THE TECHNIQUE OF RATE MAKING AS ILLUSTRATED BY THE 1920 NATIONAL REVISION OF WORKMEN'S COMPENSATION INSURANCE RATES.

BY

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To one who has never taken active part in such proceedings, a revision of rates means probably little more than a new manual with various innovations in classifications, rules and rates. From this point of view a revision is simple; the manual suddenly appears as a completed product, there follows a short period of adjustment to changes in rates and methods of underwriting and then the order of things runs on as usual. The new manual is only an incident and is accepted more or less as a matter of course, as a necessary development in the business. To a person in this position a manual is apparently created over night, or possibly in the short space of time it takes a committee to make certain fundamental decisions without which it would be impossible to have a revision at all.

Such, however, is not the case. The production of a manual is a huge task requiring months of preparation by the individual insurance carriers and by the organization prosecuting the work, elaborate machinery for assembling and compiling statistics, numerous committee meetings for the determination of actuarial, underwriting and engineering principles and a large staff trained in the minutiae. The beginnings of a revision are to be found in the offices of the insurance carriers where the necessary statistical data are brought together from original sources. The final publication of the manual can come only after these raw statistics have been filed with some central organization, audited, combined with similar figures filed by other carriers and subjected to actuarial and statistical processes by means of which they are converted into compact form for the use of the technical committees which translate them into rates.

It is for the purpose of outlining the rate making process in its various details that this paper is presented. The several steps in

a rate revision will be described and the reader will be taken through the procedure from beginning to end. In order that the paper may deal with particulars instead of with generalities, the recently completed 1920 national revision of workmen's compensation rates has been selected as an example, and the data, methods and machinery discussed will be those employed in this revision. The procedure of this revision is typical and differs only in detail from that which might be adopted for any revision of rates. Fundamentally, all revisions requiring extensive use of statistics must proceed along similar lines and in accordance with the same general principles. The present paper will, therefore, enable persons experienced in the methods used in other lines of insurance to compare such methods with those which have been established after years of experimentation in the field of workmen's compensation insurance. The 1920 national revision represents the latest development in rate making in this field.

THE MACHINERY.

The 1920 national revision of workmen's compensation rates was conducted under the auspices of the National Council on Workmen's Compensation Insurance. It is proper, therefore, to preface this paper with a brief outline of the purposes of the Council, its organization and the machinery by means of which it performs its rate making functions.

The Council is a federation of rate making boards and bureaus with offices in New York City.* Its fundamental objects are "to coöperate with rating organizations and public officials in all states in the determination of equitable premium rates for workmen's compensation insurance, and to promote a true public understanding concerning the establishment of such rates."

To further the accomplishment of these objects, the constitution provided, among other things, that the Council shall

"1. Collect and compile experience for rate making purposes.
"2. Establish classifications for rate making, and rules and procedure governing the application of same.

* The present membership comprises the following organizations: Independent rating bureaus of the states of Alabama, California, Delaware, Massachusetts, New Jersey, New York, Pennsylvania, Tennessee, Virginia and Wisconsin; the National Association of Mutual Casualty Companies and the National Workmen's Compensation Service Bureau.

"3. Establish basic pure premiums and formulate fundamental general principles applicable to all states for translating such pure premiums into rates.
"4. Establish rating plans for the purpose of modifying manual rates on individual risks.*

The general administrative and financial affairs of the Council are under the supervision and direction of two committees, the Governing Committee and the Committee of Managers. Upon the Governing Committee are six insurance carriers, membership being equally divided between "participating" and "non-participating" carriers.† This committee appoints the General Manager and has control over the finances of the Council. The second administrative committee is made up of the General Manager of the Council and the Managers of the affiliated boards and bureaus. This committee elects the members of the various technical committees, designates the chairmen of these committees, passes upon applications for membership in the Council and assists the Council in an advisory capacity.

The technical work of the Council is in charge of committees of insurance carriers. Each committee is equally representative of participating and of non-participating insurance and the chairman is, in each case, a representative of a state insurance department supervising workmen's compensation rates.

In recognition of the fact that workmen's compensation insurance for coal mines presents peculiar problems requiring special knowledge, a section has been formed for dealing with technical problems in this field. This section has its central committee known as the Coal Mine Committee and two sub-committees, the Actuarial Sub-committee, whose function it is to consider the actuarial phases of the subject; and the Engineering Sub-committee which deals with engineering and inspection problems.

* The term "risk" used in this connection includes the operations of an assured which are the subject of insurance. Thus, a manufacturing plant, a chain of stores, a garage, the construction of a dam, the operations of a brick-mason, a mine, a quarry, etc., may each constitute a "risk" for insurance purposes.

† The constitution of the Council defines "participating" and "non-participating" carriers as follows: "'Participating carriers' are defined as stock corporations issuing dividend policies, mutual corporations, state funds, and reciprocal interinsurers. 'Non-participating carriers' are stock corporations issuing non-dividend policies."

There is a similar organization of technical committees for dealing with the general rate making problem. A central committee, known as the General Rating Committee, is in charge. It is the duty of this committee "to prepare a manual of classifications and rules, to establish basic pure premiums and subsequent amendments in such manual and basic pure premiums, and to approve rating plans determined upon by the Actuarial and Engineering Committees." In this work the General Rating Committee is assisted by the Actuarial Committee which has jurisdiction over actuarial and statistical problems and over the plan of experience rating, and by the Engineering Committee which deals with engineering problems and more particularly with the schedule rating plan.

The Council proper is in charge of a staff of officers headed by Harwood E. Ryan as General Manager. It is equipped to perform actuarial, engineering and statistical work and serves as the agency by means of which the decisions of the various technical committees are put into proper form for practical application.

The Council has no absolute power over rates and rating plans. The results which it produces are advisory only; the member boards and bureaus may accept or reject them. It does, however, exercise considerable influence and its recommendations carry much weight because of the completeness of its statistical data and the reputation and ability of the members of its technical committees.

The most important feature of the Council's work is its function as a clearing house for the member boards and bureaus. Each member is obligated to file with the Council proposed changes in rules, classifications, rates and rating plans. The Council analyzes these propositions, checks them against the available statistical data in its files, subjects them to actuarial, engineering and underwriting tests, secures a decision from the proper technical committee and then reports this decision to the proposing member and to every other member as well. Through this procedure each member keeps in touch with developments in other jurisdictions and at the same time receives the benefit of the statistical experience and the advice and recommendations of the technical committees of the Council. Thus, even though the conclusions of the Council are only advisory, they are nevertheless most important factors in promoting uniformity in underwriting, actuarial, statistical and engineering procedure in all sections of the country.

The Problem.

Before considering the technique of a rate revision, it is essential to examine the nature of the problem requiring solution. This problem is the production of the manual, a book containing rules of underwriting procedure, a schedule of classifications describing the various risks to be rated, and rates applicable to the classifications.

In workmen's compensation insurance there are approximately 1,000 classifications. For the most part each classification represents an entire industry or business, as, for example, bakeries, landscape gardening, mining, department stores. But this is not necessarily so. Some classifications still follow occupations, such as carpentry, locksmithing, plastering; others represent processes, such as wood-turning, rolling mills, rubber reclaiming.

Classifications should meet certain general qualifications.* They should be clearly phrased so that their scope may be readily understood by everyone who uses them. They should represent units for which accurate payroll and loss records can be kept. There should be no possibility of manipulation, either for the purpose of misapplication in classifying risks or of "juggling" payroll from one classification to another carrying a lower rate. The statistician in the home office of the insurance carrier should be able to allocate the payrolls, premiums, and losses to the classification to which they belong.† There should be as few classifications as possible since accurate rates cannot be established if the total experience is distributed among many classifications. The best results will be achieved if there is a reasonable concentration of experience in important classifications which actually represent distinct industrial units.

* See paper by E. H. Downey entitled "The Classification of Industries for Workmen's Compensation Insurance," *Proceedings C. A. S. S. A.*, Vol. II, pp. 10–24.

† Cases are on record where unintentional errors in charging pay-rolls or losses to classifications have had a serious influence upon the experience which is used as the basis for rate making. Take, for example, the case of "Blasting." It is customary to require a separation of payroll for blasting wherever it is found. This payroll is usually estimated or taken at an arbitrary amount, it being difficult to obtain an accurate statement; the losses, however, are clearly indicated from accident reports and are properly charged. The result probably is an experience indication that is excessive; the losses are correct but the payroll exposure is too low because it is not accurately determined.

The present classification system is an inheritance from the days of employers' liability insurance. During each revision many changes are made. For example, in the 1920 revision there were 1,319 classifications at the beginning of the work. Of these, 466 classifications were eliminated. On the other hand, 100 new classifications were erected. The total number remaining in the manual at the completion of the revision was thus reduced to 953.

It cannot be urged that the classification system is scientifically satisfactory, but it is difficult to improve it by making radical changes. Just as, in some forms of insurance, there are old policy contracts which retain their original phraseology, entirely different from present day language,* so the classifications as they stand have a certain value because long practice has given them the weight of precedent and interpretation.

The rules, likewise, are the result of gradual development and experiment. In each revision they are subjected to thorough overhauling in order that they may be kept abreast of the times. Radical changes have to be avoided, however, because the underwriting procedure covered by the rules has become more or less firmly established in practice and violent adjustments or amendments would undoubtedly react seriously upon the business. For example, in the latest revision, there were only three such changes of any consequence. One of these provides for the inclusion of bonuses as part of the payroll upon which premiums are computed. This was adopted in recognition of the fact that bonuses are practically universally considered as wages for the purpose of determining the amount of compensation benefits. Another involves an addition to the so-called "payroll" rules which govern the sub-division of risks into constituent manual classifications. Formerly, when several operations were involved in a risk, all of which were specifically classified in the manual, it was not permissible to use the individual manual classifications for parts of the risk on the same floor of a building. Under the rule as amended, a "division of payroll" may be made in these cases provided each operation is in a separate department surrounded by structural partitions, and has no interchange of labor with other departments. The third change involves the erection of a new rule governing the writing of business upon a monthly, quarterly, or semi-annual premium collection basis; certain percentages of the annual premium are established

* For example, the marine insurance contract.

as the amounts to be deposited with the insurance carrier in these several cases.

The real crux of a revision, however, and the phase which will receive attention in this paper, is the problem of establishing rates. In a thoroughgoing revision, such as the present, the old rates are discarded completely and new rates are produced from fundamental data. This work requires extensive preparation and the greatest part of the time is consumed in that way. To fully appreciate a revision, therefore, it is necessary to know what the manual rate represents, how it may be analyzed, upon what it is based and what processes are essential to its determination.

The rate is the price of insurance per $100 of payroll exposure.* The manual rate is an average rate applicable to all risks within the classification to which it relates but it is not necessarily the final rate charged. It is, however, the starting point, the modifications produced by the systems of merit rating (schedule or experience rating)† being subtracted from, or added to it, depending upon whether the individual risk is better or worse than the average of its type.

The rate must be adequate to cover the losses arising out of accidents in the industry represented by the classification and also the expenses incurred by the insurance carrier in administering the insurance. The *pure premium* is that part of the rate which represents the loss cost per unit of exposure. The *loading* is the part which provides for the various items of expense. The best indication upon which to base the pure premium is actual experience assembled from the records of insurance carriers. The expense loading must be established with proper regard for the prevailing methods of doing business and for the actual expense requirements of individual carriers.

* Payroll has been taken as a basis for premium calculation because the state workmen's compensation laws base compensation payments upon the wages of workmen who are injured, and also because it is the measure of the number and working time of employees most readily furnished by employers.

† Schedule rating is a method of rating physical hazards. The schedule is a list of hazards with debits and credits therefor and is applied by inspectors who make actual surveys of individual risks. Experience rating measures both physical and moral hazards. It involves the use of the past loss history of the individual risk and a comparison of this with the general experience of the classification.

It is obvious, when experience is made to serve as a basis for pure premium determination, that the values selected with reference to such experience will represent the conditions and requirements of the past.* There may, therefore, be some discrepancy between the pure premium based upon experience and the pure premium which will be adequate to meet the conditions of the future period for which the rate is contemplated. Items affecting this change, such as wage level, employment or unemployment, industrial conditions, immigration and emigration, amendments to the workmen's compensation law, changes in the interpretation of the workmen's compensation law or in the procedure of the board or commission supervising and administering the law, merit rating, accident frequency and severity, etc., are usually measured collectively or individually by a factor or by factors which are applied to the pure premium established upon past experience. By this process the pure premium is increased or decreased, depending upon whether the conditions effecting the change have resulted in a higher or lower level of cost for the period during which the rates will be applied than that for the period represented by the available experience.

The pure premium for a classification based upon experience after analysis and comparison with the experience of other classifications, may be termed the *selected* pure premium† and the pure premium which is correct for the future may be designated the *final* pure premium.

In practice, complications are found. The classifications in a given state having adequate experience upon which to establish pure premiums are comparatively few in number. Where the state experience is inadequate for rate making purposes it is necessary to combine the experience of several states or possibly to combine the experience of all states in order to obtain an experience which will produce a dependable indication. There must, therefore, be regional pure premiums applicable to a number of contiguous states and national pure premiums applicable to all states except those with sufficient local experience to determine their own rates. In the 1920 national rate revision the experience of all states was

* In workmen's compensation insurance, classification experience "lags" approximately two years behind the present. This is due to the "policy year" method of accounting which will be described later.

† The pure premium taken direct from the experience without modification is known as the *indicated* pure premium or the *experience* pure premium.

available. It was converted to a common level and was presented by states and by regions as well as for the country as a whole. The General Rating Committee in establishing pure premiums started with the country-wide experience and made exceptions for regions and states wherever necessary.

THE DATA.

We come next to the consideration of the data available for a rate revision. In workmen's compensation insurance the major part of the experience utilized for rate making is in the form of special exhibits compiled by insurance carriers which are known as schedules "Z" and "W."

Schedule "Z" is a record, by manual classifications, of the experience of an individual state. The policies written in a given calendar year are reported upon as a single experience group. Thus, the payrolls and premiums of policies written during calendar year 1920 and all losses arising out of these policies constitute the experience for policy year 1920.* Since the policies are customarily written for a period of twelve months, it follows that policy year 1920 will not be complete until December 31, 1921, when the last policy expires. In fact, the experience will not be available in *final* form until some time later, for the payrolls of each individual risk must be audited, the premiums adjusted accordingly and all the injuries resulting from accidents chargeable to the 1920 policies must be definitely determined and compensated before the ultimate cost of insurance can be known. The record of policy year 1920, for instance, continues to develop for a number of subsequent calendar years and it often requires a long period, depending upon the provisions of the state workmen's compensation law, to determine its ultimate status.†

The first approximation to the final result may be obtained, however, not long after the expiration of the last policy issued in 1920, provided sufficient time is permitted to elapse to enable the carriers to secure audits of payrolls and reports of all claims chargeable to the account. In this event the losses actually paid may be

* Also termed 1920 "year of issue" or "year of risk" (inaccurately).

† In New York certain payments continue during the lifetime of the beneficiary. The account for any year will, therefore, remain open until the death of the last beneficiary entitled to receive compensation on account of accidents chargeable to policies issued in that year.

ascertained with exactness; but the liability for future payments must be estimated. Schedule "Z" for 1920 may, therefore, be originally reported in calendar year 1922. It cannot, under present conditions, be reported earlier. It is this method of accounting that is responsible for the "lag" of the available experience behind the current rates.

Schedule "Z" for a given state is reported in several parts. In 1919 there were four parts. Part I was a record by classifications of the payrolls, premiums and losses of a single policy year. The sample form of the 1919 Part I blank reproduced as Exhibit I is more or less self-explanatory, but one or two comments may serve to clear up doubtful points.

It will be noted that payrolls and premiums are reported separately for policies including medical aid and for policies excluding medical aid. It is customary in many states to provide a form of contract under the terms of which the insurance carrier reduces the premium by a stipulated amount, the policy holder, for this consideration, assuming the responsibility of providing medical, surgical and hospital treatment for his injured employees. This arrangement is designed particularly to meet the convenience of policy holders who have installed hospitals in their plants. In these cases the entire payroll will be reported but the premium and the losses will be incomplete. The purpose of reporting the payrolls and premiums for such contracts as separate items is to permit a modification of the experience to take account of its incompleteness.*

Attention should also be directed to the analysis of losses. Accidents are classified by nature of injury into five classes as follows:

1. Death Cases.
2. Cases resulting in permanent total disability, i.e., absolute incapacity for work, as for example, accidents involving the loss of both arms, both legs, both eyes, insanity, total paralysis, etc.

* Take for example the following situation:

Kind of Policy.	Payroll.	Medical Losses.	Total Incurred Losses.
Policies including med. aid.....	$10,000,000	$5,000	$250,000
" excluding " "	1,000,000	0	20,000

It may be assumed that the medical experience of policies excluding medical aid will be the same as for policies including medical aid. The indicated medical pure premium for policies including medical aid is .05 ($5,000 divided by 100,000). Applying this to the payroll excluding medical aid, we obtain expected medical losses of $500. These are assumed

3. Cases resulting in permanent partial disability,* as for example, injuries involving the loss of one hand, one eye, one leg, or any other disability permanent in character which does not totally incapacitate the injured worker.
4. Indeterminate cases, i.e., cases in which the exact nature of the disability is not ascertainable at the time the report is prepared. The number of these cases will decrease in subsequent reports as information is obtained which will permit the carrier to allocate them to one of the other groups.
5. Temporary disability cases, i.e., cases involving loss of time in excess of the waiting period specified in the state workmen's compensation law, which are known not to involve any permanent injury.

All indemnity losses, whether paid or "outstanding," arising out of each of these classifications of injury are reported in the proper loss column:† the number of cases is also given. All medical losses are reported in one classification, irrespective of the kind of accident. The first approximation to the selected pure premium is the

to be the medical losses which would have been incurred had the $1,000,000 payroll been written with full aid coverage; $500 is, therefore, a measure of the deficiency in the loss experience. The total experience on a correct basis may, therefore, be written as follows:

Payroll.	Medical Losses.	Total Incurred Losses.
$11,000,000	$5,500	$270,500

* In the 1920 schedule "Z" this classification will be sub-divided, "major" permanent partial disability cases being reported in one classification, "minor" permanent partial disability cases in another. For this purpose "major" permanent partial disability will include the following cases:

"(*a*) Every permanent injury, not constituting permanent total disability, which involves the loss of sight of an eye or the loss of a hand, foot, arm, or leg:

(*b*) Every permanent injury involving the impairment to the extent of 50 per cent. or more of a hand, foot, arm or leg:

(*c*) Any permanent injury, whether enumerated above or not, which is compensated on the basis of 25 per cent. or more of permanent total disability (or 25 per cent. or more of the full-benefit for permanent total disability allowed under the act applicable thereto)."

† It will be noted upon reference to the blank in Exhibit I that three columns are provided for losses, one for "paid" losses, a second, for "outstanding" losses and a third, for total losses. The first two columns need not be used; they are provided for the convenience of certain carriers in preparing the schedule.

experience indication, that is, the ratio of the actual incurred losses to each $100 of payroll exposure.*

The remaining parts of the 1919 Schedule "Z" were individual reports of certain cases included in part I concerning which special additional information was required. Individual reports of death, permanent total disability and indeterminate cases were made. The cause of accident, nature of injury, number of dependents, nature and extent of dependency and other items were given, thus facilitating the audit of the schedule and the correction of estimated losses and assisting in the allocation of these "serious" cases to the appropriate classifications. The individual reports also served a valuable purpose in enabling the rate making committee to graduate the pure premiums for the more serious types of injury and to spread the cost so that it was properly distributed to the individual classifications.

Whereas Schedule "Z" presents experience by policy years and for individual classifications, Schedule "W" presents it by calendar years and for all classifications combined. Schedule "W" is an underwriting "gain and loss" exhibit—it contains not only a record of premiums and losses but also a statement of expenses so that the carrier and the supervising authority may determine whether the established rates were adequate in their provision for both losses and expenses. The value of Schedule "W" lies in its indication of the latest loss experience; inasmuch as it is on a calendar year basis it is always one year closer to the present than is Schedule "Z." Its use for this purpose, however, must be attended with many reservations owing to the considerable element of judgment and estimate involved in its preparation.

The real use of Schedule "W" is for the determination of the expense loading. The exhibit presents a detailed analysis of expenses and taxes, so that each item may be evaluated in terms of percentage of gross premium income.

* For example, referring to Exhibit I, the "indicated" pure premiums are as follows:

Death $66,907 ÷ 346,150	= $ .193
Permanent Total	= $ 0
Permanent Partial $142,703 ÷ 346,150	= $ .412
Temporary Total $99,254 ÷ 346,150	= $ .287
Indeterminate	= $ 0
Medical $66,477 ÷ 327,520 × 346,150/327,520	= $ .215
Total	= $1.107

PART 1

NEW YORK SCHEDULE Z—1919

POLICY YEAR 1916

3632 (CODE NO.) CLASSIFICATION EXPERIENCE _____ (CARD NO.)

Insurer All carriers combined.

Manual classification

Machine Shops - without foundry.

Manual Rate.....

	COVERAGE	EARNED PAYROLL (Dollars only)	EARNED PREMIUM (Dollars only)
A	Excluding medical	1,863,000	16,237
B	Including medical	32,752,000	358,429
C	Total	34,615,000	374,666

LOSS EXHIBIT

	NATURE OF INJURY	NO. OF CLAIMS (1)	PAID (Dollars only) (2)	OUTSTANDING (Dollars only) (3)	TOTAL INCURRED (Dollars only) (4)
D	Death	16			66,907
E	Permanent total disability				
F	Permanent partial disability (Dismemberment, loss of use, etc.)	269			142,703
G	Temporary disability (Total and partial)	1767			99,254
H	Indeterminate				
J	Medical	——			66,477
K	Total	2052			375,341

4-17-19-52,000 (14-4155)

EXHIBIT I.

In addition to these particular schedules, each revision brings forth requests for special exhibits of data required for the solution of peculiar problems. In the 1920 revision, for example, three special calls were issued. The first was for wage data for calendar years 1917 and 1919. This was used to test the effect of wage fluctuation upon the cost of compensation and also for the purpose of determining the effect of amendments to the workmen's compensation laws of the several states. The second was a special call for premium and loss data for use in projecting the experience for policy years 1916, 1917, 1918 and 1919 to an approximately ultimate basis. This study was made in connection with the projection of rates, the purpose being to ascertain the trend of cost in order that the committee might predict the cost of calendar years 1920 and 1921—the period for which rates were established. The last was a call for special information concerning the relative cost of medical aid in 1917 and 1919. This information was used to determine the increase in medical cost over this period.

Preliminary Work.

In a manual revision the order of events preliminary to the actual determination of pure premiums involves the following steps. The first step is the determination of the exact scope of the experience to be used. An outline of the desired data is prepared and submitted to the individual carriers who compile from their records the necessary information and file it with the central organization. These reports are then audited, after which the experience is assembled and reduced to convenient form for the use of the rate making committees.

In the 1920 national revision of workmen's compensation rates the process was shortened by reason of the fact that Schedule "Z" data previously had been assembled by the several state insurance departments and rating bureaus and the experience was thus available for immediate compilation in proper form for rate making. The Actuarial Committee, therefore, proceeded without delay to formulate a number of rulings to govern the staff of the Council in this important preliminary work.

Mr. Mowbray, in his paper, discusses the actuarial problems of the revision and the methods adopted for their solution. I, therefore, shall merely state the conclusions of the committee and describe the procedure by means of which they were given practical application.

1. It was decided to use the available experience of all carriers for each workmen's compensation state for policy years 1916 and 1917. The 1916 experience represented the second reporting for that year and was, therefore, practically altogether matured. The 1917 experience was necessarily taken from the first report. Both experiences were made up as of December 31, 1918, and were reported in calendar year 1919. As the revision was inaugurated in November, 1919, this was the latest experience then available.

2. It is obvious that these experiences by states and policy years could not be simply added together without adjustment. They represented varying wage levels, widely different conditions surrounding the production of accidents, and as many standards of indemnification as there were benefit schedules in the workmen's compensation laws effective in the United States during calendar years 1916, 1917 and 1918. The committee recognized this fact by a decision to take the experience of a single state for one year of issue as representing a common level to which the experiences of other states and years of issue might be converted and combined. For this purpose, New York Schedule "Z" for 1917 was selected as the basis of reference.

3. The next decisions had to do with the process of converting the experience to the common level:

(*a*) There were six loss divisions in the original Schedule "Z" data, namely:

1. Death.
2. Permanent total disability.
3. Permanent partial disability
4. Temporary total disability.
5. Indeterminate disability.
6. Medical.

These were grouped into three divisions as follows:

1. "D. & P. T. D."—i.e., death and permanent total disability losses.
2. "All Other Indemnity"—i.e., permanent partial disability, temporary total disability and indeterminate disability losses.
3. "Medical"—i.e., medical losses.

(*b*) Two distinct methods of conversion were selected for these loss divisions:

1. It was decided to convert the "D. & P. T. D." division on a numerical basis; that is to say, to obtain the converted losses by

counting the number of cases for each classification for all states and years of issue, and by multiplying this by an average value per case determined from New York Schedule "Z" for 1917.

2. For converting the "All Other Indemnity" and "Medical" loss divisions an "experience differential" method was adopted; the converted losses to be obtained by the application of a conversion factor to the actual state losses for 1916 and 1917. The committee adopted Greene's formula* for the purpose of developing conversion factors for these divisions. This formula in the form in which it was used may be written as follows:

$$\text{Conversion Factor} = \frac{R - D\dfrac{\text{Losses for N. Y. Schedule "Z"—1917}}{\text{Losses for Additional State}\dagger}}{1+D}$$

where

$$R = \frac{\text{Average Pure Prem. for N. Y. Schedule "Z"—1917.}}{\text{Average Pure Prem. for Additional State}}$$

$$1+D = \frac{\text{Expected Losses for N. Y. Schedule "Z"—1917 (Using } R \text{ as conversion factor)}}{\text{Actual Losses for N. Y. Schedule "Z"—1917}}$$

It will be noted that a first approximation to the conversion factor is the simple ratio of average pure premiums for the two experiences under comparison.‡

3. Recognizing the fact that the proposed analysis of the total pure premium into three divisions threw into the "All Other Indemnity" division two important classes of losses, those arising out of permanent partial disability and out of temporary total disability accidents, and that for this reason absolutely correct results for individual classifications were not to be obtained in the process of conversion if a single factor for "All Other Indemnity" was used for all classifications, the committee erected three groups of classifications and calculated conversion factors for each group. These groups are described as follows:

* See paper by Mr. Greene entitled "Upon Combining Compensation Experience from Several States," pages 10–30 inclusive, Volume VI, Part I, *Proceedings C. A. S. S. A.*

† The "additional state" experience is that to be converted to the basic level, *e.g.*, Connecticut experience for 1916 and 1917—Michigan experience for 1916 and 1917, etc.

‡ An analysis of Greene's formula developing this relationship will be found in Mr. Mowbray's paper.

(*a*) Classifications involving essentially contracting and building operations including excavation and other heavy outdoor work.

In these, the "All Other Indemnity" division will be created by injuries which are generally severe, such as those resulting from fractures, sprains and bruises.

The nature of the operations performed is the basis of classification rather than the relative proportion of permanent partial disability and of temporary total disability losses.

(*b*) Classifications characterized by a marked dismemberment hazard.

In these, the "All Other Indemnity" losses will be unequally distributed, the larger percentage being created by permanent partial injuries.

(*c*) All classifications not covered by groups 1 and 2.

It was assumed that the ratios of permanent partial disability losses to temporary total disability losses in all classifications in each of these groups were sufficiently uniform to obviate violent inaccuracies arising from the use of an average differential for the "All Other Indemnity" division.*

4. The committee decided to group the experience of individual classifications according to the "Groups" and "Schedules" of the "Manual Classifications Code." The code is an arrangement of the manual classifications designed particularly to assist the underwriter in rate making. Classifications presenting similar hazard characteristics are thrown together into groups. These groups in turn are associated in schedules. For example, group 102—"Baking" includes the following four classifications:

2000—Bakeries
2001—Cracker Manufacturing

* Strictly speaking the losses for each kind of injury should be converted independently, as there is likely to be a different cost relationship as between states for each class. The points raised in connection with the "All Other Indemnity" division are that the ratio of the two important loss elements making up the division is not constant for all classifications and that the use of one conversion factor, rather than two separate conversion factors, would produce inaccurate results particularly if an attempt were made to apply a single factor to all classifications.

2002—Macaroni Manufacturing
2016—Breakfast Food Manufacturing—prepared foods—excluding oatmeal and corn milling.

This group is one of thirteen groups making up Schedule 5—"Food and Tobacco."

The use of the code has the advantage of associating analogous experiences in homogeneous groups and of so arranging the work of revision that classifications which should be considered together for rate making, come up automatically in the proper order.

5. Finally, it was decided to present the classification, group and schedule experiences for each of the following regional sections and also for the country as a whole:

Eastern

Connecticut, Maine, Maryland, Massachusetts, New Jersey, New York, Pennsylvania, Rhode Island, Vermont.

Central

Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Nebraska, South Dakota, Wisconsin.

Western

California, Colorado, Montana, New Mexico, Utah.

Southern

Kentucky, Louisiana, Oklahoma, Texas.

The purpose of presenting the data in this manner was to afford the General Rating Committee an opportunity to study the experience not only by states, but also by sections of the country, thus simplifying the establishment of exceptions to the national pure premiums wherever the experience of individual states or regions warranted such treatment.

The first step in the execution of the program outlined by the Actuarial Committee was the calculation of conversion factors. For this purpose the blank reproduced as Exhibit II was prepared.

Twenty classifications in each of the three conversion groups were selected as a basis for the calculations. In this process it was necessary to exercise considerable care in order that the classifications selected might be typical and at the same time represent a sufficient volume of the total experience to produce dependable results. Lists were prepared of the seventy-five classifications in

WORKMEN'S COMPENSATION RATES

CALCULATION OF CONVERSION FACTORS

ADDITIONAL STATE Illinois

LOSS DIVISION All Other

CLASSIFICATION CODE NO.	ACTUAL EXPERIENCE: PAYROLLS NEW YORK 1917	PAYROLLS Illinois (STATE) 1916 & 1917	PAYROLLS COMBINED NEW YORK ILLINOIS (STATE)	LOSSES NEW YORK 1917	LOSSES Illinois (STATE) 1916 & 1917	CALCULATION OF FACTOR: CONVERTED Illinois (STATE) LOSSES (1838) × (6)	COMBINED LOSSES	PURE PREMIUM	EXPECTED NEW YORK LOSSES	TEST OF FACTOR: CONVERTED LOSSES (1814) × (8)	COMBINED LOSSES	PURE PREMIUM	EXPECTED NEW YORK LOSSES
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
			(2) + (3)				(5) + (7)	(8) ÷ (4)	(9) × (2)		(5) + (11)	(12) ÷ (4)	(13) × (2)
5643	61,020	97,765	158,785	52,318	57,529	105,738	158,056	.995	60,715	104,358	156,676	.987	60,227
5642	32,190	60,029	92,219	42,613	53,680	98,664	141,277	1.532	49,315	97,376	139,989	1.518	48,864
5602	63,210	57,527	120,737	51,391	27,060	49,736	101,127	.838	52,970	49,087	100,478	.832	52,591
5022	51,120	32,835	83,955	98,900	27,180	49,957	148,857	1.773	90,636	49,305	148,205	1.765	90,227
5204	19,240	31,365	50,605	57,121	28,011	51,484	108,605	2.146	41,289	50,812	107,933	2.133	41,039
3724	41,020	27,488	68,508	25,591	16,047	29,494	55,085	.804	32,980	29,109	54,700	.798	32,734
5401	49,730	25,614	75,344	135,366	51,610	94,859	230,225	3.056	151,975	93,621	228,987	3.039	151,129
5502	20,050	22,054	42,104	12,206	7,718	14,186	26,392	.627	12,571	14,000	26,206	.622	12,471
6042	62,460	18,692	81,152	76,652	9,079	16,687	93,339	1.150	71,829	16,469	93,121	1.147	71,642
5500	9,780	15,614	25,394	13,260	8,119	14,923	28,183	1.110	10,856	14,728	27,988	1.102	10,778
5209	15,560	15,574	31,134	11,556	6,912	12,704	24,260	.779	12,121	12,538	24,094	.774	12,043
6300	9,740	7,378	17,118	18,739	6,519	11,982	30,721	1.795	17,483	11,825	30,564	1.785	17,386
5545	7,660	6,710	14,370	32,327	6,865	12,618	44,945	3.128	23,960	12,453	44,780	3.116	23,869
7531	38,320	5,371	43,691	32,669	5,390	9,907	42,576	.974	37,324	9,777	42,446	.972	37,247
6041	17,690	5,123	22,813	14,178	1,538	2,827	17,005	.745	13,179	2,790	16,968	.744	13,161
6227	8,150	4,231	12,381	6,996	2,046	3,761	10,757	.869	7,082	3,711	10,707	.865	7,050
6220	6,830	3,709	10,539	10,997	5,371	9,872	20,869	1.980	13,523	9,743	20,740	1.968	13,441
6321	5,640	2,450	8,090	8,117	1,238	2,275	10,392	1.285	7,247	2,246	10,363	1.281	7,225
5541	580	3,865	4,445	4,735	6,268	11,521	16,256	3.657	2,121	11,370	16,105	3.623	2,101
6003	8,260	1,652	9,912	15,652	2,383	4,380	20,032	2.021	16,693	4,323	19,975	2.015	16,644
TOTAL	528,250	445,046	973,296	721,384	330,563	607,575	1,328,959		725,869	599,641	1,321,025		721,869

$$R = \frac{1.366}{.743} = 1.838; \quad 1+D = \frac{725869}{721384} = 1.006; \quad D = .006; \quad E = \frac{1.838-.006\left(\frac{721384}{330563}\right)}{1.006} = 1.814$$

EXHIBIT II.

each group which had the largest payroll and loss exposure in New York Schedule "Z" for 1917. Classifications peculiar to New York, that is, those representing industries which might produce unique experience were then eliminated. Similar lists were prepared for each state from the combined experience for policy years 1916 and 1917. These lists were then compared and the twenty classifications common to both lists for each conversion group were taken as a basis for the calculations. In some states, where the available exposure was too small to provide a satisfactory basis, the groups were consolidated.* In two cases even this procedure did not produce enough volume to insure dependable results and the state experience was not converted at all.† Wherever possible group 1 was maintained because, particularly in the western states‡ the classifications comprising the group (mining, oil production, etc.) are unique and it was desired to convert the losses on the most consistent basis that could be obtained.

The conversion factors for the several states are presented in the following table:

State.	Group I.		Group II.		Group III.	
	All Other.	Med.	All Other.	Med.	All Other.	Med.
New York 1916	1.022	.827	1.254	.936	1.302	.866
Connecticut	2.902	.780	2.919	.904	1.928	.588
Maine	3.326	1.460	2.527	1.173	2.113	1.552
Massachusetts	1.503	.964	1.850	1.090	1.665	.984
New Jersey	2.525	1.742	2.543	1.639	2.089	1.465
Pennsylvania	3.714	2.148	3.372	1.662	3.109	1.715
Rhode Island	2.894	1.043	2.894	1.043	2.894	1.043
Vermont	2.718	1.438	2.718	1.438	2.718	1.438
Maryland	3.493	1.302	3.042	1.273	3.522	1.214
Illinois	1.814	.760	1.712	.855	2.040	.723
Indiana	1.682	.944	1.754	1.075	1.767	1.039
Iowa	2.334	1.156	1.873	.955	2.692	.983
Kansas	1.294	1.479	1.337	1.700	1.337	1.700
Michigan	2.204	1.158	2.193	1.143	2.783	1.116
Minnesota	1.442	.740	1.605	.844	1.846	.756
Nebraska	1.743	.795	1.589	.651	1.589	.651
Wisconsin	1.535	.589	1.799	.819	1.806	.704
California	.835	.360	1.355	.549	1.433	.477
Colorado	2.837	1.593	3.300	1.090	3.300	1.090
Montana	3.675	1.322	3.675	1.322	3.675	1.322
Utah	3.222	1.002	3.222	1.002	3.222	1.002
Kentucky	1.210	.841	1.541	.796	1.836	.761
Louisiana	1.652	.726	1.939	.774	2.539	.770
Oklahoma	2.514	1.136	2.098	.708	2.098	.708
Texas	2.047	1.124	1.255	.746	1.768	.783

* This was true of the experience for the states of Montana, Rhode Island, Utah and Vermont.

† New Mexico and South Dakota.

‡ Colorado, Kansas, Nebraska and Oklahoma.

The next step was the selection of average "D. & P. T. D." values from New York Schedule "Z" for 1917. As a basis for this work the committee had an exhibit presenting the following information for each schedule of the Manual Classifications Code:

(*a*) Number of "D. & P. T. D." cases.*
(*b*) Total incurred "D. & P. T. D." losses.*
(*c*) Average cost per case.

The exposure in many schedules being inadequate, an attempt was made to group schedules according to predominant characteristics affecting the cost of death and permanent total disability. Such factors as the employment of women and children or single men, the probable number of dependents and the degree of dependency, the average age of injured employees and similar factors were considered. The experience was then assembled according to this tentative grouping and the average value of "D. & P. T. D." cases obtained for each group. To this point the grouping was based entirely upon *a priori* considerations. A comparison was then made of the group average value with the average value for the individual schedule, exceptions being established where the value for the schedule was out of line and where the exposure was broad enough to produce a reliable indication. As a result, seven groups of schedules were selected with average values as follows:

I—$3500.00.—
Agriculture
Wood
Contracting, not erection
Care, custody and maintenance
Miscellaneous occupations
II—$3500.00.—
Food and tobacco
Textiles
Clothing
Laundries
Leather
Paper goods
Fine machines and instruments
Commercial enterprises
Clerical and professional
III—$4400.00.—
Rubber, composition, bone, etc.
Paper and pulp

* New York Schedule "Z" for 1917.

Printing
Metal forming
Machine shops
Vehicles
Stone products
Clay products
Glass and glass products
Chemicals
Miscellaneous manufacturing

IV—$5300.00.—
Mining
Metallurgy
Quarrying, stone crushing, etc.
Erection—metal
Erection—not metal
Ship building
Railroad Operation
Public utilities—not railroad operation

V—$4400.00.—
Garage and trucking

VI—$1900.00.—
Vessel operation

VIII—$2300.00.—
Stevedoring and freight handling

Finally the committee tested these values to ascertain how closely they reproduced the total incurred "D. & P. T. D." losses of New York Schedule "Z" for 1917. The comparison being found satisfactory the selected values were adopted as a basis for conversion.

The final step preliminary to the determination of pure premiums was the conversion of the state experiences to the common level. For this work the blank reproduced as Exhibit III was used. This blank calls for the combination of the payrolls and actual losses for each state for policy years 1916 and 1917.* It also requires the combination of the loss elements entering into the "All Other Indemnity" division. These combinations were made on intermediate cards which were designed in the same form as the Schedule "Z" blank. The original Schedule "Z" figures for the two policy years were combined and entered on these cards after which the necessary information for the working sheet was

* New York is an exception because the selection of Schedule "Z" for 1917 as representative of the common level made it necessary to deal separately with the experience for 1916.

NATIONAL COUNCIL ON WORKMEN'S COMPENSATION INSURANCE
WORKMEN'S COMPENSATION EXPERIENCE
COMPILED IN 1919

CLASS: 3632 - Machine Shop - no foundry

SCHEDULE & GROUP NO 18-461
CONFLAGRATION GROUP NO II

	STATE	POLICY YEAR	PAYROLL (IN HUNDREDS)	ACTUAL LOSSES								CONVERTED LOSSES (NEW YORK 1917 BASIS)								
				DEATH		PERM.TOTAL		ALL OTHER		MEDICAL	TOTAL	DEATH & PERM.TOTAL			ALL OTHER			MEDICAL		TOTAL	
				NO. CASES	AMOUNT	NO. CASES	AMOUNT	NO. CASES	AMOUNT	AMOUNT	AMOUNT	NO. CASES	AMOUNT	P. P.	NO. CASES	AMOUNT	P. P.	AMOUNT	P. P.	AMOUNT	P. P.
1	NEW YORK	1917	302390	9	44800			1178	233651	78672	357123	9	39600	.13	1178	233651	.77	78672	.26	351923	1.16
2	NEW YORK	1918	346150	16	66907			2036	241957	70266	379130	16	70400	.20	2036	303414	.88	65769	.19	439583	1.27
3	CONNECTICUT	1916-17	103650	6	11017			490	28739	32157	71913	6	26400	.26	490	83889	.81	29070	.28	139359	1.35
4	MAINE	1916-17	25260	2	3035			-	11291	7185	21511	2	6800	.35		28532	1.13	8426	.33	45760	1.81
5	MARYLAND	1916-17	27595	3	9898			54	8442	5635	23975	3	13200	.48	54	25681	.93	7173	.26	46054	1.67
6	MASS.	1916-17	381694	18	34845	1	4000	-	137469	89155	265469	19	83600	.22		254318	.67	97179	.26	435097	1.15
7	NEW JERSEY	1916-17	303966	4	8149	1	4000	855	83387	47202	142738	5	22000	.07	855	212053	.70	77364	.26	311417	1.03
8	PENN.	1916-17	754410	31	72153	3	11025	2691	167837	119458	370473	34	149600	.20	2691	565946	.75	198539	.26	914085	1.21
9	RHODE ISLAND	1916-17	39843	1	265			94	4298	6483	11046	1	4400	.11	94	12438	.31	6762	.17	22600	.59
10	VERMONT	1916-17	31989	2	4633			94	9146	4622	18401	2	8800	.28	94	24859	.78	6646	.21	40305	1.27
11	TOTAL EASTERN STATES		2316947	92	255702	5	19025	7492	926217	460835	1661779	97	426800	.19	7492	1744781	.75	575602	.25	2747183	1.19
12	ILLINOIS	1916-17	243550	6	20537	1	5370	1825	123014	75439	224360	7	30800	.13	1825	193480	.79	64500	.27	288780	1.19
13	INDIANA	1916-17	76571	3	4729			460	36770	21155	62654	3	13200	.17	460	64495	.84	22742	.30	100437	1.31
14	IOWA	1916-17	21422	4	7406			110	5969	5899	18674	4	17600	.82	110	11180	.52	5273	.25	34053	1.59
15	KANSAS	1916-17	3942					31	2872	1047	3919				31	3840	.98	1780	.45	5620	1.43
16	MICHIGAN	1916-17	126261	7	11047			482	51711	31769	94527	7	30800	.24	482	113402	.90	36312	.29	180514	1.43
17	MINNESOTA	1916-17	33997					142	16120	9486	25606				142	25873	.76	8006	.24	33879	1.00
18	NEBRASKA	1916-17	5955					45	3546	2740	6286				45	5635	.95	1784	.30	7419	1.25
19	SO. DAKOTA	1917	164																		
20	WISCONSIN	1916-17	154153	1	3000			1143	67503	46121	116624	1	4400	.03	1143	121438	.79	37773	.25	163611	1.07
21	TOTAL CENTRAL STATES		665851	21	46719	1	5370	4238	307505	193056	552650	22	96800	.15	4238	539343	.81	178170	.27	814313	1.23
22	CALIFORNIA	1916-17	97382	4	10727	1	4159	-	56505	46008	117399	5	22000	.23		76564	.79	25258	.26	123822	1.28
23	COLORADO	1916-17	20448					75	5244	7112	12356				75	17305	.85	7752	.38	25057	1.23
24	MONTANA	1916-17	963					2	25	186	211				2	92	.10	246	.26	338	.36
25	NEW MEXICO	1917	35																		
26	UTAH	1917	1816					13	910	827	1737				13	2932	1.62	829	.46	3761	2.08
27	TOTAL WESTERN STATES		120609	4	10727	1	4159	90	62684	54133	131703	5	22000	.19	90	96893	.80	4085	.28	152978	1.27
28	KENTUCKY	1916-17	11964	1	4075			69	4560	4306	12941	1	4400	.37	69	7027	.59	3428	.29	14855	1.25
29	LOUISIANA	1916-17	8531					96	3794	3623	7417				96	7550	.89	2804	.32	10354	1.21
30	OKLAHOMA	1916-17	4895					42	5022	2775	7797				42	10536	2.15	1965	.40	12501	2.55
31	TEXAS	1916-17	16654	1	5400			110	6619	5036	17055	1	4400	.26	110	8307	.50	3757	.23	16464	.99
32	TOTAL SOUTHERN STATES		42044	2	9475			317	19995	15740	45210	2	8800	.21	317	33420	.80	11954	.28	54174	1.29
33	GRAND TOTAL		3145451	119	322623	7	28554	12137	1316401	723772	2391350	126	554400	.18	12137	2414437	.77	799811	.25	3768648	1.20

EXHIBIT III.

noted in a column especially designed for this purpose. The adjustment of medical losses in classifications for which "ex-medical" policies were reported was also made on this preliminary card. The total of the combined experience of each state was then balanced against the totals of the two individual years, thus verifying the work to this point.

The data for columns 3 to 9 inclusive of the working sheet were then posted from the intermediate state card, the work being so arranged that each clerk had a certain group of working sheets for which she was responsible. The code numbers in the upper right-hand corner of the working sheet had been previously inserted and a list of conversion factors prepared. The work of conversion, that is, of applying the conversion factors to the state losses was carried on at night by a special crew so that the working sheets might be used to the maximum advantage. Thus, as rapidly as the actual losses were entered in the day time they were converted at night, both jobs going forward simultaneously. The night crew also calculated pure premiums wherever necessary and obtained territorial and country-wide totals of payroll and converted losses. Later, when the day force had completed its work of entering the raw state experience, it checked the calculations of the night force.

As soon as the working sheets for individual classifications were completed, the work of grouping classifications was started. The grouping was of two kinds. First, there was the throwing together of the experiences of classifications which were essentially cross references. As a basis for this work a special committee of underwriters had previously reviewed the Manual Classifications Code and had indicated certain combinations. These, as has been stated, were really the bringing together of experiences which were similar. For example, prior to the present revision there were several classifications in the manual for various forms of millwright work, such as:

3720—Conveyors—Coal and Ash—installation, etc.
3722—Acetylene Gas Machines—installation.
3723—Refrigerating Machinery—installation.
3727—Engines—installation.
3729—Pumps—installation.
3732—Leather Belting—installation and repair.
3734—Automatic Stokers—installation.

"WORKMEN'S COMPENSATION EXPERIENCE - COMPILED IN 1919

Machine Shop - no foundry

CODE NO. 3632

CONVERTED LOSSES (NEW YORK 1917 BASIS)

SCHEDULE & GROUP NO 18-461

CONVERSION GROUP NO II

1919 CONVERTED PURE PREMIUM (NEW YORK BASIS) .90

	STATE	POLICY YEAR	PAYROLL (IN HUNDREDS)	DEATH & PERM. TOTAL			ALL OTHER			MEDICAL		TOTAL	
				NO. CASES	AMOUNT	P. P.	NO. CASES	AMOUNT	P. P.	AMOUNT	P. P.	AMOUNT	P. P.
1	NEW YORK	1917	302390	9	39600	.13	1178	233651	.77	78672	.26	351923	1.16
2	NEW YORK	1916	346150	16	70400	.20	2026	303414	.88	65769	.19	439583	1.27
3	CONNECTICUT	1916-17	103650	6	26400	.26	490	83889	.81	29070	.28	139359	1.35
4	MAINE	1916-17	25250	2	8800	.35		28532	1.13	8428	.33	45760	1.81
5	MARYLAND	1916-17	27595	3	13200	.48	54	25681	.93	7173	.26	46054	1.67
6	MASS.	1916-17	381694	19	83600	.22		254318	.67	97179	.26	435097	1.15
7	NEW JERSEY	1916-17	303966	5	22000	.07	855	212053	.70	77364	.26	311417	1.03
8	PENN.	1916-17	754410	34	149600	.20	2691	565946	.75	198539	.26	914085	1.21
9	RHODE ISLAND	1916-17	39843	1	4400	.11	94	12438	.31	6762	.17	23600	.59
10	VERMONT	1916-17	31989	2	8800	.28	94	24859	.78	6646	.21	40305	1.27
11	TOTAL EASTERN STATES		2316947	97	426800	.19	7492	1744781	.75	575602	.25	2747183	1.19
12	ILLINOIS	1916-17	243550	7	30800	.13	1825	193480	.79	64500	.27	288780	1.19
13	INDIANA	1916-17	76571	3	13200	.17	460	64495	.84	22742	.30	100437	1.31
14	IOWA	1916-17	21422	4	17600	.82	110	11180	.52	5273	.25	34053	1.59
15	KANSAS	1916-17	3942				31	3640	.93	1780	.45	5620	1.43
16	MICHIGAN	1916-17	126261	7	30800	.24	482	113402	.90	36312	.29	180514	1.43
17	MINNESOTA	1916-17	33997				142	25873	.76	8006	.24	33879	1.00
18	NEBRASKA	1916-17	5955				45	5635	.95	1784	.30	7419	1.25
19	SO. DAKOTA	1917	164										
20	WISCONSIN	1916-17	154153	1	4400	.03	1143	121438	.79	37773	.25	163611	1.07
21	TOTAL CENTRAL STATES		665851	22	96800	.15	4238	539343	.81	178170	.27	814313	1.23
22	CALIFORNIA	1916-17	97382	5	22000	.23		76564	.79	25258	.26	123822	1.28
23	COLORADO	1916-17	20448				75	17305	.85	7752	.38	25057	1.23
24	MONTANA	1916-17	963				2	92	.10	246	.26	338	.36
25	NEW MEXICO	1917	35										
26	UTAH	1917	1816				13	2932	1.62	829	.46	3761	2.08
27	TOTAL WESTERN STATES		120609	5	22000	.19	90	96893	.80	4085	.28	152978	1.27
28	KENTUCKY	1916-17	11964	1	4400	.37	69	7027	.59	3428	.29	14855	1.25
29	LOUISIANA	1916-17	8531				96	7550	.89	2804	.32	10354	1.21
30	OKLAHOMA	1916-17	4895				42	10536	2.15	1965	.40	12501	2.55
31	TEXAS	1916-17	16654	1	4400	.26	110	8307	.50	3757	.23	16464	.99
32	TOTAL SOUTHERN STATES		42044	2	8800	.21	317	33420	.80	11954	.28	54174	1.29
33	GRAND TOTAL		3145451	126	554400	.18	12137	2414437	.77	799811	.25	3768648	1.20

ADOPTED PURE PREMIUM (For Use of Rating Committee Only)

STATES	D. & P. T. D.	ALL OTHER	MEDICAL	TOTAL
NATIONAL				
EXCEPTIONS				

NOTE

The above is a key classification and includes the experience for the following classes (LIST THE CODE NUMBERS)

EXHIBIT IV.

These, in reality, were no more than cross references to the key classification, 3724—Millwright Work. The experiences, therefore, were thrown together and grouped with that of 3724. For the purpose of this grouping the regular working sheet was used, proper note being made of the individual experiences going into the combination.

The second combination involved the determination of the experience for each group of the Manual Classifications Code. For this purpose a working sheet, identical in form with that for individual classifications but of a different color, was prepared. The working sheets for the individual classes in each group were assembled and a group working sheet properly designated was attached to each set, after which the necessary consolidations were made, entered on the group sheet and checked. Finally, the group working sheets were assembled by schedules and combined.

It was then necessary to reproduce the experience data in convenient form for use by the General Rating Committee. Much thought was given to this phase of the arrangements inasmuch as proper presentation of the data is an important factor in determining the speed of a revision and the accuracy and convenience of the work. After a careful canvass of the various methods or reproduction it was decided to photograph the exhibits. For this purpose a special form was prepared on onion skin paper with rulings and column headings printed on the reverse side. The experiences were typed on these forms from the working sheets, a carbon being used to throw the figures on the back of the sheet thus making a clear impression through the paper. Plates were then prepared from these copies by a photographic process, after which the sheets for the use of the Committee were printed.* Samples of the sheets in the form presented to the Committee are reproduced in Exhibits IV, V and VI.

The experience in Exhibit IV is for classification 3632—"Machine Shops—no foundry" which is in group 461—schedule 18 and falls in the second conversion group. The blank in this case was white. The 1919 converted pure premium noted in the upper right-hand margin is an approximation to the old pure premium in the manual in effect immediately prior to the revision. The arrangement under the heading "Adopted Pure Premium"

* This work was done for the Council by the National Process Co. of New York City.

		YEAR	(IN HUNDREDS)	DEATH & PERM. TOTAL			ALL OTHER			MEDICAL		TOTAL		COMPILED IN 1919
				NO. CASES	AMOUNT	P P	NO. CASES	AMOUNT	P P	AMOUNT	P P	AMOUNT	P P	
1	NEW YORK	1917	323920	9	39600	.12	1228	244142	.75	82218	.25	365960	1.12	
2	NEW YORK	1916	358710	16	70400	.20	2069	310552	.87	67889	.19	448841	1.26	SCHEDULE 18
3	CONNECTICUT	1916-17	122428	7	30800	.25	537	87952	.72	32892	.27	151644	1.24	Machine Shops
4	MAINE	1916-17	26028	2	8800	.34		28706	1.10	8511	.33	46017	1.77	
5	MARYLAND	1916-17	28276	3	13200	.47	56	25724	.91	7245	.26	46169	1.64	----
6	MASS.	1916-17	491930	24	105600	.21		281111	.57	110633	.22	497344	1.00	GROUP 461
7	NEW JERSEY	1916-17	333483	5	22000	.07	928	235092	.70	87514	.26	344606	1.03	Machine Shop -
8	PENN.	1916-17	804640	36	158400	.20	2865	609269	.76	213068	.26	980737	1.22	no foundry
9	RHODE ISLAND	1916-17	52445	1	4400	.08	163	17882	.34	10569	.20	32851	.62	
10	VERMONT	1916-17	31989	2	8800	.28	94	24859	.78	6646	.21	40305	1.27	
11	TOTAL EASTERN STATES		2573849	105	462000	.18	7940	1865289	.72	627185	.24	2954474	1.14	
12	ILLINOIS	1916-17	254871	7	30800	.12	1886	199999	.78	66814	.26	297613	1.16	
13	INDIANA	1916-17	91850	4	17600	.19	523	68342	.74	25281	.28	111223	1.21	
14	IOWA	1916-17	25788	4	17600	.68	125	13087	.51	6175	.24	36862	1.43	
15	KANSAS	1916-17	3942				31	3840	.97	1780	.45	5620	1.42	
16	MICHIGAN	1916-17	135836	7	30800	.23	509	115535	.85	38703	.28	185038	1.36	
17	MINNESOTA	1916-17	36745				152	26281	.72	8449	.23	34730	.95	
18	NEBRASKA	1916-17	5955				45	5635	.95	1784	.30	7419	1.25	
19	SO. DAKOTA	1917	-									-	-	
20	WISCONSIN	1916-17	179237	1	4400	.02	1346	141665	.79	42658	.24	188723	1.05	
21	TOTAL CENTRAL STATES		734224	23	101200	.14	4617	574384	.78	191644	.26	867228	1.18	
22	CALIFORNIA	1916-17	117201	5	22000	.19		92499	.79	29145	.25	143644	1.23	
23	COLORADO	1916-17	20451				75	17305	.85	7752	.38	25057	1.23	
24	MONTANA	1916-17	963				2	92	.10	246	.26	338	.36	
25	NEW MEXICO	1917	-									-	-	
26	UTAH	1917	1816				13	2932	1.61	829	.46	3761	2.07	
27	TOTAL WESTERN STATES		140431	5	22000	.16	90	112828	.80	37972	.27	172800	1.23	
28	KENTUCKY	1916-17	12690	1	4400	.35	70	7119	.56	3483	.27	15002	1.18	
29	LOUISIANA	1916-17	8539				96	7550	.88	2806	.33	10356	1.21	
30	OKLAHOMA	1916-17	4956				42	10536	2.13	1965	.40	12501	2.53	
31	TEXAS	1916-17	17053	1	4400	.26	114	8420	.49	3863	.23	16683	.98	
32	TOTAL SOUTHERN STATES		43238	2	8800	.20	322	33625	.78	12117	.28	54542	1.26	
33	GRAND TOTAL		3491742	135	594000	.17	12969	2586126	.74	868918	.25	4049044	1.16	

NOTE

Includes

3281-Safe
3304-Bedstead
3522-Acetylene
3583-Automatic
3608-Engine
3632-Machine
3636-Cartridge.
3637-Washing
3639-Projectile

EXHIBIT V.

was provided for the use of the General Rating Committee. In this space the committee entered the selected pure premiums. If one set of pure premiums was adopted for the entire country it was entered in the first set of squares opposite the word "National." If exceptions were established they were noted under the caption "Exceptions," the state or region in question being written in the square at the left-hand side. The note in the lower right-hand margin was used to indicate the identity of discontinued and cross reference classifications, the experience of which had been included. In the case of classification 3632 there were no such inclusions.

Exhibit V gives the sheet for group 461 "Machine Shops—no foundry." It was reproduced on yellow paper. The data here are for the group of classifications noted in the box in the lower right-hand margin. In addition to classification 3632 the group includes eight related classifications.

Exhibit VI presents the experience for schedule 18 "Machine Shops." This is in the same form as the group and classification sheet and gives a summary of the experience for the seven groups comprising the schedule. It was reproduced on blue paper.

An idea of the extent of the data available to the General Rating Committee upon the completion of this preliminary work may be obtained from Exhibits VII and VIII. Exhibit VII gives the total experience by states. Exhibit VIII presents the same experience by schedules. The total payroll, it will be noted, was close to $12,000,000,000 and the converted losses were approximately $115,000,000, a truly imposing volume of experience, the largest, in fact, ever available for a revision of workmen's compensation rates.

Establishment of Basic Pure Premiums.*

With the preliminary work out of the way we can next consider the first phase of the revision proper, namely, the establishment of basic pure premiums. This involves the determination of national, regional, and state pure premiums upon the basis of the converted experience. These pure premiums have no significance in themselves; they must be reconverted to the level of the state experiences before they can be used for rate making purposes. They are, however, an important link in the procedure because they are the starting point from which state rates are eventually developed.

* The basic pure premium is the selected pure premium on the New York 1917 level.

	STATE	FISCAL YEAR	PAYROLL (IN HUNDREDS)	DEATH & PERM. TOTAL			ALL OTHER			MEDICAL		TOTAL	
				NO. CASES	AMOUNT	P. P.	NO. CASES	AMOUNT	P. P.	AMOUNT	P. P	AMOUNT	P. P.
1	NEW YORK	1917	632320	19	83600	.13	2394	456073	.72	160227	.26	699900	1.11
2	NEW YORK	1918	651310	27	118800	.18	3583	526661	.81	146256	.23	791717	1.22
3	CONNECTICUT	1916-17	405378	11	48400	.12	1572	256070	.63	80020	.20	384490	.95
4	MAINE	1916-17	62453	2	8800	.14		50188	.81	15161	.24	74149	1.19
5	MARYLAND	1916-17	41598	3	13200	.32	135	41278	.99	11275	.27	65753	1.58
6	MASS.	1916-17	1332229	43	189200	.14		794213	.60	276087	.21	1259500	.95
7	NEW JERSEY	1916-17	728173	19	83600	.11	2072	532932	.73	178788	.25	795320	1.09
8	PENN.	1916-17	1279680	56	246400	.19	5140	1101717	.86	354636	.28	1702753	1.33
9	RHODE ISLAND	1916-17	82827	1	4400	.05	317	59654	.72	18814	.23	82868	1.00
10	VERMONT	1916-17	37093	3	13200	.35	113	25517	.69	8466	.23	47183	1.27
11	TOTAL EASTERN STATES		5253061	184	809600	.15	15326	3844303	.73	1249730	.24	5903633	1.12
12	ILLINOIS	1916-17	569023	22	96800	.16	3850	424282	.72	127448	.22	648530	1.10
13	INDIANA	1916-17	191042	7	30800	.16	1064	154131	.81	53800	.28	238731	1.25
14	IOWA	1916-17	57991	6	26400	.46	251	41212	.71	14548	.25	82160	1.42
15	KANSAS	1916-17	5693				49	5995	1.05	2621	.46	8616	1.51
16	MICHIGAN	1916-17	274411	8	35200	.13	1055	205938	.75	70857	.26	311995	1.14
17	MINNESOTA	1916-17	71214	4	17600	.25	375	66369	.93	18721	.26	102690	1.44
18	NEBRASKA	1916-17	7907				56	7123	.90	2247	.28	9370	1.18
19	SO DAKOTA	1917	-										
20	WISCONSIN	1916-17	214500	3	13200	.06	1596	163222	.76	51935	.24	228357	1.06
21	TOTAL CENTRAL STATES		1411781	50	220000	.16	8296	1068272	.76	342177	.24	1630449	1.16
22	CALIFORNIA	1916-17	215080	6	26400	.12		169321	.79	60903	.28	256624	1.19
23	COLORADO	1916-17	27672	2	8800	.32	123	31881	1.15	10901	.39	51582	1.86
24	MONTANA	1916-17	3956				11	1518	.38	810	.21	2328	.59
25	NEW MEXICO	1917	-										
26	UTAH	1917	4202				32	5177	1.23	1775	.42	6952	1.65
27	TOTAL WESTERN STATES		250910	8	35200	.14	166	207897	.83	74389	.30	317486	1.27
28	KENTUCKY	1916-17	17895	1	4400	.25	95	8616	.48	4810	.27	17826	1.00
29	LOUISIANA	1916-17	11876	1	4400	.37	137	8909	.75	3593	.30	16902	1.42
30	OKLAHOMA	1916-17	8126				58	12601	1.55	3017	.37	15618	1.92
31	TEXAS	1916-17	34363	3	13200	.38	426	23956	.70	9395	.27	46551	1.35
32	TOTAL SOUTHERN STATES		72260	5	22000	.30	716	54082	.75	20815	.29	96897	1.34
33	GRAND TOTAL		6988012	247	1086800	.16	24504	5174554	.74	1687111	.24	7948465	1.14

EXPERIENCE COMPILED IN 1919

Summary

SCHEDULE 18

Machine Shops.

NOTE

Includes

452-Heavy Shops
453-With Foundry
460-Brass
461-Without Foundry
462-Special Mach'y.
470-Electrical
471-Misc. Products

EXHIBIT VI.

The problem may be stated in simple terms. Here we have experience which is in such form that the losses for all states and policy years are expressed in terms of a common denominator; it may be assumed that the converted national experience is merely a magnified New York Schedule "Z" for 1917. This experience is presented by states, regions and for the country as a whole and it is analyzed to show not only the total indicated pure premiums but also the indications for each of the pure premium divisions. It is obvious that if there is great uniformity in the experience of the several states and regions, the national indications may be taken as representative of the cost of workmen's compensation insurance in all states. Where there is no uniformity and the experience is broad enough to give dependable results for individual states, the experience being on a comparable basis, the states and regions requiring individual consideration can be singled out by inspection, and proper exceptional pure premiums created.

The aim should be to follow the converted experience as closely as possible, using it in mass where permissible, but always watching for variations indicating regional or state conditions representing actual differences in cost. The test of the accuracy of the work is primarily whether the selected pure premiums actually reproduce the converted losses. The results, from the standpoint of the individual state, will be satisfactory only if, in addition, every important classification which produces sufficient local experience to indicate the state pure premium is accorded exceptional treatment.

With this plan of procedure in mind the reader will appreciate that the establishment for 1,000 classifications of basic pure premiums, with the necessary exceptions for states and regions, is by no means a task that can be disposed of in a short time. In the 1920 revision over two solid months were consumed by this phase of the work.

At this point it may be wise to offer a word of warning in connection with the use of experience for pure premium determination. In workmen's compensation insurance it is impossible to develop rates by rule and solely in accordance with mathematical principles. Such methods may come in time but at present rate making in this field involves the use of a large element of judgment in addition to statistics, although statistics always provide the best basis for rate making. The statistics in themselves do not provide the solution. The correct interpretation of the available

COMPILED IN 1919

	STATE	POLICY YEAR	PAYROLL (IN HUNDREDS)	CONVERTED LOSSES (NEW YORK 1917 BASIS)									
				DEATH & PERM. TOTAL			ALL OTHER			MEDICAL		TOTAL	
				NO. CASES	AMOUNT	P. P.	NO. CASES	AMOUNT	P. P.	AMOUNT	P. P.	AMOUNT	P. P.
1	NEW YORK	1917	1,568,148,4	720	2929300	.19	37669	7667941	.49	1953439	.12	12550680	.80
2	NEW YORK	1916	1,414,574,5	871	3600700	.25	43473	6999727	.50	1774727	.12	12375154	.87
3	CONNECTICUT	1916-17	387,053,7	196	821500	.21	11869	2049766	.53	530269	.14	3401535	.88
4	MAINE	1916-17	159,771,1	96	389400	.24		984558	.62	256021	.16	1629979	1.02
5	MARYLAND	1916-17	171,425,4	131	545500	.32	4851	1276151	.74	286332	.17	2107983	1.23
6	MASS.	1916-17	1,619,792,9	818	3459400	.21		8028617	.50	2066249	.13	13554466	.84
7	NEW JERSEY	1916-17	762,655,2	431	1838700	.24	17874	4485139	.59	1181704	.15	7505543	.98
8	PENN.	1916-17	2,266,387,8	1618	7030400	.31	59530	13822484	.61	3493450	.15	24346334	1.07
9	RHODE ISLAND	1916-17	125,660,2	51	203000	.16	2911	650837	.52	170895	.14	1024732	.82
10	VERMONT	1916-17	43,384,7	51	216300	.50	1731	351310	.81	94238	.22	661848	1.53
11	TOTAL EASTERN STATES		8,518,853,9	4983	21034200	.25	179908	46316730	.54	11807324	.14	79158254	.93
12	ILLINOIS	1916-17	743,715,6	435	1838500	.25	34661	4254287	.57	1038764	.14	7131551	.96
13	INDIANA	1916-17	273,031,4	175	780800	.29	10866	1533826	.56	423401	.16	2738027	1.01
14	IOWA	1916-17	142,291,7	127	530000	.37	4044	829549	.58	202323	.14	1561872	1.09
15	KANSAS	1916-17	37,354,6	52	250400	.67	2182	384244	1.03	73116	.20	707760	1.90
16	MICHIGAN	1916-17	398,756,5	264	1147100	.29	13049	2664706	.67	659109	.17	4470915	1.13
17	MINNESOTA	1916-17	212,898,5	182	817000	.38	7642	1183662	.56	271358	.13	2272020	1.07
18	NEBRASKA	1916-17	58,320,6	57	231000	.40	2055	290708	.50	70271	.12	591979	1.02
19	SO DAKOTA	1917	-										-
20	WISCONSIN	1916-17	305,560,9	249	1034400	.34	18276	2131638	.70	541494	.18	3707532	1.22
21	TOTAL CENTRAL STATES		2,171,931,8	1541	6629200	.31	92775	13272620	.61	3279836	.15	23181656	1.07
22	CALIFORNIA	1916-17	726,378,9	501	2085600	.29		3656030	.50	947662	.13	6689292	.92
23	COLORADO	1916-17	100,488,6	131	622300	.62	2296	757333	.75	165836	.17	1545469	1.54
24	MONTANA	1916-17	32,512,4	19	80900	.25	827	294716	.91	46754	.14	422370	1.30
25	NEW MEXICO	1917	-										-
26	UTAH	1917	30,483,4	26	118900	.39	941	241525	.79	40866	.13	401291	1.31
27	TOTAL WESTERN STATES		889,863,3	677	2907700	.33	4064	4949604	.56	1201118	.13	9058422	1.02
28	KENTUCKY	1916-17	75,025,7	73	328600	.44	3196	429082	.57	105307	.14	862989	1.15
29	LOUISIANA	1916-17	55,355,0	91	338400	.61	4366	405984	.73	96238	.17	840622	1.51
30	OKLAHOMA	1916-17	78,458,1	108	496800	.63	2763	791274	1.01	188154	.24	1476228	1.88
31	TEXAS	1916-17	165,312,2	164	702900	.43	12927	1235118	.75	289015	.17	2227033	1.35
32	TOTAL SOUTHERN STATES		374,151,0	436	1866700	.50	23252	2861458	.76	678714	.18	5406872	1.44
33	GRAND TOTAL		11,954,800,0	7637	32437800	.27	299999	67400412	.57	16966992	.14	116805204	.98

EXHIBIT VII.

experience and its use for rate making involves a knowledge of the way the business is underwritten and administered, an intimate acquaintance with industrial processes, particularly from the standpoint of accident production, and, above all, an appreciation of the weaknesses inherent in the data themselves. Underwriters usually are responsible for the establishment of pure premiums, but they find it necessary to keep in close touch with actuaries, statisticians, and safety engineers. In fact, the best results are obtained by rate making committees upon which all these professions are represented.

It is impossible, in a paper of this length to describe the many interesting questions which present themselves during a rate revision. One must live with the problem to learn its many variations. It will be possible, however, to discuss the selection of pure premiums for several typical classifications and in this way to convey to the reader an idea of the procedure followed in establishing pure premiums under various conditions.

1. The simplest case is where the experience is reasonably uniform by states and regions and represents a sufficient volume for the entire country to produce a true indication for each pure premium element. A classification of this type is 3632—"Machine Shops—no foundry," the experience of which is reproduced in exhibit IV. For this classification the national indications were adopted without modification and no exceptions were established. The selected pure premiums thus correspond to the indicated pure premiums, namely:

D. & P. T. D.	All Other Indemnity.	Medical.	Total.
$.18	$.17	$.25	$1.20

2. A second case of common occurrence is where there are several classifications so related from the standpoint of hazard that the combined experience of the group is representative. A group of this description may constitute one of the groups of the Manual Classifications Code or it may be made up by associating classifications within a single code group or from several different code groups. In these cases the group experience may be uniform by states and may aggregate a dependable volume for the United States thus enabling the committee to establish the country-wide indications for all states and for all classifications in the group. The group experience is then the basis for rate making, it being used as the experience of a single classification would be used, and the results applied to the individual classifications.

SCHEDULE	PAYROLL (IN HUNDREDS)	CONVERTED LOSSES (NEW YORK 1917 BASIS)									
		DEATH & PERM. TOTAL			ALL OTHER			MEDICAL		TOTAL	
		NO. CASES	AMOUNT	P P	NO. CASES	AMOUNT	P P	AMOUNT	P P	AMOUNT	P P
1 Agriculture	100,477,8	111	388500	.39	1995	756514	.75	172893	.17	1317907	1.31
2 Mining	82,389,3	331	1754300	2.13	3429	1121256	1.36	218823	.27	3094379	3.76
3 Metallurgy	67,260,1	145	768500	1.14	3630	776812	1.15	194419	.29	1739731	2.58
4 Quarrying	59,586,2	207	1097100	1.84	3914	1090793	1.83	216940	.36	2404833	4.03
5 Food	503,725,6	311	1088500	.22	15022	3061044	.61	839535	.17	4989079	1.00
6 Textiles	857,477,1	204	714000	.08	8402	2847202	.33	737140	.09	4298342	.50
7 Clothing	606,890,2	50	175000	.03	5839	758558	.12	303194	.05	1236752	.20
8 Laundries	58,795,0	17	59500	.10	1324	396348	.67	80145	.14	535993	.91
9 Leather	342,164,5	80	280000	.08	3931	1246127	.36	331266	.10	1857393	.54
10 Rubber	101,618,8	43	189200	.19	2239	721842	.71	191406	.19	1102448	1.09
11 Paper & Pulp	88,561,9	94	413600	.47	3601	798876	.90	230695	.26	1443171	1.63
12 Paper Goods	87,861,8	33	115500	.13	2830	540009	.61	166674	.19	822183	.93
13 Printing	266,948,4	44	193600	.07	3459	900171	.34	222679	.08	1316450	.49
14 Wood	416,254,3	427	1494500	.36	27455	4964772	1.19	1061560	.26	7520832	1.81
17 Metal Forming	777,796,7	387	1702800	.22	35520	7022644	.90	2044430	.26	10769874	1.38
18 Machine Shops	698,801,2	247	1086800	.16	24504	5174554	.74	1687111	.24	7948465	1.14
19 Fine Machines	208,517,7	33	115500	.06	3084	690694	.33	216903	.10	1023097	.49
20 Vehicles	210,208,1	70	308000	.15	6528	1441559	.69	441343	.21	2190902	1.05
21 Stone Products	83,286,7	64	281600	.34	2811	678406	.81	143162	.17	1103168	1.32
22 Clay Products	54,958,9	43	189200	.34	1690	351545	.64	72035	.13	612780	1.11
23 Glass	105,663,2	21	92400	.09	2853	485412	.46	165962	.16	743774	.71
24 Chemicals	207,579,4	296	1302400	.63	7425	1713397	.83	444621	.21	3460418	1.67
25 Miscl. Mfg.	60,489,0	19	83600	.14	1358	231482	.38	70005	.12	385087	.64
26 Contracting*	287,796,0	634	2219000	.77	13067	3763017	1.31	810761	.28	6792778	2.36
27 Erection	768,349,1	1267	6714700	.87	35032	10413497	1.36	2020765	.26	19148962	2.49
28 Shipbuilding	63,349,7	88	466400	.74	2491	747119	1.18	169511	.27	1383030	2.19
29 Vessel Operation	28,252,5	129	245100	.87	1078	238526	.84	44232	.16	527858	1.87
30 Stevedoring	46,658,4	119	273700	.58	11008	1715616	3.68	228783	.49	2218099	4.75
31 R.R.Operation	60,992,3	133	704900	1.16	1340	512654	.84	124393	.20	1341947	2.20
32 Trucking	443,285,7	659	2899600	.65	20113	3920223	.88	987724	.22	7807547	1.75
33 Public Util.	78,300,6	201	1065300	1.36	2429	618656	.79	183527	.23	1867483	2.38
34 Commercial	1,285,659,9	640	2240000	.17	29816	5220226	.41	1486011	.12	8946237	.70
35 Clerical	2,332,710,3	115	402500	.02	2852	736292	.03	216518	.01	1355310	.06
36 Care, Custody	473,888,1	312	1092000	.23	7078	1530336	.32	398223	.08	3020559	.63
37 Miscellaneous	38,245,5	63	220500	.58	852	214233	.56	43603	.11	478336	1.25
Total	11,954,800,0	7637	32437800	.27	299999	67400412	.57	16966992	.14	116805204	.98

*Not erection

EXHIBIT VIII.

A case in point is group 161 of the Manual Classifications Code which comprises the following classifications:

2501—Clothing Manufacturing
2502—Fur Goods Manufacturing
2503—Dressmaking
2520—Collar and Cuff Manufacturing
2521—Shirt Manufacturing
4416—Rubber Garments Manufacturing—no rubber mill.

The regional and country-wide indications for this group are presented in the following table:

Region.	Payroll Exposure.	Indicated Pure Premiums.			
		D. & P. T. D.	A. O.	Medical.	Total.
Eastern.....	$400,818,500	$.02	$.11	$.05	$.18
Central.....	40,140,800	.05	.10	.03	.18
Western.....	7,142,300	0	.09	.03	.12
Southern.....	4,583,800	0	.08	.03	.11
U. S. A.....	452,685,400	.02	.11	.05	.18

It will be noted that if account is taken of the limited exposure in the western and southern regions and the fact that no "D. & P. T. D." losses appear in either experience, the indications of the total pure premiums and also of the partial pure premiums are fairly uniform. In this case the national indications were adopted for all states and for the six classifications in the group.

3. The next type includes cases of classification and group experiences which have developed unique indications in individual states and regions requiring the establishment of exceptions. Such a case is that of classification 1321—"Oil Producing—operation of oil leases, etc." It is apparent from a consideration of the nature of the operations falling under this classification that a single set of pure premiums for the United States would not measure the varying conditions found in individual states in which this industry is important. This is fully borne out by a review of the experience for the more representative states which is presented in the following table:

Region.	Payroll Exposure.	Indicated Pure Premiums.			
		D. & P. T. D.	A. O.	Medical.	Total.
Pennsylvania..	$5,172,000	$1.14	$1.78	$.27	$3.19
California.....	7,709,100	.41	.39	.14	.94
Oklahoma.....	9,298,200	.29	1.07	.29	1.65
Texas.....	4,628,400	1.15	1.23	.44	2.82
U. S. A.....	30,872,500	.81	1.03	.26	2.10

In this case exceptions were established for the states of Pennsylvania, California, Oklahoma and Texas based upon the local experience in each state.

4. There are many cases, however, where the experience of a single classification or even the experience of a homogeneous group is inadequate. These are the cases presenting difficulties. No practical criteria have been developed which may be applied to the payroll or losses for the purpose of measuring the adequacy of experience for rate making purposes. Judgment is still an important factor. It is evident that the losses which occur with the greatest frequency require the least exposure to produce a dependable indication, and that those which occur infrequently cannot be measured except by large volumes of data. In general, losses furnish the most reliable guide to a dependable experience and the volume necessary to provide a reliable rate making basis varies from the "Medical" division, for which the least exposure is required, to the "D. & P. T. D." division, where the experience indication is only conclusive if the exposure is large.

Two cases will illustrate these points. Take, for example, classification 3075—"Coppersmithing—shop only." For this classification the total payroll for the United States was $1,554,300 and the indicated pure premiums were as follows:

D. & P. T. D.	All Other Indemnity.	Medical.	Total.
0	$.48	$.26	$.74

The experience obviously was so limited that there was no basis for establishing exceptions for individual states or regions. As a matter of fact the country-wide experience itself was incomplete, as evidenced by the absence of death and permanent total disability losses. In this case the committee accepted the indications of the experience for the "All Other" and "Medical" pure premiums and supplied the "D. & P. T. D." pure premium by adopting $.12, the indication for a number of related groups in schedule 17.

The second example is that of classification 5103—"Door, Window Frame, or Sash—erection and repair—metal or metal covered." The experience for this classification for the United States on a payroll exposure of $2,722,100 indicated the following pure premiums:

D. & P. T. D.	All Other Indemnity.	Medical.	Total.
$1.95	$1.58	$.36	$3.89

The committee, after a careful review, decided that the "D. & P. T. D." indication was abnormal. It was willing, however, to accept the "All Other" and "Medical" indications as correct. The problem was to find a "D. & P. T. D." pure premium which might be used for the classification. The "D. & P. T. D." indication of group 664—"Ornamental and Architectural Metal Work Within Buildings," the group in which classification 5103 falls was selected, the adopted pure premiums being as follows:

D. & P. T. D.	All Other Indemnity.	Medical.	Total.
$1.23	$1.58	$.36	$3.17

5. Finally, there are cases where there is some experience but it is of such small volume as to be of no value whatever for rate making, or where there is no available experience at all. These will arise where the classification has not been in effect long enough to permit the accumulation of a representative experience, where the classification is newly erected, or where an existing classification is radically amended, thus making it impossible to use the experience accumulated under the old wording for the purpose of establishing pure premiums for the new classification. Such cases are treated in several ways:

(*a*) They may be found to represent substantially the same hazards as classifications for which experience is available in sufficient volume for rate making purposes, in which event the pure premiums of the analogous classification may be adopted.

(*b*) They may be compared with some classification for which experience is available and a factor of relationship established which will permit the derivation of pure premiums from those established for the related classification.

(*c*) The pure premiums may be established entirely upon judgment.

(*d*) The existing pure premiums may be continued.

Several cases typical of this class may be described as follows:

(*a*) Prior to the revision there was a single classification in the manual for "Fertilizer Manufacturing." This was classification 4580—"Fertilizer Manufacturing—no phosphate companies." It was found in practice that this classification, which carried a substantial rate, did not properly reflect the hazards of certain concerns, which buy ingredients and manufacture fertilizer by the simple process of mixing these materials by hand and putting them into sacks or other containers. During the revision it was decided to eliminate classification 4580 and to erect two classifications in its place, one of which was particularly designed to fit the type of risk just described and which was expressed in the following language: "Fertilizer Dry Mixing Plants—excluding the manufacture or handling of acid, bone and rock crushing, and the preparation of tankage—not available for division of payroll."* The new classification could not be compared with classification 4580 and the experience for classification 4580 was, therefore, of no value in determining pure premiums for it. This being the case the committee sought some analogy which would enable it to determine pure premiums. The new classification for this purpose was related to classification 4581—"Phosphate works—no mining": and the following pure premiums—previously adopted for classification 4581—were established:

D. & P. T. D.	All Other Indemnity.	Medical.	Total.
$.51	$.56	$.25	$1.32

(*b*) A similar case is that of a new classification described as follows: "Cord and Twine Manufacturing—not from manila, hemp, sisal or jute—including the manufacture of cotton rope or cord." In the absence of experience this classification was deemed to represent the same hazards as classification 2222—"Cotton Spinning and Weaving" and the pure premiums of classification 2222 were, therefore, adopted.

(*c*) The next example is the case of classification 4923—"Photographic Supplies Manufacturing." For this classification the national experience was deemed to be entirely out of line and was,

* The "not available for division of payroll" clause means that the classification cannot be used unless it expresses the complete operations of the risk. It therefore, cannot be used to cover the mixing operations of a fertilizer manufacturing risk which manufactures fertilizers from raw materials.

therefore, discarded. In the absence of a better indication the old pure premium of $.48 was continued and arbitrarily divided as follows:

D. & P. T. D.	All Other Indemnity.	Medical.	Total.
$.12	$.24	$.12	$.48

(*d*) During the revision the "steel making" classifications were radically amended. Prior to the revision the classifications had included the steel making processes and had specifically excluded rolling mill and forging operations for which separate classifications and lower rates were provided. It was found that this division of the industry was impracticable and the new classifications, therefore, include rolling mill and forging operations. For example, classification 3000—"Steel Work—open hearth, bessemer, and crucible, or open hearth and bessemer, casting ingots, and puddling and blooming mill operations" was eliminated and the following classification erected in its place: 3002 "Steel Making—open hearth furnaces including bessemer, with blooming mills or forging and rolling mills—excluding blast furnace operation and coke manufacturing." Naturally the experience of classification 3000 could not be used to obtain pure premiums for the new classification. An investigation was made to determine the relative proportions of "steel making" and "rolling mill" operations which would fall under the new classification and the pure premiums were obtained by using the experience of 3000 as well as the experience of 3018—"Iron and Steel Rolling Mills—n. o. c.—with or without puddling furnaces," a weight of two being assigned to the latter experience as compared with the weight of one to the experience for classification 3000, these being the proportions of payroll for the two operations assumed to be included under the new classification.

After all the pure premiums were established the General Rating Committee carefully reviewed them for the purpose of detecting inconsistencies, particularly in the "D. & P. T. D." division. The "D. & P. T. D." division requires the broadest exposure for a dependable indication and, in the absence of sufficient experience, the pure premiums in many cases had been selected with reference to the group or schedule indication—in other words a large element of judgment had been employed. Inasmuch as each classification had been taken up in the order in which it appeared in the Manual

Classifications Code there was a possibility that classifications representing the same "D. & P. T. D." hazards but having a limited experience might have received different treatment merely because they were not all considered at the same time. For the purpose of making this final survey two lists of the selected pure premiums were prepared. One presented the pure premiums for each classification and was arranged according to the groupings of the Manual Classifications Code. The other also presented the selected pure premiums but in a special arrangement in which all classifications having the same "D. & P. T. D." pure premiums were thrown into a single group. These lists were carefully reviewed, and some inconsistencies were located although not so many as were anticipated. In several cases groups were combined and pure premium variations of $.01, $.02, $.03, $.04 or $.05 eliminated. In other cases corrections were made for individual classifications, for the purpose of truing up the results.

After this final review of the pure premiums, a test was made to ascertain how closely the committee had followed the converted experience. This test was made by extending the payrolls at the established pure premiums, exceptions being taken into consideration, and comparing the expected losses obtained in this manner with the converted losses. The comparison was made by groups and schedules and for all schedules combined. The total expected losses were within $\frac{1}{10}$ of 1 per cent. of the actual converted losses and the results for individual groups and schedules compared favorably and were within reasonable limits, thus indicating that the national pure premiums had been selected with care and with proper regard for the experience indications.

Determination of State Pure Premiums.

We have gone through the process of bringing all experience to a common level for the purpose of finding the necessary volume for establishing a relationship of hazard between classifications and have obtained an expression of this relationship in terms of basic pure premiums. We are now confronted with the problem of retracing our steps. This means the breaking up of the national experience and the translation of the basic pure premiums so that they may be expressed in terms of state level rather than of basic level. We must secure for each state a set of pure premiums which

in the aggregate will reproduce the experience of the state and which we may later project into gross rates for the several manual classifications. The experience of each state is the sole criterion for the determination of its own level of rates.

The first step in this procedure involves nothing more than the reversal of the conversion process. Instead of attempting to bring the experience to a common level we now have to translate pure premiums established on the converted experience back to the level of the individual state. For example, let us take the problem of bringing the national basic pure premiums to a level represented by the Connecticut Schedule "Z" data for policy years 1916 and 1917 combined.

It has been demonstrated that the established basic pure premiums reproduce the converted losses which, according to our hypothesis, are representative of New York Schedule "Z" for 1917. These basic pure premiums must, therefore, correspond to the experience for New York Schedule "Z" for 1917. We have a set of factors for the "All Other Indemnity" and "Medical" loss divisions by means of which Connecticut losses for policy years 1916 and 1917 were converted to the basic level. As a first approximation to the translation factors we may assume the reciprocals of these conversion factors.*

For the translation of the "D. & P. T. D." element, it is necessary to make a comparison of average values taken from the Connecticut Schedule "Z" experience for 1916–1917 with the corresponding values which were used in the conversion process. The ratios of these values constitute the translation factors for this element.

The factors having been obtained the actual translation of the basic pure premiums is accomplished by the simple process of applying the factors to the basic pure premiums. Thus, assuming a simple hypothetical case, let us say that the national basic pure premiums for a certain classification are as follows:

D. & P. T. D.	$1.00
All Other	1.50
Medical	.50

and that the translation factors applicable to this particular classification are as follows:

* This is only an approximation as Mr. Greene points out in his paper.

D. & P. T. D.	.75
All Other	1.00
Medical	1.10

Expressed in simple terms, the "D. & P. T. D." factor means that in the particular state for which the translation is to be made, the death cost for this classification is 75 per cent. of the cost as measured by New York Schedule "Z" for 1917. A similar interpretation applies to the remaining translation factors. The translated pure premiums are obtained by applying the factors to the basic pure premiums as follows:

	Basic Pure Premium.		Translation Factor.		State Pure Premium.
D. & P. T. D.	$1.00	×	.75	=	$ .75
All Other	1.50	×	1.00	=	1.50
Medical	.50	×	1.10	=	.55
	$3.00				$2.80

In this procedure care must be exercised to see that all the exceptions for the state under consideration are recognized and properly treated. If the exception is based upon regional experience, the pure premiums, which will be expressed in terms of the basic level, must be translated. If the exception is based entirely upon local experience, the indications of the local experience, without translation, may be accepted as the selected state pure premiums. A copy of the blank used in the translation process is reproduced in Exhibit IX.*

* It will be noted on this blank that the term "projection" is applied to the process of obtaining state pure premiums from basic pure premiums Thus, the factors are referred to as "projection factors," the state pure premiums (columns 13 to 16 inclusive) as "projected state pure premiums," etc. It was originally planned to refer to this process as "projection." Later, when the writer undertook to prepare this paper, it struck him as more logical to reserve the term "projection" for the final step in the rate making procedure, namely—the determination of gross rates from the selected state pure premiums. A new term "translation" was therefore established for the process of going over from the basic pure premiums to the state pure premiums.

If this new term is accepted, the rate making process may be broken up into four phases, as follows:

1. *Conversion* of state experience to the basic level.
2. *Selection* of basic pure premiums.
3. *Translation* of basic pure premiums to the state level.
4. *Projection* of state pure premiums into final rates.

NATIONAL COUNCIL ON WORKMEN'S COMPENSATION INSURANCE

TEST OF PURE PREMIUMS ADOPTED AT 1920 RATE REVISION

PROJECTION FACTORS

	D. & P. T. D.	ALL OTHER	MEDICAL	TOTAL
PROJECTION GROUP I	.457	.2865	.2165	
" " II	.457	.3287	.2055	
" " III	.457	.2839	.2237	

STATE Maryland

SCHEDULE 7

GROUPS 161-2-4-5-9

	CLASSIFICATION		PAYROLL	STATE LOSSES				PROJECTION GROUP	ADOPTED BASIC P. P.				PROJECTED STATE P. P				EXPECTED STATE LOSSES				PRESENT RATE	PROPOSED RATE	STATE PREMIUMS.	
	CODE NO.	WORDING (IST WORD ONLY)		D. & P. T. D.	ALL OTHER	MEDICAL	TOTAL		D. & P. T. D.	ALL OTHER	MED-ICAL	TOTAL	D. & P. T. D. (50% LARGER)	ALL OTHER (28% LARGER)	MED-ICAL (11% LARGER)	TOTAL (29% LESS THAN COL 12)	D. & P. T. D.	ALL OTHER	MEDICAL	TOTAL			PRESENT RATES	PROPOSED RATES
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
1	Group	#161																						
2	2581	Shirt Mfg	4 885 252	-	1 044	3 036	4 080	III	.02	.11	.05	.18	.01	.03	.04	.08	489	1 466	1 954	3909	.25	.22	12213	10748
3	2502	Fur "	43 196	-	103	50	153	III	.02	.11	.05	.18	.01	.03	.04	.08	4	13	17	34	.23	.22	99	95
4	2501	Clothing	12 761 240	750	4 967	6 290	12 007	III	.02	.11	.05	.18	.01	.03	.04	.08	1 276	3 828	5 104	10208	.23	.22	29351	28075
5	2503	Dressmkng	501 525	-	116	29	144	III	.02	.11	.05	.18	.01	.03	.04	.08	30	90	121	241	.23	.21	693	635
6																								
7	Group	#162																						
8	2550	Hat Mfg	18 868	-	60	35	95	III	.05	.19	.06	.28	.01	.05	.05	.11	2	9	9	20	.28	.32	53	60
9	2551	Straw	1 966 286	-	693	948	1 641	III	.03	.09	.04	.16	.01	.03	.03	.07	197	590	590	1377	.28	.20	5506	3935
10	2554	Feather	29 713	-				III	.03	.09	.04	.15	.01	.03	.03	.07	5	9	9	21	.28	.20	83	59
11	2552	Millinery	39 621	-	21	23	44	III	.03	.09	.04	.16	.01	.03	.03	.07	4	12	12	28	.28	.19	111	75
12	2556	Hair	203 066	-	200	370	570	III	.03	.15	.09	.27	.01	.04	.07	.12	20	61	142	243	.62	.32	1259	650
13																								
14	Group	#164																						
15	2570	Mattress	132 879	-	76	101	177	II	.17	.61	.19	1.17	.08	.27	.15	.50	106	359	199	664	.95	1.48	1263	1967
16	2571	Quilt	600	-	-	-	-	II	.13	.17	.08	.38	.06	.06	.06	.18	-	-	-	-	.95	.49	6	3
17	2572	Feather	12 668	-	-	-	-	III	.13	.17	.08	.38	.06	.06	.07	.18	8	6	9	23	.40	.47	51	60
18																								
19	Group	#165																						
20	2561	Glove	300	-	-	-	-	III	.02	.11	.05	.18	.01	.03	.04	.08	-	-	-	-	.23	.22	1	1
21	2561	Neckbie	85 330	-	-	-	-	III	.02	.11	.05	.18	.01	.03	.04	.08	9	26	34	69	.23	.22	196	188
22	2525	Cap	57 470	-	-	10	10	III	.02	.11	.05	.18	.01	.03	.04	.08	6	17	23	46	.28	.22	161	127
23	2553	Furnishng	1 500	-	-	-	-	III	.02	.11	.05	.18	.01	.03	.04	.08	-	-	1	1	.23	.22	3	3
24	2550	Suspender	4 393	-	-	-	-	III	.02	.11	.05	.18	.01	.03	.04	.08	-	1	2	3	.23	.22	10	10
25	2554	Corset	38 746	-	-	-	-	III	.02	.11	.05	.18	.01	.03	.04	.08	4	12	15	31	.23	.22	89	86
26	2560	Umbrella	223 625		32	63	95	III	.02	.11	.05	.18	.01	.03	.04	.08	22	67	89	178	.23	.22	514	492
27																								
28	Group	#169																						
29	2573	Sail	19 809	-	-	-	-	III	.17	.38	.13	.68	.08	.11	.11	.30	16	22	22	60	.40	.82	79	162
30	2574	Awning	154 257	-	125	415	540	III	.17	.38	.13	.68	.08	.11	.11	.30	125	170	170	453	.66	.82	1018	1265
31	2575	Bag	106 094	-	114	118	232	III	.17	.38	.13	.68	.08	.11	.11	.30	85	117	117	319	.54	.82	573	870
32																								
33																								
34		Total	21 086 445	750	7 540	11 588	19 878										2 404	6 898	8 639	17939			53332	49561
35																								
36																								

FORM 6

After a complete list of selected state pure premiums is available a test is made to ascertain how nearly the state losses for policy years 1916 and 1917 have been reproduced. This test requires the extension of the payroll for each classification by means of the selected state partial pure premiums. The expected losses produced in this manner are then compared with the actual state losses. If the work has been properly done the expected losses for each division thereof will closely correspond to the actual state losses. If this relationship does not hold an analysis must be made to ascertain wherein the process has failed to reproduce the original state experience. Additional cases requiring exceptional treatment may be discovered, in which case the translated national pure premiums must be modified in whole or in part to make them follow more closely the indications of the state experience. Or it may develop that the translation factors require correction, in which case a slight change one way or the other will bring about the desired balance of expected and state losses. At any rate, a balance or a reasonable approximation thereto is obtained before the set of selected pure premiums is definitely adopted as a basis for the determination of gross state rates.

Projection of Rates.

We have now reached the final stage of the revision, namely the establishment of gross or manual rates. As a starting point we have the selected pure premiums for each state which, in the aggregate, reproduce the actual state experience for policy years 1916 and 1917 combined. Our problem now is to project these pure premiums to meet the cost conditions of the future period for which the rates are intended, thus producing final pure premiums. After this we can obtain gross rates by the simple process of applying the expense loading and adding to the result one cent, as provision for the catastrophe hazard.*

As developed by the Actuarial Committee in the 1920 revision, the process of projection assumed two phases. First, the 1916–1917 pure premiums were brought to the present cost level (represented by the experience of policy year 1919). They were then modified to meet the requirements of the future. This involves correcting the pure premiums so far as possible in the light of the

* In addition, as will be explained later, a loading for schedule rating is applied for classifications subject to schedule rating.

most recent statistical data available and then projecting them into the future to the level of cost which is expected for the period during which the rates will be in effect.

As a basis for bringing the selected state pure premiums up to date the committee used loss ratio experience for policy year 1919.* The actual loss ratio for policy year 1919 is not definitely known because the ultimate experience for that year is not yet available. A close approximation was obtained, however, by studying separately the premium and loss developments of previous policy years and projecting the incomplete premiums and losses of 1919 to an ultimate basis by means of appropriate factors.† A loss ratio was then obtained for policy years 1916–1917 by using 1919 manual rates, with a suitable modification for merit rating, to develop premiums on the 1916–1917 payrolls (thus putting both loss ratios on the same rate basis) and relating the premiums thus obtained to the actual incurred losses of that period. A comparison of these loss ratios is, in fact, equivalent to a comparison of average pure premiums and reflects the influence of every factor affecting the cost of workmen's compensation during the intervening period. (From 1916–17 to 1919.)

Such a comparison measures collectively such factors as changes in wage level, amendments to the benefit schedules, greater liberality on the part of administrative claim bodies in interpreting workmen's compensation laws, a possible tendency on the part of claimants to malinger and to present fraudulent claims, the influence of immigration and emigration, variations in accident frequency and severity rates or in employment and unemployment, and, in fact, any and all influences acting upon the cost. The result, known as the projection factor, does not provide a separate measure of each of these items but, as it is based upon actual experience, it represents the net effect of all causes acting upon the pure premium

* The loss ratio is the ratio of incurred losses to premiums. Thus assuming an expense loading of 38 per cent., the normal loss ratio is 62 per cent. If the rates are exactly correct the loss ratio will be normal thus indicating that the pure premium has been entirely consumed. If the experience has been better than expected the loss ratio will be lower than normal, thus indicating a saving because of failure to use entirely the provision for losses. If the loss ratio is higher than normal, the actual experience has been worse than expected.

† See Mr. Mowbray's paper for an explanation of this process from the actuarial point of view.

cost. Inasmuch as policy year 1919 has not yet expired, it may be assumed that the application of the projection factor to the 1916–1917 pure premiums will bring them to a level entirely representative of present-day conditions.

The next problem is to look ahead for changes in cost which can be anticipated and measured. There are many tendencies at work which may possibly result in decided changes in cost in the future but, for the most part, these cannot be measured statistically; conjecture must be resorted to if they are to be considered at all. We have learned from years of experience that estimates in such cases are as likely as not to be entirely contrary to the final result. Hence, early in the 1920 revision it was decided to avoid conjecture and to introduce only such factors as could be statistically developed and defended. A prediction with reference to the future trend of wages, industrial conditions, accident frequency and severity rates, and other individual factors of similar character, was not attempted. This leaves only one factor which can be considered in this category, namely, the effect of changes in statutory compensation benefits.

Enough experience has now developed so that we know with reasonable exactness what change in cost an amendment to the workmen's compensation law will carry with it. If the waiting period is reduced or the percentage of wages, which is the basis of compensation payments, is increased or any one of numerous changes in benefits is made, we can foretell almost with certainty just what the result will be when measured in terms of cost.

For the purpose of calculating the effect of amendments a new accident distribution was developed and applied in the 1920 revision. For convenience this has been termed the "American Accident Distribution,"* and, as its name implies, it is based entirely upon American accident data obtained from Schedule "Z" and from other sources. The table is a sample distribution of accidents taken from all industries. These accidents are arranged according to nature of injury in the following general divisions:

Kind of Injury.	Number of Cases.
Death	776
Permanent Total Disability	63
Permanent Partial Disability	3,855
Temporary Total Disability	95,306
Total	100,000

* Work of Miss Olive E. Outwater, a Fellow of this Society.

Each division is further subdivided—the "Death" cases by nature and extent of dependency, the "Temporary Total Disability" cases by duration of disability, etc. This standard distribution is used to measure the effect of amendments by the simple process of ascertaining how much the old and the amended benefits will cost for the 100,000 accidents and taking the ratio of the two results. The results can be obtained separately for the three pure premium elements by making appropriate comparisons.

The application of the projection and amendment factors converts the selected 1916–1917 pure premiums into final pure premiums and we are now ready to produce gross rates.

In this final step three factors were used:

1. Catastrophe* loading. In establishing basic pure premiums all catastrophic losses were eliminated except where they were normally incidental to the industry, as for example, in mining, celluloid manufacturing, starch manufacturing (dry process), etc. There is no provision, therefore, in the pure premiums for ordinary classifications for the catastrophe hazard. It is known, however, that catastrophies occur even in low-rated industries as witness the recent falling of a dirigible into a bank building in Chicago, the Triangle fire in the clothing industry in New York, etc. The frequency of these accidents cannot be accurately foretold; furthermore, they fall at random affecting certain classifications this year, others next year and failing to produce sufficient experience to enable the rate maker to measure the cost for individual classifications. The fairest method, therefore, is to charge all industries alike with a contribution toward these losses. One cent for each $100 of insured payroll in all states was estimated as adequate to create a fund to cover the catastrophe losses. This charge is assessed by making a flat addition of one cent to each gross rate.

2. Loading for schedule rating. In the past there have been loadings for both plans of merit rating in recognition of the fact that these plans in actual practice have failed to produce sufficient debits to offset the credits and thus have tended to make inadequate the premium level as measured in terms of manual rates.† In the 1920 revision it was decided to provide for the deficiency due to

* A catastrophe is an accident involving five or more death or permanent total disability cases.

† The manual rate is the average rate for all risks and consequently it must on the average be collected.

experience rating in the experience rating plan itself thus rendering unnecessary a specific loading in the manual rates. However, it was impracticable at the time to make any adjustment in the schedule rating plan and the Actuarial Committee decided to introduce a factor to take account of the fact that the schedule rating plan does not in practice produce a balanced result. This factor is applied only to the rates for classifications which are subject to schedule rating.

3. Expense loading. This covers the expense portion of the premium and is applied as a percentage of the gross rate. A standard loading of 38 per cent. was adopted, made up as follows:

	Per Cent.
Acquisition cost	17.5
Administration	8.0
Inspection and Accident Prevention	2.0
Claim Adjustment	7.0
Taxes—state	2.0
Taxes—federal and miscellaneous	1.5
	38.0

This loading was established for universal application in all states having a state tax of 2 per cent. with the proviso that, in cases where the state tax varies from 2 per cent. (the usual tax requirement) an adjustment should be made. Thus, in Maryland the normal tax is 1½ and there is a special tax for the maintenance of the Industrial Accident Board which amounts to an additional 1½ per cent., thus bringing the total tax to 3 per cent. For Maryland, therefore, the expense loading is 39 per cent. On the other hand, in a state such as Illinois the loading is 38 per cent. because there are no abnormal state taxes.

We now have all the materials necessary to the construction of gross rates. The procedure by means of which these are assembled for this purpose may be illustrated by an example. Let us continue the determination of gross rates for the classification used to illustrate the translation process, the figures for which are given on page 241.

Pure Premium Element.	Selected State Pure Premium (1916–17.)		Projection Factor (1919).		Amendment Factor (1920–1).		Final Pure Premium.
D. & P. T. D.	$ .75	×	.95	×	1.00	=	.712
A. O Indemnity.	1.50	×	.95	×	1.50	=	2.137
Medical	.55	×	.95	×	1.10	=	.574
Total	2.80						3.423

Assuming that the classification in question is subject to schedule rating and that the factor for schedule rating is 1.05 we next apply this loading as follows:

$$1.05 \times 3.423 = 3.594.$$

The gross rate is then obtained by the following calculation:

Rate = Final P. P. (loaded for schedule rating) + .38 Rate,

Rate (1 — .38) = Final P. P. (loaded for schedule rating),

$$\text{Rate} = \frac{3.594}{.62} = 5.80.$$

With the catastrophe loading this becomes \$5.81 (\$5.80 + \$.01).

In conclusion, a word concerning the form of the manual resulting from the 1920 revision. The manual is in two parts:

1. The manual proper, in which items of general application to all states are presented. This contains fundamental rules of underwriting and an alphabetical arrangement of classifications with corresponding code numbers.

2. State rate sheets which present items of local interest. These contain exceptions to the general rules of underwriting, special classifications applicable only to the local jurisdiction, and rates. The rate sheet is a list of code numbers in numerical order with corresponding state rates and minimum premiums.*

Thus, the manual for an individual state is a combination of the universal basic manual and the exception and rate sheets for the local jurisdiction. Rates are obtained by first consulting the manual proper, locating in the alphabetical arrangement the classification for which the rate is desired, noting the code number and

* The minimum premium is "an expression of the lowest premium amount for which a single risk can be written and carried for any period not exceeding one year." It is intended to provide

First: For the minimum cost of issuing and administering a policy of insurance, and

Second: For the losses produced by the lowest exposure which any insurance carrier wishes to assume, namely, the exposure of one employee for the full period of one year.

The formula by which the minimum premium is obtained is as follows:

Minimum premium equals \$8 plus ten times the manual rate.

\$8 is the policy charge for the first item; ten times the manual rate is equivalent to the premium on a payroll exposure of \$1000, the assumed payroll of one employee for one year. It is provided that the lowest minimum recognized shall be \$10.

then referring to the state rate sheet where the code number is to be found in its proper numerical order with the rate opposite it.

Conclusion.

It is difficult to summarize a paper of this character: the detailed description of the rate making process must be covered in its entirety, if the reader wishes to understand the subject. It is hoped that it will be of value as a record of the 1920 rate revision, primarily from the standpoint of students, who have not had the advantage of close association with the work and thus have been denied the opportunity to examine Schedule "Z" and the other materials used for rate making in this field and the processes by means of which these materials are transformed into manual rates.

The statement has been made that the 1920 revision represents the latest development in rate making in workmen's compensation insurance. The work throughout was highly constructive. The volume of workmen's compensation insurance data is the largest ever compiled for rate making and the methods employed have produced greater accuracy both in the aggregate rate level of each state and in the distribution of the total cost to individual industries. The revision does not, however, represent the ultimate development: even at this moment, before the results are in actual application, changes in procedure are being proposed. It is my personal opinion that the future will bring many innovations. There is plenty of room for improvement, particularly in the way of simplification. Present-day rate making procedure, as must be evident to any one who has carefully read this paper, is in serious danger of being overbalanced by sheer weight of complexity. The ultimate rate making process should be designed to produce the best results with the least expenditure of effort. It is in this direction that future progress should be made.