causes and remedies. (Wisconsin Safety Review, Vol. 1, No. 4, February, 1919. 24 pp.)

Iron Age,

Industrial deaths exceed those of war. First Annual Massachusetts Accident Prevention Congress, Worcester. (Iron Age, Vol. 105, March 18, 1920, pp. 809-11.)

Literary Digest.

Makers of accidents. (Literary Digest, Vol. 64, February 7, 1920, pp. 91-3.)

378

Love, T. B. Government's responsibility for disabled industrial workers. (Academy of Political Science. Proceedings, Vol. 8, February, 1919, pp. 286-90.) Medical Record. Causation and prevention of industrial accidents. (Medical Record, Vol. 95, May 3, 1919, pp. 745-6.) Meeker, Royal. Cost of industrial accidents. (Monthly Labor Review, Vol. 10, April, 1920, pp. 831-43.) Industrial hazards. (Monthly Labor Review, Vol. 9, September, 1919, pp. 609-16.) Payne, E. G. Education in accident prevention, 1919. (Chicago, Lyons and Carnahan, 1919. 158 pp.) Scheffel, Carl. Análysis of 216 industrial accidents. (Medical Record, Vol. 95, April 26, pp. 685-7.) United States. Bureau of Labor Statistics. Accident frequency and severity rates in Wisconsin, 1915-17. (Monthly Labor Review, Vol. 7, October, 1918, pp. 1043-50.) Economic consequences of permanent disability accidents in California. (Monthly Labor Review, Vol. ", October, 1918, pp. 898-920.) International Association of Industrial Accident Boards and Commissions. Fourth Annual Meeting, Boston. (United States. Bureau of Labor Statistics, Bulletin No. 248, 1919, pp. 1-306.) Proceedings of the Fifth Annual Meeting of the International Associa-tion of Industrial Accident Boards and Commissions. (United States. Bureau of Labor Statistics, Bulletin No. 264, 1919, pp. 1-224.) Recent reports of industrial accident commissions. (Monthly Labor Review, Vol. 10, February, 1920, pp. 522-7.) Trend of accidents frequency rates in certain plants in the iron and steel industry to the end of 1918. (Monthly Labor Review, Vol. 8, June, 1919, pp. 1781-4.) Wisconsin industrial accident rates, 1915-1917, classified by industry (Monthly Labor Review, Vol. 9, July, 1919, pp. 184-5.) United States. Labor Department. Working Conditions Service. How to give illustrated lectures on accident prevention to workmen. (Washington. Government Printing Office, 1919. 13 pp.) 2. Industrial Diseases and Poisons. Albaugh, R. P. Brass poisoning; symptoms and diagnosis. (Modern Medicine, Vol. 1, July, 1919, p. 202.) Wood alcohol poisoning. (Modern Medicine, Vol. 1, August, 1919, p. 300). American Public Health Association. Committee on Industrial Morbidity Statistics. Sickness records for industrial establishments. (United States. Public Health Reports, Vol. 34, November 14, 1919, pp. 2593-2604.) Baskerville, C. Skin diseases from certain lubricants. (Journal of Industrial and Engineering Chemistry, Vol. 11, August, 1919, pp. 797-8.)

Cone, L. C.

Dangers in the dyestuff industry. (Chemical and Metallurgical Engineering, Vol. 22, January 7, 1920, pp. 33-5.) Great Britain. Ministry of Munitions.

Health of munition workers committee. Industrial health and efficiency; final report, 1919. (United States. Bureau of Labor Statistics. Bulletin 249. 374 pp.)

Hamilton, A.

Industrial poisoning; abstract. (Scientific American Monthly, Vol. 1, January, 1920, pp. 89-90.)

Industrial poisoning in American anilin dye manufacture. Poisoning from exhaust gas. (Monthly Labor Review, Vol. 8, February, 1919, pp. 517-33; 537-9.)

Hubbard, S. D.

Occupational affections of the skin. (New York City Department of Health. Monthly Bulletin, Vol. 9, February, 1919, pp. 41-4.)

La Forge, Zoe.

Health bazards of pottery workers. (Public Health Nurse, Vol. 12, January 1920, pp. 26-31.)

Lanza, A. J.

Occupational diseases; with discussion. (United States. Department of Labor. Proceedings of the Fifth Annual Convention of the Asso-ciation of Governmental Labor Officials of the United States and Canada, 1918, pp. 68-75.)

Lauffer, C. A.

Industrial health hazards. (Modern Medicine, Vol. 1, November, 1919, pp. 588-94.)

Literary Digest.

Is infection legally an accident? (Literary Digest, Vol. 63, December 13, 1919, pp. 109-10.) National Safety Council.

Industrial dermatosis to be investigated by National Safety Council. (Monthly Labor Review, Vol. 10, February, 1920, pp. 510-12.) New York. Department of Labor. Division of Industrial Hygiene. Health hazards of the chemical industry. (Special bulletin 96, 1919.

69 pp.) Perry, A. R.

Preventable death in cotton manufacturing industry. (United States. Bureau of Labor Statistics. Bulletin No. 251, 1919, pp. 1-534.) Rand, W. H.

Composite industrial poisons: a review. (Monthly Labor Review, Vol. 10, February, 1920, pp. 480-501.)

Sherlock, C. C.

Disease and accident liability. (Iron Trade Review, Vol. 65, July 17, 1919, pp. 168-9.)

Diseases and infections. (American Machinery, Vol. 50, January 2, 1919, pp. 28-30.)

United States. Bureau of Labor Statistics.

Carbon monoxide poisoning in factories. (Monthly Labor Review, Vol. 9, November, 1919, pp. 1565-6.)

Factory conditions and pulmonary phthisis in Great Britain. (Monthly Labor Review, Vol. 9, February, 1919, pp. 552-5.)

Industrial hygiene work of the New York City Department of Health. (Monthly Labor Review, Vol. 9, September, 1919, p. 906-8.)

Women in the lead industries. (United States. Bureau of Labor Statistics. Bulletin No. 253, 1919, pp. 1-38.)

D. MISCELLANEOUS, STATISTICS AND GENERAL THEORY.

### 1. Economics.

Anderson, B. M. Jr.

Effects of the war on money, credit, and banking in France and the United States. Carnegie Endowment for International Peace. Preliminary Economic Studies of the war, No. 15. New York, Oxford University Press, 1919. 27 pp.

Bloomfield, Daniel.

Modern industrial movements. New York, H. W. Wilson, 1919. 377 pp. Bogart, E. L.

Direct and indirect costs of the great world war. Carnegie Endowment for International Peace. Preliminary Economic Studies of the war. No. 24. New York, Oxford University Press, 1920. 338 pp.

Bureau of Applied Economics.

Changes in the cost of living, 1914-1919. Washington, Bureau of Applied Economics, 1919. 51 pp.

Standards of living: A compilation of budgetary studies. Washington, Bureau of Applied Economics, 1919. 49 pp.

Carver, T. N.

Government control of the liquor business in Great Britain and the United States. Carnegie Endowment for International Peace. Preliminary Economic Studies of the war, No. 13. New York, Oxford University Press, 1919. 192 pp.

Principles of political economy. Boston, Ginn, 1919. 588 pp. Carlton, F. T.

Elementary economics. An introduction to the study of economics and sociology. New York, Macmillan Company, 1920. 212 pp.

Daly, T. F.

Government in private business. (Economic World, new series, Vol. 16, October 12, 1918, pp. 525-8.)

Evans, Henry.

Labor, capital and democracy with particular reference to government insurance. (Economic World, new series, Vol. 16, October 26, 1918, pp. 599-600.)

Fisher, Irving.

Stabilizing the dollar. New York, Macmillan, 1920. 305 pp.

Glasier, J. B.

The meaning of socialism. London, National Labour Party, 1919. 245 pp.

Gompers, Samuel.

Labor movements and labor problems in America. Compiled and edited from the addresses and writing of Samuel Gompers. Vol. 1. Labor , and the common welfare. Vol. II. Labor and the employer. New York, E. P. Dutton and Company, 1919.

Hanna, H. Ś.

Summary of increased cost of living, July, 1914, to June, 1919. (Monthly Labor Review, Vol. 9, October, 1919, pp. 989-96.)

Huntington, Ellsworth.

World power and evolution. New Haven, Yale University Press, 1919. 287 pp.

Husslien, J. C.

Democratic industry: A practical study in social history. New York, P. J. Kennedy and Sons, 1919. 362 pp.

Keynes, J. M.

Economic consequence of the peace. New York, Harcourt, Brace and Howe, 1920. 298 pp.

Mitchell, W. C.

History of prices during the war. Summary. Washington, War Industries Board, 1919. 95 pp. National Industrial Conference Board.

Wartime changes in wages, September, 1914, to March, 1919. Research report No. 20. Boston, National Industrial Conference Board, 1919, 128 pp. Pigou, A. C.

The economics of welfare. London, Macmillan, 1920.

Roberts, G. E.

The distribution of wealth. New York, National City Bank of New York, 1919. 16 pp. Robinson, C. E.

New fallacies of Midas: A survey of industrial and economic problems. New York, McBride, 1919. 294 pp.

Society of Industrial Engineers.

American and International labor conditions. Cleveland, Society of Industrial Engineers, 1919. 230 pp.

Spargo, John.

The enemy of political and industrial democracy. New York, Harper, 1919. 389 pp.

Taussig, F. W.

Free trade, the tariff, and reciprocity. New York, Macmillan, 1920. 219 pp.

### 2. Sociology.

American Red Cross.

The work of the American Red Cross during the war: A statement of finances and accomplishments for the period July 1, 1917, to February 28, 1919. Washington, American Red Cross, 1919. 90 pp.

Barnes, H. E.

Two representative contributions of sociology to political theory: The doctrines of William Graham Sumner and Lester Frank Ward. (American Journal of Sociology, Vol. 25, July and September, 1919, pp. 1-23; 150-69.) Crane, R. N.

Infant welfare legislation. (Journal of Comparative Legislation and International Law, Vol. 1, April, 1919, pp. 58-65.)

Ellwood, C. A.

The social problem: A reconstructive analysis. New edition, revised with new matter, Macmillan, 1919. 289 pp.

Hoffman, F. L.

A plan for a more effective federal and state health administration. Newark, New Jersey, Prudential Press, 1919. 87 pp.

Smith-Gordon, L. and Obrien, C.

Co-operation in many lands. Manchester, England. Co-operative Union. 1919. 72 pp. Sonnichsen, Albert.

Consumers co-operation. Introduction by John Graham Brooks. New York, Macmillan, 1919. 223 pp.

#### 3. Statistics.

American Public Health Association. Committee on Relation of 1920 Census to Vital Statistics.

Report on 1920 Census. (American Journal of Public Health, February, 1920, p. 173.)

[Conclusions of committee are of interest to casualty actuaries and statistics.]

Bowley, A. L.

Division of the product of industry: An analysis of national income before the war. New York, Oxford University Press, 1919. 60 pp. Caverly, R. R.

Annual cyclopedia of insurance in the United States, 1919. New York, R. R. Caverly, 1919. 613 pp.

Harvard University Committee on Economic Research.

Review of Economic Statistics. ("Besides the Review, the statistical service will include . . . a monthly supplement to the quarterly publication which will deal with current monthly data and will present an index of business conditions.")

Haskell, Allan C.

How to make and use graphic charts. New York, Codex Book Company, Inc., 1919. 539 pp. Insurance Almanac and Encyclopedia.

Insurance almanac and encyclopedia: An annual of insurance facts for 1919. Containing handy information of the business insurance, the officers and the managers of all classes of companies insurance department officials etc. New York, Weekly Underwriter. 592 pp. International Encyclopedia.

New international year book:  $\Lambda$  compendium of the world's progress for the year 1918. New York, Dodd, Mead, 1919. 791 pp. Knibbs, G. H.

Mathematical theory of population, of its character and fluctuations, and of the factors which influence them. (Australia. Census and Statistics Bureau. Census of the Commonwealth for 1911. Melbourne, 1917, Vol. 1. 466 pp.)

#### Lipka, Joseph.

Graphical and mechanical computation. New York, John Wiley and Sons, 1918. 264 pp.

Secrist, Horace.

Statistics in business. New York, McGraw Hill Book Company, 1920. 137 pp.

West, C. J.

Introduction to mathematical statistics. Columbus. R. G. Adams and Company, 1918. 150 pp.

Whipple, G. C.

Vital statistics: An introduction to the science of demography. New York, John Wiley and Sons, 1919. 517 pp.

#### 4. Miscellaneous.

#### Bailey, B. P.

Merits of reciprocal insurance. (Textile World, Vol. 53, June 22, 1918, pp. 6208-9.5

Fisher, Arne.

Future of German re-insurance. (Economic World, new series, Vol. 18, September 27, 1919, pp. 457-8.)

Joyce, J. A.

Mr. Royal Meeker on insurance is a "community enterprise." (Eco-nomic World, new series, Vol. 18, September 13, 1919, p. 380.)

Morrison, C. E.

Experiment in insurance co-operation. (Electrical World, Vol. 71, May 25, 1918, pp. 1082-3.)

Rees, Fred Harris.

Investigators and adjusters hand book, by Fred H. Rees . . . A text book on automobile, team, general liability workmen's compensation, burglary and theft insurance. Chicago: Spectator Company, 1918. 264 pp.

Underwood, W. E.

State insurance monopoly and its langers. (Independent, Vol. 97, February 22, 1919, pp. 274-5.)

E. BIBLIOGRAPHICAL NOTES,

Insurance Society of New York.

New books (on insurance). News letter No. 32, February, 1919. New York, Insurance Society of New York, 1919. 3 pp.

Journal of Industrial Hygiene and Abstract of Literature.

This gives abstracts of current literature on industrial hygiene. National Workmen's Compensation Service Bureau. Weekly bulletin. Bibliography for current literature in workmen's compensation and allied subjects. New York City. Spectator Company.

Insurance works. New York, Spectator Company, 1919. 4 pp. United States. Library of Congress. Select list of recent references on employers' liability and workmen's compensation. (Obtainable only through Public Affairs Information Service, 11 West 40th Street, New York City.) 9 pp.

# CURRENT NOTES.

## WHAT IS HAPPENING IN THE CASUALTY INSURANCE FIELD.

Beginning with this number we hope regularly to present, as a feature of this department, memoranda outlining such developments in the various branches of casualty insurance as are of current interest to our members.

# Personal Accident and Health Insurance.

The health insurance field is one in which only a few of the more prominent companies have made any attempt to obtain proper statistical data. This condition was disclosed through a call recently issued by the Bureau of Personal Accident and Health Underwriters for health statistics. A majority of the companies were unable to furnish any experience whatever, while a few were able to show only earned premiums and incurred losses on the total business. This situation was equally true of companies writing a large volume of business and of those writing only a comparatively small volume.

The fact that the companies have not compiled statistics on a basis which would enable them to underwrite properly is indeed surprising, for health insurance has been written for the past twenty years, and for the last five years the volume has been increasing very fast. Furthermore, the loss latio on the business during the past few years has been very unsatisfactory, and it would seem a wise expenditure to make the outlay necessary to install a system of compiling statistics. The health premiums for the year 1918, as shown in the Spectator Year Book, amounted to \$9,290.586 (41 companies), the plate glass premiums \$7,636,113 (37 companies), and the burglary and theft premiums to \$7,786,099 (38 companies). For several years the companies have been operating the Burglary Bureau and the Plate Glass Bureau of which one of the functions is the furnishing of statistics. If statistics are necessary for the management of these two lines of business, there is no good reason why they are not also necessary for the health business.

The health insurance policy at its inception was somewhat limited, but from time to time the contract has been considerably liberalized. As stated above, however, no attempt has been made to gauge accurately the cost of the various features of the contract, as for instance, the partial indemnity and life indemnity features. This information should be obtained and it would also be wise to compile experience so as to show results for the various occupations, forms of contract, age groups and state groups.

It is the intention of the Committee of Five on Statistics of the Bureau of Personal Accident and Health Underwriters to devise a not too elaborate statistical plan for the guidance of those companies who have not yet gone into the work.

E. S. FALLOW.

## Burglary Insurance.

Prior to the year 1915, there were very few available statistics on burglary insurance, with the possible exception of some information relating to the burglary insurance business as a whole. A statistical bureau was organized in conjunction with the Burglary Insurance Underwriters Association in 1914, and has compiled statistics on the various burglary lines for the policy years 1915, 1916, 1917 and 1918. The figures on these four policy years have been compiled to January 1, 1920, and they show rather interesting results.

An idea of the growth of burglary insurance in the United States may be gained from the figures given below, which show a marked increase in premium volume.

Year. 1915	Net	Premiums Written \$4,747,762
1916		5,406,594
1917		6,470,927
1918		7,786,099
1919		13,494,833

As the residence business comprises approximately 45 per cent. of the total burglary premiums, a study of the loss ratios on this particular line by cities and states is interesting, particularly with a view to ascertaining the increase in burglaries during the period following the European war and the effect of the increased valuation of household property upon the business. National prohibition also has had its effect on this particular line of business.

The loss ratios on the earned premiums, and the average loss under residence policies for the four policy years 1915, 1916, 1917 and 1918, with losses thereon down to January 1, 1920, are as follows:

Year of Issue.	Loss Ratio.	Average Loss
1915	46%	\$145
1916	48%	150.52
1917	50%	138.80
1918	67%	164.89

The loss frequency under residence policies has doubled in five years. On the same basis that showed one loss in 1915, the number was two in 1919, as will be noted from the following figures:

Policy Year	. Numi	per of Losses.
1915 .		. 1
1916 .		1.2
1917 .		1.2
1918 .		1.5
1919 .		2

These figures show an increase of  $33\frac{1}{3}$  per cent. for 1919 over 1918, and 100 per cent. for 1919 over 1915.

Naturally the increasing loss frequency with the increasing average loss has resulted in an increased loss ratio. With the exception of a few changes in rates in certain cities, due to the re-grouping of certain territories, there has been no increase in residence rates, excepting the 10 per cent. increase promulgated in December, 1917, but a more radical increase in rates and a further application of the co-insurance policy is now under consideration and will undoubtedly be adopted.

There is at least one other cause that has contributed largely to our increasing losses, and that is national prohibition. During the year 1915 the losses on wines and liquors occurred infrequently, and were so small in volume that they were not separately coded, and even during the first half of 1919 such losses were comparatively small in volume, but had increased some over 1915 owing to prohibition having become effective in certain states; but after July 1, 1919, these losses increased tremendously, and while the figures on wines and liquors for all companies combined are not available at this time, a careful estimate based or, the figures compiled by a few of the companies indicates that the total payments must have amounted to at least \$200,000 last year, of which 90 per cent. was paid after July 1, 1919. Such losses became so serious that the companies decided on January 1, 1920, to limit the insurance on wines and liquors to 20 per cent. of the total blanket insurance under the policy, unless an additional amount is specifically insured at a separate rate.

It is the opinion of burglary insurance underwriters generally that there has been no reduction in the proportionate number of losses and no reduction in the average loss for the first five months of 1920. In fact, both of these factors will undoubtedly show a still further increase. The losses on wines and liquors continue at about the same rate as for the last six months of 1919, and inasmuch as the residence policy permits the assured to leave his premises vacant for four months, it is feared that the losses on this class of property during the coming summer will be exceedingly heavy.

F. S. GARRISON.

## Group Insurance.

The analogy between group insurance and casualty insurance is becoming more apparent as the business develops. Life companies have expanded from group life to the group health business and both are being written along the lines of compensation insurance. In both cases the employees of employers are insured for the benefit of the employee or his beneficiary and the employer pays the premium in whole or in part.

Under group life policies the insurance is only against death and total and permanent disability, so that the various hazards are not so numerous as to necessitate a manual of rates. At the present time most companies have adopted a minimum standard rate with constant extra premiums for different industries. The standard rate is generally based on the "American Men Table of Mortality (Ultimate)," from which in some cases an average premium determined from the age classification in the group is used. The extra premiums range from \$1 per \$1,000 up and cover the increased cost somewhat as in compensation insurance.

Non-participating group policies contain an experience rating clause, while the dividends on participating group policies are determined on the same principles as dividends on compensation policies. The general experience obtained through the compensation business in being availed of by the underwriters and students of group insurance.

Mr. E. E. Cammack is now undertaking an investigation of the

combined mortality experience of those companies doing group business with the intention of showing the actual mortality experienced in the various industries now insured. The data are now being collected and it is expected this investigation will be well advanced by the end of the year.

J. D. CRAIG.

## Plate Glass Insurance.

There were several increases in plate glass rates during the year 1919, and another increase in several states on February 1, 1920, and still another one in practically all states on June 1, 1920. These increases are due to the steady increase in the cost of furnishing and setting new glass, which cost is more than three times what it was in 1915.

While several catastrophe losses, such as the explosions at Black Tom Island and Morgan, N. J., cost the plate glass companies over \$400,000, the increased cost of furnishing and setting glass is the real cause for the raise in rates.

The European war had a marked effect on the price of glass in this country. Prior to the war, there was practically no glass exported from this country to Europe, as the large factories in England, France, Belgium and Germany supplied the European markets. Early in the war the Belgian factories were destroyed. A little later many of the English factories were destroyed by air The French factories also were forced out of business and raids. the American factories during the war supplied not only the European markets but also those of India and other countries which had formerly obtained their glass from the European markets. Prior to the war Canada obtained most of her glass from the English factories. While many of the European factories are beginning to resume operations, the effect on the market has been very slight as yet.

Another factor entering into the increase in the price of glass is the increase in wages paid to workmen in glass factories and to glaziers' employees, the actual cost of glazing having advanced nearly 100 per cent. in five years.

If a plate of glass is not kept in stock in the town or city where the loss occurs, the new plate must be shipped from the nearest market, and as freight rates have increased, this adds another item of increase to the cost of furnishing the glass. Cartage charges from the freight station to the Assured's premises have also increased.

The statistics of one company showing the various causes of plate glass losses are shown in the following table by percentages which the number of losses in each class bears to the total number of losses.

Cause Perce	entage.
Articles (other than cash carriers) dropped on show cases	2.74
Awnings falling	.55
Burglars	1.17
Cash carriers dropped on show cases	.16
Defective setting	1.03
Doors slamming	2.92
Explosion	5.25
Fighting and street disturbances	1.46
Frost, snow, hail or ice, and weather other than windstorms	2.28
Intoxicated persons	1.35
Persons leaning against or falling on glass	3.02
Settling of building	3.73
Shelves, shutters or transoms falling	.56
Stone or missile or baseball throwing	15.91
Stones or other objects thrown by automobiles	4.91
Street vehicles (excluding stones or other objects thrown by auto-	
mobiles)	2.65
Sun's heat	.01
Window dressing	.36
Window cleaning	.74
Window or showcase display articles falling	.54
Windstorm	6.91
Workmen in or about premises	1.74
All other known causes not specifically classified	9.82
Unknown causes	30.19
1	100.00

PLATE GLASS PREMIUMS WRITTEN.

1915		\$4,866,727
1916		5,107,365
1917		5,884,191
1918	, <u></u>	7,636,113
1919		9,227,330
		F. S. GARRISON.

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## Automobile Insurance-1920 Revision of Rates.\*

Automobile insurance divides itself into two broad divisions, the casualty insurance and the property insurance. Casualty companies write liability, property damage and collision coverage and the fire and marine companies write fire, theft, transportation, collision and property damage coverage. Some companies are permitted to write all forms of automobile insurance in certain states. The National Workmen's Compensation Service Bureau makes rates and rules on liability, property damage and collision insurance for use by the member casualty companies. The National Automobile Underwriters Conference makes the rates and rules on fire, theft, transportation, collision and property damage coverage for use by its member fire and marine companies. The two organizations cooperate on property damage and collision rates and rules.

Three automobile manuals are issued by the Bureau, the manual of rates, the rule manual and the "list of automobiles."

For purposes of rating, all automobiles have been classified into four broad divisions,-private passenger automobiles, commercial automobiles, public automobiles and manufacturers' and dealers' automobiles. Private passenger cars were previously rated for liability and property damage insurance on a horse-power basis, the rates increasing as the insurable horse-power increased. The S. A. E. horse-power formula was used to determine the insurable horsepower of each car manufactured. Each make of car was listed in the "list of automobiles" showing specifications, list price and insurable horse-power. An innovation was adopted when the 1919 manual was issued, in that the list price basis was used as a basis for rating, instead of the horse-power basis. Manufacturers had been improving the engine design to such an extent that the S. A. E. horse-power formula was no longer even approximately correct. For example, the formula produced the same insurable horse-power for the Mercer and the Ford, whereas the actual horse-power of the Mercer was twice that of the Ford. In looking around for a better basis for rates it was found that the list price itself was a reasonable guide to the hazard involved. All cars were finally classified into four general lists price groups-\$0 to \$1199, \$1200 to \$2499, \$2500 to \$3499 and \$3500 and over.

During the year, however, it was found that the list price basis

\* This memorandum was prepared by Mr. A. Ryder, of the National Workmen's Compensation Service Bureau, at the invitation of the Editor. was not entirely satisfactory, partly because of the constant changes in list prices announced by the manufacturers, but also because of difference in list price of the various types of bodies attached to the same model of chassis. The touring car, or the roadster, might have a list price just underneath \$2500, whereas the same car equipped with wire wheels would be listed slightly above \$2500. This would produce a higher liability rate for the latter than for the former, although to all practical purposes the hazard was just the same. It was decided, therefore, to do away with the list price basis, in favor of a symbol for every car listed in the "List of Automobiles." This task was completed in time for the 1920 manual, which manual is now in effect. The fire companies have also adopted the symboling method for fire and theft insurance, so all five leading forms of automobile insurance are now written on that basis.

All cars are divided into four symbol groups for liability and property damage rating purposes,—namely, W, X, Y and Z. The cars in class Z are the expensive cars and the rates for same are approximately 50 per cent. above the rates for cheaper cars of class W.

The property damage rates for private passenger cars are approximately 25 per cent. of the liability rates, and the rates named now include the "loss of use" coverage. (By "loss of use" is meant indemnity to the assured for his legal liability in connection with loss of use of property of others that was damaged as a result of the ownership, maintenance or use of the insured automobile.) Formerly, property damage rates had been named to exclude "loss of use" with the provision that 10 per cent. was to be added to include "loss of use."

Automobile liability and property damage rates are much higher in some territories than others. This is true not only for private passenger cars, but for all types of automobiles. Eight different territorial groupings have been established. Some of the classifications are rated seven or eight times as high in New York City (which is called Territory 1) as in the western rural districts (Territory 8). The 8 per cent. reduction established in the 1919 manual for the private type car restricted to "private purposes" has been continued in the 1920 manual; likewise, the 20 per cent. reduction, for driving restricted not only to "private purposes" but also to the owner.

Commercial cars have been rated for liability and property dam-
age purposes not only in accordance with territory but also in accordance with the business of the assured. Formerly, there were seven different general classes of risks: ambulances and fire engines were rated in the highest class, with baggage transfer trucks in the next highest. Truckmen were rated in a lower class, coal dealers in a still lower class, department stores in the next lower class, then most of the other retail stores and finally the wholesale risks were in the lowest group of all. The latest experience showed, however, that the cars used for wholesale delivery were costing just as much as the cars used in retail delivery. The 1920 manual shows only three general divisions in place of the former seven. Newspaper delivery cars, baggage transfer trucks and all cars used in emergency work are rated at the highest rates. Coal dealers, truckmen and certain other risks are written at a medium rate and all of the ordinary retail and wholesale risks are written at the lowest rate.

Still another innovation has been adopted in the 1920 manual. Commercial cars are rated in accordance with the load capacity of the car, the rate being highest for the heavy trucks (over 3½ tons), a little lower for the medium weight trucks and lowest of all for the light trucks (one ton load capacity, or less). Prior to 1920, opinion had been divided as to the respective hazards of heavy and light trucks, but the latest experience warranted the higher rate for heavy trucks so rates were computed accordingly.

Electrics are now granted a 10 per cent. reduction from the rates for gasoline driven commercial cars. (The 10 per cent. reduction also extends to collision coverage.)

Public automobiles are divided into two general classes,—livery cars on the one hand and taxicabs jitneys, omnibusses, etc., on the other hand. The liability rates are higher for livery cars than for private passenger cars, and they are higher yet for the taxicabs and omnibusses. Jitneys and busses are rated for liability and property damage coverage according to seat ng capacity.

Collision insurance was written on the list price basis prior to 1920. The list price basis was found impractical, however, because of the constant changes made in list prices by the manufacturers. List prices were changed so frequently during the year that the same model and type of car would be insured by three different purchasers at three different list prices and at three different collision rates. It was necessary, therefore, to symbol all of the cars so there would be no such discrepancies in the future. The 1920 manual therefore shows collision symbols (as well as the liability and property damage symbols) for all cars manufactured or sold in the United States.

Three forms of collision coverage are sold, namely, full coverage, \$50. deductible, and \$100 deductible. The rates are very much higher for the full coverage than for the deductible forms, especially on the cheaper cars. Of course, the rates increase as the cost of the car increases. Some of the collision rates were increased as much as 100 per cent. when the 1920 manual was issued, particularly on the cheaper cars.

Prior to the issuance of the 1920 manual the collision rates had been the same for an old car as for a new car, provided the list prices were the same. The latest experience, however, developed a higher cost for the new car, so three sets of collision rates were established in the 1920 manual. The highest rates were applied to "new" cars, then a scale of rates about 15 per cent. lower was adopted for the "one year old" cars and a scale of rates about 30 per cent. lower for the "over one year old" cars. Furthermore, a 10 per cent. reduction is applied to electrics. (Prior to this time, both gasoline and electric cars had taken the same rates throughout.) A rule was also promulgated granting a 10 per cent. reduction for the attachment of an approved front bumper and an additional  $2\frac{1}{2}$  per cent. reduction for the attachment of an approved rear bumper.

The collision rates were the same in 1919 for commercial cars as for private passenger cars of the same list price, and in years previous the collision rates were even higher for commercial cars. The latest experience indicates, however, that collision is not costing quite as much on commercial cars as on private passenger cars, so the 1920 manual shows a separate scale of rates for commercial cars somewhat lower than the rates for the private passenger cars. Furthermore, the experience on commercial cars did not bring to light any difference in cost between new and older cars, so the collision rates are the same for a new commercial car as an old commercial car.

It was previously mentioned that the rates depend on the territory. The entire United States has been carefully charted and every city, town and village has been classified in one of the eight different territory schedules. Territory schedule 1 applies to New York City, schedule 2 to New York "suburban territory," schedule

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CURRENT NOTES.

3 to Boston and other large cities, and each succeeding schedule applies in general to smaller and smaller cities; finally the rural districts are placed in territory schedule 7 for the east and territory schedule 8 for the west and scuth. Each city territory has been defined to include surrounding territory to the extent of five or ten miles or so, on the theory that the hazard is the same for a car garaged in the suburbs as for a car garaged in the city itself.

Considerable progress has been made in the matter of keeping automobile statistics. The automobile statistical plan has been revised to take care of the underwriting changes embodied in the 1920 manual. Statistics will be kept according to the symbols adopted for the liability and property damage coverage on private passenger cars, instead of on the previous list-price basis. Ford cars will be kept in a separate experience group. Each group will also be divided according to whether the body is open or closed. A re-grouping of the commercial car classifications was also embodied in the statistical plan and experience is to be kept separately for each of the three load capacity trucks within each classification. Experience is also to be kept seperately for each classification, depending on whether the policy is written with or without trailers. Collision experience is also kept according to symbols. Likewise the experience is divided according to whether the car has an open or closed body.

The automobile statistical plan was also revised to include a complete list of all territories for coding purposes. Prior to this time, there had been some uncertainty as to the coding of surrounding territory for the larger cities, especially for those cities where definitions of the surrounding territory had been changed from time to time. With the revised statistical plan it is hoped that a foundation has been laid for a permanent statistical record, regardless of territorial changes that may be made from time to time for underwriting purposes.

A few important changes were made in the rules governing the writing of automobile insurance, but the great majority of the rules remain unchanged. The previous table of excess limit percentages was continued for private passenger cars, but was amended to provide a double charge for excess limits on public automobiles where passenger hazard is included. On the other hand, the percentage charges for higher property damage limits were reduced.

The omnibus coverage privilege is now limited to private pas-

senger automobiles and commercial automobiles. (By "omnibus coverage" is meant extension of the indemnity contract so as to protect persons other than the named assured who may be driving the car.) Prior to the adoption of the omnibus coverage endorsement, many assureds neglected to name other members of their families as additional assured (at a slight additional cost), only to learn later that a wife or son had no protection under the policy when suit was brought against said wife or son for an accident involving the insured car. An extra charge is made for additional assureds named in connection with policies covering public automobiles, livery cars or manufacturers' and dealers' cars.

Garage risks are written for public liability and property damage coverage on the payroll basis. Rates were considerably reduced in the 1920 manual. On the other hand, the basis of computing the payroll was amended so as to arrive at a higher payroll figure than was arrived at in accordance with the 1919 manual. The 1919 manual placed a limit of \$1500 on the amount of salary for any one employee that was to be used in the premium computations. The 1920 manual eliminates this maximum for most of the employees and uses a flat \$2000 charge for owners, officers, automobile salesmen and general managers.

Automobile conditions in the field have improved considerably in the past few years. The volume of business has been steadily increasing, and more and more of the companies are either charging the full manual rates, or rates only slightly reduced from manual. There was some disturbance this spring because the new rates were announced during the busy season, but this quieted down within a few weeks and at present automobile insurance conditions are quite satisfactory throughout the country.

#### A. RYDER.

## BULLETINS ON 1920 CENSUS STATISTICS AVAILABLE.

The Bureau of Census, Washington, D. C., distributes copies of the preliminary announcements of the 1920 Census counts of the population in the various civil divisions as soon as the schedules are received in Washington and checked. Insurance organizations, statisticians and others interested may be placed upon the mailing list upon application to the Director of the Census.

#### CURRENT NOTES.

#### HEALTH INSURANCE IN SWEDEN.

A commission appointed by the Swedish Govenment has recently issued a report in which the introduction of compulsory insurance against sickness is unanimously advocated. Maternity insurance is also recommended. It is calculated that 80 per cent. of the total population will be included in this scheme. The highest and lowest daily sickness benefits will be 10 kr. and  $\frac{1}{2}$  kr. respectively. It is anticipated that the annual cost of medical treatment and drugs will be 39 million kr., medical benefits will cost 60,800 000 kr., maternity benefits 11 million kr., administration 71/2 million kr., the total cost being about 118,300,000 kr. On this basis the state would contribute 731/2 million kr., the remainder being found by the insured, with the exception that employers would contribute to cover certain risks.—British Medical Journal, April 17, 1920.

Wm. Leslie has returned to California. He is Assistant Professor of Insurance at the University of California at Berkeley and has opened an office as Consulting Actuary in San Francisco.

Edward T. Jackson is now Statistician of the General Accident Fire and Life Assurance Corporation.

Emil Scheitlin is Assistant Treasurer of the Globe Indemnity Company.

Leonard W. Hatch has been appointed Manager of the State Insurance Fund of New York.

C. E. Scattergood is Vice-President of Alfred M. Best & Co.

A. H. Mowbray and G. F. Michelbacher are associated with the National Council on Workmen's Compensation Insurance as Actuary and Secretary respectively.

C. G. Smith, as Actuary of the New York Insurance Department, is now in charge of the Workmen's Compensation Bureau in New York City.

F. Highlands Burns is President of the Maryland Casualty Company.

W. W. Amerine has been made Assistant Secretary of the Georgia Casualty Co.

Wm. J. Graham is Second Vice-President of the Equitable Life Assurance Society.

Barrett N. Coates is now Assistant Secretary as well as Actuary of the Western States Life Insurance Co. OBITUARY.

OBITUARY.

DON A. BAXTER.

Born, October 14, 1891.

Died, February 10, 1920.

GORDON CASE.

Born, September 24, 1887.

Died, February 4, 1920.

JOHN T. STONE.

Born, November 21, 1859.

Died, May 9, 1920.

## DON A. BAXTER.

Don A. Baxter was born in Bronson, Michigan, October 14, 1891. On February 12, 1913, after graduating from the Ferris Institute of Big Rapids, Michigan, he entered the Department of Insurance of Michigan as stenographer and was rapidly advanced to the offices of chief clerk actuary and deputy commissioner of insurance, which latter position he held at the time of his death.

He became an associate of the Casualty Actuarial and Statistical Society of America by examination on October 22, 1915.

Mr. Baxter died of pneumonia Tuesday evening, February 10, 1920, at the St. Lawrence Hospital, City of Lansing. His death occurred seven years lacking one day from the date of his employment in the Insurance Department. His illness was of short duration, he apparently being in good health and spirits until the Saturday preceding the day of his death.

In the death of Mr. Baxter, the insurance fraternity has lost one of its most loyal, conscientious, and dependable members. He was a man of quiet disposition, unostentations at all times, and one whose whole career was a demonstration of his sterling qualities.

# GORDON CASE.

Gordon Case was born in Peconic, Long Island, New York, September 24, 1887, and died suddenly of pneumonia in Indianapolis, Indiana, February 4, 1920.

Mr. Case received his early education at Southold Academy and Dean Academy. After graduating from Yale University, he took a postgraduate course at the University of Goettingen, Germany.

He was with the Spectator Company of New York for several years, became an examiner of the New York Insurance Department in 1913 and remained with that department, except while on military service, until May, 1919, when he left the Department to become associated with Mr. Frank J. Haight, consulting actuary of Indianapolis. He was a fellow of the Casualty Actuarial & Statistical Society of America.

Mr. Case served on the Mexican border in 1916 as a member of the 71st Regiment, N. G. N. Y. Returning to New York he entered the Officers' Training Camp at Plattsburgh and was commissioned a First Lieutenant in the Field Artillery. After being stationed at Camp Meade, he served at the front in France with Battery "C" of the 351st Field Artillery as First Lieutenant and was Acting Captain of the Battery when the armistice was signed.



By the death of John T. Stone on May 9, 1920, the business of casualty insurance lost one of its strongest leaders.

Mr. Stone was born in Baltimore, November 21, 1859, and was educated in the public schools of the city. His insurance career began in 1895, when he organized, and became secretary-treasurer of the American Bonding Compary. In the early part of 1898 he organized the Maryland Casualty Company, was elected president, and served in that capacity until his death.

In 1917 Mr. Stone organized the Maryland Assurance Corporation, to write life and accident and health insurance, the corporation being controlled by the Maryland Casualty Company. He was also president of this Corporation. Mr. Stone, during his insurance career, was honored by being elected to practically all the offices of distinction in the gift of those engaged in the casualty insurance business.

His activities outside of the insurance business were many. He was a devout churchman, and was one of the leaders in the Methodist Church. He was also one of the leading citizens of Baltimore and was called upon many times to serve as chairman of committees engaged in the furthering of the interests of the city. He gave liberally to educational and religious movements, both in time and money.

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# THE CASUALTY ACTUARIAL AND STATISTICAL SOCIETY OF AMERICA

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# FELLOWS.

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November 7, 19	914,
Those marke	d (*) have been admitted as Fellows upon examination by
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Date Admitt	ed
4	Amerino W. M. Assistant Secretary Georgia Cas-
1	ualty Co., Macon. Ga.
<b>4</b> .	Benjamin Boland Comptroller Fidelity & Deposit
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÷	Black S. Bruce, Vice-President and Actuary Liberty
f	Mutual Ins. Co. 185 Devenshire St. Boston
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	Now York Municipal Building,
Mar. 96 1016	INCW LOFK.
may 20, 1910	Ducking, waiter S., President, Liberty Mutual Ins.
1	Co., 185 Devonsnire St., Boston, Mass.
T	Budiong, W. A., Superintendent of Claims, Com-
	Mercial Travelers Mutual Accident Assn., Utica,
Ann 90 101	IN, L. Dumbon W. H. Asal Some on I. Ast T. J.
Apr. 20, 1917	Mutual Liability T and Actuary, Employers
	Mutual Liability Ins. Co., Wasau, Wis.

404	MEMBERSHIP OF THE SOCIETY.
Feb. 19, 1915	Burns, F. Highlands, President, Maryland Casualty
· • • •	Cammack, Edmund E., Associate Actuary, Aetna
ŧ	Carpenter, Raymond V., Assistant Actuary, Metro- politan Life Ins. Co., 1 Madison Ave., New York.
*Nov.21,1919	Carver, Harry C., Assistant Professor of Mathe- matics and Insurance, University of Michigan, Ann Arbor, Mich.
Feb. 25, 1916	Close, Charles L., Manager, Bureau of Safety, U. S. Steel Corporation, 71 Broadway, New York.
*Nov. 15, 1918	Coates, Barrett N., Assistant Secretary and Actu- ary, Western States Life Ins. Co., San Francisco, California.
Oct. 27, 1916	Cogswell, Edmund S., General Manager, National Association of Mutual Casualty Companies, 233 Broadway, New York.
t	Cole, Richard H., Secretary, Connecticut General Life Ins. Co., Hartford, Conn.
Feb. 19, 1915	Collins, Henry, Assistant Manager, Ocean Accident & Guarantee Corporation, 114 Fifth Avenue, New York.
t	Conway, Charles T., Vice-President, Liberty Mu- tual Ins. Co., 185 Devonshire St., Boston, Mass.
†	Copeland, John A., Consulting Actuary, 124 Hurt Building, Atlanta, Ga.
t	Cowles, W. G., Vice-President, Travelers Ins. Co., Hartford, Conn.
t.	Craig, Arthur H., Fredk. C. Smith Co., 1 Liberty St New York
t	Craig, James D., Assistant Actuary, Metropolitan
t	Craig, James M., Actuary, Metropolitan Life Ins.
May 26, 1916	Crum, Frederick S., Assistant Statistician, Pruden- tial Ins. Co. Newark N. J.
Nov. 15, 1918	Davis, Mervyn, Assistant Actuary, Equitable Life Assurance Society 120 Broadway, New York
<b>†</b> .	Dawson, Alfred B., Miles M. Dawson & Son, 26 W. 44th St. Naw York
ţ	Dawson, Miles M., Counsellor at Law and Consult-
†	De Kay, Eckford C., Vice-President, T. G. R. Pier- son & Co., Insurance Brokers, 15 William St., New York
t	Dearth, Elmer H., President, General Casualty & Surety Co., 114 Woodward Ave., Detroit, Mich.

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MEMORDETTE 

Deutschberger, Samuel, Chief Examiner, Under-May 19, 1915 writers' Association Bureau, New York Ins. Dept., 165 Broadway, New York. t Downey, E. H., Compensation Actuary Insurance Department, Harrisburg, Pa. ł Dublin, Louis I., Statistician, Metropolitan Life Ins. Co., 1 Mad son Ave., New York. Dunlap, Earl O. Metropolitan Life Ins. Co., 1 May 19, 1915 Madison Ave., New York. Egbert, Lester D., Office of Willcox, Peck, Brown t & Crosby, Insurance Brokers, 3 S. William St., New York. † Epsteen, Saul, La Jara, Col. ŧ Fackler, David Parks, Consulting Actuary, 35 Nassau St., New York. t Fackler, Edward B., Consulting Actuary, 35 Nassau St., New York. Fallow, Everett S., Actuary, Accident Dept., Travelers Ins. Co., Hartford, Conn. † Farrer, Henry, Actuary, Hartford Accident & Int demnity Co., Hartford, Conn. Fellows, C. W., Manager, State Compensation Ins. Fund, 525 Market St., San Francisco, Cal. Feb. 19, 1915 Fitch, Frank M., Auditor, Hartford Steam Boiler ŧ Inspection & Ins. Co., Hartford, Conn. Flanigan, James E., Actuary, Bankers Life Co., Feb. 19, 1915 Des Moines, Iowa. Flynn, Benedict D., Assistant Secretary, Travelers t Ins. Co., Hartford, Conn. Fondiller, Richard, Supt., Bureau of Records & Accounts, Group Ins. Dept., Equitable Life As-surance Society, 120 Broadway, New York. Feb. 15, 1915 Forbes, Charles S., Consulting Actuary, 68 William t St., New York. May 26, 1916 Frankel, Lee K., Third Vice-President, Metropolitan Life Ins. Co., 1 Madison Ave., New York. Franklin, C. H., 825 West 7th St., Plainfield, N. J. Feb. 25, 1916 Froggatt, Joseph, President, Joseph Froggatt & Co., Insurance Accountants, 25 Church St., New York. Furze, Harry, Treasurer, Globe Indemnity Co., 45 William St., New York. Garrison, Fred S., Assistant Secretary, Travelers Indemnity Co., Hartford, Conn. Feb. 19, 1915 Gaty, Theodore E, Vice-President and Secretary, t Fidelity & Casualty Co., 92 Liberty St., New York. Glover, James W., Professor of Mathematics and In-May 19, 1915 surance, University of Michigan, 620 Oxford Road, Ann Arbor, Mich.

406	MEMBERSHIP OF THE SOCIETY.
t	Goodwin, Edward S., Goodwin-Beach & Co., Bank- ers. 36 Pearl St., Hartford, Conn.
t	Gould, William H., Consulting Actuary, 256 Broad- way, New York.
Oct. 22, 1915	Graham, George, Vice-President and Actuary, Mis- souri State Life Ins. Co., St. Louis, Mo.
Oct. 22, 1915	Graham, T. Bertrand, Metropolitan Life Ins. Co., 1 Madison Ave., New York.
t	Graham, William J., Second Vice-President, Equi- table Life Assurance Society, 120 Broadway, New York.
t	Grandfield, Robert E., Secretary, Industrial Acci- dent Board, State House, Boston, Mass.
t	Greene, Winfield W., Special Deputy Commissioner of Banking and Insurance, 571 Broad St., New- ark, N. J.
ŧ	Hamilton, R. C. L., Comptroller, Hartford Acci- dent & Indemnity Co., Hartford, Conn.
t	Hammond, H. Pierson, Assistant Actuary, Life
t	Hansen, Carl M., Vice-President, American Re-In- surance Co., Huntingdon, Pa.
. Oct. 27, 1916	Hardy, Edward R., Assistant Manager, New York Fire Ins. Exchange, 123 William St., New York.
Oct. 22, 1915	Hatch Leonard W., Manager, State Insurance Fund, 124 E. 28th St., New York.
Nov. 21, 1919	Henderson, Robert, Second Vice-President and Actuary, Equitable Life Assurance Society, 120 Broadway, New York.
Oct. 22, 1915	Hess, Herbert, Joseph Froggatt & Co., Insurance Accountants, 25 Church St., New York.
ţ	Hillas, Robert J., President, Fidelity & Casualty Co., 92 Liberty St., New York.
Nov.15, 1918	Hinsdale, F. W., Secretary, Workmen's Compensa- tion Board, Vancouver, B. C., Canada.
Oct. 22, 1915	Hodgkins, L. G., Secretary, Masonic Protective Assn., Worcester, Mass.
†	Hoffman, Frederick L., Third Vice-President and Statistician, Prudential Ins. Co., Newark, N. J.
Oct. 22, 1915	Holland, Charles H., President and General Man- ager, Royal Indemnity Co., 84 William St., New York.
1	Holmes, Mrs. Dorothy M., 24 W. 45th St., New York.
Nov. 21, 1919	Hookstadt, Carl, Expert, U. S. Bureau of Labor Statistics, Washington, D. C.
<b>†</b>	Hughes, Charles, Auditor and Actuary, New York Ins. Dept., 165 Broadway, New York.

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t	Hunt, Burritt A., Actuary, Casualty Dept. Aetna
· †	Hunter, Arthur, Chief Actuary, New York Life
Feb. 25, 1916	Jackson, Charles W., Actuary, Postal Life Ins. Co.,
May 19, 1915	Johnson, William C., Vice-President, Masonic Pro-
May 23, 1919	Kelly, Gregory C., General Manager, Pennsylvania Compensation Rating & Inspection Bureau, 507
t	King, Walter I., Secretary, Group Insurance Dept., Connecticut General Life Ins. Co., Hartford,
*Nov.21,1919	Kirkpatrick, A. L., Globe Indemnity Co., 45 Wil-
t	Kopf, Edwin W., Assistant Statistician, Metropoli- tan Life Ins. Co. 1 Madison Ave. New York
Feb. 19, 1915	Laird, John M., Actuary, Connecticut General Life
Feb. 19, 1915	Landis, Abb, Consulting Actuary, 1107 Independent Life Building Nashville Tenn
ţ	Law, Frank E., 322 Claremont Ave., Montclair, N. J.
May 19, 1915	Lawson, F. W., U. S. Manager, London Guarantee & Accident Co., Ltd., 134 So. La Salle St., Chi-
ţ	Leal, J. R., Interstate Life and Accident Co., Chat-
†	tanooga, Tenn. Leslie, William, Consulting Actuary, 525 Market St., San Francisco, Cal.
Feb. 19, 1915	Lubin, Harry, State Industrial Commission, 124 E. 28th St. New York.
ţ	Luckett, D. G., General Manager and Secretary, United States Casualty Co., 80 Maiden Lane, New York
May 23, 1919	McDougald, Alfred, Accident Manager, Phoenix As- surance Company, Phoenix House, King William
*Oct.31,1917	McManus, Robert J., Travelers Ins. Co., Hartford,
Feb. 19, 1915	Maddrill, James D., Supervisor of Training, Fed- eral Board for Vocational Education, 544 Flood Building San Francisco Cal
t	Magoun, William N., General Manager, Massachu- setts Rating & Inspection Bureau, 88 Broad St., Boston, Mass.

- Maycrink, Emma C., Auditor, Compensation In-spection Rating Board, 135 William St., New May 19, 1915 Ýork.
- Feb. 19, 1915 Mead, Franklin B., Secretary and Actuary, Lincoln National Life Ins. Co., Fort Wayne, Ind.
- Apr. 20, 1917 Meltzer, Marcus, Statistician, National Workmen's Compensation Service Bureau, 13 Park Row, New York.
  - Michelbacher, G. F., Secretary, National Council on Workmen's Compensation Insurance, 16 E. 40th St., New York.
    - Miller, David W., 354 New York Ave., Brooklyn, N. Y.
    - Milligan, Samuel, Metropolitan Life Ins. Co., 1 Madison Ave., New York.
  - Mitchell, James F., First Asst., U. S. Manager, General Accident Fire and Life Assur. Corp., Fourth and Walnut Sts., Philadelphia, Pa.
  - Moir, Henry, Second Vice-President and Actuary, Home Life Ins. Co., 256 Broadway, N. Y.
    - Moore, George D., Actuary, Royal Indemnity Co., 84 William St., New York. Morris, Edward B., Actuary, Life Dept., Travelers
- May 19, 1915 Ins. Co., Hartford, Conn.
- Morrison, Charles E., Vice-President and General Nov.21,1919 Manager, Utilities Mutual Ins. Co., 5 Nassau St., New York.
  - Morrison, James, Chief Accountant, Royal Indemnity Co., 84 William St., New York.
  - Mowbray, Albert H., Actuary, National Council on Workmen's Compensation Insurance, 16 E. 40th St., New York.
- Mudgett, Bruce D., Associate Professor of Econom-May 20, 1918 ics, University of Minnesota, Minneapolis, Minn. t
  - Mullaney, Frank R., Actuary and Asst. Secy., American Mutual Liability Ins. Co., 245 State St., Boston, Mass.
  - Murphy, Ray D., Associate Actuary, Equitable Life Assurance Society, 120 Broadway, New York.
  - Nicholas, Lewis A., Statistician, Fidelity & Casualty Co., 92 Liberty St., New York.
    - Olifiers, Edward, Actuary, A Sul America, Rio-de-
      - Janeiro, Brazil. Orr, Robert K., President, Michigan Employers Casualty Co., Lansing, Mich.
      - Otis, Stanley L., Secretary, Insurance Federation of the State of New York, 80 Maiden Lane, New York.

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May 28, 1920

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\*Nov. 21, 1919 Outwater, Olive E., National Workmen's Compensation Service Bureau, 13 Park Row, New York. Pallay, Julius J., Statistician, London Guarantee t & Accident Co., Ltd., 134 So. La Salle St., Chicago, Ill. May 26, 1916 Parker, Jr., John M., Secretary, Accident and Liability Department, Aetna Life Ins. Co., Hartford, Conn. Perry, W. T., Manager for Canada, Ocean Acci-Nov. 15, 1918 dent and Guarantee Corporation, Toronto, Canada. Reiter, Charles G., Assistant Actuary, Metropolitan t Life Ins. Co., 1 Madison Ave., New York. ŧ Remington, Charles H., Assistant Treasurer, Aetna Life Ins. Co., Hartford, Conn. Richardson, Frederick, U. S. Manager, General May 23, 1919 Accident Fire and Life Assur. Corp., Fourth and Walnut Sts., Philadelphia, Pa. Rubinow, I. M., 550 Riverside Drive, New York. t Ryan, Harwood E., General Manager, National Council on Workmen's Compensation Insurance, 16 E. 40th St., New York. Saxton, Arthur F., Chief Examiner of Casualty Companies, New York Ins. Dept., 165 Broadway, t New York. Scattergood, Claude E., Vice-President, A. M. Best & Co., 103 William St., New York. ł Scheitlin, E., Asst. Treasurer, Globe Indemnity Co., t 45 William St, New York. t Senior, Leon S., Manager and Secretary, Compensation Inspection Rating Board, 135 William St., New York. t Smiley, J. W., Actuary and Chief Accountant to the West Virginia State Compensation Commissioner, Charleston, W. Va. Smith, Charles G., Actuary, New York Ins. Dept., 165 Broadway, New York. Apr. 20, 1917 Feb. 25, 1916 Strong, Wendell M., Associate Actuary, Mutual Life Ins. Co., 32 Nassau St., New York. Strong, William Richard, 39 Streatham High Road, Oct. 22, 1915 S. W. 16, London, England. ŧ Sullivan, Robert J., Secretary, Liability Department, Travelers Ins. Co., Hartford, Conn. May 19, 1915 Thiselton, Herbert C., General Manager, London Guarantee and Accident Co., Ltd., 20, 21 and 22 Lincoln's Inn Fields, London, W. C. 2, England. Thompson, John S., Assistant Actuary, Mutual Life ŧ Ins. Co., 32 Nassau St., New York. 27

ŧ	Train, John L., Secretary and General Manager,
	New York.
*Nov.21,1919	Van Tuyl, Hiram O., Examiner, New York Ins.
May 23, 1919	Welch, Archibald A., Vice-President, Phoenix Mu-
+	tual Life Ins. Co., Hartford, Conn. Whitney, Albert W., General Manager, National Warkman's Comparison Provide Review 12
+	Park Row, New York. Wolfe, Lee J., Consulting Actuary, 165 Broadway,
t	New York. Wolfe, S. Herbert, Consulting Actuary, 165 Broad- way. New York
t	Woodward, Joseph H., Associate Actuary, Guardian
t	Young, William, Actuary, New York Life Ins. Co., 346 Broadway, New York.

## ASSOCIATES.

Those marked (\*) have been enrolled as Associates upon examination by the Society.

Those marked (1) have passed Part I of the Fellowship Examination.

# Date Enrolled

*Nov. 15, 1918	Ackerman, Saul B., Assistant Actuary, State
	Industrial Commission, 124 E. 28th St., New
	York.
Nov. 15, 1918	Ankers, Robert E., Actuary, Virginia Ins. Dept.,
·	Richmond, Va.
(1)*Oct. 27,1916	Baridon, Felix E., Travelers Insurance Co.,
•	Hartford, Conn.
*Oct. 27, 1916	Bernstein, Abraham, 200 Fifth Ave., New York.
*Oct. 31, 1917	Bessey, John M., General Manager, Employers
	Mutual Ins. Co., 61 Broadway, New York.
<b>*</b> Oct. 22, 1916	Brann, Ralph M., Supt. Compensation Dept.,
·	London & Lancashire Indemnity Company of
	America, 57 William St., New York.
Nov. 15, 1918	Brooks, LeRoy, Statistician, U. S. Fidelity &
	Guaranty Company, Baltimore, Md.
*Nov. 15,1918	Brunnquell, H. G., Actuary, Wisconsin Ins.
	Dept., Madison, Wis.
*Oct. 22, 1915	Buffler, Louis, Employers Mutual Ins. Co., 61
·	Broadway, New York.

- Mar. 31, 1920 Burt, Margaret A., Office of George B. Buck, Consulting Actuary, 256 Broadway, New York.
- \*Nov. 15, 1918 Dorweiler, Paul, Aetna Life Insurance Co., Hartford, Conn.
- Nov. 15, 1918 Egli, W. H., Statistician, Zurich General Accident & Liability Ins. Co., 431 Insurance Exchange, Chicago, Ill.
- \*Nov. 15, 1918 Elston, James S., Assistant Actuary, Life Dept., Travelers Insurance Co., Hartford, Conn.
- \*Oct. 22, 1915 Feder, Marcy, Assistant Examiner, New York Ins. Dept., 165 Broadway, New York.
- May 23, 1919 Fletcher, Nicholas, Secretary, Workmen's Compensation Board, Winnipeg, Manitoba, Canada.
- Nov. 21, 1919 Haydon, George F., General Manager, Wisconsin Compensation Rating & Inspection Bureau, 373 Broad way, Milwaukee, Wis.
- May 23, 1919 Hoage, Robert J., Chief Statistician, U. S. Employees Compensation Commission, Washington, D. C.
- \*Oct. 31, 1917 Jackson, Edward T., Statistician, General Accident. Philadelphia, Penn.
  - \*Nov. 21, 1919 Jones, Loring D., Claim Auditor, State Ins. Fund, 124 E. 28th St., New York.
  - \*Oct. 31, 1917 Kearney, T. P., Manager, State Compensation Insurance Fund, Denver, Colo.
- <sup>(1)</sup>\*Oct. 27, 1916 McClure, Laurence H., Colt's Patent Fire Arms Mfg. Co., Hartford, Conn.
  - \*Oct. 22, 1915 McGuire, Vincent G., Group Ins. Dept., Equitable Life Assurance Society, 120 Broadway, New York.
- <sup>(1)</sup>\*Oct. 27, 1916 Miller, Tilford W., Travelers Ins. Co., Hartford, Conn.
  - \*Oct. 31, 1917 Montgomery, Victor, Actuary, California Ins. Dept., San Francisco, Cal.
  - \*Nov. 21, 1919 Mothersill, R V. 504 Boyer Building, Detroit, Mich.
  - \*Oct. 31, 1917 Mueller, Lou's H., Statistician, State Compensation Insurance Fund, 525 Market St., San Francisco, Cal.
  - \*Oct. 22, 1915 Müller, Fritz, New York Life Ins. Co., 346 Broadway, New York.
- <sup>(1)</sup>\*Oct. 27, 1916 Newell, William, Chief Safety Engineer, State Insurance Fund, 124 E. 28th St., New York.
  - May 23, 1919 Otto, Walter E., Treasurer and Actuary, Michigan Mutual Liability Co., Detroit, Mich.
  - Nov. 21, 1919 Perkins, Sanford B., Actuary, Compensation & Liability Dept., Travelers Ins. Co., Hartford, Conn.

- \*Nov. 15, 1918 Raywid, Joseph, Statistician, International Fire & Marine Ins. Corp., 153 Fifth Ave., New York.
- \*Nov. 21, 1919 Robbins, Rainard B., Assistant Actuary, Missouri Insurance Department, Jefferson City, Mo.
- \*Nov. 15, 1918 Schaefer, Walter A., Schenck and Schenck, Insurance Brokers, 1 Exchange Place, Jersey City, N. J.
- \*Nov. 15, 1918 Spencer, Harold S., Aetna Life Insurance Co., Hartford, Conn.

Nov. 15, 1918 Sibley, John L., Statistician, United States Casualty Co., 80 Maiden Lane, New York.

- Nov. 15, 1918 Sullivan, Oscar M., Chief Statistician, Minnesota Dept. of Labor, Old Capitol, St. Paul, Minn.
- Sept.17,1919 Tarbell, Thomas F., Actuary, Conn. Ins. Dept., Hartford, Conn.
- \*Oct. 22,1915 Tilson, Howard, Captain, Ordnance Dept., Frankford Arsenal, Philadelphia, Pa.
- \*Nov. 21, 1919 Trench, Frederick H., Utica Mutual Ins. Co., 239 Genesee St., Utica, New York.
- \*Nov. 21. 1919 Voogt, Walter G., State Compensation Ins. Fund, 525 Market St., San Francisco, Cal.
- <sup>(1)</sup>\*Oct. 27, 1916 Waite, Alan W., Aetna Life Ins. Co., Hartford, Conn.
- <sup>(1)</sup>\*Oct. 27, 1916 Waite, Harry V., Statistician, Compensation & Liability Dept., Travelers Ins. Co., Hartford, Conn.
  - May 23, 1919 Warren, Charles S., Chief Statistician, Ocean Accident & Guarantee Corp., 114 Fifth Ave., New York.
  - Nov. 15, 1918 Wilkinson, Albert E., Statistician, Standard Accident Ins. Co., Detroit, Mich.
  - Sept.17,1919 Williams, John F., Actuary, Tennessee Ins. Dept., Nashville, Tenn.
  - \*Oct. 22, 1915 Williamson, W. R., Assistant Actuary, Life Dept., Travelers Ins. Co., Hartford, Conn.
  - \*Oct. 22,1915 Wood, Donald M., of Childs, Young & Wood, Insurance Exchange, Chicago, Ill.
  - \*Oct. 22, 1915 Woodman, Charles E., Comptroller, Ocean Accident & Guarantee Corp., 114 Fifth Ave., New York.
  - \*Nov. 21, 1919 Young, Charles N., Acting Supt. Schedule Rating Dept., National Workmen's Compensation Service Bureau, 13 Park Row, New York.

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	Fellows.	Associates.	Total.
Membership, November 21, 1919	150	50	200
By death. By resignation	$\frac{2}{1}$	1 1	$3 \\ 2$
Additions	147	48	195
By election, March 31, 1920           By election, May 28, 1920	·		1 1
Membership, May 28, 1920	148	49	197

# SCHEDULE OF MEMBERSHIP, MAY 28, 1920.

# Abstract from the Minutes of the Meeting, May 28, 1920.

The semi-annual and fourteenth regular meeting of the Casualty Actuarial and Statistical Society of America was held at the Hotel Pennsylvania, New York, on Friday, May 28, 1920.

President Flynn called the meeting to order at 10:45 A.M. The roll was called, showing the following thirty-seven Fellows and sixteen Associates present:

FELLOWS

	I DEBO IN AL	
BLANCHARD	· GREENE	MICHELBACHER
Buck	HAMMOND	Milligan
BUDLONG	HARDY	MOORE
CAMMACK	Henderson	MOWBRAY
CARVER	$\mathbf{Hess}$	MULLANEY
Cogswell	JACKSON, C. W.	OUTWATER
CRAIG, J. D.	KING	Ryan
DAVIS	KIRKPATRICK	SCATTERGOOD
DEKAY	LUBIN	SMITH
FALLOW	McManus	SULLIVAN, R. J.
Flynn	MAYCRINCK	WHITNEY
FONDILLER	Meltzer	WOLFE, S. H.
GARRISON		

	ASSOCIATES.	
Ackerman	MILLER, T. W.	TARBELL
Brooks	NEWELL	WAITE, H. V.
BUFFLER	Perkins	WARREN
Burt	RAYWID	WOODMAN
Dorweiler	Spencer	YOUNG, C. N.
McGuire		2

The President's address was presented.

The minutes of the meeting held November 21, 1919 were approved as printed in the *Proceedings*.

The report of the Council was read and, upon motion, adopted by the Society. The Council reported that on account of greatly increased costs, it was decided to charge one dollar each year for the bound volume, to go into effect in November 1920, beginning with Volume VII; the sum of one dollar will be added to the dues of every member. The Council adopted the report of the Educational Committee (printed in this number) and the syllabus it contains will go into effect with the May 1921 examinations. It reported the death of D. A. Baxter, G. Case and J. T. Stone, memorial notices of which appear in this number.

The Council recommended the following for election to Fellowship in the Society, without examination, under the terms of Article III of the Constitution:

Murphy, Ray D., Associate Actuary, Equitable Life Assurance Society, New York.

After ballot this nominee was declared a duly elected Fellow.

The Council reported that the following had been enrolled, without examination, as Associate:

BURT, MARGARET A. (MISS)

The papers printed in this number were read or presented. Recess was taken until 2:15 P.M.

The papers read at the last meeting of the Society were discussed.

An informal discussion was held of several topics of current interest.

Upon motion, the meeting adjourned at 5 P.M.

## CONSTITUTION.

#### (As Amended May 20, 1918.)

ARTICLE I.—Name. This organization shall be called THE CASUALTY ACTUARIAL AND STATISTICAL SOCIETY OF AMERICA.

ARTICLE II.—Object. The object of the Society shall be the promotion of actuarial and statistical science as applied to the problems of casualty and social insurance by means of personal intercourse, the presentation and discussion of appropriate papers, the collection of a library and such other means as may be found desirable.

The Society shall take no partisan attitude, by resolution or otherwise, upon any question relating to casualty or social insurance.

ARTICLE III.—Membership. The membership of the Society shall be composed of two classes, Fellows and Associates. Fellows only shall be eligible to office or have the right to vote.

The Fellows of the Society shall be the present members and those who may be duly admitted to Fellowship as hereinafter provided. Any Associate of the Society may apply to the Council for admission to Fellowship. If his or her application shall be approved by the Council with not more than one negative vote he or she shall become a Fellow on passing such final examination as the Council may prescribe. Otherwise no one shall be admitted as a Fellow unless recommended by a duly called meeting of the Council with not more than one negative votes followed by a ballot of the Society with not more than four negative votes and not less than twenty affirmative votes.

Any person may, upon nomination to the Council by two Fellows of the Society and approval by the Council of such nomination with not more than one negative vote, become enrolled as an Associate of the Society provided that he shall pass such examination as the Council may prescribe. Such examination may be waived in the case of a candidate who for a period of not less than two years has been in responsible charge of the statistical or actuarial department of a casualty insurance organization or has had such other practical experience in casualty or social insurance as in the opinion of the Council renders him qualified for Associateship.

ARTICLE IV.—Officers and Council. The officers of the Society shall be a President, two Vice-Presidents, a Secretary-Treasurer, an Editor, and a Librarian. The officers with ex-Presidents, ex-Vice-Presidents and four other Fellows shall constitute the Council.

ARTICLE V.—Election of Officers and Council. The officers shall be elected by a majority ballot at the annual meeting for the term of one year and two members of the Council shall, in a similar manner, be annually elected to serve for two years. The President and Vice-Presidents shall not be eligible for the same office for more than two consecutive years nor shall any retiring member of the Council be eligible for re-election at the same meeting.

ARTICLE VI.—Duties of Officers and Council. The duties of the officers shall be such as usually appertain to their respective offices or may be specified in the by-laws. The duties of the Council shall be to pass upon candidates for membership, to decide upon papers offered for reading at the meetings, to supervise the examination of candidates and prescribe fees therefor, to call meetings, and, in general, through the appointment of committees and otherwise, to manage the affairs of the Society.

ARTICLE VII.—Meetings. There shall be an annual meeting of the Society on such date in the month of November as may be fixed by the Council in each year, but other meetings may be called by the Council from time to time and shall be called by the President at any time upon the written request of ten Fellows. At least two weeks notice of all meetings shall be given by the Secretary.

ARTICLE VIII.—Quorum. A majority, or seven members, of the Council shall constitute a quorum. Twenty Fellows of the Society shall constitute a quorum.

ARTICLE IX.—*Éxpulsion or Suspension of Members.* Except for non-payment of dues no member of the Society shall be expelled or suspended save upon action by the Council with not more than one negative vote followed by a two-thirds ballot of the Fellows present and voting at a meeting of the Society.

ARTICLE X.—Amendments. This constitution may be amended by an affirmative vote of two-thirds of the Fellows present at any meeting held at least one month after notice of such proposed amendment shall have been sent to each Fellow by the Secretary.

## BY-LAWS.

#### (As Amended October 27, 1916.)

ARTICLE I.—Order of Business. At a meeting of the Society the following order of business shall be observed unless the Society votes otherwise for the time being:

- 1. Calling of the roll.
- 2. Address or remarks by the President.
- 3. Minutes of the last meeting.
- 4. Report by the Council on business transacted by it since the last meeting of the Society.
- 5. New membership.
- 6. Reports of officers and committees.
- 7. Election of officers and Council (at annual meetings only).
- 8. Unfinished business.
- 9. New business.
- 10. Reading of papers.
- 11. Discussion of papers.

ARTICLE II.—Council Meetings. Meetings of the Council shall

be called whenever the President or three members of the Council so request, but not without sending notice to each member of the Council seven or more days before the time appointed. Such notice shall state the objects intended to be brought before the meeting, and should other matter be passed upon, any member of the Council shall have the right to re-open the question at the next meeting.

ARTICLE III.—Duties of Officers. The President, or, in his absence, one of the Vice-Presidents, shall preside at meetings of the Society and of the Council. At the Society meetings the presiding officer shall vote only in case of a tie, but at the Council meetings he may vote in all cases.

The Secretary-Treasurer shall keep a full and accurate record of the proceedings at the meetings of the Society and of the Council, send out calls for the said meetings, and, with the approval of the President and Council, carry on the correspondence of the Society. Subject to the direction of the Council, he shall have immediate charge of the office and archives of the Society.

The Secretary-Treasurer shall also send out calls for annual dues and acknowledge receipt of same; pay all bills approved by the President for expenditures authorized by the Council of the Society; keep a detailed account of all receipts and expenditures, and present an abstract of the same at the annual meetings, after it has been audited by a committee of the Council.

The Editor shall, under the general supervision of the Council, have charge of all matters connected with editing and printing the Society's publications. The *Proceedings* shall contain only the proceedings of the meetings, original papers or reviews written by members, discussions on said papers and other matter expressly authorized by the Council.

The Librarian shall, under the general supervision of the Council, have charge of the books, pamphlets, manuscripts and other literary or scientific material collected by the Society.

ARTICLE IV.—Dues. The dues shall be ten dollars for Fellows and five dollars for Associates payable upon entrance and at each annual meeting thereafter, except in the case of Fellows not residing in the United States, Canada, or Mexico, who shall pay five dollars at the times stated.

It shall be the duty of the Secretary-Treasurer to notify by mail any Fellow or Associate whose dues may be six months in arrears, and to accompany such notice by a copy of this article. If such Fellow or Associate shall fail to pay his dues within three months from the date of mailing such notice, his name shall be stricken from the rolls, and he shall thereupon cease to be a Fellow or Associate of the Society. He may, however, be reinstated by vote of the Council, and upon payment of arrears of dues.

ARTICLE V.—Amendments. These by-laws may be amended by an affirmative vote of two-thirds of the Fellows present at any meeting held at least one month after notice of the proposed amendment shall have been sent to each Fellow by the Secretary.

# RULES REGARDING EXAMINATIONS FOR ADMISSION TO THE SOCIETY.

#### (As Amended May 20, 1918.)

The Council adopted the following rules providing for the examination system of the Society:

1. Examinations will be held on the first Wednesday and Thursday during the month of May in each year in such cities as will be convenient for three or more candidates.

2. Application for admission to examination should be made on the Society's blank form, which may be obtained from the Secretary-Treasurer. No applications will be considered unless received before the fifteenth day of March preceding the dates of examination.

3. A fee of \$5.00 will be charged for admission to examination. This fee is the same whether the candidate sits for one or two parts and is payable for each year in which the candidate presents himself. Examination fees are payable to the Secretary-Treasurer and must be in his hands before the fifteenth day of March preceding the dates of examination.

4, 5. Editor's Note: The adoption of the report of the Educational Committee, revising the syllabus of examinations, requires a change in the rules. The amended rules are in preparation and will be presented to the annual meeting in November. In the meantime any one interested in the Associateship examinations may secure complete information from the Secretary-Treasurer.

6. Admission to Fellowship examinations is granted only to those who are Associates of the Society. The examination for Fellowship is divided into two parts. No candidate will be permitted to present himself for Part II unless he has previously passed in Part I or takes Parts I and II in the same year. If a candidate takes both parts in the same year and passes in one and fails in the other, he will be given credit for the part passed.

7. As an alternative to the passing of Part II of the Fellowship examination, a candidate may elect to present an original thesis on an approved subject relating to casualty or social insurance. Candidates electing this alternative should communicate with the Secretary-Treasurer as to the approval of the subject chosen. All theses must be in the hands of the Secretary-Treasurer before the first Thursday in May of the year in which they are to be considered. Where Part I of the Fellowship examination is not taken during the same year, no examination fee will be required in connection with the presentation of a thesis. All theses submitted are, if accepted, to be the property of the Society and may, with the approval of the Council, be printed in the *Proceedings*. 8. In Part II of the Fellowship examination the papers will be so arranged that it will be necessary for the candidate to write on only three of the four prescribed topics in order to obtain full credit.

REPORT OF THE EDUCATIONAL COMMITTEE.

(Adopted by the Council to become effective in May, 1921.)

To the Council:

At the last meeting of the Council your Committee presented a report dealing with its work in preparing a set of references to cover the syllabus of the Society, at the time the Committee was appointed the need of such a set of references being very apparent.

It was also brought to the Committee's attention from various sources that the syllabus as it exists at the present time has been subject to considerable criticism, and the Committee therefore undertook to study of the syllabus with a view of meeting this criticism. The general criticism was that the syllabus was too elaborate and in some respects not practical.

Your Committee first considered the question whether or not there should be any distinction in the syllabus, looking forward to admitting certain members to the Society primarily as actuaries and others primarily as statisticians. We quickly reached the conclusion that, whatever the distinction may be between the actuary and the statistician along general lines, in practical work in connection with casualty insurance there was little, if any, distinction in work or standing between the man holding the title of statistician and the one holding the title of actuary. The difference was mainly a slight difference in point of view, and it was felt that therefore there should be no distinction in framing the syllabus of entrance requirements.

Your Committee next considered the relationship between the status of Associate and Fellow and reached the conclusion that, at least for the purpose of framing the syllabus, it should be assumed that all those seeking admission as Associates would ultimately wish to qualify as Fellows; but it was felt that the passing of the Associate's examination should mark something more than a partial progress toward the full standing of Fellowship and should in itself be an evidence of certain qualifications which might justify an executive of a casualty company entrusting certain work definitely to those who had so passed Associateship examinations.

The Committee further felt that the whole examination program should be made rather simpler than as is outlined in the present syllabus, particularly in view of the fact that it has been found necessary up to the present time to waive a part of the Associateship requirements. In this respect it has been pointed out in Committee discussion that, while in many ways we have followed

the valuable precedents of the Actuarial Society of America, in this respect we have departed, and probably unwisely. When that Society first began its system of admission by examination, the examinations were quite simple, and as a general standard of the Society was raised the requirements for admission were correspondingly raised. It has appeared to a majority of the members of the Committee that this is a better policy than to apparently hold up higher standards in an examination and obtain the necessary new members for a healthy growth of the Society by a lower passing mark. Notwithstanding this desire for simplicity, however, the Committee has borne in mind that in many respects the future of the casualty insurance business depends upon an actuarial profession with high standards and high ideals, and it has tried to frame its syllabus so as to clearly indicate that it is not the intention of the Society to accept men who are not properly qualified but that it is the intention of the Society to stand for a high professional standard.

The ground having been cleared by establishment of these general principles, the Committee has undertaken the revision of the syllabus itself, and its first recommendation is that the Associateship be grounded upon passing two sets of examinations rather than four, as laid down theoretically at the present time. This conforms with the present practice, the first two parts of the present syllabus having been waived hitherto.

The Committee then took the scheme presented by Mr. Blanchard in his communication to the Editor, published on page 442 of Volume IV of the Proceedings, and considered what topics in the outline on page 443 should be required and in what order. Several tentative drafts of the syllabus were prepared after such discussion and submitted for criticism to the members of the Committee, and as a result of such preliminary drafts and criticisms, your Committee submits a revised syllabus as follows:

#### ASSOCIATESHIP.

## Part I.

1. Elementary algebra up to and including the binomial theorem and the use of logarithms, and compound interest and annuitiescertain.

Note.—Under this topic the student is expected to understand what is presented in the ordinary college algebras through the binomial theorems but excluding exponential and logarithmic series. He is expected to understand the ordinary use of logarithms and to be able to handle the simpler problems in compound interest and annuities-certain as thew are presented in the average college algebra, without going into the more intricate problems of bond amortization and similar matters.

2. Double entry bookkeeping.

3. Elements of statistics, including theory of compilation, tabulation and presentation, but excluding critical mathematical analysis.

## Part II.

1. Elements of the theory of probabilities—algebraic treatment only.

2. Policy forms and underwriting practice in casualty insurance, viz., Personal accident, health, liability, workmen's compensation, fidelity, surety, plate glass, steam boiler, burglary, fly wheel, automobile, workmen's collective, credit.

3. Simple practical problems relative to procedure in compilation and use of statistics relating to casualty (including social) insurance problems.

4. Simple practical problems relating to procedure in insurance accounting and statistics, including the preparation of annual statements and schedules.

Note.—As respects items 3 and 4, the student is expected to be prepared to carry through, under instructions, such compilations of statistical data as are usually made in the office of a casualty company and to carry through the usual accounting work, including the preparation of the statement. He should also be prepared to adapt, for the use of his particular company, statistical and accounting methods in general use. It is not expected that the candidate for Associateship should be prepared to work out new plans and methods for developing data and answering intricate questions, facility for coping with the latter type of problems being among the qualifications required for Fellowship.

5. Insurance law, including the more important statutes of the United States and Canada (for Canadian candidates) relating to casualty insurance.

#### FELLOWSHIP.

# Part I.

1. Advanced algebra, elementary differential and integral calculus and elementary calculus of finite differences.

2. Critical analysis of statistics, including elementary mathematical theory.

3. Elements of the theory of life contingencies, including the calculation of present values of annuities based upon life contingencies.

#### Part II.

1. Advanced practical problems in the compilation and use of statistics relating to casualty (including social) insurance problems.

2. Calculation of premiums and reserves for accident, sickness, workmen's compensation and other branches of casualty insurance, including consideration of basis of reserve.

3. Advanced practical problems in insurance accounting and statistics, including the preparation of annual statements and schedules.

4. Underwriting problems in casualty insurance, including inspection of risks, adjustment and settlement of claims, etc.

As certain candidates have already been working in preparation for examination under the present syllabus, the Committee recommends that, if the new sylabus meets the favor of the Council, it be made effective for admission during 1921, that is, for the examinations of that year; and it is also the feeling of the Committee (although the matter is perhaps more within the province of the Examination Committee) that it will needlessly complicate matters if students having already passed part of the examinations are required to go back and repass such examinations because of subjects later included in them by this syllabus, or to include such subjects in their later examinations. We believe that the interests of all will be sufficiently served if, for this purpose, the revision of the syllabus be ignored.

Respectfully submitted,

EDUCATIONAL COMMITTEE, By A. H. MOWBRAY, Chairman.

October 30, 1919.

The Educational Committee is preparing a pamphlet outlining a course of study which may be followed in connection with the syllabus. This should be available for distribution about November 1, 1920. Those who wish to secure copies may do so by communicating with the Secretary-Treasurer after that date.

# 1920 Examinations of the Casualty Actuarial and Statistical Society of America.

Examination Committee.

MERVYN DAVIS,	Chairman
In Charge of	In Charge of
Associateship Examinations.	Fellowship Examination.
EDWIN W. KOPF, Chairman	RALPH H. BLANCHARD, Chairman
WINFIELD W. GREENE	EVERETT S. FALLOW
WILLIAM H. BURHOP	EDMUND S. COGSWELL

#### EXAMINATIONS FOR ADMISSION AS ASSOCIATE.

#### Part III.

1. According to a certain mortality table out of 1,000 living at age (x) the following will respectively die in the years below named:

First year—50 Second year—51 Third year—52

Write symbols and numerical values for the following probabilities:

- (a) That a person aged (x+2) will live at least one year.
- (b) That a person aged (x) will die in the third year.
- (c) That two persons, aged respectively (x+1) and (x), will both die within one year.
- (a) Of what importance to a casualty company is the net rate of interest earned upon its investments? Are interest earnings of more importance in life insurance than in casualty insurance? Give reasons for your opinions.
  - (b) Define nominal and effective rates of interest amortization; annuity-certain.

3. Why are the terms "direct" and "indirect" taxes vague and equivocal?

4. What is "rank" or "grade" correlation? Under what practical conditions would you employ this method?

- 5. (a) Explain the meaning of the symbols  $a_x$ ,  $a_x$  and  $\bar{a}_x$ : state the relation existing between them.
  - (b) A permanently and totally disabled worker earned before his injury \$1,875 per year. The "permanent total" benefit is two-thirds wages for life, payable monthly. However, the law provides that in computing compen-

sation no wage shall be deemed greater than \$1,200 per annum. What is the present value of the benefit at 31 per cent. compound interest assuming the worker to be 45 years old and that

 $a_{46} = 8.000$ 

# $q_{45} = .087$

6. Find the value of an annuity-certain for n years, the payments under which are in geometrical progression, being represented by the series k, kr,  $kr^2$ , ... Under what circumstances could the value of the corresponding perpetuity be obtained and what would be this value.

7. What is the "subsistence theory of wages"? By whom was it first advanced, and what current economic conditions did it then seem to fit?

8. What interpretation would you place upon the "probable error" of:

(a) the arithmetic mean of a series?

(b) the standard deviation?

(c) the coefficient of correlation?

9. Of what practical value is knowledge of the theory of life annuities and assurances to the actuary of a casualty company? Give reasons for your opinions.

10. A bond paying 4 per cent. semi-annually on the 15th of January and July, and maturing January 15, 1923, is purchased July 15, 1920. If the rate realized is 5 per cent. convertible halfyearly, what is the purchase price?

(Given  $v^{5}$  (at  $2\frac{1}{2}$  per cent.)=.88385)

11. If the above bond were purchased at 99 what would be the (approximate) effective rate of interest realized on the investment.

12. Comment upon coöperative credit and marketing enterprises in their effect upon the mass of wage-carners. What are the elements necessary for the practical success of a cooperative undertaking?

13. Define the following terms:

a. frequency polygon

b. frequency curve

c. class interval.

14. (a) Write an expression for the terminal reserve on an ordinary life policy which has been in force ten years. Define the symbols which you employ, and express them in commutation symbols.

(b) Why is it necessary for a life insurance company to set aside premium reserves?

15. In the extension of any agricultural or manufacturing process what is the "point of diminishing productivity?" 16. In graphically illustrating a series of accident rates, what

kind of chart-paper do you prefer, and why?

a. ordinary cross-section paper

b. semi-logarithmic paper

c. logarithmic paper

d. arithmetic or logarithmic "probability" paper

#### Part IV.

1. Does a Universal Standard Workmen's compensation policy issued to a garage and auto salesroom cover automobile racing when such is done by the employees of the assured? Give reasons for your answer.

2. Having been given the records of fatal industrial accident cases, sketch a table to show, for married workmen, the ages of the widows in relation to the ages of dependent children.

3. What facts should an exhibit of workmen's compensation losses contain to properly determine rates for classifications.

4. To what extent is it lawful for a single insurance company to transact casualty and (a) life business (b) fire business? Criticise briefly the provisions of statute cited in your reply to the foregoing question.

5. An employ of an awning contractor while installing an awning for a bakery is thrown from a ladder by a truck owned by the bakery; does the injury come under the compensation act or public liability and why?

- 6. Discuss one of the following practical tabulating problems: (a) What general considerations (number of cases to be handled, complexity of tabulation, degree of accuracy, etc.) govern the choice of a tabulating system as between hand, and mechanical or punch-card devices? Under what conditions is the one plan more economical than the other?
- (b) Describe the various procedures for insuring accuracy of punch-cards, and state which of these methods is, in your opinion, the best; why?

7. The legislature of a state has changed the waiting period, maximum weekly wage basis and the specific injury benefits in the compensation act. All the detailed information of the cost of the original law is available. How would you determine the cost of the amendments on the basis of this information? Outline the necessary steps.

8. A stock company is being organized to write fidelity and surety; personal accident and health; automobile public liability, property damage, and collision; elevator public liability; compensation. Having a specified jurisdiction in mind, state the principal steps which must be taken before the company may lawfully issue policies in all of the above lines.

9. What factors determine or influence the automobile theft hazard?

10. Graphically illustrate, and interpret the following table:

#### 1920 EXAMINATIONS.

Wages and	the	$\operatorname{cost}$	$\mathbf{of}$	living in	$\mathbf{Eastern}$	Massachusetts
Year.				Wages	i.	Cost of Living.
1860				100		100
1861				100		111
1862				100		123
1863				109		137
1864				120		163
1865				141		175
1866				153		172
1867				173		164
1868				167		165
1869				174		163
1870				175		157
1871				178		148
1872				174		147
1873			• •	175		149
1874				170		145
1875				161		141
1876				156		134
1877				146		131
1878				142		126
1879				140		123
1880				137		125

11. Explain the "Schedule P" method of determining loss reserves and how can it be just fied.

12. To what extent are the premium rates for compensation insurance controlled by state authority?

13. What premium is paid on the salaries of executive officers of a plant assured under a workmen's compensation universal standard policy? What is the justification?

14. Describe briefly (referring to workmen's compensation insurance):

(a) Three methods of determining unearned premiums.
(b) Three methods of determining unpaid losses.
(c) How premiums in force are determined.

(d) The chief function of schedule W.

15. What recommendations as to fatal accident statistics useful in personal accident underwriting would you make to a registrar of a health department. State how you think the deaths ought to be classified, and sketch a table to show items as nature of hazard, sex and age of deceased person, number of population exposed to risk, etc.

16. How are legal loss reserves determined for the following lines? (State general principles only.)

(a) Fidelity and Surety.

(b) Public Lability.

(c) Workmer's compensation.

(1) for stock companies.

(2) for mutual companies.

#### EXAMINATIONS FOR ENROLLMENT AS FELLOW.

# Part I.

(Any one of questions 1 to 5 inclusive, and any one of questions 6 to 10 inclusive may be omitted.)

1. Describe in detail how the loss reserve under personal accident insurance should be computed. Why should the notice average under automobile property damage insurance be watched much more carefully than under personal accident insurance? 2. Outline a method of keeping automobile liability experience

in connection with the present basis of premium rates for

(a) Pleasure cars.

(b) Commercial cars.

3. Combined experience for workmen's compensation insurance for the policy years 1916-17 showed the following results for a certain classification after converting the losses to a common level.

Year of Issue.	Payroll.	Death Losses.	All Other Losses.	Medical.
1916	\$170,905	\$4,500	• • •	\$55
<b>1917</b>	195,472		518	25

Criticize this experience as a basis for the projection of rates for the year 1920. What other basis might be used?

4. Discuss the merits and demerits of the present law governing workmen's compensation loss reserves for stock companies in New For mutual companies. York State.

5. Discuss the relative importance of the items for which provision must be made in steam boiler insurance rates.

6. In inspecting a manufacturing risk for workmen's compensation insurance, what elements of hazard should be noted in connection with:

(a) working machines

- (b) stairways
- (c) elevators
- (d) power transmission

7. What items of information concerning the applicant should an underwriter have in order to pass on an application for individual accident and health insurance?

8. Account for the difference in the cost of adjusting claims in the following lines of insurance:

(a) Personal accident and health

(b) Workmen's compensation

(c) Automobile casualty.

9. What are the principal points to be considered in an application for a fidelity bond?

10. Discuss the difference between the proper attitude of an adjustor handling a public liability claim and the attitude of one handling a workmen's compensation claim.
(Any one of questions 11 to 15 inclusive, and any one of questions 16 to 20 inclusive may be omitted.)

11. What are the reasons for the low rates of foreign exchange? What factors would have a tendency to bring the rates back to normal?

12. (a) Explain what is meant by the amortization of bonds.

(b) Is it good practice for a casualty insurance company to value its securities on an amortized basis? Give reasons.

13. Discuss the present conditions of the security market from the point of view of the manager of the investment department of an insurance company.

14. What information concerning the safety of principal and dividends should be obtained in order to determine the desirability of a preferred stock as an investment?

15. To what extent should a company doing an exclusively accident and health business invest in western farm mortgages? Why?

16. What statistical information is available for calculating group health insurance rates? Comment on the relative value of these various sources of information.

17. Given the pure premium cost for the eighth to tenth days (inclusive) of disability and the pure premium cost for the eleventh day to the twenty-seventh week (inclusive), explain how you would calculate the group accident accilent rate which would provide payment in case of total disability for the difference between 80 per cent. of wages; maximum 330,00; twenty-six weeks limit; one week waiting period; and the coverage provided under a workmen's compensation law which pays 50 per cent. of wages, maximum 14, with a ten day waiting period.

18. Discuss ratios of loss and of expense as a guide to the policy holder in his choice of an insurance company.

19. Compare critically two methods of converting workmen's compensation losses in several states to the level of a "basis state."

20. Losses in burglary insurance have become abnormally high. Discuss problems involved.

#### Part II.

Note.—In accordance with Rule 3 of the rules regarding examinations for admission to the Society, candidates who are to be examined in Part II of the Fellowship examinations are required to write on only three of the four prescribed topics, in order to obtain full credit. For this reason, the examination questions are so arranged that it will be possible for the candidate to choose three of the four topics for his examination. A choice of topics is binding for both morning and afternoon papers; that is to say, if you choose as the subjects for your examination topics, 1, 2 and 3, you must be careful to limit yourself to the questions on these topics both in the morning and afternoon examinations.

#### TOPIC I. PRINCIPLES AND HISTORY OF SOCIAL INSURANCE.

1. What is social insurance?

2. Why did social insurance develop first in Germany? Why is it less developed in the United States?

## TOPIC II. COMPILATION AND USE OF CENSUS OR OTHER GOVERNMENT STATISTICS RELATING TO POPULATION, MORTALITY, INVALIDITY, SICKNESS, UNEMPLOY-MENT, OLD AGE AND ALLIED MATTERS.

3. Give briefly an outline of the information contained in the United States decennial census which has some application to the headings listed under Topic II.

4. For most practical purposes of statistical analysis, is it sufficient to make use of age groups using the information contained in the United States decennial census reports? Why?

5. What allowance must be made in drawing deductions from crude death rates as shown in "Mortality Statistics—Bureau of the Census"? Give reasons.

### TOPIC III. SYSTEMS OF INVALIDITY, OLD AGE AND EMPLOY-MENT INSURANCE.

6. Outline the present development of the old age pension idea among industrial corporations in the United States.

7. Outline the present status of unemployment insurance in European countries.

8. Is unemployment insurance adapted to conditions in the United States? Why?

## TOPIC IV. CALCULATIONS OF PREMIUMS FOR AND VALUATION OF PENSION FUNDS.

9. A large financial corporation is considering the establishment of a pension plan for its employees. State your recommendations with reasons therefore as to the following points:

- (a) Retirement age for males.
- (b) Retirement age for females.
- (c) Basis for the determination of the amount of pension at retirement.
- (d) Benefits to employees totally and permanently disabled prior to ages set for retirement under (a) and (b).
- (e) Advisability of securing contributions from employees.

10. A protestant denomination is planning a pension plan for its ministers. Point out the difference in the handling of a pension fund in the case of such an organization and in that of an industrial employer. TOPIC I. PRINCIPLES AND HISTORY OF SOCIAL INSURANCE.

11. An analogy is frequently drawn between workmen's compensation and health insurance (social). To what extent is this analogy justified?

12. Give a general outline of the extent to which the various branches of social insurance have advanced in one of the principal countries of Europe.

13. Discuss group Life insurance as a practical application of social insurance principles. To what extent has group Life insurance advanced in the United States?

### TOPIC II. COMPILATION AND USE OF CENSUS OR OTHER GOVERNMENT STATISTICS RELATING TO POPULATION, MORTALITY, INVALIDITY, SICKNESS, UNEMPLOY-MENT, OLD AGE AND ALLIED MATTERS.

14. What official governmental wage statistics are available? Comment on thir usefulness.

15. Could any use be made of governmental statistics as a basis for the development of a plan for granting sickness and superannuation benefits eo employees of an industrial plant? If so, to what extent could such use be made?

### TOPIC III. SYSTEMS OF INVALIDITY, OLD AGE AND EMPLOY-MENT INSURANCE.

16. Outline the benefits provided by the National Insurance Act of Great Britain.

17. Assuming that a health insurance act is to be passed, outline the features which would be covered, indicating what provisions would be desirable under each head.

#### TOPIC IV. CALCULATIONS OF PREMIUMS FOR AND VALUATION OF PENSICN FUNDS.

18. A Pension plan has been in operation for several years designed to provide a pension of \$1,000 to each professional employee of a large institution upon his reaching the age of sixty. Outline the method of valuing the fund, showing the total amount of reserve which should be on hand at any time. This requires a statement of the basis of valuation initially and the method of keeping the valuation correct thereafter.

19. A large employer whose staff includes a large proportion of old employees has at the present time a pension roll including about 5 per cent. of his total number of employees. He has purchased a Single Premium Life Annuity from an insurance company to each of these pensioners and promises to purchase similar Life Annuities as other employees are pensioned. What should he do to put his retirement system on a sound basis?

20. Outline and criticize the retirement system for public school teachers in force in any state or city in the United States.

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