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NOTICE

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PROCEEDINGS

NOVEMBER 15, 1918

THE RELATION BETWEEN THE ACTUARY AND THE STATISTICIAN.

ADDRESS OF THE PRESIDENT, JAMES D. CRAIG.

At the last meeting of the Casualty Actuarial and Statistical Society the question was asked, "What is the difference between an 'actuary' and a 'statistician'?" While the various publications on statistics have generally covered the history, as well as the definition of that subject, and while Walford's "Insurance Cyclopædia" deals somewhat fully with the history of the term "actuary," it has seemed appropriate that the definition, history and functions of both the actuary and statistician be brought before you as a matter of record.

As these must necessarily be taken from such books as "An Introduction to the Theory of Statistics," by Mr. G. Udny Yule, the "Elements of Statistics," by Mr. Arthur L. Bowley, and from the volumes of "The Insurance Cyclopædia," by Mr. Cornelius Walford, F.I.A., F.S.S., and as no claim is being made to originality, it has not seemed necessary to present as quotations statements found in these books. Our only object now is to gather the available information and present it in such form that the meaning of the two names may be comprehended and the differences in each profession may be clearly in your minds.

According to the Constitution of the Institute of Actuaries of Great Britain and Ireland, incorporated by Royal Charter on July 29, 1884, under the name of the Institute of Actuaries, the peculiar province of the actuary is the inquiry into all monetary questions involving a consideration of the separate or combined effects of

interest and probability, while the statistician has been designated as one skilled in the science of counting. When first stated the problems involving interest and probabilities might appear to be more complicated than those involved in the science of counting. This would be true were counting considered as a simple operation performed automatically by one person, but when the numbers counted are large, as, for instance, the population of the United States, the total count is not simple. Also, one cannot count the number of bushels of wheat, barley, etc., raised in this country in a year. From the *Literary Digest* for November 9, we have the following figures, relative to the increase in crop production for 1918:

TABLE SHOWING DECREASE AND INCREASE OF PRODUCTION OF THE FOLLOWING CROPS FOR 1918 AS AGAINST 1917.

Crop.	Increase in Bushels.	Decrease in Bushels.
Corn		441,000,000
Oats		52,000,000
Potatoes		51,000,000
Sweet potatoes		2,000,000
Total		546,000,000
Wheat	267,000,000	
Barley	26,000,000	
Rye	16,000,000	
Buckwheat	2,000,000	
Rice	5,000,000	
Beans	3,000,000	
Total		319,000,000
Net decrease		227,000,000

It is not within the power of any individual to make the count of these figures, while the limits of time and place so act as to make an absolutely accurate count impossible and reduce the conclusion from exactness to an approximation.

The same applies to the savings in gas and coal reported to have been made by the Daylight Saving plan in operation this year. The sponsor of that plan reports a saving of 1,250,000 tons of coal and an estimated cut of $2,000,000 in the gas bills of the nation, while to quote from the *Literary Digest* again:

"President Charles Lathrup Peck, of the National War Garden Commission, credits the Daylight Saving Law with being largely

responsible for the production of the record of a $500,000,000 crop of war gardens, which is 51 per cent. greater than the crop last year."

It is pointed out that one division between arithmetic and statistics is that whereas arithmetic attains exactness, statistics deals with estimates, sometimes very accurate and often sufficiently so for their purpose, but not mathematically exact. With the statistical results not being mathematically exact, it becomes necessary to have some idea as to the extent of their error and accordingly the mathematical probabilities have been largely applied in the development of statistical methods.

Furthermore, in dealing with large masses of figures, special methods are necessary, depending on particular properties of large numbers and suitable for describing complex groups, so that they can be easily comprehended. Methods must be adopted for analyzing the accuracy of statements, for measuring the significance of differences and for comparing one estimate with another. The tabulation involves a great deal of detail labor, but the determination of the exact form and the choice of the headings to which the totals shall correspond require close study from the administrative statistician.

From the nature of the problem the data so tabulated produce but an approximation, but if the number of objects counted or the number of observations made are sufficiently large, the statistician, by means of his mathematics, is often able to determine the probable limits of error or even a law which can be expressed by a definite formula. When the population is counted by ages, or shells by length or breadth, or any other tabulation recorded, the results can often be recorded graphically and the equation of the resulting curve assumed to give the correct values.

Without attempting to go into the mathematics of statistical methods, it might be stated that the equation of the curve of error is their foundation. Frequency Curves and their adjuncts, Mean, Mode, Standard Deviation and Skewness, have all distinct meanings in connection with statistics. These are described in many books and are developed in relatively simple form by Mr. Arthur L. Bowley in his "Elements of Statistics." Mr. Arne Fisher, in the Preface to his book on "The Mathematical Theory of Probabilities," states that Charlier has rightly observed that the modern statistical methods may be based on the few condensed rules con-

tained in the great work of Laplace. While in 1774 Laplace did make the first attempt to deduce a rule for the combination of observations from "The Principles of the Theory of Probability," it has been contended that the modern development in "Frequency Curves and Correlations" has come largely as a result of the work of Prof. Karl Pearson.

The fields in which the actuary and statistician operate are different. The statistician brings together facts calculated to illustrate the condition and prospects of a society and diffuse statistical information in the different departments of human knowledge. His field is unlimited and we find his methods adapted to physical sciences, biology, meteorology, demography, etc. He tabulates and examines the data in many fields, but differs from the actuary in that he does not combine interest with his statistical probabilities. The actuary does not extend his field of operations beyond the general field of insurance, but in this field he finds occasion to use all the statistical methods in the tabulation of his probabilities and then carries his operations further by dealing with the question of interest.

Strictly speaking, the statistician draws no deductions. He collects, arranges, describes, like a careful experimentist. He presents evidence, but not conclusions and it is only when the statistician, as a distinct operation, assumes the role of the economist that, in addition to conducting the experiment, he fits the theory. Thus, in the Life Supplement of the *Spectator* of August 1, 1918, there is an article taken from "Agency Items," entitled, "Thrift at Home and Abroad." This article has received considerable publicity and on account of the interesting statistics presented, together with the erroneous conclusions, the article is herewith reported in part:

"THRIFT AT HOME AND ABROAD."

"Savings bank statistics, based largely on pre-war conditions, show that

"Of every 1,000 people in Switzerland, 595 have a savings account.

"Of every 1,000 people in Norway, 468 have a savings account.

"Of every 1,000 people in Denmark, 436 have a savings account.

"Of every 1,000 people in Japan, 400 have a savings account.

"Of every 1,000 people in France, 368 have a savings account.

"Of every 1,000 people in the United States, 109 have a savings account.

"Why is it that in the United States, reputed to be the wealthiest country in the world, only ten per cent. of the population maintain savings bank accounts? Americans must be taught to save," etc.

In this table the statistical data may be correct, but the conclusion drawn is erroneous. The compiler of these figures probably meant there were 595 accounts in Switzerland to each 1,000 of population, instead of 595 people with deposits, but passing over this, the countries cited, with the exception of the United States, are older countries which are more densely populated. Large tracts of land sparsely populated would not be expected to support many savings banks and in order to draw correct conclusions, the data for similar populations should be compared. Thus, instead of comparing the entire population of the United States with that of Switzerland, why not compare Massachusetts. According to the "World Almanac" for 1910, the population of Massachusetts was 3,693,310, while the population of Switzerland was 3,741,971. The area of Massachusetts is practically half that of Switzerland, being 8,266 square miles as against 15,976. Switzerland has 1,963,417 deposits with total deposits of $307,386,431, while Massachusetts has 2,566,467 deposits with total deposits of $1,026,822,448. In the New England states the number of deposits equal 551 for each 1,000 of population, while the average deposit is over $400 as compared with $86 in Switzerland. Here we see the difference between the collecting of statistics and the fitting of the theory.

The actuary, by being limited more particularly to the field of insurance, as well as by reason of his technical knowledge, has been compelled to master the details of the entire business. He is constantly compelled to draw deductions and fit the theories.

In 1826, Mr. Babbage in his "Comparative View," speaking of the actuaries of the then offices, said:

"The degree of knowledge possessed by persons so situated at the different Institutions is exceedingly various, passing through all degrees, from the most superficial acquirements, derived merely from the routine of an office, up to the most profound knowledge of the subject."

Mr. H. W. Porter, in a paper read before the Institute of Actuaries on "Some Points connected with the Education of an Actuary," stated:

"The model actuary, then, as a statist, collects and arranges the materials for his mortality table; as a mathematician he constructs, accommodates, and corrects it, according to scientific principles; and from this course he calculates his Table of annuities and of premiums. His knowledge of the nature of disease, and of their effect upon certain constitutions and under different conditions, enables him to coöperate with the physician; and thus the medical knowledge of that officer is combined with the statistical element, in the hands of the actuary, and the knowledge of both is thus made practically useful. His legal knowledge, if sound, may save the Company much expense—his sphere of usefulness is enlarged, and he becomes a valuable coadjutor of the legal adviser of his Company. As a scholar, the actuary is continually in request. As a man of business his services are invaluable. In the term 'business' I include a knowledge of Finance."

It is probably the extensive use of the statistical methods by the actuary in the tabulation and graduation of his data before introducing the factor of interest that has caused him to be looked upon as a statistician. It is only natural that he should avail himself of statistical methods and he has shown no hesitancy in adopting them, as, for instance, in the case of the method of least squares introduced by an astronomer anxious to choose the best of several slightly discrepant observations of the position of a star, but recognized and used by the actuary as a valuable method for adjusting his mortality table. The latest illustration given to the members of this Society is in the paper, presented by Prof. Whitney at our last meeting, on "The Theory of Experience Rating," in which he states that the problem is strictly a matter for statistical treatment.

Apparently, the term "actuary," as it is now understood, has been recognized for a longer period than "statistician," as in 1774 Mr. Wm. Morgan was appointed Resident Actuary of the Equitable Assurance Company of London, while the words "statistics" and "statistician" were first used in 1787 by Mr. E. A. W. Zimmerman in a preface to "A Political Survey of the Present State of Europe."

The name "actuary" was derived from "actus," an instrument, and was first used as a designation of a public officer who drew up the writings, contracts, etc., in the Roman Courts of Justice in the presence of the Magistrate. Later the Actuarii kept the military accounts of the Romans, then acted as the clerks who registered the acts and constitutions of the convocations in the assemblies.

The officer appointed to keep savings bank accounts was formerly termed "actuary" and some dictionaries include shorthand writers, as well as registrars of public bodies under the term.

While the actuary was recognized in 1774 as a necessary officer in an insurance company, it was not until 1819 that he received government recognition. In that year Mr. John Finlaison was appointed to the office of Actuary to the Commissioners of the National Debt, while, in addition, it was enacted that the tables and rules of all friendly societies should be approved by two persons at least, known to be professional actuaries, or persons skilled in calculations.

In 1852, any judge of the Court in England was authorized to obtain the assistance of "actuaries or other scientific persons," in order to secure more speedy and efficient despatch of business, but the first step taken toward making a profession of actuarial science was in 1847, when the Institute of Actuaries of Great Britain and Ireland was founded

"for the purpose of elevating the attainments and status, and promoting the general efficiency of all who are engaged in occupations connected with the pursuits of an Actuary; and for the extension and improvement of the data and methods of the science, which has its origin in the application of the doctrine of probabilities to the affairs of life, and from which life assurance, annuity, reversionary interest and other analogous institutions derive their principles of operation. It embraces as its peculiar province of inquiry all monetary questions involving a consideration of the separate or combined effects of interest and probability."

The Institute held its first meeting on January 29, 1849, in the Guardian Assurance Office in London and it is only natural that following closely the organization of this body a good deal of attention should be given to the training and qualifications of actuaries. In 1853 the leading actuaries of that time were seriously discussing the question, while the Select Committee on Assurance Associations, which sat in that year, also took cognizance of it.

In 1868, the Faculty of Actuaries of Scotland was incorporated and the Charter set forth in detail the duties of an actuary in somewhat the same manner as has been outlined. About this same time, in fact one year earlier, in 1867, an attempt was made to found an Institute of Actuaries in the United States, but it did not proceed and it was not until 1889 that the Actuarial Society

of America was formed, at which time actuarial science was so well known that it was simply necessary for that Society to state in its constitution that the object of the Society was the promotion of actuarial science by personal intercourse, presentation of appropriate papers and discussions and such other matters as might be found desirable. The American Institute of Actuaries, organized in 1909, gave as its object the advancement of the science of insurance mathematics and the knowledge of the theory and practice of life insurance and related interests by associating together persons of like interest.

Passing from the actuary to the statistician, we find that the words "statist," "statistics" and "statistical" appear to be all derived more or less indirectly from the Latin "status" in the sense that it acquired in Mediæval Latin of a political state. The word "statist" occurred in "Hamlet" in 1602, in "Cymbeline" in 1610 or 1611 and in "Paradise Regained" in 1671, but "statistics" and "statistical" were apparently introduced in England in 1787 by Mr. E. A. W. Zimmerman in the preface to "A Political Survey of the Present State of Europe," although the science itself had been developing for forty years previous. As developed at that time "statistics" meant simply the exposition of the noteworthy characteristics of a state and had for its object the actual and relative power of the several modern states, the power arising from the natural advantages, the industries, the civilization of their inhabitants and the wisdom of their governments.

In the "Prospectus" of the Royal Statistical Society, founded in 1834, it is stated that statistics may be said to be the ascertaining and bringing together of those facts which are calculated to illustrate the condition and prospects of a society, while the American Statistical Association, organized in 1839, had as its object "to collect, preserve and diffuse statistical information in the different departments of human knowledge."

Naturally, both actuarial science and the science of statistics have developed until statistical methods are used to measure the social organism in all its manifestations and statistical probabilities combined with the effects of interest have been made the basis of all forms of insurance.

"Statistics" and "statistical" have ceased to bear any necessary reference to matters of state and are now applied in physics, biology, anthropology and meteorology, as well as in the social sciences,

while the development of statistical methods has now brought all these subjects into the realm of statistics. There are now publications relating to particular subjects, as, for instance, a *Journal for the Statistical Study of Biological Problems,* a book on "The Principles of Statistical Mechanics," etc.

The actuarial work on its technical side depends largely upon the results of statistical inquiries and all developments and improvements are of interest. The connection between the two sciences has had its first official recognition in this body, which has been organized under the name of the Casualty Actuarial and Statistical Society of America. The actuaries have had their organizations in the past, while both the Royal Statistical Society and the American Statistical Association have been developing various phases of inquiry, but, apparently, this is the only organization where both actuarial science and statistical methods are recognized in its name. We have a large field and one that is offering many opportunities.

Is it not interesting to note that hostilities in the great war just ended on the eleventh hour of the eleventh day of the eleventh month. It has brought new problems. As a total our army has probably lost more men from influenza than were killed in action, but it remains for the future statistician to make the detail studies and determine the various rates.

At present we with all the world are rejoicing at the advent of peace. Even the peoples of the defeated nations are rejoicing—not, indeed, to the same extent that we rejoice, but the new era of "Peace on Earth, Good Will to Men" permeates the heart of mankind. Discarding the time-old doctrine that "to the victor belongs the spoils" and simply fighting against the principle that "might makes right," the victors have impressed upon the vanquished the righteousness of their cause and they acquiesce in the result not so much as defeated enemies, but rather as people for whom has been opened the opportunity for self government.

Mortality from External Causes among Industrial Policyholders of the Metropolitan Life Insurance Company, 1911–1916.*

BY

LOUIS I. DUBLIN.

The group of the external causes of death is the fifth in order of numerical importance in this investigation.

In any discussion of mortality, we may, in general, distinguish two main classes; first, those diseases and conditions which arise from pathologic processes within the body, and second, conditions which follow injury by some means or agency external to the human economy. Under each of these two fundamental divisions, we attempt to identify the specific agencies at work. Oftentimes, we must have recourse simply to a statement of the disease or condition present, without reference to the particular causative agency producing the disease. This observation applies especially to diseases of internal origin. The "external" conditions are by comparison less difficult to determine causally. Our first approach to them is to establish three classes, the division being made with respect to the element of human volition involved in the fact of injury. The first group consists of the accidental deaths, those accomplished by pure chance or through personal negligence without deliberate intent to kill, maim or incapacitate. The second group of external causes of death consists of the suicides, or cases where there was deliberate intent to accomplish self-destruction Under the third class, we consider all deaths (except war deaths) which arise from the impulse of one person to kill or injure another. These latter are "homicides." For each of these main classes of violence, we shall endeavor further to distinguish the means or agency of injury. War deaths have been taken from the class of accidental and unspecified violence and shown separately for purposes of this report.

During the six-year period covered by this investigation of wage earners' mortality, there were 50,712 deaths from external violence

* This is an excerpt, being Chapter VIII of my forthcoming book entitled, "Mortality Statistics of Insured Wage Earners and Their Families."

of all kinds. The following table gives the incidence of the three chief groups of external causes represented in our records:

TABLE 1.

MORTALITY FROM EXTERNAL CAUSES OF DEATH. CLASSIFIED ACCORDING TO MAIN GROUPS.

Deaths and Death Rates per 100,000 Persons Exposed and Per Cent. of Total Mortality from External Causes Represented in Each Main Group. 1911 to 1916.

Experience of Metropolitan Life Insurance Company. Industrial Department.

Class of External Violence.	Number of Deaths.	Per Cent. of Total External Causes.	Death Rate per 100,000 Exposed.
Total external causes	50,712	100.0	94.3
Accidents, incl. unspec. violence*	39,268	77.4	73.0
Suicides	6,542	12.9	12.2
Homicides	3,753	7.4	7.0
War deaths	1,149	2.3	2.1

* Excludes "war deaths."

The total death rate corresponding to the 50,712 deaths was 94.3 per 100,000, which, as we shall see later, is very considerably in excess of the rate for the external causes prevailing in the general population of the expanding Registration Area. More than three quarters of these deaths were due to accidents. If "war deaths" were included, as perhaps they should be to follow classification practice, the proportion would reach nearly 80 per cent. Suicides comprise 12.9 per cent. and homicides 7.4 per cent. additional. We shall consider in detail first the group of accidents.

ACCIDENTS, INCLUDING UNSPECIFIED VIOLENCE.

The general accident problem in the United States, and especially as it affects the wage earner, should interest us because of the very considerable mortality which results from this group of causes. It would appear that the special conditions of American life and industry still give rise to hazards which result in an extraordinarily large fatal accident rate. When compared with accident mortality in England and Wales, the American figures show up especially badly. In the year before the war, 1913, the fatal accident rate of England and Wales was, for males 35 to 44 years,

62.4 per 100,000. In the Registration Area of the United States, the rate for males at these ages was 139.6 per 100,000, and, among the insured white males, the rate was 154.3. In other words, the rate for England and Wales was 44.7 per cent. of that for the expanding Registration Area of the United States and only 40.4 per cent. of the rate for insured white males. Even when we consider the chief types of fatal accidents, such as falls, burns, drowning, and steam railroad accidents in these three series of figures, the rates of mortality as recorded for the United States are much above the figures for England and Wales, and those for the Industrial policyholders are, for the significant age periods, highest of all. The data on fatal accidents and especially the specific forms of accidental injury which we have included for American wage earners should, therefore, constitute a very valuable contribution for the further study of the accident problem and should prove especially useful in the movement for increased industrial and public safety which has been developed during the last ten years.

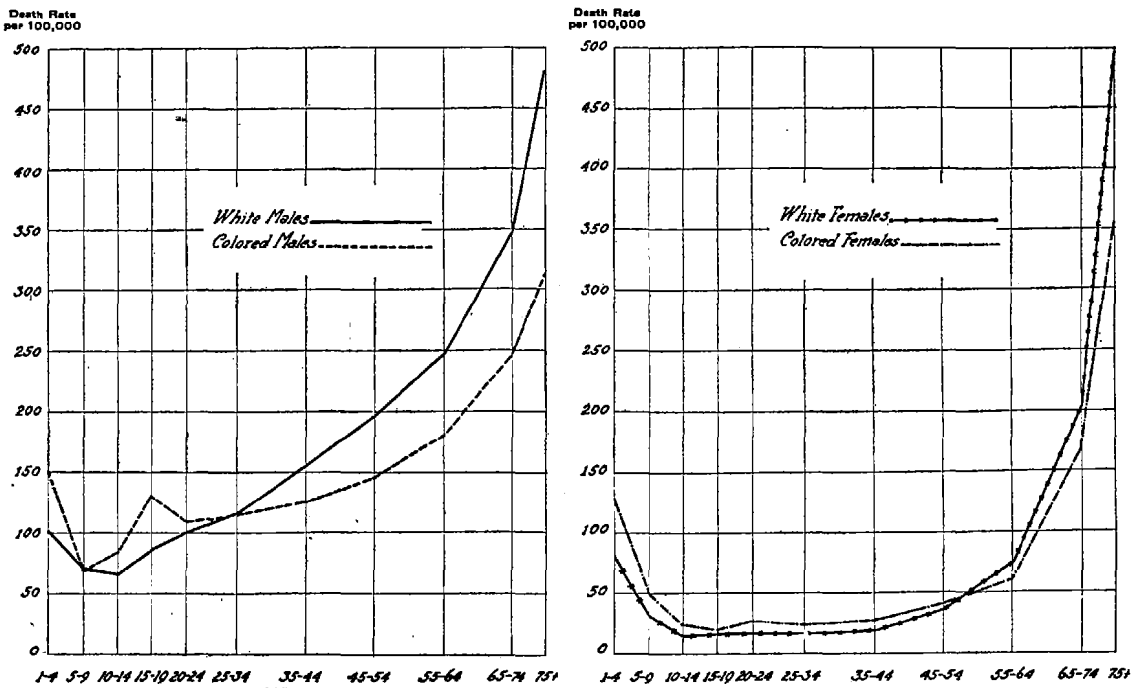
The 39,268 fatal accidents of all kinds, as we have seen, corresponded to a rate of 73.0 per 100,000 persons exposed. The fatal accident rate for males of both white and colored groups was more than three times the rate for females. The recorded fatal accident rate for colored males was somewhat higher than the rate for white males; all ages one and over being combined for purposes of these comparisons.

The accident death rate varies considerably with age; in fact, we may distinguish three divisional periods of age incidence. These are the period of early childhood, the period of occupational stress and finally the period of old age. Considering the group as a whole, we find that the highest accident death rate under age 45 was recorded between the ages 1 and under 5 years. There is a decline in the rate from the figure under 5 years of age (93.7 per 100,000) to the rate at the age group 10 to 14 years (41.4 per 100,000). This latter rate is the minimum for any age period. Beginning with the age group 15 to 19 years there is a gradually rising rate up to the highest significant age period. For the white male and white female groups the minimum accident death rate is recorded, as for the total experience, between 10 and 14 years; but for colored males the minimum rate is reached between 5 and 9 years and for colored females between 15 and 19 years. Only the white males exhibit a progressively increasing accident death rate

Chart I. MORTALITY FROM ACCIDENTS AND UNSPECIFIED VIOLENCE

Death Rates per 100,000 Persons Exposed, Classified by Age Periods. White and Colored Groups Compared for Each Sex Class

Experience of Metropolitan Life Insurance Company, Industrial Department, 1911 to 1916



with advancing age, beginning with the period 15 to 19 years. White females show a rather stationary tendency in the mortality rate between 15 and 35 years of age. Between 15 and 24 years colored males show a tendency toward decline; thereafter they exhibit a rising death rate. Colored females show a fluctuating fatal accident rate between 10 and 44 years and a rising rate thereafter. These facts are shown in the following table, and in Chart I on page 13:

TABLE 2.

MORTALITY FROM ACCIDENTAL AND UNSPECIFIED VIOLENCE,* CLASSIFIED BY COLOR, SEX AND BY AGE PERIOD.

Death Rates per 100,000 Persons Exposed. 1911 to 1916.

Experience of Metropolitan Life Insurance Company. Industrial Department.

Age Period.	Persons.	White.		Colored.	
		Male.	Female.	Male.	Female.
All ages—one and over..	73.0	115.9	36.4	121.4	38.8
1 to 4.....	93.7	100.9	79.4	151.3	126.3
5 to 9.....	51.4	68.9	31.9	67.9	51.2
10 to 14.....	41.4	65.1	14.4	83.5	22.7
15 to 19.....	53.4	85.7	16.9	131.7	18.2
20 to 24.....	55.6	99.8	16.5	109.4	25.6
25 to 34.....	57.9	114.5	15.7	115.3	22.5
35 to 44.....	71.6	154.3	19.4	124.8	27.1
45 to 54.....	95.2	195.1	35.5	145.6	41.1
55 to 64.....	137.2	246.5	73.2	180.7	59.0
65 to 74.....	251.4	346.0	201.1	247.2	167.9
75 and over .	477.8	482.4	496.4	315.5	353.9

* War deaths excluded.

Color Ratio of Accident Mortality.

The fatal accident rates of the white and colored races are, as we have seen, very different. We find, for example, that under 5 years of age, colored children, both males and females, show a fatal accident rate about 1½ times that of white children. In the period 5 to 9 years colored males show a fatal accident rate just a little less than the white male rate. Between 15 and 19 years, however, we observe the maximum percentage of excess of colored male over white male accident mortality. Colored females, on the other hand, show their maximum percentage of excess in accident mortality between 5 and 9 years of age. After the age period 25 to 34 years, colored males show a lower mortality than white males, which

condition is probably the result of their safer occupational conditions. A similar condition of lower mortality prevails among the colored females after 45 to 54 years, but the cause for this is difficult to ascertain. The following table affords a comparison of white and colored accident mortality according to sex:

TABLE 3.

MORTALITY FROM ACCIDENTAL AND UNSPECIFIED VIOLENCE.*

Percentage, Colored of White Mortality at Specified Age Periods for Each Sex. 1911 to 1916.

Metropolitan Life Insurance Company, Mortality Experience. Industrial Department.

Age Period.	Percentage, Colored of White Mortality.	
	Males.	Females.
All ages—one and over..	104.7	106.6
1 to 4	150.0	159.1
5 to 9	98.5	160.5
10 to 14	128.3	157.6
15 to 19	153.7	107.7
20 to 24	109.6	155.2
25 to 34.....	100.7	143.3
35 to 44.....	80.9	139.7
45 to 54.....	74.6	115.8
55 to 64.....	73.3	80.6
65 to 74.....	71.4	83.5
75 and over.....	65.4	71.3

* War deaths excluded.

Sex Ratio of Accident Mortality.

The differences in the stresses of occupation between the sexes are clearly reflected in the accident death rates. Considering white lives first, there was an excess of the male accident rate over the female rate in every age period of our data, with the exception of the last age group, 75 years and over. The maximum percentage of excess of male accident mortality is found between 35 and 44 years of age, when the male rate is nearly eight times greater. Among white lives between 1 and 45 years of age there is increasing percentage of excess of male over female accident mortality; after 45, the excess becomes regularly less. Colored persons did not show any such increase with age in the excess percentage of male over female mortality. The maximum percentage of excess of males over females among colored persons is found between the ages 15 and 19 years, where colored males show a fatal accident rate nearly

7¼ times that of colored females. These facts are exhibited in the following table:

TABLE 4.

MORTALITY FROM ACCIDENTAL AND UNSPECIFIED VIOLENCE.*

Percentage, Male of Female Mortality at Specified Age Periods for Each Color Class. 1911 to 1916.

Experience of Metropolitan Life Insurance Company. Industrial Department.

Age Period.	Percentage, Male of Female Mortality.	
	White.	Colored.
All ages—one and over..	318.4	312.9
1 to 4.....	127.1	119.8
5 to 9.....	216.0	132.6
10 to 14.....	452.1	367.8
15 to 19.....	507.1	723.6
20 to 24.....	604.8	427.3
25 to 34.....	729.3	512.4
35 to 44.....	795.4	460.5
45 to 54.....	549.6	354.3
55 to 64.....	336.7	306.3
65 to 74.....	172.1	147.2
75 and over.....	97.2	89.1

. * War deaths excluded.

Fatal Accident Rate among Insured Wage Earners and Population of the Expanding Registration Area Compared.

Before proceeding to a detailed consideration of the various forms of accidents represented in our experience, it might be well, in passing, to exhibit a table of the accident death rates per 100,000 among white insured wage earners and in the general population of the expanding Registration Area of the United States. The table on page 17 affords a view of these data.

Under 20 years and after 35 years of age white males of the insured wage earners' group show a higher accident mortality than do males in the Registration Area in general. For the ages under 5 years, insured white males show an accident death rate 5 per cent. in excess, between 5 and 9 years, 17 per cent., and between 10 and 14, 14 per cent. in excess of the rates among males in the corresponding age groups of the general population. Between 20 and 34 years of age insured white male wage earners show a lower mortality from accidents than was recorded among males in the Registration Area record. Beginning with the age period 35 to 44

TABLE 5.

MORTALITY FROM ACCIDENTAL AND UNSPECIFIED VIOLENCE.*

Death Rates per 100,000 Persons Exposed. Classified by Sex and by Age Period. Insured White Lives in Experience of Metropolitan Life Insurance Company, Industrial Department (1911 to 1916) and General Population Experience of Expanding Registration Area of the United States (1910 to 1915).

Age Period.	Males.			Females.		
	M. L. I. Co. (White).	U. S. Reg. Area.	Percentage M. L. I. Co. of Reg. Area.	M. L. I. Co. (White).	U. S. Reg. Area.	Percentage M. L. I. Co. of Reg. Area.
All ages—one and over....	115.9	120.8	95.9	36.4	37.4	97.3
1 to 4.....	100.9	96.4	104.7	79.4	76.5	103.8
5 to 9.....	68.9	58.8	117.2	31.9	29.6	107.8
10 to 14....	65.1	56.9	114.4	14.4	13.0	110.8
15 to 19....	85.7	85.0	100.8	16.9	15.4	109.7
20 to 24....	99.8	116.6	85.6	16.5	17.0	97.1
25 to 34....	114.5	123.4	92.8	15.7	15.5	101.3
35 to 44....	154.3	139.6	110.5	19.4	18.9	102.6
45 to 54....	195.1	156.8	124.4	35.5	27.7	128.2
55 to 64....	246.5	178.5	138.1	73.2	49.0	149.4
65 to 74....	346.0	214.3	161.5	201.1	118.1	170.3
75 and over.	482.4	418.0	115.4	496.4	534.8	92.8

* War deaths excluded.

years, however, accident mortality among white male insured wage earners begins progressively to exceed the rates among males in the general population up to and including the period 65 to 74 years. The figures for ages beyond 75 years are not significant in view of the small exposure.

The comparisons between insured white females and females in the general population also show higher death rates for the insured group, with the exception of the age period 20 to 24 years, than for the group of females in the general population. The differences are not so marked, however, as they were for the males. Below 20 years of age the percentages of excess of accident mortality among insured white females are variable. Beginning with the age period 25 to 34 years there is a progressive increase in the excess of accident fatality rates among white female wage earners over the rates for females in the general population.

Fatal Accidents According to Specific Means or Nature of Injury.

The foregoing observations on accident mortality were made without reference to the specific nature or means of injury. We

shall now consider briefly the several inclusions under the general title as shown in the following table:

TABLE 6.

MORTALITY FROM ACCIDENTAL AND UNSPECIFIED VIOLENCE.*

Deaths and Death Rates per 100,000 Persons Exposed by Specified Causes and by Color and Sex. 1911 to 1916.

Experience of Metropolitan Life Insurance Company. Industrial Department.

Cause of Death.	Persons.		Rate per 100,000.			
			White.		Colored.	
	Deaths.	Rate per 100,000.	Males.	Females.	Males.	Females.
ACCIDENTS AND UNSPECIFIED VIOLENCE—TOTAL*	39268	73.0	115.9	36.4	121.4	38.8
Poisoning by food	622	1.2	1.2	1.0	1.5	1.8
Other acute poisonings	1144	2.1	2.4	1.8	2.7	2.0
Conflagration	576	1.1	1.2	.7	2.0	2.0
Burns—conflagration excepted	4714	8.8	7.2	9.3	8.4	14.3
Absorption of deleterious gases —conflagration excepted	1431	2.7	3.9	1.9	2.3	.9
Accidental drowning	5757	10.7	20.1	2.6	23.2	2.1
Traumatism by firearms	1029	1.9	3.0	.3	8.1	1.5
Traumatism by cutting or piercing instruments	93	.2	.2	.1	.7	.2
Traumatism by fall	6917	12.9	18.8	8.9	13.3	5.3
Traumatism in mines and quarries (total)	660	1.2	2.5	†	3.6	—
— in mines	612	1.1	2.4	†	3.4	—
— in quarries	48	.1	.2	†	.2	—
Traumatism by machines	905	1.7	3.4	.1	4.8	.1
Steam railroad accidents and injuries	4485	8.3	16.8	1.2	17.3	1.6
Street car accidents and injuries	1600	3.0	5.3	1.2	4.1	.9
Automobile accidents and injuries	2507	4.7	8.1	2.3	4.6	1.3
Injuries by other vehicles	1658	3.1	5.7	.9	5.6	.5
Landslide, other crushing	381	.7	1.4	.1	1.9	.1
Injuries by animals	233	.4	.9	†	1.1	—
Starvation	16	†	†	†	.1	†
Excessive cold	217	.4	.6	.1	1.5	.5
Effects of heat	1247	2.3	3.4	1.3	4.3	1.6
Lightning	96	.2	.3	†	.5	—
Electricity—lightning excepted	452	.8	2.0	†	.7	.1
Fractures—cause not specified	806	1.5	1.9	1.2	1.9	.5
Other external violence*	1722	3.2	5.4	1.2	7.5	1.4

* War deaths excluded.

† Less than .05 per 100,000.

Thus, among all accidents included in the above table, falls were the most frequent of the specified forms of violence. There

were 6,917 deaths from falling recorded among insured wage earners over the six-year period 1911 to 1916, at a rate of 12.9 per 100,000 exposed. Accidental drowning was next in importance with 5,757 deaths at a rate of 10.7 per 100,000 in the six-year period under observation. Burns, excluding burns in conflagrations, followed with 4,714 deaths, or at a rate of 8.8 per 100,000 exposed. Steam railroad accidents and injuries showed 4,485 deaths, producing a rate of 8.3 per 100,000. Automobile accidents and injuries were recorded in 2,507 cases, with a death rate of 4.7 per 100,000 exposed. A detailed discussion of the facts for some of the more important of these modes of injury in external causes of death follows.

Traumatism by Fall.*

We have previously indicated that traumatism by fall was the chief form of the fatal accidents. The 6,917 deaths from this condition corresponded to a rate of 12.9 per 100,000 exposed. The

TABLE 7.

Mortality from Traumatism by Fall,* Classified by Color, Sex and by Age Period.

Death Rates per 100,000 Persons Exposed. 1911 to 1916.

Experience of Metropolitan Life Insurance Company. Industrial Department.

Age Period.	Persons.	White.		Colored.	
		Males.	Females.	Males.	Females.
All ages—one and over.....	12.9	18.8	8.9	13.3	5.3
1 to 4.....	10.1	11.7	7.7	19.9	9.5
5 to 9.....	4.3	6.1	2.4	7.5	1.9
10 to 14.....	3.1	4.8	1.1	5.1	2.5
15 to 19.....	3.4	5.9	1.0	5.4	1.8
20 to 24.....	4.4	8.8	.9	5.6	2.4
25 to 34.....	7.2	15.5	1.9	8.8	2.3
35 to 44.....	13.3	31.3	3.5	16.2	2.6
45 to 54.....	20.9	42.6	9.7	22.1	5.8
55 to 64.....	39.3	64.0	27.2	37.2	14.1
65 to 74.....	103.8	116.5	105.4	51.8	57.5
75 and over..	243.9	208.5	288.0	68.6	108.9

* Falls from steam railroad trains, street cars, automobiles and other vehicles, as well as falls in mines or quarries, from machinery (travelling cranes, for example), and falls in burning buildings are classified under other headings. In short, not *all* falls are classified under "Traumatism by fall."

rate was highest for white males and least for colored females. Males of both the white and colored groups showed a higher rate for this cause of death than did females. The facts by age are given on page 19.

The death rate from traumatism by fall showed a high point for the ages 1 to 4 years in our experience. The rate for all persons was 10.1 per 100,000 exposed in this age group. This rate is not exceeded in any age period thereafter until the period 35 to 44 years is reached, when it begins to rise sharply. For this age period a rate of 13.3 per 100,000 exposed is recorded. After a series of increments the maximum rate for any age period is reached at the group of ages 75 years and over (243.9 per 100,000 exposed).

The fatal accident rate for this specific cause exhibits the same age characteristics for white males as we have pointed out for the entire experience with this exception: the rate for the age group 1 to 4 years is exceeded by that for 25 to 34 years instead of by that for 35 to 44 years. For white females, however, there seems to be a practically stationary death rate from this cause between 10 and 24 years. For the ages thereafter, a rapid increase in the rate is observed. For the highest age group in our series (75 years and over) the white female fatal accident rate for this specific cause exceeds the white male rate considerably. Colored males, with advancing age, show a gradually increasing death rate from this cause, beginning with the period 10 to 14 years. Colored females between 20 and 44 years show a fairly stationary rate from traumatism by fall.

The figures for the individual years from 1911 to 1916 do not show very marked differences. The highest rate was observed in 1913, 13.7 per 100,000, and the minimum in 1915, 11.9. Unlike the acute infections and the organic diseases, we may hardly expect a definite trend over a short period of years. The average rate of the six-year period, 12.9 per 100,000, may be taken as a fair indication of the present incidence of this cause of death. Nor is there any very marked difference in incidence of this condition among the insured and the general population, all ages considered. When we analyze the facts by age period, we find that up to age 25 the rates are very much the same. Beyond that period the figures are higher for the insured group. This is especially so among the males where the occupational factor is important as a fruitful

source of mortality among wage earners. Thus, at some age periods of advanced life, such as 55 to 64 years, the rate is very much higher among insured white males than among males in the Registration Area, the rates being 64.0 and 38.1 per 100,000, respectively.

Accidental Drowning.*

The 5,757 deaths from drowning during the period 1911 to 1916 correspond to a rate of 10.7 per 100,000 exposed. As might be expected, the rate shows a very marked difference for the two sexes. The rate for white males is a little less than eight times the rate for white females. Colored males show a rate from this cause more than ten times the rate for colored females.

Deaths from Accidental Drowning by Color, Sex and by Age Period.

The death rates per 100,000 for accidental drowning, according to color, age and sex classes are presented in the following table:

TABLE 8.

Mortality from Accidental Drowning,* Classified by Color, Sex and by Age Period.

Death Rates per 100,000 Persons Exposed. 1911 to 1916.

Experience of Metropolitan Life Insurance Company. Industrial Department.

Age Period.	Persons.	White.		Colored.	
		Males.	Females.	Males.	Females.
All ages—one and over.....	10.7	20.1	2.6	23.2	2.1
1 to 4.....	6.2	9.1	3.6	5.8	1.9
5 to 9	10.2	18.6	2.3	10.7	1.6
10 to 14.....	13.9	23.8	2.7	34.8	2.8
15 to 19.....	17.0	27.4	4.7	50.2	2.6
20 to 24.....	12.7	22.0	4.4	30.2	2.6
25 to 34.....	9.0	17.8	1.7	25.2	1.5
35 to 44.....	8.0	18.7	1.2	15.6	2.1
45 to 54.....	9.3	21.5	1.9	16.3	2.9
55 to 64.....	8.7	21.3	1.3	10.2	2.2
65 to 74.....	9.1	21.9	1.6	11.7	1.2
75 and over..	9.1	22.7	2.5	—	—

* Under this heading are classified, first, the deaths from drowning that are known to be accidental and, second, those which are not definitely reported as accidental but which can not be identified as suicidal or homicidal.

The death rates for accidental drowning are highest for persons under age 25 years. Considering all persons in this experience combined, the maximum rate is reached in the age period 15 to 19 years, 17.0 per 100,000 exposed. After this period, there is a decline in the rate from this cause up to and including the period 35 to 44 years. After that period we show a slightly variable death rate, tending to vary somewhat around an average of 9.0 per 100,000 exposed at these ages.

White males show a maximum rate in the period 15 to 19 years and a declining rate thereafter up to and including 25 to 34 years. Between 45 and 74 years, the rate is almost stationary at a little more than 21 per 100,000 exposed.

The colored male statistics also show a maximum rate between 15 and 19 years of age, 50.2 per 100,000 exposed. The reader will observe that this rate is practically twice the rate recorded for white males between these ages. The colored male rate is higher than the white male rate from 10 years up to and including the age period 25 to 34 years, but is lower thereafter.

Considering the series of years 1911 to 1916, we are again unable to detect any distinct downward tendency in the death rate from this cause. The rates seem to vary but slightly from a figure of a little more than 10 per 100,000 exposed for all classes in the experience. The highest death rate was recorded in 1913, 12.1 per 100,000, and the lowest in 1916, 9.7 per 100,000. During this period the death rate from this cause showed two points of maximum incidence, in 1913 and in 1915. The high rate for 1913 is perhaps explained by the floods in the Ohio River Valley in the spring of that year. The figures for 1915 result from the inclusion of the deaths reported in connection with the EASTLAND disaster in Chicago. There were, in fact, 171 deaths of policyholders reported as arising out of this catastrophe.

The death rate from drowning among white male policyholders was higher at every age period with the exception of the years under five than among males in the general population. The reader will observe that a comparison of the death rates for this accidental cause in the two experiences is first conditioned by the differences in the areas covered by the two experiences. It is evident that for a population situated near water courses, where there is opportunity for employment in the pursuits connected with navigation, one may expect a

higher death rate for accidental drowning. We are not able to say whether the differences in the hazards of accidental drowning are greater in the localities covered by this Company than in those areas comprising the total Registration Area of the United States.

Burns (Conflagration Excepted).*

The 4,714 deaths from burns in this mortality experience of insured wage earners during the six-year period 1911 to 1916 represented a rate of 8.8 per 100,000 exposed.

The rate for this cause among white males was lower than among the other three color and sex classes of this experience. The colored death rates for males and females were higher than the white death rates in the corresponding sex classes. Colored females showed a rate for burns practically one and one-half times that of white females.

The death rates according to color, sex and age distinctions are set forth in the following table:

TABLE 9.

Mortality from Burns (Conflagration Excepted),* Classified by Color, Sex and by Age Period.

Death Rates per 100,000 Persons Exposed. 1911 to 1916.

Experience of Metropolitan Life Insurance Company. Industrial Department.

Age Period.	Persons.	White.		Colored.	
		Males.	Females.	Males.	Females.
All ages—one and over	8.8	7.2	9.3	8.4	14.3
1 to 4	43.8	42.8	40.0	74.3	76.8
5 to 9	10.4	6.7	12.5	9.4	30.1
10 to 14	2.6	1.2	3.7	2.5	7.1
15 to 19	2.1	1.1	2.7	2.6	5.9
20 to 24	3.0	1.7	3.3	3.0	7.7
25 to 34	3.2	1.9	3.7	3.3	5.0
35 to 44	4.3	3.2	4.6	4.6	6.0
45 to 54	6.7	4.6	7.5	3.9	12.8
55 to 64	10.0	5.8	11.4	7.8	20.7
65 to 74	20.3	8.8	23.4	23.4	55.2
75 and over	41.8	17.0	49.4	41.2	118.0

* Burns and scalds due to railroad machinery, and mining accidents, as well as those caused by electricity and lightning are not classified under this heading. This explains, to some extent, the comparatively low rate for males.

The age characteristics of this cause of death present a maximum rate in the entire experience at the ages under 5 years, a decline to a minimum between the ages 15 to 19 years and a gradual rise in the rate for succeeding age periods to a figure approaching the maximum at ages 75 years and over. The conformation of the mortality curve for burns is in general the same for each of the color and sex classes of this experience, although, as we have pointed out, the actual figures show considerable differences.

From the figures at hand no upward or downward tendency of the death rate for burns is evident.

The incidence of fatal burns is higher among the insured than in the general population at a number of age periods. Thus, among insured white males, there is an excess in the ages under 10, and after 45. The figures for all ages combined are in favor of the general population, 6.2 per 100,000 as compared with 7.2 for insured white males. Comparison of the mortality facts for burns among insured white females and among females in the general population shows no important differences in the experience of the two groups.

Steam Railroad Accidents and Injuries.

Fatalities arising out of railroad accidents are an important element in mortality experiences generally. Among the wage earners represented in this study we recorded during the period 1911 to 1916, 4,485 deaths arising from railroad accidents and injuries. These deaths corresponded to a rate of 8.3 per 100,000 exposed. For colored males we recorded a higher rate, 17.3 per 100,000, than for white males, 16.8 per 100,000. The colored female rate is higher than the corresponding white rate, but that for each group of females is low.

The death rate from this cause shows a minimum at the ages under 5 years and a maximum at the highest age group in this discussion. There is a fairly progressive rise in the rate by age period throughout life. Between 20 and 54 years of age, however, there is no upward tendency. After the latter age period the rate rises quite sharply. The same general age charateristics in the mortality rate from this cause are shown for white males as for the general experience. White females show no important

mortality from this cause at the ages under 45 years. Beyond that age, however, a rising rate is in evidence for this group.

The table below exhibits the data for steam railroad accidents and injuries according to the several color, sex and age classes:

TABLE 10.

MORTALITY FROM STEAM RAILROAD ACCIDENTS AND INJURIES, CLASSIFIED BY COLOR, SEX AND BY AGE PERIOD.

Death Rates per 100,000 Persons Exposed. 1911 to 1916.

Experience of Metropolitan Life Insurance Company. Industrial Department.

Age Period.	Persons.	White.		Colored.	
		Males.	Females.	Males.	Females.
All ages—one and over.....	8.3	16.8	1.2	17.3	1.6
1 to 4.....	1.1	1.5	.7	.6	—
5 to 9.....	2.3	3.9	.8	3.6	.3
10 to 14.....	3.5	6.1	.7	7.0	.6
15 to 19.....	8.4	15.2	1.2	19.8	1.5
20 to 24.....	11.8	25.1	.7	25.0	1.1
25 to 34.....	11.3	26.6	.7	20.7	1.6
35 to 44.....	10.7	26.7	.7	19.8	2.4
45 to 54.....	11.3	27.1	1.7	21.5	1.8
55 to 64.....	15.6	35.3	3.6	27.6	2.2
65 to 74.....	17.3	39.4	4.1	23.4	4.7
75 and over..	17.8	34.0	5.9	41.2	27.2

Colored males show a rather variable rate with age. There is a rising incidence for the ages under 25 years. Between 25 and 74 years the rate tends to vary somewhat between 20 and 28 per 100,000 exposed. Beyond the latter age period our figures are not of much significance. The rates by age for colored females are too small and too variable to warrant extended discussion.

Considering the period as a whole, there appears to be a decrease in the rate, especially among white males. The three years, 1914 to 1916, however, show a slight upward tendency.

In the following table we present our data for railroad accidents and injuries for single years from 1911 to 1916:

TABLE 11.

MORTALITY FROM STEAM RAILROAD ACCIDENTS AND INJURIES, CLASSIFIED BY COLOR AND BY SEX.

Death Rates per 100,000 Persons Exposed. Single Years in Period 1911 to 1916.

Experience of Metropolitan Life Insurance Company. Industrial Department.

Year.	Persons.	White.		Colored.	
		Males.	Females.	Males.	Females.
1911 to 1916	8.3	16.8	1.2	17.3	1.6
1916....	7.9	15.3	1.3	18.5	1.8
1915....	7.4	15.0	1.0	16.0	1.1
1914....	7.5	15.1	1.0	16.0	1.3
1913....	9.0	18.8	1.1	16.9	1.2
1912....	9.2	18.5	1.4	17.6	2.2
1911....	9.5	19.2	1.3	18.6	2.2

AUTOMOBILE ACCIDENTS AND INJURIES.

Automobile accidents and injuries are beginning to constitute an important cause of accident fatality. In the six years under discussion we registered 2,507 deaths from this cause. The death rate

TABLE 12.

MORTALITY FROM AUTOMOBILE ACCIDENTS AND INJURIES, CLASSIFIED BY COLOR, SEX AND BY AGE PERIOD.

Death Rates per 100,000 Persons Exposed. 1911 to 1916.

Experience of Metropolitan Life Insurance Company. Industrial Department.

Age Period.	Persons.	White.		Colored.	
		Males.	Females.	Males.	Females.
All ages—one and over.....	4.7	8.1	2.3	4.6	1.3
1 to 4.....	3.7	4.5	2.9	3.8	1.3
5 to 9.....	8.6	12.5	4.9	10.4	3.2
10 to 14.....	5.1	8.5	1.8	6.3	1.6
15 to 19.....	2.9	4.9	1.2	3.5	.3
20 to 24.....	3.2	5.9	1.5	2.0	.8
25 to 34.....	3.0	6.4	1.0	2.9	.9
35 to 44.....	3.2	6.6	1.6	3.6	.3
45 to 54.....	4.4	9.1	2.0	3.3	1.8
55 to 64.....	7.3	14.1	3.6	7.8	2.2
65 to 74.....	9.5	18.6	4.5	6.7	4.7
75 and over..	10.1	17.0	6.7	13.7	—

was 4.7 per 100,000 exposed. The highest death rate was shown for white males and the least for colored females. The color, sex and age statistics for automobile accidents and injuries are shown on previous page (Table 12).

There is a high point of mortality from automobile accidents and injuries at each end of the age curve. There is one very high rate in childhood between 5 and 9 years and another in old age at the period 75 years and over, although the ages beginning with 55 years are all heavily weighted with automobile deaths. Males of both color groups in this experience show a higher death rate than do females.

According to our records there is a progressively increasing death rate year by year from this cause. In 1911 we recorded a rate of 2.3 per 100,000 exposed. In 1916 the rate had increased to 7.4 per 100,000. This corresponds to an increase of 221.7 per cent. in the rate. The following table and Chart II on page 28 show the general trend of the death rate for automobile fatalities:

TABLE 13.

MORTALITY FROM AUTOMOBILE ACCIDENTS AND INJURIES, CLASSIFIED BY COLOR AND BY SEX.

Death Rates per 100,000 Persons Exposed. Single Years in Period 1911 to 1916.

Experience of Metropolitan Life Insurance Company. Industrial Department.

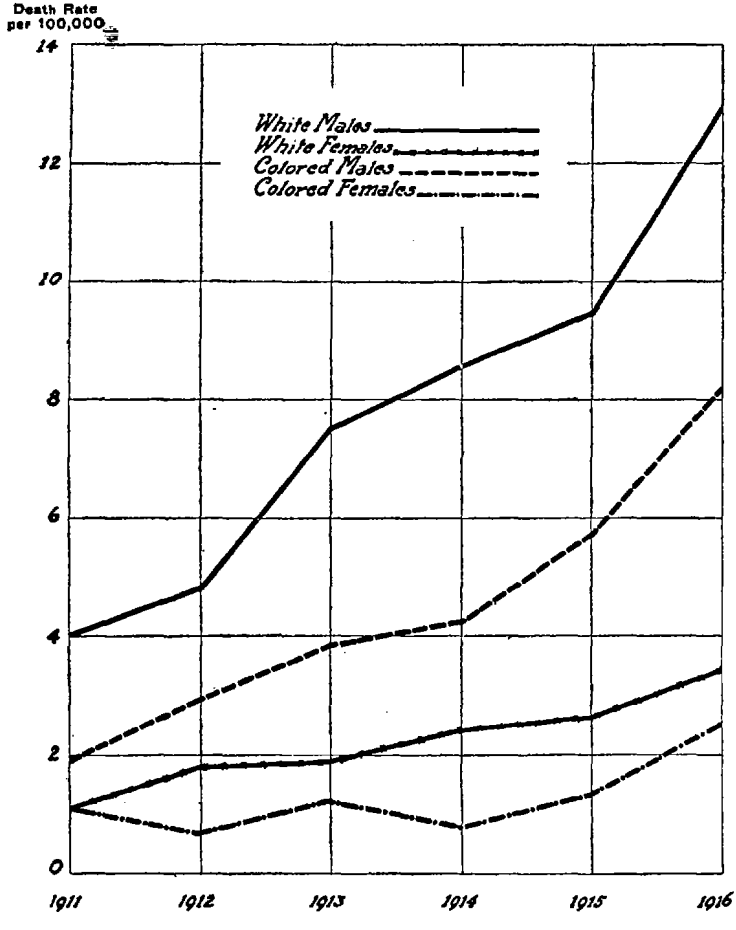
Year.	Persons.	White.		Colored.	
		Males.	Females.	Males.	Females.
1911 to 1916	4.7	8.1	2.3	4.6	1.3
1916....	7.4	12.9	3.4	8.2	2.5
1915. .	5.4	9.4	2.6	5.7	1.3
1914 ...	4.8	8.5	2.4	4.2	.8
1913....	4.1	7.5	1.9	3.8	1.2
1912....	3.0	4.8	1.8	2.9	.7
1911....	2.3	4.0	1.1	1.9	1.1

Available population mortality data show a similarly increasing rate for automobile fatalities. This fact calls for further inquiry into the causes contributing to this category of traffic accidents, especially in cities where the growth of population and the volume of street traffic conduce to an increase in liability to automobile accidents.

Chart II.—Mortality from Automobile Accidents and Injuries

Death Rates per 100,000 Persons Exposed By Single Years 1911 to 1916

Experience of Metropolitan Life Insurance Company, Industrial Department



Street Car Accidents and Injuries.

Fatalities registered as street car accidents and injuries in this experience included deaths, not only of persons riding on or operating street cars, but also those deaths on elevated and subway trains and on tracks and rights of way of street railways, interurban roads operated electrically, subways and elevated railroads. There were registered 1,600 deaths from this cause, the corresponding rate being 3.0 per 100,000 exposed in the six years under observation. The rate is highest among white males and least among colored females.

There is a fairly high rate for the ages under 5 years and a declining one thereafter through the age period 20 to 24 years. After that age group, however, the rate increases up to the maximum at the highest age group in our series. The same general observations apply to the experience of white males and white females. For the former, however, the age groups 5 to 9 years and 20 to 24 years show increases over those immediately preceding, while for the latter the decline continues through the period 25 to 34 years. The data for colored lives according to age group are based upon a small

TABLE 14.

Mortality from Street Car Accidents and Injuries, Classified by Color, Sex and by Age Period.

Death Rates per 100,000 Persons Exposed. 1911 to 1916.

Experience of Metropolitan Life Insurance Company. Industrial Department.

Age Period.	Persons.	White.		Colored.	
		Males.	Females.	Males.	Females.
All ages—one and over.....	3.0	5.3	1.2	4.1	.9
1 to 4.....	2.7	3.0	2.5	1.9	1.9
5 to 9.....	2.6	3.6	1.6	3.2	1.3
10 to 14.....	1.6	2.6	.6	1.9	.9
15 to 19.....	1.6	2.4	.5	4.5	.6
20 to 24.....	1.4	2.7	.4	2.0	.3
25 to 34.....	2.1	4.9	.2	3.4	.2
35 to 44.....	3.1	7.5	.5	4.6	.8
45 to 54.....	4.9	11.1	1.4	5.2	2.4
55 to 64.....	7.8	15.3	3.8	9.0	1.3
65 to 74.....	10.3	20.6	4.4	13.3	2.3
75 and over..	22.1	41.1	12.6	27.4	—

number of deaths under 20 years of age and there is, therefore, some irregularity in the rates for the divisional periods of life. From twenty years of age upward among colored males an increasing death rate from this cause is found.

The table on page 29 gives the rates for street car accidents, and injuries by color, sex and by age period.

For the six years under discussion a generally declining death rate from this cause is observed. This is in contradistinction to the observed facts for automobile accidents and injuries. The following table gives a view of the trend of this phase of the mortality experience for the period 1911 to 1916:

TABLE 15.

MORTALITY FROM STREET CAR ACCIDENTS AND INJURIES, CLASSIFIED BY COLOR AND BY SEX.

Death Rates per 100,000 Persons Exposed. Single Years in Period 1911 to 1916.

Experience of Metropolitan Life Insurance Company. Industrial Department.

Year.	Persons.	White.		Colored.	
		Males.	Females.	Males.	Females.
1911 to 1916	3.0	5.3	1.2	4.1	.9
1916....	2.6	4.4	1.2	3.5	.9
1915....	2.2	3.9	.9	2.1	.9
1914....	2.7	4.5	1.1	4.2	1.4
1913....	3.6	6.4	1.4	4.6	1.2
1912....	3.5	6.4	1.4	4.6	.5
1911....	3.6	6.7	1.3	5.8	.5

INJURIES BY OTHER VEHICLES.

The record of deaths from injuries by "other vehicles" is also available. Under this group, 1,658 deaths were included arising from accidents and injuries to passengers, pedestrians, drivers or riders on wagons, carriages, bicycles and other miscellaneous forms of vehicles not motor driven. The rate, 3.1 per 100,000 exposed, is similar to that for street car accidents and injuries.

The following table gives the rates per 100,000 by color, sex and age period:

TABLE 16.

MORTALITY FROM INJURIES BY OTHER VEHICLES, CLASSIFIED BY COLOR, SEX AND BY AGE PERIOD.

Death Rates per 100,000 Persons Exposed. 1911 to 1916.

Experience of Metropolitan Life Insurance Company. Industrial Department.

Age Period.	Persons.	White.		Colored Males.
		Males.	Females.	
All ages—one and over.	3.1	5.7	.9	5.6
1 to 4.....	3.8	4.6	3.2	2.6
5 to 9.....	3.8	6.0	1.5	5.5
10 to 14.....	1.6	2.8	.5	2.8
15 to 19.....	1.8	3.0	.5	4.5
20 to 24.....	2.0	4.0	.5	2.6
25 to 34.....	2.4	5.6	.3	3.9
35 to 44.....	3.2	7.7	.3	6.0
45 to 54.....	4.6	10.1	1.0	10.7
55 to 64.....	5.0	11.4	.9	12.0
65 to 74.....	8.2	16.1	3.1	16.7
75 and over....	5.3	12.8	.8	13.7

There seems to be a slight downward tendency in this group of specific causes of accidental injury. The following table gives a survey of the death rates over the period 1911 to 1916:

TABLE 17.

MORTALITY FROM INJURIES BY OTHER VEHICLES, CLASSIFIED BY COLOR AND BY SEX.

Death Rates per 100,000 Persons Exposed. Single Years in Period 1911 to 1916.

Experience of Metropolitan Life Insurance Company. Industrial Department.

Year.	Persons.	White.		Colored.
		Males.	Females.	Males.
1911 to 1916.....	3.1	5.7	.9	5.6
1916.....	2.8	5.4	.7	6.0
1915.....	3.0	5.6	.8	6.2
1914.....	2.9	5.4	.9	4.4
1913.....	3.4	6.4	1.4	3.6
1912.....	3.4	6.2	.9	7.3
1911.....	3.1	5.5	1.0	6.0

The death rate for this group of miscellaneous vehicular injuries is stationary for the age periods under 10 years, and declines to a minimum rate between 10 and 14 years. It then gradually rises to a maximum in the age period 65 to 74 years. There was a slightly higher rate for white males than for colored males. White females had a low rate of .9 per 100,000 exposed. The deaths among colored females were too few to give any significance to the rates. No figures for this class are therefore presented.

Traumatism by Machines.*

A total of 905 deaths from traumatism by machines is recorded. It will be understood that this title includes deaths by means of machines in most industries and through mechanisms such as elevators, which are not always concerned in industrial processes. This latter fact does not materially affect our figures, however, for the main working period in life. The experience available, according to age period, for all persons exposed to risk in this investigation, and for white males and colored males is shown in the following table. The experience for females is not significant.

TABLE 18.

Mortality from Traumatism by Machines,* Classified by Color for Males, and by Age Period.

Death Rates per 100,000 Persons Exposed. 1911 to 1916.

Experience of Metropolitan Life Insurance Company. Industrial Department.

Age Period.	Persons in Total Experience.	White Males.	Colored Males.
All ages—one and over....	1.7	3.4	4.8
1 to 14.....	.3	.4	.5
15 to 19.....	2.3	4.2	5.1
20 to 24.....	2.1	4.5	4.6
25 to 34.....	1.9	4.0	6.5
35 to 44.....	2.7	6.7	6.2
45 to 54.....	3.2	7.7	9.8
55 to 64.....	3.0	7.7	6.6
65 to 74.....	2.3	6.0	1.7
75 and over.....	1.9	1.4	13.7

* Deaths caused by machinery accidents in mines and quarries are classified under title No. 173 (Traumatism in mines and quarries); those due to locomotives are charged to one of the subtitles of title No. 175 (Steam railroad accidents and injuries).

The rate for white males does not vary much from the figure of four per one hundred thousand between fifteen and thirty-five years of age. The rate rises after that age to a figure of 7.7 per one hundred thousand between forty-five and sixty-five years of age and declines thereafter. The rates for this cause of death are, in general, higher among colored males than among white males. The maximum rate for colored males was observed in the age period forty-five to fifty-four years, when it was 9.8 per 100,000 exposed.

There was a fairly stationary tendency in the death rate from this cause in the present experience covering the period 1911 to 1916. The following table gives the facts for each calendar year in the investigation:

TABLE 19.

MORTALITY FROM TRAUMATISM BY MACHINES,* CLASSIFIED BY COLOR FOR MALES.

Death Rates per 100,000 Persons Exposed. Single Years in Period 1911 to 1916.

Experience of Metropolitan Life Insurance Company. Industrial Department.

Year.	Persons in Total Experience	White Males.	Colored Males.
1911 to 1916.....	1.7	3.4	4.8
1916.....	1.7	3.4	5.3
1915.....	1.4	2.9	3.4
1914.....	1.5	3.3	2.9
1913.....	2.0	4.1	5.4
1912.....	1.7	3.2	5.6
1911.....	1.8	3.4	6.9

*See footnote for Table 18 on preceding page.

A brief comparison of our data with those for the Registration Area shows that for the latter part of the main working periods of life the death rate from traumatism by machines is higher among insured white males than among males in the corresponding age groups in the Registration Area of the United States. No precise interpretation can be placed upon this fact, however, because we do not have any clue as to the approximate number of persons in both experiences exposed to risk from machinery. But it is reasonable to assume that there is a considerably larger proportion of persons exposed to machine hazards in a group such as that comprised in the insurance experience than there is in the general population of the Registration Area.

"Other Acute Poisonings"* (Food Poisonings Excepted).

All accidental poisonings in this experience have been reported under two heads: "poisoning by food" and "other acute poisonings." The second of these titles, which includes the larger number of these deaths, relates to those caused by solid or liquid poisons, excepting alkaloid products of putrefaction and other poisons in food products.

In this experience for insured wage earners 1,144 deaths from this specific cause of accidental violence occurred. The rates are slightly higher for the colored than for the white of each sex.

The age and sex characteristics for the white group only are given in the following table:

TABLE 20.

Mortality from "Other Acute Poisonings,"* White Persons Classified by Sex and by Age Period.

Death Rates per 100,000 Persons Exposed. 1911 to 1916.

Experience of Metropolitan Life Insurance Company. Industrial Department.

Age Period.	Persons in Total Experience.	White.	
		Males.	Females.
All ages—one and over....	2.1	2.4	1.8
1 to 4.....	7.9	7.6	7.1
5 to 9.....	.8	1.0	.5
10 to 14.....	.2	.3	.2
15 to 19.....	.8	.5	1.2
20 to 24.....	1.7	1.4	1.7
25 to 34.....	2.2	2.4	2.2
35 to 44.....	2.1	2.5	1.9
45 to 54.....	2.3	4.3	1.3
55 to 64.....	2.7	4.8	1.8
65 to 74.....	3.5	5.6	2.5
75 and over.....	4.3	7.1	3.3

"Other acute poisonings" show the maximum death rate under 5 years of age, the minimum death rate between 10 and 14 years and a fairly regularly rising rate thereafter. Between 25 and 54

* Deaths reported from "poisoning," "carbolic acid poisoning," "bichloride of mercury poisoning," etc., although not reported as accidental, are classified here unless identified as due to suicide or homicide. Deaths caused by accidental inhalation of poisonous gases are classified under another heading; see page 36.

years there is a slackening in the rise in the death rate. After 55 years of age the rate rises again rapidly. The rates for males exceed those for females very generally throughout life.

A slight downward tendency in the death rate for this cause is in evidence recently. In 1914 the maximum rate (2.6 per 100,000) was registered; the minimum rate was 1.6 per 100,000 in 1916. Considering the series of years from 1911 to 1916, we may perhaps be justified in concluding that recent efforts toward restriction of the sale of poisonous substances have had some favorable influence upon the death rate from acute accidental poisonings. We must remember, however, that the recently increased tendency to specify suicidal and homicidal findings in cases which would have been formerly returned as undefined violence, may have had some influence in reducing the recorded death rate for acute accidental poisonings. The following table gives the death rates for "Other acute poisonings" (food poisonings excepted) by single calendar years during the period 1911 to 1916 classified according to color and sex:

TABLE 21.

MORTALITY FROM "OTHER ACUTE POISONINGS,"* CLASSIFIED BY COLOR AND BY SEX.

Death Rates per 100,000 Persons Exposed. Single Years in Period 1911 to 1916.

Experience of Metropolitan Life Insurance Company. Industrial Department.

Year.	Persons.	White.		Colored.	
		Males.	Females.	Males.	Females.
1911 to 1916.....	2.1	2.4	1.8	2.7	2.0
1916.....	1.6	1.8	1.5	1.8	1.4
1915.....	2.0	2.2	1.5	3.4	2.4
1914.....	2.6	3.3	2.1	3.5	2.1
1913.....	2.2	2.4	1.9	3.2	1.5
1912.....	2.3	2.4	2.1	2.5	2.4
1911.....	2.2	2.3	2.2	1.7	2.2

The available population experience also shows a slightly downward trend.

* See footnote on page 34.

Absorption of Deleterious Gases.*

By far the largest proportion of deaths included under this title were caused by accidental inhalation of illuminating gas. There was, of course, a significant number of deaths from the absorption of other poisonous gases and vapors, such as sewer gas, anesthetic vapors, and gases evolved in the domestic and industrial operation of stoves and furnaces.

The following table gives the data for this cause of death with respect to color, sex and age classes of the experience:

TABLE 22.

Mortality from Absorption of Deleterious Gases,* Classified by Color, Sex and by Age Period.

Death Rates per 100,000 Persons Exposed. 1911 to 1916.
Experience of Metropolitan Life Insurance Company. Industrial Department.

Age Period.	Persons.	White.		Colored.	
		Males.	Females.	Males.	Females.
All ages—one and over	2.7	3.9	1.9	2.3	.9
1 to 4	1.0	1.0	1.0	1.3	1.3
5 to 9	.7	.7	.7	—	.3
10 to 14	.8	1.2	.4	.6	.3
15 to 19	1.1	1.2	1.2	1.0	.6
20 to 24	1.8	2.7	1.1	1.6	1.3
25 to 34	2.3	3.5	1.5	2.8	1.5
35 to 44	3.4	6.8	1.7	3.6	.7
45 to 54	5.4	10.1	3.2	5.5	1.0
55 to 64	8.5	15.6	5.7	1.8	.4
65 to 74	12.2	21.0	8.6	3.3	1.2
75 and over	20.2	28.4	18.4	—	—

There were 1,431 deaths reported for this cause. This number of deaths represented a rate of 2.7 per 100,000 persons exposed. The highest death rate was recorded for white males, 3.9 per 100,000, the next highest for colored males, 2.3 per 100,000, followed by the rate for white females, 1.9 per 100,000. The death rate from this cause among colored females was .9 per 100,000 of such persons exposed. Under twenty years of age the rate for both sexes varies from .7 to 1.1 per 100,000 persons exposed. After twenty

* Deaths reported as due to "asphyxia by gas," "gas poisoning," "illuminating gas poisoning," etc., although not reported as accidental, are classified here unless identified as due to suicide or homicide.

years of age it rises gradually from a figure of 1.8 per 100,000 in the age group 20 to 24 years to 20.2 in the highest age group in this series. Under twenty years of age, only one period shows a difference between the death rate for this cause of white males and white females. Beginning with the age period 20 to 24 years, however, the rate for accidental poisoning by deleterious gases among white males was significantly higher than that among white females. Thus, for the age period 25 to 34 years, white males showed a rate of 3.5 per 100,000 and white females one of only 1.5 per 100,000. In the two next higher groups the excess of mortality among males was even more pronounced. In the age period 55 to 64 years the death rate for this cause among white males was 15.6 per 100,000 and among white females 5.7 per 100,000. The death rate among colored males was much higher after 25 years of age than among colored females.

TABLE 23.

MORTALITY FROM ABSORPTION OF DELETERIOUS GASES, CLASSIFIED BY COLOR AND BY SEX.

Death Rates per 100,000 Persons Exposed. Single Years in Period 1911 to 1916.

Experience of Metropolitan Life Insurance Company. Industrial Department.

Year.	Persons.	White.		Colored.	
		Males.	Females.	Males.	Females
1911 to 1916.....	2.7	3.9	1.9	2.3	.9
1916.....	2.9	4.5	1.8	3.3	1.4
1915.....	2.3	3.6	1.6	1.3	.5
1914.....	2.9	4.2	2.1	1.5	1.3
1913.....	2.5	3.4	1.9	2.2	1.0
1912.....	3.0	4.3	2.2	3.7	.7
1911.....	2.3	3.4	1.8	1.5	.7

The death rate throughout the period 1911 to 1916 seems to be fairly stationary for insured wage earners. It should be recalled that in former years a fairly significant number of deaths from illuminating gas poisoning was registered under this cause of death title which, if more modern methods of certifying causes of death had then been in vogue, would have been recorded under "suicide by asphyxia." This factor of improvement in the designation of illuminating gas deaths as suicides does not affect the

present figures from 1911 onward as much as it does other figures which refer back perhaps fifteen years or more. It should be borne in mind, however, in viewing the table on page 37, that this matter of increased precision in the certification of causes of death may have affected our figures somewhat and that there may have been, therefore, an actual, though slight, decline in the death rate for this cause of death.

Traumatism by Firearms.*

Accidental deaths due to injury by firearms were recorded in 1,029 cases in this mortality experience at a rate of 1.9 per 100,000 persons exposed. This cause of death has a distinct color and sex incidence. The mortality rate among colored lives is decidedly in excess of that among white lives. Colored males, for instance, show a rate of 8.1 per 100,000 as compared with a rate of 3.0 for

TABLE 24.

Mortality from Traumatism by Firearms,* Classified by Color, Sex and by Age Period.

Death Rates per 100,000 Persons Exposed. 1911 to 1916.

Experience of Metropolitan Life Insurance Company. Industrial Department.

Age Period.	Persons.	White.		Colored.	
		Males.	Females.	Males.	Females.
All ages—one and over.....	1.9	3.0	.3	8.1	1.5
1 to 4.....	.9	.9	.5	2.6	3.2
5 to 9.....	1.4	1.9	.4	5.8	1.6
10 to 14.....	3.2	5.4	.3	10.4	1.6
15 to 19.....	4.0	6.0	.8	18.5	.6
20 to 24.....	2.5	3.5	.2	13.5	3.7
25 to 34.....	1.8	2.5	.1	10.1	1.2
35 to 44.....	1.5	2.2	.3	5.2	2.0
45 to 54.....	.6	1.2	.2	.7	.5
55 to 64.....	.7	1.2	.2	1.8	—
65 to 74.....	.8	1.5	.4	1.7	—
75 and over..	—	—	—	—	—

* Under this title are classified, also, deaths reported from "gunshot wound," "shot," etc., without qualification as to accidental, suicidal or homicidal character. Every effort is made to obtain definite information, however, in such cases, and they constitute only a small proportion of the 1,029 deaths classified here.

white males. A death rate of 1.5 per 100,000 is registered for colored females and a rate of only .3 per 100,000 for white females. The table on page 121 presents a statement of the death rates according to the several color, sex and age classes in this investigation.

Among white males the highest death rate for this means of injury occurs between 15 and 19 years of age with a declining death rate thereafter up to the advanced ages in this series. Among colored males, also, the highest death rate occurs between 15 and 19 years of age. It will be noted also that the death rate for this cause between 5 and 9 years among colored males (5.8 per 100,000) is almost as high as the maximum rate for white males (6.0). A very large proportion of these deaths in late childhood and in adolescence are caused by children playing with firearms and by reckless youths in the pursuit of sport. A considerable number, no doubt, are of the "didn't know it was loaded" type. At this time of life death rates from all causes are at a reasonably low level. A further reduction of mortality in late childhood and adolescence could be accomplished, no doubt, by concentration upon the single fact of accidental death from firearms.

TABLE 25.

MORTALITY FROM TRAUMATISM BY FIREARMS, CLASSIFIED BY COLOR AND BY SEX.

Death Rates per 100,000 Persons Exposed. Single Years in Period 1911 to 1916.

Experience of Metropolitan Life Insurance Company. Industrial Department.

Year.	Persons.	White.		Colored.	
		Males.	Females.	Males.	Females.
1911 to 1916.....	1.9	3.0	.3	8.1	1.5
1916	1.9	3.1	.3	8.4	.8
1915	1.7	2.7	.4	5.7	1.7
1914	2.0	2.7	.4	10.2	1.9
1913	2.2	3.5	.5	9.3	1.5
1912	2.0	3.1	.3	7.9	2.1
1911	1.7	2.8	.3	7.3	1.1

The figures for the period 1911 to 1916, unfortunately, do not indicate any marked declining tendency in the death rate from this cause. The rate for each year approaches closely that for the sexennium, 1.9 per 100,000 exposed. In recent years in the Registra-

tion Area of the United States a practically stationary death rate has also been observed. How far the figures in each experience are reliable for purposes of determining the general trend of mortality from accidental shooting we cannot say at present. A considerable number of deaths have been reported in the more recent years of our experience as accidentally due to the use of firearms which would have been reported in former years in such manner as to justify tabulation under some indefinite title such as "Other external violence." The table on page 39 gives a brief view of the course of accidental mortality from firearms during the period 1911 to 1916.

Accident Fatalities Arising Out of or in the Course of Employment.

The records of accident mortality of insured wage earners present a very favorable opportunity for the collection of informing statistics on fatalities arising out of or in the course of employment. We have already observed in the preceding sections a clear indication that these industrial policyholders suffer from higher accident death rates, almost uniformly, at ages where the occupational factor plays a part. Provision was therefore made early in the course of this study to distinguish and keep a record of those deaths where the occupation was clearly the primary cause of the accident. The period covered is only five years, from 1912 to 1916, inclusive. Although it was not possible to discover every case of occupational origin, there is nevertheless sufficient evidence to show that the cases overlooked or disguised were relatively few. In order to confine the data to the ages at which policyholders are gainfully employed the tabulations of deaths due to occupational violence have been limited to white males at the ages 15 years and over.

Thus, between 1912 and 1916, there were recorded 14,151 deaths from a group of selected and specific accidental causes of death, in which we might reasonably expect that occupation would play an important part. This number of 14,151 deaths does not, therefore, cover all of the deaths from occupational violence among white males 15 years of age and over. The following table gives the total number of accidental deaths reported for the specified accidents and injuries and the number and percentage of deaths of occupational origin:

TABLE 26.

NUMBER OF DEATHS FROM SPECIFIED ACCIDENTAL CAUSES OF DEATH AND NUMBER AND PERCENTAGE OF SUCH DEATHS DUE TO OCCUPATIONAL STRESS.

White Males, Fifteen Years of Age and Over, 1912 to 1916.

Experience of Metropolitan Life Insurance Company. Industrial Department.

Cause of Death.	Total Deaths From Specified Form of Violence.	No. Deaths of Occupational Origin.	Percent. Deaths of Occupational Origin.
TOTAL SPECIFIED CAUSES.....	14,151	3,963	28.0
Conflagration	149	23	15.4
Burns.....	333	61	18.3
Absorption of deleterious gases.....	665	41	6.2
Accidental drowning.....	2,381	151	6.3
Traumatism by fall.....	2,889	685	23.7
Traumatism in mines and quarries..	443	405	91.4
Traumatism by machines.....	585	473	80.9
Railroad accidents and injuries.....	2,710	954	35.2
Street car accidents and injuries....	710	137	19.3
Automobile accidents and injuries	890	97	10.9
Other vehicular acc. and injuries ..	733	321	43.8
Other crushing acc. and injuries....	205	133	64.9
Injuries by animals.....	112	43	38.4
Electricity—lightning excepted.....	323	200	61.9
Fractures—cause not specified	311	4	1.3
Other external violence.....	712	235	33.0

Out of the group of accidents selected from this experience of white males, 15 years of age and over, we found 28 per cent. to have been certified as arising out of or in the course of employment. For the various types of accidents, or means of injury, the percentage of occupational deaths varies. Thus for traumatism in mines and quarries the highest percentage of occupational accidents was registered, namely, 91.4. Under "absorption of deleterious gases" there was recorded the lowest percentage for any of the definite types of accidental violence, 6.2. It was found that 24 per cent. of the falls were certified to have occurred in the course of the employment of the deceased. We do not deem it desirable at the present time to apply these ratios to any other body of data than to the one we have given. Our table and the accompanying text will, it is hoped, stimulate further statistical inquiry, perhaps in our published official vital statistics, into the number and percentage of deaths from violence arising out of industry.

An interesting corollary to the foregoing text on the probable number of deaths due to occupational causes, is the comparison of

the variation from year to year in the ratio of deaths due to such occupational stress. The following table gives a survey of this situation by single years from 1912 to 1916:

TABLE 27.

MORTALITY FROM A GROUP OF SPECIFIED ACCIDENTAL CAUSES OF DEATH. NUMBER AND PERCENTAGE OF DEATHS DUE TO OCCUPATIONAL STRESS. *Single Years in Period 1912 to 1916.* Experience of Metropolitan Life Insurance Company. Industrial Department.

Year.	Total Deaths from Group of Specified Accidental Causes.	Number of Deaths of Occupational Origin.	Per Cent. Deaths of Occupational Origin.
1912 to 1916	14,151	3,963	28.0
1916.....	3,237	816	25.2
1915.....	2,742	638	23.3
1914.....	2,683	777	29.0
1913.....	2,931	948	32.3
1912.....	2,558	784	30.6

It would appear, therefore, from these figures that the proportion of deaths resulting from occupational accidents was on the decline during the five years under observation. The increase in the general accident rate for males at the ages 15 years and over must be due to other than occupational dangers, to which conclusion much other evidence points.

Trend of the Death Rate for Accidents.

The table on page 43 gives the total accident death rate from 1911 to 1916, qualified according to the color and sex classes of our data.

We observe from the following data a rather variable accident death rate. The maximum figure in the total experience was recorded in 1913 at 77.6 deaths per 100,000 persons exposed and the minimum in 1915 with a rate of 67.3. Perhaps if we had a longer series of annual rates to consider, we should be able to detect a slight tendency toward decline in the death rate from accidents of all kinds. From the figures at hand we are unable to say definitely whether there has been any considerable reduction in the total accident rate among insured wage earners. The conditions of grave hazard in American life and industry may not have improved, therefore, to any great extent.

TABLE 28.

MORTALITY FROM ACCIDENTAL AND UNSPECIFIED FORMS OF VIOLENCE,* CLASSIFIED BY COLOR AND BY SEX.

Death Rates per 100,000 Persons Exposed. Single Years in Period 1911 to 1916.

Experience of Metropolitan Life Insurance Company. Industrial Department.

Year.	Persons.	White.		Colored.	
		Males.	Females.	Males.	Females.
1911 to 1916.....	73.0	115.9	36.4	121.4	38.8
1916.....	73.2	118.7	34.8	122.7	37.5
1915.....	67.3	105.8	34.7	108.5	37.7
1914.....	69.9	109.3	36.5	118.2	35.5
1913.....	77.6	124.9	37.2	134.8	39.6
1912.....	73.8	115.2	37.2	128.4	41.2
1911.....	77.4	123.6	38.8	116.5	41.6

* War deaths excluded.

For white females and for colored females we are able to detect a fairly consistent but slight downward trend of total accidents. This is perhaps an indication that the graver hazards which surround women in home life have been mitigated in part by the various educational and other efforts toward security of the person from accidental violence. The white male total accident rate fluctuates somewhat from year to year and from a view of the figures in our present series we do not feel able to say that there has been any marked change for better or worse in the accident situation as it affects this group. The colored male total accident rate likewise offers no particularly encouraging evidence that the graver general accident hazards surrounding wage earners have been mitigated to any great extent.

SUICIDES.†

The suicide problem has in recent years attained considerable prominence in discussions of the aims and purposes of preventive

† Under "Suicides" are classified only those cases in which the fact of suicide or of attempt at suicide is clearly shown. By careful "editing" of our data relating to cause of death, hundreds of cases originally reported under such terms as "poisoning," "inhalation of gas," "drowning," "gunshot wound," "cut" and others have been added to this title instead of being placed under the class "accidental or unqualified."

medicine. Suicide is often a preventable source of mortality, especially when it is recalled that in many cases the suicidal impulse is the end product of a psychosis, which, if treated in good time, might have been relieved. That suicide is a serious source of mortality is indicated by the fact that in the six-year period of this experience 6,542 deaths from this cause were recorded. Interest attaches also to this mass of deaths because they have occurred among a group of wage earners. If, as has been supposed, the suicide death rate is a measure of the mental health of a people, the figures at our disposal should help us determine an important characteristic of the American industrial population in relation to that of other groups of the population. In the following table we present a statement of the suicide death rates for each of the color and sex classes of our data. Chart III graphically illustrates these age data.

TABLE 29.

MORTALITY FROM SUICIDE (ALL FORMS), CLASSIFIED BY COLOR, SEX AND BY AGE PERIOD.

Death Rates per 100,000 Persons Exposed. 1911 to 1916.

Experience of Metropolitan Life Insurance Company. Industrial Department.

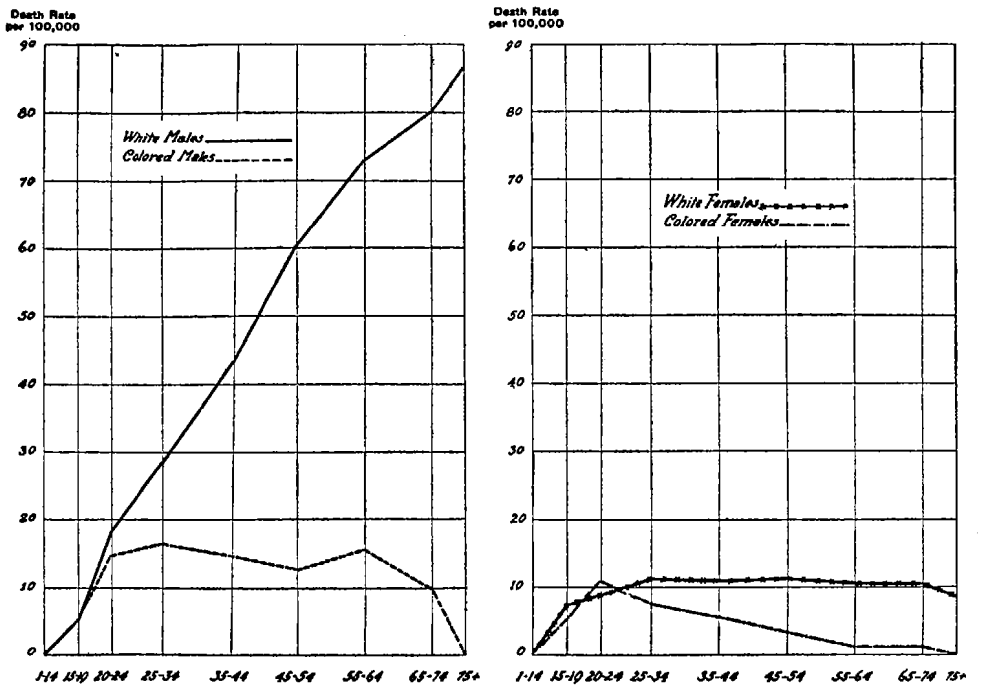
Age Period.	Persons.	White.		Colored.	
		Male.	Female.	Male.	Female.
All ages—one and over	12.2	20.1	6.8	10.1	4.9
1 to 14	.1	.2	.1	.3	.3
15 to 19	6.0	5.0	7.2	5.1	5.3
20 to 24	13.0	18.0	8.7	14.8	11.9
25 to 34	17.0	27.9	11.1	16.3	7.4
35 to 44	20.9	42.9	10.9	14.8	5.7
45 to 54	26.5	60.1	11.1	12.7	3.4
55 to 64	31.3	72.8	10.4	15.6	1.3
65 to 74	34.0	79.7	10.5	10.0	1.2
75 and over	34.1	86.5	8.4	—	—

At all ages combined, the rate was 12.2 per 100,000 persons exposed. The group of white males shows the highest rate of any of the color or sex classes, followed by colored males, by white females and finally by colored females. Males of each color group show decidedly higher suicide rates than do females.

Chart III.—MORTALITY FROM SUICIDE—ALL FORMS

Death Rates per 100,000 Persons Exposed, Classified by Age Periods. White and Colored Groups Compared for Each Sex Class

Experience of Metropolitan Life Insurance Company, Industrial Department, 1911 to 1916



Suicide Mortality According to Color, Sex and Age.

The age characteristics of these suicide data are also of significance. Beginning with a rate of 6.0 per 100,000 between 15 and 19 years, we recorded a rising rate up to and including the highest significant age period, 65 to 74 years. The age group 75 years and over has been disregarded because of its heterogeneous age composition and the small number of lives exposed and of deaths reported. This gradual upward slope of the curve for suicide mortality probably reflects very largely the experience of the white male group included in the figures for all persons. For white males there is quite a sharp rise in the curve of suicide mortality, from a figure of 5.0 per 100,000 between the ages 15 and 19 years to a rate of 79.7 per 100,000 at the age period 65 to 74 years. White females do not show as clearly this phenomenon of increasing suicide mortality with age. Beginning with a figure of 7.2 per 100,000 at the age period 15 to 19 years, there is a gradual increase to a rate of 11.1 for the age period 25 to 34 years. From this group up to and including the period 65 to 74 years there is a practically stationary suicide rate for white females, with little variation from a figure of 10.5 per 100,000.

The suicide rate for colored males does not show any tendency throughout the entire range of life toward either a decrease or an increase with advancing age. After the age period 20 to 24 years for colored females, we observe a distinct drop in the suicide rate with advancing years, from a figure of 11.9 per 100,000 in the first named age period to a rate of 3.4 per 100,000 in the period 45 to 54 years, the last age group for which we have significant figures.

In view of the importance of racial characters of suicide mortality, it will be of some interest to consider the comparative ratios of some of these mortality rates for the several color classes by sex and age.

Ratio of Suicide Mortality by Color.

In a preceding section we indicated the lower suicide mortality rate among colored persons. The colored male suicide rate was only 50 per cent. of that shown for white males at all ages combined. But this relation varies markedly at the several age periods. Between 15 and 19 years our figures indicate a slight excess in the colored male suicide rate over the rate for white males, but this may be purely accidental and of no real significance. Beginning with

the age period 20 to 24 years, the colored male suicide rate becomes increasingly more favorable in respect to the white male rate. Thus, while colored males showed a suicide mortality rate 82.2 per cent. of that recorded for white males at the age period 20 to 24 years, the ratio was only 12.5 per cent. at the age period 65 to 74 years. Among colored females also, with the exception of the age period 20 to 24 years, we observe with advancing age an increasingly more favorable suicide rate. The foregoing facts are shown in the table given below:

TABLE 30.

MORTALITY FROM SUICIDE (ALL FORMS).

Percentage, Colored of White Mortality at Specified Age Periods for Each Sex. 1911 to 1916.

Experience of Metropolitan Life Insurance Company. Industrial Department.

Age Period.	Percentage, Colored of White Mortality.	
	Males.	Females.
All ages—one and over.....	50.2	72.1
15 to 19.....	102.0	73.6
20 to 24.....	82.2	136.8
25 to 34.....	58.4	66.7
35 to 44.....	34.5	52.3
45 to 54.....	21.1	30.6
55 to 64.....	21.4	12.5
65 to 74.....	12.5	11.4
75 and over	—	—

Sex Ratio of Suicide Mortality.

We have shown that for white persons, the female suicide rate was less than the male suicide rate, the ratio being about one to three. White males show a higher rate of self-destruction at all age periods with the exception of the period of 15 to 19 years.

There is a distinctly higher suicide rate among white females in this age of early adolescence than among white males. This phenomenon is also in evidence in such population figures as we have been able to find. It is possible that the stress and strain of early adolescence is more disastrous to females than to males. We might expect, also, to find a higher index of mental disorders among female adolescents than among males of the same ages on the basis of these suicide data. It may be noted in this connection that there is a much higher incidence rate of serious cases of

dementia precox, a form of dementia characteristic of adolescence and early adult life, among females than among males in populations generally. Thus, in New York State during 1916 there were in the care of the hospitals for mental diseases under the supervision of the New York State Hospital Commission, 8,903 male and 10,046 female *dementia precox* cases. At the ages in the population from which these patients were drawn, there is a considerable excess of males. This would make the disparity between the male and female *dementia precox* rates much greater than would be indicated by the foregoing comparison of the sex ratios of such patients under hospital care.

Beginning with the age period 20 to 24 years, the white male suicide rate shows a very marked excess over the white female rate. This excess increases with advancing age. Between 20 and 24 years the white male suicide rate is 207 per cent. of the white female rate, between 25 and 34 years, 251 per cent.; between 35 and 44 years, 394 per cent., increasing to a percentage of 759 at the age period 65 to 74 years.

TABLE 31.

MORTALITY FROM SUICIDE (ALL FORMS).

Percentage, Male of Female Mortality at Specified Age Periods for Each Color Class. 1911 to 1916.

Experience of Metropolitan Life Insurance Company. Industrial Department.

Age Period.	Percentage, Male of Female Mortality.	
	White.	Colored.
All ages—one and over.....	295.6	206.1
15 to 19	69.4	96.2
20 to 24.....	206.9	124.4
25 to 34.....	251.4	220.3
35 to 44.....	393.6	259.6
45 to 54.....	541.4	373.5
55 to 64.....	700.0	1200.0
65 to 74.....	759.0	833.3
75 and over	1029.8	—

Colored males also show a suicide death rate lower than that for colored females at the age period 15 to 19 years, although the advantage of the males in relation to the females among the colored is not as great as that observed among the white lives. Beginning with the age period 20 to 24 years colored males showed a suicide

rate 124 per cent. of that recorded for colored females. There is much the same precipitate rise in the percentage of excess of male suicide mortality among colored persons as we found among white persons. The greatest difference is found in age period 55 to 64 when the rate for colored males is twelve times as high as for colored females. The foregoing observations are shown in tabular form on page 48.

Suicide Experience of Insured Wage Earners and Population of Expanding Registration Area of the United States Compared.

The suicide rates for white male insured wage earners are more favorable than the rates for males in the general population of the United States only for the ages under 25 years. Beginning with the age period 25 to 34 years we observe excesses in the suicide rate of white male wage earners—an excess of 5 per cent. for the period 25 to 34 years, of 20 per cent. for the period 35 to 44 years, of 17 per cent. for the period 45 to 54 and of 11 per cent. for the period 55 to 64 years. In other words, at the ages of early adolescence and early adult life white male wage earners show a more favorable suicide rate, but continuing through the main working period of life and up to the last age group registered in this table, the suicide rate of insured white males exceeds, and rises faster, than the rate for all males in the general population of the expanding Registration Area of the United States.

The suicide experience for insured white females is, however, more encouraging. Only between the ages 15 and 19 years and 25 and 34 years do we find an excess (very negligible) in the suicide rate of the insured group over females in the general population. For all other age periods, insured white females show a more favorable suicide rate than do females in the population of the expanding Registration Area of the United States. Moreover, between the ages 35 to 64 years, insured white females show a tendency to improve upon the already favorable ratio of their suicide rate to the rate for females in the general population. Between 35 and 44 years insured white females showed a rate 96.5 per cent. of that recorded for females in the general population; between 45 and 54 years, a rate of 88.8 per cent., and between 55 and 64 years, a rate 78.2 per cent. of that recorded for females in the general population. These observations are shown in the following table:

TABLE 32.

MORTALITY FROM SUICIDE (ALL FORMS).

Death Rates per 100,000 Persons Exposed. Classified by Sex and by Age Period. Insured White Lives in Experience of Metropolitan Life Insurance Company, Industrial Department (1911 to 1916) and General Population Experience of Expanding Registration Area of the United States (1910 to 1915).

Age Period.	Males.			Females.		
	M. L. I. Co. (White).	U. S. Reg. Area.	Percentage M. L. I. Co. of Reg. Area.	M. L. I. Co. (White).	U. S. Reg. Area.	Percentage M. L. I. Co. of Reg. Area.
All ages—one and over....	20.1	24.6	81.7	6.8	7.9	86.1
1 to 14	.2	.6	33.3	.1	.5	20.0
15 to 19	5.0	5.6	89.3	7.2	7.1	101.4
20 to 24	18.0	18.2	98.9	8.7	10.7	81.3
25 to 34	27.9	26.7	104.5	11.1	11.0	100.9
35 to 44	42.9	35.8	119.8	10.9	11.3	96.5
45 to 54	60.1	51.4	116.9	11.1	12.5	88.8
55 to 64	72.8	65.8	110.6	10.4	13.3	78.2
65 to 74	79.7	61.6	129.4	10.5	11.6	90.5
75 and over.	86.5	61.5	140.7	8.4	9.8	85.7

Suicide According to Principal Means of Injury.

The above discussion reviewed the principal facts of the suicide experience in the aggregate. A more intimate view, however, is afforded by a brief consideration of this phenomenon of self-

TABLE 33.

MORTALITY FROM SUICIDE (ALL FORMS).

Number of Deaths, and Percentage of Deaths According to Specified Means of Injury. 1911 to 1916.

Experience of Metropolitan Life Insurance Company. Industrial Department.

Means of Injury.	Number of Deaths.	Percentage of Total.
SUICIDES—TOTAL	6,542	100.0
Suicide by		
Poison.....	2,352	36.0
Asphyxia.....	1,040	15.9
Hanging or strangulation.	761	11.6
Drowning	316	4.8
Firearms.....	1,519	23.2
Cutting or piercing instruments	346	5.3
Jumping from high places.	107	1.6
Crushing.....	33	.5
Other suicides	68	1.0

destruction according to the means of injury employed. In the preceding table we display the number of deaths reported according to the chief means of injury employed, and the percentage that each "means of injury" class constitutes of the total.

Poison was the chief means of suicide in the present experience. Of the total deaths from suicide, 36.0 per cent. were accomplished by this means. This ratio is, of course, not constant in all mortality experiences. For instance, in New York City, asphyxia is the principal mode of committing suicide for both males and females and in the Registration Area of the United States it would seem that firearms were the chief means of suicidal injury as regards males. Poisoning seems to be the mode most frequently chosen by females in the Registration Area, corresponding practically to the prevalence shown in the experience of the Industrial Department of this Company. Variation in the choice of means of suicidal injury depends, of course, upon numerous factors, such as legislative restriction upon the sale of poisons, firearms and other means of injury, the extent to which publicity is given to suicides in the newspapers of various localities, and other strictly local factors difficult to enumerate. We shall take up briefly the principal means of suicidal injury in this present experience.

*Suicide by Poison.**

There were 2,352 deaths from this cause concerned in the present investigation, in which either solid or liquid poisonous substances were employed. These deaths corresponded to a rate of 4.4 per 100,000 persons exposed. The age and sex characteristics of this cause of death are shown in Table 34 on page 52.

It will be seen that the maximum rate in the entire group for suicide by poison is that among white males in the age period 55 to 64 years. Among white females and colored males, the maximum figure is found in the age period 25 to 34 and among colored females even earlier, between 20 and 24 years.

The general trend of mortality from suicide by poison seems to be downward. This is indicated by the figures given in Table 35 on page 52.

* Solid and liquid poisons only. Where poisonous gas is the means employed the death is classified under "Suicide by Asphyxia."

TABLE 34.

MORTALITY FROM SUICIDE BY POISON, CLASSIFIED BY COLOR, SEX AND BY AGE PERIOD.

Death Rates per 100,000 Persons Exposed. 1911 to 1916.

Experience of Metropolitan Life Insurance Company. Industrial Department.

Age Period.	Persons.	White.		Colored.	
		Males.	Females.	Males.	Females.
All ages—one and over	4.4	6.0	3.4	2.9	3.0
1 to 14	*	*	.1	.1	—
15 to 19	3.3	1.7	5.0	1.3	3.8
20 to 24	6.2	6.7	5.9	3.0	8.5
25 to 34	7.7	10.7	6.3	6.2	4.9
35 to 44	7.5	14.1	4.5	4.8	3.1
45 to 54	7.3	15.0	4.0	3.3	1.0
55 to 64	8.1	17.6	3.7	1.8	.4
65 to 74	7.3	16.7	2.7	—	—
75 and over	3.8	8.5	1.7	—	—

* Less than .05 per 100,000.

From a rate of 5.4 per 100,000 in 1911 the decline was fairly regular to a rate of 2.8 per 100,000 in 1916. We must remember, however, that suicide mortality is subject to considerable fluctuation with community conditions and that an opinion on the real trend of this phenomenon must be founded upon facts over a long

TABLE 35.

MORTALITY FROM SUICIDE BY POISON, CLASSIFIED BY COLOR AND BY SEX.

Death Rates per 100,000 Persons Exposed. Single Years in Period 1911 to 1916.

Experience of Metropolitan Life Insurance Company. Industrial Department.

Year.	Persons.	White.		Colored.	
		Males.	Females.	Males.	Females.
1911 to 1916	4.4	6.0	3.4	2.9	3.0
1916	2.8	3.5	2.4	2.4	1.8
1915	3.8	4.9	3.4	.9	2.8
1914	4.8	6.8	3.4	3.7	3.7
1913	5.1	7.1	3.7	4.6	3.1
1912	4.8	6.6	3.7	4.1	2.4
1911	5.4	7.7	4.1	1.9	4.1

period of time and only after the fluctuations characteristic of suicide are in full view.

Suicide by Asphyxia.

The experience for this cause of death among white males and females according to age periods is shown in the following table. No substantial facts for colored persons are available.

TABLE 36.

MORTALITY FROM SUICIDE BY ASPHYXIA, CLASSIFIED BY SEX FOR WHITE LIVES AND BY AGE PERIOD.

Death Rates per 100,000 Persons Exposed. 1911 to 1916.

Experience of Metropolitan Life Insurance Company. Industrial Department.

Age Period.	Persons in Total Experience.	White.	
		Males.	Females.
All ages—one and over....	1.9	3.0	1.5
1 to 24.....	.3	.3	.2
25 to 34.....	2.2	3.4	2.1
35 to 44.....	3.9	6.3	3.6
45 to 54.....	5.3	10.4	3.6
55 to 64.....	6.2	13.3	2.8
65 to 74.....	6.7	14.4	3.0
75 and over.....	3.4	5.7	2.5

The rates represented in the foregoing table were based upon 1,040 deaths from suicide by asphyxia. The rate for males from this cause is, at all ages combined, twice as high as that for white females. There is a constant increase in the rate with age for white males throughout the significant age groups but no very material variation for white females. The general trend of the rate for suicide by asphyxia during the six years under observation is shown in the table on page 54.

There is a practically constant death rate for this cause. Such variations as do occur are of no particular moment. If anything, there seems to be a slight increase in the rate for white females. In the expanding Registration Area of the United States, also, there has been observed in recent years a slight increase in the recorded death rate from suicide by asphyxia, but this may be almost entirely due to an increase in the precision of reporting on the part of coroners, physicians and others entrusted with the completing of death certificates.

TABLE 37.

MORTALITY FROM SUICIDE BY ASPHYXIA, CLASSIFIED BY SEX FOR WHITE LIVES.

Death Rates per 100,000 Persons Exposed. Single Years in Period 1911 to 1916.

Experience of Metropolitan Life Insurance Company. Industrial Department.

Year.	Persons in Total Experience.	White.	
		Males.	Females.
1911 to 1916	1.9	3.0	1.5
1916.....	1.9	2.5	1.8
1915.....	2.3	3.4	1.9
1914.....	1.9	3.1	1.2
1913.....	2.1	3.5	1.5
1912.....	1.7	2.4	1.5
1911.....	1.7	2.8	1.1

Suicide by Hanging or Strangulation.

Only 761 deaths from this cause were recorded. This number does not justify any detailed analysis according to age classes. It will be sufficient to remark that the death rate for this cause was practically the same among white males as the death rate from suicide by asphyxia. For white females and for colored persons the data are of no significance. The total number of deaths registered was 761; of these 626 were those of white males.

Suicide by Drowning.

There were only 316 deaths from this form of suicide. White males showed the highest rate; white females had a death rate about half that of white males.

Suicide by Firearms.

The use of firearms was next in importance to poison among the cases of suicide represented in this mortality experience. We recorded in all 1,519 deaths at a rate of 2.8 per 100,000 exposed. The mortality rate varied quite sharply according to sex, there being an almost negligible rate among females of both color or race classes. Our facts for color, sex and age are given in the following table:

TABLE 38.

MORTALITY FROM SUICIDE BY FIREARMS, CLASSIFIED BY COLOR, SEX AND BY AGE PERIOD.

Death Rates per 100,000 Persons Exposed. 1911 to 1916.

Experience of Metropolitan Life Insurance Company. Industrial Department.

Age Period.	Persons.	White.		Colored.	
		Males.	Females.	Males.	Females.
All ages—one and over	2.8	5.7	.6	4.2	.8
1 to 14	†	.1	—	.1	.1
15 to 19	1.3	1.9	.8	1.9	.6
20 to 24	4.1	7.3	1.5	7.9	1.1
25 to 34	3.9	8.1	1.0	7.2	1.3
35 to 44	4.7	11.7	.9	5.6	1.0
45 to 54	6.1	16.5	.7	5.2	.8
55 to 64	6.6	17.8	.4	4.8	.4
65 to 74	6.0	16.5	.3	3.3	—
75 and over	7.2	21.3	—	—	—

† Less than .05 per 100,000.

The chief fact of importance in this table is the practically stationary rate between 45 and 75 years of age. The trend of the mortality from this cause is displayed in the following table:

TABLE 39.

MORTALITY FROM SUICIDE BY FIREARMS, CLASSIFIED BY COLOR AND BY SEX.

Death Rates per 100,000 Persons Exposed. Single Years in Period 1911 to 1916.

Experience of Metropolitan Life Insurance Company. Industrial Department.

Year.	Persons.	White.		Colored.	
		Males.	Females.	Males.	Females.
1911 to 1916	2.8	5.7	.6	4.2	.8
1916	2.5	4.8	.6	4.2	.6
1915	2.8	5.5	.6	4.3	.9
1914	2.7	5.4	.7	3.7	.8
1913	3.1	6.5	.6	4.2	.5
1912	2.9	6.1	.4	5.0	.5
1911	3.0	5.9	.5	4.1	1.3

The figures at hand relate to so few calendar years that no final conclusion can be drawn on the general trend of suicide by firearms.

We can say at a venture that a slight decrease was observed. The underlying causes of mortality from suicide by firearms are entirely too complex to make it possible for us to speculate in any great detail upon the data shown in the foregoing table.

HOMICIDE.*

The facts on homicide among this group of insured wage earners form an important contribution to the statistics on the crime of homicide in the United States. In fact, there are not available in discussions of the homicide problem any such detailed, modern data according to age classes of the two main race groups in the population as are to be found in this present display. In this investigation there were recorded 3,753 homicides and these deaths represent a rate of 7.0 per 100,000 persons exposed. The following table gives a statement of the number and percentage of homicide deaths according to the several means of injury employed:

TABLE 40.

MORTALITY FROM HOMICIDE (ALL FORMS).*

Number of Deaths, and Percentage of Deaths, According to Specified Means of Injury. 1911 to 1916.

Experience of Metropolitan Life Insurance Company. Industrial Department.

Means of Injury.	Number of Deaths.	Percentage of Total.
HOMICIDES—TOTAL	3753	100.0
Firearms	2435	64.9
Cutting or piercing instruments	616	16.4
Other homicides	702	18.7

Of these homicides, 64.9 per cent. were accomplished through the use of firearms. This proportion is slightly in excess of that for the general population of the expanding Registration Area (61.8). Homicide by means of cutting or piercing instruments

* Under "Homicide" are classified only those cases in which the fact of homicide or of attempt at homicide is clearly shown. By careful "editing" of our data relating to causes of death many cases originally reported under such terms as "gunshot wound," "cut," "poisoning," and others have been classed as homicides instead of being placed under the "accidental or unqualified" group.

was recorded in the present investigation in 16.4 per cent. of all homicides. In the general population of the Registration Area only 14.2 per cent. were accomplished through this means.

The homicide death rate in this insurance experience was nearly 7½ times as great for colored males as for the entire group of insured wage earners. This rate (52.2 per 100,000) was almost ten times that of white males (5.4 per 100,000). Among colored females there was registered a death rate for homicide of 14.1 per 100,000 exposed. This rate is nearly three times that recorded for white males and over seven times the rate for white females. In the following table and in Chart IV, page 58, we give a comparison of the homicide death rates in this insurance experience according to color, sex and age classes:

TABLE 41.

MORTALITY FROM HOMICIDE (ALL FORMS), CLASSIFIED BY COLOR, SEX AND BY AGE PERIOD.

Death Rates per 100,000 Persons Exposed. 1911 to 1916.

Experience of Metropolitan Life Insurance Company. Industrial Department.

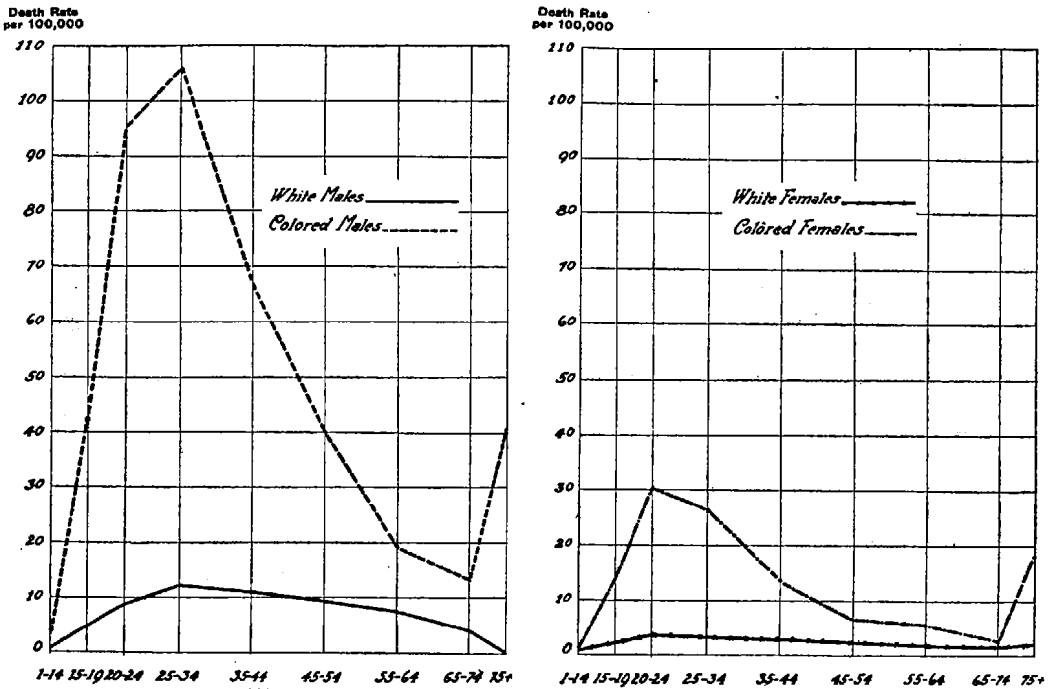
Age Period.	Persons.	White.		Colored.	
		Males.	Females.	Males.	Females.
All ages—one and over	7.0	5.4	1.9	52.2	14.1
1 to 14.....	.7	.6	.6	3.1	1.1
15 to 19.....	5.8	4.4	2.1	40.6	14.1
20 to 24.....	12.5	8.5	3.6	95.6	30.1
25 to 34.....	16.0	11.8	3.3	106.0	26.6
35 to 44.....	11.4	10.5	2.8	66.6	13.4
45 to 54.....	7.3	9.4	1.9	40.1	6.8
55 to 64.....	4.6	7.3	1.3	19.2	5.7
65 to 74.....	2.8	4.1	1.1	13.4	2.3
75 and over .	3.4	—	1.7	41.2	18.1

The age period of maximum incidence for males in both color classes was the same—25 to 34 years. For white and colored females the maximum rate occurred at an earlier period, 20 to 24 years of age. Among colored males this maximum rate was 106 per 100,000 exposed. Homicide among colored males was one of the chief causes of death, ranking next to pneumonia in order of numerical importance at this age period in life. It will be noted,

Chart IV.—MORTALITY FROM HOMICIDE—ALL FORMS

Death Rates per 100,000 Persons Exposed, Classified by Age Periods. White and Colored Groups Compared for Each Sex Class

Experience of Metropolitan Life Insurance Company, Industrial Department, 1911 to 1916



however, that the age period 20 to 24 years had only a slightly lower homicide rate, 95.6 per 100,000 exposed.

Homicide assumes alarming proportions as a cause of death among the colored population of the United States. No convenient or all-inclusive explanation of this phenomenon among colored persons can be made in this present discussion. The homicide problem is entirely too grave and grows out of so many other complex social situations that we cannot, at the present time, do more than to indicate the necessity for a further and qualified inquiry into the problem.

The ratio of the homicide rates for white and colored persons, according to sex, may be pointed out, however, in passing. The following table gives a convenient view of the ratios of white and colored mortality at the several age periods in each sex:

TABLE 42.

MORTALITY FROM HOMICIDE (ALL FORMS).

Percentage, Colored of White Mortality at Specified Age Periods for Each Sex. 1911 to 1916.

Experience of Metropolitan Life Insurance Company. Industrial Department.

Age Period.	Percentage, Colored of White Mortality.	
	Males.	Females.
All ages—one and over.....	966.7	742.1
15 to 19.....	922.7	671.4
20 to 24.....	1124.7	836.1
25 to 34.....	898.3	806.1
35 to 44.....	634.3	478.6
45 to 54.....	426.6	357.9
55 to 64.....	263.0	438.5
65 to 74.....	326.8	209.1
75 and over	—*	1064.7

* No deaths of white males from homicide in this age period.

It will be seen that for the entire experience the homicide rate for colored males is practically ten times that of white males. At the age period 20 to 24 years the colored male homicide rate is more than eleven times that of the white male rate. There is a tendency toward decrease in this ratio with advancing age. At all ages, 1 and over, in this experience, colored females show a homicide rate nearly 7½ times that of white females. At the age period 20 to 24 years colored female homicide mortality is more than 8⅓ times the

rate for white females. Between 25 and 34 years, homicide among colored females is still more than eight times as prevalent as among white females.

We may inquire briefly also into the sex ratio of homicide mortality according to age period for each of the color classes. The facts available are shown in the following table:

TABLE 43.

MORTALITY FROM HOMICIDE (ALL FORMS).

Percentage, Male of Female Mortality at Specified Age Periods for Each Color Class. 1911 to 1916.

Experience of Metropolitan Life Insurance Company. Industrial Department.

Age Period.	Percentage, Male of Female Mortality.	
	White.	Colored.
All ages—one and over.....	284.2	370.2
15 to 19.....	209.5	287.9
20 to 24.....	236.1	317.6
25 to 34.....	357.6	398.5
35 to 44.....	375.0	497.0
45 to 54.....	494.7	589.7
55 to 64.....	561.5	336.8
65 to 74.....	372.7	582.6
75 and over.....	—*	227.6

* No deaths of white males from homicide in this age period.

Males among white persons show a homicide death rate nearly three times that of females. For the colored race, males have a homicide death rate nearly 3¾ times that of females. The excess of the homicide rate for males over the rate for females increases with age up to the period 55 to 64 years among white persons and up to the period 45 to 54 years among colored persons.

Homicide Rate Among Insured Wage Earners and Among Population of the Expanding Registration Area of the United States Compared.

We offer on page 61 a comparison of the homicide death rates among white persons in the insurance experience and among all persons in the Registration Area experience.

These two groups are in many respects comparable. It must be remembered, however, that the statistics for the expanding Reg-

istration Area of the United States are affected by a small proportion of colored persons, about 5 per cent. In view, however, of the extraordinarily high homicide rate among this latter group of the population, the figures for the total population as to homicide are, undoubtedly, a little higher than they would be had it been possible to exclude this statistical group. Thus, in making this present comparison, we must bear in mind that about 5 per cent. of the population material is affected by a homicide death rate between seven and ten times as high as that of white persons. This one fact may be sufficient in itself to account for the exceptionally favorable homicide figures among insured white males and females shown in the following table:

TABLE 44.

MORTALITY FROM HOMICIDE (ALL FORMS).

Death Rates per 100,000 Persons Exposed. Classified by Sex and by Age Period. Insured White Lives in Experience of Metropolitan Life Insurance Company, Industrial Department (1911 to 1916) and General Population Experience of Expanding Registration Area of the United States (1910 to 1915).

Age Period.	Males.			Females.		
	M. L. I. Co. (White).	U. S. Reg. Area.	Percentage M. L. I. Co. of Reg. Area.	M. L. I. Co. (White).	U. S. Reg. Area.	Percentage M. L. I. Co. of Reg. Area.
All ages—one and over....	5.4	10.4	51.9	1.9	2.7	70.4
1 to 14.....	.6	.9	66.7	.6	.7	85.7
15 to 19.....	4.4	6.1	72.1	2.1	3.0	70.0
20 to 24.....	8.5	16.9	50.3	3.6	5.0	72.0
25 to 34.....	11.8	19.3	61.1	3.3	4.7	70.2
35 to 44.....	10.5	16.6	63.3	2.8	3.5	80.0
45 to 54.....	9.4	11.7	80.3	1.9	2.1	90.5
55 to 64.....	7.3	8.1	90.1	1.3	1.5	86.7
65 to 74.....	4.1	5.7	71.9	1.1	1.2	91.7
75 and over..	—	3.7	—	1.7	1.6	106.3

For all ages one and over the homicide rate for insured white males was only 52 per cent. of that among all males in the expanding Registration Area of the United States. Among insured white females the homicide rate was only 70 per cent. of the rate prevailing in the Registration Area group of females. Beginning with the age period 25 to 34 years, however, there is, with unimportant exceptions, an increasing tendency toward equality in the homi-

cide rates of the two experiences. At the age period 55 to 64 years, insured white males have a homicide rate only 10 per cent. more favorable than that of males in the population experience.

Trend of the Death Rate for Homicide.

In the experience for insured wage earners we observe a fluctuating rate from this cause, with no distinct upward or downward tendency for any of the color or sex classes, with the possible exception of colored males for whom there was perhaps a tendency toward increase. The 1916 death rate for homicide, compared with the 1911 rate, showed a slight decrease for white males, a constant rate for white females, an increase of practically eight points per 100,000 for colored males and a decrease for colored females. It will be recalled that the suicide rate during 1916 showed a tendency to reflect the conditions of unprecedented prosperity which prevailed throughout the sections of the country where the Company does business among wage earners. This condition of generally better economic status for the industrial population of the United States apparently did not affect the homicide death rate, however, probably because there is no very close connection between the homicidal impulse and material well-being. The crime of homicide is precipitated, perhaps, in persons afflicted with various types of mental and nervous defects and diseases, by other than economic stresses and circumstances. In the following table we give a statement of the trend of the homicide death rate during the six years of this present investigation:

TABLE 45.

MORTALITY FROM HOMICIDE (ALL FORMS), CLASSIFIED BY COLOR AND BY SEX. *Death Rates per 100,000 Persons Exposed. Single Years in Period 1911 to 1916.*

Experience of Metropolitan Life Insurance Company. Industrial Department.

Year.	Persons.	White.		Colored.	
		Males.	Females.	Males.	Females.
1911 to 1916.....	7.0	5.4	1.9	52.2	14.1
1916.....	6.9	5.4	2.0	54.0	14.3
1915.....	6.9	5.5	2.0	49.9	15.8
1914.....	7.0	5.5	1.9	54.0	12.6
1913.....	7.2	4.8	2.1	57.8	13.1
1912.....	6.7	5.2	1.6	50.4	12.8
1911.....	7.2	5.9	2.0	46.2	15.9

In the experience of the general population of the Registration Area we observe, likewise, a practically stationary death rate from the crime of homicide. It must be remembered, however, that between 1911 and 1915, the period for which population data are available at the present writing, a number of areas containing a large number of colored persons were added to the registration record and that this fact in itself had a tendency to slacken a slight decrease in homicide, if any such really existed.

Essentials of Family Statistics.

BY

EDWIN W. KOPF.

Introductory.

The social statistician and actuary who professes to practice in the subject matters outlined in our Society's Constitution will sometime in the course of his career have occasion to compile or to use the social statistics which are, or at least should be, the firm support for every programme of social legislation. Facts on human aggregation, association and economic status precede, in our branch of insurance science, all matters of theory and practice in administration, rate making and experience analysis. What would it avail the present actuarial and administrative structure of employers' liability and workmen's compensation if no facts on its social urgency were at hand? In what way shall we justify the institution of workmen's compensation in the first place, and its continuation along present lines, in the second place, if not through a demonstration of its social utility? Have we really determined by an appeal to facts that health insurance, for instance, should not be administered through a nation-wide, non-political, mutual carrier or organization of carriers in harmony with the principles underlying the co-operative and friendly society movement established by the great British Liberals of the nineteenth century?

The cultivation of social statistics is an obligation laid upon us by the requirement that all of our actuarial work shall have a basis of unimpeachable social fact. Social statistics endeavors to provide comparative and historical description of those social facts which comprehend problems of (1) aggregation and of (2) association of human-kind. From this observational base, we derive the crude data which, in any science, are termed empirical, or first-sort, knowledge. By the process of induction, we may discover from these data the facts of social "law" and causation—reasoned or generalized knowledge. Without these statements on the concrete, particular aspects of human aggregation and association,

social insurance science, and deductive analysis from hypotheses in that science, have but slight meaning.

STATISTICS OF (1) AGGREGATIONS OF INDIVIDUALS AND OF (2) ASSOCIATION OF INDIVIDUALS IN SOCIAL UNITS.

Census and vital statistical practice is in a fair way toward providing us with the facts of human aggregation—the arrangement of *individuals* in classes or groups according to race, sex, age, occupation, and other characteristics of such individuals. But these tabular displays of mere aggregation tell us nothing of the important fact of human association; there is no account rendered of the number and characteristics of even primary social units, of those groups of individuals which seek association for purposes of growth, advancement, reproduction, defence and social force. Our present inquiry into social units begins with family statistics.

The family is the primary social unit. No other social units—the Church, secular societies, benevolent organizations, insurance institutions and the like—would be possible without the basic social unit of the family. Through it the individual is brought from a disintegrated state into elementary ethical relations, into the race stream. Insurance institutions themselves are largely an outgrowth of the higher instinct of family preservation.

RELATED LINES OF INQUIRY IN FAMILY STATISTICS.

There are two general categories of family facts: (I) on the biological and social aspects and (II) on the economic phases of family life. The present discussion will be confined to the first and more important of these main classes (with the major emphasis on social considerations). A treatment of the second subject will be taken up in a later paper.

The strictly social statistics of the family of significance for the casualty and social insurance statistician and actuary may be considered in an orderly manner as follows:

1. The formation, or re-formation of family units.
2. The disintegration of family units through dissolution of the man-and-wife relation by reason of death, divorce or separation, and through departure of grown children into marriages of their own.
3. Functioning of the family. Reproduction and nurture of the human species.

4. Structure and composition of society in social units of the family at points in time. History of the family.

The results of research under the first three sections of our classification of family statistics could be termed studies in social kinetics (or the progress of society) and under the fourth category, studies in social statics (or the equilibrium of social forces at various points in time). It would be well, however, not to insist upon too strict classification along these lines at present. It will suffice to say that the sources of data for the first three groups arise in the practice of dynamic demology,* or statistics of the *movement* of population, whereas the fourth group derives its data from static demology,* or statistics of the *structure and status* of population at certain points in time—on days of census enumeration. A detailed discussion under each of these points follows:

1. Formation, or Re-formation, of Family Units.

In international census usage, a family is defined as a group of persons associated in sharing a common table and a common shelter. This definition is too broad for our purposes, because it embraces groups of persons sustaining the man-and-wife, parent-and-child or other relation by blood, marriage and adoption, in addition to persons living alone, and groups of persons unrelated by blood, marriage or adoption, but living in hotels, boarding-places or schools. Servants and lodgers are also included. These groups are termed *economic families.* In our branch of insurance science, we consider only groups of persons associated by relationship to the head of the family by blood, marriage or adoption. These latter groups may be called *natural families.*

Statistics of Natural Families.

In civilized society, natural families† are constituted when marital relations are formed, or when marital relations broken by death or divorce are re-formed, with the knowledge and consent of the State, and in most cases, with the knowledge and consent also of religious institutions. The variety of impulses, reactions and

* A broad term used as early as 1896 by the Hungarian statistician, Joseph Körösi, as the equivalent of "vital statistics" or "demography."

† In the discussion to follow the word "families" is understood to mean "natural families."

considerations which lead to family formation may be called *centripetal* forces.

The source of information on the formation and re-formation of family units is the return to offices of registration made by persons authorized to perform marriages. The central repository of these facts in a State such as Massachusetts is the office of the Registrar of Vital Statistics. In some States, this official is attached to the Department of the Secretary of State and in others to the Department of Health.

The tendency toward the formation and re-formation of family units is measured by the "marriage-rate," i. e., the number of marriages, or of persons married, in a specified class of population per 1,000 of mid-year estimated population in that class. When all marriages are related to the total population, the resulting rates are known as "crude" rates; when the facts are shown for marriages of persons within particular sex and age classes per 1,000 persons of those classes, the rates are called "specific" marriage rates. The ratio "persons married per unit of population" is in more general use than the ratio "number of marriages per unit of population" in reports on marriage statistics.

Development of the observational* data on the formation of family units proceeds first by the classing of marriages according to the civil status of the contracting parties: the marriages of bachelors and spinsters, bachelors and widowed or divorced women, widowers or divorced men with spinsters, widowed or divorced women. Classification is to be shown also for the first, second, etc., remarriages of widowers or divorced men, respectively. Each of the classes may be divided according to age of the one party in relation to age of the other. The tabulations provide a reasonable spread of the data for use in compiling additional analytical tables of specific rates. In Massachusetts, an attempt has been made to tabulate marriage statistics in detail. The facts are available for each calendar year by age and sex for marriages of persons in each of the chief civil or marital condition classes.

* Further reference to family statistics in the present paper will relate to the display of empirical data, that is, crude *descriptive* facts in the first category of knowledge, and to the terminology of elementary statistical processes which lead by induction to the statement of social laws. *Analytic* processes, the graduation and testing of data, and the deductive derivation of social knowledge from valid hypotheses, must be left for an additional and later paper.

STATISTICS OF MARRIAGE AND RE-MARRIAGE FUNDAMENTAL IN WORKMEN'S COMPENSATION PRACTICE.

Compensation statisticians could compute from these and from the Federal and State Census data, remarriage tables for widows, for instance, which would probably be more suitable for valuation of death benefits than the Dutch Survivorship Annuitants' Fund tables now in use. Comparison of these latter tables with some data from the Massachusetts statistics for 1910, and the actual experience of at least one State under its workmen's compensation act, seem to indicate the need for a table drawn from American registration sources. Tables of the probability of marriage, according to marital condition and age, should be made available for American Commonwealths which support satisfactory systems of registration. Auxiliary statistical facts on marriage as influenced by race or color, religious confession and blood relationship are at present anticipations, but should be provided for in plans of analysis. Important phases of the marriage question, especially in relation to insurance aspects of the probability of issue (in health and maternity insurance), are still in the stage of forensics because of the lack of these data. In fact, we may expect important symposia to follow the publication of such statistics in much the same way that the excellent collection of papers in the *American Journal of Sociology,* March, 1909, was precipitated by the Census Bureau's issue of marriage and divorce statistics in that year. This symposium, contributed by Drs. Rubinow, Zueblin, Talbot and Chapin, should be read by every student of matters relating to the American workman's family and its status and destiny.

2. DISINTEGRATION OF FAMILY UNITS.

The effect of centrifugal forces acting upon the family may now be discussed. Death is the chief proximate cause of family disintegration. Notwithstanding more than forty years of workmen's life insurance in England, no really worthwhile data have ever been published on the social values destroyed by death of the married wage earner. Industrial life insurance, fraternal insurance, workmen's compensation, establishment funds—all are based largely upon the need for meeting the economic emergency created by the death or disability of the wage earner.

Death as a Factor in Family Disintegration.

The American sources of information on the severance of the family by death are meagre, likewise the facts on the family damage produced by acute or chronic illness and by accident. Requirements under the latter head are being shaped up at present by a group of American social workers. They have at least progressed to the point of trying to develop a nomenclature of social disabilities of the family, and in this nomenclature they have recognized the place of sickness, accident and injury, and death. In the lack of the facts, however, it is not surprising to find a wide variety of vague legislative remedies offered each year, so many of which hold about the same relation to the real nature of the problem of family disintegration and impairment, as the quack patent medicine does to the diagnostic and therapeutic skill of the well-grounded physician. The gathering of the facts on this phase of family welfare should be the immediate concern of every member of our Society interested in founding an American programme of workmen's insurance on the basis of knowledge, and not presumption, of American family facts.

The requirements for a study in the next Census year of family disintegration are elementary and have been met in foreign countries most admirably, notably in Switzerland and in Australasia. These are:

(*a*) Tabulation of deaths in selected areas (if cost restrictions are imperative) by marital condition, sex and age in addition to the classifications of the population in similar groups. "Registration Area" figures for the United States are at present not shown for sex and age by conjugal classes with respect to chief causes of death. Without this latter item, how shall we determine the damage to family life set up by tuberculosis, that "captain of the hosts of death" among workmen? Or by other diseases and conditions such as heart affections, preventable infectious diseases, and accidents? The only available studies of recent American data on the severance of family ties by death is to be found in the New York State Department of Health report for 1912—a paper by Professor Walter F. Willcox.*

(*b*) Tabulation of (1) the number of live-born issue and (2) the number of such issue living at the time of death of married, widowed and divorced persons of each sex, according to (3) dura-

* Willcox, Walter F., Special Report on Vital Statistics, p. 237.

tion of marriage. This second requirement cannot be met until official death certificates at present in use are revised to include these three simple questions under the head of "personal and statistical particulars." A proposal has been made to the group of registrars represented in the American Public Health Association, Section on Vital Statistics, to have this change effected. Our interest in this matter of having supplied the necessary data for our social studies rests entirely with the registrars of our Departments of Health. It is hoped that they will meet the social statisticians fraternally by giving the proposal the most serious consideration, thus to show their appreciation of one of our vital needs. The lack of social data of this type is really conspicuous.*

Divorce as a Minor Factor in Family Disintegration.

Divorce and separation is the second and less important cause of family disintegration. A large amount of discussion of the divorce problem is available for study, especially the productions which followed the first Department of Labor report and the second Census Bureau report on marriage and divorce in the United States. In fact, students who have in mind the full significance of the whole problem of broken families, whether by death or by divorce or separation, are inclined to think that there has been too much moralizing, too much emphasis upon the divorce phase of family disintegration and a positive neglect of inquiry into the larger breach in family relations caused by preventable mortality. In Massachusetts, during the year 1910 for every divorced woman there were 24 widows, and for every divorced man, 13 widowers.

In the United States, divorces are recorded mostly in county offices. These records are by no means uniform between states. The basic facts usually available are as follows:

1. The degree of suspension of the marriage relationship through judicial decree, i. e., whether absolute divorce, "divorce *a vinculo matrimonii*"—from the bond of matrimony; or separation, limited divorce, "*a mensa et thoro*"—from bed and board, the parties retaining the legal status of married persons. Description of modes of granting divorces (1) by legislative enactment, (2) by judicial decree or (3) by automatic operation of law, would be superfluous in the present paper. Nor would it be desirable to bring into dis-

* See "Family Statistics from Registration Sources." *Amer. Journal of Public Health*, December, 1918.

cussion the social ethics of marriage and divorce. The descriptive data of divorced persons necessary for statistical study are: marital status of divorced parties before marriage, duration of marriage, number of live-born issue and number of such issue living at time of divorce, color or race, age, occupation, religious confession of both parties, alleged "cause" for divorce and whether divorce is granted upon demand of either huband or wife.

Empirical probabilities of the fracture of family relations enter into all well-considered actuarial plans for computing the probable costs of benefits which vary as between unmarried wage earners, married men without issue, and married men with issue. Tabulation procedure for divorces may follow the same plans outlined for marriages. The statistics of marriage and divorce as briefly outlined above, merit thorough study by the casualty and social insurance statistician and actuary, because they illuminate some basic issues in insurance science.

3. Functioning of the Family.

Veritable storms of discussion have arisen over questions of the functioning of the family. Of the one type, dignified scholarly essays planned with sincerity and purpose, there are the utterances of the French, American and British students and ethicists. Farther down the scale in point of scholarship, there are the publications of ardent birth-controllers. The prime function of the family is the reproduction and nurture of the human species; in a secondary way, the sacrifices and hardships entailed by marriage and the obligations of family are a powerful cultural and selective force. They insure the persistence of ethical characters in rugged individuals who take upon themselves this primary form of human association, and virtually guarantee the elimination from the race stream of some of the ethically unfit, by means of the "defense reaction" of individual selfishness engendered in the latter individuals by the prospect of sacrifice. The social statistician in quest of the facts which affect insurance questions must detach himself from attractive controversy, however, and patiently continue to assemble data, using the methods of both static and dynamic demology. In order to thread our way through the mazes of the statistical side of the problem, and primarily to serve insurance science, let us take up the two sources of data, considering first, the contributions of static demology.

3*a*. Static Demology in the Study of Family Function.

Census enumerations are the sources of these facts.*

A few preliminary definitions are in order. The capacity to bear offspring is termed "fertility"; incapacity to reproduce is called "sterility." Fecundity is the degree of fertility; a childless marriage is said to be "non-fecund," whether or not the capacity to bear exists. Non-fecund unions are not necessarily sterile. Statistics of non-fecundity include the physiologically sterile as well as what may be designated, for present purposes, artificially or voluntarily sterile unions.

The tabulation of census, or static demologic, data on fecundity is a complex operation, because of the number of variables involved and the wide limits of such variations. There are four principal elements, three of which are independent variables and one a dependent variable. The independent variables are:

(1) Age of the wife at marriage.
(2) Age of the husband at marriage.
(3) Duration of marriage.

The dependent variable is (4) the number of children live-born to the marriage, considered according to (*a*) number of children live-born to the marriage and (*b*) number of such children living on the censal day. Other complicating factors of some importance are the differential mortality of parents of small, moderate and large families, the prevailing ratio of true physiological sterility,† the probability of issue at ages under 15 and over 45 years (the age division 15 to 44 years is usually chosen as the period of childbearing in fertility and fecundity studies), and various census enumeration difficulties. Mortality among parents of small families is said to be higher than among parents of large families,‡ the ratio of physiological sterility is unknown, and the probability of issue at ages outside the usual "childbearing period," 15 to 44 years, nearly so.

* Discussion of this section will conflict slightly with the treatment of section 4 of our classes of family statistics, but this is immaterial.

† Brownlee, John, "Germinal Vitality," *Proceedings of Royal Phil. Society*, Glasgow, April, 1908.

‡ Snow, E. C., "Note on a Possible Source of Fallacy in the Interpretation of the Census Figures Relating to the Fertility of Marriages," *Journal of the Royal Statistical Society*, February, 1914, p. 313.

A first approach to what promises to be a maze of tabular practice is to establish two groups or classes of enumerated, tabulatable marriages (1) those of *continuing fertility,* i. e., still within the ages of childbearing on the census day and (2) those of *completed fertility,* where the wife has attained age 45 on the censal day. This classification is arbitrary, indeed, but is necessary in the interests of direct contact with the chief facts of family function.

Census schedules give the information on the number of children live-born to the wife, or to a widowed or divorced woman, whether born of the present or of any former marriage, and also the number of such children living on the censal day, whether then residing with the mother or elsewhere. Age of the wife or husband at marriage is computed by subtracting the reported duration of the marriage from age of the parties on the day of census enumeration. Using recent Scottish experience as a basis, perhaps 10 per cent. of the total replies for families may be excluded from the tabulation on account of palpable defects in enumeration.

Statistics of Completed Families.

With due allowance for minor qualifying influences, the facts on the structure and characteristics of completed families, compared from one censal point to another, provide one, and perhaps the best, statement of the trend of fecundity in a national group or in one subordinate thereto. The data may be arranged to show (1) the number and percentage of families having had 0, 1, 2, 3, etc., children; (2) the number of children who were first-born, second-born, third-born, etc., among (*a*) marriages of completed fertility, compared with (*b*) all tabulatable marriages on the censal days; (3) the average size of completed family according to (*a*) age of wife at marriage and (*b*) age of husband at marriage; (4) for each year of age at marriage of husband show the average size of completed family according to age of wife at marriage; (5) for each year of age of wife at marriage show the number and percentage of completed families which were (*a*) fecund and (*b*) non-fecund. These suggestions relate only to the main tables on completed families. Given the primary enumeration of the facts on the census schedules other tables leading to data on the probability of issue, and of non-issue, on the decline in fecundity according to calendar year in which the marriage occurred, on the number and percentage of children surviving out of a given number born (classed according

to occupation of parents, employment or non-employment of the mother, age of the parents at marriage, etc.), the interval between marriage and the first birth, etc., are possible. In the graduation of these data involving so many variables, there are rich opportunities for the application of the theory of skew correlation, especially the development of methods at present imperfectly understood, of computing multiple correlations from non-linear regressions.

Study of family function in statistical sources of census origin are possible to a limited extent when no enumeration is made of the number of children born to and living in families. A ratio is sometimes computed by dividing the number of children less than five years of age on the censal day into the number of (*a*) women aged 15 to 44 years and (*b*) married women 15 to 44 years of age. This ratio for several censal points, classed according to subgroups of population, i. e., the native-born, the foreign born, the negro population, etc., has been used* in discussions of family function to show the trend of fecundity for such population groups. Obviously this ratio is very seriously affected by the prevailing birth rates, the death rates of both children and adults, the average ages at marriage, and by the masculinity and marriageability of populations at the adult ages, etc.

3*b*. Dynamic Demology in the Study of Family Function.

Sources of information under this heading are the data recorded, or which may possibly be recorded, by American registrars of vital statistics. The potential record sources are the certificates of birth, death, marriage and divorce. Certain facts on family function—the rate of birth, of infant deaths, of still-birth, of child mortality, and of the survival of children to the ages of maturity, self support and marriage—are accessible more or less from published statistics. Other facts on family function—the size of families of women, the births of whose children are registered, and the size of families of men and women whose deaths are registered—are unfortunately not now recorded upon the American registrars' forms.† This defi-

* Willcox, Walter F., "The Nature and Significance of the Changes in the Birth and Death Rates in Recent Years," Quarterly Publications of the American Statistical Association, Vol. XV.

Baines, J. Athelstane, "The Recent Trend of Population in England and Wales," *Journal of the Royal Statistical Society*, July, 1916, p. 399.

† A record of this kind would have been invaluable during the recent

ciency was pointed out in a preceding section of this paper on family disintegration. Let us consider the classes of statistics which are available in dynamic demology.

Birth Statistics.

The record of birth, completed by the attending physician or midwife, is required to be reported within a specified period after birth, to the registrar of vital statistics, who in some Commonwealths is the representative of the health authorities, and in others, the local representative of the Secretary of State. Registration laws of recent enactment have designated the office of the State Board of Health as the final repository for these records; registration laws of long standing as in Massachusetts, and Michigan, specify the office of the Secretary of State. The chief difficulty in birth statistics is to secure even fairly complete registration. In some cities, New York, for instance, where the enforcement of the law is effective, registration of births is practically complete. In by far the largest proportion of cities, however, registration of births is far from reasonably satisfactory. Granted complete registration we may consider the following elements of birth statistics.

Births may be classed as (*a*) nuptial (legitimate) and (*b*) extra-nuptial (illegitimate). "Nuptial" births are related to the number of married women in a population, sometimes to the number of married women 15 to 44 years of age, to obtain "specific" birth rates. A further development is to relate the number of nuptial births to married women within narrower age groups (20 to 24 years, 25 to 29 years, etc.). Extra-nuptial births are classed against the total number of single (never married), widowed and divorced women. Rates for this class of births may be displayed specifically according to the ages of the mothers in relation to the corresponding age classes of single, widowed and divorced women combined. For certain purposes, all births regardless of whether the birth occurred in or out of wedlock are related (*a*) to the total population at all ages, (*b*) to the total of women aged 15 years or more, or to the total number of women in specific age classes.

Birth statistics are of practical interest to the insurance statis-

pandemic of influenza in tracing the children made fatherless or motherless, or both, as a result of fatalities ensuing from the disease. Instead, a house-to-house canvass was necessary in some cities.

tician because of the opportunity they present for computing an "exposed to risk" or estimated population at the ages under five years for life table purposes. The numbers of deaths at these single ages in successive calendar years are used, of course, for this purpose in conjunction with birth statistics. (The census enumeration of the child population at ages under five years is notoriously defective, and the insurance statistician and actuary who would understand the observational base of the life table child ages should be acquainted with the elements of birth statistics and their proper handling.)

By subtracting the crude death rate from the crude birth rate in a given calendar year, the *natural increase* of population per unit of that population (usually, per 1,000) may be computed. This latter ratio is the intimate concern of the statesman and publicist because it indicates the extent to which a population makes headway against the forces which oppose its numerical growth.

From the standpoint of social statistics, and the theory of social populations, this ratio of "natural increase" is significant. The student of sociology and of social statistics in classing populations, differentiates three primary orders: vitality classes, personality classes and social classes. Other classes, the product of advanced social evolution—political, industrial and economic are of secondary importance. The student of social statistics must be careful to identify classes of the social population in the genetic order in which differentiations appear.

Vitality classes are the first in order of development from the fact of human association. A high vitality class of population has a high birth rate and a low death rate. Medium vitality classes have a low birth rate and a low death rate; low vitality classes have a low birth rate and a high death rate.

We have seen how birth statistics lead to data on one phase of family function—the replenishment of population.

Another function of the family rarely referred to in social statistical literature is the safeguarding and nurture of the life committed to its care by the fact of birth, and the rearing of children to resistant, independent manhood and womanhood and to efficient citizenship. An admirable study recently completed in England* is worthy of attention. The interest of the casualty and social in-

*"The Mortalities of Birth, Infancy and Childhood," by Medical Research Committee, National Health Insurance, London, 1917.

surance statistician and actuary in these matters is fixed by the bearing of these data upon problems of maternity and family insurance.

Statistics of Infant and Child Mortality in the Study of Family Function.

The attack upon normal life of the family by improper inheritance and adverse environment and by the teeming world of bacterial life, must be considered in classes or stages. The usual studies of "infant mortality" are devoid of much meaning because of this failure to indicate the separate factors whose composite effect is the total death rate of very young children. Even in the present uncertain state of our knowledge of the facts of normal physiological progression, we may identify two radically different groups of causes of infant mortality—(*a*) those "developmental" factors characteristic of the ante-natal period and of the period immediately following birth and (*b*) the environmental factors such as infection, nutrition, housing and atmospheric conditions which begin to be felt practically at the end of the first month of post-natal life and continue up to the end of the first year, and thereafter. In other words the curve of the total mortality of infants under one year of age is compounded of two curves, each of which is in turn a compound of curves of diseases variably typical of these two periods.

Under the first period of "birth mortality," we may consider the diseases which are registered as "premature birth," "congenital malformations" and "atrophy, debility and marasmus" and others associated immediately with the crisis of birth; and under the second period or stage, true infantile environmental mortality, beginning in force approximately at the end of the first month of life, the infections such as whooping cough, measles, scarlet fever and tuberculosis, and the nutritional diseases. Study of infant mortality with the subject of maternity insurance in mind should be made with these distinctions fully in view. A proper base for computing "annual" calendar year mortality in the first year of life is the average of the number of births registered for that and the preceding calendar year. In the succeeding years of childhood up to five the base should be the number of survivors into a given age in that calendar year of the "average" births of one, two, three and four prior calendar years. After five years of age the

graduated "initial" censal population for each year of age will be found to be a fairly satisfactory base. Continuation of this process of computing q_x's up to the average age at marriage, and the reduction of an initial radix or cohort of, say, 100,000 at age 0 by these q_x values, will give the proportion of the population entering a generation who reach the age of reproducing that generation. We have thus a measure of the relative effectiveness of the family in its nurture of the life committed to its care by the processes of nature. The actuary's life table becomes the "statement of account" of social stewardship for the families of a given generation. Repetition of this measure of family function from one censal point to another will show the net effect upon the capacity of the family to perform its natural functions, of the factors of natality, fertility and mortality.

Registration Sources on the Size of the Family in the Study of Family Function.

Before dropping the discussion of dynamic demologic data, we may consider the possible uses of facts on the size of families registered on certificates of birth and death. In Switzerland and in Australasia, notably, the bill of personal and statistical particulars on birth and death certificates requires the registration of (*a*) the number of live-born issue and (*b*) the number of such issue living at the time of registry of the death of married, widowed or divorced persons and upon registry of a birth to a married, widowed or divorced woman. Discarding for the moment the question of differential mortality between parents of large, medium and small families, these registrations of size of family serve as random samples of the population living in the registration year. The data may be assembled and studied in precisely the same manner as outlined for census enumerations of families.

In a censal year where the living population is enumerated according to size of completed and continuing fertility family classes, the registered mortality data of similar kind may be used to show the comparative death rates of the several "size of family" classes, qualified according to age, race-stock or other demologic groups.

Data on the size of families of deceased married men serve as a base for estimating the need for widows' or mothers' pensions and other forms of insurance protecting children. From that standpoint alone, the casualty and social insurance statistician and actuary is concerned with the registration facts for families.

4. STRUCTURE AND COMPOSITION OF SOCIETY IN SOCIAL UNITS OF THE FAMILY AT POINTS IN TIME. HISTORY OF THE FAMILY.

Conclusions on the status and history of the family, and the bearing of these conclusions upon the fundamentals of casualty and social insurance, may be made by two methods: the comparative and the historical—granted the existence of suitable descriptive data and analytic processes. "Each method," to quote Giddings, "consists of the recognition of coherences among the observed phenomena, combined with an inference that phenomena that persist together, or that change together, are cause and effect, or are effects of a common cause. The comparative method is an observation of identical coherences of social phenomena in two or more places, or in two or more populations. . . . The historical method is an observation of coherences through periods of time." The subject-matter, registration sources and descriptive methods of our first three classes of family statistics in their social bearings, may thus be incorporated into general social statistics which support a practical sociology based upon methods of scientific inquiry.

Is it not pertinent that we ask ourselves at this point, whether insurance science of the future will be based primarily upon the facts of human *association,* and less, as in the present and past, upon facts of mere *aggregation*? With respect to certain insurable incidents, are we legislating socially, and statistifying, without a proper foundation of sound social fact?

Comparison of Actual and Expected Losses as a Means of Loss Analysis.

BY

ALBERT H. MOWBRAY.

Since life insurance practice has long been based upon established mortality tables, it is natural that there should have grown up the practice of comparison from time to time of actual mortality with tabular expected. And the habit of making such comparisons having been fixed, it is no occasion for surprise to find the actuary using the principle for many purposes for which it at first seems in no wise adapted, for example, the construction and graduation of mortality tables based upon limited data by such comparison with a standard table and graduation of the ratio of actual to expected.

The practice of comparing actual and expected occurrences or losses is not unknown to the casualty business. In 1914 Mr. J. H. Woodward caused not a little commotion by discovering through such a comparison the unconscious loading introduced by underwriting judgment into the first New York compensation rates. Since that time the test has been made with respect to the basic pure premiums at each revision of the manual. More recently, in the revision of the Pennsylvania manual, the partial differentials between New York, Massachusetts and Pennsylvania were found by taking the sectional pure premiums from the experience of one state, applying them to the payroll exposures in the other and comparing actual and expected losses over a range of classifications, and then reversing the process to avoid error from magnification of eccentricities which arose when one state had a large exposure in one classification and the other a very small one with an apparently erratic loss. The two approximations gave an excellent basis for a final judgment on the problem.

Probably because we have no set tables as in life insurance and are afraid of being misled by erratic indications which may be lost sight of in the mass, we do not in casualty insurance frequently make use of such a comparison, and I think we are losing a great

deal thereby. It is true we must always take precautions, as was done in the Pennsylvania work, against being misled; but if we do not use the method blindly and have a sufficient volume of data, we may expect erratic indications to offset each other and very useful conclusions to be pointed out to us. I believe that a number of troublesome, apparently almost hopeless problems, in casualty insurance may be very successfully attacked in this way, such as the proper credit or charge for certain types of items in the schedule rating plans in compensation insurance, the proper charge for certain benefit conditions in personal accident and health insurance, or the reduction in compensatable disability from more extended medical treatment.

I have recently used the method to secure a very satisfactory solution of a problem of the latter nature which at first sight seemed hopeless. The problem itself is not a practical one for us from the rate-making point of view, although the result obtained may assist us in determining reserves for individual accidents. It has, however, a general interest for us all as a phase of the problem of industrial accidents. I am, therefore, giving a brief account of the investigation both on this account and to call attention to the applicability of the method above referred to. The problem was to determine the average increase in disability from accidental injury which occurs when infection is present. This was for an address on the subject before a safety congress.

My solution of this problem was made possible by the extensive tables published by the Industrial Insurance Department of the State of Washington, particularly those in the fifth and sixth annual reports, for the years ending, respectively, September 30, 1916, and September 30, 1917. Washington statistics are unusually complete in many ways. It is the practice in that jurisdiction to study statistically not the cases which arise during a given period but the cases which are closed ("finaled") during that period. Under this system much more is known about the cases which are studied than where the statistical data is tabulated with respects to the accidents occurring during the calendar period. There are some disadvantages to this system which will occur to all members of the Society, and this is particularly true during the early years of the institution making the tabulations. After the lapse of a sufficient time, however, to enable matters to get on a stable basis, this basis of study seems for many purposes to be much the better.

Among other tables contained in the Washington report are a series of tables dealing with the more common types of injuries, wherein are tabulated the number of such injuries according to the several parts of the body affected, the number of days' time lost, and the average number of days per case, together with the amount of compensation awarded for lost time and the number of awards and amount of compensation awarded for permanent partial disability cases. In this connection it should be borne in mind that there is no waiting period under the Washington Act, and, therefore, compensation is awarded from the date of injury. The following types of injuries are so studied: Bruises, cuts, punctures, dislocations, sprains, amputations, fractures, scalds and burns, and infections, and there is a further table designated as unclassified. In addition, there is a table entitled "Causes of Infection," in which the cases are tabulated according to the part of body affected and the primary injury. A comparison of this latter table with the tabulated data preceding indicates that the infected cases are not tabulated in the earlier tables, but that the earlier tables deal solely with uninfected cases. The two tables relating to infections and the causes of infections in the sixth annual report are reproduced in the appendix to this paper. The tables in the fifth report are similar.

Since we have tabulated, for example, the number of cases where the injury was a bruise of the foot and where infection had not occurred, together with the time lost on such cases and the amount paid for permanent partial disability, we are able to determine an average period of disability corresponding to such injury, and then, having the number of foot bruises which became infected, we are able to determine what the total disability on account of such cases would probably have been had they not become infected. The tables we have do not enable us to compare this directly with the loss for similar injuries where infection took place. We can, however, make the comparison with respect to all injuries to certain members of the body or with respect to all cases. It would appear entirely reasonable to assume that the excess of the actual over the expected is to be attributed to the presence of infection.

Two points in connection with this proposed method require some further discussion. The first is as to permanent partial disability cases, how they should be brought in. The Washington Law provides, among other things:

"For any permanent partial disability resulting from an injury, the workman shall receive compensation in a lump sum in an amount equal to the extent of the injury, to be decided in the first instance by the department, but not in any case to exceed the sum of fifteen hundred dollars. The loss of one major arm at or above the elbow shall be deemed the maximum permanent partial disability. Compensation for any other permanent partial disability shall be in the proportion which the extent of such disability shall bear to the said maximum."

Acting upon this provision, the Washington Commission has adopted a scale of benefits for each type of permanent disability, basing this scale upon a study of the scale of benefits in the acts of various other states and countries and the U. S. Pension Board. This scale of awards is expressed in dollars. A comparison of the lost time in the temporary cases with the amount of the time awards discloses that the compensation runs very close to $1.35 per day. In the study I have made, therefore, I have reduced the partial permanent disability awards into terms of "days' lost time" by taking three fourths of the amount of such award as the corresponding number of "days' lost time" and adding this amount to the actual days' lost time on temporary cases. Of course, the correctness of this process depends upon the correctness of the scale used by the Washington Commission, and if the scale is considered badly out of line, then to make a more correct study it would be necessary to obtain, by correspondence with the Commission, further particulars regarding these awards and evaluate them in accordance with our judgment of a better scale and the facts in each case. For the purposes in hand this did not seem necessary.

The second point requiring consideration arises from the fact that there were not a sufficient number of certain types of injuries to clearly indicate the average duration of disability when no infection was present, so that the expected loss in a particular type of injury to some member might be based upon an average that was very much too high or very much too low. In view of the number of divisions of the data, the fact that there was no reason to expect an error continuously on one side, and the large number of cases entering into the total, it seems a reasonable assumption that the errors will balance each other and that the average expected so brought out will not be far from the true expected loss from such injuries where no infection takes place. I have the greater confidence in this conclusion in view of the fact, as noted

below, that the studies based upon the data in the fifth report and sixth report quite closely agree in the final result.

The tables referred to above do not include fatal cases, but the fatal cases are elsewhere discussed in the report. The one difficulty, however, with the treatment of fatal cases in the report is that sufficient particulars are not given from which to forecast what the results would have been but for the intervention of infection. From our general knowledge of the nature of infections it seems reasonable to assume that the cases would not otherwise have been fatalities, and it is perhaps not unreasonable to assume they would have been cases of temporary disability of average duration. Following the treatment of permanent partial cases, it may be proper to assign a weight equal to 3,000 days to a fatal case ($4,000) in getting the actual losses and the average duration of all non-fatal cases for determining the expected losses with which these are to be compared. If this is done, the comparison method furnishes a very neat solution of the problem.

The results of this investigation are shown in the following table:

	Data from Fifth Report. Closed Cases, Oct. 1, 1915, to Sept. 30, 1916.			Data from Sixth Report. Closed Cases, Oct. 1, 1916 to Sept. 30, 1917.		
	Actual Time Lost.	Expected.	Ratio Actual to Expected, Per Cent.	Actual Time Lost.	Expected.	Ratio Actual to Expected, Per Cent.
All non-fatal.....	38,566	20,801	185.4	37,431	26,020	143.1
Infection fatalities ...	15,000	232	6,465.5	33,000	546	6,044.0
Total infected cases ..	53,000	21,033	254.7	70,431	26,566	264.4

From this it seems a reasonable conclusion that, allowing for possible fatal consequences, the average disability cost in infection cases is approximately two and one-half times that in uninfected cases.

At first sight it might appear that so much work was not necessary and that results approximately the same would have been obtained had I merely compared the average duration of disability in uninfected cases with the average duration in infected cases. Such a comparison for non-fatal cases gives the following results:

	Date from Fifth Report.	Date from Sixth Report.
Average duration all uninfected injuries.	47.24 days*	51.06 days*
Average duration infected injuries.....	37.48 days*	30.86 days*
Ratio average duration infected to uninfected cases.....	79.3 per cent.	60.4 per cent.
Corresponding ratio of actual to expected in infected cases.....	185.4 per cent.	143.1 per cent.

* Including adjustment for partial permanent disability.

This anomalous result shows the falsity of such reasoning and the need of such careful methods of comparison as I have suggested. It is explained by the more severe character of the basic injuries on the average for the uninfected group. The very severe injuries are usually under such medical care that infection does not often occur. It is the self-cared-for slight puncture that is the most likely to become infected.

It was at first my intention to separately study hand injuries, among which there were a large number of infected cases in the Washington experience, but as the contingency of fatal consequences is so important in connection with infections and the report did not give sufficient data with respect to them, this was impossible.

APPENDIX.

EXTRACT FROM

SIXTH ANNUAL REPORT, INDUSTRIAL INSURANCE DEPARTMENT, STATE OF WASHINGTON.
—INFECTIONS.

Members.	Number.	Days Time Loss.	Average.	Award Time Loss.	Average Award.	Permanent Partial Disability.		Total Awards.
						No. Awards.	Amount Awards.	
Foot	56	1,058	18.8	$1,432.80	$25.58	2	$1,200.00	$2,632.80
First toe	11	162	14.7	221.40	20.13	..	.....	221.40
One other toe	3	162	54.	227.80	75.93	..	.....	227.80
Two toes	1	31	31.	35.75	35.75	..	.....	35.75
Leg	58	3,414	58.8	4,572.25	78.83	4	1,075.00	5,647.25
Thigh	7	340	48.5	355.35	50.76	1	550.00	905.35
Ankle	8	282	35.00	362.95	45.37	..	.....	362.95
Knee	38	1,113	29.2	1,594.00	41.94	1	25.00	1,619.00
Hip	1	274	274.	270.75	270.75	1	750.00	1,020.75
Hand	341	5,286	15.5	7,567.94	22.19	9	2.412.50	9,980.44
Thumb	121	2,387	19.7	3,235.55	26.74	11	2,211.25	5,446.80
First finger	155	2,512	16.2	3,622.60	23.37	12	1,765.00	5,387.60
Second finger	135	2,431	18.	3,087.25	22.86	19	1,800.00	4,887.25
Third finger	69	1,082	15.6	1,577.75	22.86	4	425.00	2,002.75
Fourth finger	57	1,153	20.2	1,569.05	27.52	6	375.00	1,944.05
First and second fingers	4	99	25.	152.00	28.00	2	325.00	477.00
2nd and 3rd fingers	4	29	7.	38.05	9.51	..	.....	38.05
3rd and 4th fingers	8	160	20.	212.55	26.57	1	187.50	400.05
Four fingers	2	63	31.5	66.70	33.35	1	200.00	266.70
Thumb and one finger	5	137	27.4	226.30	45.26	1	262.50	488.80
Thumb and two fingers	1	28	28.	56.55	56.55	..	.....	56.55
Wrist	33	726	22.	1,020.50	30.92	1	300.00	1,320.50
Forearm	19	363	19.	506.95	26.68	..	.....	506.95
Elbow	6	250	41.6	323.75	53.96	..	.....	323.75
Arm	7	95	13.3	132.05	18.86	..	.....	132.05
Shoulder	1	6	6.	12.10	12.10	..	.....	12.10
Neck	1	13	13.	26.25	26.25	..	.....	26.25
Back	2	83	42.	95.75	47.87	..	.....	95.75
Buttock	1	40	40.	46.15	46.15	..	.....	46.15
Groin	1	22	22.	44.40	44.40	..	.....	44.40
Head	3	45	15.	80.50	26.83	..	.....	80.50
Scalp	1	9	9.	10.40	10.40	..	.....	10.40
Face	6	111	18.5	158.55	26.42	..	.....	158.55
Nose	1	3	3.	4.05	4.05	..	.....	4.05
Forehead	1	7	7.	10.10	10.10	1	150.00	160.10
Eye	43	619	14.4	874.50	20.33	6	2,675.00	3,549.50
Ear	1	19	19.	39.35	39.35	1	125.00	164.35
Multiple members	1	7	7.	8.65	8.65	..	.....	8.65
Totals	1,213	24,621	20.2	$33,879.34	$27.93	84	$16,813.75	$50,693.09

EXTRACT FROM

SIXTH ANNUAL REPORT, INDUSTRIAL INSURANCE DEPARTMENT, STATE OF WASHINGTON.
—CAUSES OF INFECTIONS.

Members.	No. of Bruises.	No. of Cuts.	No. of Punctures.	No. of Dislocations.	No. of Fractures.	No. of Amputations.	No. of Scalds and Burns.	No. of Poisons, Oak, etc.	Foreign Substance.	Total Number of Injuries.
Foot	19	10	24	..	..	..	3	..	..	56
First toe	7	1	3	..	..	..	..	..	..	11
One other toe	2	1	..	..	..	..	..	..	..	3
Two toes	1	..	..	..	..	..	..	..	..	1
Leg	27	17	2	..	4	..	8	..	..	58
Thigh	2	1	3	..	1	..	..	..	..	7
Ankle	5	1	..	..	..	..	2	..	..	8
Knee	13	15	9	..	..	..	1	..	..	38
Hip	..	..	..	1	..	..	..	..	..	1
Hand	75	86	172	..	1	..	4	3	..	341
Thumb	32	28	58	..	..	..	3	..	..	121
First finger	28	51	71	..	..	1	4	..	..	155
Second finger	25	30	71	..	1	..	7	1	..	135
Third finger	17	10	42	..	..	..	..	..	..	69
Fourth finger	12	17	26	..	..	1	1	..	..	57
1st and 2nd fingers	1	2	..	..	..	..	1	..	..	4
2nd and 3rd fingers	1	1	2	..	..	..	..	..	..	4
3rd and 4th fingers	2	5	1	..	..	..	..	..	..	8
Four fingers	..	1	1	..	..	..	..	..	..	2
Thumb & 1 finger	1	3	1	..	..	..	..	..	..	5
Thumb & 2 fingers	1	..	..	..	..	..	..	..	..	1
Wrist	8	7	17	..	..	..	1	..	..	33
Forearm	1	8	5	..	..	..	4	1	..	19
Elbow	5	1	..	..	..	..	..	..	..	6
Arm	2	2	2	..	..	..	1	..	..	7
Shoulder	1	..	..	..	..	..	..	..	..	1
Neck	1	..	..	..	..	..	..	..	..	1
Back	1	..	1	..	..	..	..	..	..	2
Buttock	1	..	..	..	..	..	..	..	..	1
Groin	..	..	1	..	..	..	..	..	..	1
Head	..	3	..	..	..	..	..	..	..	3
Scalp	1	..	..	..	..	..	..	..	..	1
Face	1	3	..	..	..	..	2	..	..	6
Nose	1	..	..	..	..	..	..	..	..	1
Forehead	..	1	..	..	..	..	..	..	..	1
Eye	6	4	..	..	..	..	..	..	33	43
Ear	..	..	..	..	..	..	1	..	..	1
Multiple members	..	..	..	..	..	..	..	1	..	1
Totals	300	309	512	1	7	2	43	6	33	1,213

LEGAL NOTES.

BY

RICHARD FONDILLER.

(OF THE NEW YORK BAR.)

ACCIDENT AND HEALTH.

DROWNING—PROXIMATE CAUSE OF DEATH:—(Kinsey *vs.* Pacific Mutual Life Ins. Co., Supreme Court of California, 172 Pac. Rep. 1098.) The insured, who had an accident policy in the defendant company, was accidentally drowned while bathing, according to the claim of the beneficiary (plaintiff). The defence was that there was a breach of warranty in that the insured made a warranty that he was in sound physical condition, whereas he had heart disease at and prior to the issuance of the policy. A trial was had by jury, which rendered a judgment in favor of the plaintiff.

Upon appeal, the judgment was affirmed. The following extracts from the opinion are instructive:

"The court told the jury that, if they found that Edward W. Kinsey was drowned as the result of an accident, it was immaterial for the purpose of the case how he came to drown, provided it found that such drowning was the proximate result of accident. The ultimate fact was that he was drowned as the result of accident. The nature of the accident which caused him to drown was immaterial, provided it constituted the proximate cause of the drowning. . . ."

"It is next claimed that the evidence was insufficient to sustain the verdict. There is no merit whatsoever in this contention. While there was expert testimony to the effect that the appearance of the body of deceased was consistent with the fact that his death might have been due to other causes such as apoplexy or heart failure, it also clearly tended to establish facts which indicated that his death was due to drowning, and the jury, whose province it was to determine the question upon such conflict of evidence, so found."

FALSE REPRESENTATIONS AND CHANGE OF OCCUPATION:—(Bucknam *vs.* Interstate Business Men's Accident Assn., Supreme Court of Iowa, 167 N. W. Rep. 594.) In his application for accident insurance, the insured stated that his occupation was as cashier in a

freight office for a railroad, that his actual duties were clerical only, and that he had no other occupation. The application was filled out and the answers written down by the defendant company's agent, who had previously been employed in the freight department of the same railroad and was well aware that the insured's duties included the inspection of freight cars in the yards. On this point, the court found for the plaintiff (beneficiary) for the reason that the knowledge of the agent was to be imputed to the company, and the insured could not be held to have made false representations under the circumstances.

Two years after the issuance of the policy, the insured left the employ of the railroad company and managed a dray business which he had purchased. While so engaged, he received accidental injuries from which he died. In affirming the judgment for the plaintiff, the court wrote:

"It seems to us that, since it appears by the undisputed evidence that deceased had changed his occupation entirely, the character of his duties as stated in the application were not connected in any way with his injury, and this change of occupation was known to the company and its agents, and because of such change of occupation the company may not now rely upon the statements in the application as to his occupation, and especially is this so if the company has waived the provisions of the policy in regard to change of occupation, accepting premiums with knowledge thereof."

"Now, as to the change of occupation, and the claimed waiver by reason of accepting premiums: Plaintiff contends that the new occupation of deceased was under the record an insurable occupation, but they say that, whether this is true or not, if the company accepted premiums with notice of the character of the new occupation, they are estopped from claiming a forfeiture. . . . It does appear that defendant's agents did know of this new occupation of deceased after he moved to Ames, which was his occupation at the time he was hurt, and that thereafter, and with such knowledge, the company accepted premiums for a considerable time, and up to the time he was hurt."

TEMPORARY CHANGE OF OCCUPATION:—(Midland Casualty Co. *vs.* Anderson, Supreme Court of Colorado, 172 Pac. Rep. 1067.) The plaintiff was the beneficiary of the deceased, who was insured under an accident policy containing the following provision:

"If the insured suffers such injury while engaged in any occupation classified by the company as more hazardous than that herein given, the amount payable shall be for such proportion of the in-

demnity herein provided as the premium paid would purchase at the rate and within the limits fixed by the company for such more hazardous occupation. The insured shall notify the company immediately in writing of any change in his occupation."

The usual occupation and that given in the application of the deceased was as a mine superintendent. While there was no work of this description, his employer had temporarily employed him for a few weeks as a timberman. The day before the accident, his temporary employment had ceased and he had arranged to resume his usual occupation after the Christmas holidays. During these holidays, and while not employed by anyone, his death was caused by a snowslide. The defendant company contended that only one-quarter of the face of the policy, in accordance with its rates for a timberman, was payable, the case herein falling within the above provision.

The court, however, did not agree with the defendant's contention, which the court stated might be applicable had the accident occurred while the deceased was a timberman. The court affirmed a judgment for the face of the policy, upon the ground that the temporary change in occupation had nothing to do with the cause of death and also that the deceased had no intention of resuming the occupation of timberman.

WHEN SUNSTROKE IS AN ACCIDENT:—(Elsey *vs.* Fidelity & Casualty Co., Supreme Court of Indiana, 120 N. E. Rep. 42.) This was a suit upon an accident insurance policy issued to the plaintiff by the defendant company. Among other conditions, the policy provided for a weekly indemnity "against bodily injury sustained through accidental means, and resulting directly and exclusively of other causes in immediate, continuous and total disability," and also that "sunstroke . . . suffered through accidental means . . . shall be deemed a body injury within the meaning of the policy." The plaintiff was on his way to work in a street car, and was about to alight therefrom when he suffered a sunstroke. Notice was promptly given of the accident, which disabled the plaintiff continuously and totally. The court below found for the defendant company.

The following dictum of the Supreme Court will doubtless be decisive in the new trial which it ordered, and is here reproduced as the law of that state:

"The purpose of accident insurance is to protect the insured against accidents that occur while he is going about his business in the usual way, without any thought of being injured or killed, and when there is no probability, in the ordinary course of events, that he will suffer injury or death. The reason men secure accident insurance is to protect them from the unforeseen, unusual, and unexpected injury that might happen to them while pursuing the usual and ordinary routine of their daily vocation, or the doing of the things that men do in the common every-day affairs of life. We are of opinion that the better reasoning points out, and the weight of authority holds the true test to be, that if in the act which precedes the injury, though an intentional act, something unusual, unforseen, and unexpected occurs, which produces the injury, it is accidental; but, if in the act which precedes the injury something usual, foreseen, and expected occurs, which produces the injury, it is not accidentally effected. We are supported in our holding by the following cases, which involve the question of whether sunstroke, suffered while engaged in the usual daily duties, is accidental: (citing cases). We are constrained to hold that the injury here in question as shown by the evidence was caused by 'accidental means' that the decision of the court is contrary to law and the evidence, and that the court erred in overruling plaintiff's motion for a new trial."

WHEN INFECTION IS THE RESULT OF ACCIDENT:—(Lewis *vs.* Ocean Accident & Guarantee Corp., Court of Appeals of New York, 120 N. E. Rep. 56.) The insured had an accident policy in the defendant company which covered "loss or disability resulting directly, independently and exclusively of all other causes from bodily injuries effected solely through accidental means." The evidence showed that the insured was an athlete, in the best of health, that he had a pimple on his lip which he punctured, through which infection was induced, and his death resulted.

The court below had affirmed the decision of the trial judge in dismissing the complaint. The Court of Appeals held that this was a case for a jury, reversed the judgment of the courts below, and granted a new trial. In again defining the nature of an accident, the court wrote in its opinion:

"We think there is testimony from which a jury might find that the pimple had been punctured by some instrument, and that the result of the puncture was an infection of the tissues. If that is what happened, there was an accident. We have held that infection resulting from the use of a hypodermic needle is caused by 'accidental means.' (Citing cases.) The same thing must be true of

infection caused by the puncture of a pimple. Unexpected consequences have resulted from an act which seemed trivial and innocent in the doing. Of itself, the scratch or the puncture was harmless. Unexpectedly it drove destructive germs beneath the skin, and thereby became lethal. To the scientist who traces the origin of disease there may seem to be no accident in all this. . . . But our point of view in fixing the meaning of this contract must not be that of the scientist. It must be that of the average man. Such a man would say that the dire result, so tragically out of proportion to its trivial cause, was something unforeseen, unexpected, extraordinary, an unlooked-for mishap, and so an accident. This test —the one that is applied in the common speech of men—is also the test to be applied by courts."

WHEN INFECTION IS AN ACCIDENT:—(Lewis *vs.* Iowa State Troveling Men's Assn., U. S. District Court, S. D. Iowa, 248 Fed. Rep. 602.) The insured opened a pimple on his lip with his gold scarf pin, which, being infected, in turn infected the wound. The infection spread and resulted in his death a few days later. The court held that the means were accidental in that the effects of the insured's act were both unusual and unexpected.

The by-laws of the defendant provided that "the association shall not be liable . . . for accidental death . . . resulting wholly or partially, directly or indirectly, from . . . local or general infection, except when such infection or inflammation results from a visible or open wound caused by external, violent and accidental means." The court stated that an infection could not "result" from a visible or open wound, and that in this case the pin and infection germs were the means of causing the wound. The court then proceeded to resolve any doubts as to the meaning of the above clause in favor of the beneficiary.

In handing down judgment for the beneficiary, the court wrote:

"If the injury resulted from the pin alone, and there was no proof that the pin was infected, the accidental result would not be covered by this policy; but the deceased clearly used something which he did not intend to use. He used, not only the pin, but he used an infected pin, a poisoned pin. This infection was such that it could not, in the nature of things, be discovered by him without perhaps a microscopic investigation. To my mind the means were clearly accidental."

CONSTRUCTION OF "IN OR ON":—(Turner *vs.* Fidelity & Casualty Co., Supreme Court of Missouri, 202 S. W. Rep. 1078.) The

insured's accident policy included a double indemnity clause reading as follows:

"The amounts specified in articles 1, 2 and 4, and in section 1 of article 3, shall be doubled, if the bodily injury is sustained by the assured: (1) While in a passenger elevator (excluding elevator in mines); (2) while in or on a public conveyance (including the platform, steps and running board thereof) provided by a common carrier for passenger service; (3) while in or on a private conveyance (excluding bicycles, motorcycles, and saddle horses)."

While the insured and his wife, the beneficiary and plaintiff herein, were out riding in the insured's automobile, the engine stopped. The insured got out of the car and began to crank it, when it suddenly began running and struck the insured, who was killed. While in the act of cranking the car, no part of the insured's body was in contact with it except his right hand.

The company made a tender of $5,000, the face of the policy, but the beneficiary claimed that $10,000 was due under her construction of the double indemnity clause quoted above. Her counsel urged that the clause meant "while riding in or on a private conveyance" which should include the whole trip and anything necessary to conclude the trip, such as cranking the car; thus, he would be on the trip, even while out of the car.

In its opinion, the court calls attention to the omission of the words "passenger" or "riding" in the above clause, which excludes any idea of continuity of journey, also that when a passenger disconnects himself from the vehicle of conveyance he can no longer be said to be "in" or "on" it. It holds that the words "on" and "in" should be construed as used ordinarily, and that the latter word is given a narrower significance than the former. The opinion concludes in these words:

"There is no question but that, if a provision in a contract of insurance be ambiguous, such provision is by the settled law to be construed most strongly against the insurer and most liberally in favor of the assured; so that if possible, that security or indemnity against loss which the assured intended when he bought the insurance shall be accomplished. But the contract here is not ambiguous. Such ambiguity as is urged arises wholly from the insistence of plaintiff that strange words which do not appear in the policy be interpolated therein, and then that upon the policy as amended by the interpolation a construction be put which we are constrained to consider unwarranted.

"We conclude that assured, when he sustained the injury which

caused his death, was neither "in" nor "on" the automobile, within the plain language and meaning of the policy, and therefore that the limit of plaintiff's recovery is the single indemnity provided in the contract."

INSURED'S MISTAKE BARS FUTURE RECOVERY:—(General Accident, Fire & Life Assur. Corp. *vs.* Harris, Supreme Court of Mississippi, 78 South. Rep. 778.) The insured (Harris) sustained an injury, for which he was treated by his own physician. His accident policy provided for an indemnity of $20 monthly, for a period not exceeding 24 months, and also that no payment was due until final proof of total disability had been furnished. The insured was never examined by the company's physician. The insured furnished proofs at a time when be believed that he had fully recovered, substantiated by his physician's report, and received indemnity for 3 months' total disability.

Some time later, the insured discovered that his injury was much more serious than he had originally believed, and in fact he was disabled for over 2 years. He brought suit for the rescission of the release which he signed for 3 months' indemnity, and requested a recovery for the total allowable period of 24 months.

The court held adversely to the insured's contention. Had the insured wished to be certain of the extent of his injuries, he could have waited. He was not only mistaken as to the extent of his injuries, but also as to the duration of his disability. Since there was no fraud or misrepresentation on the part of the defendant company, there remained no equitable ground upon which to cancel the insured's release.

WORKMEN'S COMPENSATION.

OFFICER OF CORPORATION NOT AN EMPLOYEE:—(Cashman's Case, Supreme Judicial Court of Massachusetts, 120 N. E. Rep. 78.) The plaintiff, who was the president, and his brother, who was the treasurer, owned all the capital stock of the Cashman Bros. Company, Incorporated, with the exception of one share owned by their counsel. When the brothers took out a workmen's compensation policy in the defendant company, their remuneration was excluded because they objected on the ground that they were practically a partnership. The plaintiff was injured while superintending the work of the corporation. The Industrial Accident Board held that the plaintiff was an employee and awarded him compensation.

The court, in reversing the Board and holding for the defendant company, wrote in its well-considered opinion:

"The policy provided:

"'This agreement shall apply only to such injuries so sustained by any person or persons in the service of the subscriber under a legal contract of hire, express or implied, oral or written, and whose entire remuneration is included in the declarations hereinafter contained, and upon which the premium of this policy is computed, such injuries being sustained by reason of the business operations described in said declarations, conducted at the places and in the manner therein described. If the subscriber is a corporation, the remuneration of the president and vice-president, secretary or treasurer, not actually in connection with, or in the personal superintendence of, the manual or mechanical operations described in such declarations, need not be included, this policy covering such officers, nevertheless.'

"The interpretation of this clause under the circumstances here disclosed is that a president, vice-president, secretary or treasurer, who is injured while actually engaged in the manual or mechanical operations of the corporation is not included as a beneficiary under the policy, unless his remuneration has been included as the basis of the premium to be paid on the policy, and the Workmen's Compensation Act cannot be construed so as to afford the plaintiff compensation contrary to this agreement.

"While insured as an individual, he was an employer and could not claim compensation as an employee. Assuming he was an employee of the corporation of which he was president, his remuneration not being included in the pay roll, it would be manifestly unjust to require the defendant to pay him compensation."

PARTNER NOT AN EMPLOYEE:—(Cooper *vs.* Industrial Accident Commission, Supreme Court of California, 171 Pac. Rep. 684.) The deceased (Cooper) was a member of a partnership owning certain mines. The firm requested him to go to the mines to verify reports of conditions there and it was agreed that the firm was to pay his expenses and an allowance of $5.00 per day for his time. While at the mines, Cooper was injured through the operation of the mining machinery and subsequently died therefrom. His widow's application for compensation was denied by the Industrial Accident Commission.

The sole question for review by the court was whether Cooper was an employee, under the above conditions. In holding in the negative and in affirming the decision of the commission, the court wrote:

"We are constrained to hold that the Industrial Accident Commission was correct in its conclusion upon this subject. Ordinarily the relation between a partnership and its members performing services for it is not the relation of employer and employee. The definition of the term 'partnership' as 'an association of two or more persons for the purpose of carrying on business together and dividing its profits between them' implies that each of its members shall render such services to the firm as he is able, and without compensation, in the absence of special agreements to the contrary. In the rendition of such services the partner is acting in no sense in the capacity of a servant or employee subject to the direction, or it may be discharge, of his firm acting as his master or employer....

"The Workmen's Compensation Act clearly does not contemplate such a mixed relation as that existing between partners, wherein each member of the partnership is at the same time principal and agent, master and servant, employer and employee; and wherein each, in any services he may render, whether under his general duty as a partner, or under a special agreement for some particular service, is working for himself as much as for his associates in carrying on the business of the firm. The obvious intent of the act was to substitute its procedure for the former method of settling disputes arising between those occupying the strict relationship of master and servant, or employer and employee, by means of action for damages, with their pleas of negligent acts or omissions in the way of providing suitable places to work, or proper appliances and the like, and with their defenses of assumed risks, or of the negligence of fellow servants, or of contributory negligence, and with the uncertainties or inequities incident to jury trials, all elements of damage, defense, or consequence, which obviously could not arise out of the partnership relation.

"The instant case illustrates this aptly. The decedent was fatally injured through the giving way of the standards of a bucket tram being operated at the time, by reason either of its improper construction or negligent operation. Had the decedent survived to sue for his injury, he could not recover against his firm or his associates upon the plea that the appliance was defectively constructed, for the reason that as a member of the firm he was as fully responsible for such defects as were his fellow members thereof; nor could he recover for the negligent operation of the appliance by the employees in charge of it, for they were his own employees as much as they were the employees of his fellow partners; nor, as to such employees, could he be said to be a fellow employee, without involving the legal aspects of the case in hopeless contradiction. In a word, the law relative to compensation as between master and servant, or employer and employee, for injuries suffered by the latter, contemplates two persons standing in this opposed relation, and not the anomaly of one person occupying the dual relation of master and servant, employer and employee, plaintiff and defendant, or

person entitled to a judgment or award in his favor and person bound to pay a part thereof out of his own proportionate share of the partnership property and the balance, amounting possibly to the whole thereof, out of his own individual estate."

WINDOW CLEANING AN EXTRA HAZARDOUS OCCUPATION:—(Chicago Cleaning Co. *vs.* Industrial Board, Supreme Court of Illinois, 118 N. E. Rep. 989.) The deceased had been employed by the Chicago Cleaning Company (plaintiff in error) as a window cleaner, but for some time prior to the accident had not worked because of illness. He had then worked for two days, was told to lay off, which he did for one day. The following day he went to his locker at the office of his employer, secured his tools and an assignment slip directing him to work at the premises where his body was found later that day. No one saw him at work or saw the accident, but incontrovertible evidence showed that he had fallen from the third floor of the building, while at work. The Industrial Board held that the accident arose out of and in the course of employment and awarded compensation to the dependents of the deceased.

As to the first point raised by the plaintiff in error, that the relation of employer and employee terminated when the deceased was told to lay off until he was able to work, the court held that this did not constitute a discharge. The employer had placed in the employee's locker an assignment slip to go to work, which direction the employee had executed by taking his tools and had been killed in the performance of the assignment. This clearly established the relation of master and servant.

The court's opinion below as to the second point is an illustration of judicial notice, which supreme tribunals everywhere are taking in compensation cases.

"It is further insisted that plaintiff in error was not under the act, for the reason that the business in which it is engaged—i. e., cleaning and washing windows—is not included in the provisions of the Workmen's Compensation Act. While such employment is not specifically enumerated as one of the hazardous employments included under such act, it is nevertheless an employment which is extra-hazardous, and which we think it was the intention of the Legislature should come under that act. The act is commendable legislation, and should be liberally construed in order to give effect to the purpose and object in adopting such act. The Legislature has not attempted to enumerate all of the various classes of work

which shall be held to come under the act, but has attempted, by a general statement of the various kinds of business in which employers are engaged, to include all of the hazards incident to the employment of those engaged in any of such businesses. Among the businesses included are the building, maintaining, removing, repairing, or demolishing of any structure. The business of washing windows, as such, in large cities is as much a part of the maintenance of buildings as would be the replacing of glass in windows, the painting and decorating of the buildings, or the repointing of the outside where the mortar between the bricks was giving way. No one can seriously question, but that those engaged in any of such businesses and employments would come under the act. We think the same may be said as to the business of plaintiff in error. The occupation of the deceased at the time he fell, and at other times—that of washing windows on the outside of buildings several stories high, supported by a belt and ropes attached to the window frame —was, in fact, dangerous."

MUNICIPAL OPERATIONS NOT CONDUCTED FOR GAIN:—(Redfern *vs.* Eby, Supreme Court of Kansas, 170 Pac. Rep. 800.) The plaintiff was injured while at work in the construction of a sewer system for the city of Anthony, against which he made a claim for compensation. The section of the Workmen's Compensation Act under which the plaintiff attempted to recover reads:

"This act shall apply only to employment in the course of the employer's trade or business on, in or about a railway, factory, mine or quarry, electric, building or engineering work, laundry, natural gas plant, county and municipal work, and all employments wherein a process requiring the use of any dangerous explosives or inflammable material is carried on, which is conducted for the purpose of business, trade or gain."

The court held that cities do not engage in trade in the construction of sewers, nor do they derive any gain in the operation of sewers. In order to hold a city liable, the additional element must be present, the court proceeded to state, of conducting the enterprise for the purpose of business, trade, or gain. For this reason, the unanimous opinion sustained the court below in non-suiting the plaintiff.

SUBROGATION—SETTLEMENT BY THIRD PARTY:—(Rosenbaum *vs.* Hartford News Co., Supreme Court of Errors of Connecticut, 103 Atl. Rep. 120.) The employee (Rosenbaum) of a news company was injured by a railroad company, which voluntarily settled with him for $3,000 and agreed to pay him the additional sum of

$1092 if the courts held that he was not entitled to compensation. The total amount agreed upon was the statutory compensation for the specific injury which Rosenbaum had suffered.

The employee's claim for compensation was denied both by the commission and the court. The compensation act provided that damages recovered from the third party responsible for the injury must be used to reimburse the employer for the latter's damage by way of compensation paid and legal expenses, but no provision was made in the act for the disposition of moneys paid voluntarily by the third party direct to the injured employee. That the same reasoning is to be applied in this class of cases, is indicated by the following extract from the court's opinion:

"True, the statute states only the rule for the apportionment and application of compulsory payments made by the tort-feasor after his legal liability has been ascertained by a judgment; but the rule is based on the legal relation of the parties as defined by the act, namely, that the tort-feasor is primarily liable, and that, as between the employee and employer, the latter is entitled to precedence for the purpose of reimbursement or discharge. The legal relation of the parties, being thus ascertained, furnishes the principle for the apportionment and application of all payments made by the tort-feasor for the purpose of obtaining a release from his primary liability. Suppose, for example, that a joint action brought before any award of compensation is settled before trial by the payment directly to the injured employee of a sum greater than the expenses of litigation. Evidently the employer is discharged to the same extent and upon the same principle as if the payment had been made after a judgment for a like sum had been rendered. And the same must be true of a settlement made before suit is brought, whether the employer takes part in the negotiations or not. If the settlement is made behind the back of the employer he will not be bound by it. But, if it is for his advantage to do so, he must be permitted to ratify it, and to assert his right, arising out of the legal position assigned to him by section 6, to be discharged pro tanto by the settlement. Otherwise, the injured employee might first settle with the tort-feasor for a sum in excess of his statutory compensation, on the correct basis that the tort-feasor was primarily liable for the whole damages, and then recover his statutory compensation also."

COMPENSATION ACT DOES NOT COVER OCCUPATIONAL DISEASE: —(Jerner *vs.* Imperial Furniture Co., Supreme Court of Michigan, 166 N. W. Rep. 943.) The plaintiff was employed as a mahogany stainer by the defendant, which made it necessary for him to place

his hand into the staining solution. His hand became infected from the solution. The evidence showed that gloves were often used by operators at this class of work, but no gloves were furnished to the plaintiff by his employer; also that men in this occupation frequently suffered from sore hands, which was caused by chemicals in the solution.

The court reversed the decision of the Industrial Accident Board, which had granted compensation. The court held that there was no evidence of an accident and that the compensation act does not provide for covering the effects of occupational disease.

"CASUAL EMPLOYMENT"—"PERSON CASUALLY EMPLOYED": —(Western Union Telegraph Co. *vs.* Hickman, U. S. Circuit Court of Appeals, Fourth Circuit, 248 Fed. Rep. 899.) The plaintiff was a lineman who had been hired for not over five days to make certain repairs. While climbing a telegraph pole on the fourth day, the pole broke under his weight and he fell to the ground severely injured. The West Virginia Compensation Act excepts from its operation "casual employment" and "person casually employed." The plaintiff brought an action at law for damages, but the defendant company set up the compensation act in defense as the remedy to which plaintiff was entitled and also that the act barred plaintiff's action at law.

In its opinion the court pointed out that the important test was the nature of the contract of employment, and wrote:

"The English Compensation Act, which some of our states have closely followed, excepts 'a person whose employment is of a casual nature and who is employed otherwise than for the purpose of the employer's trade or business.' Construing this act, the English courts have held that the kind of work done by the employee, rather than duration of service, is the determining factor. If the work pertain to the business of the employer and be within the scope of its purpose, the employment is not 'of a casual nature,' although the hiring be only for a short period of time. The Connecticut statute . . . is practically the same as the English, and accordingly the Supreme Court of that state has held . . . that the nature of the employment was measured, not by tenure of service, but 'by the character of the work.' The New Jersey statute likewise exempts those 'whose employment is of casual nature.'

"But the West Virginia act, in defining exceptions, uses the terms 'casual employment' and 'person casually employed.' The equivalent exemption of persons 'whose employment is but casual' appears in the Compensation Laws of Massachusetts . . ., Illinois

. . ., Michigan . . .. and Minnesota. This noticeable departure from the language of the English statute indicates a legislative intent to broaden the exception and place it on a different basis. Its apparent effect is to make exemption depend, not on the nature of the work performed, but on the nature of the contract of employment. If the hiring be incidental or occasional, for a limited and temporary purpose, though within the scope of the master's business, the employment is 'casual,' and covered by the exception. And so it has been held by the courts of states whose compensation acts have substituted 'casual employment,' or words of the same import, for the 'employment of a casual nature,' found in the English statute . . . (quoting cases). These decisions, and the convincing reasons on which they rest, warrant the conclusion that plaintiff was engaged in 'casual employment' when the accident occurred."

Having held that the suit was maintainable, the court felt bound by the findings of the jury that the plaintiff was not guilty of contributory negligence and that there was no assumption of risk. The judgment of the court below in favor of the plaintiff was affirmed.

SKYLARKING NOT COMPENSATABLE:—(Mountain Ice Co. *vs.* McNeil, Court of Errors and Appeals of New Jersey, 103 Atl. Rep. 184.) While two boys were skylarking in the employer's plant, one of them seriously injured the other one (McNeil), who is the plaintiff herein seeking compensation. On the same day, previously, while the boys had been skylarking, the president and superintendent of the employing company had ordered them back to work, with which order the boys complied.

The court's opinion concedes that the injury arose in the course of employment, but since it did not arise out of the employment, held that it was not compensatable. Furthermore, the opinion states that the previous horseplay merely put the president and superintendent upon notice that there might be a repetition, but not that it would result in an injury to either boy. Such an accident, caused by the wrongful act of a fellow workman outside of the scope of employment, is not such an accident intended to be covered by the compensation law.

INJURY CAUSED BY SKYLARKING OF FELLOW WORKMAN:—(Johnson Sash & Door Co. *vs.* District Court, Hennepin County, Supreme Court of Minnesota, 167 N. W. Rep. 283.) Some of the employees of the defendant company were accustomed to throw

sash pins at one another during working hours, which was known to the defendant. A fellow workman threw a block at Filas (plaintiff) and injured him; Filas had previously complained of this coworker to the defendant. The evidence proved that Filas was working at the time and had never engaged in throwing missiles or other skylarking.

The court held that the accident arose out of the employment and sustained an award of compensation. The principles covering this class of cases are stated in the following extract from the opinion:

"The rule is well enough settled that where workmen step aside from their employment and engage in horseplay or practical joking, or so engage while continuing their work, and accidental injury results, and in general where one in sport or mischief does some act resulting in injury to a fellow worker, the injury is not one arising out of the employment within the meaning of compensation acts. . . . (quoting numerous cases) Here we conceive the situation to be different. Filas was exposed by his employment to the risk of injury from the throwing of sash pins in sport and mischief. He did not himself engage in the sport. His employer did not stop it. The risk continued. The accident was the natural result of the missile throwing proclivities of some of Filas' fellow workers and was a risk of the work as it was conducted. In McNicol's Case, 215 Mass. 497, . . . injuries resulting from blows administered in frenzy by an intoxicated fellow worker known by the employer to be in the habit of becoming intoxicated and in that condition to be dangerous were held to arise out of the employment. Liability was rested 'upon the causal connection between the injury of the deceased and the conditions under which the defendant required him to work.' In Clayton *vs.* Hardwick Colliery Co., 9 B. W. C. C. 136, . . . a finding that a boy who was working with other boys in a colliery picking stones from coal and was injured by a stone thrown by another boy was so subjected by his employment to a special risk that the injury arose out of his employment was sustained. In Challis *vs.* London, etc., Co. (1905), 2 K. B. 154, the injuries to an engineer who was driving his engine under a bridge and was hit by a stone thrown by a boy from the bridge were held to arise out of his employment."

INJURY DURING INTERVAL IN WORK:—(Dzikowska *vs.* Superior Steel Co., Supreme Court of Pennsylvania, 103 Atl. Rep. 351.) The duty of Dzikowska was to load steel, which was oiled, upon a railroad car. He wore an apron of burlap and also burlap around his arms for protection, all of which became saturated with oil. During an interval while awaiting the arrival of more steel, he

stepped out of the room to smoke, which practice was permitted by the defendant company. He struck a match which set fire to his oil-soaked apron, and was fatally burned.

In affirming the award of compensation to the employee's dependents, the court wrote:

"In the compensation acts of some of the states compensation is allowed only for injuries 'arising out of and in the course of his employment,' thus attaching two conditions to the right to recover. In the Pennsylvania statute the words 'arising out of' do not appear, and we are therefore relieved from the necessity of considering the question whether in this case the accident arose out of or was due to the character of the employment. Under our statute compensation is given for personal injury or death of an employee 'by an accident in the course of his employment,' and it is further provided that, while the term used shall not include certain injuries caused by acts of third persons, it 'shall include all other injuries sustained while the employee is actually engaged in the furtherance of the business or affairs of the employer, whether upon the employer's premises or elsewhere.'

"The fact that, in the present case, Dzikowska met with an accident during a short interval of waiting for the arrival of more material to load made no difference. His period of employment was not broken thereby. He was discharging precisely the duty laid upon him by his employer, and in the manner expected of him. . . .

"What we regard as a sound statement of the principle involved appears in Honnold on Workmen's Compensation, §111, as follows:

"'It cannot be said that the employment is broken by mere intervals of leisure such as those taken for a meal. If an accident happened at such a time, there would be no break in the employment, even though the workman is paid by the hour for the time he is actually at work, especially where the accident occurs on the employer's premises, or about his property, unless the workman is doing something that is wholly foreign to his employment. Acts of ministration by a servant to himself, such as quenching his thirst, relieving his hunger, protecting himself from excessive cold, performance of which while at work are reasonably necessary to his health and comfort, are incident to his employment and acts of service therein within the workman's compensation acts, though they are only indirectly conducive to the purpose of the employment. Consequently no break in the employment is caused by the mere fact that the workman is ministering to his personal comforts or necessities, as by warming himself, or seeking shelter, or by leaving his work to relieve nature, or to procure drink, refreshments, food, or fresh air, or to rest in the shade.'"

SELF-INSURERS MUST DEPOSIT SECURITY:—(Industrial Com-

mission of Utah *vs.* Daly Mining Co., Supreme Court of Utah, 172 Pac. Rep. 301.) Section 53 of the Workmen's Compensation Act provides:

"Employers, but not including municipal bodies, shall secure compensation to their employees in one of the following ways: (1) By insuring and keeping insured the payment of such compensation with the 'state insurance fund'; or (2) by insuring and keeping insured the payment of such compensation with any stock corporation or mutual association authorized to transact the business of workmen's compensation insurance in the state; or (3) by furnishing to the commission satisfactory proof of financial ability to pay direct the compensation in the amount and manner and when due as provided for in this act. In the latter case the commission may in its discretion require the deposit of acceptable security, indemnity, or bond to secure the payment of compensation liabilities as they are incurred."

The application of the defendant company to the Industrial Commission to become a self-insurer was approved, upon the condition that it file with the commission its surety bound or liquid collateral in the sum of twenty-five thousand dollars. The defendant refused to comply with the condition and this suit was brought by the commission to compel compliance.

The court held that the statute does not authorize the bringing of a suit by the commission for the amount which the defendant would pay as a premium, if insured. Furthermore, that the commission may proceed in mandamus to compel employers to secure the payment of compensation in one of the three ways given in the above section, and that it is within the sole power of the commission to determine the conditions under which an employer may become a self-insurer.

In granting the writ of mandate requested by the commission, the court construed the act to be compulsory in the following language:

"It will be observed that the language of section 53 is mandatory and not merely permissive. True, employers are given the right to elect whether they will insure the payment of compensation in the 'state insurance fund,' or by obtaining insurance with some insurance company, or whether they will furnish proof to the commission that they are financially able to make prompt payment of the compensation to their employees. A mere cursory reading of the whole act will convince any one, we think, that the Legislature manifestly intended that all employers by one of the three

methods referred to shall in advance secure the payment of the compensation to which any one of their employees may become entitled under the act. Such laws are in force in many states. . . . The compulsory feature of such laws has not only been held valid and enforceable by state courts of last resort . . . (citing cases), but has also been held valid and enforceable by the Supreme Court of the United States in Mountain Timber Co. *vs.* Washington, 243 U. S. 219, . . . and in New York Cent. R. Co. *vs.* White, 243 U. S. 188."

COMPENSATION CONTINUED TO WIDOW AFTER REMARRIAGE:—(Bott's Case, Supreme Judicial Court of Massachusetts, 119 N. E. Rep. 755.) A woman was awarded compensation upon the death of her husband under the Workmen's Compensation Act. She remarried and the evidence showed that she was then not dependent upon her compensation. The question was whether her right to compensation was barred by her remarriage.

The court pointed out in its decision that it had previously held in Murphy's Case, 113 N. E. 283, that the right to compensation was not vested and that payments ceased upon the death of the dependent. It held that the reasoning in that case did not apply to the instant case, and in affirming the continuance of compensation, wrote:

"It is provided that the payments shall be made to the dependents as therein defined. There is no doubt that the widow came within that descriptive word. The ascertainment of dependents is made as of the time of the injury to the deceased employee. It cannot be made as of any other time. . . . The widow was wholly dependent upon the deceased employee, her husband, at that time, by the conclusive presumption of the act because she was living with him. (Section 7 as amended.) No provision is made by the act for inquiry into any change in her condition of dependency. She may become heiress to a fortune after his death and thus be utterly independent of the payments provided by the act. But there is no provision for an adjudication of that fact. If such an event should occur, it would be immaterial so far as concerns any procedure under the act. So long as she lives, the act provides that the stated payments shall be made to her. Whatever incongruity there may be in continuing payments to a person on the presumption that she is dependent on a deceased husband, when in fact she is receiving ample support from a new husband, is a matter for the Legislature and not for the courts to remove."

NOTICE OF DISABILITY REQUIRED:—(Hynes *vs.* Pullman Co.,

Court of Appeals of New York, 119 N. E. Rep. 706.) The claimant injured his finger, but continued at work for several days, when it became infected, but he reported to his employer in good faith that he had rheumatism. Blood poisoning resulted and he submitted to several operations and did not give written notice of the accident until over two months after its occurrence, which was later than the statute required. The State Industrial Commission ruled that the failure to give notice did not prejudice the employer by reason of there being no witnesses of the accident and consequently the employer would be unable to secure any evidence as to the accident. The Commission thereupon made an award of compensation.

The court held that a written notice must be given within the time required, that the Commission must not make an award in the absence of notice unless it finds a reason why it could not be given or it rules that the employer has not been prejudiced. The burden rests upon the claimant who failed to file written notice in time to show the facts in order to secure a finding from the Commission to support an award. Such a finding is a conclusion of law and is reviewable by the court. The court then stated that blood poisoning might result from a number of causes other than the accident. The award was reversed and the claim dismissed because the facts adduced failed to support the Commission's findings.

AWARD FOR DISFIGUREMENT:—(Erickson *vs.* Preuss, Court of Appeals of New York, 119 N. E. Rep. 555.) The claimant received an injury resulting in facial disfigurement, for which an award of $1,000 was made by the State Industrial Commission.

Part of the opinion of the court, in affirming the award, follows:

"The Workmen's Compensation Law, among other things, provides: '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.'

"The provision quoted was added to subdivision 3 of section 15 in 1916, Chapter 622. Prior to this enactment the theory of the Workmen's Compensation Law was not indemnity to a workman for loss of a member or physical impairment as such, but compensation for disability to work made on the basis of average weekly wages. . . . The amendment of 1916, however, so far as facial or head disfigurement is concerned, is a departure from or modification to that extent of the prior theory upon which an award was

based. The entire matter of awards under the Workmen's Compensation Law is committed to legislative discretion. . . . The commission may now make an award for serious facial or head disfigurement, even though such disfigurement does not diminish or impair the earning capacity of the claimant. The amount is to be such as the commission deems proper and equitable, in view of the disfigurement, not exceeding $3,500.

"Concurrent awards may be made, one for serious facial or head disfigurement, and one for disability or loss of earning power. If so made, then it should clearly appear that the award for facial or head disfigurement does not include anything for diminished earning power. We think that fact does here so appear."

PRESENT VALUE OF FUTURE BENEFITS UNDER FEDERAL EMPLOYERS' LIABILITY ACT:—(Jones *vs.* Kansas City Southern Rwy. Co., Supreme Court of Louisiana, 78 South. Rep. 568.) The plaintiff is the widow of a railroad employee who was killed through the negligence of his employer, the defendant, who is an interstate commerce carrier. A judgment for $17,500 affirmed by this court was reversed by the United States Supreme Court because certain evidence had been excluded. Upon the second trial, plaintiff obtained a judgment in the court below for $26,500. The first opinion of the court held that there was no reason for the jury to penalize the defendant by increasing the amount of the judgment, which was ordered reduced by the court from $26,500 to $17,500.

On a rehearing at a later date, the court handed down a second opinion, reading in part as follows:

"The Supreme Court of the United States has announced, as a definite rule, that the amount of compensation to be allowed the beneficiaries of a deceased employee, if any be due them, under the Federal Employers' Liability Act, is only the cash value of what the employee might reasonably have contributed to the support of the beneficiaries during the term of his life expectancy. That is because the right of recovery is limited to the pecuniary loss suffered by the beneficiaries. And that loss is to be ascertained or computed by discounting the lost future benefits, at a fair or reasonable rate at which the money could be loaned or invested safely at interest, for each year of the life expectancy, according to the evidence. Chesapeake & Ohio Railway Co. *vs.* Kelly, 241 U. S. 485.

"We have concluded from the evidence taken on the second trial that Jones was 56 years of age at the time of his death. The evidence shows also that the life expectancy of a locomotive engineer, because of his hazardous occupation, is taken 8 years beyond his

age. Accordingly a locomotive engineer 56 years of age is rated at 64. That rule has been adopted by the life insurance experts, and there is no reason why we should not avail ourselves of their knowledge and experience. In fact, we have this strong equitable reason for considering the danger of the occupation: That it is presumed that the employee was compensated for the risk, in the wages he received, and that the beneficiaries will therefore have the compensating advantage of a higher rate of future benefits in our calculation than they would have if the risk had been an ordinary one.

"The life expectancy of a locomotive engineer aged 56 years, or of an ordinary risk at 64, according to the expectation table constructed from the American Experience Table of Mortality, and therefore according to the reliable theory of chances, is 11.7 years. That is the presumed term of the future benefits of which the beneficiaries in this case were deprived by the death of Jones.

"The amount of the future benefits or contributions that the beneficiaries lost is the difference between the amount that Jones would have earned and the amount he would have spent upon himself if he had lived 11.7 years longer. He was earning $2,100 a year, and, from the evidence of his good habits, we have concluded that $600 a year is a fair allowance to be made for what he would have spent for his own maintenance. Hence we fix the amount of the lost future benefits at $1,500 per annum for 11.7 years; that is, a total sum of $17,550 that would have been equally distributed or contributed in installments during a period of 11.7 years. . . .

"Our opinion is that 5 per cent is a more appropriate rate, and is fully warranted by the evidence. That is the legal rate of interest—the rate we are constrained to allow when none is stipulated and interest is due. It seems quite equitable that the discount charged to the beneficiaries in computing the present value of deferred payments should be at the rate at which interest would be allowed to the plaintiffs on a past due claim of similar character.

Years.	Amount.	Divisor.	Discount.	Cash Value.
1	$1,500	1.05	$ 71.43	$1,428.57
2	1,500	1.10	136.36	1,363.64
3	1,500	1.15	195.64	1,304.36
4	1,500	1.20	250.00	1,250.00
5	1,500	1.25	300.00	1,200.00
6	1,500	1.30	346.15	1,153.85
7	1,500	1.35	388.89	1,111.11
8	1,500	1.40	428.57	1,071.43
9	1,500	1.45	465.52	1,034.48
10	1,500	1.50	500.00	1,000.00
11	1,500	1.55	532 26	976.74
11.7	1,050	1.585	387.54	662.46
Totals.....	$17,550		$4,002.36	$13,547.64

"We have concluded, therefore, to reduce the amount of the

judgment in this case to the present value of 11.7 annual payments of $1,500 each, that is, the net proceeds, or what would be the present or cash value, of $17,550, payable in 11.7 yearly installments discounted at 5 per cent. The result of our calculation is that the plaintiffs are entitled to a judgment for $13,547.64, viz.:

"The judgment appealed from is amended by reducing the amount to $13,547.64, and, as amended, it is affirmed."

Editorial Note.—On October 22, 1886, the United States Supreme Court made its first declaration concerning the rules to be followed in such cases in Vicksburg &c. R. R. *vs.* Putnam, 118 U. S. 545, in the following words:

"In order to assist the jury in making such an estimate, standard life and annuity tables, showing at any age the probable duration of life, and the present value of a life annuity, are competent evidence. . . . But it has never been held that the rules to be derived from such tables or computations must be the absolute guides of the judgment and the conscience of the jury."

On June 5, 1916, the United States Supreme Court handed down its decision in the case of Chesapeake & Ohio Railway Co. *vs.* Kelly, 241 U. S. 485. The principal question involved was the application of the seventh amendment of the United States Constitution to suits arising under the Federal Employers' Liability Act and tried in state courts. Because of the importance of this case, the following extracts from the opinion are given:

"The damages under the Federal Employers' Liability Act should be equivalent to compensation for the deprivation of the reasonable expectation of pecuniary benefits that would have resulted from the continued life of the deceased employee. . . .

"As a rule, and in all cases where it is reasonable to suppose that interest may safely be earned upon the amount that is awarded, the ascertained future benefits ought to be discounted in the making up of the award. . . .

"We are not in this case called upon to lay down a precise rule or formula and it is not our purpose to do this, but merely to indicate some of the considerations that support the damages recoverable for the deprivation of future benefits, the principle of limiting the recovery to compensation requires that adequate allowance be made, according to circumstances, for the earning power of money; in short, that when future payments or other pecuniary benefits are to be anticipated, the verdict should be made up on the basis of their present value only.

"We are aware that it may be a difficult mathematical computation for the ordinary juryman to calculate interest on deferred

payments, with annual rests, and reach a present cash value. Whether the difficulty should be met by admitting the testimony of expert witnesses, or by receiving in evidence the standard interest and annuity tables in which present values are worked out at various rates of interest and for various periods covering the ordinary expectancies of life, it is not for us in this case to say. Like other questions of procedure and evidence, it is to be determined according to the law of the forum."

The United States Supreme Court then quotes with approval the case of Vicksburg &c. R. R. *vs.* Putnam, mentioned above, and continues:

"That where future payments are to be anticipated and capitalized in a verdict the plaintiff is entitled to no more than their present worth, is commonly recognized in the state courts. We cite some of the cases, but without intending to approve any of the particular formulæ that have been followed in applying the principle; since in this respect the decisions are not harmonious and some of them may be subject to question."

While the dicta expressed in the above case would appear to be binding upon state courts trying this class of cases, yet the Supreme Court of Appeals of West Virginia (in Dumphy *vs.* Norfolk & W. Ry. Co. 95 S. E. Rep. 863) held (at a date later than the Jones case) that the present value of a life annuity at 4 per cent. interest equal to the earning power of an injured employee was a fair measure of the damage suffered.

It is unfortunate that the inaccurate rule in the Vicksburg case should be the precedent to be followed in so diverse a manner by the state courts of highest jurisdiction. In some courts, that rule is interpreted to mean a calculation taking into account the life expectancy and a rate of simple interest depending upon local conditions, as in the Jones case. Other courts interpret the rule to mean a calculation based upon some standard annuity table, at a rate of interest ordinarily realized from a conservative investment, as in the Dumphy case.

The determination of damages under employer's liability insurance has in the past been fixed by the age and earnings of the deceased employee, a rule which is followed under the Federal Employers' Liability Act. Under compensation statutes, present values are based upon the ages of the dependents of the deceased employee, where the statute provides for actuarial standards, as in the New York State Workmen's Compensation Law.

R. F.

Miscellaneous.

Indirect Damage Due to Burglary:—(Downs *vs.* New Jersey Fidelity & Plate Glass Ins. Co., Court of Errors and Appeals of New Jersey, 103 Atl. Rep. 205.) Plaintiff had a policy of burglary insurance, which insured him against direct loss by burglary, theft or larceny of property listed in a schedule. While the plaintiff's home was closed for the summer, burglars entered it and took away a number of valuable articles. They also scattered about the room various articles of clothing, which had been protected by camphor. The unprotected clothing was damaged by moths, and plaintiff sued to recover the value of the clothing in addition to the articles that had been stolen.

In holding that plaintiff could not recover for the value of the clothing under the policy, the court wrote:

"It is to be remembered that the insurance was for direct loss by burglary, theft, or larceny. Burglary is the breaking and entering into a mansion house in the night time with intent to commit a felony. . . . While the breaking open of a house wherein no man resides, and which for the time being is not a mansion house, is not attended with the circumstances of midnight terror, nevertheless, the house wherein a man sometimes resides and which the owner has only left for a short season animo revertendi, is the object of burglary, though no one be in it at the time of the act committed. . . . Theft is defined to be a popular term for larceny. Larceny is the felonious taking and carrying away of the personal goods of another. . . .

"In no event was the displacing and disposal of the premises, of certain goods which were not stolen, direct loss by burglary, theft, or larceny, so far as damage by moths is concerned, although such damage may be directly traceable to the exposing of the goods to attack by moths, which before, by reason of the packages containing them and the repositories in which they were placed, were immune from those insects. If it may be said that the damage was due at all to burglary, theft, or larceny, it was certainly indirect and consequential, but not direct. And this because a new and independent cause intervened between the peril insured against and the damage."

Indemnity in Automobile Insurance:—(Fullerton *vs.* United States Casualty Co., Supreme Court of Iowa, 167 N. W. Rep. 700.) The defendant company issued to the plaintiff (Fullerton) a contract which indemnified him against claims for damages on account of bodily injury "accidentally suffered or alleged to have been suffered . . . by any person or persons by reason of the ownership,

maintenance or use" of his automobile. At the issuance of the policy, the company knew that the insured did not himself drive or operate the car. The insured had a son who was over 21 and resided with his father as a dependent.

While the son was driving the car, it collided with a buggy containing one Hockenberg and his wife and their friend Mrs. Jacobson, and the occupants of the buggy were injured. The defendant company finally settled the claim of the Hockenbergs for $1,250. The negotiations between the defendant company and Mrs. Jacobson proving fruitless, the latter began suit against the insured's son as a defendant. The insurance company, upon notice, came forward and assumed the conduct of the defense in this suit, which was removed by consent of all parties to another county. Thereafter, but before trial, the insurance company withdrew from the case, apparently on the theory that its policy did not afford indemnity in the case at bar. The plaintiff was thus compelled to make arrangements through counsel for the defense of his son. A settlement was reached by which Mrs. Jacobson accepted $1,500, which was paid by the plaintiff, in full discharge of her claim against him and his son.

The plaintiff herein then brought suit against the insurance company for the amount expended by him in counsel fees and in satisfying the Jacobson claim. The following extracts from the opinion, which affirmed the judgment for the plaintiff, discuss the questions raised upon this appeal:

"The contract as written indemnifies the plaintiff against claims for damages on account of bodily injury 'accidentally suffered or alleged to have been suffered . . . by any person or persons by reason of the ownership, maintenance, or use' of the described automobile. This clearly does not limit the indemnity to claims for damages on account of injuries occurring while the insured is personally using the car, but extends to all claims of that nature made by reason of his ownership or maintenance thereof. While we have held that the owner of an automobile is not liable for injury caused to another by the neglect of a person, even a member of his own family, who attempts to operate the car without the authority, express or implied, of such owner, yet we have never held that one who purchases and owns an automobile for family use, and permits it to be used by the dependent members of his family for their own pleasure, may not be held liable for their neglect in such use of it. (Citing cases.) On the contrary, we think it may well be said that when a car owner gives it over to the use of his family, and per-

mits it to be operated by the dependent members thereof, the individuals to whom it is so intrusted may properly be considered his representatives or agents in such a sense that their negligence in the use of the car is imputable to him, and that persons injured by reason of such negligence without fault on their own part may hold such owner liable for damages so sustained. . . . Indeed, the clause in the policy already mentioned, exempting the company from liability when the accident occurs while the car is being driven by any one under sixteen years of age, seems to be an implied concession or recognition of such liability, where the driver is any member of the family over that age. . . .

"We are further disposed to the view that the insurance company having, with full knowledge of the facts, undertaken to defend against the claim and suit of Mrs. Jacobson at its own cost and on its own responsibility, it could not, while the case was still pending and undetermined, rightfully abandon it for no better reason than its belated conviction that the policy did not impose upon it the duty to assume such defense. The company had not only bound itself to assume the defense of 'any claim' against which it undertook to indemnify the plaintiff, but had also carefully excluded him from all right to act independently of the company in the matter of such suit by a provision in the policy that the 'assured shall not voluntarily assume any liability either before or after the accident, nor shall he, without the written consent of the company, incur any expense or settle any claim except at his own cost, nor interfere in any negotiation for settlement or in any legal proceeding conducted by the company on account of any claim.' When, therefore, it was notified of the accident and of the claims of the Hockenbergs and Mrs. Jacobson, the company was called to act, either to deny that it was under any obligation in the matter, and leave the plaintiff and his son to conduct the defense in their own way and upon their own responsibility for making a defense or settlement, as it should find expedient. It accepted the latter alternative, took the business out of the hands of the insured, made its own settlement with the Hockenbergs, and took exclusive control of the defense to the suit of Mrs. Jacobson. Such conduct of the parties was tantamount to an agreement or mutual concession that the policy was intended to cover these claims for damages, and both parties have proceeded on that basis to a settlement with the Hockenbergs, and on to a point midway in the Jacobson suit; the insurer will not be permitted then to change front, abandon a defense it had undertaken, and escape liability on the plea that it has mistaken the nature of its obligation."

TIMELY NOTICE OF LOSS IN AUTOMOBILE INSURANCE:—(C. S. Brackett & Co. *vs.* General Accident, Fire & Life Assur. Corp., 167 N. W. Rep. 798.) The plaintiff had an indemnity policy protect-

ing it against loss from accidents occurring in the operation of automobiles in its business. One of its automobiles injured one Boll, who sued plaintiff for damages. The defendant company refused to defend the action, and the plaintiff paid the judgment which Boll secured against it. The plaintiff then brought this suit to secure reimbursement for the amount of Boll's judgment.

The plaintiff's policy included these provisions:

"C. The assured, upon the occurrence of an accident, shall give immediate written notice thereof, with fullest information obtainable at the time, to the corporation's head office at New York City, or to its duly authorized agent.

"K. No condition or provision of this policy shall be waived or altered except by written indorsement attached hereto and signed by the United States Manager, or the Assistant United States Manager, nor shall knowledge possessed by an agent or by any other person be held to effect a waiver of or a change in any part of this contract."

The evidence showed that on the day of the accident the plaintiff telephoned to the company's general agents all the details and was assured that the matter would be taken care of by them. Within ten days, the company's adjuster came to the plaintiff's office and again came on the thirty-fifth day after the accident with blanks which were filled out and taken away by the adjuster. The defendant made no claim that this notice of loss was untimely until over a month later.

Under these conditions, the court held: That it was a question for the jury to decide whether the written notice given on the thirty-fifth day after the accident was timely and in substantial compliance with provision C above. That, as to provision K, numerous authorities had held that "It applies only to those conditions and provisions in the policy which relate to the formation and continuance of the contract of insurance, and are essential to the binding force of the contract while it is running, and does not apply to those conditions which are to be performed after the loss has occurred, in order to enable the assured to sue on his contract, such as giving notice and furnishing preliminary proofs." That, as under this rule, waiver of written notice had been proved by the general agents acting upon the oral notice, plaintiff was entitled to recover.

AUTHORITY OF GENERAL AGENT TO "COVER" RISK:—(Barrette

vs. Casualty Co. of America, Supreme Court of New Hampshire, 104 Atl. Rep. 126.) Dubray applied to the local agent of the defendant company for employers' liability insurance, in connection with the taking down of a building which necessitated the use of a material hoist. The local agent forwarded the application to the general agent, who advised the former that the defendant company would "cover" Dubray. The court held that the general agent had authority to "cover" such a risk.

One of Dubray's employees was killed by a material hoist and the administratrix recovered a judgment, which she attempted to enforce both against Dubray and the company. The policy for which application had been made had been issued prior to the date of the accident, but it excepted risks in which a material hoist was used, as the defendant company did not underwrite risks of this description. At the delivery of the policy, the company did not notify Dubray of its refusal to cover such risks and of the exception in the policy relating thereto, and in fact the local agent gave him to understand that the policy protected him from all liability to employees. Dubray did not read the policy until after the accident.

The court held that the company was at fault in not notifying Dubray, and also that Dubray was not at fault in not reading the policy because the risk had first been "covered" by the general agent, as evidenced by the subsequent delivery of the policy. Under these circumstances, the court concluded that the defendant company was estopped from denying its liability for the judgment recovered by the administratrix of the deceased employee, and that Dubray was not liable.

MISREPRESENTATION AS TO PREVIOUS CANCELLATION:—(Employers Liability Assur. Corp. *vs.* Industrial Accident Commission, Supreme Court of California, 171 Pac. Rep. 935.) An employee met with an accident resulting in death, while employed on a ship in course of construction. The Industrial Accident Commission awarded compensation to the widow against the employer (Johnson) and against the insurance carrier. The award was contested by the insurance carrier, who urged that the commission had no jurisdiction, upon the grounds that the employment was maritime in character, and also that Johnson had obtained a policy by misrepresentation.

The court held that as the ship had not been launched, which

fact was stipulated by the parties, the California compensation law applied. In holding that the commission had jurisdiction to determine the validity of a workmen's compensation policy as between the employer and his insurance carrier, the court wrote:

"That section (21 of the Constitution) authorizes the Legislature to 'create and enforce a liability on the part of all employers to compensate their employees for any injury incurred by the said employees in the course of their employment.' . . . This court is committed to the view that the language just quoted is to be read in the light of a liberal interpretation. A scheme of insurance for the protection both of the employer and the employee has been a part of virtually every workmen's compensation statute enacted in other jurisdictions prior to the adoption of our own constitutional provision. To permit the employer to limit his obligation by procuring an insurer—private or governmental—to assume the burden of payment, and at the same time to give the workman a direct right of recovery against the insurer, is, we think, a mode of defining the extent of the employer's liability, and therefore embraced within the power to 'create and enforce' such liability. The insurer, assuming the risk voluntarily, is in privity with the employer, and stands in his place. An adjudication of liability under the policy is a settlement of a dispute arising out of the liability of the employer to his employee. The right of the commission to make an award against the insurer, where the validity of the policy is conceded, has never been questioned. If the commission may, in any case, make an award against one who has agreed to stand in the employer's place and protect him against claims by his employees, it must have the power to determine all questions of law and fact upon which the liability of the alleged insurance carrier depends. . . .

"In the application or 'statement of particulars' furnished to the insurer, it was stated that no company had canceled or refused to issue workmen's compensation insurance in connection with the risk during the past three years. . . . It appeared that these statements were not true, in that a policy had been issued by the New Amsterdam Casualty Company, and had been canceled by said company shortly before application made to the petitioner. . . . The statement with reference to the existence or cancellation of other insurance did not constitute a warranty. It was not contained in the policy itself, nor was it in 'another instrument signed by the insured and referred to in the policy, as making a part of it.' Civ. Code, Sec. 2605. There was no declaration in the policy that the violation of this provision should avoid it, and the breach therefore would not affect the validity of the insurance unless the statement or representation was material."

The court concluded that the reason assigned for cancellation was

an immaterial one so far as another company was concerned and since the contestant (insurance carrier) had not proved the materiality of the misrepresentation, the award must be affirmed against it.

IMMEDIATE WRITTEN NOTICE IN PUBLIC LIABILITY INSURANCE: —(McCarthy *vs.* Rendel et al., Supreme Judicial Court of Massachusetts, 119 N. E. Rep. 188.) The Travelers Insurance Company issued a public liability policy to a copartnership, Rendle & Stoddard (assured). The policy contained the following clause:

"This agreement is subject to the following conditions: D—the assured upon the occurrence of an accident shall give immediately written notice thereof to the company, or to its duly authorized agent, with the fullest information obtainable. He shall give like notice with full particulars of any claim made on account of such accident. . . ."

On January 6, 1915, the plaintiff (McCarthy), in the employ of a park commission, was injured while lawfully upon the premises of Rendle & Stoddard, whom he did not notify at the time. Their foreman learned of the accident the same day and notified them within a week. The plaintiff returned the next day to his duties at the workshop of Rendle & Stoddard, and remained at work until January 14, when he stopped working because his injury developed seriously. His attorneys mailed a letter to Rendle & Stoddard, which they forwarded the same day to the insurance company, who received the letter on Jannuary 29. As this was the first notice of the accident, the company objected that it came too late.

The court took cognizance of the fact that Rendle & Stoddard knew of the occurrence of the accident from their foreman at least fifteen days before reporting it to the company. The court comments upon the phraseology of the clause quoted above and notes that immediate notice of the occurrence of an accident is required regardless of any claim for damages, in order to secure material facts and names of witnesses at the earliest date. The plaintiff had secured a judgment against the assured and this was an action in equity to recover this judgment against the insurance company. Holding that the doubts of the assured as to the existence of either injury or liability to McCarthy cannot be construed to deprive the insurance company of its contractual rights to immedate notice, the court dismissed the action as to the insurance company and held the assured solely liable.

ABSTRACT OF THE DISCUSSION OF THE PAPERS READ AT THE PREVIOUS MEETING.

A NEW CRITERION OF ADEQUACY OF EXPOSURE—ALBERT H. MOWBRAY.

VOL. IV, PAGE 263.

WRITTEN DISCUSSION.

MR. WILLIAM LESLIE:

This paper deals with the application of the Tchebycheffian criterion to empirical probabilities of hazard derived from workmen's compensation data. It presents a practical method of analyzing by means of this criterion the data used in constructing compensation rates.

The value of mathematical tests to supplant, or at least supplement, the judgment now used in combining experience and deriving pure premiums for compensation insurance is evident to anyone familiar with either the present method of rate-making or the many inconsistencies found in applying the rates appearing in our compensation manuals.

The particular test here described is one for measuring the payroll exposure necessary to give a predetermined degree of accuracy in the pure premium or, with a given exposure, for calculating the degree of accuracy in the resulting pure premium. As Mr. Mowbray points out, however, inadequacy of exposure is only one of the elements entering into the present necessity for the use of judgment in rate-making. Even were this not so the test here described would not do away with the necessity of using judgment in grouping classifications and erecting pure premiums where the exposures are inadequate. Its value lies in the guide it affords in the use of judgment, both in furnishing a measure of the extent of departure from the indicated pure premium warranted by the paucity of the data and also in giving the exposure which should be obtained by appropriate grouping of classifications to give dependable pure premiums. If it is based upon sound principles, it should prove of great assistance in rate-making.

The weak point in the application of this criterion to workmen's compensation experience lies in the assumption that the hazard probabilities constitute a Bernoullian Series. Mr. Mowbray recognizes this weakness, as witness the following quotation: " . . . after due allowance and correction has been made for disturbing factors (such as 'increasing cost,' 'industrial activity,' and other items

considered at the last rate conference) the first may perhaps be taken as approximately true. Indeed, its approximate truth when so corrected seems to be a fundamental requirement of prospective rate-making." In this statement "the first" refers to the assumption regarding the constancy of the probability of hazard throughout the period observed. The formula derived by Mr. Mowbray is a development of the application of the criterion of Tchebycheff to a Bernoullian series and we cannot, in the absence of proof to the contrary, assume that it would give even approximately accurate results if the probability of hazard should not remain constant.

In the absence of any knowledge of the true facts, and in the light of the accepted methods of making rates for compensation insurance on the basis of the ratio of total combined losses (with appropriate adjustments) to total combined payroll, we might be justified in accepting the approximate truth of the assumption of a Bernoullian series. It seems to me, however, that further investigation on this point is warranted before applying the criterion in practice.

Arne Fisher in his "Outline of a Method for Determining Basic Pure Premiums," reported in the *Proceedings,* Vol. II, p. 394, casts a doubt upon the identity between a Bernoullian distribution of occurrences and a workmen's compensation loss series. He suggests an actual test of the stability of the series of losses for each classification, but under present conditions of rate-making, such a test of the stability of the pure premiums is impractical.

Albert W. Whitney in his article "The Theory of Experience Rating," published in the *Proceedings,* Vol. IV, p. 274, deals with the theory that each risk within a particular classification has its own real risk hazard and that these risk hazards group themselves about the real class hazard according to some law of frequency. If this is a true hypothesis then the series is not a Bernoulian series because the probability of hazard is not constant but fluctuates from risk to risk within the classification.

Not only does our practical experience teach us that there is very probably a fluctuation in the probability hazard from risk to risk within a given classification, but my personal observation of certain large risks, over a period of several years, indicates to me that the risk hazard fluctuates from year to year, due to changing conditions for which as yet appropriate modifications have not been established.

Perhaps Mr. Mowbray contemplates a reduction to the Bernoullian series by means of judgment corrections applied to cases showing pronounced and evident variations in the risk hazards, but it seems to me that such corrections can at most affect but a relatively small number of risks and if the probability of hazard to begin with is not approximately constant for all risks within the class, then these more or less sporadic adjustments will not convert the data into a Bernoullian series.

These facts indicate to me that the experience for the majority of our manual classifications probably does not embrace a constant probability throughout the period observed. Furthermore I cannot entirely agree with Mr. Mowbray that such a conclusion is inconsistent with the theory of our present system of prospective rate-making. In this connection I believe we must assume that the modifications for increasing cost, etc., as well as the various state differentials have been accurately determined so that our "sets" or "samples" of experience (each constituting the experience under policies of a particular year of issue in a particular state covering various risks falling within the same classification), when corrected and reduced, each contain the same average probability of hazard. If there is no variation within each set then the experience would constitute a Poisson series. In our scheme of prospective rate-making we form a mean or average classification rate from past experience which we hope, in view of the above referred to modification factors, will properly represent the average rate for the classification under consideration. From the theory of probabilities, we know that the mean of a Poisson series with varying probabilities is equal to the mean of a Bernoullian series whose constant probability is the arithmetic mean of the varying probabilities of the corresponding Poisson series. Therefore regardless of whether or not our loss data represents a Bernoullian or a Poisson series, the present method gives a true prospective class rate upon the assumption that the modification factors and the law differentials are accurate.

In applying this class rate to individual risks the several schemes which have been adopted to adjust it to the varying hazards of the risks within the class seem to give further evidence of the varying risk hazard and to me seem to be a tacit admission that the loss series is not normal.

A very interesting feature of Mr. Mowbray's paper is his adoption of the pure premium as a basis for a probability. That it simplifies the procedure in applying the criterion is quite evident. Whether or not it is logical is not quite so clear.

The probabilities dealt with in the paper, and generally met with in practice in connection with compensation hazards, are quite small. Suppose, however, the following purely hypothetical case existed:

Out of each thousand soldiers engaged in the war, seventy die from one cause or another during the year and an average death benefit of nine thousand dollars is paid. If the average annual earnings of each soldier are six hundred dollars, what is the probability that 100 per cent. of the payroll unit will be required for death claims arising out of the expenditure of that unit. It is readily seen that the value of the probability exceeds unity, although the probability of death is only seven one-hundredths.

If Mr. Mowbray's expression for a probability is a logical one,

how is a result such as the above explained? If each of the events in the denominator is equally likely and they constitute the whole range of possible events how can the above situation arise?

MR. ARNE FISHER:

Mr. Mowbray is one of the few actuaries in this country who has made an attempt to extend the application of mathematical analysis to actuarial and statistical work beyond the common rules and comparatively elementary methods usually employed by the actuaries of the life assurance companies. I think that it will be admitted that invalidity and sickness assurance require more refined mathematical methods than those required in ordinary life assurance calculations, and the statisticians and actuaries of our society need a far more extensive mathematical training than that usually attained by an actuary of a life company.

It is, therefore, very pleasing to note that Mr. Mowbray in this article strays away from the well-beaten paths of his colleagues in the life branch, several of whom are, as I once upon a time asserted, suffering from what the Italian philosopher, Morselli, has called "the sterilization of the mind."

Taken as a whole, I agree with the conclusions of the author, but a few points may perhaps be subjected to a more critical analysis. Mr. Mowbray makes frequent use of the term "homogeneous," without defining what he means by homogeneity in statistical series and mass phenomena. As far as I can judge, his classification of statistical data is rather of a subjective kind. What Mr. Mowbray would call homogeneous another statistician might indeed consider as heterogeneous. Homogeneity, if such a thing can be said to exist in statistical observations, is not a fixed and universal notion, but is a varying element in itself, since it is evident that there are various degrees of homogeneity. We might, for instance, ask whether the Mongolian race is more homogeneous than the White race. All statistical analysis is in its last instance simply a study of variation, this latter word taken in its most general sense. The majority of statistical mass phenomena exhibit a tendency to cluster around certain norms. But this clustering tendency varies with the statistical object. An interesting example is offered in anthropometric measurements. Measurements of recruits from various countries show decided variations of clustering tendencies around certain norms, as for instance around the mean value. And even inside each locality we find great variations. Probably one would term the measurements of recruits from a snug little country like Denmark as homogeneous. But, strictly speaking, this is not the case. If we take the members of the regiment of the Royal Guards, none of whom are below 6 ft. 2 in. in height, we will find a much denser clustering around the mean than in the case of the other arms of the service. Unless we are able to express this varying degree of homogeneity by means of abstract numbers, the volu-

minous verbalisms about "homogeneous" material, of which actuaries and statisticians are so fond of speaking, becomes to a very large extent a matter of personal judgment.

Personally, I prefer the term "stability" to that of "homogeneity." This is also a variate, and the question arises as to how we shall measure this varying degree of stability. One of the simplest and speediest test is by the so-called Lexian-Charlier dispersion theory. To quote from Charlier, "when a statistical *homograde* series is given (as, for instance, the rates in compensation insurance) the first task of the statistician is to compare it with the series which in the given case should follow as the consequence of the Bernoullian Theorem. If the series agrees with this theorem it demands, beyond the determination of errors due to random sampling, no *explanation is necessary*—as little as it is necessary to 'explain' why in coin-tossing a head and not a tail appears in a certain case."

I should have wished that Mr. Mowbray had made use of this simple and quick method to test whether the series with which he is dealing are Bernoullian series or not. As it is, we are—as far as I can see—forced to rely upon Mr. Mowbray's personal subjective judgment, which, no matter how excellent and keen it may be, nevertheless does not come up to the exactness of the cold and impersonal analysis by purely objective methods.

Assuming, however, for the moment that Mr. Mowbray's personal subjective judgment is so keen that it can be substituted for the more careful and conservative methods of the objective analysis, we shall, in the absence of further information about the specific details of the data, also assume that the series with which he is dealing are Bernoullian series. Mr. Mowbray now makes use of the criterion of Tchebycheff to test the probability of deviations from the indicated empirical rates. Mr. Mowbray could have simplified his calculation somewhat if he had used the formulas on pp. 110–111 of my book on "Probabilities" instead of the formulas on page 108. As a matter of fact, I have on p. 111 used Tchebycheff's criterion to prove the Bernoullian Theorem. However, this is a mere matter of taste and does not alter the final results as reached by the author. Moreover, the application of Tchebycheff's criterion is very conservative, inasmuch as it over-estimates by a wide margin the limits inside which the expected deviation may occur. The criterion, at least in the form used by Mowbray, however, does not give us the means to determine the probability of the occurrence of a specific deviation.

I trust, therefore, that Mr. Mowbray will pardon me for showing how such probabilities can be shown in tabular form as frequency functions and also in graphical form by means of frequency curves, which, of course, only are plotted from the computed values of the various probabilities. Space forbids me to give the theory and the necessary formula from the theory of the frequency curves of homo-

grade statistics, and I shall limit myself to giving a few actual numerical results relating to the statistical data on p. 270, as furnished by Mr. Cogswell.

The contingencies in question are, with the possible exception of certain temporary disability benefits, events which in the language of mathematical statistics are termed as "rare events," or events whose probability of occurrence is small, *i. e.*, less than, say, .005. Hence we are, unless we had an infinitely large payroll exposure, dealing with what is known as the "Law of Small Numbers." This law, so termed by the Russian statistician Bortkiewicz, was originally introduced by the French mathematician, Poisson, and has of late years been extended and perfected to a very high degree by the members of the modern Scandinavian school of mathematical statistics. Its importance is especially in the theory of risk, much greater than that anachronism which a lot of actuaries and statisticians usually call "the law of averages," a vague and nebulous product of the brains of some academicians, and which, like the ghost in "Hamlet," stalks through the majority of actuarial and statistical writings in this country. The "Law of Small Numbers" is represented by frequency curves of the Poisson-Charlier or the Poisson-Jörgensen type.

As the first illustration I take the death losses in classification 2286. Following the procedure by Mr. Mowbray, let us take $3,000 as the unit of a death loss. We then have:

s = sample set exposed = 13,198 units equivalent to about $39,600,000.

m = number of observed attributes in the sample = 2.364 units equivalent to $7,091.

q = indicated probability or statistical frequency = .000179.

We might now ask: What is the probability to obtain, say, x favorable events in a second sample of the same size? Or, stated in a slightly different form: What is the frequency curve, $F(x)$, of this sample?

This Poisson-Charlier cure is of the form:

$$F(x) = \psi(x) + B_2\Delta^2\psi(x) + B_3\Delta^3\psi(x) + \cdots$$

which has the important property to vanish for all negative values of x.

I give below the numerical values of this curve.

X means here the amount of a loss expressed in units of $3,000, and $F(x)$, which is a function of x, is the probability of the occurrence of such a loss.

By means of the well-known Gamma Functions it is also possible to interpolate values in this table.* Suppose we wanted to find

* The ordinary interpolation formulas as based upon the finite difference formula of Newton fail to render service here.

the probability that a loss would fall between, say, \$5,400 and \$6,000. An actual computation or interpolation by means of Gamma Functions gives us .0526908 as the probability of the occurrence of such a loss. Likewise we would find a value equal to .0408415 as the probability of the occurrence of a loss between \$9,000 and \$9,600. Similar interpolations can be carried out for arbitrary values of the different losses.

Loses.	x.	$F(x)$.
Below \$1,500	0	.094043
\$1,500– 4,500	1	.222318
4,500– 7,500	2	.262780
7,500–10,500	3	.207072
10,500–13,500	4	.122379
13,500–16,500	5	.057861
16,500–19,500	6	.022797
19,500–22,500	7	.007699
22,500–25,500	8	.002275
25,500–28,500	9	.000598
28,500–31,500	10	.000141
31,500–34,500	11	.000030
34,500–37,500	12	.000006
37,500 or more	13	.000001
	Sum:	1.000000

The interesting point of the above table is, however, the evidence of marked variations due to random sampling in spite of the comparatively large payroll. The curve is decidedly skew, as is seen from a mere glance of its graph (Fig. 1). If we were to fit the curve to a normal curve with standard deviation or Bernoullian dispersion equal to $\sqrt{spq}$ we would obtain a symmetrical curve. I shall not dwell at a closer discussion of a comparison between these two curves at the present, as I intend to discuss the gross fallacy to fit skew frequency distributions by means of the normal curve in one of the illustrations immediately following.

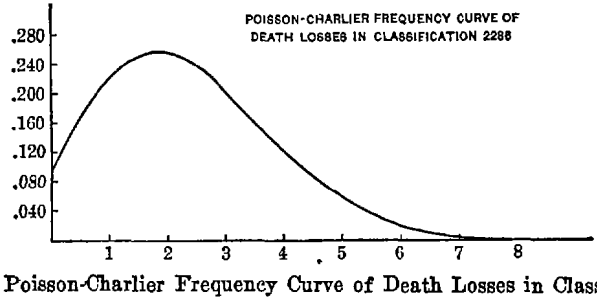


FIG. 1. Poisson-Charlier Frequency Curve of Death Losses in Classification 2286.

Let us in the meantime examine the frequency curve for death losses in classification 2222. We have here, using the same notation as above:

$$m = 8.804$$
$$s = 21{,}781$$
$$q = .000404$$

Our object is to find the frequency curve of this sample. I shall only give the table of $F(x)$ in summary form, as the run of the variations can fully be seen from the graph in Fig. 2. The numerical values are (in groups of 7):

x.	$F(x)$.
0–6	.225610
7–13	.710171
14–20	.063890
20 and over	.000329

From the graph it might at a first glance appear that the curve is almost normal in character. This, however, is an optical illusion, due to the fact that the drawing is made on a very small scale. If we consult the actual table we find, however, a decided skewness. This is also seen from the figure where the range to the left of the maximum value or the mode amounts to about 8 intervals or units, while the range to the right of the mode is more than 15 intervals. If the curve had been of the normal type the left half of the range should have been equal to the right half.

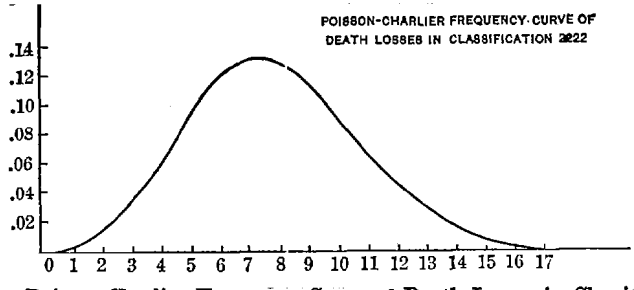


FIG. 2. Poisson-Charlier Frequency Curve of Death Losses in Classification 2222.

As a different illustration I take the permanent total disability losses in classification 2660. I have been informed that the average loss of that kind of invalidity is about $4,000. In order to simplify the computations so as to work with round numbers, I have chosen $3,950 as the unit loss. Whether this be exact or not has no bearing, however, on the construction of the frequency curve. Using this unit we have:

$s = 19{,}985$ (equivalent to a payroll of about \$79,000,000)
$m = 0.9$
$q = .000045$
I give below a table of the frequency function:

x.	$F(x)$.	x.	$F(x)$
0	.406570	5	.002001
1	.365913	6	.000300
2	.164661	7	.000039
3	.049398	8	.000002
4	.011115		

The graph of the curve is shown in Fig. 3. It is decidedly skew. In fact, it is a one-sided curve.

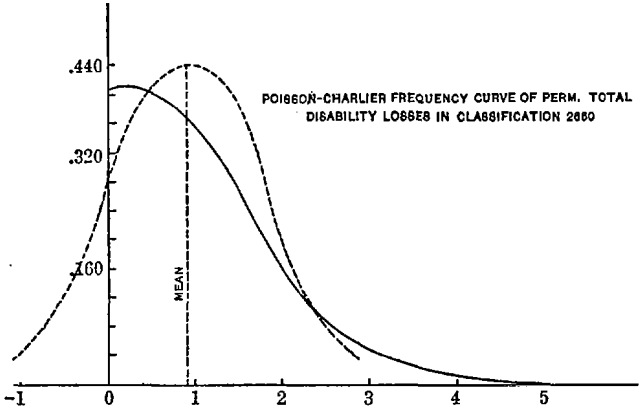


FIG. 3. Poisson-Charlier Frequency Curve of Permanent Total Disability Losses in Classification 2660. Illustrating the error to fit the "Law of Small Numbers" by a Gaussian Normal Error Curve. (Dotted curve represents the Gaussian and full drawn line the Poisson-Charlier Curve.)

We shall now see how the Gaussian normal would fit this frequency distribution. I have fitted the Gaussian curve to the data in order to show the gross fallacy a number of statisticians and actuaries make themselves guilty of in insisting to use this curve. This fallacy has of late been accentuated by the recent articles of Professor Whitney and Mr. Michelbacher on experience rating. If I have understood rightly the trend of these articles, their authors throughout employ the formulas for the Gaussian normal distribution. Let us see how this will turn out in the present case. The standard deviation is in this case given by the formula:

$$\sigma = \sqrt{sqp} = \sqrt{19985 \times .000045 \times 999955} = .94820.$$

The mean or the origin of the curve is equal to $sq = .899325$.

Since only about two thirds of the Gaussian curve is included between the two ordinates corresponding to the abcissas $-\sigma$ and $+\sigma$, that is between the abcissas $-.94820$ and $+.94820$, as reckoned from mean as origin, it is evident that a goodly part of the curve will fall in the region of negative values of the abcissa. This is shown by an actual calculation of the normal curve values as given in the following table:

Interval.	$F(x)$.
Below -3	.00003
From -3 to -2	.00110
From -2 to -1	.02146
From -1 to 0	.14872
From 0 to 1	.37066
From 1 to 2	.33480
From 2 to 3	.11178
From 3 to 4	.01090
From 4 to 5	.00053
From 5 and over	.00002

This table shows that 17.121 per cent. of the curve corresponds to negative values of the variate, a fact which is also strikingly illustrated in the graph of the normal curve where the tail piece to the left falls over negative values of the abcissa. This means, of course, the presence of negative losses or actual gains. In other words, the insurer would, if the hypothesis of a normal distribution was true, encounter actual gains from certain death claims. This is too good to be true, and common sense shows the absurdity of such results. In spite of the comparatively large payroll in the class—about $79,000,000—it is evident that on the hypothesis of a normal distribution we encounter a decided negative piece of the tail of the Gaussian curve. It would be of great interest to know what Professor Whitney and Mr. Michelbacher actually have done with this annoying tail-end of the Gaussian curve. Such absurdities do not occur when we use the Poisson-Charlier frequency curve, which, as already stated, has the property to vanish for negative values of the variates.

As a final illustration, I shall take a somewhat different example. Suppose that we were to investigate the variations in the permanent partial disability losses in the classification 2660 on a payroll of $1,000,000. Taking in conformity with Mr. Mowbray $1000 as the unit loss, we have:

$$s = 1000$$
$$q = .000097 \text{ or } .001 \text{ approximately.}$$

This is a decidedly skew distribution, as is seen by a glance from the values of s and q. I shall construct the curve for intervals of

losses of $200, that is, 0.2 of the original unit as chosen by Mr. Mowbray. Using the method of interpolation by Gamma Functions we shall have the following values of $F(x)$:

x.	$F(x)$.	x.	$F(x)$.
0.0	.355389	2.2	.000925
0.2	.244218	2.4	.000473
0.4	.159460	2.6	.000279
0.6	.099909	2.8	.000120
0.8	.060470	3.0	.000059
1.0	.035530	3.2	.000029
1.2	.020352	3.4	.000014
1.4	.011390	3.6	.000007
1.6	.006244	3.8	.000003
1.8	.003360	4.0	.000001
2.0	.001777		

Let us again try to see how the Gaussian distribution would fit these results. The mean is here equal to $sq. = 0.1$, while the standard deviation or Bernoullian dispersion amounts to 0.316234. The table of $F(x)$ is as follows:

x.	$F(x)$.	x.	$F(x)$.
—1.0	.0006	0.2	.2399
—0.8	.0044	0.4	.1610
—0.6	.0218	0.6	.0723
—0.4	.0723	0.8	.0218
—0.2	.1610	1.0	.0044
0.0	.2399	1.2	.0006

The mode of the normal curve falls at $x = 0.1$. It is not necessary to go into details to show the utter impossibility to attempt to fit this distribution by means of a normal curve, which is also shown at a glance from the graph in Fig. 4.

Almost from the very organization of this Society, I have pleaded for the introduction of more refined mathematical statistical methods in compensation insurance than those commonly used by the life actuaries. I have always insisted that most of the frequency distributions of losses around the average values were essentially skew distributions, because we were dealing with the "Law of Small Numbers." If I had chosen to select my examples from medical statistics relating to inoculation and sample tests on the effect of various vaccines, or if I had selected my numerical examples from the realm of biology, I could easily have shown that my assertions were true. However, it is quite likely that I would have been told that while such things were true in biology they were not necessarily true in compensation insurance. Unfortunately, I did not

have access to any of the statistical data used by the various rate-making experts, so I had to abide my time. Mr. Mowbray and Mr. Cogswell have, however, now supplied me with some authentic data, which has put some very excellent ammunition in my hands, not

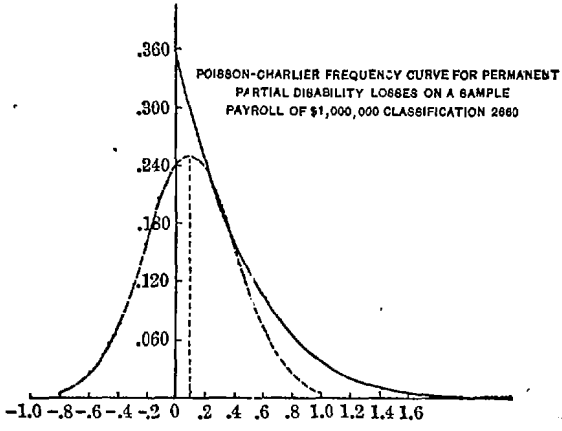


FIG. 4. Poisson-Charlier Frequency Curve for Permanent Partial Disability Losses on a Sample Payroll of $1,000,000 in Classification 2660. Dotted curve represents the fit according to a Gaussian Normal Curve. Full line curve represents the Poisson-Charlier distribution.

only to defend my previous statements, but also to attack some of the methods of my adversaries, if occasion should make this necessary. For this reason I feel very grateful to Mr. Mowbray for having presented his valuable article to the members of this Society.

MR. ALBERT H. MOWBRAY:

(AUTHOR'S REVIEW OF DISCUSSION.)

I am very much gratified to find that my paper has produced two such thoughtful discussions as those presented by Mr. Leslie and Mr. Fisher. I am also pleased to note that both my critics recognize the tentative way in which the results were put forward rather as a pioneer effort in guiding the attempts at solution of the problem of compensation rate-making than a complete solution of the intricate problem discussed.

Mr. Leslie points out that the criterion is applicable only when the hazard probabilities constitute a Bernoullian series and he feels that the hazard probabilities rather constitute a Poisson series. I cannot agree with him in this regard, as it seems to me that probabilities in actual fact very nearly correspond to a Lexian series; but I expressed the view that our various factors employed tended

to reduce the series to a Bernoullian type, on the assumption that such a type was fundamental to our present system of rate-making. To this Mr. Leslie also takes exception, holding that we may apply our present methods equally upon the basis of the probabilities forming a Poisson series, because the mean of a corresponding Poisson and Bernoullian series is the same. I must confess to a much less familiarity with the general dispersion theory than I would like to have, but, if I correctly understand the matter, the fundamental characteristic of a Poisson series as distinguished from a Bernoullian is that in the former the hazard probability is varying and in the latter it is constant. It does not seem to me that the mere fact that in the past the mean of a number of varying probabilities approaches a constant value justifies us in using that for the future unless we assume that that hazard is to remain constant in the future. This, it seems to me, is equivalent to the assumption of a Bernoullian series, and I think that is what Mr. Fisher refers to throughout as determining the question of stability.

Mr. Fisher criticises, and I think with considerable justice from his point of view, my use of the word "homogeneity" in this paper, suggesting in lieu thereof the term "stability." From the mathematical standpoint Mr. Fisher's suggestion is not in the least objectionable, and yet I am not sure but that, from the practical point of view, the term "homogeneity" is preferable. The classification of risks is a problem for underwriters and we have as the first basis a number of manual classifications. It is highly improbable that as applied to the individual risks classified, as, for example, machine shop, Mr. Fisher's tests would show any real homogeneity or stability in the class; yet when the problem of rate-making is under way we have no means of analyzing generally the experience making up a classification. We, of course, are aware that the wire drawing experience in Massachusetts, for example, is dominated if not actually controlled by the experience of the American Steel and Wire Company and that the experience in the electrical apparatus classification in that same state, to use another example, is dominated by the experience of the General Electric Company; but these are rare instances and generally we cannot go back of the classification experience reported to us, and must therefore assume that such experience is homogeneous, perhaps using the term in the way in which we would use it of the Chinese race as compared with other races, notwithstanding that there may be a great variability within the race itself. When, however, we pass beyond the boundaries of the individual classification and combine the experience for several classifications we are taking a further step and the little homogeneity which may be present in the single classification may be further disturbed by the addition of other material, even on the basis of assumed analogy of hazard.

As rate-making is carried on today, both time and money are lacking for mathematical test of stability along the line suggested

by Mr. Fisher. This may be a future development, but, personally, I doubt if we can hope for as much, at least until mathematical methods are better known and mathematical statistics has the appreciation of the public. The executive officers of the companies are not trained in such matters. Heretofore they have entrusted the rate-making to underwriters and rate-making has been wholly a matter of what Mr. Fisher terms subjective judgment. Gradually the actuary has been entrusted with a larger part in the rate-making work, but attempt at too much refinement may tend to deprive the actuary of the position he has so far attained in this respect. It seems to me the need of the hour in many ways is the popularization of mathematical statistics through the preparation of treatises in popular form which will tend to familiarize the general public with these methods, supplemented by careful scientific treatises of the kind put forth by Mr. Fisher to train mathematicians in the more advanced theory of the work.

I do not mean by this that we should encourage those who do not properly understand statistical mathematics to try to use them. Such work would probably produce startling results. Rather, I would like to see the public taught that such methods exist and produce truer results, so that it will come to accept the necessity for their use as it does engineering mathematics, or the reserve in life insurance, or generally the use of mortality tables, when it really does not understand in any but the most superficial way the use that is made of them. The public is generally disposed to look upon statistics as a field where every man can and should make his own analysis and deductions from the figures as they stand and where "hifalutin'" mathematical formulae are all "tommyrot." Too many so-called "practical" statisticians are prone to encourage this idea.

I must admit that the form of theorem referred to by Mr. Fisher would have been simpler for use in preparing the table, although, perhaps, the process might not have been entirely as clear to those with less experience, for whom the paper was in part designed.

I am also disposed to agree with Mr. Fisher that we can get much further by frequency curve methods such as he uses than this paper attempts to carry us. In the hurly-burly of a rate revision as carried on at the present day, it is hopeless to undertake such work, for the frequency curves would have to be prepared practically for each of the several sets of data before the committee. It has seemed to me, however, that there was need of a simple rule of thumb which would be safe, which might act as a restraint against, on the one hand, too great confidence in insufficient data, and, on the other, too great fear of serious results where the statistical data, even of considerable volume, runs counter to preconceived notions. A rule to meet present day requirements must therefore be given in the somewhat blind fashion in which the problem has been attacked here, without precise knowledge of the

particular data to which it is to be applied. If it give a safe indication of the dependability of the data, then all the purposes for which it was undertaken have been carried out.

A large part of Mr. Fisher's discussion is not directed particularly at the subject matter of the paper, but is devoted to the use of statistical data quoted in the paper in illustraion of frequency curve work based upon the use of Charlier A and B type curves. This is very interesting and useful, and I think Mr. Fisher deserves our thanks for having given it to us. Although I have not made extensive search, I have not been able to find anywhere clearly stated the fundamental equations of the Charlier A and B type curves used by Mr. Fisher and their law of development. Might I suggest that Mr. Fisher would do a most useful service for us all if he would give us in compact form the equations of these curves and their developments?

Mr. Leslie takes issue with my suggestion in proposing that we might express our probabilities with reference to payroll exposure, and to prove that the suggestion is illogical uses a rather curious and admittedly hypothetical illustration. It would require, perhaps, no more forced illustration to prove that our present method of stating the probabilities of life and death are illogical. Of course, if we were to write insurance of the type Mr. Leslie uses on a payroll basis and attempt to express the probabilities as I have suggested, we would obtain results which are not interpretable in accordance with our established theory of probabilities. But this is merely a demonstration of the unquestioned fact that if we wish to use our present developed theory of probabilities our fundamental definitions must be adapted so that they will not be in conflict with such a theory. I am disposed to believe that throughout the general range of practical use the suggestion I have made for defining our probabilities squares with the fundamental law.

THE THEORY OF EXPERIENCE RATING—ALBERT W. WHITNEY.
VOL. IV, PAGE 274.

THE PRACTICE OF EXPERIENCE RATING—G. F. MICHELBACHER.
VOL. IV, PAGE 293.

WRITTEN DISCUSSION.

MR. W. W. GREENE:

Not so very long ago I contributed a paper to the *Proceedings* of this Society, which paper was in opposition to experience rating. My objections to experience rating were largely upon the ground that as then practiced it was contrary to the basic principles of insurance.

There is no doubt that present methods of determining manual rates are not sufficiently elastic to permit of even substantial justice to many individual risks, unless some such method as experience rating be employed. However, as between the inequity resulting from the absence of an experience rating plan and the unsound demoralized condition which follows from the use of a weak experience rating plan, I would unhesitatingly choose the former.

I have felt that the plan of experience rating developed by the Actuarial Section of the National Reference Committee on Workmen's Compensation Insurance was worthy of a trial, chiefly because the structure of the plan is, in my opinion, not inconsistent with the fundamental principles underlying workmen's compensation insurance. In taking this position I am fully mindful of the fact that in all probability we are a long way from anything approaching perfection in many important details of the plan.

Mr. Whitney's brilliant mathematical investigation, undertaken in conjunction with the work of the Actuarial Section, and for its benefit, was, I believe, the first notable attempt to place experience rating upon a basis consistent with the mathematical theory of probabilities, a step which necessarily would have to be taken before experience rating could be anything worthier than a more or less orderly method of juggling with payrolls, loss ratios and rates.

To discuss thoroughly from all important technical and mathematical angles the papers presented by Mr. Whitney and Mr. Michelbacher would require, not only considerable time and space, but also, as regards Mr. Whitney's paper, a more complete knowledge of certain branches of mathematics than I claim to possess. In fact, it was my own unfamiliarity with the tools employed by Mr. Whitney that led me to undertake an investigation of my own, which resulted in a suggestion to the Actuarial Section embodying the working formula which has been finally adopted for general practical use.

For the benefit of those who have not yet had an opportunity to read the papers in question, I may say that Mr. Whitney points out that in order to employ experience rating, it is necessary that there be such a thing as "risk experience." In other words, the particular risk must have an experience distinct from that of the class to which it is assigned. This condition does not obtain in the case of ordinary life insurance, nor in the case of fire insurance. Therefore, experience rating can be applied to workmen's compensation insurance, certain forms of liability insurance and group life insurance, only.

The problem of experience rating is defined as that of how best to weight two usually conflicting bits of evidence, namely, the indication of the class experience and the indication of the individual risk experience. In this connection it is pointed out that the credibility of the risk experience increases with the exposure (meaning number of employees) and also with the degree of hazard.

The greater part of Mr. Whitney's paper is devoted to the development of formulæ for the most probable value of the true hazard of true rate for the individual risk in view of the experience indications of the class and risk, upon the theory that risks within a class are distributed by hazard in accordance with the so-called normal frequency curve.

Mr. Michelbacher's paper is, as he says, devoted to the "development of a practical plan from fundamental theoretical principles."

Neither of these papers touch upon one important phase of the experience rating problem, namely, the manner in which the losses are to be computed for the purposes of the plan. When the Actuarial Section of the National Reference Committee was in session upon this subject, I expressed myself as of the opinion that in order to place the plan upon a sound and non-discriminatory basis, it was necessary to provide an uniform method of computing losses. Such an uniform method has in fact been adopted for use in connection with the plan in Pennsylvania and New Jersey and I believe such a step is being considered in other states.

In the early days of schedule rating, the schedule contained certain items which were called "discretionary charges" and "discretionary credits." Considerations of soundness have dictated that these discretionary portions of the schedule be eliminated. In the same way the experience rating plan of the future will, I believe, be free in so far as is humanly possible from that discretionary element arising from the valuation of losses by exercise of personal judgment only. In fact, we cannot consider the experience rating problem as solved by any means until we have, not merely a tabular method of valuing outstanding losses, but such a tabular method tested and corrected in the light of actual experience.

On the first page of his paper Mr. Whitney says: "The problem of experience rating arises out of the necessity, from the standpoint of equity to the individual risk, of striking a balance between class experience on the one hand and risk experience on the other."

A great deal of emphasis has been placed by advocates of experience rating upon its importance as an incentive to accident prevention. I cannot see where there is any ultimate ground for conflict between the advocates of equity and the advocates of accident prevention as purposes for the experience rating plan. A good experience rating plan will encourage the prevention of accidents and will also deal more equitably with the individual risk than is possible without such a plan.

I have heard it said that the present experience rating plan will not be of any value as a means to accident prevention because the experience rate is calculated in terms of losses instead of in terms of number of accidents. Accident prevention and prompt and efficient medical service are paramount in the workmen's compensation field. If the present experience rating plan is not so adjusted as to encourage the elimination of unnecessary loss of human life and efficiency, it should be so amended as to serve these higher purposes of the business, which are of greater value even than is equity as between risks. I am inclined, however, to the view that with losses computed upon a tabular basis the experience rating plan can be used as an accident prevention incentive if an affirmative attempt is made to do so. It seems to me that there is not a vast difference between the so-called "weighted accident frequency" and the tabular method of valuing losses. I believe that such difference as exists is more a matter of terminology than anything else.

Mr. Whitney makes some very interesting comments as to future developments of fundamental theory in the rating of workmen's compensation risks. He says that "the time is now come when there should be a complete reconsideration of the manual system, the schedule system and the experience system in the effort to develop one thoroughly concatenated and consistent rating system. This involves the necessity for a thoroughgoing analysis of the logic and philosophy of rating."

Mr. Whitney has done well to emphasize the importance of regarding the rating of workmen's compensation risks as one problem. In the past the general viewpoint has frequently, in fact, usually, been sacrificed to the somewhat biased view of the specialist, whether underwriter, engineer, actuary or statistician. Admitting the desirability of an abstract study such as he suggests, I would say that it is of paramount importance to bring about a situation wherein it shall be the recognized task of some group in the compensation insurance profession to periodically review and reconcile current developments in methods of rating compensation risks, with the avowed purpose of coördinating all these developments into one consistent and logical system.

Personally I do not anticipate revolutionary progress, but rather evolutionary progress in this field. I feel that excellence in the system of rating compensation risks will, for the most part, come through the unremitting and conscientious labor of members of

this profession, and their associates in the compensation business, provided that adequate agencies exist for the purpose of coördinating the results of individual effort.

It seems to me that what we need even more than a reconsideration of fundamental theory is the establishment of a more effective clearing house for principles than the present National Reference Committee on Workmen's Compensation Insurance has proved to be. The reorganization of this body into the proposed National Council will, I trust, successfully take place, thereby marking, I believe, the beginning of a new era in the compensation business.

If the National Council becomes an effective organization we shall have in the central committee of that body, which will be termed merely the "National Reference Committee," an agency for supervising and coördinating the work of technical committees, such as the engineering committee and the actuarial committee. We shall not have, as we had during the past year, two "National Reference Committees" operating independently with no means of reconciling conflicting results. The new organization will have an executive committee in the Bureau Managers, who see to it that the time of the central committee is not taken up at the regular quarterly meetings by discussion of proposals which are not based upon the results of sufficiently thorough investigation. It should be the function of this committee of managers to anticipate problems and make sure that such problems are not lost sight of until it is a case of "locking the barn after the horse is stolen," as I fear has been too often the case during the present national emergency.

As a post-script to this discussion I am appending for the information of members of the Society copy of the memorandum which I submitted to the Actuarial Section, National Reference Committee on Workmen's Compensation Insurance upon February 12, 1918. This memorandum embodies the method by which in the first instance I arrived at the present working formula of the experience rating plan.

My efforts to develop a working formula were moved by the fact that the formulas suggested by Mr. Whitney presented serious difficulties in their practical application. In fact, the formula of Mr. Whitney, which was given most attention by the Actuarial Section, would have required the use of very extensive tables requiring a considerable volume of clerical labor for their computation, which labor would have to be repeated in case of any revision in the constants employed.

It occurred to me during the course of Mr. Whitney's investigation that if what might be termed less advanced methods were employed a simpler formula might be derived. Considerable labor finally revealed that, assuming that the risk indicated premium and the class indicated premium are both the fortuitous results of the play of a true pure premium common to both risk and class, an expression could be written in terms of simple algebraic probabili-

ties for the probability that a given value x is the true pure premium for both risk and class.

The most probable value of x, that is, the most probable true rate for the individual risk, would upon this hypothesis be that where the above referred to expression assumes its maximum value. A determination of this maximum indicated the most probable value of x to be

$$\frac{mP + np'}{m + n}$$

The above formula was at once recognized as that for the weighted average of the risk and class indicated rates. The memorandum addressed to the Actuarial Section follows:

"A BASIC FORMULA FOR EXPERIENCE RATING.

"Mr. Whitney has pointed out the usefulness of considering the experience rating problem as a case in inverse probabilities, and has developed expressions for the most probable value of x (the 'true' rate of the individual risk) upon the assumptions that the individual risks in a given class are dispersed (as to true rate) in conformity to the 'normal law,' and that the true rate x operates to produce p' in the actual experience in accordance with the conventional algebraic theory of probabilities. Mr. Whitney has also pointed out, to a degree at least, the substantial conformity of the dispersion under the 'normal law' to that produced by the expansion of $(p + q)^n$.

"As a case in inverse probabilities, the experience rating problem may be approached from a slightly different angle in such a manner as to avoid any assumptions as to the distribution of individual hazards within the class and materially simplify the resulting formulæ, both in form and application.

"The class pure prem., P, and the risk indicated pure prem. p' are both clues to the true risk pure prem. x. The most probable value of x is that which implies the maximum of consistency between the risk experience and that of the class. What then is the most probable value of x, where x represents the true prem. of both risk and class, and where P and p' are both the more or less random results of the operation of the true pure prem.?

"The probability that x is the *true* pure prem. in both risk and class, where P and p' are the *indicated* pure prems. in class and risk, respectively, is

$$\frac{{}^{m}C_{mP} \cdot x^{mP}(1-x)^{m-mP} \cdot {}^{n}C_{np'} \cdot x^{np'}(1-x)^{n-np'}}{\text{Sum of numerator for all values of } x}$$

where m corresponds to class exposure,

where n corresponds to risk exposure.

"Then the most probable value of x is that which obtains when the above fraction is at its maximum, or when

$$x^{mP+np'}(1-x)^{(m+n)-(mP+np')}$$

is at its maximum, as neither the other factors in the numerator, nor the denominator, vary with x.

"The required condition is satisfied if

$$(mP+np')\log(x)+\{(m+n)-(mP+np')\}\log(1-x)=\text{maximum.}$$

Equating first derivatives to zero,

$$\frac{mP+np'}{x}-\frac{(m+n)-(mP+np')}{1-x}=0$$

$$x\{(m+n)+(mP+np')-(mP+np')\}-(mP+np')=0$$

$$x(m+n)-(mP+np')=0$$

$$x=\frac{mP+np'}{m+n} \tag{1}$$

or if

$$Z=\frac{x-P}{p'-P}$$

$$Z=\frac{\frac{mP+np'}{m+n}-P}{p'-P}=\frac{n}{m+n}$$

or, more significantly,

$$Z=\frac{nP}{mP+nP} \tag{2}$$

"The formula (1) above is readily recognizable as the weighted average of the risk experience and that of the class. It is not, however, necessary or desirable in practice to make the weight actually assigned to the class experience depend upon the volume of payroll upon which the manual rate is based. It is better to take a standard earned prem. (MP) as reflecting the weight assigned to the class experience. This can readily be adjusted, and is a tangible concept with which we are all familiar. Probably even the assured can understand the logic of giving his experience more weight than that of the class where the earned prem. is over a certain figure, and less where under such figure.

"In practice it is most convenient to use formula (2)

$$z=\frac{nP}{mP+nP}$$

deriving x by the formula

$$x = P + Z(p' - P). \tag{3}$$

"These formulæ can be readily applied, readily adjusted, and, I believe, readily justified regardless of whether the manual rate be split, and regardless of the number of splits, if any. Their use necessitates a minimum of tabulation."

MR. ARNE FISHER:

"Inverse Probabilities"—or, to use the more correct name, the Principle of Bayes—have for years been one of my pet subjects in the mathematical theory of probability. I therefore trust that Professor Whitney and Mr. Michelbacher will pardon me for asking a few questions for the purpose of eliminating certain doubts which have occurred to me in reading their papers in the last number of the *Proceedings*. Possibly these doubts are due to me not having understood the methods which have been employed. Certain fundamental differences remain, however, which I should like to see explained in a more detailed manner, and I must therefore ask the indulgence of the members if I will have to go to some length in explaining the nature of such differences.

I have heard several university professors and several academians lecture on the Principle of Bayes. I must confess that I have never been able to grasp what these learned gentlemen really were driving at. Being a rather stupid fellow I therefore decided to read the available literature on the subject. Right here I made a sudden discovery, and rather a startling one at that. I found that the learned savants themselves by no means agreed about the so-called "inverse probabilities." Thus Professor Chrystal, the eminent Scotch mathematician, in an address delivered before the Faculty of Actuaries advised "practical people like the actuaries to bury the laws of inverse probabilities decently out of sight, and not embalm them in text books and examination papers." The Danish astronomer and actuary of the Danish Government Life Assurance Institution, Dr. T. N. Thiele, one of the foremost authorities on the theory of statistics and observations, speaks in his "Theory of Observations" of "the fallacies underlying the Principle of Bayes and the determination of a posteriori probabilities by a purely deductive process." This was rather some interesting opinion which strengthened my budding suspicion that there was something rotten—not in the state of Denmark, but in the minds of the learned gentlemen in the lecture rooms of the universities. I therefore began to study the whole literature of the "inverse probabilities," not alone in English, but in French, Italian, German, Dutch and Scandinavian as well. One of the first things I found out was that the name "inverse probabilities" in itself is a great misnomer. Its use is limited to certain English writers—it is, for instance, not

used by the Pearsonian school—and was probably first introduced by De Morgan. The principle was first discovered by the English clergyman, Bayes, and published by his friend, the actuary, Dr. Price, as a posthumous contribution in the *Transactions of the Royal Society* for 1763. Bayes stated the rule in a rigorous manner and in a very general form. Later writers, especially English and American mathematicians, have, however, lost sight of the true Principle of Bayes and substituted in its place a false, or, to be more exact, a special case of the exact principle under what they, like Professor Whitney, call "inverse probabilities." This special case of the principle of Bayes makes use of what in logic is known as "*insufficient reason*," or what Boole aptly called "*the equal distribution of ignorance.*" Now, in the great majority of cases it is absolutely fallacious to use this principle. Yet, scores of mathematicians insist upon using this false hypothesis as a basis for their computations. In my book on "Probabilities" I have shown that on the basis of the principle of "insufficient reason" we can prove that a x year old person is sure to die inside a year after we have observed that out of a group of m persons, all aged x, *none* had died during the year. This paradoxical result arises from the fact that we have assumed on the basis of "insufficient reason" that it is equally likely that there will die 0, 1, 2, . . . or m persons during the year. Many mathematicians insist upon making this rather absurd hypothesis, although they perfectly well know that it is far more probable that, for instance, 90 per cent. of a large number of, say, forty year old persons will survive one year that no one or every one will die during the year. No wonder that we encounter absurd results if we use absurd hypothesis. The principle of insufficient reason can, in my humble opinion, not be used except as a test for variation due to random sampling. If fundamentally different causes are at work in the different sample groups or complexes from which the observed event may originate, it is not permissible to use the special rule of Bayes, which is based on the above mentioned hypothesis.

Professor Whitney in the beginning of his article says:

"There would be no experience-rating problem if every risk within the class were typical of the class, for in that case the diversity in the experience would be purely adventitious. The problem arises out of the necessity of assessing the degree to which the disparity between risk experience and class experience reflects a real divergence between the true risk hazard and the average hazard of the class rather than mere chance."

It appears from this that Professor Whitney intends to investigate a fundamentally different problem than that of random sampling, and that if we were to use the principle of Bayes we should make use of the most general case where the probabilities of existence of the various complexes can not be considered as being equally likely. Yet later on Professor Whitney makes use of the special Rule of Bayes when he says:

"From this point of view one value of the real hazard of the class will be as probable as another."

It seems to me that this is a tacit assumption of the principle of insufficient reason, and that Professor Whitney bases his calculations which follow upon the same fallacious hypothesis upon which numerous other applications of the Rule of Bayes have suffered a total shipwreck.

Admitting for the present that the course followed by Professor Whitney is permissible, there remain, however, several other difficulties to be explained in the development of the various mathematical formulas in his paper. I do not pretend to be an expert judge on the subject of symbolic logic. I tried to attempt to read the massive volumes of Whitehead's "Universal Algebra," but found the task too heavy for me. Pearson in an article in *Biometrika* has taken Mr. Yule severely to task for his extended use of symbolic logic and claims that the method tends to obscure the fundamental problem in a mass of bewildering detail. There are, however, several equations, which Professor Whitney derives by ordinary algebraic methods, and on which I feel better qualified to speak than on the methods of symbolic logic.

On page 276 we find, for instance, the following statement:

"From a general knowledge of conditions we are safe in assuming that this law as a first approximation may be taken to be of the normal type. There will doubtless be some skewness. . . . The standard deviation may be taken as the measure of dispersion."

I do not wish to discourage Professor Whitney, but I feel that I can not agree with this statement. First of all, the Gaussian normal error curve which Professor Whitney insists upon using throughout his entire investigation does not even approximately represent the true distribution when the probability of the happening of an event is small. Whenever the probability of the happening of an event is less than 0.01 the Gaussian curve will surely not serve as a good representation of the distribution around the mean, unless the number of exposures approach infinity as a limiting value.

From practical experience from a large number of computations relating to various frequency distributions I know this to be true. If some of my readers are inclined to doubt my statement I can offer additional evidence by referring to the writings of Pearson and his assistants. Thus in speaking about the representation of deviations by means of a Gaussian curve, we find the following remark in the well known mathematical-statistical journal *Biometrika*, edited by Pearson:

"It is not till we get something like 30 out of 1000 in a cell that we can trust the Gaussian curve to give us at all a reasonable approach."

Again, Mr. Greenwood writing in *Biometrika* has this to say about the representation of the point binomial by a Gaussian curve:

"Its limitations are obvious. If either p or q be very small unless m is very large indeed, and for all values of p and q when m is small, the normal curve does not approximate closely to the binomial."

In the same article Mr. Greenwood states:

"This rule certainly applies to all cases of m less than 300 or 400 and p or q less than 0.1."

From this it would appear that in all questions of experience rating where the probabilities of the happening of an event certainly are much less than the above values given by some of the most eminent biometricians, and where the values of the units exposed to risk also are comparatively small, it is absolutely out of the question to use the Gaussian curve.

I shall illustrate this by an actual example. Suppose that an event has happened once in 100 trials. What is the probability of its happening 0, 1, 2, 3, 4 or more than 5 times in a second sample of 50 trials?

Evaluating the results by an exact computation and also by means of the normal curve with standard deviation $\sqrt{mpq}$, we obtain the following results:

	Exact Values.	Values from Normal Curve.
Chance of 0–2 successes	0.8938	0.9202
Chance of 3–5 successes	0.1007	0.0022

This strikingly illustrates how the Gaussian curve underestimates the probabilities. The estimate of the chance of 3–5 favorable events is in this particular example 50 times too small. I leave it to my readers to decide whether such an error can be called small.

I suppose that most of the members of this society will agree with me in the statement that it is useless to deal with sample payrolls of less than 500,000 or 1,000,000 in extent. According to this limit most of the figures given by Mr. Michelbacher will seldom exceed an exposure of 100 individual samples. Moreover, in such sample sets it appears that the probabilities are very small. The pure premiums per $100 in the tables on page 301 seem on the average to be about 1.50 and go seldom over 2.57. This would give a value of p or q considerably less than those quoted by Pearson and Greenwood and thus completely eliminate the use of the Gaussian normal curve, as advocated by Professor Whitney.

Matters do not become better when Professor Whitney says: "The standard deviation may be taken as a measure of dispersion." It is only in a true Bernoullian series, that is to say, a series of sample sets wherein the probability for success remains constant for all sets, that this is permissible. The dispersion equals in this case the standard deviation. Professor Whitney, however, at the very beginning of his brochure admits that there are variations from one sample set to another. In fact, it is such variations that

his methods intend to discuss. We are therefore dealing with a typical Lexian Series and not with a Bernoullian Series. Now it is a well known fact, which can be proven by simple algebra, that the dispersion in all Lexian Series is greater than in the correlated Bernollian series. It often happens that the dispersion in a Lexian series is four to five times as large as the corresponding Bernoullian dispersion or standard deviation. The measure of dispersion as advocated by Professor Whitney is therefore in all cases too small. This means again that his computed values of the probability of happening of some of the greater deviations from the mean value will become too small.

Taken as a whole, it appears to me that it is much more important at the present stage of our collected statistical data to investigate the variations due to purely random sampling than try to determine basic differences by elaborate mathematical formulae. I personally am of the opinion that most of the differences which the subsequent paper of Mr. Michelbacher determines as basic or inherent deviations from the class hazard are nothing more than the results of random sampling, or if you prefer another expression, the results of pure chance. This opinion is rather strengthened by the complete omission of the computation of the important statistical quantity known as the "*mean error*" in the tables of values of z in Mr. Michelbacher's table on pages 311–313. As far as I can judge this z is a statistically determined quantity and is therefore afflicted with errors due to sampling. Unless the mean error is small in comparison with the value of z itself, it will be of little value to attach much importance to the latter value, and I think that common prudence ought to have led Mr. Michelbacher to evaluate such mean errors.

Summarizing the above remarks my objections to Professor Whitney's paper may briefly be expressed as follows:

1. The application of the special Rule of Bayes as based upon the principle of insufficient reason can only be used to investigate variation due to random sampling and not to investigations of basic or inherent differences. For this reason it appears to the present writer that the results given in Professor Whitney's paper has reference to chance variation rather than basic differences in the various risks.

2. The assumption that the normal error curves express the frequency distribution around the mean can not be considered as even approximately true in cases where the probability is small or the number of sample sets small. This is always the case with the majority of rates in workmen's compensation.

Moreover, as I have shown in my previous discussion of Mr. Mowbray's paper, the use of the Gaussian normal curve will even for comparatively large units of exposures of payrolls produce negative losses, which of course is an absurdity. The formulas as produced by Professor Whitney are of course correct if the hypothesis

of the normal distribution is true, but they surely can not be used if the distribution around the mean value is essentially skew. Mr. Michelbacher is therefore in my opinion to be blamed for having used the Whitney formulas in a very indiscreet manner. As I showed by an actual computation from the statistical data supplied by Messrs. Mowbray and Cogswell the left end of the Gaussian curve will correspond to negative losses. Of course, it is possible that Mr. Michelbacher can explain such rather curious happenings, but I confess they puzzle me, and I am at a loss to explain the presence of the Michelbacherian negative piece of tail of the curve (representing actual gains to the underwriter from certain death and disability losses) unless the dependents of workmen indeed were willing to pay money to have their providers killed or maimed for life.

3. The standard deviation (Bernoullian dispersion) can not be used as a measure of dispersion because the frequency distribution around the mean is a Lexian frequency curve, wherein the dispersion always is greater than the corresponding Bernoullian dispersion or standard deviation. This choice of the standard deviation as a measure of dispersion leads to an underestimate of the variations arising from random sampling.

4. It would be highly advisable to have an exact computation of the "mean error" of the parameter designated by z in Mr. Michelbacher's paper.

While Professor Whitney has made a highly commendable attempt to investigate the theory of experience rating by means of the principle of Bayes, it would be of great interest to attack the same problem by means of the frequency curves and the frequency correlation surfaces from the theory of homograde statistics. Stated as a purely mathematical-statistical problem the whole question of experience rating may be given in the following compact form:

"Given a series of N sample sets, each set consisting of s individual samples (trials or observations), to determine the equation of the frequency curve of this series."

This gives the whole problem of experience rating in a nut shell. Moreover, the theory of the frequency curves and correlation surfaces of the homograde statistical series has of late years been fully developed and adopted to practical applications, so that we ought to have no difficulty in using the theory to insurance problems, provided sufficient statistical data have been accumulated.

In conclusion I wish to emphasize—in fact, I can not emphasize it too strongly—that I have no fault to find with the purely deductive part of Professor Whitney's theory, and he deserves the thanks of the members of our society for bringing this matter to our attention. It is only with the application of the theory to concrete practical problems that I see serious obstacles.

Every mathematical theory is in the last instance founded upon certain hypotheses. In so far as we are dealing with pure mathe-

matics as apart from applied mathematics we are at complete liberty to choose any hypothesis we please as the fundamental basis for our mathematical operations. We are then always sure to reach some answer, which from the point of pure logic always will be right, provided we in our calculations have not violated the rules governing the various mathematical operations. The situation is, however, different as soon as we leave the realm of pure mathematics and turn to applied mathematics. We are then dealing with certain concrete facts or sense objects, which form the basis of our problem, and we can not indiscriminately apply any theory we please to these basic facts unless the particular hypothesis upon which this theory is founded corresponds or agrees with such facts. If the concrete sense objects or facts underlying our problem are at variance with the hypothesis of our theory it is useless to employ the mathematical formula on our observations as expressed by statistical data, because we generally will encounter absurd results of the sort I have just pointed out.

"Mathematics is," as Huxley once pointed out, "an exceedingly fine mill." But as another philosopher, the Dane, Kroman, once has said: "We can not expect to get wheat flour from the mill after we have filled the quern with oats."

I must honestly confess that in my opinion Mr. Michelbacher has filled Professor Whitney's newly knapped quern with some rather "wild oats" and the result is accordingly. We have—if actually not gotten stones—at least got some queer sort of a porridge instead of bread.

MR. GEORGE D. MOORE:

The application of experience rating to workmen's compensation insurance has always aroused considerable interest. Early proceedings of the Society will disclose many papers bearing upon the subject, so, when the Actuarial Section of the National Reference Committee was directed to develop a plan for experience rating from the ground up, the task appeared to me to be hopeless. The results, however, justified the demand and the results of their labors, as contained in the two papers presented to the Society, seem to be the last word on the subject. As a member of the committee, I followed with considerable interest the logical and mathematical developments of the plan by Mr. Whitney and must admit that I have been converted from an opponent of experience rating to one of those who sees in it the solution of one of our most vexing problems.

Before the plan was adopted a number of actual risks were rated but, as one of the members of this Society suggested, the plan, to prove sound, must not only fit actual risks but hypothetical risks of extreme nature. Following out this line of reason and using the tests which were applied to the previous plan, I submit the following with the reasons for the results disclosed.

Tests.

Assuming the Earned Premium in each case to be $10,000—State New York.

1. (*a*) A risk having a rate of $.59 with non-serious losses $1,000 and three deaths at $3,500 a piece, total loss ratio 115 per cent., receives a credit of 28.17 per cent.

(*b*) The same risk with the same experience if the rate is $11.51 would obtain a credit of 7.48 per cent.

2. (*a*) Another risk having a rate of $.59 with $1,000 non-serious losses and five deaths at $3,500 loss ratio 185 per cent., receives a credit of 23.62 per cent.

(*b*) The same condition with a rate of $11.51 results in a charge of 2.6 per cent.

3. (*a*) A risk with a loss cost of $4,500 without deaths gives results ranging from 18.13 per cent. credit with a rate of $.59 to 9.47 per cent. credit for a risk having a rate of $11.51.

(*b*) A risk with losses $1,000 and ten deaths at $3,500 each, total loss ratio 360 per cent., with a rate of $.59 gives a credit of 12.25 per cent., while a risk with losses of $8,000 and no deaths, loss ratio 80 per cent., gets a credit of 1.26 per cent.

At first glance, after viewing the loss ratios, one is misled by these results; however, upon further consideration and study, one is impressed with the absolute fairness of the plan, for, taking the case of 1 (*a*), where the expected cost of fatalities to all other losses is in the proportion from 1 to 4, while in 1 (*b*) the relation is about fifty fifty and considering the basic assumption that the greater cost of fatalities should be distributed evenly over all assureds and little debit or credit being given for this portion of the experience, it will be readily seen that in the first case that the proportion of the rate to meet the all other losses being 80 per cent., and in the latter 52 per cent., the credit would naturally be reduced as the results of the plan disclose. Again the small premium of the risk in question is an indication that few if any death cases are expected and it therefore follows that the three deaths must have been caused by a disaster or some other condition not necessarily inherent in the risk with a great probability of its non-occurrence in the immediate years following. The cases of 2 (*a*) and (*b*) can be analyzed in the same manner with the same result. Case 3 (*a*), however, presents another phase of the same subject. Here the proportion of premiums for all other losses ranges from 80 per cent. at the $.59 rate to 52 per cent. at the $11.51 rate, but the all other losses being much heavier, *i. e.*, $4,500 as compared with $1,000 for type 1 and 2, the credits on the same assumption used in the discussion of these latter types should be materially smaller. This is also disclosed by the application of the plan. Case 3 (*b*) is still another type. It is reasonable to expect that with an attempted even distribution of deaths over all risks and a slight debit or credit therefore that the percentage of credits will be reduced when all

other losses are increased from $1,000 to $8,000 and that they shall not be so great as is the case of 1 (*a*). The effect, however, of the heavy increase in fatality from $10,500 to $35,000 should and does have a decided effect upon the size of the credit. All of these examples tend to indicate that the method of determining whether a risk is desirable or not depends upon the loss ratio is now obsolete when the results of the present application of the experience rating plan are under observation and the effect of the application of the plan to these extreme hypothetical cases appears to give fairly good results in the light of general reasoning.

The adoption of an experience rating plan which seems to prove so satisfactory in all respects should tend to bring about the elimination of many superfluous classifications in the very near future. It is obvious, as Mr. Whitney points out, that "the problem of experience rating arises out of the necessity from the standpoint of equity to the individual risk of striking a balance between class-experience on the one hand and risk-experience on the other." The application of the plan having rated the risk properly, it would seem that broader groups of classification could safely be determined upon without working any substantial injustice to any group of assureds. Take the case of the Wood Products, Schedule 15, Group No. 368 of the new manual grouping:

	No.	Symbols.
Organ Building—pipe, including setting up at the place of delivery	2920	BR
Organ Building—cabinet or parlor	2921	BR
Musical Instrument Mfg.—wood	2922	BR
Piano Mfg.	2923	BR
Piano Action Mfg.	2923	BR
Piano Forte Case Mfg.	2925	BR
Piano Keys Mfg.	2926	BR
Piano Players Mfg.	2927	BJ
Phonograph Mfg.	2928	BR
Piano and Piano Players—assembling of manufactured parts and finishing only (N.P.D.)	2929	BJ

These ten classifications could undoubtedly be merged into one and a rate determined for the group. Any variations from these rates in risks subject to experience rating could and should be corrected by the application of the plan. Also let us take the Construction, Schedule No. 26, Groups 606 and 607, Excavation and Dredging:

EXCAVATING AND DREDGING.

	No.	Symbols.
Cellar Excavation (no caisson or subaqueous work), including digging holes and filling them with concrete for foundations for buildings	6220	DM

Excavation—bridge foundations, retaining walls and bases of dams—no caisson work or cellar excavation (no blasting)	6221	DM
Pile Driving—building foundations only	6222	DM
Dredging—N.O.C. (all operations except rock drilling and blasting)	6223	DB
Dredging—excavation by means of suction dredges only. All operations except rock drilling and blasting	6224	DG
Ditch Digging—no sewer or canal building or excavation for water or gas mains (no blasting)	6225	CR
Cellar Excavation (no caisson or subaqueous work and no blasting) maximum depth of excavation 12 ft. (N.P.D.)	6227	DA
Canal Construction (excluding barge or ship canal construction)—all operations in connection therewith, except railroad operations, bridge building, caisson work and wrecking.	6361	DJ
The above excepted classifications to take full manual rates. For contracts involving the performance of dredging work only—no rock work, no blasting and no other operations of any nature whatsoever—apply the rate for the classification "Dredging, by floating dredges."		
Canal Construction—barge or ship	6363	(a)

Group 607.

PILE DRIVING, DAMS AND DOCKS.

Dam Construction—excluding the construction of concrete dams (no blasting)	6002	DM
Pile Driving—including timber wharf building	6003	DM
Marine Railway—Construction	6004	DM
Jetty and Breakwater Construction (no blasting)	6005	DM
Dry Docks—construction (no blasting)	6008	(a)
Waterworks—construction of pumping stations, dams and reservoirs	6010	(a)

Of the fifteen classifications in the above groups, six could be safely merged. The condensing of the classifications would be of immeasurable value in the compilation of Schedule Z, which has now become such a necessary part of rate-making, and, as experience rating has apparently become a permanent fixture in compensation insurance, why not extend its use in this manner, thus conserving considerable labor and expense which could be more profitably applied to the analysis of individual accidents so sorely needed at this time.

One of the most radical changes in the method proposed in the plan was the application of experience rating to the policy premiums as effected by schedule rating, the argument being advanced that experience rating, of necessity, discloses results of physical conditions, morale and every other loss-producing factor and that it was therefore inequitable and gave far too much weight to debits and credits when both plans were applied separately. After careful consideration of the matter, however, I have come to the following conclusion: As experience rating now applied under the new plan may nullify the effect of schedule rating and for the purpose of simplifying the work of experience rating, I am inclined to believe that the experience rate should be applied to the full manual premium, after which the debit or credit, depending upon the change in the effect of the application of schedule rating as disclosed at the date of last renewal and that disclosed at the date of current renewal, should be applied to the experience rate determined above. The application of schedule rating in its full detail should, of course, be applied to non-experience rated risks.

MR. WILLIAM J. GRAHAM:

"The Theory of Experience Rating" by Albert W. Whitney and "The Practice of Experience Rating" by G. F. Michelbacher admirably complement each other and ably present the subject of experience rating. The Society is fortunate in having this wealth of authoritative information on experience rating to discuss at this meeting. The subject, however, is so broad that even the two papers read together must naturally presume knowledge on many important references not included in the text of the papers, such, for example, as the investigation of the theory of experience rating and the theory recently adopted by the Actuarial Section of the National Reference Committee on Workmen's Compensation Insurance.

In the assumption that experience rating is now established and destined to be a factor in life underwriting when there is a risk experience to be considered as well as a class experience, the authors of the papers have avoided the tedium of repeating defenses in behalf of experience rating, which simplifies their subject and enables them to go directly to the point of the application of the theory. While these papers are differently titled, both deal with theories, and both in a measure deal with practices. The practical references to underwriting problems which have introduced the need of some such refinement in fixing premium costs as is found in experience rating, constitute a clean-cut analysis of practical problems as they are today in the various branches of underwriting in which there is a risk-experience as distinguished from a class-experience.

Experience rating has arisen out of the necessity for a greater equity in fixing premium rates in workmen's compensation insur-

ance, where manual rates and even schedule rating have been more or less qualified failures. Viewing manual rates purely as class rates, and schedule rates as a refinement of the general class rate, to those more intimate studies with reference to some factors of risk affecting the class hazards, there remains to be evolved a system that would take into account risk-experience where the same could be done with profit and justice because of the character of the hazard and the sufficiency of the exposure within the particular risk. All forms of underwriting must remain a class-underwriting one to the extent of dependency upon averages. Carried to its highest refinement, experience rating must be restricted to the field in which a balance may be properly obtained between the risk effect and the class effect, so that while taking into account in a proper degree the risk affecting the same must ever be balanced and subordinated to the class effect. The four elements of balance are exposure, hazard, degree of concentration, and credibility of the manual rate.

It is quite conceivable that a particular risk may reach proportions through frequency of hazard and quantity of exposure to the point where it constitutes a complete class. If this risk is homogeneous and eliminates all the problems which must otherwise arise with reference to balancing class effect and risk effect, it will in itself establish the perfect balance and accord between the two.

While experience rating offers an incentive to insurers to keep down losses within the establishment, it does this in the indirect way of having such saving reflected in the new rating. The schedule rating system, however, directly credits methods adopted for saving life and limb in a more feasible way, and thus contributes an element of value which we must conserve so far as compatible with the broader principles of life underwriting because of its unquestioned value in the prevention of accidents.

One way of viewing and applying the theories expressed in these two papers would be to consider the manual rate as the basic, unrefined class-rate; to view the action of schedule rating on the manual rate as a refined class-rate. This rate is adopted as the basic rate and subjected to an intelligent experience rating plan which would supplement a manual rate supposedly refined to the greatest practical point by balancing this rate with an experience weighted for the particular risk, so far as the incidence of exposure or hazard warrant. I would point out here, however, that the result of this action merely produces a new rate which in itself may be viewed as a prospective rate. There is nothing in the theory or practice of experience rating as announced that would correct any mistakes of the past as developed from the actual experience. This experience is merely to be utilized to quote a new rate, which rate in turn will be subjected one year hence to the same type of mathematical analysis with reference not only to adjusting the year's experience by a system of debits or credits, but to further weigh in the

risk experience in fixing a new rate for the class. In theory this system would mean a large accuracy in equitable adjustments, if it is carried on through the years with factors which permit of increasing risk weight as against the decreasing class weight. None the less, practical conditions concerning changes in industries and in the methods of manufacturing, besides voluntary changes from one type or company of underwriters to another, all introduces difficulties which emphasize the point that the experience rating formula is not, properly speaking, a retrospective formula except as it is compared with a formula for class rating such as manual rates or the more refined schedule rates. It is possible to apply the experience rating formula in thoroughly retrospective fashion to give weight to the risk experience in a series of debits by calling for the payment of additional premiums at the end of the year on the one hand, and on the other allowing credits with reference to the particular year's experience. In practice, however, this theory would have many disadvantages, not the least of which would be the great difficulty of attempting to collect greater debits than may be deemed to be due by reason of the past year's experience.

A practical way in which a retrospective experience rating can be effected is by charging a premium appreciably higher than would be called for by the class experience and permitting premium refunds at the end of the year to be effected by an experience rating formula. This formula should provide for credits to be made in excess of the average class dividend up to the full amount of the gross premium, and of appropriate counterbalancing debits. This would introduce the participating and mutual idea of underwriting into the workmen's compensation field. In itself this would be no particular departure, since there are now types of organizations attempting to apply the mutual principle, without, however, going to the point of advocating a thoroughly retrospective experience rating method of adjusting the risk-experience to the class-experience through the medium of a general increase to the class rates, to be offset by appropriate experience rating premium refunds to the end of the policy period. This general principle is announced in harmony with the general theories of the papers that experience rating is restricted to contemplate and adjust independent occurrences of a simple contingency.

Boiling down the theory of experience rating to the point of conserving the equity of the individual risk by striking a balance between the weight to be given to class experience and the weight to be given to risk experience, there remains two ways in which the theory may be applied. First, with reference to non-participating rates such as evolved and applied by Messrs. Whitney and Michelbacher and which, with apologies to that portion of Mr. Whitney's paper which refers to the theories of experience rating as a retrospective plan, I would describe it as a prospective method of rate readjustment. Secondly, the other way of applying the same prin-

ciple is that of the participating plan of not attempting the same degree of nicety with reference to the original class rate, but to increase that rate to a point which would permit of a much greater ultimate nicety of adjustment to the individual risk by the debit and credit method of premium refunds to be decreased or increased above the average refund of the class within the limits of the plan according to actual experience. An expansion of this thought would lead to the conclusion that the larger the premium the less the effect and consequently the larger ultimate justice that could be done to the class. Theoretically this is true and in practice could be true to a large degree, in fact up to the point where a variation in risk-experience would reach its maximum and extend beyond to extra hazardous classes obviously requiring additional classifications.

No one in the field of practical underwriting is looking for perfection, or has any illusion or hope as to realizing it. The business of insurance is to average up risks. In this averaging lies the security of the credits as against the premium payments of the individual who may or may not realize at all upon his premium payments, or who may or may not realize in anything like the same measure of returns for premiums paid. Professor Whitney admirably restates this principle when he says at page 281: "The fundamental theory of insurance involves this, that, at the point when the effort to analyze and differentiate the hazard of various risks has been carried as far as is deemed feasible, the risk in each residuum shall be treated as of equal hazard. This means therefore that each risk shall take the average hazard of the group."

In all our efforts for risk refinement we must keep the inherent class factors in mind as a basis on which insurance endures. The papers of both Professor Whitney and Mr. Michelbacher have pointed out the limitations of the experience rating theory. While pointing out that the problem of experience rating is peculiar to workmen's compensation insurance chiefly and not found in life insurance, it makes exceptions of the potential possibilities of the problem in group insurance. Naturally in life insurance there is no risk experience since a person dies but once. It is interesting to note that the participating plan in life insurance has developed a contribution formula by which a refinement for classes as against individuals has been made possible by the application of analogous principles. The contribution formula subdivides and returns to classes of life insurance risks a premium refund in the form of annual dividends, adjusted with reference to the experience of the class as regards the different factors which go to make up the so-called dividend earnings. In group insurance, however, the risk-experience is introduced directly and the life insurance as a factor would be clearly distinguished from class-experience. I have treated this problem at some length in a written discussion of the joint paper submitted to the Actuarial Society of America, the able contribution of Messrs. E. E. Cammack and E. B. Morris. The paper

was presented to that Society in May, 1918, and is entitled "Joint Mortality Experience of the Aetna Life and Travelers Insurance Companies on Group Policies." (*T. A. S. A.*, XIX, 29.)

The problem in group insurance furnishes a particularly happy application of the theory so well developed and worked out by Messrs. Whitney and Michelbacher, since in group insurance the law is of that simple character which lends itself most readily to the application of the formulas developed. The amount of the risk is apparently not large in group insurance, as it is subject to the following regulations:

Maximum Amount to an Individual.—The maximum amount of insurance as to any individual in any class shall not exceed two and one-half times the average of the group (to the next $500) determined by excluding such class, but in no case shall the insurance on any individual exceed $5,000. The usual minimum amount of insurance on any individual is $500.

This again excludes the element of catastrophe, which for reasons so well developed in the papers under discussion are not properly the subject of experience rating discussions.

The Equitable Life Assurance Society issues all its group insurance on the mutual plan at participating rates, and applies to all its business at this time an experience rating dividend formula. This formula contains many of the arbitrary factors which both Professor Whitney and Mr. Michelbacher found necessary to introduce with reference to workability, and with essential reference to preserving a balance between risk-experience and class-experience which would not unduly penalize the small risk having a bad experience, which so far as its individual classification was concerned, might be considered more or less adventitious. The Equitable takes into account the size of the group, the number of years experience in each group and the constantly changing character of industrial establishments by carrying its debits and credits algebraically, checking back over the entire experience of the group except as the size of the group may increase.

Group insurance is governed by the laws of the various States of the Union applicable to individual life insurance. Thus the matters of fixing premium rates with reference to individual ages and the maintenance of individual reserves are matters of statute, and so long as they remain matters of statute would not permit of the experience-rating methods of rate making. Where the individual rates, however, are in conformity with the state standards, the theory and practice of rate making as outlined by Professor Whitney and Mr. Michelbacher may, with modifications, be used with reference to computing premium refunds or dividends. But the problem of premium refunds in a group life risk, in retrospection, eliminates many of the difficulties with which Professor Whitney and Mr. Michelbacher have made their analysis to so large an extent in the broader and more comprehensive formulas developed

by them, with workmen's compensation hazards particularly in mind.

A. W. WHITNEY:

(AUTHOR'S REVIEW OF DISCUSSION.)

Mr. Greene refers to the manner in which the losses are to be computed in the application of the experience rating plan. The computation of losses is doubtless the weakest part of the system and every effort should be made to standardize and regularize the procedure.

Experience rating has come to stay and as a method for making right rates will be more important than schedule rating. There seems to be no other field in which the necessity of making essentially right rates for the individual risk is so imperative as in the field of workmen's compensation. This new actuarial method must therefore be given as dignified and useful a place as possible.

I am very glad that Mr. Greene has added as a matter of record the memorandum that he presented to the Actuarial Committee. It was Mr. Greene's assumption which brought to light the form for z which, on account of its great simplicity, was adopted for practical use. As a matter of record also I might state that the original working out of the problem was made on the assumption that the class-experience was so large as to make the class-rate entirely dependable. In the paper which was presented to the Society and which is now under discussion the treatment was generalized so as to include both points of view as special cases.

While the assumption which Mr. Greene made was valuable in bringing immediately to light a very simple formula I cannot consider that the assumption itself really reflected the facts. It is certainly not true that experience-rating as a balance between the credibility of risk-experience and class-experience depends solely or even primarily upon the relative amount of experience for class and risk. Mr. Greene assumes that all risks of the same class have the same hazard.* This of course is flatly at variance with the facts; the need for experience-rating rests upon the exact contrary, namely, that the hazard of the risk in general is not the same as the hazard of the class.

Incidentally notice should be taken of the fact that the symbols used in Mr. Greene's memorandum were adapted to those used in the earlier devlopment and do not wholly agree with the symbols used in the paper which is the subject of this discussion.

There are three distinct processes in the theory of probabilities: first, an analysis of the logical relationships among the events in question; second, the superposition upon this logical structure of

* Formula (22) reduces to the form $Z = \frac{Pn}{Pn + Pm}$ by letting $H^2 = \infty$ which is the condition that the hazard of all risks in the class is the same.

a system of quantitative relationships, and third, the making of explicit judgments regarding the magnitude or relative magnitude of the quantities involved. The first process follows out of the fundamental laws of thought; the second, out of similar quantitative laws; the third process is entirely different for it involves specific judgments regarding the nature and detail of reality itself. All three processes involve judgments but in the first two cases the judgments are so fundamental, so general, so well-established, that they are non-controversial. The structure of inverse probabilities for instance is something that is not open to question.

The main difficulty is concentrated in the third process of making judgments as indeed is the case in the more ordinary affairs of life. People on the whole reason logically, and live consistently. Their failure to meet successfully the pragmatic test of reality lies mainly in their inability to make sound judgments on which to base their reasoning or their living.

The practical value of a determination of the probability of an event is wholly conditioned by these initial judgments. The result carries with it all the qualities, the imperfections as well as the perfections, the inadequacy as well as the adequacy, of the assumptions. Here, as elsewhere in life, one of the chief difficulties lies in the fact that we forget that our results are qualified,—we take them as absolute. In the application of the theory of probabilities and notably in the application of Bayes' rule these limitations are often overlooked and the results are given a credence that is unwarranted.

So far as mere logic is concerned any self-consistent assumptions are admissible. Whether these will lead, however, to results that have any practical value depends entirely upon the question of whether such assumptions are a correct description of reality.

Among the various probabilities that follow from various assumptions is there such a thing as *the* probability par excellence? Yes, it is that probability that is based upon the best possible judgments, —that reflects most thoroughly the known facts. But who shall be the judge?

In the case of hypothetical problems where the body of assumed facts is explicitly given, and particularly where the domain of ignorance is posted with signs marked "at random" the determination of *the* probability is not difficult. In real life the situation is quite otherwise; here it is almost impossible to marshall in review all the knowledge, much of it scattering, which goes to make up the logical background. And yet with a characteristic mental carelessness we do even in such cases use the term *the* probability. Similarly in the more ordinary affairs of life we neglect in general to recognize the fact that our conclusions have strict validity only for one particular substratum of experience. In some parts of the theory of probabilities, notably in the case of inverse probabilities, this procedure is too crude. Distinctions must be explicitly real-

ized between the results that arise out of different experiential backgrounds.

There is such an air of mystery about the theory of probabilities; —it is so startling to be able to get dependable results where there is ignorance,—that it is not strange that there should seem to be some alchemy by which ignorance itself is transmuted into knowledge. Here, however, as everywhere else the fact is that what we do we do in spite of our ignorance and not because of it.

The validity of our conclusions with regard to the probability of an event is an exact measure of the extent of our knowledge. There must to be sure be ignorance if there is to be probability (rather than certainty) but this ignorance is in the nature of lacunae in a body of knowledge and it is out of this knowledge rather than out of this ignorance that the theory of probability builds a bridge across the gap.

It is true that a determination of probability based on perfect ignorance would have no value whatsoever. The attempts of a being who dropped into this world from a totally different sphere of existence to apply either certain inference or probable inference (even though he were familiar with the structural nature of logic and of the theory of probability) would be perfectly futile because of the fact that he had no underlying basis of experience out of which to construct judgments. Such a case in actual life is impossible. However tenuous may be the threads of knowledge there is nevertheless something that can be woven into a probability determination.

There is, however, in real life not only no case of perfect ignorance but there are all gradations of knowledge. For instance, here are 501 of them: An urn contains 1,000 balls which are known to be no other than black or white.

1. A ball is drawn; what is the probability that it is white?

2. 2 balls are drawn and found to be one black and one white, and replaced; a ball is now drawn. What is the probability that it is white?

3. 4 balls are drawn and found to be two black and two white and replaced; a ball is now drawn. What is the probability that it is white?

. . . . . .

500. 998 balls are drawn and found to be 499 black and 499 white and replaced; a ball is now drawn. What is the probability that it is white?

501. 1000 balls are drawn and found to be 500 black and 500 white and replaced; a ball is now drawn. What is the probability that it is white?

In the first case the only knowledge is an underlying acquaintance with the world in general; this throws a few rays of light upon the conditions of the problem. In each succeeding case there is slightly greater knowledge, until in the last case there is com-

plete knowledge with regard to the contents of the urn. The application of the theory of probabilities in each case gives the same result, namely, that the drawing of a white ball and the drawing of a black ball are equally likely and yet the credence to be attributed to the result in the different cases is very different. In each of these cases except the last a probability determination requires the making of arbitrary a priori assumptions.

The difference produced by variations in the amount of knowledge available can also be shown by a modification of the first problem.

Problem I. An urn contains 1,000 balls which are known to be no other than black or white. A ball is drawn at random; what is the probability that it is white?

Problem I–A. There are 1,001 urns each containing 1,000 balls. In the first urn all are white, in the second all but one are white . . . in the 1,000th 999 are white, in the 1,001st all are black. An urn is selected at random and then a ball is selected at random from this urn. What is the probability that it is white?

The mathematics and the result in the case of these two problems are exactly the same. In the first case assumptions are made that are the equivalent of facts in Problem I–A. It is evident that there is a larger amount of knowledge in Problem I–A than in Problem I and the result to just that extent is more worthy of credence. Problem 501 differs from Problem I–A in the addition of still further knowledge; in fact one element of probability has given way to certainty.

At the bottom of every probability determination in real life there are assumptions that are more or less arbitrary. Furthermore it is often if not usually impossible to determine just what assumptions arise most consistently from the logical background.

Both of these conditions are matched in the case of certain inference. Before experience is accumulated arbitrary tentative judgments must be made; the results do not command a high degree of credence and must be tested pragmatically. Furthermore it is often exceedingly difficult to pick out those assumptions which are most consistent with the logical background of experience.

The conclusion therefore is that the credence which is to be given to a probability determination varies with the extent of the logical background and the degree to which it is possible to express this with certainty in the form of assumptions.

Mr. Fisher's example in which 0, 1, 2, $\cdots$ m deaths are assumed as all equally probable and from this assumption is derived an improbable result illustrates only what seems to be self-evident, namely, that consistency must be judged within a uniform field of experience. It is not legitimate to apply a different criterion of reasonableness to the final result from that which is applied to the assumptions. If a body of experience is called into evidence for the purpose of pronouncing the fact unreasonable that an x-year-

old person is sure to die during the year then this same body of experience must be called into use in passing upon the reasonableness of the assumption that 0, 1, 2, $\cdots$ m persons will die during the year. In other words anyone who is qualified to pronounce the result unreasonable is also qualified to pronounce the assumption unreasonable. Similarly the result is not unreasonable if the same body of ignorance is assumed that is assumed in testing the assumptions.

It is just as fundamental in a logical problem that the same body of experience should be assumed throughout as it is that the same universe of discourse should be preserved throughout. It is not allowable to swap the horse carrying our load of experience in the middle of the logical stream.

Now to come to the particular case in point. Is it allowable to assume that one value of the real hazard of a particular class is as probable as another provided the experience of the class is set aside. This is by no means a case of complete ignorance. We have not only a fund of general knowledge but with regard to this particular class we doubtless should be able from a technical point of view even barring experience to form some idea of the probable hazard and to assert that in reality all values of the hazard were not equally probable. It would be very difficult, however, to establish an a priori law of probable hazard that would produce a consensus of approval. Furthermore, for the range of values in which our chief interest lies it is pretty evident that such a law expressed as a curve would be nearly flat.

Under the circumstances, with the additional motive of producing the greatest possible simplicity, we are certainly justified in going back to the more naïve view that all values of the hazard are equally probable. The difference in the results produced by using this law and by using some more complicated relationship in practice can certainly not be great. I doubt if it would be desirable to make a different assumption, considering the purpose of the investigation, even if more explicit estimates were possible.

It is pertinent to ask what is that purpose? The answer is that the investigation was undertaken to discover a form, a structure, for a plan of experience rating that would be in general agreement with underlying conditions and requirements. The best assumptions that were practical were to be made use of but the result itself was to be judged by pragmatic tests. In this connection I may note that this plan is being used to rate twenty million dollars worth of business and is apparently giving satisfaction.

I agree with Mr. Fisher that normal curves do not exactly describe the conditions of the problem; they were not supposed to. For the purpose in hand, however, they were exactly the instrument that was needed. This was not a theoretical investigation; it was governed by eminently practical considerations. The normal probability curve with its ease of handling marked the exact limit

to which it was feasible to go in the direction of nicety of treatment.

Even aside from this consideration, however, Mr. Fisher's criticism is not to the point. The first factor in formula (2), viz., $H'/\sqrt{\pi}\cdot e^{-H'^2(P-X)^2}$ does not affect the form (at least only remotely); it affects only the constant

$$\frac{H^2H'^2}{H^2+H'^2}=J^2;$$

but this constant J^2 in practice is determined arbitrarily. The second factor $H/\sqrt{\pi}\cdot e^{-H^2(x-X)^2}$ represents a frequency distribution and is not used as an approximation to a binominal form. The question of skewness for the purpose in hand is not important. The third factor ${}_nC_{pn}(1-x)^{qn}x^{pn}$ is exact, not an approximation.

I hope that somebody with time and patience will investigate the problem of experience rating from a more comprehensive point of view. I conceive that such an investigation would be not only theoretically interesting but might throw some light on the practical problem. The present investigation was inspired by the necessity of producing immediately practical results.

The term "inverse probabilities" has no great merit, neither is it pernicious. The theory of probabilities in form is reversible. In its applications, however, there are considerable differences. Usually we argue from cause to effect; in some cases, and particularly in the application of Bayes' rule we argue from effect to cause. This inversion of the more usual process was evidently what led to the term "inverse probabilities," as well as to the term, the probability of causes.

Mr. Fisher's remarks about dispersion are hardly to the point in view of the fact that no use was made of the idea of dispersion in the technical sense.

I am very glad that Mr. Moore has taken the trouble to enrich the discussion of experience rating with the submission and analysis of critical cases. What the experience rating plan ought to do is to reproduce in a systematic manner the judgment of the underwriter. These cases seem to indicate that the plan is successful in doing this.

The difficulty in using experience rating to displace complexity in classification lies in the difficulty of dealing with the small risk. The rating of the small risk, whatever its experience, will have to be kept pretty closely to manual and if the classification is in error experience rating will not go far in the way of correction.

THE INDUSTRIAL COMPENSATION RATING SCHEDULE, 1918—E. H. DOWNEY.

VOL. IV, PAGE 325.

WRITTEN DISCUSSION.

MR. G. F. MICHELBACHER:

Everyone who has come in contact with the latest edition of the Industrial Compensation Rating Schedule will admit its superiority over the schedules which had their existence prior to 1918 and out of which the present schedule has developed. I can find no basis for criticism, therefore, of Mr. Downey's analysis of the faults of the first workmen's compensation schedules, nor have I any comment to offer with reference to the efforts of the National Reference Committee on Schedule Rating to overcome these faults and to produce a truly practicable and equitable plan of schedule rating.

I am not intensely interested in the details of schedule rating because I have had no training in the technique of safety engineering. Personally, I am content to leave these matters in the hands of safety engineers. It is their business to know what conditions are of sufficient importance to warrant consideration in a schedule and they are better qualified than I to speak both in terms of the relative values of these hazards and the methods which should be employed in their elimination. The right sort of statistical information should be available but, after all, the limitations of our experience data are such and it is so obviously impossible to obtain the exposure to individual hazards with any degree of accuracy that the actual valuation of the items of any schedule must remain largely a matter requiring the expert judgment of engineers.

I do feel, however, that the structure of schedule rating and its place in the general plan for rating workmen's compensation risks are matters in which actuaries should have a decided interest. In this connection I have two points upon which I feel at liberty to comment.

In the first place, I believe the present schedule to be too cumbersome and complicated. Efforts have been made periodically to simplify schedule rating. The injection of new ideas and the desire on the part of those participating in these conferences to experiment with new principles has, however, led to the gradual building up of a most formidable array of items and formulæ. I have no facts before me to substantiate my case, but I am certain that if it were possible to make the right sort of examination it would be discovered that there are many of these items which have

little effect on the aggregate results obtained upon all the risks which are schedule rated. It appeals to me that there are too many refinements; there are a number of items representing hazards which are not of sufficient importance to warrant the trouble and cost of attempting to measure them. In this respect the schedule is top-heavy. There must be a possible middle ground upon which to build a schedule which will efficiently and equitably measure physical hazards without the necessity of considering minute details and hazards which, as regards the broad spread of industry, are comparatively insignificant. It may be that our attempt to make the schedule universally applicable to manufacturing risks is responsible for this condition. It is possible that the fact that one schedule is applied to manufacturing risks of every description requires the inclusion of items which are important in certain classifications and of absolutely no importance in others. Nevertheless, the recent development of formulæ for the purpose of better fitting the schedule to individual classifications should remove this difficulty. I look forward to the establishment some day of a schedule which as regards industry will produce identically the same results as our present schedule but which will contain only a few items of general application to all risks.

The second point upon which I should like to speak has to do with the place of schedule rating in the general plan for rating workmen's compensation risks. At the time the latest experience rating plan was devised, the theory was advanced that the schedule may be considered as a method of refining the classification of a risk. If this theory is applied in actual practice, it results in the use of the manual first, the schedule second, and the experience rating plan third. Each of these parts of the system has a definite mission to perform.

It is the purpose of the manual to furnish a convenient method of breaking up industry into a number of suitable parts for classification purposes and to provide an average or base rate for each division. The first step in the underwriting of an individual risk involves the consultation of the manual. The classification which most nearly describes the operations conducted by the assured is located and the rate applicable thereto is taken as the basis for rating the risk. It is recognized, however, that this is an average rate—that it is based upon experience into which has been thrown individual risk experiences of all kinds ranging from the experience of superior risks to that of risks which because of physical and moral conditions are extra hazardous within the manual classification. Equity and good underwriting judgment dictate the necessity of making some variation from this average or base rate in order that the rate for the individual risk may more intimately measure the hazards and thus insure a more accurate contribution from the assured. The next step, therefore, is the application of the schedule.

The schedule measures physical conditions and according to the theory that it may be used to refine the classification of a risk, its application is equivalent to the breaking up of a manual classification. It is as if all the risks which are thrown into a heap within a manual classification were sorted into a number of smaller heaps. The schedule is supposed to accomplish this result by measuring the extent to which the physical characteristics of the individual risk vary from those assumed to be represented by the manual or base rate. After the schedule has been applied the risk is more accurately classified. It is thrown into immediate relationship with risks of substantially similar hazards where the physical conditions are comparable and it no longer takes its place at random with the good and bad risks of the classification.

The last step is then taken. The loss history of the risk is reviewed and the experience obtained in this manner is compared with the experience for the classification. There is a process of weighing the relative evidential value of the risk experience and the schedule rate and an adjustment is made which, if the risk experience is better than the average, results in a credit, or if the risk experience should indicate a contrary deviation, a debit.

This theory of rating is being followed at the present time. The manual rate is first modified by schedule. The rate thus obtained is then subjected to further modification by experience rating.

This is not the only theory which has been advanced, however, and personally I am not convinced that it is the best that can be found. There is a distinct movement in favor of reversing the order of application of schedule and experience rating. Experience rating would thus be employed as the method of refining the classification if a risk and schedule rating would constitute a means of stimulating accident prevention and of anticipating the effect of safety work.

All the hazards of a risk, both physical and moral, are reflected in the experience of the risk. Why is it necessary, therefore, to look further for a dependable criterion to use in bringing together those risks within a manual classification which represent approximately the same hazards? To be sure, the present experience rating plan does not consider the experience of all risks to have the same evidential value. Nevertheless, some suitable modification might be made if the plan were used exclusively for classification purposes—*e. g.*, greater weight might be given to the "all other" experience, and less weight to the "D. and P.T.D." elements.

Schedule rating in the past has been designed to accomplish two purposes: first, it has been used as a method of measuring physical hazards or of determining how much each physical hazard present in a risk contributes to the total loss cost; second, it has been used to stimulate accident prevention. By forcefully bringing to the attention of assured the importance of serious hazards it has more than any other agency advanced the safety first movement.

As a plan for the measurement of hazards, the schedule has not produced good results; as a booster for safety, it has accomplished wonders. Of the two purposes of schedule rating the commercialization of accident prevention is by far the more important. It is so important that I should not like to see it go. I believe that this result may be accomplished, however, without an elaborate schedule and without permitting the schedule to have too much influence as a method of measuring the hazards of a risk.

I would accomplish this by placing the schedule third in the scheme and using it merely for the purpose of anticipating the value of safety work. If we assume that the effect of guarding a saw will some day be reflected in the experience of the risk, why not permit experience rating to measure it? The difficulty is that if an employer has to wait until the experience of his risk reflects his accident prevention work he may not be particularly interested in making safety installations. The stimulus which the schedule in its present form applies to accident prevention would be lost if schedule rating were entirely discontinued. If, however, the employer were afforded the opportunity of earning a credit for a safety appliance, say, for two years following its installation, the incentive would still be there. A rule might be established, therefore, which would limit the application of the schedule to new installations and those which have been in effect one year at the time of inspection. After that the schedule would not recognize the condition and the experience rating plan would reflect the credit which the safety installation is entitled to receive. This would be measured in an actual saving in loss cost and not in some arbitrary manner based upon the assumed value of the hazard which has been eliminated or the cost of making the safety installation.

This plan has certain advantages over the one in present use. In the first place its adoption would render unnecessary a change in the experience rating modification each time the schedule modification is changed. It is customary to inspect risks as often as three times a year, depending upon the size of the premium. The present plan requires a recomputation of the experience modification as the result of each of these inspections, for presumably the condition of the risk will be found to be different else there could be no argument in favor of so many inspections. In accordance with present theory a change in the schedule modification is equivalent to a change in the classification of a risk. There is not much logic in the contention that this can happen several times a year. It is far more logical to assume that the classification of a risk is temporarily fixed for at least a term of twelve months. The character of the risk may differ from time to time because of an actively conducted safety campaign. Under the proposed plan such changes would be measured by the successive inspections and the rate modifications based thereon.

Then, again, the proposed plan would avoid the possibility of

a duplication of debits or credits. There is this danger if the schedule is applied before the experience rating plan comes into play. Let us assume, for example, that there is a superior condition in a risk. If this condition is treated by the schedule it will receive consideration when the schedule is applied. But it also will be reflected in the experience of the risk and it will thus have an influence in determining the experience rate. To be sure this influence may not be such as will double the schedule credit—it will be felt, however, and in the smaller risks items of this character may have an appreciable effect upon the adjusted rate. In the larger risks, of course, the experience rating plan will tend to reproduce the risk experience and here the schedule will have little influence. Under the proposed scheme the jurisdiction of the schedule and the experience rating plans could be clearly defined. I am not at all certain that the experience of a risk accurately reflects the effect of safety work within two years after installations are made. This is a matter which could be studied statistically and also one concerning which the judgment of engineers would be valuable. It should not be difficult to produce a rule which would result in carrying the value of safety work by the schedule until such time as the experience is capable of taking over the burden. Even though the rule were not accurate the present situation would be much improved.

Finally, the proposed plan, if adopted, would remove certain difficulties which are inherent in the present plan. At present if a subsequent inspection produces a greater credit than the original inspection the schedule ratable classifications are given lower rates. However, the fact that the average rate and the indicated risk rate come closer together produces a smaller experience modification and when this is applied to the non-schedule ratable classifications the result is an increase in these rates. It is true that the average rate for the risk decreases but the practical result is a decrease on one set of classifications and an increase on another, and this is by no means a simple matter to justify to an assured. Another condition which has confronted the Bureaus is this: under the present plan a risk cannot be completely rated until the schedule modification is available. Furthermore, all the operations of an assured within a given jurisdiction must be taken together for experience rating purposes. If there are three manufacturing plants under the control of a single assured three inspections must be made and the experience for the entire risk must be compiled before any of the constituent parts can be completely rated. If there is a controversy concerning the application of the schedule to one part of the risk, the rating of the entire risk is delayed. It is a case where the tail may wag the dog. To be sure these difficulties can be overcome but any rule which would eliminate them under the present plan would be awkward. Under the proposed plan there would be no conditions of this character, for with the schedule as the last

step in the rating procedure, any delay in determining the schedule modification or any adjustment in rates made necessary by reinspection could readily be taken into consideration.

This subject is at present under investigation by the National Reference Committee on Workmen's Compensation Insurance. I trust, therefore, that this plan and others which may be proposed will be thoroughly discussed here, as the coördination of the various elements of our scheme of rating is undoubtedly the next important problem in the field of workmen's compensation insurance which must be solved.

MR. W. H. BURHOP:

In view of the fact that Dr. Downey's paper on the above subject presents mainly a comparison of the Universal Analytic Schedule with the Industrial Compensation Rating Schedule, and offers a very complete explanation of the latter, little opportunity for a discussion is presented. The paper should give a better understanding of the subject to those not immediately connected with the preparation or application of rating plans.

Dr. Downey places a great deal of emphasis on the balancing feature of rating schedules. It is difficult to understand how we could ever have a plan that would be in balance and remain so without frequent revision of the credit and charge items. Our pure premiums, the basis of our rates, represent average conditions; so the rating schedule is intended to produce the manual rate for the average plant, and a higher or lower than manual rate for plants presenting a poorer or better than average condition. Safeguarding of machinery is continually increasing; much of such guarding is entitled to a credit under merit rating. The average condition of plants from point of safety is therefore continually improving. A schedule in balance at the starting point would soon be out of balance because the foundation upon which it was built, the average condition, has changed. Credits in excess of charges would necessarily be the result. This could, of course, be overcome by erecting a schedule upon the basis of a perfect condition and giving charges only. This would not result in a balanced plan, but would take care of changing general or average conditions. The present circumstances making such a schedule impracticable have been set forth in Dr. Downey's paper.

The point was also made that improved safety conditions over the average assumed are gradually reflected in the pure premiums, and that a double credit results by giving reductions in rate for certain items. This is no doubt an important fact, and is a weighty argument for periodic revisions of the schedule, raising the standards and eliminating credits.

As pointed out by Dr. Downey, one of the most valuable features accomplished, at least in part, by the Industrial Compensation Rating Schedule is the adjustment of the standards to conform

more nearly to the legal standards of the various states. Many controversies have arisen in Wisconsin because of the difference in the standards of the state and the insurance carriers. The Wisconsin Industrial Commission has vigorously inspected elevators for many years. Few elevators in the state do not meet the commission's requirements. The standards in the 1916 schedule were, in some instances, more stringent than the state standard, and the employer who had fully met the state standard, acting under instructions from state inspectors, and then was charged for not meeting the rating standard, objected to paying the charge, and did so with justice. To overcome the difficulty the rating standards on elevators were changed to conform to the state standards. State authorities are anxious for unified standards and are open to conviction regarding the correctness of their requirements. This good work should be continued; it is the greatest advance for proper guarding, and when enough states will have adopted the common standard manufacturers of machinery will be compelled by competition to make their products complete, including the universal guard.

In discussing the 1918 schedule Dr. Downey compares the method of basing credits and charges upon the number of employes with the old plan of flat charges and credits. The inaccurate method of reducing items to cents on the rate, making necessary the use of the estimated payroll, has been eliminated. The old evil could, of course, have been overcome by a flat addition or subtraction of the charges or credits instead of a reduction to cents on the rate.

It is extremely questionable if the number of employees can be ascertained in advance with much more accuracy than the payroll. Dr. Downey suggests that the average may be obtained from plant records taken at monthly or quarterly intervals. These must necessarily be the records of the past period. So also can the payroll be determined with even greater accuracy for the past year or part of the year. The records of the past period may, however, be of little value for estimates of the future. During this period payrolls have fluctuated greatly from year to year. Such variations are likely to continue until industrial conditions have again become stabilized. The number of employees has fluctuated in about the same degree as the payroll. Under present conditions at least it does not appear that the number of employees can be more accurately estimated than the payroll. Notwithstanding this fact, if it is correct, the plan of the 1918 schedule is superior to the schedules of the past.

The success of the 1918 schedule must depend to a large degree upon the accuracy of the value of K in the various formulæ. It should not be long before sufficient statistics have developed to aid in producing values with considerable accuracy. The methods employed in determining the value for K were not fully explained in Dr. Downey's paper.

The unfortunate feature of schedule rating of physical hazards is that the items chiefly considered produce only about one fifth of all the accidents. During the three years 1915, 1916 and 1917, 40,980 injuries were compensated in Wisconsin. Of these only nineteen per cent. were caused by machinery, with a corresponding time loss, weighted in accordance with the recommendations of the Statistical Committee of the International Association of Industrial Accident Boards and Commissions, of less than twenty-four per cent. of the total.

MR. WILLIAM NEWELL:

The subject has been so well covered in this paper and the details so thoroughly discussed by the author, that I fear there is little of value that I can add. Having charge of the inspection work of a compensation insurance carrier naturally leads me to consider the schedule from the point of view of its practical application, with special reference to the determination of the charge removed or credit granted, expressed in dollars and cents per year, for the safeguarding of individual conditions. In common with other carriers, we receive numerous requests from our assured to whom we have sent safety recommendations, asking us to advise them the credit they will receive for compliance with each individual item, and they invariably desire to have this expressed in dollars and cents annual saving per item, together with the total saving expressed both in terms of premium reduction and rate reduction.

This leads me to a discussion of the so-called flat premium values in the schedule. Mr. Downey states on page 331, in referring to the 1916 Schedule, that "the flat values, lastly, are not in practice—what the theory requires—fixed premium amounts," pointing out that the rate as respects the flat values necessarily depends upon the payroll disclosed by the policy declaration, differences in payroll estimate causing these values to fluctuate by as much as one hundred per cent. This was overcome to some extent by the Compensation Inspection Rating Board of New York by using an estimated payroll based on the average number of employees during the policy year as determined by inspection and the approximate annual average wage in the industry classification. In the footnote on page 331 Mr. Downey states "In the 1916 Pennsylvania Schedule an attempt was made to treat the flat charges as net premium additions, over the above the rate expressed in the policy. This practice would have realized the theory of the flat items—only the flat premium additions proved uncollectible in practice." I quote this here because I shall have occasion to refer back to it presently.

Mr. Downey states in Section 2 on page 332 that the Committee wholly abandoned the flat premium method of value expression in the 1918 Schedule, all items being valued either in per cent. of manual rate or in cents on payroll. This is true as regards the values carried into the charge and credit columns on either side of

the rating form, but I am unable to see that such is the case in the assignment of flat charge and credit points under Schedule items 120 to 210 inclusive, comprising defective flooring, floor openings, stairs, elevated runways, traveling cranes, elevators, and certain boiler and electrical defects, which are converted into terms of rate by the formula:

$$\frac{D}{E} \times K = \text{cents on pay roll},$$

in which D = number of defect points multiplied by the item weight of each, E = number of plant employees, K = a constant per unit of payroll.

The author states on page 337 that this formula gives a practically constant premium value per defect, and that pending the statistical determination of D, the actual judgment values of the former schedule were retained. If D is to represent these values in dollars as well as in points the formula becomes:

$$\frac{D}{E} \times 12.5 = \text{cents on pay roll},$$

which is equivalent to assuming an average annual wage of $800 per employee. The value of a point will only be exactly a dollar, however, in manual classifications in which the payroll averages $800 per employee per year, and for any other classifications the value of a point will bear the same ratio to a dollar as the average annual wage bears to $800. Thus an assured whose payroll per employee averages $800 per year will be charged $2.00 annually for a non-standard elevator gate, while a risk averaging $600 will be charged only 75 per cent. of $2.00, or $1.50, and a risk averaging $1,000 will be charged 125 per cent. of $2.00, or $2.50. This comes about through the fact that although the charge for items 120 to 210 inclusive (or credit in case of superior conditions) expressed in cents on payroll by use of the above formula will be constant for all risks having the same total of defect points and same number of employees, the premium derived by applying this rate increase to the actual total payroll will naturally vary directly with the average payroll per employee.

The author states on page 335: " Given the same number of employees, an unrailed stair, an unguarded elevator entrance or a hole in the floor presents practically the same risk of injury in a silk factory as in a carpenter shop." The actual premium charges for the defects mentioned would not be the same, however, for the reason explained above—the premium charge per defect in the silk mill would bear the same ratio to the premium charge per similar defect in the carpenter shop as the average annual payroll per employee in the former bears to the payroll per employee in the latter.

This does not coincide with the theory expressed by Mr. Downey in his reference to attempting to collect the flat charges as net premium additions, which I have quoted above. This latter method, which was found impracticable would of course result in making the values of the so-called flat charges and credits uniform for all risks.

OBITUARY.

VIRGIL MORRISON KIME.

Virgil Morrison Kime, Actuary of the Casualty Departments of The Travelers Insurance Company, died October 15, 1918, of bronchial pneumonia following a short illness with influenza.

Mr. Kime was born in Petersburg, Indiana, November 8, 1885, was educated in the public schools of Atlanta, Georgia, and was graduated from the University of Michigan in 1906. He began his insurance career with the Michigan Mutual Life Insurance Company, which, however, was interrupted by a two years' service as instructor in accounting in the Department of Economics at the University of Michigan. He then entered the service of the Missouri State Life Insurance Company at St. Louis and later, in 1911, became actuary of The American Central Life Insurance Company of Indianapolis. He came to the Travelers on May 1, 1916. Mr. Kime was elected a Fellow of the Society on October 22, 1915, was elected to the Council in October, 1917, and at the time of his death was serving as chairman of the Educational Committee. He was also a Fellow of the Actuarial Society of America by examination, a Fellow of the American Institute of Actuaries and a member of Phi Beta Kappa.

Mr. Kime's accomplishments in life actuarial work, and later in the field of casualty actuarial work, are a fine testimonial to his unusual mentality and his habit of careful and thorough study. He had an unquenchable thirst for knowledge upon subjects of all kinds. This fact gave him a breadth of view and an understanding of many matters which was an invaluable asset.

The outstanding characteristic of Mr. Kime was his gentlemanly and courteous manner. He was admired by all who knew him for his pleasing personality and graciousness. His untimely death was a sad shock to his many friends and a great loss to the actuarial profession.

Reviews of Books and Publications.

Workmen's Compensation and Insurance. Durand Halsey Van Doren. Department of Political Science of Williams College, 1918. Pp. viii + 332.

While we may not all honestly concur in Burns' wish:

> "O wad some Power the giftie gie us
> To see oursels as ithers see us!"

we probably all agree that it is at times stimulating to so see ourselves, even though it is not always flattering to our pride. In this No. 5 of the David A. Wells Prize Essays of Williams College we have such an opportunity. There is in it the freshness and clearness of vision of the recent graduate who has not yet had long and bitter enough contact with the unpleasant practicalities of life to make him mistrust his own convictions.

The author presents all sides of his subject as fairly as he can, but, convinced himself of certain propositions, he does not hesitate to express his conviction nor to present the arguments for it. For example, he begins his resume of the chapter on "Insurance Features." "Although this chapter has been chiefly devoted to an attempt to establish the superiority of compulsory state-managed insurance over all other methods of securing the compensation award . . ." Again, dealing with the question of an elective or compulsory law, he says:

"As we have seen, state legislatures imbued with the spirit of progress, but restrained by a craven fear of having their enactments overthrown by the courts, have endeavored, by raising presumptions of acceptance and by other means, to make nominally elective laws compulsory in fact; these are disgraceful subterfuges, and inexcusable in this day and age. If constitutional provisions are so antiquated or inelastic as to stand in the way of needed labor legislation, they should go; the path of amendment is open to all, and has been availed of in many states."

Certain suggestions as to the benefit scales which the author feels the ideal law should provide show a lack of contact with the practical problems either of claim administration or insurance.

Yet these very excesses are but evidence of the earnestness with which the author has taken up his task. Whether or not we agree with the writer, such writings usually well repay reading, if in no other way than by showing how such earnest thinkers look upon our problems.

The style is popular, yet the copious annotations show a wide reading and an endeavor to properly cover the subject and to facilitate further study if the reader is so inclined. The first four chapters on Underlying Principles, The Rise of Workmen's Compensation, Questions of Constitutionality, and Compensation Legislation in the United States form an excellent introduction to the subject for any student. The other chapter headings are Insurance Features, How It Works in New Jersey, The Attitude of Labor, The Soldiers' and Sailors' Insurance Act, Requisites of the Ideal Law. Some at least of these chapters would provoke sharp criticism at various points from different ones among membership.

Perhaps the spirit of the book is best summarized by a remark of the author in the Foreword, "The present work is in answer to the demand for a brief critical presentation of the subject, as distinguished from an exhaustive and non-committal treatise."

A. H. M.

The Statistical Plan of the National Workmen's Compensation Service Bureau has been fundamentally revised effective January 1, 1919. The following is quoted from the introduction to the new plan:

"The original plan stood the test of providing the necessary information for the development of rate making in a satisfactory manner. Changes were necessary from time to time as new problems arose, but these were successfully assimilated without the necessity of radically revising the plan as a whole.

"However, for some time, there has been a feeling on the part of those charged with the administration of the plan that certain features of it were somewhat too complicated for practical purposes. This feeling culminated in a proposal to revise the plan, and beginning with the month of June of this year the Statistical Sub-Committee on the Bureau Compensation Plan held a number of sessions, some of two days' duration at which the plan was gone over item by item, with the aim of simplifying and condensing it as much as possible. No real progress was achieved, however, until the meeting of July 19. At this meeting a very radical proposal was made to do away entirely with the method of reporting paid losses separately from the outstanding losses.

"It was explained that the Bureau has no need for the outstanding information on individual cases, nor for that matter, on individual classifications, for the reason that the outstandings are never taken into consideration in the establishment of pure premiums, and that such information is only valuable in bulk for investigating the question of underestimates.

"Viewing this question in this light, it was held that the outstandings should be divorced from the punch card system and given in bulk on a separate report, and that instead of punching on one card the paid amount and on another the outstanding amount, the companies should report a single card for each case showing the total amount of incurred loss. The acceptance of this method resolved all the difficulties the committee labored under. . . .

"Other changes are as follows:

"1. The new punch card does not contain space for cents in the 'medical' and 'compensation incurred' fields. This saves four columns of digits.

"2. Of the columns saved one column is added to the 'age' field, thus making it possible to punch the actual age instead of the age group. This may not seem very important, but it does nevertheless save the work of coding and also gives better data to work on.

"3. Two columns have been added to the 'counter' column. There are now three 'counter' columns headed respectively 'tabulatable,' 'non-tabulatable' and 'medical.' This corrects one of the shortcomings of the old plan. For many purposes, especially for Schedule Z, it is necessary to count not only the number of tabulatable acidents and the number of tabulatable accidents which are compensable, but also the number of cases on which medical has been incurred regardless of whether tabulatable, non-tabulatable or compensable.

"4. The duration of disability or payment no longer will be required in cases of death, permanent total disability, and permanent partial disability which are compensated in accordance with a specific dismemberment schedule. Time and experience have demonstrated such information to be of no value actuarially and that to require it would be a sheer waste of labor.

"5. Heretofore, owing to the enormous amount of detail required in fatal cases it was thought best to have the Bureau punch fatal cards from information supplied by the companies on Form 1082, entitled 'analysis of fatal accidents.' Under the revised plan the companies will do this punching on ordinary green cards. However, instead of a complete analysis as to kind of payment (whether benefit to widow, children, other total dependents, etc.) all it will be necessary to do will be to indicate whether the payment is for funeral expenses or a death benefit. The special detailed analysis of fatal cases will be required as heretofore with a more thorough analysis of payments. A detailed analysis will also be filed for every payment total disability case."

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Date Admitted	
†	§Amerine, W. M., Actuary, Georgia Casualty Co., Macon, Ga.
†	Archer, William C., Second Deputy Commissioner, State Industrial Commission, 230 Fifth Ave., New York.
†	Baldwin, F. Spencer, Manager, State Insurance Fund, 230 Fifth Ave., New York.
†	Benjamin, Roland, Comptroller, Fidelity & Deposit Co., Baltimore, Md.
†	Black, S. Bruce, Treasurer, Liberty Mutual Ins. Co., 185 Devonshire St., Boston, Mass.
Apr. 20, 1917	§Blanchard, Ralph H. Instructor in Insurance, 506 Journalism, Columbia University, New York. (Lieutenant.)
May 19, 1915	Bradshaw, Thomas, Commissioner of Finance and City Treasurer, Toronto, Canada.
†	Breiby, William, Office of Fackler & Fackler, Consulting Actuaries, 35 Nassau St., New York.
*Oct. 31, 1917	§Brockway, U. Hayden, Travelers Ins. Co., Hartford, Conn. (Lieutenant.)
†	Brodin, Richard, Actuary, United Life and Accident Ins. Co., Concord, N. H.
Oct. 22, 1915	Brown, Herbert D., Chief of U. S. Efficiency Bureau, Washington, D. C.
Oct. 22, 1915	Brown, William H., Second Vice-President, Columbian National Life Ins. Co., Boston, Mass.
†	Buck, George B., Actuary, Teachers' Retirement System, City of New York, Municipal Building, New York.
May 26, 1916	Bucklin, Walter S., President, Liberty Mutual Ins. Co., 185 Devonshire St., Boston, Mass.
†	Budlong, W. A., Superintendent of Claims, Commercial Travelers Mutual Accident Assn., Utica, N. Y.

Apr. 20, 1917	Burhop, W. H., Member, Wisconsin Compensation Insurance Board, State Capitol, Madison, Wis.
Feb. 19, 1915	Burns, F. Highlands, First Vice-President, Maryland Casualty Co., Baltimore, Md.
†	Cammack, Edmund E., Associate Actuary, Aetna Life Ins. Co., Hartford, Conn.
†	Carpenter, Raymond V., Assistant Actuary, Metropolitan Life Ins. Co., 1 Madison Ave., New York.
Feb. 19, 1915	§Case, Gordon, Assistant Examiner, New York Ins. Dept., 165 Broadway, New York.
Feb. 25, 1916	Close, Charles L., Manager, Bureau of Safety, U. S. Steel Corporation, 71 Broadway, New York.
*Nov. 15, 1918	§Coates, Barrett N., The Fraternal Brotherhood, Los Angeles, Cal.
Oct. 27, 1916	Cogswell, Edmund S., Third Deputy Insurance Commissioner, State House, Boston, Mass.
†	Cole, Richard H., Secretary, Connecticut General Life Ins. Co., Hartford, Conn.
Feb. 19, 1915	Collins, Henry, Assistant Manager, Ocean Accident & Guarantee Corporation, 59 John St., New York.
†	Conway, Charles T., Vice-President, Liberty Mutual Ins. Co., 30 E. 42d St., New York.
†	Copeland, John A., Consulting Actuary, 1709 Third National Bank Building, Atlanta, Ga.
†	Cowles, W. G., Vice-President, Travelers Ins. Co., Hartford, Conn.
†	§Craig, Arthur H., Lieutenant, Machine Gun Training Center, Camp Hancock, Ga.
†	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, Prudential Ins. Co., Newark, N. J.
Nov. 15, 1918	Davis, Mervyn, Assistant Actuary, Equitable Life Assurance Society, 120 Broadway, New York.
†	Dawson, Alfred B., Miles M. Dawson & Son, 141 Broadway, New York.
†	Dawson, Miles M., Counsellor at Law and Consulting Actuary, 141 Broadway, New York.
†	§De Kay, Eckford C., Recorder, New York Ins. Dept., 165 Broadway, New York. (Lieutenant-Commander.)
†	Dearth, Elmer H., President, General Casualty & Surety Co., 114 Woodward Ave., Detroit, Mich.
May 19, 1915	Deutschberger, Samuel, Chief Examiner, Underwriters' Association Bureau, New York Ins. Dept., 165 Broadway, New York.

†	Downey, E. H., Special Deputy, Insurance Department, Harrisburg, Pa.
†	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.
†	§Egbert, Lester D., Office of Willcox, Peck, Brown & Crosby, Insurance Brokers, 3 S. William St., New York.
†	Epsteen, Saul, Wiggins, Col.
†	Fackler, David Parks, Consulting Actuary, 35 Nassau St., New York.
†	Fackler, Edward B., Consulting Actuary, 35 Nassau St., New York.
†	Fallow, Everett S., Assistant Actuary, Casualty Dept., Travelers Ins. Co., Hartford, Conn.
†	Farrer, Henry, Actuary, Hartford Accident & Indemnity 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.
May 19, 1915	Fisher, Arne, Prudential Ins. Co. Newark, N. J.
†	Fitch, Frank M., Auditor, Hartford Steam Boiler Inspection & Ins. Co., Hartford, Conn.
Feb. 19, 1915	Flanigan, James E., Actuary, Bankers Life Co., Des Moines, Iowa.
†	Flynn, Benedict D., Assistant Secretary, Travelers Ins. Co., Hartford, Conn.
Feb. 15, 1915	Fondiller, Richard, Equitable Life Assurance Society, 120 Broadway, New York.
†	Forbes, Charles S., Forbes & Co. Inc., 66 Broadway, New York.
May 26, 1916	Frankel, Lee K., Third Vice-President, Metropolitan Life Ins. Co. 1 Madison Ave., New York.
†	Franklin, C. H., U. S. Manager, Frankfort General Ins. Co., 123 William St., New York.
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.
Feb. 19, 1915	Garrison, Fred S., Assistant Secretary, Travelers Indemnity Co., Hartford, Conn.
†	Gaty, Theodore E., Vice-President and Secretary, Fidelity & Casualty Co., 92 Liberty St., New York.
May 19, 1915	Glover, James W., Consulting Actuary, University of Michigan, Ann Arbor, Mich.

†	Goodwin, Edward S., Care of F. R. Cooley and Co., Bankers, 49 Pearl St., Hartford, Conn.
†	Gould, William H., Consulting Actuary, 256 Broadway, New York.
Oct. 22, 1915	Graham, George, Vice-President and Actuary, Missouri State Life Ins. Co., St. Louis, Mo.
Oct. 22, 1915	§Graham, T. Bertrand, Metropolitan Life Ins. Co., 1 Madison Ave., New York. (Captain.)
†	Graham, William J., Third Vice-President, Equitable Life Assurance Society, 120 Broadway, New York.
†	Grandfield, Robert E., Secretary, Industrial Accident Board, State House, Boston, Mass.
†	Greene, Winfield W., Special Deputy Commissioner of Banking and Insurance, 571 Broad St., Newark, N. J.
†	Hamilton, R. C. L., Comptroller, Hartford Accicident & Indemnity Co., Hartford, Conn.
†	Hammond, H. Pierson, Assistant Actuary, Life Dept., Travelers Ins. Co., Hartford, Conn.
†	Hansen, Carl M., Secretary, American Re-Insurance 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., Chief Statistician, State Industrial Commission, Albany, N. Y.
Oct. 22, 1915	§Hess, Herbert, Sergeant, Base Hospital No. 15, American Expeditionary Force.
†	Hillas, Robert J., President, Fidelity & Casualty Co., 92 Liberty St., New York.
Nov. 15, 1918	Hinsdale, F. W., Secretary, Workmen's Compensation 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 Manager, Royal Indemnity Co., 84 William St., New York.
†	Hughes, Charles, Auditor and Assistant Actuary, New York Ins. Dept., 165 Broadway, New York.
†	Hunt, Burritt A., Actuary, Casualty Dept. Aetna Life Ins. Co., Hartford, Conn.
†	Hunter, Arthur, Chief Actuary, New York Life Ins. Co., 346 Broadway, New York.
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 Protective Assn., Worcester, Mass.

†	King, Walter I., Secretary, Group Life Insurance Dept., Connecticut General Life Ins. Co., Hartfort, Conn.
†	Kopf, Edwin W., Assistant Statistician, Metropolitan Life Ins. Co., 1 Madison Ave., New York.
Feb. 19, 1915	Laird, John M., Actuary, Connecticut General Life Ins. Co., Hartford, Conn.
Feb. 19, 1915	Landis, Abb, Consulting Actuary, 1107 Independent Life Building, Nashville, Tenn.
†	Law, Frank E., Vice-President, Fidelity & Casualty Co., 92 Liberty St., New York.
May 19, 1915	Lawson, F. W., U. S. Manager, London Guarantee & Accident Co., Ltd., 134 So. La Salle St., Chicago, Ill.
†	Leal, J. R., Actuary, Florida Ins. Dept., State Capitol, Tallahassee, Fla.
†	Leslie, William, Actuary, New York Ins. Dept., 165 Broadway, New York.
Feb. 19, 1915	Lubin, Harry, State Industrial Commission, 230 Fifth Ave., New York.
†	Luckett, D. G., General Manager and Secretary, United States Casualty Co., 80 Maiden Lane, New York.
*Oct. 31, 1917	§McManus, Robert J., Travelers Ins. Co., Hartford, Conn.
Feb. 19, 1915	Maddrill, James D., Supervisor of Training, Federal Board for Vocational Education, 997 Monadnock Bldg., San Francisco, Calif.
†	Magoun, William N., General Manager, Massachusetts Rating & Inspection Bureau, 88 Broad St., Boston, Mass.
†	Marsh, W. B., Business Manager, The Economic World, 128 Water St., New York.
May 19, 1915	Maycrink, Emma C., Auditor, Compensation Inspection Rating Board, 135 William St., New York.
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., Actuary, National Workmen's Compensation Service Bureau, 13 Park Row, 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., Phila., Pa.
†	Moir, Henry, Actuary, Home Life Ins. Co., 256 Broadway, New York.
†	Moore, George D., Statistician, Royal Indemnity Co., 84 William St., New York.
†	Moore, W. S., Secretary-Treasurer, Guarantee Bonding & Ins. Co., Wichita, Kan.
May 19, 1915	Morris, Edward B., Actuary, Life Dept., Travelers Ins. Co., Hartford, Conn.
†	Morrison, James, Chief Accountant, Royal Indemnity Co., 84 William St., New York.
†	Mowbray, Albert H., Actuary, State Industrial Commission, 230 Fifth Ave., New York.
May 20, 1918	Mudgett, Bruce D., Assistant Professor of Insurance, University of Washington, Seattle, Wash.
†	Mullaney, Frank R., Actuary, American Mutual Liability Ins. Co., 245 State St., Boston, Mass.
†	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 New York State, 80 Maiden Lane, New York.
†	Pallay, Julius J., Statistician, London Guarantee & 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.
Nov. 15, 1918	Perry, W. T., Manager for Canada, Ocean Accident and Guarantee Corporation, Toronto, Canada.
†	Reiter, Charles G., Assistant Actuary, Metropolitan Life Ins. Co., 1 Madison Ave., New York.
†	Remington, Charles H., Assistant Treasurer, Aetna Life Ins. Co., Hartford, Conn.
Feb. 19, 1915	Rolph, Mrs. Dorothy M., Director, Compensation Division, War Risk Bureau, Washington, D. C.
†	Rubinow, I. M., 550 Riverside Drive, New York.
†	Ryan, Harwood E., Superintendent, Accident and Health Dept., Equitable Life Assurance Society, 120 Broadway, New York.

†	Saxton, Arthur F., Chief Examiner of Casualty Companies, New York Ins. Dept., 165 Broadway, New York.
†	Scattergood, Claude E., Assistant Treasurer, Sperry Gyroscope Co., 40 Flatbush Ave. Extension, Brooklyn, N. Y.
†	Scheitlin, E., Statistician, Globe Indemnity Co., 45 William St., New York.
†	Senior, Leon S., Manager and Secretary, Compensation Inspection Rating Board, 135 William St., New York.
†	Smiley, J. W., Actuary and Chief Accountant to the West Virginia State Compensation Commissioner, Charleston, W. Va.
Apr. 20, 1917	Smith, Charles G., Actuary, New York Ins. Dept., Albany, New York.
Feb. 19, 1915	Smith, George Lambert, Consulting Actuary, 55 John St., New York.
Feb. 19, 1915	Stone, John T., President, Maryland Casualty Co., Baltimore, Md.
Feb. 25, 1916	Strong, Wendell M., Associate Actuary, Mutual Life Ins. Co., 32 Nassau St., New York.
Oct. 22, 1915	Strong, William Richard, 39 Streatham High Road, S. W. 16, London, England.
†	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 Ins. Co., 32 Nassau St., New York.
†	Train, John L., Secretary and General Manager, Utica Mutual Ins. Corp., 239 Genesee St., Utica, New York.
†	Whitney, Albert W., General Manager, National Workmen's Compensation Service Bureau, 13 Park Row, New York.
†	Wolfe, Lee J., Consulting Actuary, 165 Broadway, New York.
†	§Wolfe, S. Herbert, Colonel, War Risk Bureau, Washington, D. C.
†	Woodward, Joseph H., Associate Actuary, Guardian Life Ins. Co., 50 Union Square, New York.
†	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.

Those marked (§) are in the military or naval service of the United States.

Date Enrolled	
*Nov. 15, 1918	Ackerman, Saul B., Assistant Actuary, State Industrial Commission, 230 Fifth Ave., 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. 22, 1915	Baxter, Don A., Deputy Ins. Commissioner, Michigan Ins. Dept., Lansing, Mich.
*Oct. 27, 1916	Bernstein, Abraham, Accountant, State Ins. Fund, 230 Fifth Ave., New York.
*Oct. 31, 1917	Bessey, John M., Secretary, National Association of Mutual Casualty Insurance Companies, 233 Broadway, New York.
*Oct. 22, 1915	Brann, Ralph M., Manager, Colorado Branch, National Workmen's Compensation Service Bureau, Denver, Colo.
Nov. 15, 1918	Brooks, LeRoy, Statistician, U. S. Fidelity & Guaranty Company, Baltimore, Md.
*Nov. 15, 1918	Brunnquell, H. G., Second Asst. Actuary, Wisconsin Ins. Dept., Madison, Wis.
*Oct. 22, 1915	Buffler, Louis, Jr., State Ins. Fund, 230 Fifth Ave., New York.
*Nov. 15, 1918	Carver, Harry C., Actuary, London Guarantee & Accident Co., Chicago, Ill.
*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.
*Nov. 15, 1918	Greenleaf, Allen R., First National Bank, Boston, Mass.

*Oct.	31, 1917	Jackson, Edward T., Statistician, Maryland Casualty Co., Baltimore, Md.
*Oct.	31, 1917	Kearney, T. P., Assistant Manager, State Compensation Insurance Fund, Denver, Colo.
*Nov.	15, 1918	Kirkpatrick, A. L., National Workmen's Compensation Service Bureau, 15 Park Row, New York.
*Oct.	22, 1915	Levy, S. Leon, War Trade Board, Washington, D. C.
(1)*Oct.	27, 1916	McClure, Laurence H., Colt's Patent Fire Arms Mfg. Co., Hartford, Conn.
*Oct.	22, 1915	McGuire, Vincent G., 3056 Decatur Ave., New York.
(1)*Oct.	27, 1916	§Miller, Tilford W., Travelers Ins. Co., Hartford, Conn.
*Oct.	31, 1917	Montgomery, Victor, Actuary, California Ins. Dept., San Francisco, Cal.
*Oct.	31, 1917	Mueller, Louis H., State Compensation Insurance Fund, 525 Market St., San Franfrancisco, Cal.
*Oct.	22, 1915	Müller, Fritz, New York Life Ins. Co., 346 Broadway, New York.
(1)*Oct.	27, 1916	Newell, William, Chief Safety Engineer, State Insurance Fund, 230 Fifth Ave., New York.
*Nov.	15, 1918	Outwater, Olive E., National Workmen's Compensation Service Bureau, 15 Park Row, New York City.
*Nov.	15, 1918	Raywid, Joseph, Statistician, International Fire & Marine Ins. Corp., 3 S. William St., New York.
*Nov.	15, 1918	Schaefer, Walter A., Ocean Accident & Guarantee Corp., 59 John St., New York.
*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.
*Oct.	22, 1915	§Tilson, Howard, Captain, Ordnance Dept., Frankford Arsenal, Philadelphia, Pa.
(1)*Oct.	22, 1915	Van Tuyl, Hiram O., Examiner, New York Ins. Dept., 165 Broadway, New York.
(1)*Oct.	27, 1916	§Waite, A. W., Aetna Life Ins. Co., Hartford, Conn.
(1)*Oct.	27, 1916	Waite, Harry V., Travelers Ins. Co., Hartford, Conn.

Nov. 15, 1918 Wilkinson, Albert E., Statistician, Standard Accident Ins. Co., Detroit, Mich.

*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., Chief Accountant, Ocean Accident & Guarantee Corp., 59 John St., New York.

SCHEDULE OF MEMBERSHIP, NOVEMBER 15, 1918.

	Fellows.	Associates.	Total
Membership, May 20, 1918	144	25	169
Withdrawals:			
By death	1	—	1
By resignation	2	—	2
	141	25	166
Additions:			
By election, November 15, 1918	3	6	9
By examination	1	11	12
	145	42	187
Transfers from Associate to Fellow		1	1
Membership, November 15, 1918	145	41	186

ABSTRACT FROM THE MINUTES OF THE FIFTH ANNUAL MEETING, NOVEMBER 15, 1918.

The fifth annual and eleventh regular meeting of the Casualty Actuarial and Statistical Society of America was held at the Yale Club, New York, on November 15, 1918.

President Craig called the meeting to order at 10:45 A.M. The roll was called, showing the following thirty-two Fellows and ten Associates present:

FELLOWS.

BRODIN	GOODWIN	MOORE, G. D.
BUDLONG	GOULD	MOWBRAY
CAMMACK	GREENE	NICHOLAS
CRAIG, J. D.	HUGHES	PALLAY
DEARTH	HUNT	RYAN
DEUTSCHBERGER	JACKSON, C. W.	SCATTERGOOD
DUNLAP	KOPF	SCHEITLIN
FARRER	LUBIN	SENIOR
FISHER	MELTZER	STRONG, W. M.
FLYNN	MICHELBACHER	WOODWARD
FONDILLER	MOIR	

ASSOCIATES.

ACKERMAN	EGLI	RAYWID
BROOKS	JACKSON, E. T.	VAN TUYL
CARVER	NEWELL	WAITE, H. V.
	OUTWATER	

The President's annual address was presented.

The minutes of the meeting held May 20 and 21, 1918, were approved as printed in the *Proceedings*.

The report of the Council was read and, upon motion, adopted by the Society. It reported the death of Virgil M. Kime, a Fellow, a memorial of which appears elsewhere.

The Council reported that a committee had been appointed to consider periodical meetings in the central part of the United States and to report back to the Council. This matter had been discussed at length, with the object of arranging the place of future meetings, so that the members of the Society residing in the western part of the United States could be present at the meetings.

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:

Davis, Mervyn, Assistant Actuary, Equitable Life Assurance Society, 120 Broadway, New York.
Hinsdale, F. W., Secretary, Workmen's Compensation Board, Vancouver, B. C., Canada.
Perry, W. T., Manager for Canada, Ocean Accident & Guarantee Corporation, Toronto, Canada.

After ballot, these nominees were declared duly elected Fellows.

The Council reported that the following had been enrolled without examination as Associates:

ANKERS, R. E.	EGLI, W. H.	SULLIVAN, O. M.
BROOKS, LEROY	SIBLEY, J. L.	WILKINSON, A. E.

The Council also reported that Barrett N. Coates had passed the necessary examinations and had been admitted as a Fellow; that the following candidates had passed the necessary examinations and had been enrolled as Associates:

ACKERMAN, S. B.	ELSTON, J. S.	RAYWID, JOSEPH
BRUNNQUELL, H. G.	GREENLEAF, A. R.	SCHAEFER, W. A.
CARVER, H. C.	KIRKPATRICK, A. L.	SPENCER, H. S.
DORWEILER, PAUL	OUTWATER, OLIVE E.	

The reports of the Secretary-Treasurer, Editor, and Librarian were read and accepted. A summary of the Editor's report follows:

During the fiscal year November, 1917–November, 1918, the fourth year of the Society's existence, Volume IV of the *Proceedings* has been issued. This volume consists of Numbers 9 and 10, 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:

	Pages.	Papers.	Discussions.
Volume I (Numbers 1, 2, 3)	331	16	5
Volume II (Numbers 4, 5, 6)	521	30	7
Volume III (Numbers 7, 8)	328	14	31
Number 9	247	6	19
Number 10	219	5	13
Total, Volume IV	466	11	32

All the volumes have been bound in buckram and supplied to members and subscribers. Numbers 9 and 10 have been mailed to members promptly upon publication; in addition, Volume IV, bound, has been furnished gratis to members.

The Auditing Committee (Mr Charles Hughes, Chairman) re-

ported that the books of the Treasurer had been audited and his accounts verified.

The Committee on 1920 Census (Mr. I. M. Rubinow, Chairman) reported as to its work to have the Federal Census Bureau include statistics of value to the casualty statistician.

The Examination Committtee (Mr. G. F. Michelbacher, Chairman) submitted a report, of which the following is a summary:

Examinations were held on May 1 and 2, 1918, throughout the United States. By reason of the war, the number of candidates was smaller than last year.

Two Associates presented papers in Part II of the Fellowship examination, and only Barrett N. Coates passed. He was the only candidate in Part I of the Fellowship examination, and also passed that part.

Eight candidates presented papers in Part III of the Associateship examination and six passed, as follows:

CARVER, H. C.
DORWEILER, PAUL
GREENLEAF, A. R.
KIRKPATRICK, A. L.
OUTWATER, OLIVE E.
SCHAEFER, W. A.

Fourteen candidates presented papers in Part IV of the Associateship examination and twelve passed, as follows:

ACKERMAN, S. B.
BRUNNQUELL, H. G.
CARVER, H. C.
DORWEILER, PAUL
ELSTON, J. S.
GREENLEAF, A. R.
KIRKPATRICK, A. L.
OUTWATER, OLIVE E.
RAYWID, JOSEPH
SCHAEFER, W. A.
SPENCER, H. S.
WEBBER, C. W.

A vote of thanks was individually extended by the Society to the President, Secretary-Treasurer and Editor for the efficient manner in which they had performed their 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 .....Joseph H. Woodward
Vice-President .....C. E. Scattergood (resigned)
Vice-President .....Benedict D. Flynn
Vice-President .....George D. Moore
Secretary-Treasurer .....Richard Fondiller
Editor .....W. W. Greene
Librarian .....Louis I. Dublin
Member of Council (term to expire November, 1920) .....G. F. Michelbacher
Member of Council (term to expire November, 1920) .....Leon S. Senior
Member of Council (term to expire November, 1919) .....Burritt A. Hunt

Recess was taken until 2:30 P.M.

The papers printed in this number were read or presented and those read at the last meeting of the Society were then discussed. An informal "Question Box" concluded the meeting.

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 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 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 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.—*Expulsion 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 1919.* Examinations will be regularly held in May, 1919, 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 1920, 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.

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:

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.

A copy of a pamphlet entitled "Recommendations for Study" may be obtained upon application to the Secretary-Treasurer.

VOLUME V, PART II. NUMBER 12.

PROCEEDINGS

MAY 23, 1919

INSURANCE AND HUMAN BEHAVIOR.

ADDRESS BY THE PRESIDENT, JOSEPH H. WOODWARD.

I.

In a presidential address delivered before the American Statistical Association on December 28, 1918, Professor Wesley C. Mitchell said:

"Taking us all together as one people in a group of mighty peoples, our first and foremost concern is to develop some way of carrying on the infinitely complicated processes of modern industry and interchange day by day, despite all tedium and fatigue, and yet keeping ourselves interested in our work and contented with the division of the product. That is a task of supreme difficulty—a task that calls for intelligent experimenting and detailed planning rather than for agitation or class struggle. What is lacking to achieve that end, indeed, is not so much good will as it is knowledge—above all, *knowledge of human behavior.*"*

Just a year previous—December 28, 1917—the late Professor Carleton H. Parker, in a paper read before the American Economic Association, remarked:

"We economists speculate little on human motives. We are not curious about the great basis of fact which dynamic and behavioristic psychology has gathered to illustrate the instinct stimulus to human activity. Most of us are not interested to think what a psychologically full or satisfying life is. We are not curious to know that a great school of behavior analysis called the Freudian has been built around the human instincts."

* Italics not in original.

I shall attempt to define as simply as possible some of the more important concepts of this new school of behavior analysis, to briefly apply these concepts to a few general questions which pertain to all business and professional activity, and to consider insurance and some of its problems in the light of these theories.

II.

In our mathematical work we have become familiar with the importance of studying extreme and exceptional cases. We may find an empirical formula for, let us say, the schedule rating of a certain type of risk which will give "workable" results in "average" cases. But that ultimate scientific validity which distinguishes a law of nature from an empirical rule depends upon the formula being true for all values of the variables, including the limiting values. No man of science has done more to demonstrate the importance of abnormalities in facilitating an understanding of the normal than has Freud, the Austrian psychologist.

As long ago as 1881, Freud, in treating one of his patients suffering from hysteria, became impressed with the dominating influence of the unconscious upon the personality. But it was not until 1900 that he published his great work on the "Interpretation of Dreams" which, by offering a scientific means of exploring and charting the hidden recesses of the psyche, laid a new foundation for both normal and abnormal psychology. Up to that time psychology had devoted itself mainly to a consideration of that relatively small part of the personality within the boundaries of the conscious and had given but little attention to the unconscious, by which is understood not so much that portion of the mind which is not in the immediate field of awareness as that vast underlying stratum of impulses and impressions which by no effort of the will can be brought into the field of awareness.

Today our economics, sociology and social philosophy generally are beginning to modify their teachings on the basis of this new scientific material. Education has commenced to respond to its fructifying influence. An entire new school of psychiatrical therapeutics has come into existence. It seems as if no field in which the laws of human behavior play a rôle were destined to escape its influence.

III.

The most important concept of this new psychology—the *unconscious*—has already been partly defined. The unconscious embraces all that portion of the individual personality or psyche of which the individual is not aware. Its content, in addition to impressions of adult experiences, consists of a vast amount of repressed or forgotten infantile material together with primitive traits and conflicting impulses evolved through thousands of generations. It is not merely the individual but the racial past of its possessor. It should not be forgotten that the Piltdown Man lived 150,000 years age, the Heidelberg Man, 250,000 and the Ape Man of Java, 500,000. Ninety-nine per cent. of this period antedates anything which even remotely resembles modern civilization. The often repeated statement that civilization is only skin deep thus appears to have a sound statistical as well as psychological basis.

The sole function of the unconscious, according to the Freudian theory, is to desire or to wish. The fundamental desires, instincts or cravings are of two kinds only, those of hunger and those of sex. The successful transmutation or conversion of the energy liberated by these crude desires for the furtherance of other ends—and especially the social or higher ends—is called *sublimation*. Instincts or cravings which are not either satisfied or successfully sublimated give rise to individual or social maladjustments.

A *conflict*, in a broad sense, is a struggle between opposing desires or sets of ideas, one or both of which need not necessarily be in the conscious but may be in the unconscious. Most ethical problems—whether individual or social—involve the resolution of some conflict.

A *resistance* is a hostile attitude in the unconscious. It is the result of an attempt of the psyche to banish unpleasant or unwelcome thoughts. It is a mechanism of self protection. A familiar example of resistance is found in the lines written by Tom Brown (1663–1704):

> "I do not love thee, Doctor Fell,
> The reason why I cannot tell;
> But this alone I know full well,
> I do not love thee, Doctor Fell."

It will be desirable to attempt one more definition before passing on. We all know in a general way what *rationalization* means. But in the new psychology it is applied more particularly to the

elaboration by our conscious of a logical and plausible reason for satisfying a wish or desire of our unconscious. It is because of this tendency to rationalize an unconscious wish that we are likely to defend with a fine moral enthusiasm those particular views or institutions whose maintenance happens to be advantageous to us. Who has not been impressed by the frequent failure of honest efforts to settle differences of opinion on a basis of logic and reason?

IV.

"Progressive civilization [says Brill] depends on the harnessing and controlling of the forces of nature as well as the forces of the individual and in directing these forces into useful channels. . . . Sooner or later every normal human being must give up many of his natural prerogatives and become part of the society he lives in. He must renounce many of his individual desires and must exert continuous effort for the common weal. That is, every individual must contribute something to the society he lives in by adding something useful to it. We may designate such contributions as work."*

We may well pause to note a distinction implied in this definition. Mere activity or the expenditure of effort is not necessarily work as thus conceived. The activity must be directed to an end outside the individual himself. There must be a useful effect on the environment.

In organized societies each individual elects or is designated to perform some special kind of work which constitutes his vocation. From one point of view the selection of a vocation is simply a part of a general scheme for getting the world's work efficiently done. From the standpoint of the individual, however, it is a question of satisfying his biological needs. If insurance men are useful to the business of insurance, so is the business of insurance useful to insurance men. If we so perfected the mechanics of our affairs that they functioned automatically like a sort of gigantic slot machine, we should every one of us be faced by a difficult problem of psychic rehabilitation.

It is well established that there are many determinants in the choice of a vocation which spring from the unconscious and of which the individual is quite unaware. Normally we select an occupation for the reason that—consciously or unconsciously—it appeals to us. A man cannot really succeed in any pursuit unless

* A. A. Brill, M.D., "The Psychopathology of Selections of Vocations," *Medical Record*, February 23, 1918.

it interests him and he is generally interested in pursuits in which he has a natural superiority. Occasionally, the psychologists tell us, the mechanism is otherwise. Demosthenes was in his youth afflicted with stammering and he thereupon determined to overcome his handicap and become an orator. He succeeded, and in so doing he illustrated the psychopathological law of over-compensation for a natural inferiority. Thus it might happen, for example, that a childhood difficulty with the multiplication table might become the determinant of an over-compensation resulting finally in the choice of an actuarial or statistical vocation. This, however, is not the process to be normally expected.

V.

An occupation which fails to adequately utilize and successfully transform the energies generated by the human dynamo gives rise to conflicts, resistances and other maladjustments. The fundamental instincts must be sublimated into the instinct of craftsmanship. The cook rejoices in the artistic blending of a sauce, the skilled mechanic finds satisfaction in the accuracy and perfection of his work, the street cleaner loves to see the water from the hydrant "flush the streets and clean them through and through."*

* Brill, *op. cit.*

The use of machinery and the grouping of like operations are fundamental principles of large scale production. But the efficiency expert, in solving some old problems, has created new ones. The main psychological distinction between the so-called laboring man and the intellectual worker lies in the lesser capability of the former to sublimate his fundamental impulses. Hence the peculiar difficulty, under modern industrial conditions, of successfully suppressing such supplementary outlets as the use of the milder alcoholic beverages or exhibitions of pugilism without at the same time providing acceptable substitutes. Bearing in mind the fundamental fact that work which is psychologically satisfying stands in the same relation to a normal life as does the gratification of the affections or the satisfaction of hunger, it is clear that an industrial system under which the work to be done fails to meet the biological needs of the worker contains the germ of a social danger of titanic proportions.

In the field of scientific and technical labor the same general principles apply. We have only to reflect that the greatest of

human accomplishments have been those in which the money-stimulus has played but a minor rôle to realize that there as elsewhere a profound organic craving for the satisfaction of doing a good job is the prime essential—a gratification of the instinct of craftsmanship the highest reward. A corollary of this theorem is that in scientific work it does not pay to confine the worker too closely by the leading strings of immediate utility. The great advances in the world's knowledge have not been brought to pass in that way. All intellectual activity rests upon a strong emotional foundation and the very essence of human emotion is its spontaneity. A narrow routine is not likely to bring forth the impulse which forms the biological basis of original scientific achievement.

Perhaps the greatest difficulty in applying the psychology of high accomplishment to the everyday life of the statistician or actuary lies in the fact that generally he is working as one of the many cogs in a ponderous commercial machine. This fact is by no means without its offsetting advantages but it also follows that unless a considerable amount of freedom for research and for study of a character not immediately productive is permitted and encouraged scientific progress will be unnecessarily limited. The great size of some of our modern insurance institutions has made it possible for them to provide for statistical work on a generous scale and it is heartening to see what excellent use has been made of these exceptional opportunities by those who enjoy them. It is a part of that spirit of service without too close a scrutiny of the immediate pecuniary return which happily distinguishes the policy of many of the great corporations of today.

But the instinct of craftsmanship is not without its drawbacks and disadvantages. The instinct is a powerful one and is apt to make us lose our sense of proportion. The technical man has an indifferent reputation as an executive. The mutilation of his work, necessary to fit it to practical uses, fills him with horror, and his absorption in his specialty makes him uninterested in and neglectful of those constantly shifting problems of administration which confront the executive. The mathematician desires above all things consistency and elegance in his solutions and precision in his results. He wishes this not merely consciously, but unconsciously and the rationalization of his unconscious wish may cause him to antagonize the views of his non-technical associates. Their view, on the other hand, may be warped by the influence of their own

unconscious desires concerning the question at issue coupled with an inability to follow the highly abstract reasoning of the mathematician. The best hope of preserving the peace under such conditions appears to lie in a better understanding on both sides of the psychological mechanism involved. It is only thus that we may hope to reach that golden mean which is the finest fruit of philosophy.

VI.

In defining our fundamental concepts we saw that a resistance is a hostile attitude in the unconscious. There is abundant evidence that insurance—and especially life and disability insurance—meets with a strong resistance in the minds of most people.* In our attempt to suppress painful thoughts or impressions and to escape from associations which are unpleasant we unconsciously deny reality to disaster or misfortune.

The very nomenclature of insurance is perhaps the most obvious indication of our attitude. Ordinarily we designate the kind of insurance by reference to the hazard insured against. Thus we speak of fire insurance, accident insurance, burglary insurance—fire, accident and burglary being the respective hazards insured against. But if, insisting on logic and consistency, we should organize a *death* insurance company, would the outlook for its successful career be promising? Common sense emphatically informs us that it would not. Again, in England it is usual to speak of *sickness* insurance; in America our resistance to the idea of sickness has transformed the term into *health* insurance. Both the foregoing instances exemplify the inability of the unconscious to face reality. They are examples of a common mechanism by which a word or idea with painful associations is replaced by its opposite. The numerous unsuccessful attempts to sell insurance without the use of agents or other special means of overcoming the resistance constitute further corroborative evidence. Finally, can the peculiar lack of cordiality in the attitude of the public and of the legislatures toward insurance and insurance companies be completely

* An application of the Freudian concept of resistance to the problems of life insurance has been made by Mr. Philip Burnet, president of the Continental Life Insurance Company, in an address to the Insurance Officers of the United States Army entitled "The Value of a Human Life," February 15, 1919.

explained without granting some recognition to this hostility in the unconscious?

Speaking of the effect of the war on our attitude toward death Freud remarks:*

"Our attitude had not been a sincere one. To listen to us we were, of course, prepared to maintain that death is the necessary termination of life, that every one of us owes nature his death and must be prepared to pay his debt; in short, that death was natural, undeniable, and inevitable. In practice we were accustomed to act as if matters were quite different. We have shown an unmistakable tendency to put death aside, to eliminate it from life. We attempted to hush it up. . . . We cannot indeed imagine our own death; whenever we try to do so we find that we survive ourselves as spectators. . . . In the unconscious every one of us is convinced of his immortality."

In everyday life we studiously refrain from referring to the inevitable death of our friends. When death does occur we are likely to resort to some circumlocution or euphemism. We say that the deceased has "passed away," "entered into rest," or "departed this life." Even in actuarial science—supposed to be cold-blooded and unemotional—we speak of *life* contingencies, not *death* contingencies. It is not surprising, therefore, that the idea of insurance should share in the resistance attaching to the thought of the event insured against.

All insurance belongs to one of two great classes—property insurance and personal insurance, the principal and best example of the former being fire insurance. While the general resistance to unpleasant ideas doubtless contributes to maintain the long-standing unpopularity of fire insurance with the public and with the law makers, it has succeeded, in spite of this obstacle, in reaching the normal limit of its development in the sense that the future extension of the business depends rather upon the increase in insurable values than upon a wider acceptance of the idea of insurance.

Personal insurance may be considered broadly as including all pecuniary indemnification by an insurer for death—whether accidental or natural—and for the effects of disability arising either from sickness, accident or old age. It is worthy of note that the development of personal insurance is only beginning: the amount of such insurance in existence as compared with the aggregate of human insurable values is inconsiderable.

* "Reflections on War and Death," by Prof. Dr. Sigmund Freud, authorized translation by A. A. Brill and Alfred B. Kuttner, 1918, pp. 30–31.

There are two social institutions in the absence of which the principal forms of personal insurance would, in anything approaching their present development, be unthinkable. These are (1) the family and (2) the principle of inheritance, or the legal right to transmit property by will or descent.

If children were assembled at birth in mammoth orphan asylums and brought to maturity by the state, life insurance would lose its *raison d'être.* The biological purpose which it serves is the protection of the family. It is a general rule that the higher the type of the organism in the scale of evolution the more elaborate and protracted becomes the care of the offspring by the parents. The spawn of a single codfish may contain several million eggs, a provision of nature for offsetting very high rates of prenatal and infant mortality. Birds and mammals leave their offspring to shift for themselves after a brief period of parental care. Civilized man, however, in following out his parental instinct, not merely provides for his children during the large proportion of life which precedes physiological maturity, but often for years thereafter, while by means of life and accident insurance he arranges that this protection shall not cease in the event of his premature death or disability. Is it going too far to say that the degree to which he sacrifices himself to this end is a measure of his civilization?

Personal insurance subserves other social ends by caring for the individual during sickness or old age, thereby relieving the family or the community from this burden. And it is interesting to consider that extreme old age and disability are, biologically speaking, nothing more nor less than reversions to infantility—states in which the organism is incapable of taking care of itself without assistance. Shakspere—a great intuitive psychologist—wrote: "The last scene of all is second childishness."

The right to transmit property by inheritance serves as an outlet not merely for the parental instinct, but also for the instinct of accumulation—the desire which exists in most men, including those who have no families, to leave an estate for the use of succeeding generations. As an example of the operation of the instinct of accumulation may be cited the failure to achieve popularity of many supposedly scientific life insurance policy-contracts designed to fit the "real economic needs" of the insured. Under these contracts the insurance is generally high at the younger and middle ages and either reduced or the benefit changed to an annuity after

age 65. Such contracts run so strongly counter to the powerful desire to leave an unimpaired estate that they are not even popular among the actuaries who invent them.

The family instinct and the instinct of accumulation are positive factors tending to make men insure. The unconscious resistance to the idea of death creates a conflict by operating in the opposite direction.

If one reflects upon the history of insurance in European countries and the gradual development of opinion now taking place in the United States he may well reach the conclusion that the two most fundamental categories into which personal insurance may come to be divided will be (1) compulsory insurance and (2) voluntary insurance.

The natural field of compulsory insurance appears to be to provide that those who have met with misfortune for which they cannot be held responsible will receive a certain minimum amount of assistance necessary to restore their ability to work and to maintain the integrity of the family during the period of disability. Voluntary insurance fails, for numerous practical reasons, to operate with sufficient effectiveness in this field. The amount of existing insurance protection for the wage-earner is negligible as measured by social requirements.

A large part of the functions of such compulsory insurance consist in nothing more than what has to be done in some way or other under existing social arrangements. It is simply a matter of redistributing the burden, amplifying the protection, and more equitably assessing the cost. There are, to be sure, some primitive tribes among which those no longer able to labor are killed and eaten. While such a solution of the social problem has the double merit of simplicity and cheapness, it can hardly be regarded as a practical way out for civilized communities. We already have in this country in workmen's compensation insurance an example of the compulsory principle, for although this insurance is generally not legally compulsory it is made virtually so by placing at a legal disadvantage those employers desiring to escape from providing it. And it may be well to emphasize in passing that the distinction between compulsory insurance and voluntary insurance has no necessary connection with the distinction between state insurance and private insurance. While compulsory insurance has more often than not been state administered this is not necessarily so and the converse holds true as to voluntary insurance.

The natural field of voluntary insurance is the gratification of the family instinct and of the instinct of accumulation on the part of those having a margin of income over what is needed for immediate necessities which they are willing to voluntarily devote to these ends. The potential demand for such insurance is practically unlimited and is likely to grow as civilization increases. When we cease to want more and better things—including more and better insurance—we have stopped growing.

What better evidence can be desired of the unlimited demand for life insurance than the fact that the sudden springing into existence of $35,000,000,000 of government war risk insurance—an amount which instantaneously doubled the total of the old line life insurance in force in the United States—has apparently served merely to whet the public appetite for more? This is almost certainly one among the several reasons why the life insurance companies are writing new business today at a rate far surpassing any previous records. It seems not unlikely that a general introduction of compulsory insurance will operate similarly as an education in the benefits of insurance and a stimulus to the development of a vigorous and effective system of voluntary insurance.

VII.

It has been shown that the chief psychological obstacle to be overcome in persuading men to insure is the unconscious resistance to the idea of disaster or death. We may now consider the means of breaking down this resistance and overcoming this hostile attitude in the unconscious.

A legal compulsion to insure or to be insured is not a genuine overcoming of the resistance and is furthermore not a desirable method of extending insurance protection except within well-defined limits. Interference with personal liberty, even if more apparent than real, is today as undesirable as it ever was and to be resorted to only where the indications for such interference are unmistakable.

The most important and only really effective method of expanding the business of voluntary insurance is through the use of agents. Insurance salesmen, by reason of the peculiar resistance which they have to overcome, require exceptional natural gifts and thorough training if they are to be successful. The selection and education of an efficient agency force is a problem which is ever present with

the insurance executive. Numerous statistical studies have been made intended to show from what sources agents should be recruited with best prospect of success. Shall they be sought from the ranks of clerks or of real estate men, of salesmen or of lawyers, of clergymen or of college students? About all that is known is that a relatively large proportion of the business is produced by a relatively small proportion of the agents, that previous occupation is not a factor, that experience is necessary before a man becomes a good producer and that men who have entered the business when young are more likely to be successful than recruits from later life.

How, then, is that high type of selling ability indispensable to success to be discovered? The new psychology teaches that the question should be first attacked by securing detailed information from a large number of agents as to the reasons which led them to select this particular vocation in preference to any other and then attempting to correlate this data with the producing records of the same men. Such a procedure would be imperfect in that it could deal with conscious motives only. The unconscious motives, which might in many instances prove the more important, could be ascertained, if at all, only by means of a psychoanalytic procedure, the expense and difficulty of which would make it out of the question for such purposes. Top notch producers are born and not made. A strong spontaneous interest is the prime requisite to success.

A secondary method of attacking the resistance to insurance would be through the use of coöperative or institutional advertising. Just as the constant dripping of water will wear away a stone, so persistent advertising of the right kind will come eventually to exercise an almost hypnotic effect upon the community.

A negative consideration is the avoidance by insurance companies of anything which may serve to stimulate a hostile attitude. In this respect every company is its brother's keeper. Every claim contested on technical grounds, every failure to live up to previously aroused expectations, every misstatement by an agent, every shortcoming in that prompt, intelligent and courteous service which the public desires and expects helps to create an unfavorable public opinion and reacts to the disadvantage of all.

VIII.

During the years to come it seems likely that the machinery of insurance will be called upon for the world's work to a degree far

surpassing anything experienced in the past. As insurance men it will become our duty, in so far as we may be permitted to perform it, to see that this machinery is well designed, efficient and smooth running.

One who predicted ten years ago what has actually happened during the past decade in the field of workmen's compensation would have been generally regarded as a deluded victim of over-enthusiasm. Not only has the principle of work-accident indemnity become embodied in the statutes of practically all the important states, but the past five years have marked a rapidity of technical progress unparalleled in the history of any other branch of insurance. The crude practices of liability underwriting have been molded into a highly perfected system of rates and reserves. Schedule rating and experience rating have been developed and become accomplished facts. The classification of industries and their hazards—a work monumental in itself—has been placed upon a scientific basis. In addition to all this, methods of coöperation have been concurrently developed which are even more noteworthy than the progress which they made possible. Rate control legislation conceived on sound lines and made effective by active and efficient state supervision has largely eliminated the discriminations, rate-cutting and other evils which are practically certain to exist wherever there is free and unrestricted competition in insurance rates. Inspection, rate-making and other technical processes common to all insurance carriers alike have been delegated to central bureaus under state supervision. Stock companies, mutual companies and state funds have sat at committee tables together and pooled their interests. The fact that so much has been accomplished in so short a time gives rise to the hope that perhaps the wheels of social progress accelerate as time goes on.

To attempt to prophesy is dangerous and yet one can hardly go wrong in saying that among the more notable social developments of the years to come will be a wider extension of the principle of compulsion as applied to insurance. As an indication of the trend of the times it may be noted that a far-reaching health insurance bill introduced in New York State at the last legislative session passed the Senate and, although it failed in the Assembly, received a substantial vote in that body.

In the midst of this rapidly moving current of events what means of self-orientation are available to us? As individuals we cannot

escape having a mental attitude of some kind. Shall we drift, navigate or throw over the anchor? The first of these alternatives seems unintelligent; the last of doubtful efficacy. Whether we like it or not it would seem that we must navigate. But navigation, like every other branch of applied science, depends for its success on expert knowledge and at this juncture it would appear that what we most need is not so much knowledge of insurance technique—that we have already—as knowledge of human behavior—and especially, socialized human behavior.

IX.

The biological function of organized society is to provide for the individual a maximum satisfaction of his fundamental impulses and their higher derivatives compatible with the existence of those inhibitions and restraints necessary to maintain the continuity and solidarity of the group. "Every one," says John Stuart Mill,* "who receives the protection of society owes a return for the benefit." Is it not equally true that all who contribute to the best of their ability to the maintenance of society are entitled to its protection to a degree considerably greater than that accorded under prevailing standards?

The effectiveness of social dictates depends not merely upon laws, but upon a highly emotionalized agreement of opinion. This emotional unanimity is most powerful and complete in time of war—a time when the very existence of the group as an independent social unit is at stake. But the identical mechanism extends to the trivial details of dress, manners and speech. Other-than-expected behavior and other-than-expected opinion are in all situations likely to provoke an emotional protest. Thus is the past experience of the race made available to serve as a stabilizing influence in the present. Every new idea must survive the severe ordeal of incredulity, misconception and ridicule before it is allowed to take its place in respectable society. Since, however, it is only the exceptional new idea which truly deserves a cordial reception, this mechanism for separating the wheat from the chaff is perhaps as it should be.

We have seen what is meant by the rationalization of an unconscious wish. Through a similar process most of our classical economics and social philosophy may be regarded as a rationalization of the *status quo*—a defensive reaction assisting the individual to

* "On Liberty," by John Stuart Mill.

live at peace with his environment. Also, it is one of the commonest of happenings that an unconscious resistance to a certain idea should be rationalized into an argument against it. The fundamental point to remember in dealing with social phenomena is that we have to do primarily with emotion camouflaged with reason—with unconscious desires decked out in the fair habiliments of logic.

A society is entitled to be considered progressive and modern if its prevailing condition of emotional unanimity which we call public opinion is responsive to the lessons to be learned from the constantly increasing body of knowledge which is being contributed by scientific research. If it looks to the past for its standards, if the social mind becomes fixed upon some ancient body of beliefs—as in China and the Moslem countries—social and material progress halt. The success of the group depends upon maintaining the balance between those inhibiting forces necessary to its solidarity and that degree of freedom and personal liberty which will provide an adequate outlet for the fundamental impulses of the individual and their higher derivatives. Social health involves the successful resolution of the conflict between these opposing forces.

How shall this conflict be resolved? The first suggestion would naturally be to place social questions on a really scientific basis by bringing over into the social field those methods which have proved so successful in the physical sciences and biology. In the form as stated this procedure has been and would continue to be a relative failure.

The difficulty is that questions of human behavior rest, as we have seen, upon an emotionalized basis and that emotion is very largely a matter of the unconscious. The root of our troubles lies therefore outside the field of awareness. It is for this reason that most debate on social questions never gets anywhere or convinces anybody save those who were already convinced before it started.

The solution, if there be one, apparently is to interpose between the application of the principles of the physical and biological sciences to social problems a new science—the science of human behavior—based upon a full understanding of the operation of the fundamental human impulses under various conditions.* This would make it possible to observe toward social questions some

* Cf. a paper by Prof. W. I. Thomas on "Primary-Group Norms in Present Day Society," appearing in *Suggestions of Modern Science Concerning Education*, Macmillan, 1918.

measure of that serenely impartial attitude which now marks our treatment of problems in physics, chemistry and mathematics. To achieve the best results we must be prepared to discuss these questions on a de-emotionalized basis and with a full understanding of the psychological mechanisms involved. Only thus may we hope to gain a control of social phenomena in some measure comparable to our present degree of control over physical phenomena.

Casualty Insurance for Automobile Owners.

BY

G. F. MICHELBACHER.

The title of this paper requires an explanation. Automobile insurance embraces such a wide range of coverage that it is necessary to limit the scope of the subject matter to be discussed. Every conceivable misfortune that can happen to the owner of an automobile or to the automobile itself (except deterioration and wear and tear of the automobile) has been made the basis for insurance. The principal forms of coverage are fire, transportation, theft, public liability, property damage and collision. Fire, marine and casualty insurance companies are interested in different phases of the insurance. In some states a single carrier may issue so-called complete protection, embracing all forms of coverage. However, these cases are exceptional and as a general rule the field is parcelled out to the three branches of the insurance business. Where this condition obtains complete coverage can be offered only under combination policies issued by fire or marine and casualty insurance companies acting coöperatively.

There is some slight overlapping of jurisdiction. Fire and marine insurance companies in general enjoy a monopoly with reference to forms of protection against loss by theft, fire, lightning, explosion and the hazards of land and marine transportation. Casualty insurance companies exercise exclusive control over public liability coverage. All three classes of carriers offer protection against loss occasioned by property damage and collision. As regards these forms of coverage the casualty companies write the larger volume of property damage insurance and the fire and marine companies the larger volume of collision insurance.

It is the purpose of this paper to discuss automobile insurance from the point of view of casualty insurance companies. The forms of coverage to be described, therefore, are public liability, property damage and collision.

There are two reasons for thus limiting the scope of the paper. In the first place, this Society is primarily interested in the problems peculiar to casualty insurance. In the second place, the entire

field of automobile insurance is so extensive that it cannot be adequately described in limited space.

The subject will be treated with the idea of providing a simple explanation of this form of casualty insurance which will assist prospective students in preparing for our examinations. It is hoped also that it may broaden the viewpoint of those members of the Society whose business interests touch casualty insurance only in a limited way.

It should be borne in mind that automobile insurance is becoming one of the most important lines from the standpoint of the casualty company. It has grown rapidly and to-day it represents a premium volume of respectable size; in 1917, forty-five casualty companies wrote an aggregate volume of premiums exceeding $45,000,000. There will be a material increase in these figures, for it cannot be said that the field has been thoroughly developed. The ratio of insured automobiles to the total number of automobiles owned in the United States is still very low; it has been estimated that not over one car in ten is covered by casualty insurance. The future will show an increase in this ratio as automobile insurance becomes more thoroughly standardized and thus more attractive to the automobile owner. Furthermore, the number of automobiles in use is steadily increasing. In 1917 there were approximately 425,000 automobile trucks in the United States and approximately one in twenty families owned a private pleasure car. As the automobile becomes more thoroughly established in the life of the country, the field for insurance will expand. There is every reason to believe that in time automobile insurance will overtake and exceed workmen's compensation insurance as a source of premium income.

COVERAGE.*

Public Liability.

Automobile public liability insurance provides coverage against loss arising out of the legal responsibility for personal injuries

* No attempt has been made to go into refinements in describing the various forms of coverage—general principles only have been treated. Thus, no mention is made of the incidental employers' liability insurance which may be written in conjunction with public liability coverage, the so-called "defect coverage" which protects manufacturers against responsibility for public liability and property damage suits attributable to imperfections in automobiles manufactured by them, the property damage insurance for garage owners which offers coverage against claims for property damaged while in their care, etc.

accidentally caused or alleged to have caused by reason of the ownership, use or maintenance of automobiles.*

The protection is limited to claims presented by the public, injuries to the owner himself not being covered. To secure such coverage personal accident insurance must be purchased. Nor are the employes of the assured covered. If such coverage is desired a workman's compensation or employers' liability policy must be obtained depending upon whether or not the employers' liability is defined by a workmen's compensation statute.

There are certain standard limitations upon the scope of this coverage. Naturally it does not extend to accidents which occur outside the period named in the policy. Nor is an accident covered unless it occurs within the limits of the United States of America and Canada. This latter rule is subject to exception in the case of automobiles of the private pleasure type provided an additional premium is paid for such extra-territorial coverage. Furthermore, the insurance is not effective while an automobile is being operated in any race or speed contest or while it is driven by any person in violation of law as to age, or in any event by a person under the age of sixteen years.

With these exceptions, the insurance carrier engages to place itself in the position of the assured—to investigate the accidents in which the assured's automobile is involved; to receive claims for damages; to make such settlement of these claims as it may deem desirable; in case of litigation to represent the assured in court; to defend him in such legal proceedings and to pay the cost thereof as well as the judgment if the case is decided in favor of the claimant. However, in the payment of claims the carrier is not obligated to exceed the limits of liability expressed in the policy. Nor does it assume any responsibility to provide defense to the assured or his chauffeur or other employe on account of arrest.

A policy is usually written with two limits upon the liability of the carrier. The smaller limit is the maximum amount which the carrier is obligated to pay on account of injury to a single individual in any one accident. The higher limit is the maximum

* Originally these policies were purely contracts of indemnity and were so interpreted; the carrier escaped liability if the assured became insolvent and thus financially unable to pay a judgment. To-day, however, it is the general rule that the carrier assumes responsibility up to the limits stated in the policy irrespective of the financial status of the assured.

amount for which the carrier is responsible on account of all the claims arising out of a single accident in which more than one person is injured. Thus, in the case of the standard limits of $5,000 and $10,000, the carrier assumes liability up to the limit of $5,000 on account of the claim presented by a single individual and subject to this limit per individual, it is responsible for a total liability not to exceed $10,000 on account of all the claims arising out of a single accident. If insurance with these limits is purchased by an assured and a judgment of $15,000 is awarded a person injured by the assured's automobile, the insurance carrier is responsible for $5,000 of this amount and the assured is personally responsible for the remainder. However, if three persons are injured in a single accident and the judgments awarded are respectively $1,000, $3,000 and $6,000, the insurance carrier is responsible for the entire amount of the first two claims and $5,000 of the third claim. In this case the assured must personally take care of the excess $1,000. If the second person should receive an award of $5,000 the insurance carrier would be responsible for a total of $10,000 on account of the three claims. The assured would thus be called upon personally to account for $2,000. The question of limits is a most important one, particularly in view of the tendency which has become apparent in late years, for juries to make excessive awards in individual cases. In these days verdicts exceeding $25,000 are no longer rare. The limits of liability included in the coverage for which so-called manual rates are charged are the standard limits of $5,000 and $10,000 (commonly known as limits of 5/10—"five and ten"). Higher limits may be obtained, however, upon payment of an increased premium. Thus, if limits of 10/20 are desired, such coverage can be had upon payment of a premium based upon 120 per cent. of manual rates.

It is usual to provide that the carrier shall reimburse the assured for the reasonable cost of such immediate surgical relief as is imperative at the time of any accident covered by the policy. This obligation extends to any person except the assured.

Public liability coverage may be offered alone or in conjunction with property damage or collision coverage. In certain cases all three forms are included in a single policy. In others, the policy is for public liability only, but either of the other forms may be added by an endorsement.

Property Damage.

The automobile property damage policy protects an assured against his legal liability for injury to or destruction of the property of others on account of accidents due to the ownership, maintenance or use of automobiles.* The coverage does not extend to property owned by the assured or his employes or to any property in charge of the assured or any property carried in his automobiles.

There are limitations similar to those imposed upon public liability policies with reference to the operation of automobiles in speed contests or by persons under age. Likewise the coverage does not extend to accidents unless they occur during the period of insurance and within the boundaries of the United States and Canada.

The coverage is also similar to public liability as regards the obligation of the carrier to represent the assured in the investigation and adjustment of claims. In this case, however, the liability of the carrier is limited by the actual value (at the time of the accident) of the property injured or destroyed or in any event by a certain sum which is specified in the policy. The standard limit is $1,000 per accident and is offered at manual rates. If higher limits are desired they may be obtained upon payment of an additional premium. Thus, a limit of $5,000 may be secured if the manual rate is increased 36 per cent.

In recognition of the possibility of claims against the assured for damages on account of the "loss of use"† of property involved in an accident, coverage against this liability may be included in the property damage insurance. For this purpose the regular rates are increased 10 per cent.

Property damage is never made the subject matter for an individual policy. It is only written concurrently with public liability coverage and then either in a combination policy or by endorsement.‡

* See note on page 215 with reference to a change in the form of the automobile public liability insurance contract. The same situation is found in connection with property damage insurance.

† For example, a delivery truck is damaged and the owner is deprived of its use. He has a legal right to sue the person responsible for the accident not only for the cost of repairs but also for the loss of use of the services of the truck and the inconvenience and expense thus caused.

‡ Property damage may also be written concurrently with a fire policy.

Collision.

This insurance is designed to protect the assured against loss or damage to his automobile if such damage is caused by collision with another object, either moving or stationary. Whereas property damage coverage is intended to protect the assured against the legal liability arising out of damage to the property of others, this coverage applies to damage done to his automobile.

As in the case of public liability and property damage insurance, the accident must occur within the policy period and inside the boundaries of the United States and Canada. Similarly, the policy does not apply while the automobile is being operated in a race or speed contest or by a person under age. In addition to these there are two important restrictions peculiar to this coverage.

1. Loss or damage by fire arising from any cause is excluded.

2. The coverage does not extend to any loss or damage to tires due to puncture, cut, gash, blow-out or ordinary tire trouble or to loss or damage to any tire unless caused in an accidental collision which also involves other loss or damage to the insured automobile.

At present there are three forms of collision coverage: $100 deductible, $50 deductible, and full coverage. In the first, the loss arising out of each accident is deemed a separate claim and $100 is deducted from the total amount of the claim, the carrier being responsible only for the excess above $100. The $50 deductible coverage is similar. In the third case the carrier is responsible for the entire amount of each loss.

There are no arbitrary limits imposed upon the liability of the carrier as in other forms of coverage. The liability is limited to the actual cost of repair of the damaged automobile or to the actual intrinsic value at the time of destruction.

In place of the clauses of public liability and property damage policies which govern the adjustment of controversies in which third persons are involved, the collision policy contains clauses governing the adjustment of controversies which may arise between the carrier and the assured. The carrier reserves the right to make investigations of the insured property at any time. In case of loss, provision is made for the adjustment of claims between the carrier and the assured. If an agreement cannot be reached concerning the value of the loss, two appraisers may be chosen, one by each party, and if these cannot agree they may select a third appraiser. The award in writing of any two appraisers determines

the nature and extent of the repairs to be made at the expense of the carrier or the value of the destroyed automobile. Each party pays its own appraiser and both pay the expenses of appraisal and the fee of the third appraiser. The carrier may exercise an option either to replace or repair damaged property or to pay the assured in cash. Either the assured or the carrier may take such steps as are necessary to recover, salve or preserve the insured property in case of loss or damage without prejudice to the rights of either party and all reasonable expenses thus incurred shall be paid by the carrier.

Collision coverage is written either in a combination policy with public liability and property damage insurance, or by endorsement upon a public liability form.*

Miscellaneous Policy Provisions Common to All Forms of Coverage.

There are certain policy provisions which are common to all three forms of coverage and which are important enough to warrant mention.

The longest term for which any automobile policy is written is one year. The policy may be cancelled by either party upon proper notice. If cancelled by the carrier the premium is subject to adjustment upon a pro-rata basis. Thus, if cancelled by the carrier at the end of six months the carrier is entitled to retain one-half the annual premium. If cancelled by the assured the premium is adjusted in accordance with a so-called "short rate" table which places a slight penalty upon the assured and thus in some measure prevents excessive "twisting" of business from one carrier to another. Thus, if a policy is cancelled by the assured at the end of six months the carrier is entitled to retain 70 per cent. of the annual premium.

The assured accepts the responsibility of giving prompt notice of any accident in which the insured automobile is involved. This notice is sent either to the home office of the insurance carrier or to the office of one of its duly authorized representatives. It must be in writing and contain a full statement of details. Likewise, immediate notice must be given of any claim for damages or any legal proceedings which may be brought against the assured.

* Collision coverage may be written also by endorsement on a fire policy.

Except that he may furnish reasonable surgical attention immediately following the occurrence of an accident involving liability for personal injuries, the assured agrees to leave the investigation and adjustment of claims entirely in the hands of the insurance carrier. He may not voluntarily assume any liability or interfere in any adjustment or incur any expenses without the written consent of the carrier. He shall, however, upon request, assist in effecting settlements, in securing information and evidence and in the adjustment of legal controversies. In such cases, he is not obliged to incur any expense, this being taken care of by the insurance carrier.

All policies contain a subrogation clause. This provides that the carrier shall take over all rights which the assured may have to proceed against third parties who may be implicated in an accident. Thus, in case of a collision claim for which a third party is responsible the carrier, after indemnifying the assured, may proceed against the third party and reimburse itself either in whole or in part for any expenditure it has made.

Every policy contains certain warranties. The address of the assured must be given, also the name of the city or town in which the automobile is maintained and garaged. In addition, the assured must specify the city or town in which the automobile is principally used. The automobile must be described and certain information necessary to the proper computation of rates is required. It is usual also to incorporate a statement in the policy to the effect that the automobile is not and will not be rented to others or used to carry passengers for a consideration. If the automobile is used for livery purposes the proper classification and rate must be applied. Other essential particulars are likewise covered by warranties. Information concerning the prior history of insurance on the car is demanded. It is also usual to provide a warranty to the effect that the automobile is not being and will not be used for towing or propelling a trailer. In case coverage for a trailer is desired it can be secured upon payment of the proper additional premium.

As a general rule every policy provides an "omnibus coverage"; that is to say the policy covers, in addition to the interest of the assured, the interests of any person while riding in or operating the insured automobile with the express or implied permission of the named assured or an adult member of his household who is not a chauffeur or a domestic servant.

In the case of collision coverage, the number of insurable interests is not important because the value of the car limits the liability of the insurance carrier, and one rate is charged irrespective of the number of owners or persons interested in the property.

Why Complete Coverage for Automobiles is not Generally Offered by Casualty Companies.*

If there is a demand for complete coverage on the part of automobile owners, why is this not met by the issuance of a single policy by an individual carrier? It has been pointed out that this can be done in certain states although specific laws on the subject are not numerous. For the most part rulings by insurance departments govern and the usual rule is to have the field distinctly apportioned among the different classes of insurance carriers, fire and marine on the one hand and casualty on the other. Where these conditions obtain a single policy may be issued providing complete coverage only in case a coöperative arrangement is entered into by two carriers.

There seem to be several good reasons why it would be inadvisable to give general sanction to the principle of providing complete protection against all the misfortunes incidental to the use, maintenance and operation of automobiles:

1. The general field has been mapped out and each class of insurance carrier has a certain territory over which it exercises jurisdiction. Thus, there are certain generally accepted lines of insurance open to the casualty insurance company, the life insurance company, and so on. If this system is to be discarded in the case of automobiles it likely will be further modified in other cases. For example, the same logic may be advanced in favor of the issuance of a combination policy to cover all the possible forms of coverage required by a factory owner. Furthermore, insurance practices have developed laws with regard to reserves and underwriting principles which are entirely satisfactory if the present system is continued but which would become seriously complicated with a general change.

2. It is doubtful whether the demand cannot adequately be met by the present coöperative method of providing coverage. By this

* See paper on "Automobile Insurance: Should Fire Companies Be Authorized to Give Full Coverage, Including the Person?" by Henry D. Appleton, Deputy Superintendent of Insurance for the State of New York.

method a single policy is written and delivered to the assured, although as a matter of fact behind the scenes two insurance carriers are interested in the contract and the premiums and losses are shared. These internal adjustments are made without any inconvenience to the assured and the situation is, therefore, just as simple as it would be if one policy were issued by a single carrier.

3. Furthermore, it has not yet been demonstrated that the demand for complete coverage is great. As a matter of fact, even in those states where an individual carrier may write this form of policy there are few carriers who have exercised the privilege.

4. Finally, the specialization which has resulted from the American system of parcelling out the insurance field and assigning certain subjects to certain classes of carriers has been most satisfactory. It has been efficient and economical and it, therefore, should be continued unless there are strong reasons to the contrary.

Classification of Automobile Risks.

A proper classification of risks is a prerequisite to the successful underwriting of any form of insurance. This is particularly true where the hazards are so diverse that a single rate cannot be made applicable to all risks. A description of the hazards involved in automobile insurance will be given later. At this point, however, it may be said that the hazards are of a wide range so that different methods of assessing premiums and convenient and logical classifications are essential to the proper conduct of the business.

In respect to the complication of the classification scheme, automobile insurance takes second place to no other line of insurance. The present scheme is not complete, nor is it thoroughly satisfactory. Like Topsy it has just grown up and additions and alterations in the old structure have been made as necessity arose. The structure itself has never changed, however, and the day is not far distant when radical amendments must be made, both in the direction of simplification and with the idea of developing a more thoroughly consistent and logical scheme.

At present there are six general classifications. These are known by titles which are not entirely descriptive and which will, therefore, require explanation.

The general classifications are as follows:

1. Private Pleasure Automobiles.
2. Private Pleasure Automobiles with Occasional Commercial Use.

3. Livery Automobiles.
4. Public Automobiles—Other than Livery Automobiles.
5. Commercial Automobiles.
6. Manufacturers and Dealers Automobiles (Including Sales Agency, Garage or Station Risks).

Private Pleasure Automobiles.

These are automobiles of the private pleasure type propelled by gas, steam and electricity. The classification also includes two-wheeled motorcycles of the private pleasure type and bicycles designed to carry a single person which are equipped with the recently patented motor wheel.

Care is taken to restrict the use of the classification to cars operated exclusively for private use and business and professional calls. Thus, commercial delivery is not permitted. Nor may the car be rented or used for carrying passengers for a consideration.

For public liability and property damage coverage, private pleasure cars until recently were classified with reference to insurable horse power. This was obtained by the use of the horse power rating formula of the American Society of Automobile Engineers. The elements necessary to obtain a result from the formula were the bore of the cylinder and the number of cylinders. Thus, the insurable horse power for a car with six cylinders of 5-inch bore was 60.

On April 1, 1919, a radical change was made in the method of classifying these automobiles. A two-way classification was substituted for the former classification according to insurable horse power. One of these depends upon the manufacturers' list price, the other upon the use to which the car is put and who is permitted to drive it. There are four list price classifications, each of which includes cars falling within a certain range of list price. This is defined as "the manufacturers' list price for the type and model of the automobile insured, to which list price must be first added the cost of special bodies, winter tops and other additional equipment." Provision is made for three "use and driver" classifications under each list price group. The first of these includes cars of the private pleasure type used exclusively for "private purposes" and driven only by the assured named in the policy who must be the owner or one of the owners. "Private purposes" is defined as including "personal pleasure and family use" and ex-

cluding "regular and frequent use for business or professional calls and commercial delivery." The second classification is similarly restricted as to use but is unrestricted as to driver. Anyone may drive—the owner, members of his family, a chauffeur or any other person who receives the owner's permission. The third classification is unrestricted as to driver. As regards use it is limited only by the provision that it must not include a car of the private pleasure type used either for commercial delivery or for the carrying of passengers for a consideration. It covers the numerous private pleasure automobiles used in business by agents, solicitors, professional men and others.

For collision coverage automobiles are classified according to the manufacturers' list price. In this connection there are a few practical difficulties which are met by special rules. For example, when two bodies are used interchangeably on the same chassis, the higher priced body determines the classification for collision insurance. Again, where a special top or body is used, the extra cost of this feature must be added.

As a general rule, this classification does not cover trailers. If coverage for trailers is desired it may be obtained upon payment of the proper additional premium. For liability and property damage coverage this premium is a certain percentage of the premium for the highest rated automobile to which the trailer is attached. In the case of collision coverage the cost of the trailer itself determines the classification and rate.

Private Pleasure Automobiles With Occasional Commercial Use.

This general classification, as the name implies, includes cars of the private pleasure type which are occasionally used for commercial delivery purposes. These are of three types:

1. Automobiles of the private pleasure type which, without alternation in chassis or body, are occasionally used for the transportation or delivery of merchandise.
2. Automobiles of the private pleasure type used for rural free delivery.
3. Automobiles equipped with bodies of the private pleasure type and commercial type which are used interchangeably.

Automobiles of the first two descriptions are classified as ordinary private pleasure automobiles. However, the rate for public liability and property damage insurance is obtained by applying a

special loading to the rates for these classifications. For collision insurance no loading is applied to the regular private pleasure rates.

For automobiles of the third type the commercial classification determines the rates to be charged for public liability and property damage coverage. For collision coverage both the commercial and the private pleasure classifications and rates must be considered and that rate which is the highest is charged.

If trailers are attached to any of these automobiles the classification of the trailer for public liability and property damage insurance follows that of the automobile to which it is attached. The rates are a specified percentage of the normal rates for these classifications. For collision coverage trailers are separately classified according to list price and the classification and rate depend upon the list price.

If a private pleasure car has been altered to permit of the transportation or delivery of goods or merchandise it is considered a commercial car for the purpose of classification and rating.

Livery Automobiles.

This classification covers automobiles of the private pleasure type used for pleasure and rental purposes which are subject to call from a garage. The automobile must not be equipped with a taximeter, nor must it be offered for hire at stands, hotels, or stations, or on the public highway or other places of public resort. In addition, school buses used exclusively for carrying children to and from school, and automobiles of the private pleasure type used as funeral carriages are included. All these automobiles are embraced by a single classification for property damage coverage. There is a subdivision of this classification for public liability coverage, two classifications being provided according as the liability of the assured to the passengers carried in the insured automobile is or is not excluded from the policy coverage. For collision coverage the automobiles are classified according to the manufacturers' list price.

Public Automobiles Other than Livery Automobiles.

This classification includes automobiles which are kept for hire at public stands—for example, taxicabs, omnibuses, sight-seeing busses and jitneys.

For public liability and property damage coverage the automobiles are classified according to carrying capacity and the use to which the car is put. Thus, there are classifications for hotel omnibuses, taxicabs, other public vehicles designed to carry not more than twelve passengers, and so on.

There is a provision similar to that for livery automobiles as regards coverage for the public liability hazard, specific rates being quoted for each classification for the inclusion and exclusion of the passenger hazard. For collision coverage the automobiles are classified according to the manufacturers' list price.

Commercial Automobiles.

These are automobiles specially designed for the transportation of goods or merchandise and propelled by gasoline, steam or electricity; also three-wheeled motorcycles or tricycles designed for delivery purposes. In addition the following specific types of automobiles are covered:

1. Two-wheeled motorcycles of the private pleasure type used by telegraph companies to deliver messages.
2. Industrial and dock trucks—the low four-wheeled trucks which are driven by electric power and are used for carrying baggage at railway stations, terminals or docks or in factories as substitutes for hand trucks.
3. Tractors of all descriptions—farm and otherwise.
4. Automobiles of special design and use, such as ambulances, hearses, fire engines, etc.

For public liability and property damage coverage, policies include the so-called loading and unloading hazards—that is to say, the coverage applies to accidents incidental to the loading and unloading of goods and merchandise. The coverage also extends to any incidental pleasure use which may be made of the insured automobile.

For the purpose of classifying these automobiles for public liability and property damage insurance a series of classifications is provided. These are based upon the kind of work in which the automobile is engaged. Thus, there are classifications for automobiles used by department stores, ice dealers, dyers and cleaners, etc. If an automobile is engaged in more than one line of business it is assigned to the classification which produces the highest rate.

For collision insurance, commercial automobiles are classified

by manufacturers' list price. In view of the fact that many of these automobiles are provided with specially built bodies and that, therefore, in many cases the manufacturers' list price does not include anything except the cost of the chassis, special provision is made that where this condition obtains the cost of the body and other additional equipment must be added to obtain the proper collision classification.

Trailers are treated as in other general classifications. For public liability and property damage insurance the trailer follows the classification of the automobile to which it is attached and the rate is obtained by applying a differential to the rate for this classification. For collision insurance trailers are classified according to the manufacturers' list price.

Manufacturers' and Dealers' Automobiles.

These are of two types:

1. An automobile of any description used by a manufacturer for the purpose of demonstrating it or its parts.
2. An automobile of any description used by a dealer, garage or automobile station for the purpose of demonstrating or testing the automobile and the parts thereof, or for other purposes incidental to such business including renting for the carrying of passengers or the property of others.

These automobiles are all thrown together into one general classification for property damage coverage. As regards public liability there are four sub-classifications depending upon whether or not the coverage will extend to the use of the automobile for livery purposes or whether or not the passenger hazard is to be included. For collision coverage the risks are grouped according to the manufacturers' list price.

PREMIUM BASES.

Public Liability and Property Damage Coverage.

For all classifications of automobiles except manufacturers' and dealers' automobiles, the unit of exposure is one car insured for twelve months and rates are quoted per car annum.

For manufacturers' and dealers' automobiles, there are four alternative methods of premium computation.

1. The first is the so-called "named chauffeur basis." A policy

may be written naming the drivers who will operate automobiles of any make or type and limiting the coverage to the operation of automobiles by these drivers or their successors or substitutes in case of illness or discharge. Where this basis is used the unit of exposure is one named driver for a period of twelve months and the rates are quoted per driver per annum. The use of this basis is limited to automobiles employed for demonstrating and testing.

2. The second is the "specified car basis." In this case the type and make of each car is specifically described in the policy and the unit of exposure is one car per annum. Thus, rates are quoted per specified car per annum.

3. The third method is the "payroll basis." It is used for garage and sales agencies. The unit of exposure is $100 of payroll and rates are quoted, as in the case of compensation and liability insurance, per $100 of payroll. Rates are quoted for inside and outside payroll separately, but each rate applies to the total payroll. These rates vary. Each branch or separate location is considered individually and rates are provided for the first $10,000 of payroll, for the next $15,000 of payroll, and for any payroll in excess of $25,000. Separate rates are provided for gasoline or steam-propelled automobiles and motorcycles.

The rates for the first three classifications do not cover the hazards incidental to the renting of automobiles for private pleasure or commercial purposes. If such coverage is desired, it can be obtained upon payment of a premium based upon the livery earnings. Separate rates are provided for livery earnings of automobiles of the private pleasure and commercial types. The unit of exposure is $100 of gross livery earnings which is defined as the total amount charged by the assured whether collected or not. The assured must agree to keep complete and accurate records of these earnings.

4. The last method of rating these automobiles is known as the "car output"* basis, each risk requiring individual consideration and special rating.

Collision.

For collision coverage all types of automobiles are rated on the same basis. The unit of exposure is one car insured for a period of twelve months and rates are quoted per car per annum.

* The basis for premium calculation is the number of cars manufactured or repaired during the policy period.

HAZARDS.*

The hazards of automobiling from the viewpoint of casualty insurance carriers are created by various conditions, most of which have something to do with causing collisions between automobiles and persons or property. A loss involving public liability or property damage will arise out of the same general sort of occurrence, viz., the coming in contact of the assured's automobile with the persons or property of others. The same is true in general of collision coverage, although of course the car itself may also be damaged by skidding, jumping embankments, etc. Instead of attempting to specify the hazards of casualty automobile insurance, therefore, I shall briefly outline the more fundamental conditions which are responsible for the occurrence of accidents or which influence the adjustment of losses. These contributing factors are not specific enough to be dignified with the term "hazards." They cannot be isolated and individually evaluated as are the hazards of workmen's compensation insurance. Each must be considered in relation to the others and only by taking them in the aggregate can a proper conception of hazards be obtained.

The elements of the hazard may be classified in two ways; first, according to whether the element is a physical or a personal one; second, according to whether it applies to the individual risk or contributes to the environment in which the risk is situated and to which all risks within a given territory are exposed.

The important physical factors of the individual risk are as follows:

1. *The Purpose for Which the Automobile is Designed.*—A motorcycle, a car designed for private pleasure use, a commercial delivery car, a ten-ton truck and an omnibus, all present peculiar individual characteristics and each represents a different possibility from an accident point of view.

2. *The Purpose for Which the Automobile is Actually Used.*—An automobile is not always used for the purpose for which it was designed. Thus, cars of the private pleasure type are used for rural free delivery, for the carrying of merchandise and as livery vehicles. The actual use as well as the designed use is important. For example, a car of the private pleasure type which is used by a

* This analysis of automobile hazards is based upon the author's personal observation and judgment. The reader has a perfect right to differ with the presentation either in whole or part.

professional man in business or by a merchant for delivery purposes does not present the same hazards as a car which is used exclusively in private family life.

3. *The Method of Propulsion.*—An electrically driven automobile for obvious reasons does not present the same hazards as an automobile driven by gasoline or steam.

4. *Weight.*—The weight of the automobile is not independent of its other physical characteristics; it has relation to the design, the use to which the automobile is put, etc. Nevertheless, it is in itself an important element of the hazard. The relative results produced in collision by a fourteen-ton truck and a light delivery truck are in no way comparable. In the one case, there is a certain momentum, a difficulty of management and a force which in impact with objects of normal size is overwhelming. In the other, while there may be speed, there is possibility of control and greater chance of complete destruction of the automobile itself.

5. *Speed.*—An automobile which is incapable of attaining high speed represents less hazard than one which without any appreciable effort can be operated at high speed. In this connection the horse power is a criterion if the car is propelled by gasoline or steam.

6. *The Degree to Which the Automobile is Used—that is, the Mileage it is Driven During a Year.*—The exposure to accident varies directly with the number of miles the automobile is operated during the period of insurance. If it is garaged part of the year, the exposure is appreciably reduced. If, on the other hand, it is in operation constantly, the potentiality of accident is substantially increased. The mileage also is an important factor in determining the deterioration of the car. It is reasonable to expect that as the car deteriorates, it represents a greater hazard, particularly from the point of view of collision coverage for as time goes on the equipment will require more frequent repair and will be more easily damaged. As regards public liability and property damage coverage, it is apparent that as wear and tear affect the car and its equipment, the chance of accident is increased.

7. *The Physical Equipment Which the Automobile Carries to Prevent Accidents.*—If a car is equipped with an efficient bumper, proper head and tail lights, a windshield, non-skid chains and all the other accident prevention apparatus now on the market, it undoubtedly is a safer risk than another car which is deficient in this respect.

The physical factors which affect all risks within a given territory may be enumerated as follows:

1. *Traffic Density.*—Traffic density ordinarily is related to population density, although there need not necessarily be a close relationship between the two. In some territories of small population traffic density will be great because the territory may be in immediate proximity to a large city, or it may lie along a popular highway, or it may be a vacation center. Traffic density is important because naturally if there are many cars on the road, the probability of accident is increased. It has been stated that on the average there are fifteen cars on every mile of road in the United States. As this ratio increases, new conditions and new possibilities of accident will be developed.

In this connection it is interesting to note the recent stimulus in the use of motor trucks for the transportation of freight. The auto truck has certain advantages over other freight carriers. Under normal conditions it can do the work of six teams; consequently, it is efficient for short hauls. For reasonably long hauls it can compete with railroad transportation on the basis of efficiency, promptness of delivery and economy. It has the advantage that merchandise can be delivered to the door, thus avoiding cartage charges. These facts are becoming more and more generally recognized. Automobile truck lines now operate in some cases for distances of 800 miles on fixed schedules.

2. *Population Density.*—Population density is related to many other factors. As it increases the traffic density undoubtedly will increase and there will be a greater exposure of pedestrians to risk. On the other hand, it is likely that with greater population density there will be more efficient traffic regulations and this will have a contrary effect upon accident frequency.

3. *Number of Automobiles.*—Given two territories of the same population and all other things being equal, the hazard undoubtedly is greater where the ratio of automobiles to population is greater.

4. *Traffic Regulations.*—Under this heading a number of items may be mentioned. An efficient code of traffic rules is without question the greatest accident preventive. There are certain fundamental rules of traffic which every driver should know and respect. The system of licensing cars and drivers makes it possible for the authorities to insist upon this elementary knowledge. It has become a custom to have separate branches of municipal police known as

traffic departments, the business of which is to study and regulate traffic problems. In certain outlying districts where it is impracticable to use policemen for traffic control, silent automatons equipped with red lanterns and other distinguishing marks are installed for the purpose of guiding traffic and forcing it to observe proper channels. The one-way street is a method of avoiding difficulty where streets are narrow and congested. These are only random examples of what may be accomplished by intelligent regulation.

5. *Road Conditions.*—Road conditions may either increase or decrease hazard. Good roads invite use, encourage traffic and impel speed. Wide streets increase the possibility of accident to pedestrians. Narrow and crooked streets congest traffic and create dangerous conditions. If roads are properly planned, it should be possible to divert traffic so that it will avoid centers of congestion. Thus, the highways of the future may be built so that they will not pass through cities or towns. Much is being done by road clubs and public safety commissions, not only to stimulate the demand for good roads, but also to prevent accidents. For example, this movement has almost entirely eliminated dangerous railroad grade crossings.

6. *Climate.*—Automobiles are now used the year around so that all sorts of weather conditions must be recognized. Slippery roads and fogs and haze in the atmosphere present distinct dangers to traffic and pedestrians and thus create acute traffic problems.

7. *Topography.*—Naturally the hazards are increased if the country is hilly and it is necessary to build roads with sharp curves or steep grades.

The personal elements inherent in the individual risk are separate and apart from the car itself. The term "personal" has been used because the hazard is created by persons who own and operate automobiles. Thus, the following inquiries are important:

1. *Who Owns the Automobile?*—In the case of collision insurance much depends upon the disposition of the assured to be fair and to avoid fraudulent claims. In public liability and property damage insurance, the ownership is of some importance because undoubtedly there is a tendency for juries to make greater awards if the owner is wealthy or if the car which causes the damage is engaged in the service of a corporation.

2. *Who Drives the Car?*—The driving of the automobile is one

of the most important elements of all. If the driver is careless or ignorant accidents will occur. If he is careful and well versed in the operation of automobiles, the hazard is reduced.

In this connection it may be noted that the lowest rate for private pleasure automobiles is applied to automobiles driven exclusively by the owner. There is still discussion and controversy with reference to the question of chauffeur driving.

The personal factors which create the environment to which all risks within a certain territory are exposed are similarly created by persons. Some of them may be mentioned as follows:

1. *The Automobile Drivers of the Community.*—Speed maniacs, joy riders and reckless drivers create distinct hazards for the careful driver. In some territories this is a most important element as, for example, in the southern states where a large percentage of drivers are negroes. The problem created by the employment of a large number of crippled ex-soldiers and sailors as chauffeurs already has received recognition in England. "Dry" and "wet" zones in close proximity establish lanes of traffic to be avoided by peaceful citizens.

2. *Character of the Population.*—It has been estimated that 70 per cent. of personal injuries are the fault of the injured and 30 per cent. the fault of the driver. If the public is well educated and has received instruction in public safety, accidents to pedestrians probably will be few in number. On the other hand, where there is a large population of uneducated persons contrary conditions may obtain. Furthermore, a moral hazard is found in certain territories because of the tendency of the public to present unreasonable and fraudulent claims. It is a well-known fact that a large element of alien population has a decided influence upon public liability losses.

3. *The Prevailing Sentiment in the Community towards Automobiling and Automobile Owners.*—In some localities municipal officials and juries are inclined to be very severe because of antagonism toward automobile owners. This spirit is probably passing away in large degree with the general acceptance of the automobile as a means of locomotion.

4. *Local Laws Affecting Accidents and Claims for Damages Arising Therefrom.*—The statutes of the territory may create a distinct legal hazard if adverse or they may improve the situation as where a definite limit is imposed upon claims for damages for personal injury.

History of Rate Making.

The first rates for automobile casualty insurance were promulgated long before the automobile became generally accepted as a part of our daily life. In 1899, which is the first year for which statistics regarding the automobile industry in the United States are available, the value of the output was slightly over $1,000,000. By 1903 the output had reached a valuation of $16,000,000. The automobile industry during this period was in its infancy, but as early as 1901 manuals of liability insurance contained rules with reference to the classification and rating of automobiles for public liability insurance.

It was natural that these first classifications and rates should follow the practices of teams insurance, for in those days automobiles were beginning to take the place of teams and in the absence of any experience the extension of the form of teams insurance to include coverage for automobiles was a logical step.

In the manual of May, 1901, the reference to automobile insurance was very brief. Public liability coverage only was mentioned and it was provided that with certain exceptions the rates for all automobiles should be double the rates for teams insurance. The exceptions were not numerous and included cabs, hacks, hansoms, omnibus lines, private vehicles and others. It is interesting to note that for all classifications except private vehicles the passenger risk was included. This of course was a very rough classification, and the rates were purely judgment rates.

The analogy of automobile to teams insurance, while it was a satisfactory basis for a beginning, was soon found to be inadequate and it was not long before it became necessary to issue a separate manual for automobile insurance and to develop individual forms of coverage, classifications, premium bases, and underwriting rules for this class of business. The rates continued to be judgment rates, pending the accumulation of a sufficient volume of experience.

It was unfortunate that the statistical phase of automobile insurance was not given attention at the inception of the business for one of the difficulties which soon confronted underwriters was created by the fact that there was no standardized system of compiling automobile experience and reporting it to a central bureau. Notwithstanding this handicap a considerable volume of experience was accumulated and the beginning of scientific rates was made in

the automobile revision of 1914. At that time rates were established for all three forms of coverage.

The movement toward uniform statistics was given new life in 1916 by the promulgation by the National Workmen's Compensation Service Bureau of a statistical plan for automobile insurance. This plan represents a complete analysis of automobile underwriting methods and provides for uniform methods of compilation and reporting to the bureau. It became effective as of January 1, 1917, and the first experience compiled in accordance with its provisions will be due this year. Nevertheless, pending the accumulation of results under the uniform plan, revisions of rates were accomplished in 1915, 1916, 1917 and 1918 upon the basis of considerable volumes of experience obtained under the old statistical systems of the companies. For example, at the time of the last revision there was available for the establishment of public liability rates, an experience based upon an exposure of 294,000 cars of the private pleasure type and 60,000 commercial cars.

Difficulties in Rate Making.

A review of the hazards of automobile casualty insurance will convince anyone that rate making is not a simple task. There are numerous elements of the hazard which can be demonstrated to have an appreciable effect upon the rate, but which are of such character that it is difficult and at times impossible to measure them by any analytical method.

Several examples of difficulties which arise in the practice of rate making may be given.

1. Mileage is one of the most important factors in determining the public liability hazards of automobiles of the private pleasure type. Still it is impracticable as a basis for insurance rate making for the reason that up to the present time no effective device has been perfected which will guarantee the measurement of mileage and at the same time prevent anyone with fraudulent intentions from falsifying the record.*

2. The measurement of the hazards of environment requires some method of establishing rates for geographical territories. At present this is accomplished by a zone system which does not produce entire satisfaction because it inevitably results in a series of

* Mileage is used by certain underwriters in England as a basis for premium calculation. However, it never has been tried in this country.

sharp lines of demarcation with consequent abrupt changes in rates. It is not uncommon to find, as an extreme case, two automobile owners whose rates for the same type and model of automobile are considerably different merely because one of them happens to reside on one side, the other on the other side of the imaginary boundary line of a territorial division. What is the solution? It is obvious that these inequities will persist until a simple workable plan of shading the picture is devised which will recognize centers of high and low hazard and at the same time grade rates so that instead of hard and fast zones there will be gradual changes with no shock or breaking points.

3. So far commercial automobiles have been classified and rated for public liability and property damage coverage on the basis of use alone; that is to say, any car in the service of a baker takes a certain rate; any car in the service of a brick mason, another rate, etc. Undoubtedly from a theoretical point of view, use is not a complete criterion of hazard. Weight, speed, motive power and numerous other factors are vitally important, but to recognize and measure them without complicating the underwriting procedure beyond all reason, is a problem which still remains unsolved.

These are random examples of the many problems which face underwriters in connection with the determination of rates. Many of these problems will be solved as reliable statistical information becomes available in greater volume because the solution depends entirely upon statistical analyses. Others probably never will receive a thoroughly satisfactory solution because of the inherent impossibility of obtaining a correct measurement of hazards which at the same time is consistent with underwriting principles. In other words, automobile insurance rate making is not unique. It suffers from all the ills of insurance rate making in general. The theoretically perfect method of procedure is often impossible of application because practical underwriting demands a scheme of rates that can easily be applied and that limits the possibility of fraudulent manipulation to a minimum. Where practice conflicts with theory, practice dictates the answer to the problem.

This should be borne in mind in criticizing the present automobile rates. They are based upon the most logical analysis of the problem that can be made in the light of available statistical information. As statistical and underwriting experience is gained, there undoubtedly will come a tendency to make greater refine-

ments and this will have the result of producing a more and more equitable distribution of premium income and a closer approximation to the actual hazards of individual risks.

RATES.

The scope of this paper will not permit a complete description of rates. All that can be attempted is a general statement of fundamental principles and an illustration of their application to some particular form of coverage and type of automobile.

The gross or manual rate is made up of two elements, (1) pure premium, or provision for the payment of losses and legal expenses, and (2) expense loading or provision for the payment of the expenses of administering the insurance, the taxes imposed upon premium income by state and federal authorities and a reasonable underwriting profit.

The pure premium is the loss cost per unit of exposure. Thus, in the case of commercial automobiles the pure premium represents the losses and legal expenses which a single car is expected to produce during a period of twelve months. The first approximation to the pure premium for any classification is obtained from the experience which insurance carriers have accumulated. For rate making purposes experience is usually reduced to a statement giving the ratios of losses to exposure. Thus, if in a certain classification 10,000 insured cars have produced losses and legal expenses aggregating $200,000, the indicated pure premium is $200,000 ÷ 10,000 or $20.00.

The indicated or experience pure premium has much or little significance depending upon several conditions:

1. It is obvious that the reliability of experience increases as the number of risks under observation increases. A single car does not produce experience of value because the exposure is so small that it is more likely than not that the result will be irrational. If there is no accident the indicated pure premium will be 0; if an accident does occur it may be as high as $10,000. Numerous risks must be considered if the law of averages is to have full play and it is only when the experience covers a broad exposure that the indicated cost can be considered trustworthy. One of the difficult problems in rate making is the determination of the amount of credence which can be attached to experience. This is one place where trained judgment is essential and the intelligent underwriter

will mix judgment and experience in the proper proportions in establishing pure premiums.

2. One weakness inherent in all insurance rate making rests on the fact that the available experience is always representative of the past, whereas the rates must be designed for the future. This introduces a second element of judgment for it is necessary not only to know the past conditions which are reflected by the experience, but also to forecast the conditions of the future and to anticipate them in the rates. If the cost exhibits a tendency to fluctuate the law, if one exists, by which this phenomenon is controlled must be observed and measured. This usually can be done statistically, but it is apparent that facts will carry the investigator only to a certain point. From that point he must proceed upon his own resources. The casualty actuary with his training in the theory of probabilities is properly equipped for this service and a legitimate field awaits him not only in automobile insurance, but in other branches of casualty insurance as well.

In automobile casualty insurance at least two conditions have been noted which require correction of past experience if it is to be used for the determination of future rates.

1. The first is the difficulty of properly estimating claims. Naturally, as past experience is the only available basis for rate making it is necessary to bring it as close to the present as possible. This creates a problem because an experience record is not complete until all the policies have expired, all the accidents have occurred, and all the resulting claims have been adjusted. By regulating the compilation of experience it is possible to insure complete exposure and accident data. It is, however, impossible to arrange to secure the latest experiences and also to know exactly what the claim cost will be. This condition is more important in some forms of insurance than others. It creates a serious difficulty where, for example, claims are subject to litigation as in the case of public liability coverage. In this case there will be a number of claims in the most recent experience concerning which little is known. The statistician must rely upon the claim department to estimate the liability for these claims. This is not simple because there is no definite standard of settlement as in the case of workmen's compensation and some other insurances. There has been a tendency to underestimate the value of these deferred claims. The error has not been great, and by reviewing past experience as

it gradually develops to maturity the tendency can be measured. Obviously, it is necessary to introduce a factor in the experience to raise the cost to an ultimate basis before it is used for rate making.

2. Secondly, conditions have been changing rapidly. The war had its effect upon costs of repair; it also curtailed the automobile output. Automobiles are now used the year around, whereas a few years ago it was customary, in certain localities at least, to put them up for the winter. The number of automobiles in use is increasing. The automobile is being used for purposes not dreamed of five years ago. Juries are forming the habit of excessive awards. All these and many additional items must be recognized and reflected in the rates so that the teachings of past experience may not lead us astray in the future. This is usually accomplished by the establishment of a factor to measure the rate of changing conditions.

Concerning the expense loading, little need be said except that it is built up by a cost-accounting method. Upon the basis of a review of the universal practices of insurance carriers the various expense factors are analyzed and each is expressed in its proper percentage of the gross rate.

The gross or manual rate is obtained by combining several elements.

If,

P = gross rate.

p = selected pure premium.

i = rate of change in conditions anticipated for the future as compared with those reflected by the experience used as the basis for the establishment of pure premiums.

e = loading for management expenses, taxes and underwriting profit expressed as a percentage of the gross rate.

then,

$$P = \frac{p(1+i)}{1-e}^{*}$$

* This formula is developed as follows:

$$P = Pe + p(1+i),$$

$$P(1-e) = p(1+i)$$

or

$$P = \frac{p(1+i)}{(1-e)}$$

It is understood that p is established by the underwriter from the pure premium experience properly modified for the underestimate of outstanding losses. It, therefore, need not necessarily be the indicated pure premium. It will approximate this if the exposure is large, otherwise it will be fixed by analogy to the pure premiums for other classifications or by underwriting judgment.

With this general statement of fundamentals it will be interesting to outline in brief the method pursued in establishing rates for a single form of coverage and a certain type of automobile.

As an example, let us assume that rates are desired in two territories for public liability coverage for a certain type of automobile for which four classifications are provided. Assume further that with proper allowance for the underestimate of outstanding losses, the experience in the four classifications of automobiles for the entire United States is as follows:

PURE PREMIUM EXPERIENCE FOR THE U. S. A.

Classification.	Indicated P. P.
1	$ 9.56
2	13.99
3	19.50
4	25.06
All classes	15.02

This experience is carefully analyzed by the underwriter and as a result of choice and graduation the following selected pure premiums are established:

SELECTED PURE PREMIUMS FOR THE U. S. A.

Classification.	Selected P. P.
1	$10.00
2	15.00
3	20.00
4	25.00

Next let us assume that changing conditions are such as to require the establishment of a factor of 1.10 to measure them. Also that the loading for management expenses, taxes and underwriting profit is 45 per cent. Then gross rates for United States may be obtained as follows:

DETERMINATION OF GROSS RATES FOR U. S. A.

Class.	Selected P.P.	Increasing Cost Factor.	Expense Loading.	Gross Rates.
1	$10.00	1.10	.45	$20.00
2	15.00	1.10	.45	30.00
3	20.00	1.10	.45	40.00
4	25.00	1.10	.45	30.00

The next problem is to translate these rates into rates for the two territories in question.

Carrying our assumptions further, let us assume that it is found that a comparison of the total experience for all four classifications produces the following results:

DETERMINATION OF TERRITORIAL DIFFERENTIALS.

Territorial Division.	Indicated P. P. All Classifications.	Differential.
U. S. A.	$15.02	1.00
A	7.51	.50
B	30.04	2.00

Upon the theory that the fundamental relationship of hazard as between classification can be ascertained from the combined experience for the United States, it is obvious that a set of rates can be obtained for each of the territorial divisions in question by the simple calculation of applying the territorial differential to the U. S. A. gross rates as follows:

DETERMINATION OF RATES FOR TERRITORIAL DIVISIONS.

Class.	U. S. A. Gross Rate.	Territory A.	Territory B.
1	$20.00	$10.00	$40.00
2	30.00	15.00	60.00
3	40.00	20.00	80.00
4	50.00	25.00	100.00

It will be noted that if a fundamental law of hazard can be established, the problem is simplified. For example, the statistician need go into the refinement of classification experience only for the United States. For the territory he need only produce experience for the form of coverage and the type of automobile. It is not known definitely at the present time whether this plan is practicable. The validity of the assumption is, therefore, always carefully checked with reference to the actual classification experience

for individual territories. For example, in practice, the classification experience would be carefully considered for the two territories and an adjustment would be made for any classification where the experience indicated this to be necessary.

Conclusion.

There are many interesting phases of the subject which I have found it impossible to cover. For example, experience rating is being practiced in connection with the determination of rates for fleets of automobiles and garages; there is a distinct safety first movement in the field of automobile insurance; just as teams insurance was extended to cover automobiles in earlier days so today automobile insurance is being utilized as the starting point for the development of airplane insurance, etc. These subjects, however, while they are of interest have no direct bearing on the fundamental principles of automobile casualty insurance. If I have done nothing more than point out the complicated structure of this line of insurance and to indicate the many problems which still await solution, I shall feel that the paper has accomplished its purpose.

THE REVISION OF PENNSYLVANIA COMPENSATION INSURANCE RATES, 1918.

BY

E. H. DOWNEY AND G. C. KELLY.

The revision of Pennsylvania compensation insurance rates in October, 1918, is notable for several innovations which had been approved, officially or unofficially, by many actuaries and underwriters, but had not theretofore found practical application in rate making. The more important of these innovations are:

1. The deliberate limitation of experience, in point both of time and of geographical distribution, for the sake of greater homogeneity.

2. The emphasis upon industry-group experience as the basis of classification rates.

3. The combination of experience from different states by means of (*a*) *partial reduction factors* corresponding to the "law differential" for each nature of loss (death, permanent total, permanent partial, temporary and medical); (*b*) *experience differentials* for temporary disability and medical losses, and (*c*) *average values* for deaths and permanent totals.

4. The introduction of accident severity rates as an element in rate making.

5. The incorporation of a "wage level" factor for the modification of the rate level.

6. The use of a graded expense loading.[1]

7. The presentation of statistical experience in a form convenient for committee use.

8. The printing of the manual by industry groups.

None of these departures from traditional practice was strictly new; yet, taken in the aggregate, they constitute a somewhat novel rate revision.

[1] A graded expense loading was suggested by Mr. Woodward to the Actuarial Committee of the Augmented Standing Committee, 1917, and was adopted by the Pennsylvania Compensation Rating & Inspection Bureau in the revision of August, 1917.

I.

Pure premium experience, as every associate knows, is dependable for rate projection only in so far as the exposure is adequate in volume and homogeneous in composition. Roughly it may be said that the volume of losses should be such that the addition or subtraction of a single death would not affect the total by more than one or two per cent.[2] But adequate volume alone is not sufficient: the experience relied upon should represent the same or similar conditions with respect to wage level, business activity, character of working personnel, industrial methods and processes—in fine, so nearly as may be, the same accident frequency and severity as the period and State for which the rates are to be projected. These two criteria mutually limit each other. The shorter the time and the narrower the area from which the experience is taken, the more homogeneous will be its composition, but also the less adequate will be the volume of exposure. Conversely, the longer the period and the wider the area covered by the experience data, the less homogeneous, and thereby the less dependable, will be the statistical average. In practice some compromise of these conflicting requirements is usually necessary.

The Actuarial Committee[3] of the Pennsylvania Compensation Rating & Inspection Bureau, having regard to the above-mentioned criteria, decided to limit the review of experience to Pennsylvania, New York, Massachusetts and New Jersey Schedule "Z" for the policy year 1916. This limitation assured a high degree of homogeneity as respects general industrial conditions, while it brought the whole experience within the initial period of war activity. The four states in question have a wide range and huge volume of

[2] For practical purposes, $100,000 of losses under Pennsylvania 1915 scale of benefits may be accepted as a reasonably adequate exposure for classification rate making. This volume of losses, according to the aggregate of Schedule Z experience of 1916, would "normally" be distributed as follows:

Nature of Loss. 1	No. of Accidents. 2	Amount. 3
Death	15	$26,000
Permanent total disability	1	3,000
Major permanent partial disability	15	15,000
Temporary disabilities (over two weeks)	640	36,000
Medical, all cases	—	20,000

This distribution will, of course, vary from industry to industry.

[3] Messrs. Mowbray, Black, Moore, Scheitlin, Nicholas, Mullaney, Pennock and Kime.

industry, they are presumably not dissimilar in the processes and products covered by the same industry classifications, their recorded experience was susceptible of loss analysis by nature of injury, and it was believed that the reported classifications and losses had been more carefully ascertained than is the case in non-Schedule "Z" states.[4] In short, the committee believed that the gain in volume from the inclusion of other experience would be more than offset by the loss of comparability.

Unfortunately the results of New Jersey's Schedule "Z" were not received in time for utilization. Nevertheless, the aggregate exposure presented to the Classification Committee represented $3,000,000,000 of audited payroll, whereof approximately one third was Pennsylvania experience. This is exclusive of $150,000,000 of Pennsylvania coal mine payroll. The total experience so obtained was distributed into 280 industry-groups, treated as rate-making units. An exposure amounting to at least $100,000 of "reduced" losses was obtained on 34 of these groups, to at least $50,000 on 71 groups, and to at least $25,000 on 120 groups.[5] The remaining 160 groups represented less than 15 per cent. of total losses. On these minor classifications the former "selected pure premium" was re-affirmed on the ground that the exposure was insufficient to warrant change.

With respect to homogeneity, the Pennsylvania pure premium was almost identical with the combined reduced pure premium on

[4] On the same general grounds, the Massachusetts, New York, New Jersey, and Pennsylvania Insurance Departments have recommended to the National Council on Workmen's Compensation Insurance that in future rate revisions for these states only "Schedule Z" experience shall be considered.

[5] FREQUENCY DISTRIBUTION OF INDUSTRY GROUPS BY VOLUME OF LOSSES—PENNSYLVANIA, NEW YORK AND MASSACHUSETTS EXPERIENCE, 1916.
Pennsylvania Rate Revision, 1918.

Volume of Losses.	No. of Groups.
All groups	280
Under $10,000	80
$10,000 and under $25,000	80
$25,000 and under $50,000	49
$50,000 and under $75,000	26
$75,000 and under $100,000	11
$100,000 and over	34

The 120 groups with losses over $25,000 each represented 85 per cent. of the total losses and the 71 groups with losses over $50,000 each represented 70 per cent. of the total losses.

practically every classification for which there was substantial experience both in Pennsylvania and in the other states whose experience was utilized.[6] The marked exceptions were those classifications in which the payroll of one state greatly predominated.

II.

The grouping of industry classifications by analogy of hazard for rate-making purposes is older than workmen's compensation insurance in the United States. The earliest systematic attempt at such grouping, however, was that utilized by the Augmented Standing Committee of 1917.[7] Subsequently to that date the grouping then used was revised and systematized by the so-called "Informal Committee,"[8] which reported jointly to the National Reference Committee on Compensation Insurance Rates and to the Association of Industrial Accident Boards and Commissions. The grouping so evolved by the Informal Committee was used, with few exceptions, in the Pennsylvania rate revision.

The end proposed by the Informal Committee was to bring together, so far as possible, those industries which are closely similar in kind and degree of accident hazard. Within the broad divi-

[6] The close correspondence of Pennsylvania with combined pure premiums will be apparent from the following table:

PENNSYLVANIA, NEW YORK AND MASSACHUSETTS "SCHEDULE Z" EXPERIENCE POLICY YEAR 1916.

Industry. 1.	Payroll (000 Omitted).		Pure Premium.	
	Pennsylvania. 2.	Combined. 3.	Pennsylvania. 4.	Combined. 5.
Iron foundries	$17,277	$26,209	$.63	$.64
Stove foundries	4,608	11,695	.62	.60
Forging	7,204	11,999	.78	.79
Cutlery and tools	5,931	19,070	.31	.32
Machine shops	42,337	88,922	.56	.55
Brick	11,633	14,772	.78	.79
Glassware	9,834	13,536	.192	.198
House construction	15,850	33,056	.78	.81

[7] The grouping used by the Augmented Standing Committee was developed largely upon the basis of a preliminary grouping by Dr. I. M. Rubinow by the joint labors of the Statistical Committees of the International Association of Industrial Accident Boards and Commissions and of the National Workmen's Compensation Service Bureau.

[8] Messrs. Hatch, Verrill, Magoun, Michelbacher and Downey. Messrs. Duffy, Meltzer, Alberti and Kelly attended certain sessions.

sions—agriculture, mining, manufacturing, construction, transportation, trade—the committee sought to arrange industrial enterprises, first by kind of materials worked with, and second by processes used. In this way the 1,500 manual classifications were thrown into some 300 ultimate groups, each more or less homogeneous within itself. The grouping so attained still leaves much to be desired, owing both to insufficient knowledge on the part of the committee, and to difficulties inherent in the disparate bases of the manual classifications themselves.[9] Nevertheless, it is believed that a majority of the committee's groups are reasonably homogeneous; a belief which was well substantiated by the results of compiling New York, Pennsylvania and Massachusetts Schedule "Z" experience in accordance with these groups.

The purposes served by grouping classification experience in the manner above described are: (*a*) to secure a more adequate exposure, particularly for minor classifications, and (*b*) to avoid inconsistencies in rates for classifications of substantially similar hazard. There is no reason to suppose, *e.g.*, that "stair building," "window strip installation" or "parquet floor laying" differs essentially, in point of hazard, from other branches of interior carpentry, or that a pure premium divergence as between "printing press manufacturing" and "machine shops" signifies anything but insufficient volume of exposure. Even where there are significant differences of pure premium between related industries, as between "cement quarrying" and "slate quarrying," it is advantageous to compare the two experiences.

For the reasons just recited, the Classification Committee of the Pennsylvania Bureau relied more upon group experience than upon the experience of individual classifications. In a majority of instances the group pure premium was adopted for all classifications within the group; in other cases the group death and permanent pure premium was combined with the medical and temporary pure premium of specific classifications. In a few cases, however, the group result was ignored, and the pure premium of the predominant classification applied to the entire group.

[9] See Downey, "Classification of Industries for Compensation Insurance," *Proceedings*, II, 10–24.

III.

The weaknesses of the "flat" or average "law differential" have been so fully expounded in the *Proceedings* of this society[10] that further animadversion upon that head would be out of place. Whatever may once have been the case, actuaries now recognize that the ratio of deaths to permanent disabilities and of both to temporary disabilities varies widely from industry to industry, and, consequently, that an average differential between unlike scales of benefits is erroneous for every industry that departs from the average in relative frequency of death and permanent disability.[11] If, indeed, compensation scales differed by a uniform percentage, the

[10] See, especially, Rubinow, "Theory and Practice of Law Differentials," *Proceedings*, IV, 8–44, and discussion, IV, 366–382.

What has been said here or elsewhere in criticism of the flat law differential implies no aspersion upon the *Standard Accident Table* nor upon the methods which are necessarily used in the early attempts to combine the experience of different jurisdictions. The Standard Table is more than a magnified piece of pioneer statistical work, accomplished under great difficulties and with meagre materials: it retains a high permanent value for all students of accident experience. The flat law differential also represented a great advance in its day. Only, with the accumulation of statistical experience and the increase of actuarial knowledge, more refined and more accurate methods have become feasible.

[11] The following exhibit from Pennsylvania Schedule Z, 1916, will sufficiently illustrate the point:

Industry.	Payroll (000 Omitted).	Losses.	No. of Comp. Accidents.			Pure Premium.		
			D. and P. T.	All.	Ratio.	D. and P.	All.	Per Cent. D. and P.
1.	2.	3.	4.	5.	6.	7.	8.	9.
ALL INDUSTRIES	$1,234,045	$7,734,202	1,340	46,543	1:35	$ .34	$ .63	54
Anth. coal mining	18,686	516,282	131	1,819	1:14	1.96	2.77	70
Bit. coal mining.	125,176	2,026,611	384	9,858	1:26	.96	1.62	59
Quarrying	13,338	219,632	46	980	1:22	1.07	1.65	65
All manufacturing.....	542,784	2,655,472	337	20,561	1:61	.22	.49	45
Textiles	89,421	148,194	16	1,328	1:83	.06	.17	35
Blast furnaces ..	4,521	87,063	20	324	1:16	1.20	1.92	65
Iron foundries ..	13,410	93,031	13	900	1:69	.26	.70	40
Machine shops ..	33,158	192,717	17	1,397	1:82	.21	.56	38
Building construction	69,417	814,708	132	4,077	1:31	.57	1.17	49
Carpentry N.O.C.	4,190	86,689	8	525	1:66	.42	2.07	33
Masonry N. O. C.	4,293	81,156	16	283	1:11	.72	1.88	59
Stores	123,256	337,963	59	2,793	1:47	.12	.27	45
Clerical office ...	124,874	25,370	6	101	1:17	.01	.02	50

average differential would be universally valid. Such, however, is far from being the case. Pennsylvania death benefits, *e.g.*, are to those of New York approximately as 4 to 7; permanent total disability benefits as 1 to 3; major permanent disability benefits as 1 to 2; temporary disability benefits as 2 to 3; and medical benefits as 3 to 5. In face of such diverse ratios a basic pure premium is meaningless and the combination of experience or projection of rates by means of flat reduction factors is misleading.[12]

Accepting these premises, the Actuarial Committee of the Pennsylvania Compensation Rating and Inspection Bureau directed that losses be analyzed into death, permanent total, permanent partial, temporary and medical benefits, and that the losses of other states be reduced to the Pennsylvania 1916 level by applying separate reduction factors to each type of loss. The "reduced" losses were then divided by the combined payroll and the resultant fractional pure premiums added to a total. The "reduced" pure premiums so obtained bore, of course, a varying ratio to the reported New York and Massachusetts pure premiums, dependent upon the accident-severity composition of New York and Massachusetts losses.

In practice the method projected by the Actuarial Committee was not fully realized because it was not possible to analyze the losses of the several states upon a strictly comparable basis. The methods actually employed are more fully set out below.

Three methods have at different times been projected or employed for reducing losses experienced under dissimilar scales of

[12] The National Actuarial Committee has voted to convert the experience of all states to the level of New York benefits for a combined total. Such total would be extremely useful for comparing the level of benefits in different states, and as a convenient comparative measure of industrial hazard. It would also, of course, be available for rate making in New York. The basic pure premiums so obtained could not, however, be used for rate making in any state other than New York. It would be necessary to reconvert these pure premiums by separate reduction factors applied to each fractional pure premium. The double operation of conversion from the reporting state to New York and from New York to the state for which rates to be projected, would simply multiply the error inherent in any method of arriving at differentials or reduction factors. The acceptance of the principle of partial law differentials—or of less analyses by nature of injury—carries with it the abandonment of the whole theory and practice of basis pure premiums. This fact has latterly been recognized by the Insurance Departments of New York, New Jersey, Massachusetts and Pennsylvania in a memorandum submitted to the National Council on Workmen's Compensation Insurance.

benefit to a common denominator. (*a*) The so-called "actuarial" or "theoretical" method computes the cost of compensation under any given act by applying the legal scale of benefits to a standard frequency-distribution of accidents by severity of injury. The total cost so calculated is divided by the total calculated cost of the same accidents under a standard or "basic" act to obtain the "law differential," which is then used to convert the reported losses under the given act to the level of the basic act.[13] This method has hitherto been employed in conjunction with a flat "law differential," but it is equally applicable to the development of partial or fractional differentials. (*b*) The "loss experience" method consists in comparing realized pure premiums for a large number of classifications and arriving thereby at an average ratio which is then applied to the reported losses of each classification in turn.[14] This method has been advocated only in connection with partial differentials. (*c*) Lastly, the reported monetary losses may be ignored and the projected losses for a given jurisdiction arrived at by applying to the reported accidents of each jurisdiction the experienced average cost of similar injuries in the given jurisdiction.[15] For brevity's sake this *modus operandi* may be styled the "accident experience," in contra-distinction from the "loss experience" method. Each of these methods has its own weaknesses and its own field of peculiar applicability.

The *à priori* ("theoretical") cost calculation must perforce be used for projecting losses under an untried scale of benefits, but it has the defect of all *à priori* reasoning—that the hypotheses may not fully cover the facts. The compensation of work accidents depends upon many circumstances besides the bare legal provisions: *e.g.*, upon administrative and judicial interpretation, supervision of claim settlements, and the opportunities for reëmployment after injury. Further, the actually realized death and permanent total disability losses in a particular classification are not an indication of probable losses even within the same jurisdiction, unless the number of such accidents is large enough to establish a dependable

[13] This was the method employed for all "law differentials" calculated prior to 1918.

[14] The use of an experience differential was proposed by Messrs. Mowbray and Black to the Actuarial Committee of the Augmented Standing Committee, 1917. Credit for further development of the idea is due especially to Messrs. Greene and Moore.

[15] For discussion of this proposal see *Proceedings*, IV, pp. 372–376.

average cost.[16] Whence it happens that the combination of these losses by means of a "reduction factor," whether "theoretical" or derived from experience, gives erratic and sometimes absurd results.

The "loss experience" differential has the very great advantage that it combines within itself all the causes, known or unknown, of pure premium divergence: benefit scales, wage levels, industrial activity, age of act, or inherent hazard. It is, however, subject to the same weakness as any other loss differential in respect to deaths and permanent total disabilities. Temporary and medical losses are its special province. It is, indeed, the only available method of combining medical losses. Medical costs vary not only with statutory requirements, but with the practice of insurance carriers in respect to voluntary medical care, with the prevalence of plant hospitals, with the fee, contract and salary systems of medical payment, and with the availability of free treatment in state-aided institutions.[17] Any calculation of these manifold cost elements in advance of experience is, at best, highly conjectural.

The "accident experience" method, finally, is especially appropriate for the projection of death and permanent disability losses. A death under the Pennsylvania Act may cost anything from $100 to $8,500, according to wages and number of dependents; a per-

[16] The frequency distribution of deaths by manual classifications in Pennsylvania Schedule Z experience, 1916, is shown below:

No. of Deaths in Each Classification.	No. of Classifications.	Aggregate No. of Deaths.
Total	1,203	1,276
0	934	0
1	141	141
2 and under 5	82	225
5 and under 10	29	195
10 and under 100	15	225
Over 100	2	490

It will be seen that more than three fourths of the classifications for which losses were reported showed no deaths, that two thirds of the remainder showed fewer than five deaths each, and that only 17 classifications out of 1,200 had enough deaths to indicate a dependable classification average cost. Seven twelfths of all the deaths occurred in these 17 classifications—40 per cent. of the total in two classifications.

[17] The low cost of medical benefits under the Pennsylvania Compensation Act, particularly in the coal mining industry, is due in part to free treatment in the state-aided hospitals. Twenty-eight such hospitals incurred costs of $60,000 in one year over and above the sums paid in pursuance of the Compensation Act.

manent total disability under the New York Act may cost a few hundred dollars in the event of early death, or $20,000 if the victim be young and long-lived. That thesingle death in the classification "jewelry stores" actually cost $5,500, while two deaths in "grease manufacturing" cost $170; that a permanent total disability in "woolen and worsted spinning" was reported at $565, and a like injury in "cutlery manufacturing" at $18,000—signifies nothing for the projected pure premium of any of these classifications. The like observation would hold true of serious permanent partial disabilities if compensated—as in all equity they should be—by life pensions. Wherever the number of occurrences is small and the fortuitous range of cost extreme, the average cost of accident method is indicated. For other classes of injury, the "loss experience" differential will give more dependable results with less labor.

In practice, the actuarial committee adopted a combination of the "accident experience" and "loss experience" methods. To project death and permanent total disability losses on the basis of Pennsylvania benefits, the reported number of such accidents in each state was multiplied by the average cost in Pennsylvania, without regard to the reported monetary losses in the particular classification. It was recognized, of course, that a general average for all industries is not valid for each industry: high or low average wages and high or low average dependency are characteristic of certain employments.[18] In a few very important industries—bituminous and anthracite mining, stone quarrying, iron and steel manufacturing, building construction—the number of deaths was great enough to establish a dependable specific average cost, which was accordingly used. For other industries, however, the general average was thought to be more dependable than any conjectural deviation. Permanent total disabilities were taken at the uniform average value of $3,000 for all classifications. Probably the method since adopted by the National Actuarial Committee, of combining deaths with permanent totals and applying the resultant average value to both, is preferable to the procedure followed by the Pennsylvania Committee. Losses other than death and permanent total disability were reduced to the Pennsylvania level by means of "loss experience" differentials.

Adequate handling of permanent partial disabilities would require their separation into major and minor. In most American

[18] The following table shows the average weekly earnings and dependency distribution for death cases in certain leading industries as disclosed by Pennsylvania Schedule Z, 1916.

It will be seen from Column 9 that the number of dependents per fatality, which was 1.70 for all industries, ranged from 1.21 in "Construction, Not Building"—a "floater's" occupation—to 2.11 in coal mining.

Column 11 shows how the combined effect of relative dependency and wage level affects the average death cost.

Industry Schedule.	No. of Deaths.	No. with Specified Number of Dependents.					No. of Dependents.	Av. No. of Dependents.	Average Weekly Wage.	Average Cost of Death.
1.	2.	None. 3.	One. 4.	Two. 5.	Three. 6.	Four or More. 7.	8.	9.	10.	11.
ALL SCHEDULES	1,276	387	376	144	118	251	2,173	1.70	$16	$2,025
All manufacturing	316	84	106	45	32	49	538	1.70	15	2,000
Iron and steel manufacturing	70	27*	17	8	9	9	106	1.51	18	2,000
Metal working and machinery manufacturing	91	14	36	14	12	15	175	1.92	18	2,200
Coal mining	490	159	105	55	40	131	1,034	2.11	21	2,500
Quarrying	44	15	14	2	3	10	75	1.70	15	2,200
Construction—not building	65	28	15	12	4	6	79	1.21	19	1,850
Building erection	125	41	38	10	12	24	202	1.61	19	2,200
Cartage and trucking	50	15	12	8	7	8	85	1.70	14	1,800

* Of these 27 cases, 10 had unascertained alien dependents. For blast furnaces and open hearths the number of dependents per fatality was 1.89 and the average cost $2,500.

jurisdictions disabilities of this class are compensated for limited periods under "specific indemnity schedules." But these schedules differ both in respect to the injuries covered and in respect to relative, as well as absolue, compensation for the same injury. Wisconsin, *e.g.*, awards relatively large amounts for serious and relatively small amounts for minor dismemberments. In New Jersey the precise reverse is the case. In Pennsylvania the enumerated injuries include only loss or complete loss of use of arm, hand, leg, foot or eye; minor injuries, in general, are compensated only as temporary disabilities during the healing period. In New York the specific schedule includes nearly every conceivable injury of a permanent character and compensation thereunder is practically exclusive. In Massachusetts the list is somewhat comprehensive, but has little to do with the compensation paid.

All these variations are susceptible of intelligent treatment if only the number and cost of these accidents are reported in sufficient detail. For the major disabilities enumerated in the Pennsylvania Act, *e.g.*, a sufficiently accurate reduction factor as between New York and Pennsylvania or Pennsylvania and New Jersey could be calculated *à priori* or derived from loss experience. Since, however, the ratio of compensation, as between Pennsylvania and New York or New York is not the same for major and minor permanent injuries; since, moreover, the frequency distribution of such injuries is not the same for all industries—arm and leg injuries predominating in the building trades, eye injuries in stone, glass and clay working, hard and arm injuries in the textile trades, finger injuries in metal stamping[19]—a flat reduction factor for

[19] The following table compiled from unpublished reports of the Pennsylvania Department of Labor and Industry shows the relative frequency of major permanent partial disabilities in Pennsylvania:

	Loss of					
	All.	Eye.	Hand.	Arm.	Foot.	Leg.
ALL	100	52	23	7	10	8
Mines	100	54	14	6	14	12
Food	100	25	58	5	10	2
Testiles	100	19	52	24	5	—
Paper	100	17	69	11	3	—
Wood	100	44	48	5		3
Metal	100	55	23	7	9	6
Clay, glass, stone	100	59	18	9	12	2
Public service	100	41	13	5	17	14

permanent partial disabilities taken in the lump is necessarily fallacious.

Unfortunately for the realization of these principles, the requisite analysis had not been made in the reported experience. New York Schedule "Z" gave the number and cost of permanent partials in one lump; Pennsylvania Schedule "Z" gave the number and cost of *major*, but not of minor permanents; Massachusetts Schedule "Z" gave neither the number nor the cost of permanent, as distinguished from temporary disabilities.[20] Nothing remained, therefore, but to lump permanent partial with temporary disabilities for the purpose of combining experience.

Two sets of experience differentials, accordingly, were calculated for each state whose experience was to be utilized: (1) "permanent partial and temporary" and (2) "medical." The method of calculation was:

(*a*) Determine for each representative classification—

1. Pennsylvania losses,
2. Pennsylvania pure premium (π),
3. Massachusetts losses,
4. Massachusetts pure premium (π),
5. Pennsylvania pure premium $\times$ Massachusetts payroll,
6. Massachusetts pure premium $\times$ Pennsylvania payroll;

(*b*) Add the products of Pennsylvania pure premiums by Massachusetts payrolls and of Massachusetts pure premiums by Pennsylvania payrolls to schedule and grand totals;

(*c*) Then—

$$\text{Reduction factor} = \tfrac{1}{2}\left(\frac{\pi_M \times \text{Mass. Payroll}}{\text{Penna. Losses}} + \frac{\pi_P \times \text{Mass. Payroll}}{\text{Mass. Losses}}\right)$$

The process is illustrated by Table II. Table III shows the results of the calculations exhibited in Table II.

This calculation was made for every classification which had developed as much as $1,000,000 of payroll in each state. The mean Pennsylvania reduction factors so obtained were .52 for New York and .60 for Massachusetts permanent partial and temporary losses, .60 for New York and .65 for Massachusetts medical losses.

[20] Massachusetts losses are analyzed by "kind of benefit"—a wholly irrelevant category—not by "nature and severity of injury." The amounts appearing in the "specific indemnity" column are the benefits paid *eo nomine;* the bulk of the compensation for permanent partial disabilities is combined with temporary disability benefits under the caption "weekly indemnity."

This method proved extremely laborious and the results not wholly satisfactory. Thus the Pennsylvania reduction factor for Massachusetts medical losses was .58 by the direct, .71 by the inverse calculation; the range by industry schedules was from .44 to .85, and the extreme divergence between the direct and inverse calculations for any one schedule was .16 (see Table III). These marked divergences are due in great part to dissimilar payroll distribution by industries. Some striking instances of such dissimilarity are shown below (Table I). Obviously the multiplication of the Massachusetts "small arms" or "cotton spinning" payroll by the Pennsylvania pure premium will produce a widely different result in the schedule total from the reverse process. To avoid the effect of such undue weighting care should be had to exclude classi-

TABLE I.

CONTRASTING INDUSTRY DISTRIBUTION IN PENNSYLVANIA AND MASSACHUSETTS.

Industry.	Massachusetts.		Pennsylvania.	
	Payroll (000 Omitted).	Medical Pure Premium.	Payroll (000 Omitted).	Medical Pure Premium.
1.	2.	3.	4.	5.
Boot and shoe manufacturing	$57,900	$.063	$8,439	$.031
Cotton spinning and weaving	59,361	.092	4,965	.038
Iron foundries	4,305	.247	13,410	.195
Machine shops	15,683	.255	33,158	.182
Small arms manufacturing	10,134	.138	629	.213

fications which show a large payroll in one state and a petty exposure in the other—a point not sufficiently regarded by the present writers when computing the Pennsylvania-Massachusetts experience differentials. The inverse calculation was, in fact, biased by the coincidence of large Massachusetts payrolls with high Pennsylvania pure premiums for classifications nowise characteristic of Pennsylvania industry. Errors of sampling apart, payroll weighting gives full effect to undetected misreporting of losses. An error of this class is strongly indicated by the exhibit in Table IV. That the same industry, under like conditions and upon substantial exposures, show show a divergence of 1,000 per cent. in medical cost is more difficult to credit than that some insurance carrier reported cents for dollars or assigned the medical losses to another classi-

TABLE II.

COMPUTATION OF PENNSYLVANIA-MASSACHUSETTS MEDICAL DIFFERENTIAL.

Industries.	Penna. 1916 Policy Year.				Mass. 1916 Policy Year.				Differentials.	
	Payroll (000 Omitted.	Med. Losses.	Penna. π 3÷2.	Mass. $\pi \times$ Penna. Payroll. 2x8.	Payroll (000 Omitted.	Med. Losses.	Mass. π 7÷6.	Penna. $\pi \times$ Mass. Payroll. 6x4.	Direct 3÷5.	Inverse 9÷7.
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
ALL INDUSTRIES	$460,942	$470,037	$.102	$811,287	$443,007	$611,982	$.139	$435,751	.58	.71
Foods, beverages, tobacco	18,244	24,744	.138	36,279	10,251	17,940	.179	12,763	.68	.71
Bakeries	6,506	7,215	.111	11,255	3,336	5,766	.173	3,703	.64	.64
Sugar refining	1,772	1,736	.098	2,180	1,135	1,401	.123	1,113	.79	.79
Confectionery manufacturing	3,255	3,286	.101	3,873	8,495	4,161	.119	3,529	.85	.85
Packing houses	986	2,816	.287	3,916	455	1,807	.397	1,307	.71	.71
Breweries	5,724	9,671	.169	15,055	1,830	4,805	.263	3,111	.64	.64
Textiles	56,361	26,440	.047	45,281	112,548	101,344	.090	68,742	.58	.68
Yarn manufacturing	4,205	2,615	.062	6,613	3,703	5,297	.143	2,296	.43	.43
Cotton spinning and weaving	4,345	1,756	.040	4,002	59,361	54,680	.092	23,745	.44	.44
Wool spinning and weaving	10,383	9,477	.091	7,787	36,407	27,174	.075	33,130	1.21	1.21
Silk manufacturing	24,506	5,529	.023	14,213	3,092	1,807	.058	680	.40	.40
Knit goods manufacturing	5,006	1,916	.038	3,404	1,985	1,353	.068	754	.56	.56
Carpet manufacturing	5,176	1,836	.035	5,176	3,328	3,339	.100	1,165	.35	.35
Textile finishing	1,579	2,573	.163	2,558	4,041	6,529	.162	6,587	1.00	1.00
Bleaching	1,156	738	.061	2,128	632	1,165	.184	385	.35	.35
Care and custody	26,550	13,213	.050	25,490	18,401	18,099	.100	9,148	.52	.51
Office buildings	5,768	2,835	.049	5,075	4,241	3,739	.088	1,654	.56	.56
Hotels	12,535	5,920	.047	12,410	7,209	7,137	.099	3,388	.48	.48
Restaurants	5,951	3,987	.067	6,904	5,754	6,652	.116	3,855	.58	.58
Clubs	2,296	471	.021	1,101	1,196	571	.048	251	.43	.43
Leather	12,380	6,510	.054	10,834	65,125	46,790	.072	25,029	.60	.53
Tanning	3,941	3,879	.098	5,518	7,224	10,115	.140	7,080	.70	.70
Boot and shoe manufacturing	8,439	2,331	.031	5,316	57,901	36,675	.063	17,949	.50	.50
Printing	20,502	10,201	.050	11,917	11,225	6,919	.063	5,387	.85	.78
Printing, N.O.C.	12,531	6,839	.055	6,767	5,479	2,952	.054	3,014	1.01	1.01
Newspaper publishing	5,008	2,388	.048	3,606	3,184	2,297	.072	1,528	.66	.66
Publishing, N.O.C.	2,232	731	.033	1,005	1,155	516	.045	381	.73	.73
Bookbinding	8,301	243	.033	599	1,407	1,154	.082	464	.41	.41

fication.[21] Notwithstanding these and perhaps other sources of error, the mean differentials calculated in the manner above described are probably not wide of the mark.

TABLE III.

PENNSYLVANIA-MASSACHUSETTS MEDICAL DIFFERENTIAL.

Schedule. 1.	Simple Average of Pure Premiums. 2.	Weighted Differential. Mean. 3.	Direct. 4.	Inverse. 5.	Divergences. Simple. 6.	Mean W. 7.
ALL CLASSIFICATIONS.....	.67	.65	.58	.71		
5. Food.....	.73	.69	.68	.71	.06	.06
6. Textiles.....	.60	.63	.58	.68	.07	.02
7. Clothing.....	.64	.68	.68	.67	.03	.03
9. Leather.....	.60	.67	.60	.53	.07	.02
11. Paper.....	.73	.82	.78	.86	.06	.17
13. Printing.....	.71	.82	.85	.78	.04	.17
17. Metal goods.....	.62	.70	.68	.71	.05	.05
18. Machine manufacturing...	.74	.77	.69	.85	.07	.12
27. Construction.....	.53	.47	.44	.50	.14	.18
32. Drivers and chauffeurs....	.60	.53	.53	.52	.07	.12
34. Commercial.....	.67	.64	.63	.64	.00	.01
36. Care, custody, maintenance	.61	.52	.52	.51	.06	.09

TABLE IV.

CLASSIFICATION 6042. ROAD OR STREET MAKING.

State. 1.	Payroll. 2.	Medical Losses. 3.	Pure Premium. 4.	Reduction Factor. 5.
Pennsylvania.....	$5,325,400	$ 3,831	$.072	$1.00
New York.....	5,478,000	17,167	.313	.23
Massachusetts.....	1,602,800	11,582	.723	.10

It is likely that a simpler procedure would yield better results, and with far less labor. Obviously, for any one classification,

$$\frac{\text{Penna. losses}}{\text{Mass. pure premium} \times \text{Penna. payroll}} = \frac{\text{Penna. pure premium}}{\text{Mass. pure premium}}.$$

For any one classification, moreover, the inverse calculation necessarily gives the same quotient as the direct. For particular clas-

[21] An error in pointing off was responsible for a discrepancy of $3,000,000 in the reported Logging payroll for Pennsylvania. Errors in punching code numbers transferred nineteen fatalities from anthracite to bituminous mining and produced Pennsylvania payrolls in "gold mining" and "cotton compressing."

sifications, in other words, the ratios sought are ratios of pure premiums under the two scales of benefit. If then the pure premium ratios are computed for a sufficient number of classifications—care being had to exclude classifications which developed either a small exposure or a clearly abnormal pure premium in one or the other state—the simple average of these ratios will probably represent the true law differential.[22] This method avoids the laborious multiplication of the classification payrolls of each state by the classification pure premiums of the other. That it gives more dependable results than the method used in the Pennsylvania rate revision is indicated by Table III, whereby it will be seen that the simple averages of pure premium ratios (Column 2) for industry schedules deviates less widely from the grand average than do the weighted averages (Columns 3, 4 and 5). The same table shows a fairly close agreement between the grand average of pure premium ratios (.67) and the mean of the grand weighted averages (.65)—a fact which again confirms the general accuracy of the method.

TABLE V.

PENNSYLVANIA-MASSACHUSETTS MEDICAL REDUCTION FACTOR
SCHEDULE 27—BUILDING ERECTION.

Classification. 1.	Penna. Medical Losses. 2.	$\pi_M \times$ Penna. Payroll. 3.	Reduction Factor, 2 ÷ 3. 4.
SCHEDULE TOTAL.....	$111,067	$209,562	.53
5190. Electrical equip.—instal. ...	2,206	4,977	.44
5602. Additions	3,012	6,720	.45
5643. Residences—carpentry	8,695	13,840	.63
5401. Carpentry—N.O.C.	12,287	22,946	.54
5002. Masonry—N.O.C.	9,767	14,977	.65
5204. Concrete construction.....	5,715	13,131	.44
5209–10. Concrete foundations ...	7,128	13,249	.54
5183. Plumbing	5,226	8,551	.61
5461–90. Painting	3,811	8,958	.43
5480. Plastering.....	2,358	3,956	.60

The rather wide divergencies of schedule averages from the grand average, exhibited by Table III, are probably due in most instances to chance fluctuations in pure premiums. Medical aid for a single serious accident may easily cost $500—enough to cause a variation of fifty per cent. in the medical pure premium on $1,000,000 of

[22] This is Mr. Kelly's suggestion.

machine shop payroll. When it is added that the number of classifications in any given schedule which developed $1,000,000 of payroll in both Massachusetts and Pennsylvania was quite small, it will be seen that one or two serious injuries in either state might markedly affect the medical differential for the entire schedule. For this reason the grand average is probably more to be depended upon than any schedule deviation therefrom. Table V, however, appears to show a consistently lower ratio of Pennsylvania to Massachusetts pure premiums for the building industry than for industry at large.

All law differential calculations heretofore have proceeded upon an assumed normal distribution of accidents by severity of injury as ultimately developed in a mature experience. Practical exigencies shall be considered in rate making. In an immature experience, as is well known, a large proportion of major permanent disabilities have not disclosed themselves as such and are commonly carried on the books of the insurer as "temporary disabilities."[23] It is on this class of undeveloped permanents and deferred deaths

TABLE VI.

REPORTED AND EXPECTED FREQUENCY DISTRIBUTION OF ACCIDENTS BY SEVERITY OF INJURY—PENNSYLVANIA SCHEDULE "Z," 1916.

Severity of Injury 1	No. Reported. 2	No. Expected. 3
1. ALL ACCIDENTS	46,543	46,543
2. Deaths	1,276	1,276
3. Permanent totals	64	85
4. Major permanent partials	853	1,200
5. Temporaries	43,460	43,982
6. Indeterminates	890	

that underestimates of outstandings commonly occur. Known deaths and permanent disabilities can, under most compensation acts, be valued in accordance with definite rules. Closed cases of temporary disability require no reserves. Medical outstandings can be ascertained with approximate accuracy at a date three months after the close of the policy year. But the incurable opti-

[23] Investigation disclosed that several permanent totals in Pennsylvania Schedule Z, 1916, were grossly underestimated by the insurance carrier from failure to revise the "temporary" reserve when the severity of the accident was finally discovered. In the reporting of individual risk experience for experience rating "temporary disabilities" have not infrequently been set down at such impossible values as $2,000.

mism of claim adjusters produces a persistent underestimate of ultimate liability on injuries of indeterminate severity.

For this reason the Pennsylvania Insurance Department called for a separate statement of "indeterminates"—*i. e.*, injuries the ultimate severity of which was unascertained at the date of reporting. The result is exhibited below (Table VI).

From the Rubinow Standard Accident Table and from mature American experience there is reason to expect at least one permanent total for every fifteen deaths,[24] and about the same number of major permanents as of deaths. Upon this assumption about forty per cent. (368) of the indeterminates in the above exhibit will ultimately develop into permanent disabilities while the remainder will prove to be temporary in character. Reasoning from these premises, the Actuarial Committee of the Pennsylvania Bureau calculated the ultimate value of the reported indeterminates and found a deficit of $180,000 in the reported, as compared with the calculated indeterminate losses. They accordingly directed the addition of $200 to the reported value of each indeterminate disability. This procedure introduced a loading for underestimate of outstanding upon a more definite basis than that heretofore used, and distributed this loading to those classifications only in which the occurrence of indeterminates gave reason to suspect an underestimate.

For the current year the Pennsylvania Insurance Department has asked that indeterminate disabilities be individually reported and valued upon the Department table. In this way it is believed that the necessity for an underestimate factor will be avoided.

IV.

Accident severity rates are not directly convertible into pure premiums, on which account, probably, this phase of accident expe-

[24] The Rubinow Table, based upon European experience, gives one permanent total to ten deaths. But this proportion has not been realized in American experience apparently because accidents which in the United States are treated as partial or even temporary disabilities are in Europe compensated as permanent totals. To some extent this is a matter of defective statistics on both sides of the ocean. Thus the Austrian statistics give, not the number of permanent total disabilities, but the number of cases for which the maximum pension was allowed. The maximum being small, it is sometimes awarded, *e.g.*, for loss of thumb.

rience hitherto has been little regarded by insurance rate makers.[25] Yet pure premiums express industrial hazard only at the second remove; they vary with every change in wage levels as with every divergence in compensation benefits and so call for all sorts of qualifications in any comparative study. Accident severity rates[26] are the best, because the most stable and uniform, measures of relative hazard as between different industries at different times and under different benefit scales. The uses of such a measure of industrial hazard, for the purposes of compensation insurance, are manifold. Severity rates by cause of accident are the only satisfactory statistical basis for schedule rating and the only scientific basis of industry grouping for rate making. The number of accidents, also, and not the volume of monetary losses—much less the volume of payroll—is the ultimate criterion of the adequacy of exposure.[27]

The considerations just recounted led the Insurance Departments of New York, Massachusetts, New Jersey, Pennsylvania and Wisconsin to include number of accidents in the next ensuing call

[25] Mr. Scattergood presented an interesting study of accident frequency to the Actuarial Committee of the Augmented Standing Committee, 1917. But his results, being based upon accident notices without analysis of severity, were inconclusive and the whole subject was allowed to drop.

[26] By accident severity rate is meant the number of accidents, weighted for severity, per unit of exposure—technically, the accident time-loss per 1,000 full-time workmen per annum. A standard system of severity weighting has been proposed by the Committee on Statistics of the International Association of Industrial Accident Boards and Commissions—see Bulletin 201 of the U. S. Bureau of Labor.

[27] This point is rather implied than clearly brought out in Mr. Mowbray's very able paper "A New Criterion of Adequacy of Exposure," *Proceedings*, IV, 263–273. A direct statement of the criterion in terms of accident numbers would be both clearer and more convenient for practical use than the awkward double conversion from average cost per accident to volume of loss and from volume of loss through pure premium to payroll.

Volume of losses, in fact, is a measure of exposure only for a given class of injuries and only under a given benefit scale. Ten permanent partial disabilities under the existing Pennsylvania scale correspond to $10,000 of losses. But the same accidents, if compensated by life pensions, would cost $50,000, which volume of losses would, accordingly, represent no greater exposure than $10,000 under the present Pennsylvania law. This point has been consistently overlooked in fixing the "constants" and the earned premium qualifications for experience rating.

Payroll, again, is a measure of exposure only for a given classification under a given scale of benefits.

for pure premium experience. A like call was included in Pennsylvania and New Jersey Schedule "Z," 1916, and in New York Schedule "Z," 1915. The use made of this data, in the Pennsylvania rate revision, for the projection of death and permanent total disability losses and for the valuation of indeterminate disabilities was adverted to above. The number of permanent partial and temporary disabilities was used only as a rough *indicium* of the credibility of limited exposures. A permanent partial disability loss, *e.g.*, of $5,000 from one accident tells nothing of inherent hazard. But a loss of like magnitude from a score of minor dismemberments points to a characteristic of the industry and helps to fix its place in a definite rate group. In like manner a given volume of temporary disability losses will have a different meaning if derived from numerous accidents of low average cost than if produced by a few expensive accidents. The completeness of an experience—in comprising or failing to comprise accidents of each degree of severity—and the numerical proportion of deaths and permanents to temporary disabilities are likewise important criteria of dependability. A loss of even $15,000 which includes two deaths, two permanent partials and a hundred or more temporary compensatable accidents affords a fairly reliable indication of pure premium; a loss of the same magnitude made up, as in the case of Pennsylvania clay mining experience, 1916, of four deaths, one permanent partial and only nineteen temporary disabilities is an utterly unsure guide to rate making.[28]

The whole subject of accident rates is inchoate; no competent studies have been made in the United States such as would serve to develop the characteristics of different industries in point either of accident occurrence per unit of exposure or of frequency distribution of accidents by severity of injury. But it is the belief of the present writers, at least, that data of this character, when assembled in volume and analyzed upon a systematic basis, will be found increasingly significant for rate projection.

V.

Pure premiums, for compensation insurance, are invariably expressed in per cent. of payroll, and are thereby subject to fluctua-

[28] The limited Pennsylvania exposure—$381,000 of payroll—gave one death to every $95,000 of payroll. That this fatality rate is wholly abnormal is indicated by an experience of $3,372,000 of payroll from Ohio with ten deaths —one to $337,000 of payroll.

tion from changes in wage level. If, indeed, compensation for work accidents bore a fixed relation to wages, pure premiums would be little affected by wage rates. In the United States, however—as

TABLE VII.

RATIO OF COMPENSATION TO WAGES.[30]

FREQUENCY DISTRIBUTION OF COMP. ACCIDENTS BY WEEKLY EARNINGS OF INJURED—BITUMINOUS COAL MINING.

Weekly Wage Groups. 1.	1916. No. of Cases. 2.	1916. Ratio of Comp. to Wages. 3.	1917. No. of Cases. 4.	1917. Ratio of Comp. to Wages. 5.	1918. No. of Cases. 6.	1918. Ratio of Comp. to Wages. 7.
ALL WAGE GROUPS	842	.47*	1587	.41*	554	.37
Under $10	30	.67	17	.63	2	.56
$10 and under $12	33	.50	18	.50	2	.50
$12 and under $14	109	.50	51	.50	3	.50
$14 and under $16	131	.50	113	.50	13	.50
$16 and under $18	126	.50	124	.50	15	.50
$18 and under $20	145	.50	216	.50	51	.50
$20 and under $25	205	.45	541	.45	152	.45
$25 and under $30	47	.37	275	.37	144	.37
$30 and over	16	.30	232	.29	172	.29

* Aggregate weekly compensation to aggregate weekly wages.

Schedule Z experience comprised 59 per cent. of 1916 and 41 per cent. of 1917 payroll. Applying these percentages to Columns 3 and 5 above we obtain .445 as the effective average ratio of compensation to wages during the period covered by Schedule Z. The "wage level factor" is then: .368 ÷ .445 = .85.

All Industries Except Coal Mining. 1.	1916. 2.	1917. 3.	1918 (First Half). 4.
Effective ratio of compensation to wages ...	.474	.457	.438
Average weekly compensation	$ 7.12	$ 8.10	$ 8.64
Average weekly wages	$15.00	$17.71	$19.73
BITUMINOUS COAL MINING.			
Effective ratio of compensation to wages....	.47	.41	.37
Average weekly compensation	$ 8.49	$ 9.42	$ 9.78
Average weekly wages.....	$18.06	$22.91	$26.57

[30] The effective ratio of compensation to wages was, of course, computed from the frequency distribution of weekly earnings, in the manner illustrated below.

also in European countries—the rate of compensation is subject to arbitrary maxima; insomuch that at the higher ranges of weekly earnings the percentages stated in the Compensation Act become fictitious. In Pennsylvania, *e.g.*, compensation is fifty per cent. of wages, *but not more than $10 per week*—which comes to some twenty-five per cent. of the wages of a skilled mechanic and to something wholly negligible for a plant superintendent. These arbitrary limits evidently operate to pull down the ratio of compensation cost to payroll in a period of advancing wages and to increase the ratio in a period of falling wages. If, then, there has been a marked change in wage level between the period for which pure premium experience is available and the period for which rates are to be projected, the pure premiums derived from such experience will no longer reflect the current cost of compensation.

The Classification Committee of the Pennsylvania Bureau, in projecting rates for 1919, was confronted by precisely this situation. Between 1916, the year predominantly represented by the available experience, and 1918, the year of rate revision, the purchasing power of money had declined by at least one third, and average weekly earnings of wage workers had increased in about the same ratio. The consequent alteration in the ratio of compensation cost to payroll is exhibited in Table VII. It will be seen that for all industries other than coal mining, taken as an aggregate, the effective ratio of compensation to wages declined from .474 in 1916 to .438 in the first half of 1918. On this showing the pure premiums of 1916 should be multiplied by a factor of .92 to approximate the conditions of 1918.[29] This ratio will vary, of course, as between high and low wage industries, as also between industries directly and those more remotely affected by wartime inflation. The data in hand, however, were insufficient to establish dependable

[29] The actual reduction in pure premiums was probably greater than the foregoing calculation would indicate. When jobs are scarce and wages low compensation necessarily becomes, in some degree, unemployment insurance; conversely, when employment is plentiful and compensation falls to one third of earnings, men return to work, often at full wages, while still in a partly disabled condition. It is probable that the consequent falling off in number of accidents compensated, and in the average duration of compensation, will much more than offset any tendency to higher accident rates. If this view is correct, the "industrial activity factor," injected in the rate revision of 1917, should have been *less*, not *more*, than unity. It will be interesting to study 1918 experience with this thought in view.

factors for particular industries. Still less was it possible to forecast the trend of wages or of industrial activity. At most the broad assumption—thus far borne out by events—seemed justified, that wage rates would not during 1919 recede from the level attained in the first half of 1918.[31] The average wage level factor of .92 was, accordingly adopted for all classifications except coal mining, for which the specific indication of .85 was followed. For rate pro-

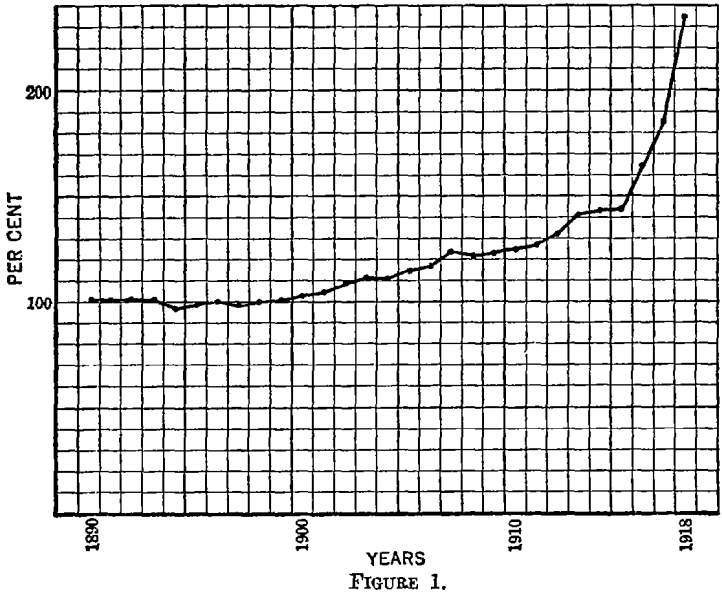


FIGURE 1.

WEEKLY WAGES RELATED TO THOSE OF 1890.[32]

jection, the "wage level" factor was combined with the "age of act" factor of 1.14, computed in the usual manner, giving a total multiplier of 1.05 for the conversion of 1916 to 1919 pure premiums.

A "wage level" factor, is should be remarked, is important only in face of a very exceptional advance (or decrease) in wage rates,

[31] The upward trend continued, as is well known, through the latter half of 1918. But for the end of the war, which at the time of the Pennsylvania rate revision no one foresaw, the present year would doubtless have established a new high level of prices and wages.

[32] Compiled from Rubinow's, "The Recent Trend of Real Wages," *American Economic Review*, 1914; Statistical Abstract of the United States, 1917; Hatch, The Labor Market Bulletin, February, 1919.

and then only for such jurisdictions as have fixed a low maximum of weekly compensation. In ordinary times, wage fluctuations from year to year are inconsiderable and the effect thereof upon pure premiums practically negligible. (See Fig. 1.) Between 1910 and 1915, *e.g.*, the increase in wage rates was about 16 per cent. The great bulk of wage earners in 1915 were still within the low maximum ($20 per week) fixed by the Pennsylvania statute, so that compensation cost would have increased almost *pari passu* with wages. The wage increase during the three years 1916–1918 was greater than the total for the preceding twenty-five years and carried a large proportion of wage workers, for the first time, beyond the Pennsylvania compensation maximum. Hence the propriety of a wage factor for converting pre-war to the post-war level.

VI.

The grounds for preferring a "graded" to a "flat" expense loading have been elsewhere expounded.[33] It only remains to set forth the practical application of the principle to Pennsylvania Compensation Insurance Rates.

Management expenses for stock companies were taken at 42.5 per cent. of gross premiums, distributed as follows:

TABLE VIII.

1.	Total. 2.	Proportionate to		
		Gross Rate. 3.	Pure Premium. 4.	Payroll. 5.
ALL EXPENSES	42.5	25.0	11.0	6.5
Acquisition.....	17.5	17.5	—	—
Taxes	5.0	5.0	—	—
Claim adjustment...	6.5	—	5.0	1.5
Inspection	3.5	—	2.0	1.5
Audits.....	2.0	—	—	2.0
Home office	6.5	1.0	4.0	1.5
Profits.....	1.5	1.5	—	—

From this distribution are obtained the values of A, E and K in the formula:

$$(1) \qquad R = \frac{\pi(1+E)+K}{1-A},$$

[33] Woodward, "Provision for Expenses in Workmen's Compensation Premiums," *Proceedings*, III, 140–148, and discussion, IV, 135–147; Downey, "The Making of Rates for Workmen's Compensation Insurance," *Journal of Political Economy*, XXV, 974–981.

wherein R is gross rate, π is pure premium, and E, A and K are the fractional expense ratios proportionate, respectively, to pure premium, gross rate and payroll. Since the total average expense loading is 42.5 per cent., E, which is 11 per cent. of gross rate (Column 4) is 19 per cent. of pure premium. Since, moreover, the average gross rate is known to be \$1.00, K (Column 5), is \$.065 per \$100 of payroll or, with the addition of the catastrophe pure premium, \$.075. Applying these values to formula (1) we have:

$$(2) \qquad R = \frac{1.19\pi + \$.075}{.75},$$

which reduces to $1.58\pi + \$.10$. But pure premiums were obtained at the 1916 level, whereas rates were to be projected for 1919. The conversion factor, as already explained, was taken at 1.05. With this modification the rate projection formula becomes:

$$(3) \qquad R = 1.67p. + \$.10,$$

where p = 1916 pure premium.

The resultant gradation of expense loading is illustrated by the accompanying graph. It will be observed that the grading is very steep at the lower and practically nil at the upper end of the scale. Low rates, accordingly, are sharply increased; high rates are moderately reduced. A flat loading of the same average amount would give a rate of \$.17 with a \$.10 pure premium, of \$3.49 with a \$2.00 pure premium, and of \$5.22 with a \$3.00 pure premium. The corresponding graded rates are \$.26, \$3.28 and \$4.87.

VII.

The classification experience was presented upon a form which showed for each state the payroll, the losses distributed into death, permanent total, permanent partial, temporary, and medical benefits, the number of compensatable accidents classified by severity of injury, and the partial and total pure premiums for the combined experience reduced to the Pennsylvania 1916 level. There was likewise a form for each industry group which gave the combined payrolls and partial pure premiums for each classification and for the group total, and separately, the group total of Pennsylvania payrolls and partial pure premiums. A complete set of classification and group sheets, typewritten and bound in con-

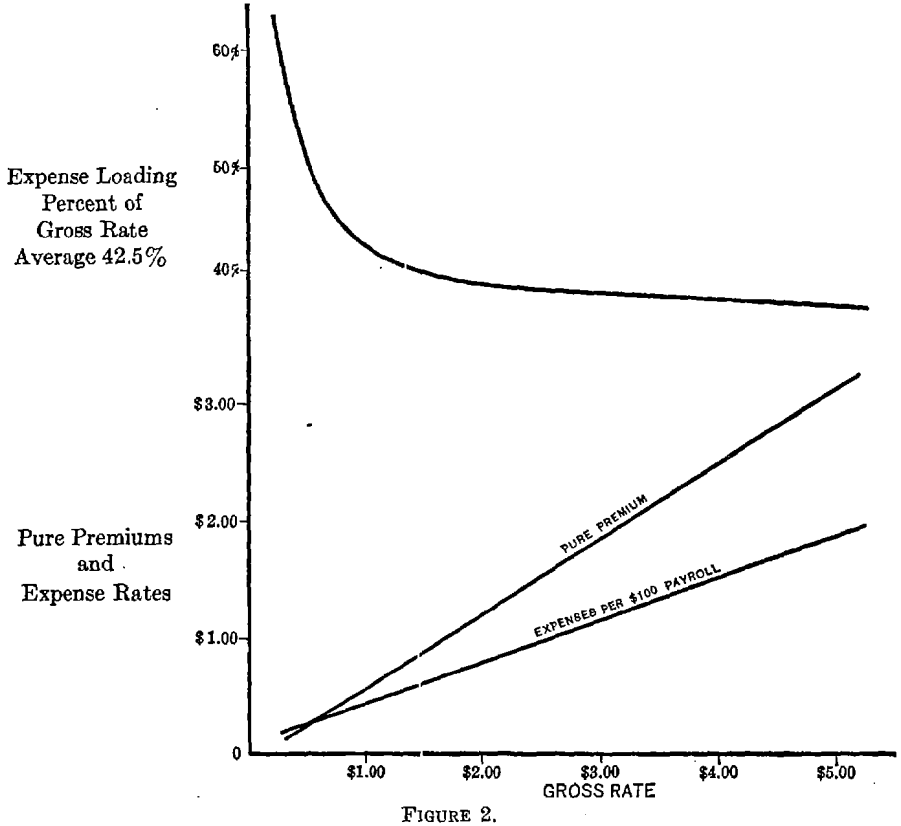


FIGURE 2.

EFFECT OF GRADED EXPENSE LOADING.

venient form, was furnished tc each member of the Classification Committee. The resultant saving of committee time very much more than covered the cost of this somewhat elaborate tabulation.

VIII.

Compensation insurance manuals have been printed in many forms—as an alphabetical list of classifications, from "abdominal truss manufacturing" to "zinc smelting," alphabetically within industry schedules,[34] and by industry groups with alphabetical index. The last-mentioned arrangement was probably suggested

[34] A familiar arrangement in employers' liability manuals, wherein the "state differentials" often varied from schedule to schedule.

to American manual makers by the Manual of the Swiss Accident Insurance Institute;[35] its use has been urged upon the National Reference Committee by Messrs. Woodward, Magoun and others, and it was unanimously adopted by the Classification Committee of the Pennsylvania Bureau.

The principal advantage of the group, as against an alphabetical manual, are:

1. The bringing together of related classifications upon the same page, which admits of ready rate comparisons and facilitates the detection of errors and inconsistencies in the assignment of rates by bringing to bear thereon the criticism of agents, employers and home office underwriters.

2. The elimination, as independent classifications, of cross-references and petty subdivisions of the same industry or occupation.[36] Some six hundred classifications were, in this way, stricken from the Pennsylvania Manual.

3. The expression of classification limitations in the group head note which—apart from the notable saving of space—assures that any given qualification shall be applied to all closely related classifications. Good examples are the exclusion of founding, forging and woodworking from the machine shop classifications, the exclusion of hot and cold rolling from the wire products classifications, and the inclusion of drivers and chauffeurs in the several classifications for fuel and material dealers. In the past, qualifications expressed for certain classifications have inadvertently been omitted from others covering similar industries or from cross references.

4. The affording of a cue to the intent of a classification by means of the group title. Thus the group title "wood turning" qualifies "woodenware manufacturing, N.O.C." in such a way as to indicate the exclusion therefrom of a risk whose output is a miscellaneous line of wood products in the manufacture whereof wood turning does not form a substantial element.[37]

[35] Woodward, "Premiums and Reserves of the Swiss Accident Insurance Institute," *Proceedings*, IV, 53.

[36] Such, *e.g.*, as "silo erection—metal," "cornice and skylight erection," "tank erection, metal—within buildings," "corrugated iron buildings, erection," "coppersmithing—away from shop," "tinsmithing—away from shop" and "roofing—sheet metal."

[37] One risk formerly so classified manufacturers of children's sleds, baby fences, porch swings and "other wood novelties."

With respect to convenience for agents' use, it is probable that the group manual is more convenient to one who is conversant therewith than any alphabetical list. An alphabetical list, in fact, suffers from the two-fold limitation, that the same key-word will not occur to every user—few will remember to look under "circular looms" for "flexible piping" or under "insulators" for "slate pencils"—and that the indefinite multiplication of key-words (*i. e.*, cross references) leads to an indefinite extension of space. A good index should, of course, accompany the group manual; but this index should consist of key-words and references only, without the verbiage necessary to delimit manual classifications.

Compensation manuals have heretofore been burdened with a mass of matter pertaining to public liability insurance. It is probable that the compilation of a separate public liability manual would be to the advantage of all concerned. Risk classifications for compensation insurance are in great part irrelevant to public liability—there being, in general, no discoverable relationship between the hazard to employees and the hazard of passersby. In many cases, indeed, the basis of rates is totally distinct—area and frontage, number of seats, number of vehicles or number of floors. There results from the use of compensation classifications for public liability insurance a complicated system of rate symbols, symbol values, notes and references, difficult to interpret and laborious to use. The number of public liability rates is small and the list of relevant classifications would presumably be brief. The rates, moreover, are not dependent upon compensation benefits, so that a public liability manual might well be substantially uniform throughout the country. Such a manual, complete within itself, might readily be issued in a form convenient for binding in the same cover with the compensation manual. This suggestion is respectfully submitted to the bureau having jurisdiction thereover.

. . . . . .

The methods and results of the Pennsylvania Manual revision, 1918, have yet to approve themselves by the test of time. The actuarial procedure, however,—here the matter of chief interest—has already been adopted, in its leading features, by the National Actuarial Committee. It seems not inappropriate, therefore, to suggest that this procedure, so far as it undertakes to convert realized experience to the supposed current level, might well be simplified. Compensation insurance rate makers have come to depend,

in an unfortunate degree, upon theoretical modifiers of pure premium experience. "Age of act," "industrial activity," "wage level," "underestimate," and "merit reduction" factors[38] have been so piled one upon the other that rates have ceased to bear a close and consistent relationship to experienced pure premiums.[39] In good part, this over-extension of hypothetical multipliers has been a natural, if not inevitable, result of immature experience. So long as recorded exposures were limited, reserves of doubtful adequacy, benefits unstable, and the trend of compensation cost obscure, insurers were justified in adding an appreciable safety factor to the bare pure premiums. So long, moreover, as such need exists, actuarial computations, however fallible in themselves, are a safer, because a more systematic guide, than underwriting judgment alone. In part, also, pure premium modifiers have been made necessary by frequent changes in compensation benefits, and this condition is with us still. Yet, when all allowances are made, it may be questioned whether theoretical factors have not been too freely introduced in the vain and illusory attempt to keep rates abreast of current cost.

The attempt to reflect current cost in current rates is futile just because current cost can never be ascertained. Time is required to mature losses and to audit payrolls. The experience relied upon for current rate making is necessarily past experience and the features of the current situation which will serve to modify that experience have already changed before their effect can be determined. No sooner is an industrial activity factor injected into rates than a radical advance in wages alters the whole relationship of compensation cost to payrolls. By the time a corrective wage level factor has been established, wage levels have taken a downward trend.[40] In this game of hide and seek, accordingly, rates never do reflect current cost; it cannot even be said that the approximation is closer than would be obtained by reliance upon unmodified pure premiums, while the fluctuations from year to year are far more ex-

[38] In the Pennsylvania rate revision, 1918, only two modifiers—age of act and wage level—were used, and these nearly cancel each other ($1.4 \times .92 = 1.05$).

[39] Compare Downey, "The Making of Rates for Workmen's Compensation Insurance," *Journal of Political Economy*, XXV, 971–974.

[40] To judge from past experience with credit inflation, wages and commodity prices will maintain a permanently higher level than in the pre-war period, though how much higher it were bootless to conjecture.

treme. If the whole attempt to approximate current cost were frankly abandoned and rates based directly opon pure premium experience for, say the five years next preceding each annual revision, modified only for differences in compensation benefits[41]—it is almost certain that rates would be more stable and the long term results more satisfactory to all concerned.

[41] Mr. E. J. Bond cogently urged some such procedure at a recent meeting of the National Reference Committee.

WORK OF THE STATISTICS BRANCH, UNITED STATES ARMY.

BY

RALPH H. BLANCHARD.

The statistical problems of the United States Army during the present and passing war emergency have been characteristic of the organization and nature of war activities. The unprecedented extent, urgency and multiplicity of demands upon the military forces called for the development of a system of centralized and epitomized information for the chief executives of the Army with the least possible delay. The lack of such a system would have meant a disastrous failure of coördination of our activities among themselves and with the efforts of the Allies.

There was no ground work on which to build. The peace time army had been small and relatively inactive and the need of a modern statistical service had not made itself felt. Nor were there many sources of instructive figures in the past records of the army. Its work had not been such as to furnish a suitable basis for predicting the future. The immediately effective use of probabilities was largely precluded because of this lack of a basis in past experience.

It was seen that, in order to attain the greatest measure of usefulness, there should be organized a system of current information which would present a complete, vivid and compact picture of the progress and status of army activities. On the basis of such information pressure could be applied to accelerate lagging or urgently needed work and, as information accumulated sufficiently to indicate trends and relationships, increasingly adequate prophecies of accomplishment could be made. These prophecies could be used as a basis for promises and for future plans, while the current operating indices would furnish a check on fulfillment of promises and plans.

The War Department had no agency for such work at the time of our entrance into the war. But there was organized in the first

month of our participation, in the Council of National Defense, a division of statistics which established relations with the various bureaus of the War Department, securing from them regular reports on the progress of their work. Information obtained in this way was brought together in a weekly statistical report for the Secretary of War and, in addition, special studies were made from time to time on shipping, ordnance and aircraft.

In order that the War Department might have a central statistical bureau in its own organization it was decided to establish the Statistics Branch in the office of the Chief of Staff, this branch to have charge of the collection and presentation of all statistics of army work for the guidance of the Secretary of War, the Chief of Staff, and their associates.

Accordingly, those of the personnel of the statistics division of the Council of National Defense who had been immediately concerned with army statistics were transferred to the War Department. Several were given commissions, others continuing in a civilian capacity. The chief of the division was made Chief Statistical Officer of the newly created branch.

The weekly summary report on War Department activities was continued. Specialized sections of the branch were established to deal with important phases of the war program. Specialized reports were issued from time to time on personnel of the army; shipping; ordnance and chemical warfare; quartermaster and motor transport; signal, medical, engineers and construction; and the air service. There was also instituted a weekly statement of progress for the personal information of the President. Thus there was developed gradually a system of control statistics which enabled the executives responsible for the conduct of the war to learn with the least possible expenditure of time the absolute and comparative accomplishments of their bureaus.

The lecture service of the statistics branch was another significant contribution. Regular conferences were held by War Department executives, by officials of the War Department and associated officials from other departments, and by congressional committees at which lectures were given by representatives of the branch. Figures and diagrams covering the work of each conference were presented on large wall charts, and their significance explained. These lectures assisted in furnishing a sound basis for discussion and in concentrating discussion on pertinent points.

The work of the branch can best be described by presenting some of the diagrams which were actually used in its reports and which served as a guide for the operation of the military organization. Those presented are but a small proportion of the whole number.

Strength of Divisions.

TABLE 7.

Strength of 15 Divisions Reporting from Camps in the United States November 1, 1918.

Division.	Location of Headquarters.	Officers.	Men.	Total.	Percentage of 28,164.
9	Sheridan	1,013	22,913	23,926	85
10	Funston	924	26,729	27,653	97
11	Meade	954	23,041	23,995	85
12	Devens	1,027	25,895	26,922	96
13	Lewis*	1,039	20,680	21,719	77
14	Custer	1,059	20,755	21,814	77
15	Logan	710	11,526	12,236	43
16	Kearny*	762	11,196	11,958	42
17	Beauregard	469	5,520	5,989	21
18	Travis	788	11,989	12,777	45
19	Dodge	888	11,940	12,828	45
20	Sevier*	506	8,769	9,275	33
95	Sherman	564	6,816	7,380	26
96	Wadsworth	245	1,051	1,296	5
97	Cody	368	3,064	3,432	12
Total		11,316	211,884	223,200	53

* No written report, telegraphic figures used.

Percentage of Authorized Strength.

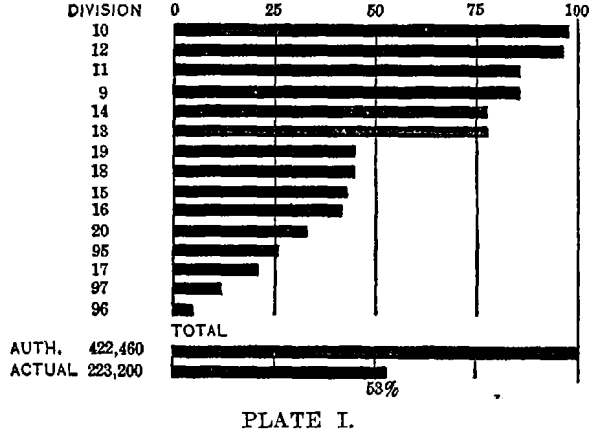


PLATE I.

LENGTH OF SERVICE IN DIVISIONS.

TABLE 24.

LENGTH OF SERVICE OF ENLISTED MEN IN DIVISIONS IN UNITED STATES NOVEMBER 1, 1918.

(From telegraphic reports.)

Div.	Location.	Total Men Reported.	Length of Service.						Total Officers Reported.
			Over Three Months.		One to Three Months.		Less Than One Month.		
			Number.	Per Cent.	Number.	Per Cent.	Number.	Per Cent.	
9	Sheridan*.	22,997	16,653	72	6,311	28	33	0	1,014
10	Funston...	26,833	23,528	88	3,299	12	6	0	937
11	Meade	18,979	14,118	74	4,773	25	88	1	739
12	Devens....	20,290	17,315	85	2,974	15	1	0	717
13	Lewis.....	20,680	13,308	64	7,362	36	10	0	1,039
14	Custer	20,127	15,159	75	4,945	25	23	0	1,051
15	Logan†...	11,526	8,439	73	3,086	27	1	0	710
16	Kearny ...	11,196	7,654	68	3,451	31	91	1	762
17	Beauregard	5,520	3,234	59	2,282	41	4	0	477
18	Travis	11,462	9,912	86	1,550	14	—	0	751
19	Dodge	9,265	5,211	56	3,967	43	87	1	588
20	Sevier	8,769	8,379	96	383	4	7	0	506
95	Sherman ..	6,817	3,318	49	3,492	51	7	0	564
96	Wadsworth	1,061	991	93	70	7	—	0	245
97	Cody‡....	1,190	907	76	283	24	—	0	222
Total		196,712	148,126	75	48,228	25	358	0	10,322

* Includes 9th Field Artillery Brigade and Ammunition Train at McClellan.

† Includes 15th Field Artillery Brigade at Stanley and 215th Engineers at Humphreys.

‡ Does not include 172nd Field Artillery Brigade and 322nd Ammunition Train at Jackson and en route.

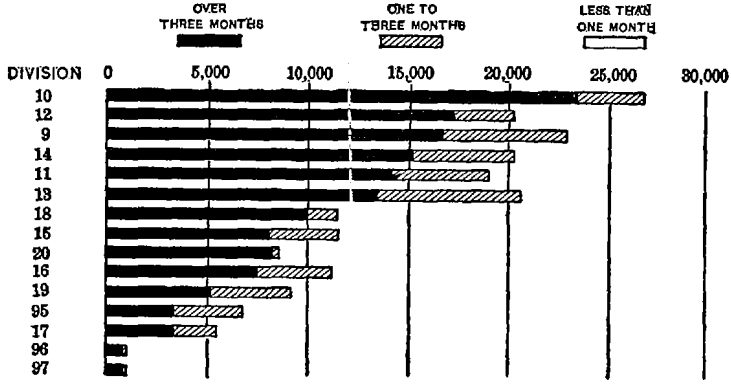


PLATE II.

They have been selected as a representative collection, covering a wide range of subject matter and of methods of presentation.*

Of first importance to the Army was the question of personnel. Several pages of the weekly report and an extensive semi-monthly report were devoted to this subject. Plates I and II show the status

DISCHARGES *vs.* ARRIVALS FROM OVERSEAS.

A comparison of discharges and arrivals by weeks indicates that by late in February the bulk of home units had been demobilized and that since then discharges have been largely among troops returned from the A.E.F.

Source of information: Miscellaneous Division, Adjutant General's Office; Transportation Service, Purchase, Storage and Traffic Division, General Staff.

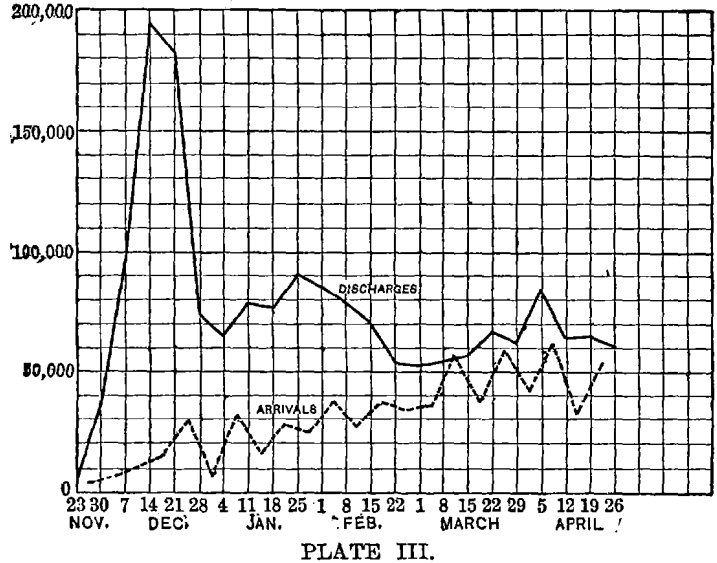


PLATE III.

of divisional organizations in the United States on November 1, 1918, Plate I indicating their development in terms of strength and Plate II in terms of experience. Diagrams of this sort served as a basis for planning the movements of men overseas and the drafting of new men into the army.

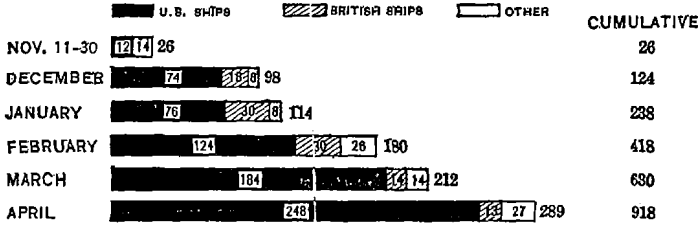
* For presentation to the army executives each of the diagrams used in this paper was combined with typewritten text and/or tables, photostated and the photostatic sheets bound together to make a complete report. Each "Plate" represents one page of the report and differs somewhat from the original as text and tables are set in type, a positive rather than negative method of reproduction is used, and the size is reduced.

When the Armistice had been signed and problems of demobilization were uppermost, diagrams were regularly presented to show progress in this work. Plate III indicates the progress of demobilization and the source of discharges.

Plate IV reproduces the diagram and table used to summarize the movement of troops homeward, showing the rapid acceleration of the movement and the increasing importance in its accomplishment of ships flying the United States flag.

TROOPS EMBARKED FROM A.E.F.—BY MONTH, PERIOD, AND FLAG OF TONNAGE.

Thousands of troops embarked since November 11, 1918, including officers, enlisted men, nurses and civilians.



TROOPS EMBARKED FROM A.E.F. BY PERIOD AND FLAG.

	U. S.	British.	French.	Italian.	Other.	Total.
Nov. 11–20	5,377	8	—	—	—	5,385
" 21–30	6,813	13,992	—	—	—	20,805
Dec. 1–10	18,080	7,014	—	—	—	25,094
" 11–20	18,226	5,693	3,721	—	—	27,640
" 21–31	37,078	5,677	11	—	2,130	44,896
Jan. 1–10	26,999	9,887	883	—	—	37,769
" 11–20	26,237	6,671	1,164	1,776	—	35,848
" 21–31	23,070	13,349	422	3,226	—	40,067
Feb. 1–10	48,336	6,228	5,342	3,777	4,805	68,488
" 11–20	35,222	7,000	4,868	—	—	47,090
" 21–28	40,535	16,820	1,419	1,662	3,975	64,411
Mar. 1–10	45,187	3,094	4,125	1,837	3,172	57,415
" 11–20	75,668	1	1,372	—	1,880	78,921
" 21–31	62,902	10,463	287	1,749	—	75,401
Apr. 1–10	50,678	4,808	619	3,272	2,269	61,646
" 11–20	124,100	7,874	1,740	4,038	1,636	139,388
" 21–30	72,985	—	2,874	6,650	5,176	87,685
Total	717,486*	111,586	28,847	27,987	25,043†	917,949
Per cent. of total	78	13	3	3	3	

* Includes 16,314 troops carried on German ships taken over since the armistice.

† Represents Dutch ships carrying 14,313, Austrian 5,541, Swedish, 2,082 and Spanish 3,107 troops.

PLATE IV.

These past performances combined with collateral information furnish the basis for estimates of future troop-carrying capacity presented in Plate V.

ESTIMATED CARRYING CAPACITY U. S. FLAG TROOP TRANSPORTS—BY MONTH AND TYPE.

The figures show the embarkation capacities in thousands of men it should be possible to offer France for sailings in each month. Carrying capacity obtained from Allied and neutral ships will be additional to that shown below. Estimates revised as of May 14, 1919.

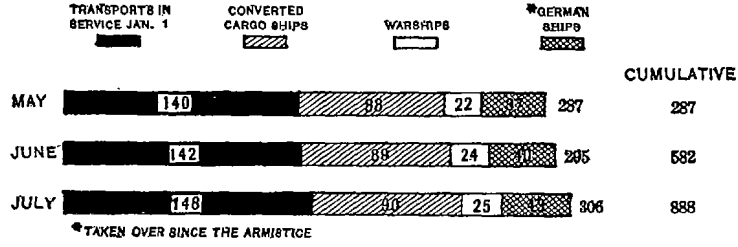


PLATE V.

Plate VI is a particularly interesting example of the methods used to follow the supply of equipment. This diagram deals with aeroplanes of the De Havilland 4 type, serving as a check on estimated production and on the fulfillment of production requirements. In addition, a "Floated" curve shows the number of planes actually loaded on vessels for transportation overseas.

De Havilland 4 Planes.

De Havilland 4 Planes Delivered and Floated to November 1.

Estimated production is based on schedule of July 12, 1918; cabled requirements on incoming cable S.O.S. 208.

Source of information: Incoming cable S.O.S. ‡208; Program and Statistics Department, Bureau of Aircraft Production.

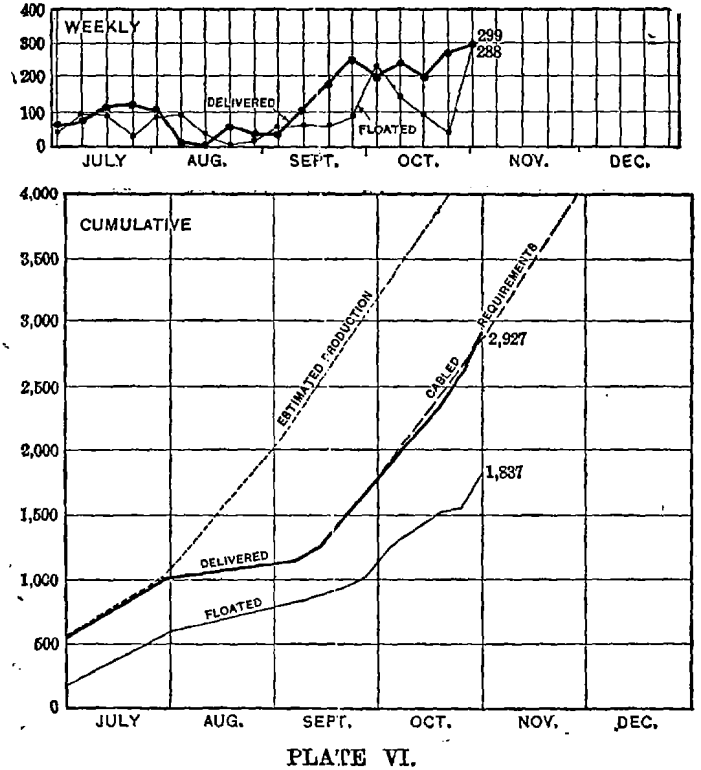


PLATE VI.

Facilities to care for sick and wounded under normal and crisis conditions and the actual use of such facilities are covered by the diagram in Plate VII. A similar diagram was used for hospitals in the United States.

BEDS IN BASE HOSPITALS—A.E.F.

SITUATION, OCTOBER 12.

Source of Information: Statistics Branch, General Staff, S.O.S., A.E.F.

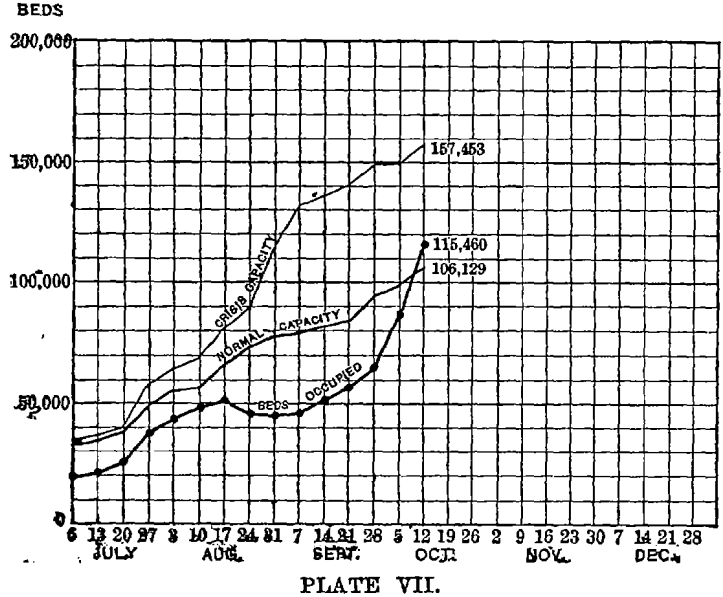


PLATE VII.

Statistics dealing with the health of the army have occupied a place of peculiar importance. The diagrams on this subject, Plates VIII to XI, inclusive, are self-explantory.

Deaths from Disease, Annual Rates Per Thousand, U. S. and A.E.F.

Source of information: Current Statistics Section, and Medical Records Section, Division of Sanitation, Medical Department.

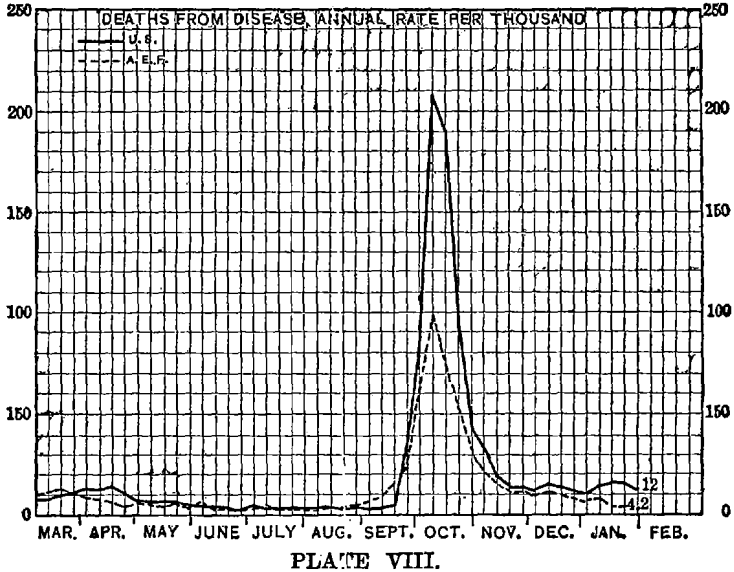


PLATE VIII.

DEATHS FROM DISEASE, BY DISEASES.

Proportion of deaths caused by the more important diseases, computed for 46,836 of the 54,249 deaths from disease which occurred in the Army from the beginning of the war to the latest date reported.

Source of information: Current Statistics Section, Medical Records Section, Division of Sanitation, Medical Department.

Disease.	Deaths.
Pneumonia	38,290
Cerebrospinal meningitis	1,935
Influenza	1,367
Tuberculosis	828
Empyema	458
Typhoid fever	177
Scarlet fever	161
Measles	115
Other	3,505
Total	46,836

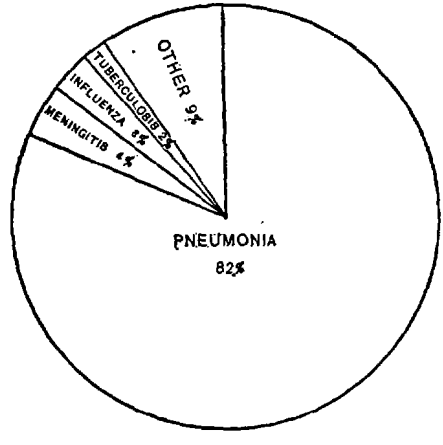


PLATE IX.

New Cases of Influenza and Pneumonia, Total in Army in U. S.

Data from Sanitation Division, S.G.O. Daily from September 19, to October 30, 1918.

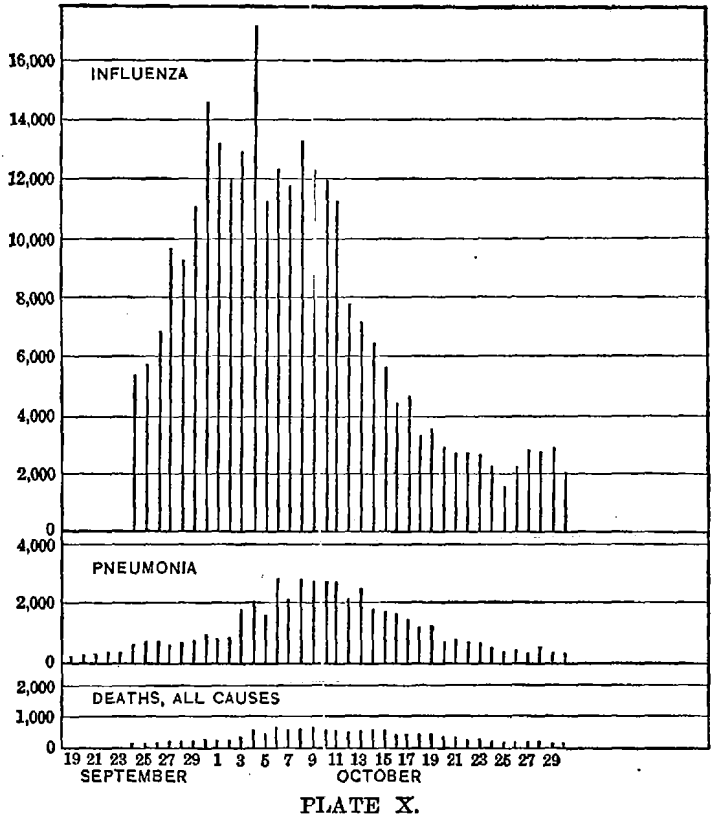


PLATE X.

INCIDENCE OF TYPHOID FEVER IN THE UNITED STATES AND THE A.E.F.

For week ending January 23, 85 new cases of typhoid fever were reported in the A.E.F. The present rate is strikingly high, being greater than has previously obtained in the United States or in the A.E.F. during the war.

Source of information: Current Statistics Section and Medical Records Section, Division of Sanitation, Medical Department.

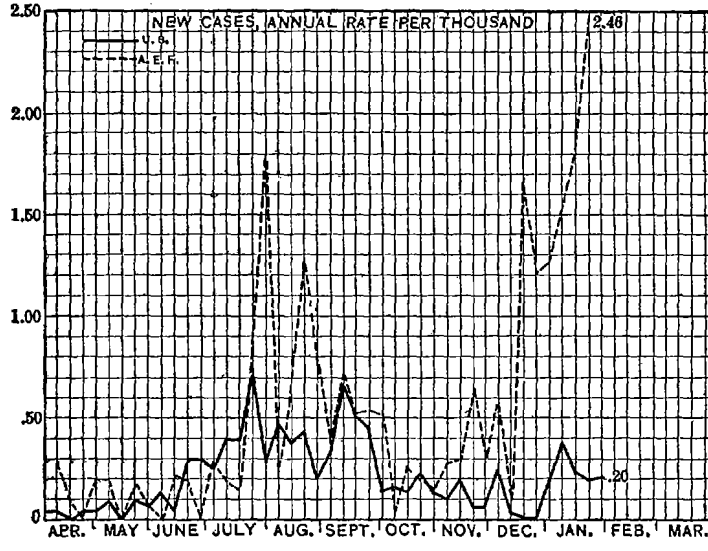


PLATE XI.

Studies are now being made, on the basis of tentative plans, to determine the availability of supplies for the equipment of a standing army. Plate XII details information on items of clothing and equipage.

SURPLUS CLOTHING AND EQUIPAGE IN THE UNITED STATES.

Estimated amounts on hand September 30, 1919, of important items of present clothing stock in the United States and number of years' maintenance of each item for an army of 500,000 men. Requirements to September 30, 1919, figured on the following basis:

1. Stock figures as to February 1, 1919.
2. Actual strength of the Army to May 1, and thereafter 500,000 enlisted men.
3. Rate of consumption as estimated by the Office of the Quartermaster General, September 7, 1918, making no allowance for reclamation.
4. Surplus clothing overseas September 30, 1919, shown in last week's report, not included in this estimate.

	Figures in Thousands.		Years, Stock on Hand Sept. 30 would Maintain 500,000 Men.
	Estimated Requirements to Sept. 30.	Estimated Stock Sept. 30.	
Undershirts, summer	1,250	30,593	20.4
Gloves and mittens, leather	348	8,812	17.6
Drawers, summer	1,250	23,970	16.0
Belts, waist	214	3,588	14.4
Drawers, winter	444	12,998	13.0
Coats, cotton	413	6,362	12.7
Undershirts, winter	444	11,445	11.5
Breeches, cotton	833	9,298	9.3
Blankets, all kinds	426	4,974	8.9
Stockings, wl., light	1,240	21,574	8.6
Coats, denim	323	2,589	6.9
Overcoats	220	1,656	6.6
Boots, rubber	43	323	6.5
Stockings, wl., light	890	15,092	6.0
Coats, wool	426	2,943	5.9
Leggins, canvas	860	5,726	5.7
Shoes, marching	1,291	7,599	5.1
Breeches and trousers, wl.,	860	4,380	4.4
Trousers, denim	426	2,197	4.4
Shirts, flannel	1,291	4,820	3.2
Raincoats, ft. and mtd	426	1,409	2.8
Hats, service	860	2,173	2.2
Puttees, wl., spiral	0	2,618	
Caps, overseas	0	755	NOT ISSUED IN THE UNITED STATES
Jerkins	0	592	
Mackinaws	0	124	

PLATE XII.

Contracts have been placed with a view to our continued participation in active warfare. These are now being cancelled as rapidly as possible in the interests of economy. Progress along this line is shown by the diagram in Plate XIII.

STATUS OF CONTRACTS, BY BUREAS, APRIL 12, 1919.

Value of contract terminations and deliveries in per cent. of contracts outstanding November 9, 1918.

Terminated contracts as shown represent canceled and suspended contracts now in the process of liquidation. The saving that will result from terminations depends on the amount paid contractors in settlement.

Only 9 per cent. of the contracts in effect November 9, 1918, now remain outstanding.

Source of information: Office of the Director of Purchase and Storage; Office of the Director of Army Air Service; Ordnance Department.

PER CENT. OF CONTRACTS OUTSTANDING NOVEMBER 9, 1918.

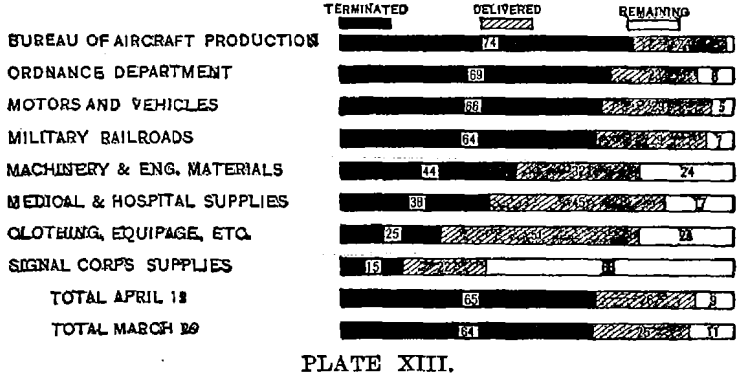


PLATE XIII.

Transatlantic tonnage under army control increased rapidly from the beginning of the war and decreased rapidly after January 1, 1919. Plate XIV shows the development of the fleet as a whole and the relative development of various classes of tonnage.

Transatlantic Tonnage Under Army Control—by Month and Type.

Total tonnage under Army control exclusive of Cross-channel Service and British Loan.

Cargo ships authorized for release are regarded as out of operation upon arrival in home ports. Similarly, cargo ships for conversion to troop ships are classified as troop ships upon arrival in home ports.

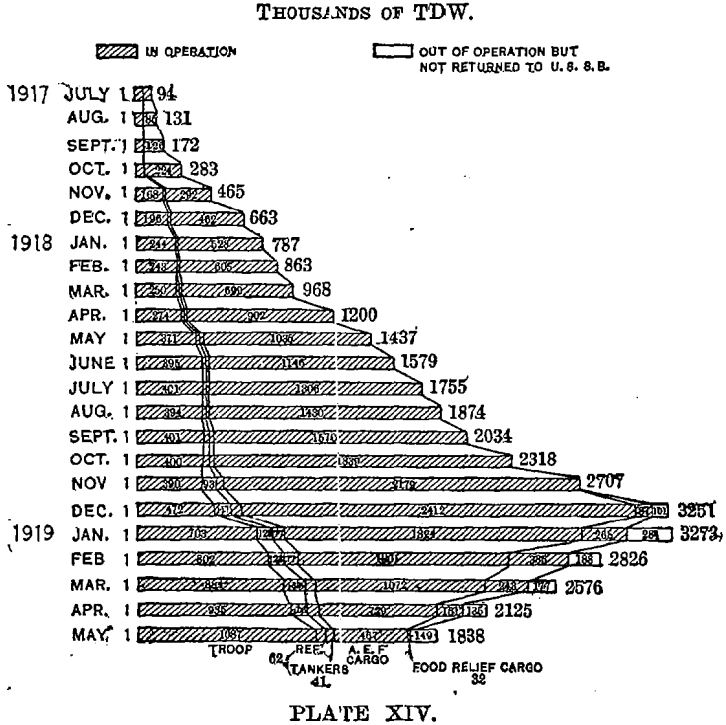


PLATE XIV.

The relation between shipping tonnage lost and built during the war was carefully followed, for on the net results of these two opposing factors depended in large degree the ability of the United States and the Allies to maintain forces at the front. Plate XV presents the situation from month to month.

ALLIED AND NEUTRAL SEAGOING TONNAGE—LOST AND BUILT.

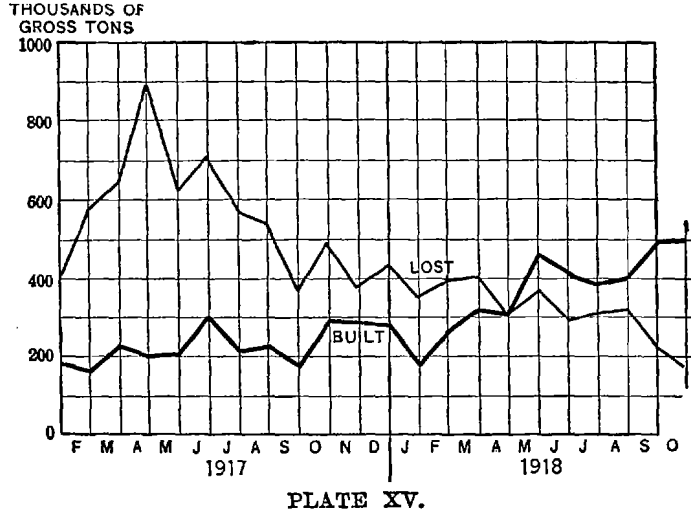
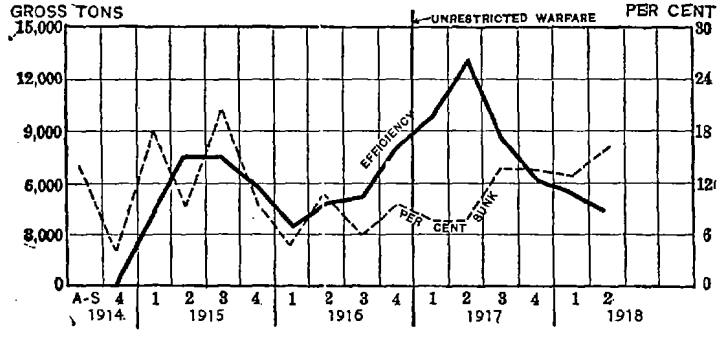


PLATE XV.

The curbing of submarine effectiveness was a large element in the reduction of tonnage losses. This was done both by destroying submarines and by developing means of protection from their activity. Plate XVI indicates the success of efforts in these directions and their relation to the declaration of unrestricted submarine warfare by Germany.

PER CENT. OF SUBMARINES SUNK *vs.* MERCHANT TONNAGE SUNK PER SUBMARINE.

Number of submarines sunk per 100 available at beginning of period and gross tons of merchant ships sunk by submarines per submarine available at beginning of period.



Period.	Submarines Sunk per 100 Available.	Tonnage Sunk per Submarine Available.
1914—Aug.-Sept.	14	
4th	4	113
1915—1st	18	4,010
2d	9	7,590
3d	21	7,610
4th	10	5,930
1916—1st	5	3,620
2d	11	5,000
3d	6	5,350
4th	10	8,280
1917—1st	8	9,940
2d	8	13,200
3d	14	8,560
4th	14	6,260
1918—1st	13	5,410
2d	16	4,420

PLATE XVI.

As an aid in determining the force which could be maintained overseas as estimate was made of the amount of cargo it would be possible to ship each month to January, 1920. This estimate is graphically presented in Plate XVII.

CARGO THAT CAN BE LIFTED FOR THE ARMY—THOUSANDS OF SHORT TONS—SEPTEMBER, 1918, TO DECEMBER, 1919.

These figures are taken from "An Estimate of Tonnage Available for the Transport of Trans-Atlantic Army Cargo," by Donald Scott, Central Bureau of Planning and Statistics. The figures are based on the estimates of probable ship production given in charts, pages 61 and 62, of this report, and on the maintenance of our essential import services. The estimates allow for enemy action and marine losses and basic turnarounds of 70 days for old ships and 77 days for new ones. The turnaround figures are increased by 10 per cent. during the winter months and six additional days are allowed for ships going to Marseille. Ships over 5,000 TDW are assumed to lift 66 per cent. of their TDW; ships under 5,000 to lift 55 per cent.; and ships in animal service to lift 46 per cent. of their TDW.

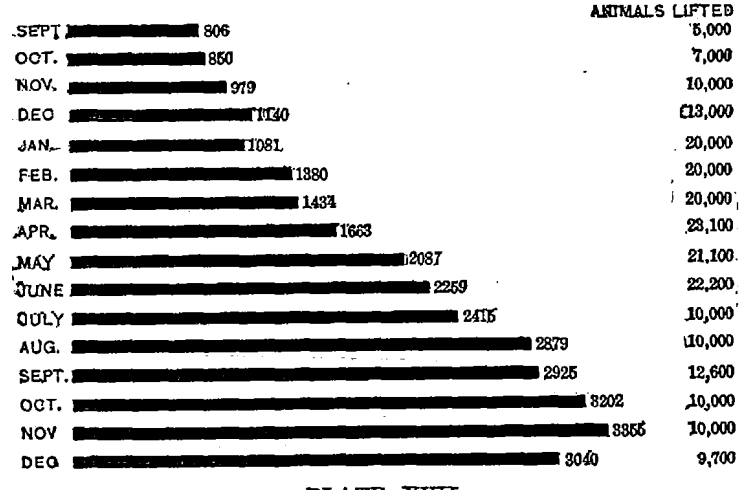


PLATE XVII.

There are two principal indices of efficiency in the operation of ships, amounts carried on each trip and rapidity of movement. Given ideal conditions a cargo ship can be loaded to carry about 75 per cent. of her deadweight tonnage. Plate XVIII shows the percentage of deadweight tonnage actually carried by month, indicating that efficiency of loading was at its highest point during the time of greatest pressure for the shipment of supplies.

PER CENT. OF TDW LIFTED BY CARGO TRANSPORTS—BY MONTH.

The figures represent the percentage that the long tons of cargo were of the total deadweight. Small transports for cross-channel service, refrigerators, British loaned ships, and Food Relief ships are excluded.

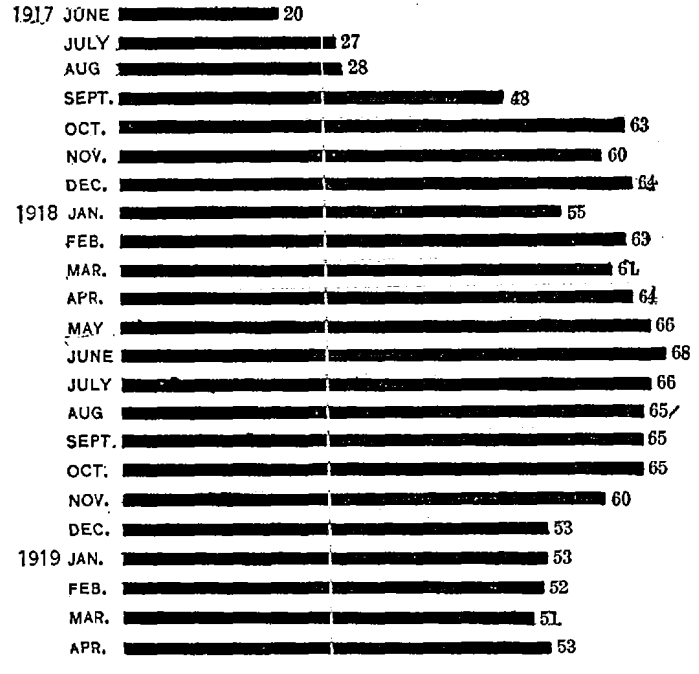


PLATE XVIII.

The rapidity of movement of ships as an index of efficiency is made the basis of the diagrams in Plates XIX and XX. The "turnaround" represents the time elapsing between two departtures from the United States. The "stay in port" represents the time elapsing between entrance to, and departure from, a port.

TURNAROUNDS OF ARMY TRANSPORTS.

Effective average in days for the last ten ships sailing in each weekly period. The effective average represents the harmonic mean.

On March 24, the first 4 converted cargo ships to sail from U. S. ports had completed turnarounds with an effective average of 42 days; on March 31, 8 such ships had completed turnarounds with an effective average of 45 days.

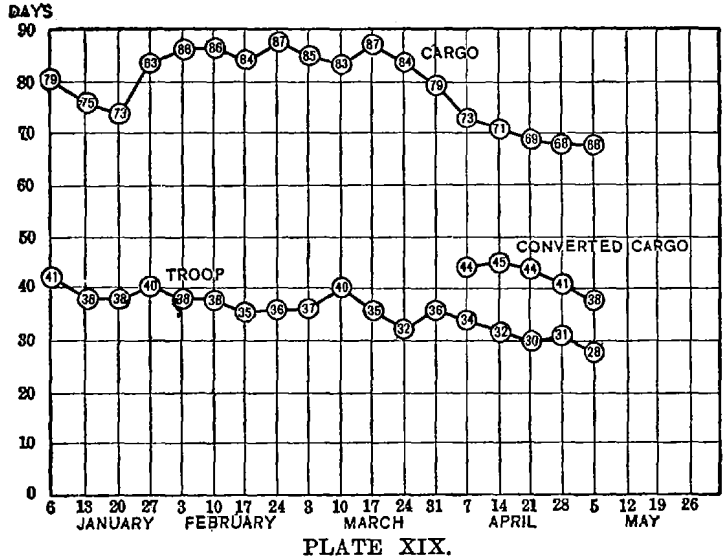


PLATE XIX.

AVERAGE STAYS IN PORT OF ARMY TRANSPORTS.

Days Spent in Port by last ten ships to leave in each Weekly Period.

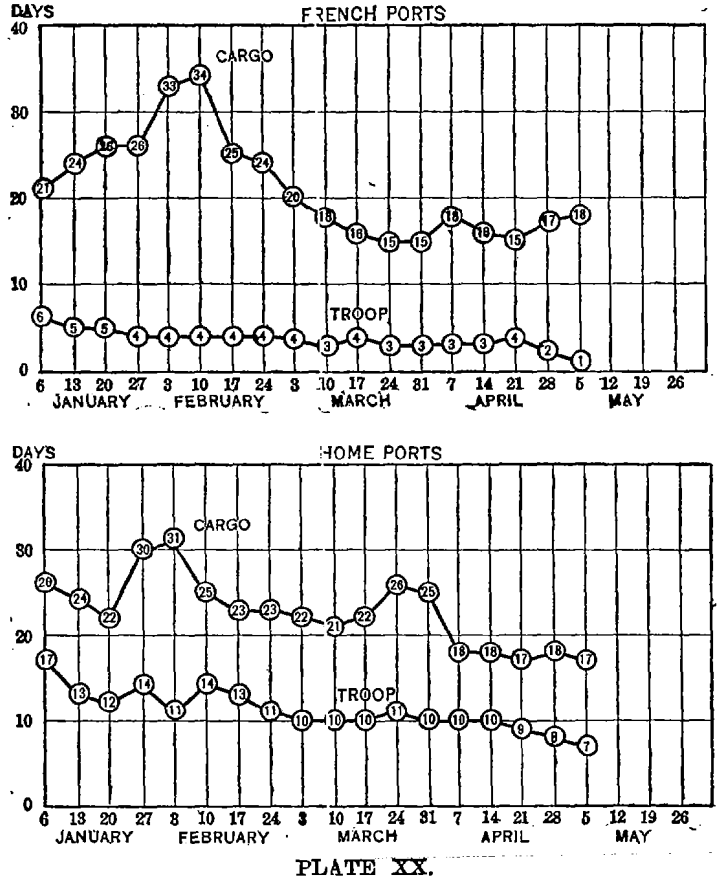


PLATE XX.

No attempt has been made to deal with the practical operations of which the diagrams presented are a history and for which they served as a guide. It has rather been attempted to indicate, by concrete examples, the methods through which the Statistics Branch of the Army contributed to the efficiency of centralized control of military operations. The Branch has acted as a coördinating and guiding agency in a task which would have been, if not impossible, certainly much more difficult without its help.

LEGAL NOTES.

BY

RICHARD FONDILLER.

(OF THE NEW YORK BAR.)

ACCIDENT AND HEALTH.

STANDARD PROVISIONS—RISK EXCEPTED BY RIDERS—(Hopkins *vs.* Connecticut General Life Ins. Co., Court of Appeals of New York, 121 N. E. Rep. 465.) The insured held an accident policy for $40,000 in the defendant company, covering death caused by the burning or wrecking of a vessel on which he was a passenger. The rider attached to the policy excepted loss caused in any manner by any of the belligerents in the World War. Delivery of the policy by the agent was conditioned upon the insured signing the rider, which he did. The insured was drowned when the *Lusitania* was torpedoed.

The policy form had been approved by the New York State Insurance Department, but as the rider had not been filed for approval, the plaintiff (beneficiary) maintained that the insurance company was liable.

Because of the clarity of the court's well reasoned opinion, in which the court found for the defendant, a number of extracts are given.

"This section (107 of the New York Insurance Law) is entitled 'Standard Provisions for Accident and Health Policies.' It largely consists of standard provisions with regard to the details of the insurance contract which must be contained in every policy together with certain optional standard provisions both of which are principally for the protection of the rights of the insured. It is not said, nor was it the intention to say, that the policy should contain only these standard provisions. Unlike the standard form of fire policy prescribed by section 121 of the same law, they are not exclusive. There is no statement as in the case of fire policies that no agreement not contained in the standard provisions shall be made. Like the standard provisions in life policies (section 101), they are to be contained in every contract of insurance, but they form simply a part, not the whole, of such contract. Two rules,

however, are laid down. No policy and no rider to a policy shall contradict, vary, or alter these standard provisions; and no policy shall be issued until a copy of its form shall have been filed with the superintendent of the insurance department for the purpose of enabling him to determine if it complies with the law. The rider in question does not contradict or vary any of these standard provisions."

The court then holds that riders must also be approved by the state insurance department, since all riders are a part of the policy.

"No corporation issuing a policy may escape liability because of its failure to obey the law. But what is the position of the insured? Clearly as to him the standard provisions are a part of his contract. If it contains clauses contradicting them, they may be ignored. . . . But it does not follow that, where the whole or a part of a policy has not been filed, the insured may recover upon a contract never made by him and which the statute does not say he shall be held to have made. The statute says the contract is valid—not simply valid as against the insurer. It is to be construed in a certain way, but the question of construction has no relation to this particular default. Nor have the rights and obligations of the parties. They are fixed by the standard provisions and by the regulations as to what the policy shall or shall not contain and the regulations as to the form required so the insured may have notice of its contents. They are not determined by the decision of the superintendent as to whether the policy complies with the law. . . . Here the statute itself says they shall not be void but valid. Neither is there conflict between the provisions of the rider and the provisions of the statute. It is suggested that the statute provides that the classification of risks mentioned in the policy shall mean only those last filed with the superintendent, and that this rider changes this classification without authority. This is not the meaning of the term "classification of risks" in insurance practice. That relates, not to the perils insured against, nor to the amount to be paid, but in fire insurance to the nature and situation of the articles insured; in accident insurance, to the occupation of the applicant. So in this policy it is said, 'Albert Lloyd Hopkins, under classification referred by occupation as president.' This classification was in no wise altered by the rider. The policy which is valid is the contract as the parties have agreed upon it, so far as it is consistent with the statute—not the contract as changed and altered by the excision of some of its provisions. What if no part of a policy defining the risks insured against had been filed? Are only the standard provisions which the law says shall be inserted in every policy to be enforced? In themselves they form no complete contract.

"The plaintiff also questions the validity of the rider under the standard clause that—

'No change in this policy shall be valid unless approved by the executive officer of the insurer and such approval be indorsed thereon.'

"There are two answers to this claim. This clause is for the benefit of the company and may be and was waived by it. Further, the policy was not changed. At its inception it included the rider. All the papers together constitute the policy, and it is as agreed upon by the parties. This is the agreement which the agent was expressly authorized to make, and he was prohibited from making any other. The policy never had any existence except as it contained the agreement in the rider. . . .

"A further objection (by the plaintiff) is made that, under the statute, it is provided that no policy shall be issued, unless such portion of the policy as purports by reason of the circumstances under which a loss is incurred to reduce any indemnity promised therein to an amount less than that provided for the same loss occurring under ordinary circumstances shall be printed in bold-face type and with greater prominence than any other portion or text of the policy. It is said that the rider comes within this clause and is not printed in bold-face type. We cannot agree with this contention. The rider does not in any sense reduce an indemnity provided for in the policy. It speaks of a case in which the policy does not apply. It is simply a limitation of the risk. Such is evidently the construction adopted by the insurance department, for a rider regarding hernia is in the same type, and, as it was filed, it must have met the approval of the superintendent."

EVIDENCE DEFEATS RECOVERY:—(North America Acc. Ins. Co. *vs.* Hill's Admx., Court of Appeals of Kentucky, 206 S. W. Rep. 170.) The insured had an accident policy, the principal sum of which was payable for the loss of his life,

"Provided such loss shall result from bodily injuries inflicted through external, violent, and accidental means, and solely and independently of all other causes, within thirty (30) days of the event causing such injuries, and only if such injuries shall occur: While actually riding as a passenger in a place regularly provided for the transportation of passengers only, within a railroad car, elevated, subway, or interurban railroad car, street car or steamboat, provided by a common carrier for passenger service."

His widow sued the insurance company, alleging that an accident had occurred to the insured, a traveling salesman, within the terms of the policy. The jury brought a verdict in for the amount claimed by the widow. The case was appealed by the company to this court, which found two grounds, both of evidence, which warranted a reversal of the judgment.

First: The family physician was asked as a witness what the deceased had told as to the accident, and answered,

"That while he was boarding a train the train started off suddenly, throwing him violently, and as to him falling on the grip, or the grip falling on him, I don't exactly recollect; I know the grip he was carrying was the cause of his injury indirectly."

In commenting upon this evidence, the court says in its opinion:

"By this answer the deceased himself was made to testify, not only as to the way and manner of receiving his injuries, but also that they were received while deceased was traveling upon a passenger train in a coach provided for that purpose, thus bringing the accident directly within the terms of the policy; for, according to those terms if the accident had not been inflicted while the deceased was thus circumstanced, it would not be covered by the policy. It is a rule quite universally recognized that it is competent for a patient to give a history of his case to his physician, so as to enable the latter to render a proper diagnosis and give such treatment as the affliction demands. This, however, in the instant case, required no more than that the patient should have said to the physician that he had sustained an accident, wherein he fell upon his grip, or the grip fell upon him, naming the part of the body affected together with the symptoms following. It was by no means essential for any purpose that the place where the accident occurred should have been mentioned. Perhaps the statement as to the place where the accident was received might have been admissible, if made immediately thereafter, so as to bring it within the familiar doctrine of the res gestae rule, but, having been made after the lapse of 16 days, it was clearly incompetent. . . .

"It was competent to show by the physician what the deceased said concerning the manner in which he received his accident, and the place upon his body where it occurred, together with other injuries he received, as well as the pain and suffering he experienced; but it was wholly incompetent to show that the accident was received upon a passenger train, as this could furnish no possible information to the physician enabling him to any better diagnose or treat the case. It was a selfserving statement, purely hearsay, and admissible under no rule of practice known to us."

Second: The deceased's family physician testified the case was one of ascites, which could have been produced by such an accident as the deceased suffered. Two other physicians had operated to discover the cause of the deceased's illness. They found that he had a cancer (which is unrelated to ascites) of such a size that would require six months to grow, while the deceased had died within a month of the accident. On this point, the court wrote:

"If the ascites condition which Dr. Spitzlberger (deceased's physician) was of the opinion existed had been demonstrated by the operation, there might be room for contending that his testimony would have been sufficient to carry the case to the jury; but the operation developed that the patient's condition was not produced by the causes which he supposed to exist, but because of entirely different ones, which could not have been produced by an accident of such recent occurrence. We therefore conclude that the evidence was not only insufficient to authorize a recovery, but that it conclusively showed that the insured's death was produced from causes wholly independent of and existing prior to the accident. . . .

"Our conclusion is that insured's death was not produced by the accident which he sustained, even conceding that the accident did occur, and in such manner as to possibly and eventually bring about the conditions which the operation disclosed."

VOLUNTARY EXPOSURE TO DANGER:—(Archibald *vs.* Order of United Commercial Travelers, Supreme Judicial Court of Maine, 104 Atl. Rep. 792.) The defendant order issued to the plaintiff's husband a certificate of insurance, payable in the event of death through external, violent and accidental means. The certificate was issued subject to the constitution of the order, which provided that benefits under the certificate did not cover voluntary exposure to danger.

There was no dispute as to the facts, which showed that the insured was walking alongside a railroad track and was attempting to cross it when he was killed by the locomotive.

In holding that the plaintiff could not recover, the court wrote:

"This brings us to the interpretation of the clause 'voluntary exposure to danger.' What is its meaning as used in this contract of indemnity? A definition so accurate in detail and yet so comprehensive in scope as to meet all cases it is difficult, if not impossible, to formulate, and yet the essential elements can be stated.

"The term is not synonymous with lack of due care or contributory negligence. To give it that broad construction would make of an accident policy a delusive snare. Many of the accidents of life are attributable to the want of due care on the part of the injured person. They may result from inadvertence, from 'thoughtless inattention,' and yet they are within the contemplation of the contract. A mere passive negligence is not sufficient to constitute voluntary exposure to danger. It must ordinarily be active in its nature. The word 'voluntary' implies an act of the will.

"It may therefore be said, speaking generally, that to render one guilty of voluntary exposure to danger he must have intentionally done some act which reasonable and ordinary prudence would know

to be dangerous. The term implies both an intention to perform the act and a conscious willingness to take the risk which is obviously connected with it. The application of this definition to the case at bar brings it clearly within the inhibition.

"Mr. Archibald, in walking along the railroad tracks in the city of Lewiston, was voluntarily and unnecessarily walking in an admittedly dangerous place. The peril was open and plain, his exposure to it was voluntary, and he was injured by the very risk which he had chosen to take. The precise injury happened which there was reason to fear. The liability of passing trains was no hidden danger, but an apparent one. He was in fact a trespasser. . . . The company itself had posted a sign in that vicinity calling attention to the penalty under R. S. c. 57, § 67, for walking, without right, on the track or bridge. The fact that others were accustomed to take the same course is immaterial in this action against the insurance company."

"PASSENGER" TRAVELING ON A PASS:—(United States Casualty Co. *vs.* Ellison, Supreme Court of Colorado, 176 Pac. Rep. 279.) The plaintiff's accident policy covered injury sustained "while the insured was a passenger and was in or on a public conveyance provided by a common carrier for passenger service." The plaintiff had a railroad company as one of his clients and was riding on a pass on an automobile rebuilt so as to run on the rails when he was injured.

The evidence showed that the car was also used as a passenger car for hire and not exclusively for the officers or employees. The court held that the fact that the plaintiff was travelling on a pass did not change his status as a passenger, that being settled law in nearly every jurisdiction. It further held that attorneys are not employees in the ordinary sense of that term and hence that plaintiff was not an employee but a passenger. The plaintiff's trip was on the business of other clients as well as the railroad company, which latter did not change his status as a passenger of the railroad. The court affirmed the judgment in favor of the plaintiff.

"POISON VOLUNTARILY OR INVOLUNTARILY TAKEN":—(Riley *vs.* Inter-State Business Men's Acc. Assn., Supreme Court of Iowa, 169 N. W. Rep. 448.) The insured had an accident policy, which exempted the association from liability if death resulted from poison voluntarily or involuntarily taken. He went to a drug store to secure a patent medicine mixture to give him relief, and drank the mixture there. He died within an hour from strychnine, which

could not be accounted for, as the mixture did not contain any strychnine. It was admitted that the deceased did not voluntarily or intentionally take poison, but the association urged that the claim was not payable even if he took it involuntarily, as provided by the exemption.

In finding for the defendant association, the court concludes its opinion:

"Deceased could not have intended to take a fatal dose of strychnine. He did not voluntarily do so. Its presence in the mixture was unknown to him. There was no exercise of the volition or will in the act of taking the poison, except in so far as the same was a necessary part of the taking of the concoction. The poison was taken independently of his will or volition, and therefore involuntarily. Thus construed, the language employed in the exception contained in the policy is given its usual and ordinary meaning. We cannot therefore escape the conclusion that the poison contained in the mixture and which caused the death of deceased was involuntarily taken by him, and that the facts bring the case clearly within the exception of the policy, and that no recovery can be had thereon."

WHEN HEALTH INSURANCE BECOMES EFFECTIVE:—(Continental Casualty Co. *vs.* Hall, Supreme Court of Mississippi, 80 South Rep. 335.) The plaintiff (Hall) took out a policy of accident and health insurance, in which the accident indemnity became effective immediately upon delivery but the health indemnity was not effective until thirty days thereafter. The health insurance part of the policy provided that if indemnity were payable for less than fifteen days that no indemnity would be paid for the first three days. A special rider was attached, reading as follows:

"In consideration of the payment of an additional monthly premium of $.50, which is to be paid as is the premium of the policy to which this rider is attached, the company further agrees that in the event the insured shall sustain loss of time on account of disability caused by sickness or disease so that indemnity is payable therefor under the provisions of said policy, then such indemnity shall be payable from the beginning of such loss notwithstanding the provision of said policy that some certain number of days at the beginning of disability from sickness or disease shall not be covered.

"This rider is subject to all of the provisions and conditions of the policy to which it is attached. It takes effect upon issue and so long as said premium is paid it continues in force concurrently with said policy but not extending in any event beyond it. It is not valid unless countersigned by a policy writer of the company."

Hall became ill on the date of delivery of the policy, from which date he claimed that sick benefits were payable under the terms of the special rider quoted above.

The court held that the contract was not ambiguous and that the effect of the special rider was merely to make the indemnity payable for the first three days, where the period of disability was less than fifteen days. It also held that with the special rider attached, there still remained a period of thirty days after delivery in which the health benefits were not effective. At to the plaintiff's contention that the agent had represented that the health insurance became effective upon delivery of the policy, the court held that he was simply a special or soliciting agent and without authority to change the terms of the policy. Judgment was thereupon entered in favor of the defendant company.

BENEFIT FOR ACCIDENTAL HERNIA:—(Conrad *vs.* Interstate Life & Accident Ins. Co., Supreme Court of Tennessee, 206 S. W. Rep. 34.) The insured's accident and health policy contained the following provision:

"In the event of rheumatism . . . hernia . . . then in any such case . . . the limit of the company's liability shall be a sum not exceeding one month's indemnity within a period of twelve months."

The insured sustained an accidental hernia, upon which the defendant company paid him for one month's disability. The company maintained that the above clause relieved it from liability for further disability and refused to pay the insured any additional benefit.

The court commented upon this case being one of first impression in this state, although it had been frequently adjudicated by the courts of other states. It construed the above clause as applying only to hernia arising out of natural causes; as to accidental hernia, it held that the clause did not limit the benefit to one month. The opinion cites with approval from another jurisdiction that

"a provision in a policy that the insurance shall not cover injury or death from or due to hernia or rupture will not prevent a recovery for the death of the insured caused by rupture or hernia accidentally produced. . . . It is, of course, possible so to frame a hernia clause as to exclude liability from hernia caused by an accident. Thus . . . where the policy provided that 'where accidental injury results in hernia, . . . the amount payable shall be one-fourth of the amount

payable shall be one fourth of the amount which otherwise would be payable.'"

RENEWAL OF POLICY:—(Upton *vs.* Travelers Ins. Co., Supreme Court of California, 178 Pac. Rep. 851.) The plaintiff had renewed his accident policy in the defendant company from year to year until October 12, 1914, which was a legal holiday. He met with an accident the day thereafter and sought to recover on a number of grounds, as to each of which the court held in favor of the defendant.

While the Civil Code of the state allows of any act which falls due on a holiday, to be done on the following day, an accident is not declared by the policy to be an act. The insured never availed himself of the option of renewal, hence the policy was not extended to cover an accident on the following day; the existence of the option was insufficient to extend the period of insurance. The acceptance of previous renewal premiums after the time had expired was held not to operate as a waiver of the condition that premiums must be paid in advance. The policy provided that "no agent has power to waive any condition of this policy" and the insured had no right to rely upon the agent's promise to call at his house for the premium.

WORKMEN'S COMPENSATION.

PRINCIPAL LIABLE FOR DEATH OF SUBEMPLOYEE:—(American Steel Foundries *vs.* Industrial Board, Supreme Court of Illinois, 119 N. E. Rep. 902.) The American Steel Foundries (defendant) made a contract with one Malone, whereby the latter was to wreck a smokestack. Malone hired one Shaw to supervise the work, during the course of which Shaw was killed. The defendant had elected to come under the compensation act, and Malone had not taken out any compensation insurance and was solvent. The Industrial Board awarded compensation to Shaw's widow to be paid by the defendant.

The defendant appealed from the award, which was confirmed by the court, which held that under the terms of the hiring Shaw was not a partner but an employee of Malone. It also held that when a man is employed for one job only, that does not by itself make the employment casual, since the governing factor is the duration of service. Finally, the principal contention of the defendant that it

could not be held liable because the law applied only to cases where there was a contractor and subcontractor, is disposed of by the court in the following language:

"A reasonable construction of the language used leads to the conclusion that it was not the legislative intention to limit the liability imposed by the section to contractors. The main purpose of the Workmen's Compensation Act was and is to provide compensation for injuries sustained by employees engaged in hazardous work. Evidently realizing that some employers are financially irresponsible and that the provisions of the act would be of no benefit to the employees of such if their claims for compensation could be made only against their immediate employers, the Legislature embodied section 31 in the act, imposing liability for compensation upon every person who should contract with another to do or have done for him work enumerated in the act as extrahazardous, and who failed to require the one undertaking to do the work to insure his liability to pay the compensation provided in the act to any employee who might be injured while engaged in that work in or about the premises of the one for whom the work was being done. The description of the person upon whom section 31 imposed liability included any person, firm, or corporation who 'contracts with others to do, or have done for him, them or it, any work enumerated as extrahazardous.' The defendant contracted with Malone to do the work of wrecking the smokestack, which work was extrahazardous, and plaintiff in error therefore comes within the description of the persons upon whom liability was imposed by the section."

STREET RISKS:—(Render *vs.* H. C. Faber & Son Co., Court of Appeals of New York, 119 N. E. Rep. 842.) The deceased employee had been sent by the superintendent of the factory across the street to another factory owned by the same company to do certain work. After completing the work, on his return trip he fell on the snow or ice in the street and received injuries which resulted in his death. The State Industrial Commission awarded compensation, and this appeal was made on the theory that the injury did not arise out of the employment, but arose from an ordinary street risk.

The court affirmed the award and quoted with approval from a recent English decision the following extract:

"'If a servant in the course of his master's business has to pass along a public street, whether it be on foot, or on a bicycle, or on an omnibus or car, and he sustains an accident by reason of the risk incidental to the street, the accident arises out of as well as in

the course of his employment. . . . The use of the streets by the workman merely to get to and from his work, of course, stands on a different footing altogether; but as soon as it is established that the work itself involves exposure to the perils of the streets the workman can recover for any injuries so occasioned.'"

LIABILITY UNDER FEDERAL EMPLOYERS' LIABILITY ACT:—(Erie R. Co. *vs.* Downs, U. S. Circuit Court of Appeals, Second Circuit, 250 Fed. Rep. 415.) The plaintiff was a brakeman, whose duties consisted of switching cars in inter-state and intra-state commerce in the yards of the defendant company. After assisting in switching a string of cars, some of which were loaded with inter-state shipments, he was returning to his engine when he was injured and lost his right arm. There was no brakeman or light on the car which struck the plaintiff. The defendant appealed from a judgment for $20,000.

Some extracts from the opinion holding plaintiff was engaged in inter-state commerce and which affirmed the judgment, are:

"Inasmuch as the action has been brought under the Federal Employers' Liability Act, the first question to be determined is whether at the time of his injury the plaintiff was actually engaged in inter-state commerce. If he were so engaged, we need not inquire further. To maintain the action it must appear that at the time of the injury he was employed in moving or handling cars engaged in inter-state commerce, or performing an act so directly and immediately connected with the act of moving or handling such cars as to be a part of it or a necessary incident thereto. From what has already been said, it is apparent that he had been engaged in shifting a string of cars from Yard A to Yard E. It is conceded that some of the cars in that string were engaged in inter-state commerce. Some of the cars contained freight transported from other states into the state of New Jersey, and some of the cars contained freight which was being transported from the state of New Jersey to other states, and remaining cars contained freight which was being transported between points wholly within the state of New Jersey; and it was stipulated that the next switching movement, subsequent to the occurrence of the accident, which was made by the switch engine and switching crew to which plaintiff belonged, consisted in moving three cars containing coal which had been transported from the state of Pennsylvania into the state of New Jersey. . . .

"Here the act prior to the injury was an act of switching cars engaged in inter-state commerce; and in returning therefrom to his engine his act was so immediately connected with his previous act as to be a necessary incident thereto. . . .

"There can be no question that this record discloses evidence which, if believed, fully justified the conclusion that the defendant was negligent. The evidence shows that defendant's employees, in their work in the yard where the accident occurred, constantly crossed the tracks, and that that practice was perfectly well known to all persons engaged in operating trains; and it was left to the jury to say whether defendant was conducting its business with ordinary care and prudence, if, with knowledge of this practice, it sent the car or set of cars down from the hump the night in question without any lanterns or lights, and allowed them to come into collision with the stationary car that was standing on the track, pushing it a considerable distance, and causing the injury complained of herein. It was usual to send a brakeman on the cars, to control their speed and prevent their striking other cars with force. . . .

"The jury was instructed at length concerning the assumption of risk and that the plaintiff assumed the ordinary risks inherent in his employment. The jury was informed that, when a man enters an employment, he assumes all the danger that comes from and only from the ordinary risks inherent in the character and nature of that employment, but that he does not assume the extraordinary risks. . . .

"The defendant asserts that the plaintiff was guilty of contributory negligence as a matter of law. The Federal Employers' Liability Act has changed the law of common carriers by railroad as respects the effect of contributory negligence. The act abolished contributory negligence as a defense, and it now merely diminishes the damages. Act April 22, 1908, c. 149, § 3, declares that:

"'The fact that the employee may have been guilty of contributory negligence shall not bar a recovery, but the damages shall be diminished by the jury in proportion to the amount of negligence attributable to such employee.'"

EXTRATERRITORIAL EFFECT:—(Industrial Commission of Colorado *vs.* Aetna Life Ins. Co., Supreme Court of Colorado, 174 Pac. Rep. 589.) Lynch, a resident of Colorado, was hired in that state by a Colorado corporation as a foreman to supervise construction work in several states. He completed some work in the state of Wyoming and received instructions to proceed to a city in the state of Idaho. He missed the regular stage and accepted an invitation to ride on a friend's automobile to the railroad junction of another city in Wyoming. During this trip, Lynch was killed as the result of the automobile skidding.

The court held that the accident arose in the course of his employment, the nature of which required the deceased employee to

travel expeditiously from state to state; he had completed his duty in one state and was on his way to another state by automobile, the only remaining means of travel. The following extract from the opinion shows the line of reasoning adopted:

"Under the principle of compensation awarded and commanded by the state, the question of negligence is in no sense involved. The validity of these statutes, in so far as has been determined by our courts, rests upon the basis of a proper exercise of the police power, as being in the interest of the public welfare. The purpose primarily is to relieve the public of the burden of supporting injured workmen and their dependents, who may by reason of such injuries become objects of charity. The expense is to be treated as an additional cost of the operation of business, and under our statute is collected by the state from the employer in the nature of premiums, based upon the number of employees, wages paid, the character of employment, and other consideration calculated to establish a reasonable charge for accident insurance. This fund is designated as an insurance fund, from which the commission is required to make allowances to the workman and his dependents according to nature and character of the injury as provided and detailed in the statute.

"It is quite apparent that it was not the purpose of the law to hold the right of compensation to such strict construction of the term 'scope of employment,' as in cases of tort where the employer may be held to compensation for his own negligence. In fact the term 'in the course of employment,' used in the statute, may well be said to differ in meaning from the term 'scope of employment' as used in judicial determinations in negligence cases. In truth, the payment of compensation does not fall upon the employer at all, but is to be charged to the expense of operation of the business, and is therefore made a part of the cost of the product, as much so as the cost of labor, materials, and other actual expenses of operation, so that this expense of insurance becomes ultimately and in fact a part of the price to the purchaser of the product and to that extent is paid by the public. . . ."

The court found some difficulty with the extraterritorial feature of this case and examined at length the decisions of courts of last resort in this country and abroad. After quoting from a number of these decisions, the court ordered an award of compensation to be made. It calls attention to the similarity of the Colorado Act to the New York Compensation Act and quotes with approval the opinion of the New York Court of Appeals, in the case of Matter of Post *vs.* Burgher, 111 N. E. 351:

"'The act, taken as a whole, in view of its humane purpose,

should be construed to intend that in every case of employment there is a constructive contract between the employer and employee, general in its terms and unlimited as to territory, that the employer shall pay as provided by the act for a disability or the death of the employee as therein stated. The duty under the statute defines the terms of the contract.

"'Where, therefore, a resident of this state, employed by a corporation engaged in business in this state, is sent by his employer to perform work in another state away from the plant of the employer but under the employer's express direction, and while engaged therein is injured, he is entitled to compensation when in other respects he comes within the provisions of the law.'"

ASSUMPTION OF RISK:—(Bay State St. Ry. Co. *vs.* Rust, U. S. Circuit Court of Appeals, First Circuit, 253 Fed. Rep. 43.) Rust was employed as a lineman to renew wires on the pole of the defendant railroad. While on a pole, through lack of proper insulation, Rust received an electrical shock which killed him. The Rhode Island Workmen's Compensation Act abolished the three customary defenses of the employee's negligence, assumption of risk and fellowservant doctrine. The railroad urged that the deceased had assumed the risks of his employment, inasmuch as his contract of employment required him to work around obviously dangerous objects.

This case is interesting in that the opinion is by a federal court of appellate jurisdiction, which construed it similarly to the Supreme Court of the State. The railroad had not accepted the act and this was a suit at common law for damages, in which the jury handed in a verdict for the plaintiff. In affirming the verdict, the court stated:

"In passing the Workmen's Compensation Act, the Rhode Island Legislature was dealing with a matter of public interest, for the protection of a great class of our citizens. Its legislation should not receive a narrow construction. The Legislature used the plain, broad language that in an action to recover damages for personal injuries sustained by accident by an employee, in the course of his employment, it shall not be a defense 'that the employee assumed the risk of the injury.' The Legislature had before it the well-known condition that there are the two ways which we have mentioned by which an employee may assume the risk of injury; namely, by his acts and by his agreements. Nothing is brought to our attention which tends to the conclusion that the Legislature intended to exclude one way of assuming risk, and to permit another. Nothing before us leads to the inference that the Legisla-

ture did not intend to exclude the entire matter of assumed risk, regardless of classifications as to the different ways by which a risk may be assumed. The Legislature may well have had in mind, also, that the master's liability depends upon negligence; and that evidence of negligence is often directed to what an employee is doing under his agreement of service."

DISPUTE OVER EMPLOYER'S WORK:—(Pekin Cooperage Co. *vs.* Industrial Commission, Supreme Court of Illinois, 120 N. E. Rep. 530.) The claimant (Rasor) was culling barrel staves when another employee at the same kind of work took some staves from the claimant's rack and placed them in his own. The claimant objected in offensive language and the other employee, who had been drinking, became the aggressor in an encounter in which the claimant was injured.

The court upheld an award of compensation to the claimant. On the subject of evidence, the court took the following position, which is that adopted generally:

"The question is whether Rasor's injury, which was received in the course of his employment, arose out of his employment, and it has been argued as if we were to determine it from the weight of the evidence. Our consideration of the evidence is limited to the inquiry whether the record contains competent evidence to sustain the award. If the evidence in favor of the applicant sustains the award, the weight of the evidence to the contrary will not be considered by the reviewing court. The determination of the facts upon contradictory evidence by the Industrial Commission is final. . . .

"Rasor clearly suffered an accidental injury in the course of his employment. It was a sudden and unexpected mishap, occurring outside of the usual course of events, without any design on his part, while he was engaged at his work. The compensation to be provided and paid by the employer under the Workmen's Compensation Act is not, however, for all accidental injuries which may be sustained by his employees in the course of their employment, but only for such as also arise out of the employment. There must be some causal relation between the employment and the injury. It is not necessary that the injury be one which after the event may be seen to have had its origin in the nature of the employment. The courts administering compensation laws similar to ours do not disagree upon the interpretation of the law, but in the great variety of circumstances which they are called upon to review, it is frequently difficult to make the application to the facts. . . .

"All the cases concur in the rule that the accident, to be within the Compensation Act, must have had its origin in some risk of

the employment. No fixed rule to determine what is a risk of the employment has been established. Where men are working together at the same work disagreement may be expected to arise about the work, the manner of doing it, as to the use of tools, interference with one another, and many other details which may be trifling or important. Infirmity of temper, or worse, may be expected, and occasionally blows and fighting. Where the disagreement arises out of the employer's work in which two men are engaged, and as a result of it one injures the other, it may be inferred that the injury arose out of the employment. The dispute was concerning the employer's work in which the men were both engaged, and there is evidence tending to show that the claimant was not responsible for the assault."

ACCIDENTAL DEATH ON SUNDAY HOMEWARD BOUND:—(State & C. *vs.* District Court, Supreme Court of Minnesota, 169 N. W. Rep. 274.) The deceased employee traveled to solicit the shipment of grain to his employers, a grain brokerage corporation. He resided in North Dakota, and the corporation was incorporated in Minnesota, where he was hired. He was on his way home on Sunday morning, when he found that railroad traffic had been suspended on account of a flood which covered the tracks. He went in a boat with several other men to cross the river, and all were drowned except one man. The other relevant facts are stated in the following excerpt from the opinion, which affirmed the award of compensation.

"It is urged that decedent was not within the protection of the Minnesota Workmen's Compensation Act at the time of his death, because it appears that he did not come to his death by reason of an accident arising out of and in the course of his employment; that at the time of the accident he had been through with his work since the preceding day; that there was no necessity for his getting home on Sunday; that in order to do so he undertook an extremely hazardous trip for his own purposes, and not in connection with the business of his employers. We are unable to agree with these contentions. Decedent's duties required his traveling from place to place in his territory, which was several hundred miles from his employers' place of business. It was proper that he have some regular or fixed place for communicating with his employers. His home was near his field of labor. He made it his headquarters, as well as his retreat for over Sunday, as he properly would, and as his employers must naturally have expected and intended that he should do. Indeed, all of the correspondence between them so indicates. We see no reason why he might not properly, and without stepping outside the scope of his employment, return to his home

from his field of labor on the Sabbath day. . . . We think the trial court was justified in finding from the evidence that decedent came to his death by reason of an accident arising out of and in the course of his employment. When he attempted to cross the river, the usual means of travel by rail had been abandoned because of the high water. The only available means of crossing was by boat. Others had crossed over safely by the same means on the previous day. It was left to decedent's judgment as to how or where he might travel. He may have been somewhat negligent, but there is nothing to indicate an intentional or wilful want of care on his part. He was in the act of returning to the shore when the accident occurred. To justify a recovery under the statute, it is unimportant that the employee might have been at fault, if not wilfully so. . . . The record justifies the findings of the trial court."

DEPENDENCY:—(Metal Stampings Corp. *vs.* Industrial Commission, Supreme Court of Illinois, 121 N. E. Rep. 258.) Compensation was awarded to the parents of the deceased employee. The employer appealed from the award on the ground that the dependency had not been proved.

The following extracts from the opinion present the outline of the court's reasoning:

"The only question presented and argued in this case is whether or not the deceased had, within four years previous to the time of his injury, contributed to the support of his parents, so as to entitle them to compensation under the provisions of section 7 of the Workmen's Compensation Act. . . . If there is competent evidence in the record which, standing alone, fairly tends to prove that the deceased had contributed to the support of his parents, as aforesaid, within four years previous to his injury, neither the circuit court nor this court may question its sufficiency, as the question of the sufficiency of the evidence is not for the court. . . .

"Paragraph (b) of section 7 of the Workmen's Compensation Act aforesaid provides as follows:

"'If no amount is payable under paragraph (a) of this section and the employee leaves any widow, child, parent, grandparent or other lineal heir, to whose support he had contributed within four years previous to the time of his injury, a sum equal to four times the average annual earnings of the employee, but not less in any event than sixteen hundred and fifty dollars and not more in any event than thirty-five hundred dollars.'

"Under this paragraph it is not necessary that contributions by a child in support of his parents should be in excess of the child's own cost and expense before the parents would be entitled to recover compensation for his death, as contended by the employer. It was the duty of the parents to support the deceased until he

reached the age of majority, and within the meaning of the statute the child contributes to the support of its parents when it contributes a substantial sum to the support of the family, although that sum is less than the actual cost and expense of its support and maintenance if the child is a minor or in a condition to demand legal support from its parents. It is not necessary that the parents be dependent upon such deceased child or that his contribution to their support have any regularity. . . . If it were necessary in this case for the proof to show that the parents were dependent upon the deceased for support or that they were particularly dependent upon him for support—*i.e.*, that his contribution to their support was greater than the cost and expense to the parents for his support—that showing is clearly made in this record for the three years preceding his death.

"As the evidence in the record is ample to sustain the finding and award of the Industrial Board, the judgment of the circuit court is affirmed."

PRIMARY CAUSE OF DEATH:—(Eggers Veneer S. Co. *vs.* Industrial Commission, Supreme Court of Wisconsin, 170 N. W. Rep. 280.) The deceased employee, who had been suffering from rupture for seven years, was injured when an elevator in which he was riding in the performance of his duties, dropped some distance. The fall aggravated the rupture, which resulted in his death the next day. The employer contended that the employee's death was caused by the defective truss he wore. The employer appealed from an award of compensation made to the employee's dependent.

The court's rulings upon the various objections made to the award follow:

"The employer made and filed a report of the accident, pursuant to the rules of practice of the Industrial Commission (rule 2), stating that the elevator operator lost control of the car and that it dropped to the bottom; that Lesperance was in the car and was injured. The contents of this report are competent and establish a prima facie case. . . .

"The evidence of the attending doctor is, in substance, that the deceased informed him, when he was called to his attendance within about an hour after the alleged accident, that the drop of the elevator hurt him, and that when he examined the injured intestine and the imperfect truss he concluded that the shock caused by the drop of the elevator was the primary cause of the injury to the intestine. This evidence is of such substantial character that a reasonable conclusion can be drawn therefrom that the injury was proximately caused by the accident. . . .

"The objection that the employer's report of the accident was not formally offered in evidence is not well taken. The employer was fully aware of the contents of this report. If any corrections thereof were deemed necessary, they should have been brought to the attention of the commissioners upon the hearing. The proceedings before the commission are not to be hampered by useless formalities nor technicalities. (Citing cases.)

"The record clearly sustains the circuit court in holding that the award is sustained by the evidence. The judgment is affirmed."

DISOBEDIENCE OF ORDERS—LEGALITY OF EMPLOYMENT:—(Frint Motorcar Co. *vs.* Industrial Commission, Supreme Court of Wisconsin, 170 N. W. Rep. 285.) The deceased employee (Healey) was a mechanic assigned to work at motorcars. Automobile and motorcar races were held on a Sunday, in which his employer entered several motorcars. Each company entering cars was allowed certain space called the pit, inside the track. The deceased was given charge of his employer's space and cars and was instructed to remain there and to work at the cars. One of the employer's cars stopped near the pit, and Healey, seeing the car stop, ran up to it and was killed by another car. Compensation was awarded the widow, over the objections of the employer, the appellant in this court.

In affirming the award, the court wrote:

"Prior to the day of the injury, Healey, deceased, was in the employ of appellant under the Compensation Act and at the time of the injury was performing services growing out of and incident to his employment, unless it can be said that because he left the pit provided for him during the races he thereby got outside of the course of his employment. The contention of appellant is that, because Healey left the pit provided for him and went upon the track where he was killed, he was not at the time of the injury within the course of his employment; hence no recovery could be had. We regard this contention untenable. The mere fact that Healey was instructed to remain in the pit, and that he violated such instruction, did not put him outside of the scope of his employment. . . .

"We are satisfied that deceased was at time of the injury acting within the scope of his employment, and the mere fact that he disobeyed orders does not defeat recovery. . . .

"It is also insisted that because the accident occurred on Sunday there can be no recovery.

"The contract of employment with Healey was made prior to the day of the accident, and on the day of the accident and prior thereto

the relation of master and servant between appellant and Healey existed, as well as the duty imposed by law upon appellant to make compensation for injuries arising out of the relation existing by force of the Workmen's Compensation Act.

"The fact that Healey was violating the Sunday law cannot defeat recovery, because it did not contribute to the injury. The right of recovery was fixed by the statute, and the relation lawfully existed between appellant and Healey at the time of the accident. . . ."

MISCELLANEOUS.

CONSTRUCTION OF "REPAIRS" UNDER ELEVATOR LIABILITY INSURANCE:—Finding *vs.* Ocean Acident & Guarantee Corp., Supreme Court of Colorado, 177 Pac. Rep. 142.) The defendant corporation issued an elevator liability policy to the plaintiff, protecting him "against loss from common law or statutory liability for damages on account of bodily injuries, fatal or non-fatal, accidentally suffered while this policy is in force, by any person or persons while in the car of any elevator mentioned in the schedule hereinafter contained, or in the elevator well or hoistway of same, or while entering upon or alighting from the elevator car." The policy contained the following exception from liability as to "any person while making additions to, alterations in, or engaged in the construction, demolition or extraordinary repair of any such elevator or the building or structure in which it is contained; but ordinary repairs to any such elevator, its shaft or attachments will be permitted provided no elevator shall be run or used while it or the shaft in which it is operated are undergoing such repairs." One of the plaintiff's employees was scraping off the paint preparatory to repainting the elevator, when he was killed. The employee's widow sued and the plaintiff paid her $5,000 after judgment. This suit was brought to secure reimbursement from the insurance company.

The court construed repairs to mean a restoration to a sound state after partial destruction or decay and held that painting did not come within the definition of repairs. Judgment was rendered for the plaintiff, with an opinion concluding:

"It is apparent that, under the rules of construction applicable to insurance contracts as above stated, we cannot say that the special agreement relied on avoids the general indemnity under the policy, without doing violence to the generally accepted meaning of the words used in such special agreement.

"The indemnity provision in the contract is broad, sweeping, and stated in language that cannot be misunderstood. There is no good reason why the exception or special agreements with which it is hedged about should not be written in language with equally explicit meaning, and with equal freedom from the necessity of interpretation or construction by a court.

"The purchaser of an insurance policy is required to do no more than to read its provisions in the light of the ordinarily accepted meaning of its words and terms.

"The law does not look with favor upon exceptions to the plain provision of indemnity, couched in language of doubtful and uncertain meaning, and courts will not supply by implication a meaning to such an exception, not clearly and unmistakably expressed by its terms."

PROMISSORY WARRANTY IN FIDELITY INSURANCE:—(Fidelity & Deposit Co. *vs.* Kane, Court of Appeals of Kentucky, 206 S. Rep. 642.) In 1905 the American Surety Company insured the People's Bank against the dishonesty of the bank's cashier, Young. One of the representations of the bank in its application for the bond was that its directors would examine the cash and securities and compare them with the books each week. The representations were warranted in the bond to be true. The bond ran for one year and was annually renewed after the bank filed with the surety company a statement that its cashier had honestly accounted for all the bank's property and was not in default.

In 1913 the American Surety Company was reinsured by the Fidelity & Deposit Company, which secured from the bank the following signed statement:

"Employer's Certificate.

"It is agreed that the information previously furnished by the undersigned to the American Bonding Company of Baltimore, Maryland, regarding the above-named employe, his duties and employment, and the supervision exercised over the work and acts of the employe, shall be warranties, and shall constitute the basis of and form part of the bond, or any continuation or continuations thereof, that may be issued by the Fidelity & Deposit Company of Maryland, to the undersigned, in behalf of the employe, whose application appears above.

"As employer, the undersigned certifies and warrants that the employe has always faithfully, honestly, and punctually accounted for all money and property in his custody or under his control, and has performed his duties in an acceptable and satisfactory manner.

We know of nothing in his habits affecting unfavorably his title to confidence, and we know of no reason why a guarantee bond in his behalf should not be issued."

The Fidelity and Deposit Company then became Young's surety to the bank, for one year commencing on July 1, 1913. The bond provided that the bank must claim within ninety days after knowledge of any dishonest act by its cashier; that there should be no liability for Young's dishonest acts committed after the bank had knowledge of previous dishonest acts but had failed to make any claim.

The cashier permitted overdrafts by certain depositors, and every time informed the discount committee, consisting of several directors, at their weekly meeting. The committee ordered him several times to collect the overdrafts and to stop the practise. The same state of affairs was reported at each meeting for several years but the bank failed to report the overdrafts to the surety company. The state bank examiner reported the overdrafts to the directors, who caused them to be collected. At two subsequent examinations by the state bank examiner, he found there were overdrafts which were known to the directors. The cashier then adopted the plan of keeping two ledgers, to conceal the true balances of the bank's depositors. A bookkeeper called the attention of the bank's president to the two ledgers and the latter asked the cashier for an explanation in the presence of several of the directors. The explanation was accepted as satisfactory, although no effort was made to examine the contents of either ledger. When the bank failed, the amount of overdrafts was greater than the amount of the bond. Suit was brought by the banking commissioner to recover the face of the bond, $5,000, from the cashier and the surety company.

The court held that the surety company was not liable. The opinion is given in full, as an exposition of the principles involved.

"The execution of a bond to indemnify an employer against the dishonesty of his employe is denominated fidelity insurance, and section 639, Ky. Stat., has been consistently held to apply to an application for such a bond. The purpose of that statute was to prevent an insured from losing the benefits of his insurance, because of either a representation or warranty which was not fraudulent or material to the risk. The statute requires 'all statements and descriptions' in any application for a policy of insurance to be held and construed to be representations, and not warranties. Any misrepresentations made in the application will not defeat a recov-

ery upon the policy, unless they are material or fraudulent. The representation made in the application to the American Bonding Company, and which was agreed should be considered in the application for the bond executed by the Fidelity and Deposit Company, contained the undertaking that, if the cashier handled cash or securities, the cash and securities would be examined and compared with the books, accounts, and vouchers once each week by the directors of the bank. The cashier handled all the cash and securities. This representation is what is termed a promissory representation, and is an assurance to the insurer of the degree of supervision which the insured will take over the duties intrusted to the employe, and his opportunities to commit the acts against which the employer is to be indemnified. A failure to strictly comply with a representation does not prevent a recovery upon the bond; a substantial compliance is sufficient. To prevent a recovery upon the bond, in the instant case, upon the ground that the bank had not complied with the promissory representation above stated, it would be necessary to show that the directors failed to substantially comply with the promise, or failed to use ordinary care in examining the books, accounts, vouchers, moneys, and securities of the bank. The degree of care required by the directors is that degree of care which ordinarily prudent directors, similarly situated, would use under similar circumstances (citing cases). If the directors failed to substantially comply with the representation to examine the securities and moneys, and compare them with the vouchers, accounts, and books, and did not exercise the care in the examination, no recovery upon the bond should be had. The examinations made, which were not once in each week as represented, unless the actions of the discount committee could be held to be substantially a compliance with the promise by the directors, consisted of an examination of the notes held by the bank. No count of the cash on hand was ever made by any officer or director, either during or before the term of the bond sued on. No examination of the checks given by depositors upon the bank was ever made, nor comparison of them with the accounts, nor any comparison of the money or securities with the accounts or checks, was ever made. A statement of the condition of the bank was, on the occasions of the meetings of the discount committee, and on the meetings of the directors, presented by the cashier, which consisted of a statement of the gross amount of the assets and liabilities of the bank, which was looked at by the directors. This was merely taking the word of the cashier, and did not amount to an examination, nor an attempt at an examination. There is no question of the exercise of ordinary care in the examinations, when really no attempt at an examination was ever made by the directors. Although the directors were persons not skillful in the keeping of books, this does not excuse them from failing, in good faith, to attempt to make the examinations, and it is difficult to see how such a want of knowl-

edge of bookkeeping could exist, with the directors of a bank, that they could not tell, by weekly examinations, when an account was overdrawn, when the books showed same to exist. The president of the bank shows, by his testimony, that when informed by the examiner that overdrafts existed, that he was capable of looking into the books and discovering them, as he testifies that he did so.

"The representation made in the application to the Fidelity & Deposit Company to execute the bond, which covered the last year of the cashier's services, to the effect that the cashier had always theretofore faithfully, honestly, and punctually accounted for all money and property in his custody or under his control, and had performed his duties in an acceptable and satisfactory manner, and that the president of the bank knew of nothing in his habits affecting unfavorably his title to confidence, and knew of no reason why a guaranty bond, in his behalf, should not be issued, was a statement relative to present and past facts. When this statement was subscribed, and designed to induce the appellant (surety company) to become the surety of the cashier, and thereby insure his honesty, the president, who signed it, and all of the directors, knew that the cashier had, repeatedly and continually permitted the depositors to make overdrafts without their consent, and contrary to their express directions. In fact, they had been informed of his habit in this regard every week for several years, and at the first examination by the examiner, as before stated, they had been informed that the cashier had permitted overdrafts in the sum of several thousand dollars, and had found same to be true. Hence, if the act of the cashier in permitting an overdraft was a dishonest one, as is contended, the conclusion cannot be scaped that the president, when he signed the above statement to induce the execution of the bond, knew that the statement was untrue. The best that can be said for him is, as he says himself, that he signed the representations without troubling himself to find out what was in it. It is scarcely believable that the appellant would have executed the bond, if the president and directors had given to it the information they then possessed to the effect that the cashier had theretofore, for years, contrary to their wishes and directions, permitted, in the language of the president, 'Tom, Dick, Harry and the Devil' to make overdrafts upon the bank. The question of good faith does not enter into the consideration of this representation, as the president proves that he knew the statement to be false. As to a fraudulent representation, in an application for fidelity insurance, if an employer makes a false answer knowingly, about a matter material to the risk, and the answer is relied upon and induces the execution of the bond, it is fatal to a recovery upon it. If an employer makes a false answer, not knowing whether or not it is true, and without having used due diligence and precaution to learn the truth, such an answer is fraudulent, and will likewise defeat a recovery, when the answer is relied upon by the insurer."

ABSTRACT OF THE DISCUSSION OF THE PAPERS READ AT THE PREVIOUS MEETING.

ESSENTIALS OF FAMILY STATISTICS—EDWIN W. KOPF.

VOL. V, PAGE 64.

WRITTEN DISCUSSION.

MR. L. W. HATCH:

One of the encouraging signs of progress in the field of statistics of late is the increasing number of studies of sources and methods for particular subjects, as distinguished from treatises on statistical sources and methods in general. Progress toward more adequate statistical material, better methods of handling it, and more effective presentation of results, is bound to be aided, and is in the long run largely dependent upon such specialized studies. As an example of such a study, Mr. Kopf's paper on the Essentials of Family Statistics is, therefore, to be welcomed. Furthermore, this paper has additional interest from the fact set forth in a footnote to the title that the paper is an excerpt from a manual which the author has in preparation on Essentials of Social Statistics, a title of sufficiently broad implication to indicate a very ambitious undertaking, involving, it would seem, a whole series of studies of individual subjects like this one of family statistics which is before us.

I shall put my comments on Mr. Kopf's paper under two heads, first, as to substance, and second, as to manner of presentation.

As to substance, the paper is mainly an enumeration and critical description of classes, sources and arrangement of statistical data relating to the family. For such a presentation in a statistical "manual," a prime quality to be expected is fullness of treatment. On this score I have only favorable comment to offer here. One cannot fail to be impressed by the extent and detail of knowledge of the subject which the author displays, knowledge based evidently on both original study of his subject and acquaintance with literature concerning it. I must confess that my own knowledge of the field has not been sufficient, nor have I had time to make critical investigation for the purpose of this discussion, to enable me to judge the matter fully, but to the best of my judgment, Mr. Kopf's presentation is exhaustive.

In two aspects, however, the substance of Mr. Kopf's paper does not impress me so favorably. One of these has to do with those

portions of the paper which present fundamental analyses of subjects as bases for classifications of material. Here there is occasionally evidence of loose generalization, and obscure statement. Of several examples of what I refer to which might be cited, only one is here noted. On p. 65 is the statement without supporting evidence or reasoning, that "No other social units (besides the family) would be possible without the basic social unit of the family." If this means that all other social units are built up upon family units, it is a generalization which is not true. There is one sense in which it is true, namely in the sense that the family is the means of reproducing individuals, so that without it there would be no individuals to form social units. If that is the idea intended, it is obscurely and ambiguously expressed, in addition to being a truism hardly worth stating.

A second criticism of the substance of Mr. Kopf's paper which I am moved to make has to do with a number of statements concerning the significance of the different kinds of family statistics for the actuary and insurance statistician. These are for the most part so brief and have so much the character of mere addenda at the close of discussion of the various topics as to weaken their force. In view of Mr. Kopf's announcement that his Manual of Social Statistics is designed for use of persons intending to become associates of the Casualty Actuarial and Statistical Society, this is particularly unfortunate. It would seem as though for that purpose greater pains and space should have been devoted throughout his paper to this aspect of his material.

Turning from substance to manner of presentation, it must be said that Mr. Kopf's paper is open to really serious criticism. Without the least inclination to be captious, and solely with a desire to be helpful, I feel that I must speak rather frankly. To put the matter in a word, the paper suffers not a little from inaccurate and incorrect use of words, clumsy sentence construction, and obscure language. Here are some examples of such defects.

On p. 68 is the expression "Auxiliary statistical facts on marriage . . . are at present anticipations," which a more accurate use of words would render, "Auxiliary statistical *data* on marriage . . . *can only be anticipated* at present."

On p. 65 it is said "Through it (the family) the individual is brought from a *disintegrated* state into elementary ethical relations," in which "disintegrated" is incorrectly used for "isolated."

On p. 70 is this sentence: "It is hoped that they will meet the social statisticians fraternally by giving the proposal the most serious consideration, thus to show their appreciation of one of our vital needs," the last clause of which is of most clumsy (if not quite incorrect) construction, the obvious remedy being to change the words "thus to show" to "and thus show."

On p. 71 following and in explanation of the statement that "the sacrifices and hardships entailed by marriage and the obliga-

tions of family are a powerful cultural and selective force" is this sentence: "They insure the persistence of ethical characters in rugged individuals who take upon themselves this primary form of human association, and virtually guarantee the elimination from the race stream of some of the ethically unfit, by means of the 'defense reaction' of individual selfishness engendered in the latter individuals by the prospect of sacrifice." It certainly requires more than one reading to free the meaning of the latter part of that sentence from obscurity.

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 a constant endeavor of our Society. Both for this reason, and because I regret to see so rich material as Mr. Kopf's paper contains, marred in the presentation, I have been impelled to inject some literary criticism into this discussion.

MR. GEORGE B. BUCK:

Mr. Kopf's paper, while of particular interest to the social statistician and developed largely from his viewpoint, presents a subject which I believe will demand of the actuary increasing attention in the future. The need for adequate social statistics in this country is especially appreciated by those actuaries who are at present confronted with the necessity of adapting for use the meagre data of this kind that are available, in an endeavor to meet in some practical fashion the requirements imposed by certain existing social legislation.

When consideration is given to the probable future development of various forms of social insurance, the value of laying a sound foundation for the compilation of required data as outlined by Mr. Kopf becomes doubly apparent. Such statistics will, undoubtedly, afford a basis for testing the actual operation of considerable social legislation and for prognosticating its future development. As a result, more careful and scientific work in the preparation of such legislation will be possible and a considerable amount of experimenting in this field, which is now necessary may be avoided.

Mr. Kopf presents a very careful and scholarly exposition of the scope and requirements of this field of statistics. I feel that there is little that I can add, unless it be from that point of view with which I am most familiar, that is, from the point of view of the actuary of an employee's benefit or pension fund. Mr. Kopf refers to the fact that family statistics are fundamental to the practice of compensation insurance. They are similarly fundamental to the scientific operation of the majority of pension and benefit funds.

The public expects every policemen's and firemen's pension fund

to provide pensions for widows and orphans. Public employees in other occupations, involving similar or extra hazards expect to be covered by like benefits. These benefits many times cover, not only payments on account of accident, similar to compensation benefits, but supplementary benefits on account of disability or death through other causes. Many of the large industrial funds offer as complicated a system of benefits. To make valuations of these funds, the probabilities of marriage and remarriage, the probability of issue, the number and ages of children within family groups, related to ages of mother and father should all be available.

A wealth of information on this subject in this country would now be accumulating, had such funds been operating scientifically. Unfortunately, however, the usual procedure in the history of these funds has been not to make actuarial valuations of cost, and therefore no need for recording basic statistics has been felt. In the future, as more scientific methods of operation are adopted, both the municipal and industrial fund are going to furnish valuable sources for these data. The statistics of the Scottish Widow's Fund as prepared by Mr. Hewat, are a notable example of the valuable data along these lines, which might be available through the proper operation of the benefit fund.

At the time of the valuation of the New York City pension funds in 1914–1916, no general data could be found upon which to predicate a valuation of a fund providing pensions to children who might be left by an employee dying in service. The United States census compilations presented no data such as are suggested by Mr. Kopf to furnish a basis for work of this character. The data which could be obtained in relation to workmen's compensation did not cover the problem. The only data available which would furnish a basis for such a valuation were those collected in connection with European benefit funds. Fortunately, the New York Service was of a size to justify the preparation of a complete set of tables to use as a basis for deriving the various probabilities needed in the valuation of benefits to the families of employees. In connection with the reorganization of the New York City funds, an adequate system of recording data will be installed and these tables will be added to and corrected as the experience develops.

I note that Mr. Kopf states that he will discuss the analytic processes and the graduating and testing of data in an additional and later paper. I hope he will also give us an indication of the general form of the tabulations of data which he believes should be made. Such a discussion will be of great value because the processes employed become somewhat intricate if we are to obtain results such as Mr. Kopf recommends. The practical use of the data after being obtained is somewhat complex and tedious. I know of cases, where, after obtaining the major part of the data required for use, the calculator has abandoned his basis in favor of some arbitrary assumption which would facilitate his calculations,

either because of the lack of time or because he is not familiar with the procedure that might have been followed.

The desire to follow the path of least resistance, or unfamiliarity with processes of tabulations and calculations often causes those not primarily concerned with the use of data, to discard certain valuable collections as a by-product. I mention "by-product" in the sense of data of possible future value for which there is no immediate need, which is collected along with other information actually required, with the idea in mind that its collection does not involve any additional expense, and yet may make available for future tabulations and use, data which might otherwise be lost.

I believe that the work that Mr. Kopf is accomplishing through this paper and the one proposed will be valuable to both the student and actuary who may undertake statistical work of this character.

MR. BRUCE D. MUDGETT:

Mr. Kopf's paper on "Essentials of Family Statistics" is planned as part of a manual on social statistics for the use of students preparing for the examination of the society. The scattered and fragmentary character of the statistical materials which are needed for these examinations has made imperative the preparation of such a manual if students from widely separated parts of the country are to have access to the facts. The paper will be considered in the light of its fulfillment of this purpose.

Such a manual, or textbook, should first attempt to give the student a broad general view of the field, and should then deal with specific details with reference only to their relationship to, or bearing upon, the larger aspects of the subject. It should, in short, present a fundamental theory as a basis for the study of particular statistical practice.

The principle here stated has been adhered to in Mr. Kopf's paper, which deals with social statistics of the family. The discussion is devoted mainly to three phases of the subject, family formation, family disintegration, family functioning. It presents under the three subdivisions the sources of materials; statistical particulars available and needed; and tabulations and ratios used to throw each problem into relief and does not confine itself to data of value solely to the insurance actuary or statistician. The references to fuller discussions by other authors are valuable in a paper of this character.

Considering the paper from the standpoint of the student, its compactness, though necessitated by its brevity, may offer a difficulty, in that the particular problems in which the student is most interested, especially the insurance problems, are not discussed at sufficient length. Possibly the fuller discussion might be made a part of the present paper, possibly continued in another and more advanced textbook. The following is an illustration: birth sta-

tistics are stated to be valuable to the insurance statistician for computing the "exposed to risk," or population, at ages under five years for the construction of life tables. For the prospective actuary who is not already working in an insurance office and on just such a problem, the presentation will be inadequate, and to familiarize himself with this use of birth statistics the examinee must go to other sources. This he will in many cases be unable to do. Students who have this preliminary knowledge of the method of constructing a life table will be much less troubled by the mazes of actuarial formulæ with which he meets in the actuary's office.

This statement is intended less as a criticism of the present paper than as a plea that the further work be done and that the methods of utilizing such statistics in insurance offices be made more generally available. The present paper is a scholarly piece of work and has made the proper approach to the subject.

MR. EDWIN W. KOPF:

(AUTHOR'S REVIEW OF DISCUSSION.)

There is evidently need for a manual on the statistical foundations of casualty and social insurance science. The older schools of statistics and actuarial science dealing with life contingencies, had need for little more than the facts of human aggregation. Their interest was confined largely to two facts,—the first, that an individual was simply a member of a group regardless of whether that individual bore any social relation to any other member or not; the second fact was the contingency of individuals leaving the group by death. And so, there has been, until recently, no need for a statistical and actuarial science concerned with more than the mere fact of aggregation,—grouping.

The issues as to social policy and programme raised in casualty and social insurance, however, deal with more than the elementary fact of grouping or aggregation. The emphasis is placed upon the kind and extent of *association* of individuals within a group and the effect of certain insurable incidents upon such associations. Many social mishaps destroy association between individuals and produce compensable losses, but the persons affected still stay within a demographic group. The casualty and social statistician, therefore, requires not only the data on human *aggregation,* but also the facts of *association* among men for purposes of growth, advancement, reproduction, defense, and force. We must be careful to note that a fact is not a *social* fact unless both aggregation *and* association are demonstrated. A social statistics suitable for the casualty and social insurance student must, therefore, deal with the several social units,—their enumeration and description in order of genetic importance of the several elementary forms of association within the "aggregates" of the older statistics. It must define and describe the various social structures, their

makeup, functioning, pathology and treatment. A simple nomenclature, borrowed from the best elements of the newer sociology, will have to be agreed upon. This social statistics will then become the research tool of the inductive sociologist, the statistician in the insurance sciences, and the legislator. In a manual thus devoted to bringing the statistics of casualty and social insurance closer to modern sociology, more space must be given to discussion of such a subject as statistics of the family than has been possible in this short article. It will be required, also, to go into greater detail of explanation of such points as the use of birth statistics (data of one phase of family function) in the compilation of life tables. The statistical needs of specialists in pension, sickness, invalidity, maternity insurance and other subjects in our field must also be considered in the required detail. Our mathematical friends will find ample opportunity for employment of their special gifts. The theory of multiple skew correlation, for instance, awaits only a supply of social data and the properly qualified man.

We may hope soon to get rid of the Spencerian mechanical view of society and of some of its misstated and misunderstood problems, when we add to our notion of Society as a structure of aggregates, the more advanced idea that Society also comprehends the causes, forms and results of the associations of individuals. Dr. Hatch mentions a fault in the manner of presenting the argument for family statistics. More attention should be paid, as Dr. Hatch has indicated, to the clearness, ease, elegance and force of the language we use in our printed papers. There is no reason why language should be used, as in several sentences of my paper, to conceal and confound thought. The defect could have been easily remedied.

MORTALITY FROM EXTERNAL CAUSES AMONG INDUSTRIAL POLICY-HOLDERS OF THE METROPOLITAN LIFE INSURANCE COMPANY, 1911–1916—LOUIS I. DUBLIN.

VOL. V, PAGE 10.

WRITTEN DISCUSSION.

MR. ALBERT H. MOWBRAY:

This paper is such a mine of information that it is hardly possible within the limits of any reasonably brief discussion to more than scratch the surface. I am bringing to the attention of the society certain points which struck me quite forcibly in my first reading of the paper, although each subsequent perusal brings out new points of interest, and it would seem well worth while for each member to carefully study the voluminous data Dr. Dublin has laid before us.

Dr. Dublin was good enough to present to us at our meeting in February, 1916, a paper with a similar title, in which the experience was traced from 1911 to 1914, and in certain respects it is interesting to compare the material in the present paper with that presented at the earlier meeting, noting the developments of the two added years. For example, at that time the total number of deaths studied was 32,057. The two additional years have added 18,655 deaths, but the death rate per 100,000 exposed has remained almost identical, that for the period from 1911 to 1914 being 94.4 per 100,000 and for the full period, 94.3. In the full period, however, were included 1,149 war deaths, at the rate of 2.1 per 100,000 exposed, so that the non-war deaths for the entire period would appear to be 92.2. This would indicate that the rate for the two additional years was somewhat below that for the earlier period. The rate per 100,000 for suicides also seems to have declined, since the rate for the entire period is 12.2 and the rate for the first three years was 12.9. On the other hand, the homicide rate of 7.0 appears to have remained constant.

Dr. Dublin makes comparisons between the accidental (including unspecified violence) death rates for the United States and for England and Wales, and it must be admitted that the comparison is not at all favorable to the United States. We might further extend the comparison by bringing in the figures from the Twenty-fourth Report of the United States Bureau of Labor, quoted from the investigation covering the years from 1887–1905 of the Leipzig Communal Sick Fund. This investigation covered 1,284,576 exposure years, during which 528 deaths from external

causes were recorded, at the rate of 41.1 per 100,000. Of course, the period from 1887–1905 was probably a period of less high pressure than the present time, but, at any rate, it appears the slower-going German city of Leipzig at that time was a much safer place, from the standpoint of accidental death, than either the British Isles or the United States of America now. Of course, we have no basis of comparison as of the present day.

To one who has given considerable attention to the graduation of mortality tables, Table II is decidedly interesting, and in some respects almost startling.

Makeham's law, which has been found to fit remarkably well many compilations of life insurance mortality experience, appears to confirm the reasoning of the late Benjamin Gompertz:

"It is possible that death may be the consequence of two generally co-existing causes; the one, chance, without previous disposition to death or deterioration; the other, deterioration, or increased inability to withstand destruction."

Most of us have doubtless been inclined to look upon the chance element, the one that remains constant regardless of age, as the chance of death due to external cause; yet Table I shows an increase with age almost, if not quite, as rapid as is the increase in the death rate from all causes. On further consideration, however, Makeham's hypothesis does not necessarily appear in conflict with this fact, since there are certain external causes which often ultimately result in death which do not necessarily result in death, but whose fatal consequences are dependent upon a lack of resistance in the individual victim almost, if not quite, as much so as with disease.

It would seem that the indications of this table would be nearly as startling to the student of personal accident insurance, since, generally speaking, it is not customary to differentiate the rates according to the age of the insured. If the probability of death from external violence is a factor which increases rapidly with age, is it not likely that disability due to external violence may be equally, if not more, a factor which increases with the age of the insured?

Tables III and IV, dealing with the relative mortality from accident and unspecified violence according to sex and color, are also very interesting, and, when all factors of life conditions are taken into account, the results do not seem unreasonable, notwithstanding apparent peculiarities upon their face.

A comparison of the mortality rates in Table VI with those in Table I of the earlier paper, PROCEEDINGS, Vol. II, p. 188, shows in certain instances a remarkable stability in the rates over the period. For example, poisonings by food during the first partial period were at the rate of 1.3 per 100,000, whereas, during the full period the rate was 1.2. The rate for burns (conflagrations excepted) was the same for the entire period as for the earlier period,

at the rate of 8.8 per 100,000. Accidental drownings varied but one-tenth of a point, the figures for the partial and complete periods being, respectively, 10.6 and 10.7. Traumation by fall during the earlier period was accountable for 13 deaths per 100,000 exposures and during the entire period for 12.9. And so for several other comparisons. It is encouraging to note that as against 3.3 deaths per 100,000 for the earlier period, due to electric railroad accidents and injuries, the figure for the entire period has been reduced to 3.0, indicating a considerable reduction in the added experience. The automobile accident fatalities, however, show a decidedly worse and discouraging condition. This is referred to specifically later on in Dr. Dublin's paper.

Dr. Dublin has indicated with regard to traumatism by fall that until after age 65 the mortality from this cause was not more than 25 per cent. of the total mortality from accidents and unspecified violence, but after that age the percentage suddenly jumps to over 50. The explanation probably lies in the greater susceptibility to fall on the part of older persons and in their weakened vitality for resisting the effect of fall.

Passing over several of the other studies, not for the lack of interest but in order not to take up too much time, we come to the important group of automobile accidents and injuries. Here we find an astounding increase in the death rate per 100,000 of exposures during the period under review, the rate having more than trebled during the period, namely, from 2.3 per 100,000 to 7.4, the increase being at about the same rate for both sexes and without regard to color, except that the increase is not so marked among colored females, as to whom it occurs to me the fluctuations may be due to relatively small numbers exposed.

It would be interesting in connection with the mortality rate from this cause to know the rate of increase in automobile registrations during the period. We know that the increase in the use of automobiles during this period has been very great, and, if the study be made in comparison with this, the results may not appear quite so bad, although even under the most favorable presentation of the facts there is still evidence here of the need of vigorous action to minimize this cause of accidental death. Were the figures for automobile registration available, it occurs to me these studies might be of considerable value for check purposes in connection with automobile liability insurance.

In the case of fatal accidents from street cars, we find that with both sexes and colors the accident death rate has decreased during the period. Public liability being a large element of cost in connection with street railway operations, the street railways have naturally rapidly fallen in with the safety first movement, and this, I believe, accounts for the reduction. It will be noted that the reduction really did not come in until 1914, the death rates per 100,000 for 1911, 1912 and 1913 being substantially the same, 3.6

per 100,000. I think we can accept as about 1914 the date when the safety movement really took hold with these public service institutions.

Passing over many other interesting studies, we come to the one which is perhaps most interesting to casualty actuaries, that of accident fatalities arising out of and in the course of employment. In view of the fact that the classification of risks in personal accident insurance is largely dependent upon occupation, it is rather surprising to find that out of deaths among white males from those external causes which seemed most closely associated with occupation, amounting to 14,151, only 3,963 were of such a nature that Dr. Dublin could definitely assign them as occupational deaths, that is, only about 28 per cent. Dr. Dublin warns us that these were only from selected causes, which were considered mainly associated with the occupation, and that probably there would be some increase in the total occupational mortality from other causes. There might also be some increase in the proportion if more complete and accurate data were available as to the circumstances in all cases. Nevertheless, the proportion attributable to occupation seems small, particularly when we remember that this is an experience developed from the industrial classes engaged in the more hazardous occupations. The paper does not give us the variation as between occupation and occupation, which undoubtedly would be large, but even under those circumstances, which undoubtedly would be large, but even under those circumstances, on the face of the figures, comparing Table 2 and Table 26, it would appear that age was a much more important factor as regards accident fatality.

Yet age is not taken into consideration at all, so far as I am aware, in connection with the fixing of rates for personal accident insurance. If age is a factor in the production of the accident fatality rate and we are correctly attributing its influence to the lack of resistance to the effect of accident, then it would seem that age would be an even more important factor in the rate of disability from accident. May we hope that in the not distant future some of our members will present us an analysis of personal accident experience which will throw some light on this question?

In connection with this exhibit, one or two points strike one as curious, which doubtless Dr. Dublin can easily explain. For example, one of the causes separately studied is "Traumatism in Mines and Quarries," from which cause there were 443 deaths. Yet only 405 of these, or 91.4 per cent., were considered to be due to occupational stress. It is difficult to see, without further illustration perhaps, how it is that a fatality might occur under such circumstances that it would properly fall in this classification, and yet not have occurred under such circumstances as would bring it within the scope of a compensation act. Perhaps, however, Dr. Dublin has taken a sligthly different point of view in dealing with occupational cause than the point of view of a compensation act.

I might point out, in connection with Table 27, that it would be interesting if Dr. Dublin had given the rate of occupational accident fatality for the several years per 100,000 exposures. This, I think, would give a little clearer measure of the effect of accident prevention.

As casualty statisticians and actuaries, we are perhaps not as much interested in the portion of the paper dealing with mortality from suicide and homicide as we would be were our approach to the subject from a somewhat different point of view. Yet it seems to me not unlikely that in our practical work from time to time we will find much interest and help in the data Dr. Dublin has given us.

As I stated at the outset, in these few brief notes I do not pretend to have presented an adequate discussion of this paper. I am sure that, as individuals and as a Society, we all feel deeply indebted to Dr. Dublin and the Metropolitan Life Insurance Company for laying before us so much valuable information.

MR. H. E. RYAN:

Dr. Dublin's paper not only is a valuable statistical contribution but it contains points of practical underwriting value. This is particularly true of those tables which show the incidence of fatal accidents according to age. Recent mortality investigations among insured lives have shown that in general the rate of accident fatality increases with age. As a rule, however, it is not customary in the practice of personal accident insurance to grade the premium rates accordingly. One reason for this is that by a continuous process of elimination the insurance company seeks to get rid of undesirable risks; thus the hazard assumed tends to remain constant at all ages.

One or two companies recently have taken up the insurance of accident and health policies at graduated rates. These policies do not contain the usual privilege of cancellation at the instance of the company, so that the steadily increasing risk has to be anticipated in fixing the premium rate. Such policies of course provide not only accidental death benefits, but include provision for weekly indemnity on account of disability from either accident or sickness. The increase, due to age, of the sickness hazard is much more important than is the increasing risk of accidental injury, but the upward trend of the accident rate is nevertheless decidedly appreciable.

The fatality rate experienced among lives accepted for *commercial* accident insurance (as distinguished from monthly premium or *industrial* accident insurance) is approximately 100 per 100,000 exposed. Such insurance is usually granted upon lives ranging from 18 to 55 and the proportion of female lives is practically negligible. Dr. Dublin has kindly furnished the relative weights

of the exposures in the Metropolitan's experience, between ages 20–55 (white males). From this information it appears that the fatality rate among industrial policyholders is 134 per 100,000 or nearly 35 per cent. in excess of the corresponding figure for commercial risks.

The marked disparity between the male and female death rates is explained chiefly by the difference in degree of the respective exposures to fatal injuries. With the single exception of deaths from "burns" the male rate, in varying degrees, is higher than the female. We are dealing here not only with industrial workers but also with housewives, so that those agencies which produce fatal accidents are, to a considerable extent, absent. On the other hand "burns" account for 9.3 deaths among white females and 14.3 among colored females, per 100,000 exposed, as against 7.2 for white males and 8.4 for colored males. The reversal of form shown by these figures is doubtless due to the exposure in domestic occupations.

That portion of the paper commencing at page 40 throws light on the relative frequency of occupational to total deaths for the years 1912–16. The total number of deaths embraced in this study is 14,151 and as these are from "specified accidental causes" it is obvious that the exposures from which precisely these (and no other) deaths arose cannot be traced. Hence, the data given do not yield an absolute occupational death rate. It is possible nevertheless to use in a comparative way the percentages shown by years in Table 27. By combining these with the death rates for the corresponding years, a factor of *relative* occupational mortality is developed. The figures of Table 27 deal with white males 15 years of age and over. The nearest corresponding values of Table 28 would be those shown in the column under "white males" but through the courtesy of Dr. Dublin I have been furnished with the death rates for white males, ages 15–65, years 1912–1916. These have been combined with the percentages of Table 27 in the following manner:

Year.	Death Rates per 100,000 White Males Ages 15–65.	Percentage of Occupational to Total Deaths (Table 27).	Relative Occupational Fatality Rate.
1916	136.2	25.2	34.3
1915	119.3	23.3	27.8
1914	124.9	29.0	36.2
1913	143.5	32.3	46.4
1912	144.3	30.6	44.2

Expressing these derived percentages and also those shown in Table 27 in terms of the corresponding figures for 1912 we obtain the following differential comparisons for the years specified:

Year.	Proportion of Occupational to Total Deaths (Table 27).	Relative Mortality from Occupational Accidents.
1916	.82	.78
1915	.76	.63
1914	.95	.82
1913	1.06	1.05
1912	1.00	1.00

These comparative ratios are interesting in connection with Dr. Dublin's conclusion that "the proportion of deaths resulting from occupational accidents was on the decline during the five years under observation." The years covered by these comparative ratios fall naturally into two groups, 1912 and 1913 being those before workmen's compensation became an important factor in our industrial and economic life, and the remaining years those which saw the general adoption of compensation measures. The comparative fatality rates and the proportion of occupational deaths to the total of accidental deaths both show a distinct downward tendency after 1913 which possibly may be indicative, at any rate it is suggestive. The upward turn shown for the year 1916 is not necessarily contradictory for it will be remembered that there was in that year an unprecedented increase of industrial activity accompanied by greatly increased accident frequency.

MR. ARNE FISHER:

It might perhaps be of interest to compare some of Dr. Dublin's tables with the results of an analysis I recently made of the mortuary experience of insured lives (industrial white males) of the Prudential Insurance Company of America for the three-year period 1915–1917.

By means of my proposed method of compound frequency curves I constructed a complete mortality table for insured industrial white males for all integral ages from 10 and upwards to the limiting age of the table. The compound frequency curve eliminates the requirements of having detailed information about the exposed to risk at various ages and makes it moreover possible to compute not alone the general death rate, q_x, from all causes of death, but specific death rates from any particular cause or group of causes as well. Moreover, the rates thus produced are automatically graduated, and the work of graduating the crude "central death" rates, such as presented by Dr. Dublin in 10-year age intervals, is not added to the final computation of the specific death rates.

The compound frequency curve method enables us thus to construct a table of graduated rates of death from accidental and unspecified violence, exclusive of suicide and homicide. This table for white males may be compared with Dr. Dublin's crude rates for white males in his Table No. 2 except for the fact that war deaths

were included in the Prudential experience. This would tend to increase the rates for younger ages from 17 to 30. The rates, of course, are not influenced by the heavy war casualties of 1918 when America threw her full strength into the conflict, and which of course falls outside the range of the period under investigation. Most of the war claims are from Canadian policyholders and American volunteers in the Allied armies.

We give below the automatically graduated rates of the Prudential experience. These rates which in the table are given for quinquennial ages only are also shown in graphical form for all ages in Fig. 1.

GRADUATED DEATH RATES, q'_x, FROM ACCIDENTAL AND UNSPECIFIED VIOLENCE. Prudential Industrial White Males, 1915–1917.*

Age.	q'_x.	Age.	q'_x.	Age.	q'_x.
17	.00128	42	.00137	67	.00284
22	.00130	47	.00142	72	.00334
27	.00131	52	.00160	77	.00390
32	.00132	57	.00194		
37	.00135	62	.00243		

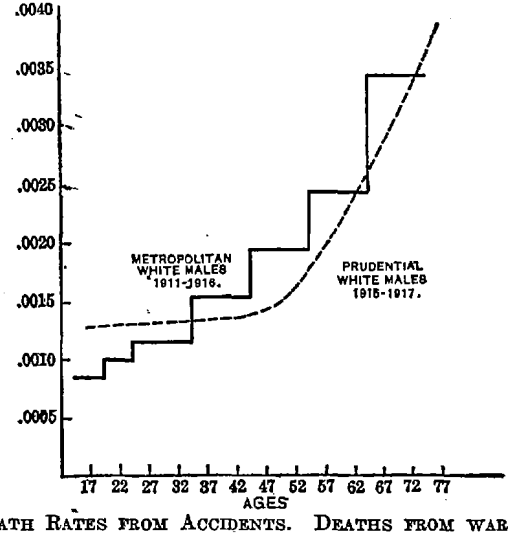


FIG. 1. DEATH RATES FROM ACCIDENTS. DEATHS FROM WAR INCLUDED IN PRUDENTIAL EXPERIENCE, BUT EXCLUDED IN THE EXPERIENCE OF THE METROPOLITAN LIFE INS. CO.

A direct comparison of these rates with Dr. Dublin's "central death" rates for 10-year intervals is impossible without further adjustments, because:

* War Deaths included.

1. Death from war are included in the Prudential experience, which as already stated would tend to increase the rate for younger ages.

2. Dr. Dublin's figures are in all probability based upon amount exposed to risk rather than the true number of lives exposed to risk. This would, except for assurance of the lives of children, tend to increase the rates for adult ages from say 20 and upwards. This well known fact has been borne out by several investigations among industrial insurance companies in England and on the continent. The industrial mortality experience of the large company "Victoria" of Berlin shows that mortality rates based upon amount insured are from 2 to 10 per cent. higher than the true rates based upon life exposures. The increase is especially marked in the life period from 35–55. Is it not possible that policyholders belonging to certain dangerous occupations and who can not obtain ordinary insurance at normal rates are apt to take comparatively large sums of industrial insurance in comparison with the great bulk of industrial policyholders? If this should be the case, it is readily seen that the accident death rate when based upon amount assured would be higher than the true death rate based upon lives exposed to risk.*

3. Dr. Dublin's figures are crude "central death rates" which have not been subjected to a process of graduation. This important distinction is seen from a mere glance at Fig. 1 where the Prudential rate is given as a continuous curve, while the Metropolitan figures are shown as a broken diagram.†

In the construction of mortality tables by means of compound frequency curves from the number of deaths by age and cause and independent of exposures we do not meet the difficulty of basing the rates upon amount insured. The ultimate rates are true death rates.

As an additional matter for comparison we give below the graduated suicide rates for white males.

* I may in this connection also mention that attempts of taking samples among both death claims and policies in force in order to determine the exact correlation factors between amount exposed and lives exposed to risk have proven failures among European companies. The exact determination of such a correlation either by regression equations or other methods is indeed a very difficult problem. If Dr. Dublin has succeeded in solving it to complete satisfaction he is indeed to be congratulated, and his formulas—if such have been developed in this connection—would be extremely valuable, not alone in this particular investigation but in general mathematical statistics as well.

† The very common method used by Dr. Dublin to draw "central death rates" in the form of a frequency polygon or broken curve is not one to be recommended. (See T. N. Thiele, "Theory of Observations," page 11.)

GRADUATED DEATH RATES, q''_x, FROM SUICIDE.
Prudential Industrial White Males, 1915–1917.

Age.	q''_x.	Age.	q''_x.	Age.	q''_x.
17	.0000501	37	.0002920	57	.0006067
22	.0001231	42	.0003263	62	.0006613
27	.0001852	47	.0003781	67	.0006592
32	.0002645	52	.0004800	72	.0005895

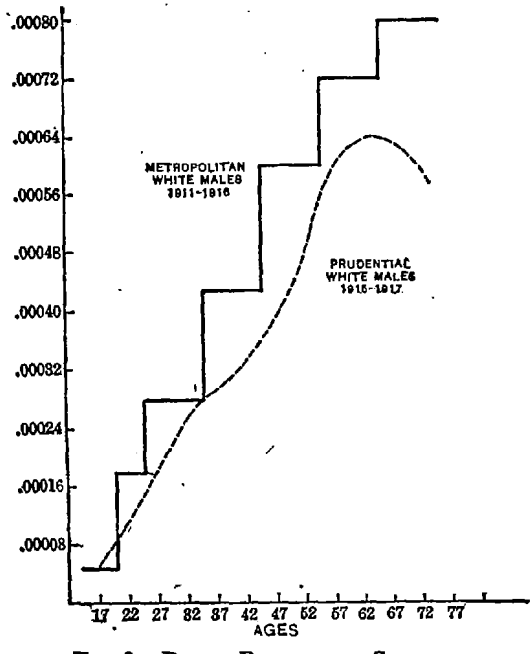


FIG. 2. DEATH RATES FROM SUICIDES.

From the graph in Fig. 2 it appears that the Prudential graduated rate is lower than the corresponding Metropolitan rate. It is quite possible that a careful editing of the number of deaths classified under "poisonings," "inhalation of gas," "drowning," *etc.*, similar to that mentioned by Dr. Dublin in his footnote on page 43 would tend to increase the rate for the Prudential experience. The graduated curve exhibits the same form of a pronounced maximum crest in the age intervals 60–64 as pointed out in previous investigations on the suicide rate by Knibbs of Australia and several Scandinavian investigators.

For homicides the trend of the Prudential graduated curve seems to follow that of the Metropolitan quite closely.

The general increase with age in the death rate from accidents as shown both in the Metropolitan and Prudential experience does by no means come as a surprise. This well known and long established fact has repeatedly been brought to light by investigators, such as Westergaard and Knibbs.

The remarks on death from purely occupational accidents in Dr. Dublin's paper do not pay any attention to the age factor. It is of course by no means an easy matter to classify an accident as purely occupational in nature. While undoubtedly most of the deaths in mines and quarries arise from occupational hazards, it is on the other hand difficult to classify burns, falls, etc., as due solely to occupation. English statistics are somewhat superior in this respect as compared with America data. From an analysis by frequency curve methods I find that the age factor in purely occupational accidents does not play so great a rôle as in ordinary accidents, *i. e.*, non-occupational accidents.

In an analysis of the experience of deaths from accidents in the case of American Locomotive Engineers by means of compound frequency curve I found the death rate of death from accidents, typhoid fever and a few minor causes of death combined into one single group. (Suicides were excluded.)

The vast majority of deaths in this grouping (probably more than 90 per cent.) are due to railroad accidents, and the rate in this group may therefore properly be looked upon as essentially occupational in nature. I give below a comparison of the death rates for the two periods 1893–1906 and 1913–1917 in the above mentioned grouping:

Age.	1893–1906.	1913–1917.	Age.	1893–1906.	1913–1917.
25	.00651	.00428	50	.00625	.00402
30	.00710	.00380	55	.00640	.00457
35	.00706	.00347	60	.00641	.00486
40	.00640	.00343	65	.00613	.00472
45	.00614	.00367	70	.00567	.00460

This table needs no further comment.

COMPARISON OF ACTUAL AND EXPECTED LOSSES AS A MEANS OF LOSS ANALYSIS—A. H. MOWBRAY.

VOL. V, PAGE 80.

WRITTEN DISCUSSION.

MR. WILLIAM LESLIE:

The results of Mr. Mowbray's investigation into the increased disability due to infection of injuries caused by industrial accidents are, in my judgment, of much less importance than the emphasis he places upon the value in casualty insurance of comparisons between actual and expected events.

The final figure of two and one-half times the average disability in uninfected cases is not a general measure of the effect of infection because the method of weighting deaths and permanent partial disabilities makes the result a function of the scale of compensation for these two types of cases. An error may also exist in this figure because of the two following conditions for which proper allowance has not been made.

First, in comparing the actual with expected for the temporary cases, no consideration seems to have been given to the fact that a very considerable number of cases would have caused no disability and hence not have counted as tabular accidents had it not been for infection. In other words, infection not only increases the average duration of disability in temporary cases but it also increases the number of such cases. Therefore, the result is too low by an amount, the measure of which cannot be obtained from the data in hand but which probably would be quite appreciable.

The other condition is the effect of infections in permanent partial disability cases. A case which is already a permanent partial disability, such as a dismemberment, where the infection may increase the period of temporary disability but not the extent of permanent injury, would be improperly treated by the method used. A case which is temporary but rendered permanent because of infection is compared with the average cost of uninfected permanent disabilities whereas the comparison should be made with the average cost of uninfected temporary disabilities. These two types of infected permanent disability cases tend to offset one another but how effectively, it is difficult to say.

Any question however as to the value of the result secured in this instance does not run to the principle employed but only to some of the details connected with the preliminary preparation of the data. As pointed out in the paper, precautions must always

be taken to prevent wrong deductions but with such precautions the method provides one of the most valuable means of solving many problems in casualty insurance.

Several of these problems have been mentioned by the author but his reference to life insurance as the source of the practice of comparing actual with expected events brings to mind one, the solution of which should be undertaken at an early date and which can be handled very nicely on this basis. I refer to the necessity of checking up on the mortality and remarriage tables which were introduced in the State of New York for the valuation of certain benefits and which have come to be rather universally considered standard tables. Following the example of life insurance companies which in their gain and loss exhibit calculate their profit or loss from annuities, a very valuable comparison could be made between the actual experience under annuities payable to beneficiaries under compensation and the expected experience indicated by the present table.

MR. A. H. MOWBRAY:

(AUTHOR'S REVIEW OF DISCUSSION.)

I am greatly pleased to find that Mr. Leslie so heartily approves the method suggested in this paper, as I have, since writing the paper, seen other instances where the method has proved exceedingly useful. For example, a friend of mine was investigating the sickness experience, by occupations, of a benefit association and found apparently a marked difference in the crude sickness disability rate between two occupations, *e.g.*, butchers and bakers, for which the apparent explanation was a difference in the age distribution in the particular experience. Obviously, however, this explanation could not be accepted without check. He discussed it with me and I suggested that he take a standard disability table showing the rates of sickness disability by age, such, for example, as the general table developed from the Leipzig Communal Sick Fund experience, and apply the rates from such table to the exposures in the several age groups in each occupation. This would give the expected disability, which was then to be compared with the actual disability recorded. The comparative ratios of actual expected would then indicate whether or not the difference in the crude disability rates really represented difference in disability according to occupation or difference in age distribution of the risks under observation. The work is not yet completed, but it is my understanding that the method is satisfactorily checking out this difference.

Mr. Leslie raises some questions as to the details of working out the particular problem which suggested this paper. He first points out that the figure of two and one-half times the average disability in uninfected cases as the average disability in infected cases is in-

fluenced by the relative weight given deaths and permanent disabilities. I recognized that this is so and endeavored to point this out in the second paragraph on page 83, suggesting that, if need be, a corrected scale might be used, but observed: "For the purposes in hand this does not seem necessary." I am glad Mr. Leslie has further emphasized this important point.

Mr. Leslie also points out that there may be cases of non-compensatable temporary disability which become compensatable after infection takes place, thus being for the first time brought within the line of vision, and that the relative cost of infection cases is not estimated when this is not brought into account. In principle he is right in his criticism, but, as I pointed out on page 82, the Workmen's Compensation Act of the State of Washington contains no waiting period, and therefore, theoretically at least, we get all cases reported. I am inclined to believe, however, that certain minor injuries are passed over and unreported, even under this Act, until after infection sets in; so that, were it desirable to get such a precise measure of the relation in cost between infected and uninfected cases as would be necessary for monetary calculations, some further allowance should be made for this.

Mr. Leslie also points out that in cases of permanent partial disability, infection may extend the time of temporary total disability without increasing the severity of the permanent impairment, and that this would not be taken account of in a comparison along these lines, using the particular statistics available. This, again, is true; but whether or not this factor should be taken into consideration depends somewhat upon the purpose of the comparison. If the compensation act provides, as does New York, for example, a fixed compensation for certain types of permanent disability without regard to the associated temporary disability, then, clearly, no additional cost, except medical cost, is created by this more extended temporary disability. On the other hand, if the compensation act is like that of Massachusetts, where the total disability benefit is payable as long as total disability exists and an additional compensation benefit is payable for permanent partial disability, then the statistics compiled along the lines of the Washington data would bring this into account.

The precise figure of comparative cost is perhaps even more open to criticism from a different point of view, namely, even though the Washington Act has provided no medical benefit, and, therefore, the medical service rendered is probably less than is generally furnished in a compensation state, yet some medical services were furnished in all of these cases and to a certain extent the infection was checked and controlled. Had it not been for this, undoubtedly, the relative cost would have been even higher, and, therefore, the figures as to relative cost of infected and uninfected injury must be used very guardedly, if used at all, for the basis of medical allowance or other provision in connection with injuries.

The comparison which led to the presentation of this paper was for use at a Safety Congress for the purpose of stressing the importance of preventing infection, and, therefore, only rough approximate figures were necessary.

As Mr. Leslie says, however, these details do not involve the principle of the method suggested.

I am very glad to find that Mr. Leslie suggests that we use this method to check up temporarily the appropriateness of our mortality and remarriage tables used in valuations under the New York and other compensation laws. There is probably not yet a sufficiently matured experience upon which to establish a truly American remarriage table, but in the meantime tests along these lines may go far to satisfy us of the suitability of the tables we are using.

REVIEWS OF BOOKS AND PUBLICATIONS.

An Investigation of the Factors concerned in the Causation of Industrial Accidents. H. M. VERNON, M.D. Memorandum No. 21 of the Health of Munition Workers Committee of the British Ministry of Munitions. 46 pp.

The above report is one rendered by Mr. H. M. Vernon, M.D., on behalf of the Health of Munition Workers Committee to the Minister of Munitions and covers their investigation made in four English plants manufacturing shells and fuses. It covers periods of 9 to 25½ months and the accidents number over 50,000. They are classified under the headings of cuts, foreign bodies in the eye, burns, sprains and other injuries. The eye accidents are considered to afford the most reliable data. Accidents are considered in relation to the following factors: (1) Speed of Production, (2) Fatigue, (3) Psychical influences and alcohol consumption, (4) Nutrition, (5) Natural and Artificial Lighting, (6) Temperature.

Speed of Production.—It was found that the number of accidents varied directly with the speed of production but not in the same proportion. They increased steadily throughout the morning hours, reaching a maximum in the last or next to the last full hour of work; while in the afternoon they showed a constant decrease with the maximum in the first hour of work.

In the night shift the accident frequency showed an entirely different course from that in the day shift. This is attributed to the fact that the night workers begin in a wide-awake condition and consequently are not subject to a high accident frequency until fatigue sets in.

Fatigue.—Accidents to women were 2½ times more numerous during the period in which they were working 75 hours a week than the subsequent period in which they worked 60 hours a week. The number of hours of work did not appear to affect the accident frequency of men.

Psychical Influences.—The figures for all factories indicated that the night shift workers suffered 16 per cent. fewer accidents than the day shift. This is not attributed to a smaller output, but to psychical influences; that is, the night shift workers begin work in a calmer mental state than the day shift workers.

Consumption of Alcohol.—No direct statistical evidence was obtained to show any correlation in this class, but direct evidence pointed to the fact that accident frequency increased with increased consumption of alcohol.

Lighting.—Accidents to the eyes were found to be considerably more frequent in the night shift than in the day shift, and the cause is assumed to be the fact that artificial light was used at night.

Temperature.—It was found that accident frequency was at a minimum when the temperature was 65–59° F. and that it increased rapidly with a rising temperature and increased less rapidly with a drop in the temperature.

Throughout the whole investigation it was evident, and is admitted, that all accidents are affected by numerous causes and it is impossible to obtain the exact correlation between accident frequency and any given cause. In fact, statistics were frequently obtained which were directly contrary to the conclusions of the committee. Their conclusions were, therefore, to a large extent based upon judgment rather than upon actual statistical evidence.

Prevention of Accidents.—The conclusion of the committee is that accidents are due very largely to carelessness and inattention and consequently their frequency could be decreased by preventing the workers from talking to one another in the shops. They also make recommendations for increasing attention to work, but it is admitted that their standards are ideal and ends to be worked toward but not to be attained

A. L. K.

CURRENT NOTES.

STANDARDIZATION OF SCHEDULES "Z" AND "W."

Recently there have been held two very helpful conferences between representatives of several Insurance Departments and company statisticians with a view to standardizing Schedules "Z" and "W."

The first meeting was held in Newark upon March 6 and 7, 1919, in the office of the Compensation Rating and Inspection Bureau of New Jersey. At this session the supervising authorities of Wisconsin, New York, Pennsylvania, New Jersey, Massachusetts and Virginia were represented. The first day's session was devoted to drafting a tentative outline of information to be called for in Schedule "Z" with a view to having this outline adopted immediately by as many states as possible.

At the session of the second day the plan tentatively adopted by the Departments was discussed with members of the Actuarial Committee of the National Council on Workmen's Compensation Insurance and the Central Statistical Committee of the National Workmen's Compensation Service Bureau. The result was an agreement upon principles mutually satisfactory to the carriers and to the Departments. Aside from mere standardization, the following principles in connection with Schedule "Z" are worthy of note:

Indeterminate disability cases are to be valued upon a tabular basis.

Number of claims to be shown for all compensated cases.

Report to be made to show "losses incurred" only, or to show also losses paid and losses outstanding, whichever is more convenient for the carrier.

Detailed individual reports upon all deaths, permanent totals and indeterminates.

Each year of issue to be reported twice in full, and twice only.

Adjustments in payroll and premiums since the first of the year of report to be omitted from the schedule.

At the second meeting held in New York upon May 21, at the office of the Compensation Inspection Rating Board, the New York State Industrial Commission was represented by Mr. Hatch and

the Bureaus of Pennsylvania, New York, Wisconsin, Massachusetts and New Jersey were represented by their Managers. The Departments and organizations which attended the first meeting were also represented.

At this meeting it was decided to extend the individual report in connection with Schedule "Z" to include "major permanent partial disabilities" (permanent partial disability cases involving loss or impairment to the extent of 50 per cent. or more of an arm, hand, leg, foot or eye). Information upon individual reports of indeterminate cases could, it was decided, be made less comprehensive than for other classes of serious cases.

As a means of facilitating early filing of Schedule "Z" it was agreed to ask for the first report in the light of developments as of February 28 of the year of report and to have the second report for any policy year prepared in the light of developments upon December 31 preceding date of report.

Arrangements were made to have the filing of Schedule "Z" conform to a schedule, which will permit each Department to secure a number of schedules early, at the same time distributing the burden of work throughout several months.

The carrier representatives suggested an entirely new form of Schedule "W," to consist principally of an exhibit showing results for the entire business of the company with certain additional items for each state. Since this proposal was to a considerable degree an innovation the matter was referred to a subcommittee to report to the individual Departments.

RECENT LITERATURE ON CASUALTY AND SOCIAL INSURANCE.

PREPARED UNDER DIRECTION OF THE LIBRARIAN.*

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———
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———
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———
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———
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———
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2. *Economics.*

BROWNE, L. A.
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3. *Sociology.*

BURCH, H. R., and PATTERSON, S. H.
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BYINGTON, MARGARET F.
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4. *Statistics.*

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5. *Other.*

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E. BIBLIOGRAPHICAL NOTES.

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THE JOURNAL OF IND. HYGIENE AND ABSTRACT OF LITERATURE. New periodical giving some fine material pertinent to the subject of industrial hygiene. In addition to articles, gives abstract of the current literature of the subject.

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Those marked (†) were Charter Members at date of organization, November 7, 1914.

Those marked (*) have been admitted as Fellows upon examination by the Society.

Those marked (§) are in the military or naval service of the United States.

Date Admitted	
†	§Amerine, W. M., Actuary, Georgia Casualty Co., Macon, Ga.
†	Baldwin, F. Spencer, Manager, State Insurance Fund, 411 Fifth Ave., New York.
†	Benjamin, Roland, Comptroller, Fidelity & Deposit Co., Baltimore, Md.
†	Black, S. Bruce, Treasurer, Liberty Mutual Ins. Co., 185 Devonshire St., Boston, Mass.
Apr. 20, 1917	Blanchard, Ralph H. Instructor in Insurance, 506 Journalism, Columbia University, New York.
May 19, 1915	Bradshaw, Thomas, Commissioner of Finance and City Treasurer, Toronto, Canada.
†	Breiby, William, Office of Fackler & Fackler, Consulting Actuaries, 35 Nassau St., New York.
*Oct. 31, 1917	Brockway, U. Hayden, Travelers Ins. Co., Hartford, Conn.
†	Brodin, Richard, Actuary, United Life and Accident Ins. Co., Concord, N. H.
Oct. 22, 1915	Brown, Herbert D., Chief of U. S. Efficiency Bureau, Washington, D. C.
Oct. 22, 1915	Brown, William H., Second Vice-President, Columbian National Life Ins. Co., Boston, Mass.
†	Buck, George B., Actuary, Teachers' Retirement System, City of New York, Municipal Building, New York.
May 26, 1916	Bucklin, Walter S., President, Liberty Mutual Ins. Co., 185 Devonshire St., Boston, Mass.
†	Budlong, W. A., Superintendent of Claims, Commercial Travelers Mutual Accident Assn., Utica, N. Y.
Apr. 20, 1917	Burhop, W. H., Member, Wisconsin Compensation Insurance Board, State Capitol, Madison, Wis.

Feb. 19, 1915 Burns, F. Highlands, First Vice-President, Maryland Casualty Co., Baltimore, Md.

† Cammack, Edmund E., Associate Actuary, Aetna Life Ins. Co., Hartford, Conn.

† Carpenter, Raymond V., Assistant Actuary, Metropolitan Life Ins. Co., 1 Madison Ave., New York.

Feb. 19, 1915 Case, Gordon, office of F. J. Haight, Consulting Actuary, Hume-Mansur Bldg., Indianapolis, Indiana.

Feb. 25, 1916 Close, Charles L., Manager, Bureau of Safety, U. S. Steel Corporation, 71 Broadway, New York.

*Nov. 15, 1918 §Coates, Barrett N., The Fraternal Brotherhood, Los Angeles, Cal.

Oct. 27, 1916 Cogswell, Edmund S., Third Deputy Insurance Commissioner, State House, Boston, Mass.

† Cole, Richard H., Secretary, Connecticut General Life Ins. Co., Hartford, Conn.

Feb. 19, 1915 Collins, Henry, Assistant Manager, Ocean Accident & Guarantee Corporation, 59 John St., New York.

† Conway, Charles T., Vice-President, Liberty Mutual Ins. Co., 30 E. 42d St., New York.

† Copeland, John A., Consulting Actuary, 1709 Third National Bank Building, Atlanta, Ga.

† Cowles, W. G., Vice-President, Travelers Ins. Co., Hartford, Conn.

† Craig, Arthur H., Fredk. C. Smith Co., 1 Liberty St., New York.

† 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, Prudential Ins. Co., Newark, N. J.

Nov. 15, 1918 Davis, Mervyn, Assistant Actuary, Equitable Life Assurance Society, 120 Broadway, New York.

† Dawson, Alfred B., Miles M. Dawson & Son, 141 Broadway, New York.

† Dawson, Miles M., Counsellor at Law and Consulting Actuary, 141 Broadway, New York.

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May 19, 1915 Deutschberger, Samuel, Chief Examiner, Underwriters' Association Bureau, New York Ins. Dept., 165 Broadway, New York.

† Downey, E. H., Special Deputy, Insurance Department, Harrisburg, Pa.

†	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.
†	§Egbert, Lester D., Office of Willcox, Peck, Brown & Crosby, Insurance Brokers, 3 S. William St., New York. (Lieutenant.)
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†	Fackler, Edward B., Consulting Actuary, 35 Nassau St., New York.
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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.
May 19, 1915	Fisher, Arne, Prudential Ins. Co. Newark, N. J.
†	Fitch, Frank M., Auditor, Hartford Steam Boiler Inspection & Ins. Co., Hartford, Conn.
Feb. 19, 1915	Flanigan, James E., Actuary, Bankers Life Co., Des Moines, Iowa.
†	Flynn, Benedict D., Assistant Secretary, Travelers Ins. Co., Hartford, Conn.
Feb. 15, 1915	Fondiller, Richard, Supt., Bureau of Records & Accounts, Group Ins. Dept., Equitable Life Assurance Society, 120 Broadway, New York.
†	Forbes, Charles S., Consulting Actuary, 66 Broadway, New York.
May 26, 1916	Frankel, Lee K., Third Vice-President, Metropolitan Life Ins. Co. 1 Madison Ave., New York.
†	Franklin, C. E., 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.
Feb. 19, 1915	Garrison, Fred S., Assistant Secretary, Travelers Indemnity Co., Hartford, Conn.
†	Gaty, Theodore E., Vice-President and Secretary, Fidelity & Casualty Co., 92 Liberty St., New York.
May 19, 1915	Glover, James W., Consulting Actuary, University of Michigan, Ann Arbor, Mich.
†	Goodwin, Edward S., Care of F. R. Cooley and Co., Bankers, 49 Pearl St., Hartford, Conn.

†	Gould, William H., Consulting Actuary, 256 Broadway, New York.
Oct. 22, 1915	Graham, T. Bertrand, Metropolitan Life Ins. Co., 1 Madison Ave., New York.
†	Graham, William J., Third Vice-President, Equitable Life Assurance Society, 120 Broadway, New York.
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†	Greene, Winfield W., Special Deputy Commissioner of Banking and Insurance, 571 Broad St., Newark, N. J.
†	Hamilton, R. C. L., Comptroller, Hartford Accicident & Indemnity Co., Hartford, Conn.
†	Hammond, H. Pierson, Assistant Actuary, Life Dept., Travelers Ins. Co., Hartford, Conn.
†	Hansen, Carl M., Secretary, American Re-Insurance 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., Chief Statistician, State Industrial Commission, Albany, N. Y.
Oct. 22, 1915	§Hess, Herbert, Sergeant, Base Hospital No. 15, American Expeditionary Force.
†	Hillas, Robert J., President, Fidelity & Casualty Co., 92 Liberty St., New York.
Nov. 15, 1918	Hinsdale, F. W., Secretary, Workmen's Compensation 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 Manager, Royal Indemnity Co., 84 William St., New York.
†	Hughes, Charles, Auditor and Actuary, New York Ins. Dept., 165 Broadway, New York.
†	Hunt, Burritt A., Actuary, Casualty Dept. Aetna Life Ins. Co., Hartford, Conn.
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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 Protective Assn., Worcester, Mass.

May 23, 1919	Kelly, Gregory C., General Manager, Pennsylvania Compensation Rating & Inspection Bureau, 507 Morris Bldg., Philadelphia, Pa.
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†	Kopf, Edwin W., Assistant Statistician, Metropolitan Life Ins. Co., 1 Madison Ave., New York.
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Feb. 19, 1915	Landis, Abb, Consulting Actuary, 1107 Independent Life Building, Nashville, Tenn.
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†	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	McDougald, Alfred, Accident Manager, Phoenix Assurance Company, Phoenix House, King William St., E. C., London, England.
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Feb. 19, 1915	Maddrill, James D., Supervisor of Training, Federal Board for Vocational Education, 997 Monadnock Bldg., San Francisco, Calif.
†	Magoun, William N., General Manager, Massachusetts Rating & Inspection Bureau, 88 Broad St., Boston, Mass.
May 19, 1915	Maycrink, Emma C., Auditor, Compensation Inspection Rating Board, 135 William St., New York.
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., Actuary, National Workmen's Compensation Service Bureau, 13 Park Row, New York.

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†	Moir, Henry, Actuary, Home Life Ins. Co., 256 Broadway, New York.
†	Moore, George D., Statistician, Royal Indemnity Co., 84 William St., New York.
May 19, 1915	Morris, Edward B., Actuary, Life Dept., Travelers Ins. Co., Hartford, Conn.
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†	Mowbray, Albert H., Actuary, State Industrial Commission, 411 Fifth Ave., New York.
May 20, 1918	Mudgett, Bruce D., Assistant Professor of Insurance, University of Washington, Seattle, Wash.
†	Mullaney, Frank R., Actuary, American Mutual Liability Ins. Co., 245 State St., Boston, Mass.
†	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., Executive Secretary, Insurance Federation of the State of New York, 80 Maiden Lane, New York.
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May 26, 1916	Parker, Jr., John M., Secretary, Accident and Liability Department, Aetna Life Ins. Co., Hartford, Conn.
Nov. 15, 1918	Perry, W. T., Manager for Canada, Ocean Accident and Guarantee Corporation, Toronto, Canada.
†	Reiter, Charles G., Assistant Actuary, Metropolitan Life Ins. Co., 1 Madison Ave., New York.
†	Remington, Charles H., Assistant Treasurer, Aetna Life Ins. Co., Hartford, Conn.
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 & Actuary, Colorado Ins. Dept., Denver, Colo.

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†	Scattergood, Claude E., Assistant Treasurer, Sperry Gyroscope Co., 40 Flatbush Ave. Extension, Brooklyn, N. Y.
†	Scheitlin, E., Statistician, Globe Indemnity Co., 45 William St., New York.
†	Senior, Leon S., Manager and Secretary, Compensation Inspection Rating Board, 135 William St., New York.
†	Smiley, J. W., Actuary and Chief Accountant to the West Virginia State Compensation Commissioner, Charleston, W. Va.
Apr. 20, 1917	Smith, Charles G., Actuary, New York Ins. Dept., Albany, New York.
Feb. 19, 1915	Stone, John T., President, Maryland Casualty Co., Baltimore, Md.
Feb. 25, 1916	Strong, Wendell M., Associate Actuary, Mutual Life Ins. Co., 32 Nassau St., New York.
Oct. 22, 1915	Strong, William Richard, 39 Streatham High Road, S. W. 16, London, England.
†	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 Ins. Co., 32 Nassau St., New York.
†	Train, John L., Secretary and General Manager, Utica Mutual Ins. Corp., 239 Genesee St., Utica, New York.
May 23, 1919	Welch, Archibald A., Vice President, Phoenix Mutual Life Ins. Co., Hartford, Conn.
†	Whitney, Albert W., General Manager, National Workmen's Compensation Service Bureau, 13 Park Row, New York.
†	Wolfe, Lee J., Consulting Actuary, 165 Broadway, New York.
†	Wolfe, S. Herbert, Consulting Actuary, 165 Broadway, New York.
†	Woodward, Joseph H., Associate Actuary, Guardian Life Ins. Co., 50 Union Square, New York.
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Those marked (1) have passed Part I of the Fellowship Examination.

Those marked (§) are in the military or naval service of the United States.

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*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.
(1)*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.
*Oct. 27, 1916	Bernstein, Abraham, Accountant, State Ins. Fund, 411 Fifth Ave., New York.
*Oct. 31, 1917	Bessey, John M., Secretary, National Association of Mutual Casualty Insurance Companies, 233 Broadway, New York.
*Oct. 22, 1915	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., Second Asst. Actuary, Wisconsin Ins. Dept., Madison, Wis.
*Oct. 22, 1915	Buffler, Louis, Jr., State Ins. Fund, 411 Fifth Ave., New York.
*Nov. 15, 1918	Carver, Harry C., Secretary-Actuary, Otis Hann Co. Inc., Life Insurance Service, 10 South La Salle St., Chicago, Ill.
*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.	15, 1918	Greenleaf, Allen R., First National Bank, Boston, Mass.
May	23, 1919	Hoage, Robert J., Chief Statistician, U. S. Employees Compensation Commission, Washington, D. C.
*Oct.	31, 1917	Jackson, Edward T., Statistician, Maryland Casualty Co., Baltimore, Md.
*Oct.	31, 1917	Kearney, T. P., Assistant Manager, State Compensation Insurance Fund, Denver, Colo.
*Nov.	15, 1918	Kirkpatrick, A. L., National Workmen's Compensation Service Bureau, 15 Park Row, New York.
*Oct.	22, 1915	Levy, S. Leon, War Trade Board, Washington, 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., Equitable Life Assurance Society, 120 Broadway, New York.
(1)*Oct.	27, 1916	§Miller, Tilford W., Travelers Ins. Co., Hartford, Conn.
*Oct.	31, 1917	Montgomery, Victor, Actuary, California Ins. Dept., San Francisco, Cal.
*Oct.	31, 1917	Mueller, Louis H., State Compensation Insurance Fund, 525 Market St., San Franfrancisco, Cal.
*Oct.	22, 1915	Müller, Fritz, New York Life Ins. Co., 346 Broadway, New York.
(1)*Oct.	27, 1916	Newell, William, Chief Safety Engineer, State Insurance Fund, 411 Fifth Ave., New York.
May	23, 1919	Otto, Walter E., Treasurer & Actuary, Michigan Mutual Liability Co., Detroit, Mich.
*Nov.	15, 1918	Outwater, Olive E., National Workmen's Compensation Service Bureau, 15 Park Row, New York City.
*Nov.	15, 1918	Raywid, Joseph, Statistician, International Fire & Marine Ins. Corp., 3 S. William St., New York.
*Nov.	15, 1918	Schaefer, Walter A., Ocean Accident & Guarantee Corp., 59 John St., New York.
*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.
*Oct. 22, 1915	§Tilson, Howard, Captain, Ordnance Dept., Frankford Arsenal, Philadelphia, Pa.
(1)*Oct. 22, 1915	Van Tuyl, Hiram O., Examiner, New York Ins. Dept., 165 Broadway, New York.
(1)*Oct. 27, 1916	§Waite, A. W., Aetna Life Ins. Co., Hartford, Conn.
(1)*Oct. 27, 1916	Waite, Harry V., 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.
*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., Chief Accountant, Ocean Accident & Guarantee Corp., 59 John St., New York.

SCHEDULE OF MEMBERSHIP, MAY 23, 1919.

	Fellows.	Associates.	Total
Membership, November 15, 1918	145	41	186
By withdrawal	4	—	4
	141	41	182
Additions:			
By election, May 23, 1919	4	3	7
By reinstatement	—	1	1
Membership, November 15, 1918	145	45	90

ABSTRACT FROM THE MINUTES OF THE MEETING, MAY 23, 1919.

The semi-annual and twelfth regular meeting of the Casualty Actuarial and Statistical Society of America was held at the Hotel Pennsylvania, New York City, on May 23, 1919.

President Woodward called the meeting to order at 10:30 A.M. The roll was called showing the following forty-six Fellows and twelve Associates present:

FELLOWS.

BLACK	FISHER	LUBIN
BLANCHARD	FLYNN	MAGOUN
BRODIN	FONDILLER	MELTZER
BUCK	GARRISON	MICHELBACHER
BUDLONG	GOULD	MOIR
BURHOP	GRAHAM, T. B.	MOORE, G. D.
CAMMACK	GRAHAM, W. J.	MOWBRAY
CONWAY	GREENE	NICHOLAS
CRAIG, J. D.	HATCH	OTIS
CRUM	HUGHES	RYAN
DAVIS	HUNT	SENIOR
DEARTH	JACKSON, C. W.	WHITNEY
DEUTSCHBERGER	KELLY	WOLFE, S. H.
DUBLIN	KING	WOODWARD
DUNLAP	KOPF	
FARRER	LESLIE	

ASSOCIATES.

ACKERMAN	KIRKPATRICK	SPENCER
DORWEILER	NEWELL	WAITE, H. V.
ELSTON	OUTWATER	WARREN
JACKSON, E. T.	RAYWID	WOODMAN

The President's address was presented.

The minutes of the meeting held November 15, 1918, 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 no definite conclusion had been reached as to holding the May, 1920, meeting at Chicago, but that an announcement would be made at the time of the next meeting of the Society, in November, 1919.

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

Gregory C. Kelly, General Manager, Pennsylvania Compensation Rating and Inspection Bureau, Philadelphia, Pa.
Alfred McDougald, Accident Manager, Phoenix Assurance Company, London, England.
Frederick Richardson, United States Manager, General Accident, Fire and Life Assurance Corporation, Philadelphia, Pa.
Archibald A. Welch, Vice President, Phoenix Mutual Life Insurance Company, Hartford, Conn.

After ballot, these nominees were declared duly elected Fellows.

The Council reported that the following had been enrolled without examination as Associates:

Nicholas Fletcher. Walter E. Otto. Charles S. Warren.

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.

The following resolution was adopted by the Society:

"*Whereas:* The published results of the forthcoming Census of population, of manufactures, mines, quarries and forestry in the United States, as authorized by the Bill enabling the Fourteenth and Subsequent Censuses, will materially advance casualty insurance science, and will help especially to solve numerous rate-making and administrative problems in that science.

"*Therefore be it unanimously resolved by the Casualty Actuarial and Statistical Society of America that—*

"1. The statistics of classified wages in the Census of manufactures, mines, quarries and forestry be tabulated to show for the principal industries in the several states the number of employees by one-dollar weekly-wage groups up to thirty-five dollars, and by five-dollar wage-groups thereafter.

"2. The statistics of the occupations of the population be classified and tabulated to show in principal states, the number of persons in the important specific occupation classes of each significant industry of each State.

"3. The classification of 'external causes' of death in the International List of Causes of Death, Second Decennial Revision, 1909, be amended to show, in its application to the annual statistics of mortality in the Registration Area for Deaths, the number of accidental deaths due to—(*a*) domestic hazard, (*b*) industrial or occupational hazard, (*c*) public liability hazard and (*d*) unknown or unspecified hazard, and that such deaths be tabulated by sex and age classes.

"4. The statistics of diseases and accidents under treatment in a representative number of hospitals or other institutions be collected by the United States Public Health Service in accordance with an approved, uniform nomenclature and classification of such diseases and accidents, and through voluntary cooperative arrangement between the United States Public Health Service and the several hospitals or other reporting institutions. It is recommended that workmen's compensation and occupational disease cases under treatment be so specified, and the data shown for sex, age, duration of disability and for other items which are in the opinion of the United States Public Health Service of sufficient economic and social importance to warrant tabulation and publication. It is suggested, furthermore, that the data for injuries show not only the means of injury, but also the nature of the injury, *i.e.*, fractures by parts affected, various classes of wounds, infections following injury, etc.

"*Furthermore be it resolved:* That a copy of this resolution be sent to the Director of the Census, to the Surgeon General of the United States Public Health Service, and to the Chairman of the Census Committees of the House of Representatives and of the Senate."

An informal "Question Box" concluded the meeting.
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 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 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 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.—*Expulsion 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.

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:

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.

A copy of a pamphlet entitled "Recommendations for Study" may be obtained upon application to the Secretary-Treasurer.

EXAMINATIONS OF THE SOCIETY.

EXAMINATION COMMITTEE.

G. F. MICHELBACHER (CHAIRMAN).

In Charge of Associateship Examinations.	*In Charge of Fellowship Examinations.*
EDWIN W. KOPF (CHAIRMAN),	E. S. COGSWELL (CHAIRMAN),
MERVYN DAVIS,	WILLIAM H. BURHOP,
FRANK R. MULLANEY.	EVERETT S. FALLOW.

EXAMINATION FOR ENROLLMENT AS ASSOCIATE.

MAY 7, 1919.

PART III. FIRST PAPER.

Time: 9.30 until 12.30 o'clock.

1. Obtain the probabilities that of two lives, (x) and (y): (a) at least one will survive n years, (b) both will die within n years, (c) the first death will occur in the nth year.

2. Define the "force of interest" (δ) and establish the relations between i, v and δ.

3. Comment on the prevailing high wages for labor. Is it a good thing for society in general? For employers in general? For an individual employer?

4. Distinguish between: (a) normal correlation, (b) partial correlation, (c) spurious correlation.

5. Answer one of the following:

(a) Show that the value of a life annuity is less than that of an annuity certain for the term of the curtate expectation.

(b) Define the phrase "expectation of life" and obtain a formula giving its value.

6. Obtain an expression for the value of $a_{\overline{n}|}$ and analyze the payments made under such an annuity to show how much of each represents repayment of principal and how much interest on principal still unpaid.

7. What different possible standards of an equitable price for a commodity do you suggest?

8. Point out the limitations upon the use of the theory of simple sampling, especially upon the practical use of the so-called "standard error."

PART III. SECOND PAPER.

Time: 1.30 until 4.30 o'clock.

9. Establish the relations between the commutation functions: D, N, S, C, M and R.

10. If $a_{\overline{n}|} = x$ and $a_{\overline{m}|} = y$, find i in terms of x and y.

11. Name the principal influences which affect the rate of exchange.

12. Define: (a) mean deviation, (b) standard deviation.

13. (a) Define the terms "mean reserve," "terminal reserve." (b) Explain what is meant by the "full net level premium," "preliminary term," "modified preliminary term" and "select and ultimate" methods of valuation.

14. A loan of $10,000 is made to be repaid in ten annual installments. Find the expression for the amount of each installment so that the lender may receive a return of interest at the rate i on his investment throughout the ten year period, it being understood that he can only reinvest the payments to him at a lower rate i'.

15. What points of superiority have bank notes over government paper money?

16. What tests would you apply to determine whether you were dealing with a stable, homogeneous, statistical series?

PART IV. FIRST PAPER.

Time: 9.30 until 12.30 o'clock.

1. Describe briefly the underwriting features of Credit Insurance. What is the basis of the premium charged? What information is necessary properly to determine the desirability of such risks?

2. Illustrate the following table graphically:

NUMBER OF DAYS LOST PER 1,000 THREE HUNDRED DAY WORKERS.

Industry.	Accidents Resulting in		
	Death.	Permanent Disability.	Temporary Disability.
Iron and steel industry	7.0	3.2	2.1
Machine building	1.9	2.1	1.1

3. Describe a method whereby a record of workmen's compensation experience for individual risks may be maintained. Sketch forms to be used in tabulating such information.

4. When control of the railways in the United States was undertaken by the Railroad Administration what, in your opinion, was the status of railway employes with respect to the United States Employees Compensation Act? Give reasons.

5. Discuss the features of Group Health Insurance as applied to manufacturing or mercantile risks having a large number of employees. Name important points to be considered in underwriting such risks.

6. Outline a method of calculating relative retail prices of food. How would you "weight" the prices of the several items in computing an index number for a representative list of articles, and why?

7. As regards casualty companies, state what percentage is applied to the premiums in force for the purpose of ascertaining the unearned premium reserve on: (*a*) Annual policies, (*b*) policies running for more than one year.

8. A compensation act is amended to include a new group of employments, "all other employments not hereinbefore mentioned in which four or more workmen or operatives are regularly employed." In your opinion would the words "workmen or operatives" apply to a group composed of: (*a*) two laborers and two bookkeepers? (*b*) four or more clerical employes?

PART IV. SECOND PAPER.

Time: 1.30 until 4.30 o'clock.

9. In automobile insurance: what are the "standard limits" on: (*a*) property damage, (*b*) public liability.

Define "loss of use" and state the feature of automobile insurance in connection with which it is written.

10. Draw a graph for, and interpret the following series. Determine whether it is possible to show the extent of correlation between the variables, and if so, what adjustments of the data are necessary?

Year.	Average Annual Price of Gold in Greenbacks.	Average Wages.	Year.	Average Annual Price of Gold in Greenbacks.	Average Wages.
1862	113	104	1871	112	184
1863	145	119	1872	112	185
1864	203	142	1873	114	183
1865	157	155	1874	111	175
1866	141	164	1875	115	163
1867	138	167	1876	112	153
1868	140	170	1877	105	143
1869	133	179	1878	101	142
1870	115	179	1879	100	139

11. Describe the method for computing loss reserves for liability and workmen's compensation by means of Schedule "P" as required in the annual statement blank for miscellaneous companies.

12. Comment on the provision for medical service in two acts,

(*a*) "such as the nature of the injury requires," (*b*) "such as is required or requested by the employee," from the standpoint of: (1) the employee's interest, (2) the employer's interest, (3) the interest of community in general.

13. Is it necessary that a policy issued by a mutual casualty company contain a provision regarding assessments? State reasons.

14. Outline the steps necessary for the preparation of the annual statistical review of the accident experience of: (choose one topic) (*a*) a state industrial accident commission, (*b*) a workmen's compensation commission, (*c*) the employers' liability and workmen's compensation department of a casualty company, (*d*) the personal accident branch of a casualty company.

Start with the handling of the report card or blank and describe the processes necessary to the preparation of a finished publication.

15. Describe the schedules required by several Insurance Departments known as "W" and "Z." State the purpose of each, and also the relation of each schedule to the other.

16. An employer voluntarily pays an employee full wages during a period of disability compensable under the Act of a certain State. The injured man subsequently claims compensation. What action would you recommend? Why?

EXAMINATION FOR ENROLLMENT AS FELLOW.

MAY 7, 1919.

PART I. FIRST PAPER.

Time: 9.30 until 12.30 o'clock.

(Candidates may omit two questions.)

1. (*a*) State briefly the present law of one of the States pertaining to the computation of reserves for workmen's compensation insurance.

(*b*) State the authorized method of computing reserves for Schedule "Z" for one of the States which requires Schedule "Z" to be filed.

2. How are the present automobile liability and property damage rates computed for cars of the private pleasure type?

What has been the basis in the past? Explain the advantages and disadvantages of each method.

3. State and give reasons as to the various points which should be considered when investigating claims under personal accident insurance for: (*a*) death losses, (*b*) weekly indemnity payments.

4. State and give your reasons as to the statistical investigations which should be made in connection with personal health insurance. Outline a system for obtaining this statistical information.

5. Describe the present plan of experience rating for workmen's compensation insurance used in one of the following states: New York, New Jersey, Pennsylvania, Massachusetts, Connecticut.

6. State the particular information that should be brought out and the reason for the same in making an inspection for: (*a*) burglary insurance on mercantile open stock, (*b*) group health insurance.

7. It is contended that schedule rating exercises considerable influence toward the adoption of safety measures and consequently that it reduces accident frequency. How would you proceed to investigate this contention?

8. (*a*) Is there any decided tendency in the new and amended workmen's compensation acts with regard to changing the scale of amount of benefits?

(*b*) If so, what is the direction of the change and what is the impelling force?

(*c*) Name at least three States in which your answers to (*a*) and (*b*) are substantiated by recent legislation.

(*d*) List California, Connecticut, Illinois, New Jersey, New York and Pennsylvania in the ascending order of the scale of benefits as of January 1, 1919 as determined by the workmen's compensation acts of the respective States.

9. (*a*) Assuming that the present workmen's compensation rates accurately measure the normal hazards of the various classifications, state any unusual arguments which may exist for or against a carrier writing policies on new risks which have participated heavily in war time activities.

(*b*) Would the force of such arguments be weakened or strengthened if the risks were subject to experience rating?

10. (*a*) What has been the effect of war time industrial conditions on workmen's compensation experience as a whole.

(*b*) How have industrial conditions affected the underwriting exhibits of the carriers and what should they look forward to as reactionary effects?

PART I. SECOND PAPER.

Time: 1.30 until 4.30 o'clock.

(Candidates may omit two questions.)

11. Are United States Liberty Bonds good investments for casualty insurance companies, and might all of the capital and surplus of a company just starting in business, except an amount of cash necessary to pay current expenses, be safely invested in them? State the reasons for your answer.

12. In making up the annual statements of casualty companies it is necessary to use the insurance commissioners' security values. What are these values and why are they used?

13. List the following securities in the order of preference as investments for casualty insurance companies at the present time and state your reasons for the same: Railroad bonds, mortgage loans on real estate, industrial bonds, Liberty bonds, street railway bonds, municipal bonds, public utility bonds.

14. Name five points in the order of their importance which should be carefully considered in purchasing securities for a casualty insurance company. Give a brief statement as to why each of the points mentioned by you has an important bearing on the value of the securities.

15. Mention some of the reasons why plate glass insurance rates have been increased.

16. A Bill has been introduced into a State Legislature to provide that a mutual company, with a surplus in excess of the capital stock required of a stock company, may issue policies that are non-assessable. State arguments for and against such a Bill.

17. Give the provisions of the statute of one of the States which provides for the regulation of workmen's compensation insurance rates.

18. What means of protecting the interests of injured workmen should the State require before permitting an employer to become a self insurer?

19. Under what circumstances should a State Industrial Accident Board permit lump sum settlements in fatal cases?

20. The Massachusetts Workmen's Compensation Act effective as of July 1, 1912, has been used as a basis in determining the pure premiums from which the rates now in force in most States were determined: (*a*) Why was this act adopted as a basis? (*b*) Should the basis be changed for the next general revision in rates? Give reasons for your answers. (*c*) What are the objections to the use of a flat reduction factor in reducing experience to a common level?

PART II. FIRST PAPER.

Time: 9.30 until 12.30 o'clock.

Note.—In accordance with Rule 8 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 1: PRINCIPLES AND HISTORY OF SOCIAL INSURANCE.

1. (*a*) What is social insurance?

(*b*) What effect will the unsettled conditions and industrial unrest throughout the world be likely to have in connection with social insurance?

2. (*a*) Name the various branches of social insurance and discuss the extent to which each branch has been adopted in the United States.

(*b*) Name two states that have investigated social insurance. Give a brief account of one of these investigations.

TOPIC 2: COMPILATION AND USE OF CENSUS OR OTHER GOVERNMENT STATISTICS RELATING TO POPULATION, MORTALITY, INVALIDITY, SICKNESS, UNEMPLOYMENT, OLD AGE AND ALLIED MATTERS.

3. Draw up a questionnaire which could be sent to sick benefit funds in a State in order to obtain the rate and extent of sickness in the State. Assuming that all the funds had a waiting period and that the period of indemnity payment was limited, show how you would arrange the information obtained above. What allowances should be made for results obtained in this matter?

4. (*a*) Define: (1) *Morbidity*, (2) *crude death rate*.

(*b*) Define the following terms as used in statistical investigations: (1) Arithmetical average, (2) median, (3) mode.

State the advantages and disadvantages of each of the three kinds of averages with illustrations.

TOPIC 3: SYSTEMS OF INVALIDITY, OLD AGE AND UNEMPLOYMENT INSURANCE.

5. Discuss the following points in connection with a system of unemployment insurance: (*a*) General plan, (*b*) factors affecting premium rates, (*c*) adjustment of claims.

6. Discuss the comparative advantages of compulsory insurance versus old age pensions in dealing with the problem of old age.

TOPIC 4: CALCULATION OF PREMIUMS FOR AND VALUATION OF PENSION FUNDS.

7. An association for thirty years has had in effect an old age pension plan providing for the payment of 2 per cent. of total salary for each year of service, limit of pension two-thirds of total salary, no pension to be paid when the length of service has been less than fifteen years. No provision has been made for repaying contributions in case of withdrawal or death. Outline the work which must be done to make a valuation of the fund.

8. Discuss the following points in connection with a pension schedule which is to be started for a large bank: (*a*) Beneficiaries, (*b*) amount of benefits, (*c*) age of retirement, (*d*) length of serv-

ice, (*e*) cases of total and permanent disability before requirements in connection with age retirement and length of service have been fulfilled, (*f*) temporary disability.

PART II. SECOND PAPER.

Time: 1.30 until 4.30 o'clock.

Note.—In accordance with Rule 8 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 candidates 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 examination.

TOPIC 1: PRINCIPLES AND HISTORY OF SOCIAL INSURANCE.

9. Give a review of the workmen's compensation movement in the United States.

10. Name three books on social insurance that you have read and sketch briefly the information contained in one of them.

TOPIC 2: COMPILATION AND USE OF CENSUS OR OTHER GOVERNMENT STATISTICS RELATING TO POPULATION, MORTALITY, INVALIDITY, SICKNESS, UNEMPLOYMENT, OLD AGE AND ALLIED MATTERS.

11. The report of Provost Marshall General Crowder on the first draft contains the following figures:

	Total Examined Physically.	Physically Qualified.	Ratio to Total Examined.
Alabama	47,867	36,399	75.98
Georgia	65.946	46,394	70.35
Massachusetts	83,796	54,067	64.52
Connecticut	29,002	15,575	53.70
New York	322,082	223,754	69.47
Pennsylvania	161,223	86,029	53.33
California	95,647	70,614	73.83
Iowa	40,961	31,875	77.82

Discuss the propriety of using these figures for comparative purposes as to the health conditions in the states mentioned.

12. (*a*) What is meant by registration area as used in the Bureau of Census Mortality Statistics?

(*b*) Name three States in different sections of the country that are included in the registration area.

(*c*) Discuss briefly the information contained in one of the following: (1) Bureau of Census Mortality Statistics, (2) Monthly Review Bureau of Labor Statistics.

TOPIC 3: SYSTEMS OF INVALIDITY, OLD AGE AND UNEMPLOYMENT INSURANCE.

13. Outline the various plans of sickness insurance with respect to management, burden of cost, scope of application and the organization of medical aid.

14. Discuss the extent to which the following systems of insurance have advanced in Europe: (*a*) Sickness, (*b*) unemployment, (*c*) old age pensions.

15. How would you proceed in making an investigation for a State in connection with the problem of unemployment insurance.

TOPIC 4: CALCULATION OF PREMIUMS FOR AND VALUATION OF PENSION FUNDS.

(Candidates may omit one of the following questions.)

16. It is proposed to organize a municipal firemen's pension fund with retirement at age sixty or in case of total and permanent disability. The pension is to be 50 per cent. of the average salary for ten years previous to retirement and the contributions are to be made equally by the firemen and the municipality. The fund is to be started at once and it is intended that current contributions from year to year shall meet current expenses, in this manner avoiding the risk of administering a large fund at any time. Criticize this plan. What recommendations would you make? How would you treat: (*a*) Voluntary withdrawals from the force, (*b*) cases of temporary disability.

17. (*a*) What is the so-called pension method?

(*b*) Name some city or state which has conducted an investigation into its pension funds and describe briefly: (1) The method of investigation, (2) the results found and recommendations made for the future.

18. Compare the present plan of compensating crippled soldiers with the plan following the Civil War. State the advantages and disadvantages of each plan.

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