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

WORK OF THE STATISTICS BRANCH, UNITED STATES ARMY—RALPH H. BLANCHARD.

VOL. V, PAGE 274.

WRITTEN DISCUSSION.

MR. EDWIN W. KOPF:

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

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

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

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

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

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

MR. HARRY LUBIN:

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

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

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

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

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

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

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

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

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

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

EMMA C. MAYCRINK:

This paper brings before us a recent statistical accomplishment of exceptional interest. The tables which Mr. Blanchard has selected from the series of reports which were sent to various departments of the United States government during the war emphasize the importance of that branch of the army by which the movements of various parts of the gigantic war machine were synchronized and controlled. They also afford an interesting study of graphic methods as a means of statistical presentation. Mere

columns of figures enumerating men or materials would have been deadly monotonous, requiring considerable effort to grasp the important details; a variety of diagrams served the purpose of arresting attention and vizualizing comparative results and significant trends.

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

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

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

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

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

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

MR. L. W. HATCH:

It has become a somewhat trite observation that in this last great war science played a far greater rôle than in any previous war. The

way in which scientific men in nearly all lines were mobilized for service was a striking feature in all the countries involved. The services rendered by such men were not spectacular nor have they been much featured by publicity, but they were none the less important and useful.

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

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

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

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

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

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

AUTHOR'S REVIEW OF DISCUSSIONS.

MR. RALPH H. BLANCHARD:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

CASUALTY INSURANCE FOR AUTOMOBILE OWNERS—G. F. MICHELBACHER.

VOL. V, PAGE 213.

WRITTEN DISCUSSION.

MR. SAMUEL DEUTSCHBERGER:

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

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

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

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

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

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

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

Mr. Michelbacher outlines the zoning scheme based upon the measurement of the hazards of environment and he points out the unsatisfactory situation produced by drawing sharp lines of demarcation with consequent abrupt changes in rates. Equally as unsatisfactory or perhaps more difficult of solution is the problem created by the establishment of zones near congested centers. All automobiles in such zones are rated upon the assumption that they are likely to be exposed to the hazards of the congested section although there can be no question that a substantial number of such automobiles are applied to a routine use which does not expose them to these hazards. In connection with the zone rating scheme, an interesting question was raised by a farmers' association regarding the zone rates on farm trucks. The trucks were maintained in a zone adjacent to New York City, a differential in rate being applied to the zone because of its proximity to that greatest of all

congested centers. The farmers confessed that their trucks brought their farm produce to the city markets, but they pointed out that farmers' trucks are kept or loaded at the farms and then taken to the most available market in the night or early morning hours when the roadways are more or less deserted and that the element of congestion hardly applied to farmers' trucks. They also drew attention to the fact that farmers located further away from the city markets received a lower rating by reason of being in a different zone, notwithstanding that their trucks traversed the same roads and were exposed to such greater hazard as might be involved in the greater mileage exposure. The farmers' contentions were recognized by the underwriters and we may at any time expect an application from the joy-riding automobilists who traverse the same roads at the same hours for special concessions in their liability and collision insurance.

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

ORAL DISCUSSION.

MR. HARDY:

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

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

> "When 'Omer smote 'is bloomin' lyre,
> He'd 'eard men sing by land and sea;

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

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

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

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

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

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

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

The original rate for fire and transportation was three per cent. This excluded fire originating within the car. Later, or in the early part of 1905, this restrictive clause was eliminated from the policy and the coverage extended to include fire arising within the car. This gave a complete fire coverage. Of course, the present fire form, the ordinary fire form, like the ordinary insurance form for buildings or property, limits the liability of the company to the

actual cash value of the property at the time of the car's destruction, said value being subject to depreciation and in any event not to exceed the actual cost of repairing or replacing. In those days it is worthy to note that the big problem was the fire problem. To-day that has entirely passed away, and I believe the dominating problem is the theft problem, the inability of certain people to distinguish between the machine that they do not own and the one that somebody else owns. In other words, the theft hazard is now the controlling thing, and the fire hazard, so far as it exists, is probably as well controlled as any hazard can be.

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

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

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

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

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

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

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

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

MR. MOORE:

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

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

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

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

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

VOL. V, PAGE 243.

WRITTEN DISCUSSION.

WILLIAM LESLIE:

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

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

It is doubtless a fact that much of the diffidence among underwriters about accepting "innovations" suggested by actuaries arises out of uncertainty as to their practical value and the result of their application. The happy feature of the Pennsylvania Rate Revision of 1918 was the fact that a wealth of new ideas had been expounded from time to time, which despite the expounding remained but ideas, and Pennsylvania seized upon the opportunity to give practical effect to many of these, thereby affording an actual test of their value. Irrespective of how opinions may differ respecting the manner in which these principles have stood the test, it is now a recognized fact that trying out a new principle does not necessarily mean certain ruin and chaos. Underwriters are not today in quite the same frame of mind they were prior to the Penn-

sylvania rate revision of 1918 and for that matter neither are we actuaries.

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

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

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

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

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

MR. GEORGE D. MOORE:

The work accomplished by the Pennsylvania Rating Board in connection with the rate revision of 1918 is admirable. The statistical investigations and the results which have been arrived at through these investigations form the ground work of the principles

which will be laid down in the future for the standardization of rate making; and the only criticism that can be made of the work outlined in this paper is one which could naturally be made of any rate revision undertaken for any given state, namely, that in some respects it does not consider the problem of a rate revision for the country as a whole; and it will be my present purpose to suggest methods which to my mind will lend themselves to nation-wide use.

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

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

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

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

(a) Death and Permanent Total Disability.

In the combination of experience by classifications the number of death and permanent total disability cases should be shown separately and the accident rate for such cases per unit of payroll should be determined by classifications. In the projection of experience the average cost of a death and permanent total disability case should be determined either by actual experience or by actuarial valuation and the values applied to the determined rate. Whether the combination of death with permanent total disability cases is preferable to that of the separation between the two is still a matter of conjecture.

An investigation of the death and permanent total disability cases undertaken in the recent Pennsylvania Rate Revision resulted in dividing the classifications into three or four groups of trades according to the predominance of men or women and the extent of dependency, and then utilizing the average cost for such cases determined from actual experience. This refinement is one which could undoubtedly be utilized in a large state but in the experience of a small state would have but little value.

(*b*) *Major Permanent Disability Cases.*

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

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

(*c*) *Temporary Total Disability.*

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

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

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

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

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

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

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

The so-called Direct Method produces:

$$\frac{28,598 \times 760,769}{647,685} = .488,$$

and the Inverse Method produces

$$\frac{14,784 \times 760,769}{1,367,230} = .480.$$

The ratio of the average weighted Pure Premiums is

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

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

$$1 + D = \frac{942,844}{647,685} = 1.455. \quad D = .455.$$

$$E = \frac{1 - .455 \dfrac{647,685}{1,367,230}}{1.455} = .54.$$

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

* Mr. Greene's formula

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

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

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

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

(*d*) *Medical.*

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

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

ORAL DISCUSSION.

MR. W. W. GREENE:

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

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

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

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

It seems to me that in general the determination of classification wording should be viewed as a national problem; and in the long run, our statistical difficulties will be great unless almost all classifications, although not necessarily universally applicable, have been determined with nation wide conditions fully in mind.

If each state is to erect its own system of classifications, the number of classifications may for each state be fewer than would otherwise be possible. Yet if the combination of experience from several states is to be continued, enormous statistical difficulties will result from multiplicity in the total number of classifications and inconsistency in their scope.

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

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

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

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

W. A. SCHAEFER:

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

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

The "machine shop" classification is a particularly good example of a classification whose dependability has been impaired in the writer's estimation. Almost invariably where machine tools are used and no specific classification exists—the risk is placed under this classification.

It matters not if the principal product consists of large-size pumps or steam engines nor whether the general hazard is comparable to the manufacturing of mining or milling machinery.

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

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

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

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

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

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