DEPARTMENT OF COMMERCE
BUREAU OF STANDARDS
S. W. STRATTON, DIRECTOR

MISCELLANEOUS PUBLICATIONS—No. 51

Weights and Measures

Fifteenth Annual Conference

OF REPRESENTATIVES FROM VARIOUS STATES
HELD AT THE BUREAU OF STANDARDS
WASHINGTON, D. C., MAY 23, 24, 25, AND 26, 1922

PRICE, 15 CENTS
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1922

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REPORT OF THE FIFTEENTH ANNUAL CONFERENCE ON WEIGHTS AND MEASURES OF THE UNITED STATES.

HELD AT THE BUREAU OF STANDARDS, WASHINGTON, D. C., MAY 23–26, 1922.

FOREWORD.

Prior to last year the custom prevailed of printing these reports of the Annual Conferences on Weights and Measures verbatim. Last year, however, on account of the urgent need for economy in the expenditure of Government funds it was found essential to abridge the report of the Fourteenth Annual Conference somewhat, and this was accordingly done.

In the case of the present report the same urgent necessity impels us to the same course, and, consequently, this report also will be found to be abridged. The same method of accomplishing this has been followed, namely, the material has been studied to determine what portions might be deleted with the least sacrifice of essential matter. The result has been that the proceedings of the first two sessions have largely been abstracted and the discussion in all other sessions has been curtailed when it appeared that this could be done without too great a loss of material of permanent usefulness.

This has resulted, as in last year's report, in the reports of State delegates being abstracted, since these are probably not of as general use in this report as discussions bringing out the consensus of opinion on some matter of importance, or resulting in some constructive action on a definite proposal. Especially is this last material of importance, since it often shows the necessity of the action taken and the data upon which the action is based, and, in addition, it will serve as a guide to the proper interpretation of the meaning of the conclusion in case any doubt arises in the mind of the reader as to its exact significance.

The bureau is confident that the report will be found not to have been greatly impaired as to usefulness by the necessary abridgments and deletions made.

S. W. Stratton,
Director, Bureau of Standards, and
President, Annual Conference on Weights and Measures.

FIRST SESSION (MORNING OF TUESDAY, MAY 23, 1922).

The conference was called to order at 11 o'clock a. m. by Dr. S. W. Stratton, president of the conference and Director of the Bureau of Standards.

The CHAIRMAN. The conference will please come to order. It gives me great pleasure to open this, the fifteenth conference, which we know from the number present will be a success and which, we hope, will surpass all others in its degree of usefulness. We welcome you here as usual, although you need no special welcome. You are now acquainted with the bureau. It is your official home while in Washington. You know the members of the weights and measures staff, and you are welcome throughout the laboratories, and we are always glad to see you.

It is perhaps a little unfortunate for me that the program is to be opened by a paper which it is extremely difficult for me to present. Nothing I could say could add to your appreciation of Mr. Fischer, and I can not do justice to the occasion. It was my privilege to know Mr. Fischer intimately for the last 25 or perhaps 30 years. What I have written is only a very poor attempt to express my feelings, but is the best that I can do under the circumstances.

ADDRESS MEMORIALIZING LOUIS ALBERT FISCHER, 1864–1921.

By S. W. STRATTON, *Director, Bureau of Standards.*

The founders of our Government early recognized the importance of standard weights and measures. Not only was the subject provided for in the Constitution, but Washington, Jefferson, John Quincy Adams, and others took a keen personal interest in such matters. The fixing of boundaries and the collection of revenue are questions of the first importance to any government; but to the government of a country newly formed by the combination of several different and independent territories, whose interior consisted of vast areas of unsurveyed domain, unsurpassed in richness of natural resources and fertility, a country with thousands of miles of coast line and harbors uncharted, it is easy to comprehend why such questions were considered as fundamental. As a consequence there grew up under the Treasury Department, since that was the department charged with the collection of revenue, and the Coast and Geodetic Survey, a bureau of the Treasury Department, a group of metrologists and instrument makers second to none in the world. The story of this development is one of the most interesting in all the history of metrology.

At the beginning of this period, the first years of the past century, the Government, through the efforts of Jefferson, was exceedingly fortunate in securing the services of a man, a native of Switzerland, who was not only one of the foremost scientists of his day,

but was skilled in the problems of construction, comparison, and preservation of standards of length, mass, and capacity. His associates in the Old World were the leaders in the subject of metrology. When he came to this country, and on succeeding trips abroad, he brought the latest and best standards of the day, which may now be seen in the collection of standards at this bureau. Perhaps no better prepared individual could have been found in all the world to establish the first scientific work of the Government.

The various Commonwealths that had been welded together to make the new country were in time each given a set of standards such as had previously been given to the customhouses of the principal ports of entry. How was it done? There were no suitable materials available to begin with. It is said that the copper out of which to make the brass was imported from Switzerland and the zinc was especially mined for the purpose in New Jersey. Mechanics, or, as we now call them, instrument makers, of the highest type were brought from abroad. Many examples of their work still exist in the bureau which would tax the skill of the present-day workman to produce, even with his great wealth of material and machinery. There were no instrument-making shops in this country at that time. Copies of the standards could not be bought, and further they had to be made where access to the originals was possible.

The work of the Coast and Geodetic Survey called for the most precise comparisons of length, the construction of working standards suitable for field work, and especially the measurement of base lines. The triangulation work of that bureau involved the construction, calibration, and use of the most precisely divided circles possible. The master circular-dividing engine of the Coast and Geodetic Survey was guarded with a care scarcely less than that of the fundamental standards. The work of the survey from its beginning in connection with the measurement of base lines and the fixing of reference points throughout the country by means of precision triangulation is regarded by the experts of the world as the foremost and greatest work of its kind.

From the first, the superintendent of the United States Coast and Geodetic Survey was also superintendent of the office of weights and measures, and the two organizations were carried on practically under one head and as one organization. It was in the atmosphere of this organization with its sacred traditions concerning standards, its unsurpassed instrument shop, its world-known experts in the construction and comparison of standards, and especially in the most precise measurements of length and mass, that the boy Fischer, scarcely over 16, found himself when he entered the employ of the Government in a minor capacity about 40 years ago. Whatever may have been the circumstances that led up to his employment, it is certain that his selection of the field of work in which he was destined to lead was guided by his natural fondness for things mechanical and precise. He found there the traditions concerning Hasler, the first superintendent of weights and measures, the Swiss expert referred to above. In fact, scarcely 40 years had passed since the end of Hasler's services and the beginning of Fischer's. His first instructors were the direct disciples of Hasler and he knew and talked with those who had come in personal contact with the first superintendent. His reminiscences of many facts concerning the early history of the

weights and measures office, gathered from his contact with the successors of Hasler, were intensely interesting, and it is to be regretted that he never found the time to record them where others might refer to them. It was these delightful and modestly told incidents in connection with his early career that lead one to conclude beyond a shadow of doubt that Fischer selected his career because of his love and fascination for precision measurements.

At the establishment of the Bureau of Standards in 1901 Fischer had risen to be the chief of the weights and measures office. By the act establishing the Bureau of Standards that office became a part of the new bureau, and by far the most valuable asset thus inherited by the Bureau of Standards was the man who had served in all branches of the work from the workshop where he began to the making of the most accurate measurements in length and mass. Indeed, his work has not been surpassed even with the standards and methods now available.

For several years after his apprenticeship he served as an assistant to those making comparisons, but they were not long in finding out his skill and reliability in the most exacting field of physical measurement, a statement to which two of his former chiefs have testified. This work did not end in the comparison of standards in the laboratory; in fact my first acquaintance with Mr. Fischer was in the early nineties while a member of the physics staff of the University of Chicago. He was on his way to Washington after having measured a base line for the Coast and Geodetic Survey at some western station. His account of the work won for him my great admiration and respect. Since that time I have met and talked with those associated with him in that work and they have more than confirmed the impression I gained of his ability to attack difficult problems outside of the laboratory.

Mr. Fischer's familiarity with the base measuring work of the Coast and Geodetic Survey enabled him to establish at the Bureau of Standards the most elaborate and efficient laboratory in the world for the comparison of the precision bars and tapes used by the Government in the measurement of base lines, and the tapes used in the engineering work of the Government or the public. This work was transferred to the new Bureau of Standards without a hitch and has gone on without interruption to the entire satisfaction of the makers of tapes, engineers, and the bureaus of the Government engaged in engineering or surveys. This alone would constitute a splendid memorial to him.

Mr. Fischer was one of the world's foremost experts in the comparison of fundamental precision standards of length, and had a large part in the establishment of the data upon which was established the ratio between the yard and the meter. He knew the history of all of our standards of length and weight and fortunately has prepared a record of them. He knew them all as a collector of art knows the history and value of his masterpieces. He was, in fact, the custodian of them all. He had the combination of the vault in which they are stored. As a matter of fact, the director of the bureau was given the combination of the vault, but it was never recorded and promptly forgotten, and while it could have been produced if necessary in case of accident, I never thought of going into the vault except through Mr. Fischer.

As most of you perhaps know, the principal countries of the world joined in the construction of international standards of length and mass in the metric system. At the same time two copies of each were prepared and distributed to each of the countries entering into the agreement. By the same treaty there is maintained near Paris an International Bureau of Weights and Measures, charged with the custody of the international standards and their comparison at regular intervals with the copies furnished to the countries entering into the convention or that may join it later. The preparation of these metric standards called for the most exacting requirements as to materials and construction, and the intercomparison of the one selected as the international standard with the national copies was a task which but few men were competent to undertake. The national standards were to be returned for comparison with the original at the end of each 10-year period, but for some reason or other it was not done in the case of our own until 1903, shortly after the organization of the Bureau of Standards.

Mr. Fischer was selected to take our meter bar to France and was very courteously allowed to assist in its comparison and to make an independent determination, the latter a most unusual and complimentary procedure. He found slight discrepancies, not of any great importance in the measurements with which you are concerned or even in precision measurements, but of the greatest importance to the whole subject of metrology. His determination, at first thought to be in error, was afterwards verified by the experts of the international bureau and a thorough intercomparison of the national prototypes with the international standard was instituted. The work has progressed far enough to cause us to even question the permanence of material standards of length. This work established beyond a doubt Mr. Fischer's rank as an international metrologist of the first order. It was another piece of work that will be a monument to his memory for a long time to come.

Under the leadership of Mr. Fischer the work of the weights and measures division of the Bureau of Standards was early organized to provide for the testing of the standards of State and city officials as well as those of the manufacturers of weights and measures and weighing devices. It was to a large degree an extension of the work of the old office of weights and measures to meet the needs of the public as well as the Government in its own work, but there was one conspicuous and important class of work where the standard had to be taken to the weighing device; namely, the testing of large track and commercial scales. By the design of new and original equipment, test cars were built which in fact, take the standards to the user and thus provide for this important but previously neglected factor in the bringing about of correct weights in the handling of vast quantities of commodities. This alone is worth annually to the country, if measured in dollars, all that the division of weights and measures has cost from the beginning.

A matter second only in importance to standards is the provision for their use by the public, for without such facilities the standards become mere historical relics. In fact, the standards given by the national Government to the States were so regarded in nearly every case; in some instances they were not even cared for properly.

How to make the bureau helpful and efficient in matters pertaining to standards used in everyday commerce and trade was one of the very first questions considered by the weights and measures division. As a result of these discussions the first of these conferences, of which this is the fifteenth, was called. It is unnecessary to repeat here what can be read in the reports, but a few of the early and recorded incidents connected with the history of your organization will be of interest at this time.

The first step was a compilation by Mr. Fischer of the laws of the various States relating to weights and measures in order to call to the attention of State officials the existence of such laws and to serve as a basis of inquiry as to what was being done in their administration. These laws all named officials of various kinds as custodians of the standards and prescribed their duties, but only in a few instances were the laws operative, a most startling revelation after the elaborate provision that had been made on the part of the Government to provide the States with standards. At the same time Mr. Fischer made a tour of several of the States and larger cities and fully verified the fact that little was being done in the making of these standards available and useful to the public. How well I remember his displeasure in finding one State that could not locate its standards, or in another instance where the standard weights of a city official were in use as door stops and as playthings by children. It was a rude shock to one who had been brought up to regard standards almost as sacred things, who had seen them made with such care and precision, and who knew the amount of work required in their verification.

While thoroughly appreciative of the importance of this field of his work, he became from that time an earnest promoter of correct standards, practical laws and their faithful administration in the local transactions of everyday life.

As predicted the call for the first conference on weights and measures resulted in but three or four responses, but it served to call to the attention of the governors of the various States the existence of such laws as were on the statute books, and brought forth an apology from most of them as to why they could not send the officials designated in such statutes to the conference. It also called to the attention of the officials themselves the neglect of a prescribed duty. This was, indeed, the deliberately planned result.

Many inquiries were received from such officials, and whenever one of them of the purely custodian type turned up at the conference he was frank enough to call to the attention of the governor of his State the importance of weights and measures regulations and proper representation at the conference. Some of the best results have originated from such reports. Nevertheless, the process was a slow one. There were periods during the early days of the conference when much time was spent on what might be termed the politics of the situation. Each year would bring forth but two or three new delegates and we often longed for the time which we knew would come when the conference would be a real clearing house through which the State and city officials could help each other and the bureau could help all of them; when the program would consist of technical papers prepared by men of experience from all parts of the country.

There were many times when the conference would have failed had it not been for Mr. Fischer's persistence in what he knew was right—a determination to win the game—a characteristic known to all who were associated with him. It was, therefore, a matter of great satisfaction to him when the conference began to grow and to take on more of the real functions for which it was intended. The results of the thirteenth annual conference were extremely gratifying to him, and you could not have pleased him more in his last days than you did in the conduct of the last one, nor could you pay a more appropriate tribute to his memory than by continuing these conferences along the lines into which they have grown and in a manner which will extend the results of his life's work into the welfare of all the people whose interests he had at heart quite as much as the scientific aspects of his work.

At the outbreak of the great war it soon became apparent that precision manufacturing standards were of tremendous importance in the manufacture of munitions. Long before we became involved, however, Mr. Fischer saw the importance of preparedness in this branch of our work. At his suggestion an estimate was submitted to Congress and an appropriation of $150,000 secured to enable the bureau to prepare for the standardization of master munition gauges. No direct opposition was made by the War Department to the bureau securing an appropriation for what seemed to them a purely military function, but few, indeed, were those in authority who knew at the time how essential it was to compare these gauges with the fundamental standard of length. One incident will serve to illustrate this point. When the first estimate for the gauge work had been submitted and was pending before Congress, I considered it my duty to explain the matter to the proper official of the War Department and to solicit his cooperation in securing the appropriation for a purpose so essential to his own work. He listened very courteously, but a young officer, who had been listening at his desk and who deemed it time to warn his chief, turned around and said very abruptly, "Colonel, that has all been done at the Rock Island Arsenal." I never told this to Mr. Fischer nor have I ever mentioned the officer's name.

When it became apparent that we would enter the war, the military departments suddenly became aware of the necessity for the standardization of gauges in large quantities, and in a manner characteristic of that period started an organization to do it. It did not take long to find out that the Bureau of Standards had secured its appropriation, had gone ahead under Mr. Fischer's direction, had devised special apparatus and methods, and was actually standardizing gauges for manufacturers engaged in the construction of munitions for the Allies.

At that time I was sent for by the chief of the Bureau of Ordnance of the War Department, who frankly admitted that they desired to utilize the services of the bureau and expressed his appreciation of the work that had already been done. He requested that Mr. Fischer be allowed to accept a commission as the only practical way to secure an efficient cooperation between the bureau and the War Department. Mr. Fischer was accordingly commissioned a major in the United States Army, and soon won the admiration of his superiors, who listened to and generally carried out his

ideas concerning gauges. Under emergency laws the War Department turned over to the Bureau of Standards whatever money was necessary to carry on this work. It was a most remarkable and successful case of cooperation.

During the war there was never a time when Mr. Fischer was not practically in charge of the gauge work of the bureau, as well as being the technical adviser of the War Department in gauge standardization, a condition that was made possible only by Mr. Fischer's tact as well as his thorough knowledge of the subject. He had organized the work of comparison at the bureau, had gathered together a competent staff of observers, had collected equipment, devised methods of testing, and studied the work of the Allies prior to the time this country entered the war. Then, at the call of the War Department, he served to introduce these standards and methods into the construction of munitions. It was one of the few things in which we were prepared for the war. They gave him the rank they saw fit when he entered the military service and he never asked for more. It was a question that never concerned him in the least. The satisfaction he received at the successful termination of his work was to him more than any commission the War Department could bestow; with him it was a case of using his ability to the best advantage in the great problem that faced our country. Few individuals were privileged to contribute as much and it was appropriate, indeed, that he should be buried at Arlington National Cemetery with full military honors consistent with his rank.

Finally, I can not close this sketch without making some reference to Mr. Fischer's personal characteristics, which I had come to know so well. He was active in athletics of the clean and wholesome kind; he became a leader in all of the sports he entered, but best of all was the great respect and admiration for him on the part of his associates in this side of his life. It was my privilege to know many of them and to be associated with Mr. Fischer in many camping and pleasure trips about the country. There was never a more lovable companion on such occasions.

At one time we owned a motor boat in common and spent many a pleasant day on the Potomac. The two-cycle gas engine of those days would try the patience of Job, but it was Mr. Fischer's boast that it never failed to bring him back. No compliment whatever to the gas engine, but a splendid example of the patience and perseverance which made his life a great success.

When in the early days he realized that his line of work called for an education beyond the high school, he went to night school, completed the work at Columbian University, now George Washington University, and received his degree. This, again, is an illustration of his sterling character and perseverance.

The following is a quotation from the letter received within the last few weeks from Dr. T. C. Mendenhall, superintendent of the Coast Survey and of the office of weights and measures from 1889 to 1894, under whom Mr. Fischer received great encouragement and of whom Mr. Fischer often spoke in the most appreciative terms:

> It is now about a third of a century since I met Louis A. Fischer for the first time. He had been appointed as an assistant in the division of weights and measures in the Coast and Geodetic Survey, of which I was then superin-

tendent, and as I had a special and personal interest in the work of that division I soon came to know him intimately.

His personality was to me most attractive. Somewhat reserved in manner and modest to a fault, he possessed an unobtrusive confidence in his own work which inspired a similar confidence in it on the part of others.

He had a fine talent for the technique of his profession and soon became an accomplished metrologist.

It was a delight to me when, on the organization of the Bureau of Standards, he was assigned to the important post which he filled with so much distinction up to the time of his death, and although, because of a prolonged absence from the country, I saw him but infrequently during the past 20 years, I watched his career with great interest and, in common with hosts of his friends, I mourn his untimely death, which means a loss to the art and science of metrology not easily repaired.

I have often thought of him as one the value of whose life and service has not yet received the tribute of praise which it deserves, and in so thinking I put him in a rather small and select group of those whom I have known.

Otto H. Tittmann, who was superintendent of the Coast and Geodetic Survey from 1900 to 1915, and who had been one of Mr. Fischer's associates in the office of weights and measures in that bureau during the entire period of the latter's service in the Government before the establishment of the Bureau of Standards, wrote concerning Mr. Fischer as follows:

My first acquaintance with him began when he was an instrument maker in the office of the Coast and Geodetic Survey. There he worked in that beautiful occupation with interested devotion and acquired skill and precision which later on stood him in good stead. It was after he was assigned to the weights and measures office where I gained a more intimate knowledge of his character and learned to appreciate his zeal and devotion to duty. As you know, the work of that office was practically confined to making and comparing standards of weight, length, and capacity, and to the testing of thermometers and densimeters of many kinds. It was largely routine work requiring care and skill but also attention to the progress science was making in these and related fields. Fischer always manifested a scientific spirit, for while he did his skilled manual work during the day, he studied at night and successfully strove to advance in knowledge, nor did he allow his interest in his work to lag because he received an inadequate salary, for he always labored with interesting zeal.

It was a great satisfaction to me that when you began to develop the Bureau of Standards you gave him further opportunity to continue in his chosen field.

It would be difficult, indeed, for me to adequately express my appreciation of Mr. Fischer's loyalty, his devotion to his work, and, above all, his unceasing watchfulness as to the bureau's reputation. This was even dearer to him than the safety of the material standards he had so carefully guarded all his life. The truthful and faithful adherence to a standard of the highest order formed not only the basis of his professional work, but was the guiding doctrine in his friendship, his athletics, and, in fact, his daily life. What greater tribute could we pay him?

His career in the Government service is a splendid example as to what can be accomplished by one who is interested in his work, beginning as an apprentice, passing through all the grades in his field of work, and ending as an international authority. What greater success could he have accomplished? He has erected a monument to his own memory far more enduring than we, his friends, might provide.

The Chairman. I am going to ask Doctor Waggoner, of West Virginia, to say a few words on the part of the State officials.

REMARKS OF C. W. WAGGONER, REPRESENTING THE STATE WEIGHTS AND MEASURES OFFICIALS.

Mr. Chairman and gentlemen of the conference, it hardly seems necessary for me to bring to you any thoughts on the work which Mr. Fischer did for the State departments. The only tribute I can bring to you this morning will be of a purely personal kind. I remember meeting him on a good many occasions, because I happened to come to the bureau as a member of the American Physical Society, and I had learned to look upon Mr. Fischer as the greatest expert in this country on the whole subject of weights and measures.

In our early days, when we made an attempt to form a State department of weights and measures in West Virginia, Mr. Fischer was our guide at a time when we were in great need of assistance. I need not tell you that I became sometimes fearful that I should make some very serious mistakes, even though I know something of precision and something of the technique of the standardization of weights and measures.

As I think back over Mr. Fischer's life as I have known it there are three things that stand out foremost. The first thing I always think of was his great kindliness. As I came to the bureau from year to year I always felt that I had a friend at this bureau. There seemed to be no watchdog at the outer door. He had a marvelous memory for faces and names, and there was always a warm handclasp, and you were welcome here.

The second big thing that comes to me was his great enthusiasm for the work of weights and measures, and certainly I can add nothing to the very splendid tribute which has been given to his work by his own director.

The third thing was his great modesty. Time and time again those of us who attended the conferences felt that Mr. Fischer did not receive the recognition that he should receive. Yet the very moment that you proposed something he was the first to insist that the work stood on its own merits, and that that was all that was necessary.

I am sure that I speak for all the members of the State departments when I voice our very great appreciation for the life of Louis Albert Fischer as a physicist, as a pioneer in weights and measures, and as a kindly man.

The CHAIRMAN. I will ask Mr. Moynihan to say a few words on behalf of the manufacturers.

REMARKS OF D. J. MOYNIHAN, REPRESENTING THE MANUFACTURERS OF WEIGHTS AND MEASURES.

Mr. Chairman, I regard my association with Mr. Fischer as one of the greatest pleasures of my life. I feel that he has been exalted here to-day, and I believe the address of the director of this bureau has caused even more deeply his memory to become enshrined in our hearts, and I, too, agree with him that a more lasting monument will be found inscribed on the tablets of memory than can be found on chiseled stone.

I will add a word, which I hope will convey the regard held for him by manufacturers and by all. I offer it as my humble con-

tribution with all the fervor and sincerity of heart to one that I loved in life and whose memory I will ever respect.

I feel highly honored in having been invited to serve on the committee on resolutions and count it a high, if somber and sorrowful privilege, to hold this connection with an official tribute to the life, character and worth of the late Louis A. Fischer.

Those loved him most who knew him best. It is not my intention to enter into a fulsome eulogy of our departed friend. It was my good fortune to have known him for many years and to be afforded exceptional opportunities to learn and appreciate his admirable qualities of heart and head that endeared him to all who knew him.

Graced as he was with an undeniable charm of personality, yet in all of his business dealings he impressed one most with his absolute fairness and unswervable adherence to grave and resolute fulfillment of duty. He did what be believed to be right and best and ever bestowed genuine regard and kindly consideration for the opinions and feelings of others. His broad and liberal views when expressed gave transparent simplicity and evident sincerity to his utterances. Exceptionally modest and unprejudiced in tastes, manner, and life, his great goodness of heart and charitable disposition toward his fellow men was without ostentation, though characterized by the highest and deepest spirit of self-sacrifice.

Tributes have never been paid to the memory of a better man. The world is better for his having lived. His passing is a distinct loss to the great work in the field of weights and measures uplift and expansion; but he leaves behind truly golden and priceless deeds that contribute to the jewels of history, the salt of life. It is merit, such as is justly his, that gives life and glory to the record of events. Ever will his example of unselfish devotion to the great work to which he consecrated so much of his life's best remain in trust for all time, serving as an inspiration for lofty and honorable emulation.

"God grant him eternal rest and peace," is a friend's sincere tribute to his memory, for he was a plain, straightforward, honest man.

The Chairman. A committee on resolutions has been appointed and will report at a later time.

ABSTRACTS OF REPORTS OF STATE DELEGATES.[1]

CALIFORNIA.

By Charles M. Fuller, *City and County Sealer of Weights and Measures, Los Angeles,* and Thomas Flaherty, *City and County Sealer of Weights and Measures, San Francisco.*

Both Mr. Fuller and Mr. Flaherty reported that the judges before whom cases were being brought in California were giving the weights and measures departments excellent support and in aggravated cases were imposing jail sentences with very beneficial results. The rapid development of the departments, and the increased confidence and cooperation of the merchants following the abolition of the fee system were also noted.

[1] For convenience of reference these reports have been arranged in alphabetical order throughout.

CONNECTICUT.

By Thomas F. Egan, *Deputy State Superintendent of Weights and Measures.*

Mr. Egan reported the passage of a law regulating the weight and marking of bread which he said had resulted in greatly improving conditions, although the department was not satisfied with that interpretation of the statute which permits the sale of nonstandard weight loaves providing these are marked with their weight. He also mentioned changes in the organization of the department and the failure of a sales-by-weight bill in the last legislature.

DISTRICT OF COLUMBIA.

By George M. Roberts, *Superintendent of Weights, Measures, and Markets.*

Mr. Roberts reported that the new weights and measures law which had been in effect for almost a year had met with general public approval and that its enforcement was already resulting in great benefits to the public. He mentioned that much time had been spent in educating merchants and public to an understanding of the provisions of the new statute.

ILLINOIS.

By William F. Cluett, *Chief Deputy Inspector of Weights and Measures of Chicago.*

Mr. Cluett reported the successful passage of a comprehensive State weights and measures law and outlined its provisions and the personnel and organization of the new department. He stated that field work had already been started and would soon be increased and greatly facilitated by the arrival of additional equipment, including several motor trucks.

INDIANA.

By I. L. Miller, *State Commissioner of Weights and Measures.*

Mr. Miller reported that the standard weight provisions of the bakery law in his State were being very satisfactorily enforced, a result due in no small degree to the almost unanimous support of the bakers themselves. He told of the success of the department in eliminating the use of the dry measure and in securing the sale of ice by weight.

KENTUCKY.

By F. Reichmann, *Official Representative of Kentucky.*

Mr. Reichmann reported that Kentucky was still without a weights and measures law, the bill which had been prepared for the consideration of the legislature having failed of passage. Hope was expressed that a greater degree of success might attend the efforts of those interested at the next legislative session.

MARYLAND.

By CHARLES A. LUTZ, *Chief Inspector of Weights and Measures of Baltimore.*

Mr. Lutz noted in his report the absence of a State weights and measures department in Maryland, but said that the necessity for one was clearly established, and expressed the belief that the next legislature would be asked to consider a bill to create such a department.

MASSACHUSETTS.

By JOHN J. CUMMINGS, *Chief State Inspector of Standards.*

Mr. Cummings reported the passage by the last legislature of a law regulating the weight of loaves of bread and a law repealing the formerly established bushel weights and requiring fruits, nuts, vegetables, and grains to be sold at retail by weight, bunch, numerical count, or in certain standard containers. He also reported progress in the promulgation of regulations affecting paper and fiber containers, milk cans, and clinical thermometers.

MINNESOTA.

By R. F. BARRON, *State Commissioner of Weights and Measures.*

Mr. Barron reported that there had been no change in the laws under which the department operates, since the preceding conference. He said that, in general, conditions in the State were very good but that a particular effort was being made by the department to cover thoroughly all the outlying portions of the State and every inland town.

NEW HAMPSHIRE.

By H. A. WEBSTER, *State Commissioner of Weights and Measures.*

Mr. Webster reported especial activity in his department in the testing of railroad track scales and in the weighing of commodities, particularly coal and ice. He also said that the cooperation of many schools had been secured in furthering the educational campaign of the department.

NEW JERSEY.

By J. HARRY FOLEY, *State Superintendent of Weights and Measures.*

Mr. Foley outlined in some detail the work accomplished by the department, with particular reference to the reweighing of packages and to the enforcement of a new marking law affecting packages of fruits and other farm produce. He also mentioned that a bread bill and a sales-by-weight bill failed to pass in the legislature.

(At this point, at 12.30 o'clock p. m., the conference took a recess until 2.30 o'clock p. m.)

(At 1.30 o'clock p. m., the delegates assembled in the exhibition room for an inspection and demonstration of the manufacturers' exhibit of weighing and measuring devices.)

SECOND SESSION (AFTERNOON OF TUESDAY, MAY 23, 1922).

The conference reassembled at 2.30 o'clock p. m., Dr. S. W. Stratton, chairman, presiding.

ABSTRACTS OF REPORTS OF STATE DELEGATES—Continued.

NEW YORK.

By W. T. White, *Director, State Bureau of Weights and Measures.*

Mr. White described a recent survey of conditions surrounding the sale of gasoline to motorists, outlining the methods employed and the results obtained. Many cases of short measure in varying amounts were found and prosecutions were started against a number of dealers. Mr. White also reported an amendment to the net-weight law which greatly strengthened this statute.

OHIO.

By John M. Mote, *Assistant Chief State Inspector of Weights and Measures.*

Mr. Mote outlined the activities of the department for the past year, reporting that, in spite of the fact that much time was spent in reweighing bread and in making surveys on package goods and gasoline deliveries, over 6,000 more pieces of weighing and measuring equipment were inspected than during the preceding year. He said that the gasoline survey revealed many cases of short measure and that a considerable number of prosecutions resulted.

PENNSYLVANIA.

Note.—The report for this State is incorporated in the paper read by Mr. McGrady on Thursday and appearing on page 60.

RHODE ISLAND.

By William F. Goodwin, *State Sealer of Weights, Measures, and Balances.*

Mr. Goodwin reported the enactment of a law to become effective July 1, 1922, regulating the sale of gasoline at retail, which it is expected will prove highly beneficial. He also told of a very satisfactory State weights and measures conference held during the year.

TEXAS.[2]

By Kit Robison, *Chief Inspector, Division of Weights and Measures.*

Mr. Robison described some of the activities of the division and reported that much had been accomplished in the three years since its

[2] This report, prepared by Mr. Robison, who was not in attendance at the conference, was presented to the conference by D. C. Hill.

organization. He stated that a complete revision of the State law would be asked of the next legislature and that an effort would be made to secure appropriations for the purchase of a railroad master scale and test car.

VERMONT.

By H. N. Davis, *Deputy State Commissioner of Weights and Measures.*

Mr. Davis reported that with increased appropriations for their work much had been accomplished during the year, particular attention having been given to gasoline-measuring devices, prescription scales and weights, cream test scales, and milk receiving scales. Mr. Davis announced the intention of the department to introduce a bill in the next legislature to standardize the weight of bread loaves.

VIRGINIA.

By John W. Richardson, *State Superintendent of Weights and Measures.*

Mr. Richardson reported that the effort to revise the Virginia weights and measures laws was unsuccessful, the legislature not acting on the bill introduced for that purpose. He stated that the number of city and county sealers was increasing, but that development along these lines was being retarded by reason of the low salaries provided in many cases. Following his report Mr. Richardson individually introduced the delegates from Virginia.

WEST VIRGINIA.

By C. W. Waggoner, *Assistant State Commissioner of Weights and Measures.*

Mr. Waggoner reported that a large amount of time had been spent in the testing of gasoline and oil pumps, this being made possible by the falling off in the number of tests of scales at the coal mines as a result of troubles in this industry. The condition of the pumps was found to be unsatisfactory and this matter will be closely followed up during the coming year.

WISCONSIN.

By George Warner, *Chief State Inspector of Weights and Measures.*

Mr. Warner reported that the condition of the weights and measures apparatus in the State was good and that as this requires less and less attention from year to year it becomes possible for the field force to devote a greater portion of its time to supervisional work. In this connection Mr. Warner mentioned some of the abuses which had been corrected through the activity of the department.

(It was moved and seconded at this point that the conference adjourn, the question was taken, and the motion was agreed to.)

(Thereupon, the conference adjourned to meet at 10 o'clock a. m., Wednesday, May 24, 1922.)

THIRD SESSION (MORNING OF WEDNESDAY, MAY 24, 1922).

The conference reassembled at 10.20 o'clock a. m. at the Bureau of Standards, Dr. S. W. Stratton, chairman, presiding.

REPORT OF SPECIAL COMMITTEE ON RESOLUTIONS, PRESENTED BY C. W. WAGGONER, CHAIRMAN.

Mr. Chairman and gentlemen, your special committee on resolutions respectfully submits the following resolutions for your consideration:

LOUIS ALBERT FISCHER (1864–1921).

Distinguished Physicist, Citizen, and Soldier, Devoted Public Servant, Pioneer in the field of Weights and Measures, and the friend of all mankind.

Whereas this Annual Conference on Weights and Measures of the United States, assembled in its fifteenth meeting in Washington, D. C., May 23 to 26, 1922, deeply and keenly realizes the irreparable loss which has been sustained through the death on July 25, 1921, of Louis Albert Fischer, who was its beloved and respected secretary from the time of the formation of the conference in 1905 to the date of his death; and

Whereas it is the earnest desire of this conference, at this, its earliest opportunity, and before undertaking its regular duties, properly to acknowledge the splendid record of his achievements in the science of metrology and in the general cause of weights and measures, to convey its deepest sympathy to his surviving wife, to express its sense of grief at the loss of one who was always ready and eager to serve, who devoted himself to the advancement of the public good and freely gave of himself to those who desired his assistance, and to signify its love and respect for the sterling qualities of the man himself; and

Whereas it is the wish of this conference to perform some act which will give expression to the sentiments and feelings herein set forth: Therefore be it

Resolved, That this conference hereby express its heartfelt sympathy to Mrs. Marion G. Fischer in her bereavement; and be it further

Resolved, That this conference, through a committee to be appointed by the chair, procure a floral offering and place it upon Mr. Fischer's grave in Arlington Cemetery; and also have prepared and suitably framed and inscribed a portrait of Mr. Fischer to be presented to the Bureau of Standards, and to be hung in the office of the director of the bureau; and be it further

Resolved, That a copy of these resolutions be engrossed and presented to Mrs. Fischer as a token to her of the respect of this conference.

(Signed) C. W. Waggoner.
M. G. Livingston.
Wm. A. Payne.
D. J. Moynihan.
A. W. Epright.
F. S. Holbrook.

(The resolution was unanimously adopted.)

EXPERIENCES IN ENFORCING SALES-BY-WEIGHT LEGISLATION AND THE ELIMINATION OF THE DRY MEASURE.

By William F. Cluett, *Chief Deputy Inspector of Weights and Measures, Chicago, Ill.*

The dry measure as a standard of measurement for the sale of bulky commodities, such as fruits and vegetables, is about the most unreliable standard that could be used.

In measuring potatoes, apples, and other large, irregularly shaped fruits and vegetables, it is utterly impossible to completely fill the inside of the measure, so for that reason the law usually provides that articles of this kind shall be sold by heaped measure and then describes how the measure shall be heaped. This generally reads that all articles sold by heaped measure shall be heaped in the form of a cone, the top of the outside of the measure to be the limit of the base of the cone, and the cone to be as high as the nature of the article to be measured will permit the measure to be heaped. The irregular shapes of the commodities measured prevent the measure from being completely and solidly filled and, in order to make up for the interstices between the fruits and vegetables in the measure, the heaping is provided for.

No two pecks of potatoes or apples are of the same shapes or are heaped in the same manner, nor do they weigh alike. We have had five different people measure up what they considered to be an honest, full peck of potatoes and found that no two of them agreed in weight. This is true of all other fruits and vegetables. If the commodities sold by dry measure were flaxseed, shelled corn, wheat, or anything that was small in size, that would pack in when put into the measure, I would concede that the dry measure as a standard of measurement was fair, but never for the sale of large, coarse, bulky commodities. In Chicago we found that the average weight of a peck of potatoes, by measure, was $12\frac{1}{2}$ pounds, the statutory weight is 15 pounds; for apples we found the average weight of a peck, by measure, was 10 pounds, the statutory weight $11\frac{3}{4}$ pounds. Other fruits and vegetables showed similar discrepancies between the weight by measure and the statutory weight.

This matter was a cause of concern and study on our part as to how it could be remedied. We recognized the unfairness of the retailer buying on a weight basis and selling on a measurement basis, but were unable for some time to figure out a way to remedy it. We finally arrived at the conclusion that it would require an act of the legislature to give us the right to require the sale of these articles on a basis of standard avoirdupois net weight or by numerical count. The Federal Government, and also the State, recognized the dry measure as a standard of measurement and we could not, by city ordinance, prohibit its use and require that all sales be made only on a basis of weight or count.

The charter under which the cities and villages in the State of Illinois function is an act of the legislature called the cities and villages act. This act confers power upon the city council in cities and the president and board of trustees in towns and incorporated villages to pass ordinances regulating certain things and gives police

power to enforce the regulations, etc.; so we had a bill drawn up that was passed by the legislature amending the cities and villages act, giving authority to the city council in cities and the president and board of trustees in towns and incorporated villages to pass ordinances, if they saw fit, requiring that fruits, vegetables, and other commodities usually sold by dry measure should, in the absence of a contract or agreement in writing to the contrary, signed by the parties thereto, be sold by standard avoirdupois net weight or by numerical count.

This act was passed some 10 or 12 years ago and the city council of the city of Chicago passed an ordinance, drawn up by our department, along the lines of authority granted by the act. This ordinance went into force and effect December 4, 1911. We then had the law and it was up to us to enforce it and eliminate the use of the dry measure. The honest merchants were in favor of selling on a weight basis, but the dishonest merchants and the peddlers did not cheerfully or quickly give up the use of a standard that made it possible for them to get 5 pecks by measure out of 1 bushel by weight. I have seen spinach sold in Chicago that was laid loosely in the measure and heaped on top that weighed but 1½ pounds to the peck, whereas the statutory weight is 3 pounds; string beans stood upon end in a quart measure that weighed but 8 ounces per quart where the statutory weight is 12. Other commodities showed just as glaring shortages, and this all went to prove the necessity of a sales-by-weight law.

Even some of our judges did not at first take kindly to the change of standards. I recall one case where we had a peddler arrested who had sold a peck of potatoes by measure that weighed but 12 pounds. He was booked on two charges, one for selling a less quantity than represented, and the other for selling by measure instead of by standard avoirdupois net weight or numerical count, in the absence of a contract or agreement in writing to the contrary, signed by the parties thereto. The court rather peevishly said that he thought the ordinance was a darn-fool ordinance passed by a lot of darn-fool aldermen. He said a peck measure had been a peck measure for 50 years and that the people were used to it and they could see what they were getting; that it was the custom to sell potatoes by measure and he refused to fine a man for using one and giving a couple of potatoes short in weight. We agreed with him that the custom of using dry measures was even older than 50 years and that the custom of picking pockets was even older, but that, of itself, did not make it right; that there were good and bad customs, and using dry measures was a bad custom that should be eliminated.

We cited instances of dry measures found in use where the bottoms had been taken out and cut off around the circumference, shortening the diameter, and the sides of the measure lapped, making them two quarts short in capacity. We cited cases where measures had been cut off at the top, making them too shallow; other cases where extra bottoms had been put in the inside of the measures; other measures that had two inches of mud packed down on the bottom; also that we had found peddlers using dry measures with one row of potatoes wedged tightly in the bottom so that they remained there after each sale. We also demonstrated with the peck measure and potatoes how a measure could be stacked by laying potatoes crosswise in the inside of the measure and putting an honest heap

on the top; a shake of the measure would cause the potatoes to fall down to the level of the top of the measure. We explained that the purchaser saw the measure and the potatoes but, notwithstanding, got cheated in the quantity he was entitled to receive.

We argued that when commodities were sold by weight it did not make a particle of difference whether they were laid loosely on the scale, packed down, or stacked, the amount registered would be the weight of the quantity delivered and this could be checked up and verified, whereas verifying the quantity by measure was very unsatisfactory, as no two people agreed on how a measure should be filled. All of this caused "His Honor" to squirm, but did not have the effect of causing him to change his decision.

In the enforcement of the law we started out first by giving the dealers a warning and explaining the ordinance. The next time we caught them using measures we took them into court and had the court explain, and then let them go with a warning. After that we insisted that the fine be imposed. Some peddlers thought they saw a way of getting around selling by weight, and they started to sell by "the pail," getting pails of liquid capacities. This was even worse than when they used the dry measure, and we quickly put a stop to this practice. Gradually, by educating, warning, and a number of fines judiciously imposed, we have practically eliminated the use of the dry measure in Chicago in the sale of coarse fruits, vegetables, and other bulky commodities. There are still a few seed houses that use the dry measure in selling seeds, but they are gradually doing away with this practice and are getting to the weight basis. Last year we tested 7 dry measures where formerly we tested 25,000.

The peddler at first carried a set of dry measures on his wagon along with his scales, and he used them whenever he had the opportunity. When asked why he carried measures when the law required him to weigh his commodities, he would say that he had them to carry stuff in with. He was advised to leave his measures home and to carry a market basket instead, or use the scoop of his scale. The dealers selling dry measures gradually cut down their orders to the manufacturers until to-day it requires some time to find a place where they can be purchased. The merchants are all better satisfied because they now have fair competition and the public is better satisfied because they can check up their purchases and more nearly get what they pay for than they could before.

So we have eliminated the use of the dry measure as a standard of measurement; not by absolutely prohibiting it, but by placing such restrictions around its use that the dealers find it easier to sell by weight than to get purchasers to sign agreements to buy by measure. It did not take the public very long to find out that by signing a contract to buy by measure they were assisting the peddler to cheat them in the quantity they were entitled to receive.

DISCUSSION OF ABOVE PAPER.

The Chairman. This is a subject which has concerned us from the very first. At the time these conferences began there were very few States, practically none except in the West, in which dry commodities were sold by weight. Now we find the custom has grown

and has extended eastward and is receiving very serious consideration from all the various States.

Therefore, in the discussion, I would like especially to hear from those States in which the subject is still under discussion, as to what progress is being made in the practice of selling by weight and count instead of by measure.

Mr. RICHARDSON. I would like to find out how many States have adopted this method.

The CHAIRMAN. Mr. Holbrook, do you know?

Mr. HOLBROOK. There are several States which prohibit the use of the dry measure and do not specify weights per bushel, but merely require that all commodities shall be sold by weight, rather than on a bushel basis. There are a number of States in addition which have fixed the weight per bushel and require that the bushel and its subdivisions shall be determined by weight, in those cases merely retaining the bushel as a convenient unit, but requiring the commodity to be weighed. In other words, if the buyer wants to order a bushel of potatoes, that is within his province, that is his right, but the man in determining the quantity constituting a bushel of potatoes is required to weight out 60 pounds.

There are probably 15 States in the United States that require sales by weight, whether by the old term of bushel or without the mention of the bushel at all.

Mr. GOODWIN. Mr. Chairman, I would say this custom is being practiced in our State. The merchants are selling by weight almost entirely, but we have no laws to regulate that subject. They have merely adopted the custom, the merchants using their discretion in dealing with the subject at the present time. On two different occasions since I have been in office this matter was before the legislature, but was always killed by the rural districts—that is, the farmers.

Mr. CUMMINGS. The Governor of Massachusetts signed a bill this month, which becomes effective about July 1, which is in exact accord with that which became effective in the District of Columbia last June. Our law abolishes all the established official weights which have been specified for over a hundred years in the State, and requires that all sales at retail be made on the basis of the avoirdupois pound or numerical count excepting in the case of some fresh fruits and vegetables.

Mr. SCHWARTZ. New Jersey wants to place itself on record as favoring the sales-by-weight law. We have at the present time in our State the dual-system law, which specifies the weights of the different commodities that are to be sold either by weight or by measure or by numerical count. That law was enacted in 1916 with considerable difficulty. But we find in our investigations that the dual system is unsatisfactory. It works a hardship on the consumer as well as the producer. It gives the profits to the middleman entirely.

At the last session of the legislature we introduced a bill designed to abolish dry measures entirely, and to regulate the sale of commodities entirely by weight, but it failed of passage. However, to a greater or less extent we have been educating not only the public but the dealer in doing away with these dry measures, and we have accomplished considerable along that line by missionary work and by enforcing the statutes now upon the books. The chain stores were the first to take up the proposition of sales-by-weight and they sell

no vegetables or fruit or anything of the kind by measures. It all goes by weight, with the exception of oranges and bananas, by numerical count. A great many of the green grocers are now adopting that system. Our great trouble is with hucksters traveling with wagons, using baskets, 2-quart, 4-quart, 8-quart and 16-quart baskets, as standards of measurement. We have largely abolished that practice and have shown them the necessity of having scales on the wagon whereby they can get the weight, and not trust to the measures that they are using.

Our position is this to-day, that we are not defeated, because we have the assurance that with the little meetings that they are going to have before the next session of our legislature this thing will probably be threshed out and we will go to the legislature of 1923 with a comprehensive sales-by-weight law.

New Jersey practically indorses everything that Mr. Cluett has read to you in his paper. We are back of any movement that will put the sales-by-weight on the statute books throughout the United States. We believe that is the proper way of handling the situation. We want to place ourselves on record as favoring not only state-wide but Federal legislation along the lines of sales-by-weight only.

Mr. Goodwin. Mr. Chairman, this brings us to the question of uniformity in weights and measures. Massachusetts and Rhode Island border on each other, and still we have different weights for different articles. Our people can go over into Massachusetts and buy products and get more weight than in Rhode Island. Without uniformity in our respective States I do not believe we are going to make any progress. I believe it is the duty of this conference to work with that object in view.

Mr. Siren. Mr. Chairman and delegates, we are coming here for the purpose of having a uniform system of weights and measures throughout the United States. We are introducing Form 2 of the model law with the exception of a change in the bread law, section 22, and in the coal section 26. Until we can get a uniform system of weights and measures I think we are coming here and wasting our time for nothing. I think if the National Government were to adopt a uniform system, and all of the States would follow suit, we would have something to work on.

I think there should be cooperation between one state and another. Our people ship a good deal of stuff to Mr. Cluett's town, Chicago, and if our shippers did not get proper return from their goods in weight, I would take it up with Mr. Cluett, and I think Mr. Cluett would look into it and see that our people got the proper weights. I think that is what we want—cooperation and uniformity in regard to weights and measures.

Mr. Davis. In Vermont the statute establishes the weight per bushel of different commodities bought and sold. The law there gives the commissioner of weights and measures the right to make rules and regulations covering the sale of commodities. The commissioner has ruled in Vermont that whenever commodities are bought or sold they shall be bought and sold by the given weights established by law. Therefore, we have done away entirely with the dry measure.

Mr. Matthews. We had some sweet potatoes shipped to Portsmouth, Va., that came from the State of Georgia, and they were marked "Net contents, five pecks" and so sold. The buyer measured

those potatoes out and he could not measure four pecks by the Virginia standard.

That goes to show the necessity of having a uniform weights and measures law, and I do hope the Federal authorities will enact such legislation. New York State standards are not like the Virginia State standards. Four bushels in accordance with Virginia standards would make about five of New York. The cubical measurements are the same, but they are different in shape. The New York State standards are made deeper and smaller in diameter, and consequently will not hold the same quantity of potatoes or apples. For that reason we do not allow a New York State standard dry measure to be used in Virginia.

We ought all to adopt the same standards for dry measures, if we are to use the dry measure. Personally I prefer dry commodities being sold by weight. It is much the better way of doing business, in my estimation.

Mr. Siren. We have the same thing in our town right now. Certain of our merchants were selling seven-eighths and three-fourths as bushels, until I went to see them.

Another trouble we have is with the oil men. We have had occasions when they were 1½ gallons short on 5 gallons. They use a 5-gallon measure as large as any 5-gallon measure, but they have a can within a can. I have two cases which call for a penitentiary sentence, a minimum of two years.

Mr. Schwartz. Is it anything like that one? [Indicating a fraudulent can.] One of these cans was sent on to the bureau from New Jersey, and is exhibited here with the idea that it might be interesting to some of the delegates to see what the bootleggers were doing over in New Jersey. This little cone-shaped can holding about a quart, was inserted in the large can and soldered around the outlet, and the balance of the large can filled with water. When the victim came on to test what was in the can, they could give him a little taste out of that funnel-shaped container. He thought it was very good, and he would pay $100 or $125 for the can. He had not quite a quart of whisky in the container, and the balance of the can, 4¾ gallons, was filled with water. We got 48 of those cans in one place in the city of Newark.

Mr. Richardson. Some time ago I received a letter from a large farmer in the State, stating that he had shipped a carload of wheat to a mill in Richmond, and it was reported to be about 35 bushels short on the carload. The wheat was originally measured in a correct bushel measure.

On further investigation I found that the shipment was "chaff" wheat. It was weighed upon receipt and paid for on a basis of 60 pounds to the bushel. The fact that "chaff" wheat is very light explained the discrepancy.

Another farmer wrote to me that on reweighing measured wheat, it gained 5 pounds on the bushel at the mill. This was a good sound wheat, and by measuring it the farmer was delivering 65 pounds of wheat to the bushel. I showed him the miller weighed and saved him 5 pounds on every bushel of wheat he sent in.

Mr. Barron. The Minnesota law since 1911 has provided that in the case of all grains, fruits, and coarse vegetables, where the term "bushel" is used, there must be sold a certain number of pounds for

a bushel—that is, a bushel of potatoes is 60 pounds; it is not a basket full. However, that does not prevent a man selling a sack of potatoes, a pail of potatoes, or a box of potatoes. With a view of amending that law last year, we added a little proviso prohibiting the sale of any grains, fruits, or vegetables except by weight or numerical count.

We found that the farming element opposed that. They claimed a farmer on his own farm had the right to sell his commodities as he saw fit, and to a certain extent there was some justice in this contention. For instance, where a man has some potatoes and I drive up to his place to bargain with him, I can see no reason why he can not sell me a carload or a sack full, if we are both satisfied. So we added another little amendment to the effect that the provisions should not apply when the products were sold on the premises where produced, and that satisfied the farmers apparently. The bill passed the house without any trouble and had no opposition in the senate, but died with many other bills when the session came to an end.

I agree with what has been said as to the variation in State laws. It is a misfortune, but I am in hopes that some day we will have a Federal standard law. I hope, though, that the word "bushel" will be left out of it altogether. I can see no reason why the word "bushel" should not be eliminated from the English language. I do not know yet why wheat or rye or barley will not more easily and economically be handled on the basis of the hundredweight. I have seen a poor elevator man chew his pencil and scratch his head trying to figure out the value of 1,675 pounds of barley at so much a bushel. It would take half the time and fewer errors would be made if he could figure on the basis of hundredweights. I know it is impossible in our community at the present time to get rid of the term "bushel," but I wish we could, and some day we will introduce a special bill prohibiting the use of the word "bushel."

Mr. Siren. Mr. Chairman, here is a package of pepper holding ½ ounce and costing 5 cents, or $1.60 a pound. Here is a package put up by a groceryman in my city, 4 ounces for 10 cents. I think a package like that ought to be small enough. I think commodities like this ought to be put in quarters of a pound and multiples of quarters. We ought to have standardization as well as uniformity and cooperation. Another thing is that some of our merchants putting out rice use the same package for three-fourths pounds as for pounds. When you open that small package it is only about half full.

The Chairman. This question of the size of packages is very similar to the bread question that you discussed last year. In the loaf of bread you said the buyer wished only certain sizes so that he knew what he was getting, and you fixed a certain weight for a loaf. The time may come, I think, when you will fix certain reasonable sizes of packages in the same way you have fixed the size of a loaf of bread. That would simplify this program very much indeed. But it is very difficult to apply this as a general rule to all substances.

Mr. Lutz. A merchant in Baltimore, who came from another town, said that in his city there were 3 pounds to a quarter of a peck of sweet potatoes. This man wanted to know why, if he sold sweet

potatoes in the State he came from on the basis of 3 pounds, he could not sell in our city. I told him that was because the laws of the other State were different from the laws in ours.

Mr. Goodwin. Mr. Chairman, it seems that the sentiment is in favor of the adoption of a uniform law. As I am here for that purpose largely, I move that the legislative committee be instructed to frame some model law, and all the States can lend their assistance by using their influence with their representatives in Congress to get some legislation passed that will be satisfactory to this conference that will bring about uniformity in weights and measures laws. I think there is not a State in the Union but what will adopt in their several States a Federal law relating to this subject the moment it is passed.

Mr. Cummings. I think that action would be simply a waste of time. Congress has already gone on record and enacted a law which is now in effect in the District of Columbia, along the lines of a model law, and all the other States need to do is to take the District of Columbia law and obtain the legislation along these lines, without going to Congress for further action.

Mr. Holbrook. The model law which has been adopted by this conference contains a provision to the effect that all dry commodities such as those under discussion shall be sold by weight or count. That is the standing action of the conference now, since it is one of the sections in the bill which you have already adopted. I think you should be advised of that because it may be found that that action as taken covers the entire subject without further action of any kind.

The Chairman. Can you tell us, Mr. Holbrook, how far this District law incorporates the model law of the conference?

Mr. Holbrook. I think the District law and the conference recommendation are practically identical in their objects.

The Chairman. If there is no more discussion on this subject I will state that the remainder of the time before luncheon has been set aside to enable the delegates to witness the manufacturers' exhibition of gasoline pumps installed as for use on the platform just north of the West Building. So, if there is no objection, the conference will stand adjourned until 1.30 o'clock.

(Thereupon, at 11.40 o'clock a. m., a recess was taken until 1.30 o'clock p. m.)

FOURTH SESSION (AFTERNOON OF WEDNESDAY, MAY 24, 1922).

The conference reassembled at 1.50 p. m., Dr. S. W. Stratton, chairman, presiding.

ADDRESS BY HON. HERBERT HOOVER, SECRETARY OF COMMERCE.

I am very glad to have the opportunity of meeting with you again. I would like to add, if I may, to any word of welcome that Doctor Stratton has conveyed to you on the assembling of the conference.

In these times when we are endeavoring to secure unity of action in a thousand directions in our country, the most important and fundamental steps in securing unity and mutuality in our national activities are periodic conferences of this type. We have gone by the time when men can advance American industry and commerce and social conditions entirely on their own individual responsibility. We have become too great in numbers, our machinery has become too complex, for single-handed action. If we would advance the welfare of our country, if we would perfect the processes of business and of commerce, it must be by unity of action on the part of great numbers of men. One alone can not attain any unity of action; it is only by organization, conference, and the establishment of standards and methods that these things may be brought about.

So that I welcome you to a part of the Department of Commerce not only as visitors but also as an institution—an institution that contributes its share to real progress in this particular field.

One of the problems that you must discuss in these times is with reference to questions of business and commercial ethics, and these are questions that concern you every day and several times a day, because obviously it is one of your fundamental preoccupations that there should be maintained accurate standards which protect not only the public but protect the honest producer and distributor. That is, indeed, one of the most important phases of all work of this character. Ninety-five per cent of the producers and distributors in the United States are honest men, but they are helpless in the face of dishonest action. It is utterly impossible for even so vast a majority to maintain high standards in business unless they can get protection from the small percentage of crooks. So that your preoccupation, and your occupation, is not in its results so much the prevention of crookedness and the capturing of crooks as it is the protection of the honest manufacturer and distributor.

I do not know of anything that has contributed more to this result than the whole system of standards that has grown up in our country. I, with you, am anxious to see those standards extended, and I believe the vast majority of our producers and distributors, as well as the whole of our consumers, are also anxious that there should be a constant, scientific expansion of all these activities in relation to standards. They go further, obviously, as you have found in your own experience, than the old and simple questions of weights and

measures. As our whole machinery becomes more complex, as science advances, and new industries and new tools become available, obviously you are expanding every day in order to maintain the integrity of these new tools and these new processes.

We have had a great deal of discussion during the past year in the department with reference to problems of simplification. You took part in a discussion of that character last year and contributed some very useful ideas. I understand that you are again considering some phases of that question.

One of the problems which we have in the department as a whole is the question of the simplification of containers—such standardization of containers as one may be able to bring about without destroying at all the elements of ingenuity and style, to secure an economic method of production, and a lessened cost of distribution, through simplification of this multitude of containers that invade every corner of the United States.

Also there is involved in the container problem one of your primary questions, and that is the necessity that the public obtain its major commodities by weight instead of by volume. That indeed is the practice in some parts of the United States, but it is not universal. It obviously can not be made universal in all commodities, but nevertheless there is no greater protection to the consumer than that we should deal by weight with a larger number of commodities than we do to-day.

There are problems of equality that sooner or later are going to come within the purview of public officials such as you. Gradually during the last 25 or 30 years we have extended into these questions of quality a great deal of public interest and public governmental action. Many acts have been passed by State legislatures and by Congress. There is nothing that makes for better competition, for cheapening of distribution, or for the protection of the consumer so much as discrimination of grades and the insistence that the commodities shall comply with their purported quality. How far that comes within the purview of your offices to-day I do not know, but I have a feeling that it is an extension of your functions, and of the functions of the Government, that is almost inevitable.

It is, however, not for me to discuss with you technical matters on which you are infinitely better informed that I am. I come merely to welcome you to the department, to reinforce Dr. Stratton's welcome to you, and to assure you of the faith we have that these conferences are of great value, not only to you but to us—that it is only through such conferences as these that the whole science and administration in which you are engaged can be advanced.

I wish to thank you for coming to Washington and sitting with us here these days to further develop these questions. It is a public service. I thank you.

PROTECTION OF HIGHWAYS BY MEANS OF PORTABLE WEIGHING DEVICES.

By John N. Mackall, *Chairman, Maryland State Roads Commission.*

Mr. Chairman and gentlemen, I am glad of an opportunity to present to you, who are interested in the preservation of our high-

ways, some of the experiences and some of the reflections which we have had upon this subject; one which we believe is of vital interest to every man, to every woman, and to every child, but one which unfortunately seems to be nobody's business.

I am going to sketch briefly for you, in order that I may develop what I have to say, the highway system as it has been developed in the State of Maryland. I ask you to pardon the reference to the highway system of the State I represent, but I assure you it is a system with which I have unfortunately had very little to do, so that I can outline that system to illustrate my points without the illustration having too much of a personal application.

We have in Maryland a total of about 13,000 miles of public roads. We have improved about 1,700 miles of that 13,000—13 per cent—a proportion of improved roads second to no State in the Union. The condition in which they are maintained is second to no State in the Union, and the service which they are rendering to the public is second to no State in the Union.

There was talk in Congress a year or two ago about a Federal system of highways, to which the Federal Government would contribute a certain percentage of the cost. A bill was drawn providing for a maximum of 7 per cent, constituting a system of roads, of which 3 per cent was to be the primary system, and 4 per cent the secondary system. I cite you that, gentlemen, to show you that the percentage of improved roads in the United States is very, very small. Taking the semi-improved types, the percentage is perhaps no more than 2, or, at the most, 3 per cent of the road mileage in the States. Then it behooves us to protect, for as long a time as we can, those highways which are rendering and are capable of rendering satisfactory service. And I ask you gentlemen, each of you, if you believe that is being done? Do you believe that in the community from which you come everything is being done to preserve the system of improved highways and semi-improved highways as they exist? Or have we not taken up and helped to carry on the propaganda put forth by the professional propagandists by believing that roads mean new roads—not old roads, not good roads, not usable roads, not serviceable roads—but new roads? I maintain, gentlemen, there are many miles of road which could at small expense be made to meet with proper specifications.

Then why do we build more new roads? Because we have been completely imbued with the idea that the only good road is a new road, one that has just been built. One of the largest producers of a commodity entering into so-called good roads started the slogan a few years ago, "Build the road to carry the load." You could not find fault with that. Fine! "Build the road to carry the load." What load? Any load that any unscrupulous person may want to put upon it? I heard the distinguished speaker before me speak about crooks, and it gave me an inspiration—any crook who wants to make the public pay a dollar in order that he may save a penny, any load of any size he may want to put upon the highways.

I started in my little way to combat that propaganda, and to substitute for that, "Limit the load to one that the road will carry." For, gentlemen, I say to you that more dollars are being squandered in permitting big trucks to destroy serviceable roads every year

in the United States than is being put in new construction; and yet we say we are trying to solve our road problem. That is the way we are trying to solve it—by getting less miles of usable road at the end of every year than we had at the beginning of that year. I maintain, gentlemen, that it is not solving it, and it can not solve it.

We have started out in our little way to see that the highways in Maryland shall be used by vehicles so designed, so constructed, and so operated as not to do unreasonable damage to the public highways. We have laid down three fundamental rules:

First, a truck may not carry more than the weight for which it made an application and paid a fee, because the fund for the maintenance of roads is based upon the fee, which in turn is based upon the weight of that vehicle. Therefore, if John Jones is an honest man and pays a license for a 2-ton truck, he should be assured that his competitors are not taking out a license for a 2-ton truck and paying a 2-ton fee, while operating a 4-ton truck.

Second, a truck may not carry a load in excess of 650 pounds per inch of width of tire.

Third, under no consideration may any loaded motor vehicle of any kind weight in excess of 20,000 pounds, 5 tons of load perhaps and 5 tons of dead weight.

After that law was placed upon the statute books of Maryland, when any man from Maryland appeared at a public conference he was hooted at, he was laughed at, and he was belittled in every way. But we fought for it; we said in Maryland that it should be carried out. And, gentlemen, I want to point to one little personal reference because it illustrates the point better than anything I know.

I attended a conference here two years ago with representatives from 28 national organizations looking toward the adoption of a uniform vehicle law for the United States, something that I believe is absolutely necessary, something I believe that you gentlemen can do a great deal to bring about, provided you do not attempt to take uniformity too far. When the question of weights came up, I got up and talked from the floor. One gentleman said, "Who is this talking?" Another one said "Mackall, of Maryland." "No, it is not." "Why is it not?" "Why, he has horns, a split hoof, and a tail, and this is just an ordinary man."

On the question of uniformity, I know you people want uniformity, and I believe in uniformity. But I maintain that the roads in Podunk should not, will not, and can not carry the same kind of traffic that the streets of New York carry. I maintain it is not necessary to have in the rural sections of the State of Maryland the same type of road that we have on Fifth Avenue, New York. I maintain there must be different types of road, different conditions of road, and different strengths of road. If that is so, then we must have different weights for the vehicles which go over them. And we have got to have a different type of load going over a road at one season than at another season.

Why have we permitted grossly overloaded trucks to be operated on and to destroy the public highways in these United States, and never said a word? Because the same propagandists I have told you about have said you can not prevent it; if you limit the size of the truck you curtail the industrial expansion of the country, and you can not do that. You hear that objection, and you let it go, and say

that you are not going to curtail the industrial expansion of the country.

Gentlemen, I want to cite you an incident. The road from Washington to Baltimore and Philadelphia during the war carried a tremendous amount of traffic; war traffic and all other kinds of traffic, but we called it all war traffic. Anyway, it carried enough traffic to destroy it, as all other highways on the Atlantic seaboard were destroyed during the war—destroyed so nobody could use them.

The Bureau of Public Roads, Department of Agriculture, made a disinterested study of the traffic that went over that road. They took figures for a month and they demonstrated that allowing the manufacturers' rated efficiency for the 5-ton unit over the 3-ton unit, if all the loads of 5 tons or larger had been carried in units of 3 tons, it would have cost those operators an additional $15,000. Yet it cost the State of Maryland the tidy sum of $600,000 to remedy the damage which was done at a saving to the operators of $15,000.

Gentlemen, it can not be done, and yet it is being done in every community in the United States. And, gentlemen, it is your business and it is my business. If you gentlemen can go home and say that the trucks can be regulated, that they are being regulated, that they must be regulated, you will have done a great service to the States from which you come. Just tell them that in the little State of Maryland it cost $600,000 to repair the damage in order that a few crooks could save $15,000. And, gentlemen, you will have to tell them that but once.

We passed the law and then we started out to enforce the law, and again they said it could not be done. I want to tell you, gentlemen, that was the easiest thing that ever was undertaken. Every one of you undertake every day a more difficult task than eliminating from the highways of this country the overloaded truck. All you need is a little portable weighing device. Two of them together will weigh about 100 pounds. You put them in the back of a "flivver," and you go along the road; you find a truck that seems to be overloaded and you weigh it. If it is overloaded, then and there you take off the amount of the overload, and then you take the driver to the judge and let him tell his story. That is all you have to do.

Perhaps, gentlemen, there is no warrant in law for removing the overload. We maintain there is, and nobody has ever substantially maintained to the contrary. Perhaps there is not any law which says that if you find a crook with your money you can take your money away from him, but you gentlemen do it, don't you, and the crook never says anything. So when you find the crook with this overload you take off the overload, put it on the side of the road, and let him get it as best he can.

Gentlemen, there is the whole story of eliminating overloads on highways by means of portable weighing devices. We started out with these portable devices and the first day we obtained 60 arrests and convictions. The first week we obtained something like 150. The second week we got about 50, the third week we got 15, and the fourth week we got none. Gentlemen, of the 130,000 vehicles in the State of Maryland to-day not one one-hundredth of 1 per cent is carrying an overload at any time, simply because you have a little accurate portable weighing device that you stick under the truck, jack up the rear end, and record the weight.

So, gentlemen, when they tell you that you can not prevent overloading upon the public highways in these United States, tell them you must do it, you have got to do it, and you are going to do it, that it can be done, that it has been done for a period of 3 years, and is going to be done as long as crooks who attempt to operate upon the public highways in the little State of Maryland insist on carrying a load greater than the law permits them to carry.

Gentlemen, if we are not going to do that, we are going to continue as we are to-day, building roads which we can ill afford, roads which we can not afford if they are built unnecessarily strong. Suppose, for instance, we are going to build a road a certain width, a certain depth, to carry all the traffic that wants to go over it, except motor vehicles carrying a gross load in excess of 5 tons, or a gross load in excess of 10 tons, or a gross load in excess of whatever figure you have set up. Suppose, now, the overloaded traffic is one one-hundredth of 1 per cent of the total. Suppose, then, that that road costs you, say, $20,000 a mile to build, and it generally costs that, taking the country over. The interest on that $20,000 at 4½ per cent, for instance, is $900 per year. To build that road to carry the total load will cost an additional $10,000 a mile. The interest on the $10,000 at 4½ per cent is $450 a year. Gentlemen, I say to you that before you can justify that additional expenditure you first must see what that additional expenditure is going to be, and if the overloaded trucks can save, not to themselves, but to the country at large, enough money to pay that $450 per mile per year, then you are justified in building a road for them. If they can not, you are not. And, gentlemen, when we say that 99.99 per cent of all the traffic that goes over a road must earn $900 a year, and one one-hundredth of 1 per cent of it must earn $450, or 50 per cent extra, we read them out of court; it can not be done.

So, gentlemen, unless we are going to limit the load to that which the roads will carry, and limit it by actually putting off of the highways the vehicles which are overloaded, we are going to saddle upon this country a tremendous burden in excess of the country's ability to pay, or we are going to build a system of roads too light, one which will be destroyed, one which can not be used by anybody.

But if I understand the temper of the American public they are not going to do either one of those. And when they rise up in their might and say, "We are going out to solve this question for ourselves, we are going to build the kind of roads which we need, the kind for which we can pay, and we are going to take a portable weighing device, with a couple of men, and we are going to eliminate the use of the overloaded truck," you will then begin to solve your highway problem, and I hope that that time is not very far distant.

DIVERGENCE OF REQUIREMENTS AFFECTING MILK BOTTLES.

By C. H. Ferris, *Representing the National Bottle Manufacturers' Association.*

Mr. Chairman and gentlemen, in connection with the Bureau of Standards we, as milk bottle manufacturers, have recently made a survey of conditions confronting us as the result of variations in practice and in the rules and regulations of the various States with regard to milk bottles. It so happens that in two particulars there

is considerable variation between the different States and some municipalities—first, in regard to the point to which the capacity is measured; and second, in regard to the designating mark on the bottle.

There are certain States that require that the point to which the capacity shall be measured shall be the rim of the cap seat; there are other States that require this point to be one-quarter inch below the cap seat.

Then in the matter of the designating marks on the outside of the bottle, certain States require the trade name, either in full or in abbreviation, in addition to the word "Sealed" and the manufacturers' designating number. Certain other States require only the word "Sealed," together with the manufacturers' mark, whereas other States have no regulations at all. This variation in regulations between the various States puts an unnecessary burden upon the milk-bottle manufacturers, which increases our costs of manufacture. These variations require a duplication of molds; or where we use the same mold and insert a plate, it requires frequent changes, which delay production. It also makes errors frequent on the part of our help in making these changes of plates, and it has some effect upon the carrying of stock.

It seems to us quite reasonable and within possibility, that the various States and municipalities could be brought to conform to standard practice as affecting milk-bottle manufacturers. We have discussed this with the Bureau of Standards, and we wish to lay before you a series of recommendations for your respectful consideration. They are as follows:

First, that in the regulation relative to the marking of milk bottles, only the word "Sealed" be required, together with the bottle manufacturer's designating mark and number.

Second, that the Bureau of Standards be authorized to cooperate with bottle manufacturers and State authorities in establishing a designating mark and number for each manufacturer; that these be registered in all States and be accepted by the States as their requirements on this point of practice.

Third, that a uniform point to which capacity is to be measured be adopted, and that all of the States bring their laws and regulations into conformity on this point.

Fourth, that the tolerance on capacity, issued in Circular No. 61 of the Bureau of Standards, be confirmed and adopted as standard by all States and municipalities.

Fifth, that the Bureau of Standards recommend and the States adopt a standard method of determining capacity.

Sixth, that milk bottles be standardized as to volume, for half gallons, quarts, pints, half pints, and quarter pints, and that the use of sizes other than these be forbidden by law.

Seventh, that the regulations in the municipality agree with those in the State in which the municipality is located.

I would like to submit those for your respectful consideration.

DISCUSSION OF ABOVE SUBJECT.

The Chairman. The question is a very important one.

Mr. Holbrook. If we could get the consensus of opinion of this conference, and this should be to the effect that the recommendations

made by the manufacturers are reasonable and should be carried into effect if possible, the bureau then during the coming year can take it up by letter with the various States and attempt to have whatever changes are necessary made in the regulations of the States. This might be taken up by resolution.

Mr. Goodwin. In the State of Rhode Island, instead of requiring the bottle manufacturers to put a special mark on the bottles that are to be used in the State, we merely request them to give their serial number and we accept that.

Some of the manufacturers, not all of them, were sending into our State a bottle holding one-third pint. I immediately issued a statement to the bottle manufacturers that this practice would not be tolerated in the State of Rhode Island.

Mr. Schwartz. I suggest that this matter be referred to the resolutions committee, that committee to report back to the conference.[3]

(The motion was seconded, the question was taken, and the motion was agreed to.)

WISCONSIN EQUIPMENT FOR TESTING HEAVY CAPACITY SCALES.

By George Warner, *Chief Inspector of Weights and Measures, State of Wisconsin.*

The Wisconsin weights and measures law provides that all cities of 5,000 population or over must have a local city sealer. All other territories must be taken care of by the State department. The State department has general supervision over the city departments, but State sealers are not required to do testing in these cities except to check up on the city sealers' work. The State inspectors each have a large territory to cover and in some territories the towns are more or less isolated. The territories comprise from 7 to 10 counties each and some are 170 miles long.

When the State department was organized in 1911 rapid progress was made in developing a system for testing the smaller scales and measures. A portable case containing equipment for testing counter and computing scales and liquid and linear measures was designed. This case weighs about 40 pounds when fully loaded and can be carried quite easily by the inspector.

Our great problem was how to transport at least 1,000 pounds of test weights to be used in testing heavy capacity scales. It is apparent to every sealer that 50-pound weights could not be shipped without being in some kind of box or crate to protect them; otherwise they would soon get chipped and might vary from the standard an appreciable amount.

Our first experiment was a box made of oak and large enough to hold five 50-pound weights, our idea being to give each sealer four of these boxes and have him ship them from town to town. This experiment was not a success for a number of reasons. The box itself was necessarily heavy in order to support a load of 250 pounds, and, when loaded, it required a man of brawn to handle it. The baggage men and freight handlers instead of trying to lift the box would drag

[3] See page 125 for text of resolution adopted.

it to the door of the car and let it drop, thereby damaging it nearly every time it was shipped.

Our next crate was built to hold only two 50-pound weights. There was no cover on this crate or box, and a separate compartment for each weight was provided with one bolt extending the length of the crate to hold the weights in place. Suitable rope handles were also provided. Each sealer was furnished with 10 of these boxes. This arrangement proved very satisfactory, and at the present time we often use the boxes when our trucks are not available. We continued the use of these shipping containers for a number of years in transporting the weights. When the weights arrived at a station the inspector would hire a livery or dray to take them from one scale to another. During the earlier years the cost of livery or dray was comparatively cheap, but as time went on this charge increased until it reached a point where it was almost prohibitive. The old faithful Dobbin was now a matter of history as far as the livery and dray business was concerned. It was not a practical proposition for a sealer to used a hired automobile or truck, as the charges were nearly always based on time spent and not on mileage. As you all know, it is often necessary for a sealer to spend considerable time in making a proper test on a wagon scale. During this time the hired truck or automobile is standing idle and expense is going on at the rate of about $1 per hour or 1⅔ cents per minute. Under these circumstances it can not be expected that a sealer will devote the time that he should to the testing of the scale. This condition forced the department to make another change, and in 1918 the experiment of a State-owned truck was tried. As this was only an experiment the department did not want to spend the money necessary for a high-priced truck; therefore, a Ford 1-ton chassis was purchased and a special body built thereon. This truck proved such a success that the department now has 4 similar trucks. In describing the construction of the truck it is unnecessary to describe the Ford truck chassis except to mention the fact that it was left unchanged. The special body contains an inclosed driver's cab with adjustable windows in the side and rear and has an adjustable windshield providing excellent ventilation. The part of the body at the rear of the cab is divided into 3 compartments. A door at each side of the body opens into the side compartments. One of these side compartments contains suitable space for one 5-gallon and one 1-gallon field standard and the other is used for personal grips, etc. The third compartment is at the extreme rear of the body and contains space for twenty 50-pound test weights. Two doors, swinging outward, are provided, so that two inspectors have ample room to work in removing the weights. Another important apparatus with which the truck is furnished is a small four-wheeled cart or truck called the "weight truck." This "weight truck" is made entirely of metal, has 12-inch wheels and is standardized at 100 pounds. It is used in moving the weights to different parts of the scale platform. Eighteen weights are placed on the truck, making a total load of 1,000 pounds concentrated within an 18-inch square. This truck when knocked down is in 5 parts. The wheels are easily removed. Self-contained pins which drop into place by gravity are

provided in the ends of the axles in such manner that a wheel can be removed with the use of only one hand. The entire truck can be assembled in 20 seconds by one man.

In the use of this equipment the usual practice in testing a wagon scale is as follows: Drive across the scale platform, stop with rear wheels of truck just off of the platform. When ready to make the test, open the rear doors of the car, place "weight truck" on one corner of scale platform, place eighteen 50-pound weights on the truck, and test at as many different places on platform as desired, making the last one at the end opposite to the motor car so that the "weight truck" can be run off of the platform at that end. Next back the motor car on scale platform, take a reading, then add the 1,000-pound test load to the car and again take a reading. If no further test is desired, simply close the car doors and proceed to the next scale.

The cost of running the trucks has averaged about 12 cents per mile during the past year. About 9 miles to a gallon of gasoline is obtained and about 50 miles to a quart of lubricating oil. They are used nearly 7 months out of the year, or about 180 working days. They average 17 miles of travel per working day at a cost of slightly more than $2.

The cost of a Ford truck chassis at present is about $500, the special body about $175, and the weight truck about $50, making a total of $725 for the entire equipment. We estimate that there is a saving of at least $5 per working day in using the truck instead of a livery or dray, and as the trucks are used 180 days, this saving would amount to $900 for each truck per year. In addition to this amount, all of the expense for excess baggage and freight is saved; therefore, it is a very conservative estimate to state that each truck saves one and a half times its original cost each season.

I wish to state that if any of you gentlemen here desire any further information on these trucks you can get it by writing to the State department of weights and measures, Madison, Wis., and I will be glad to furnish you with a copy of last year's report, which describes in detail the construction of the truck.

The CHAIRMAN. Mr. Warner has given us a very good paper, and it is an extremely practical suggestion. I hope you will have some photographs taken and distribute them to the various members.

REPORT OF COMMITTEE ON SPECIFICATIONS AND TOLERANCES ON HEAVY-DUTY AUTOMATIC INDICATING SCALES, INCLUDING RESULTS OF JOINT INVESTIGATION OF THE BUREAU OF STANDARDS AND THIS COMMITTEE ON ACCURACY OF THESE SCALES IN SERVICE, PRESENTED BY F. S. HOLBROOK, CHAIRMAN.

The Fourteenth Annual Conference on Weights and Measures referred to the committee on specifications and tolerances of the annual conference the subject of specifications and tolerances for automatic indicating scales of a capacity of 500 pounds and over, with a request that this matter be given consideration and a report made to the fifteenth conference.

Your committee early invited the cooperation of all the manufacturers of these devices and requested that they place in the hands of the committee all suggestions which they desired to submit; and from time to time during the year the committee has been giving

the subject careful consideration. Some time ago the conclusion was reached that an excellent groundwork of specifications already existed, this being the code of specifications already adopted by the conference for scales in general and for scales of various types, such as "platform scales," "spring scales," etc. It was believed that the most urgent need at the present time was the development of definite tolerances to be applied to this class of scales and that the question of any necessary specifications, additional and supplementary to those already adopted, could better be postponed until a succeeding meeting. In relation to specifications it is, therefore, the recommendation of the committee that the specifications already in force be applied to heavy-duty automatic scales in so far as they are applicable to this type of scale. If, in the course of the work of the members of the conference, it is found that any of the present specifications are not satisfactory when applied to heavy-duty automatic scales, or if it appears that there are new specifications needed properly to regulate these scales, it is requested that such information be promptly communicated to the committee to guide and assist it in its work during the coming year.

In relation to the question of tolerances a number of suggestions were received from interested parties, including manufacturers and users of this class of apparatus, and these have been given careful consideration. It was developed that the consensus of opinion among the manufacturers of these scales was to the effect that the tolerances already adopted for beam scales should be made to apply to heavy-duty automatic scales. The opinion of several large users of these scales was to the effect that the tolerances on these scales should be considerably increased over those allowed on beam scales. The committee believed that the opinions of both of the above-mentioned interests were entitled to careful consideration.

From various sources, including the Bureau of Standards, the State of Wisconsin, the Pennsylvania Railroad, and manufacturers, information was obtained on the performance of automatic indicating scales in service. This was of much value, but the committee decided to supplement these data and bring them up to date by an original investigation. The Bureau of Standards consented to collaborate in this, and work upon it was undertaken. Briefly a report of this work is as follows:

RESULTS OF JOINT INVESTIGATION OF BUREAU OF STANDARDS AND COMMITTEE ON SPECIFICATIONS AND TOLERANCES ON ACCURACY OF HEAVY-DUTY AUTOMATIC SCALES IN SERVICE.

A wide variety of materials are handled and weighed on heavy-duty automatic indicating dial scales, and these scales are used under widely differing conditions. In order that specifications and tolerances may be well founded, it is obvious that they should be based upon as extensive a knowledge as possible of the behavior of this type of scale under ordinary working conditions. This report presents data accumulated in an investigation designed to extend our practical information on the subject. The study is a continuation of an earlier one started in 1920 by the Bureau of Standards in cooperation with the American Railroad Association and the American Railway Engineering Association, when automatic dial scales were examined and tested in freight stations and elsewhere in Philadelphia, New York, and Boston.

The present investigation was started in February of this year with two purposes directly in view. One was to add to the knowledge of the subject by obtaining additional representative data to assist in establishing the conclusions to be drawn and to make it possible to anticipate with reasonable

accuracy the results likely to follow the adoption and enforcement of any particular tolerance; the other was to place those concerned with the establishment of these tolerances in close personal contact with the practical phases of the subject.

The work was carried on in the cities of Philadelphia, New York, and Chicago.

Automatic indicating scales of nearly all the various types manufactured were encountered and are included in the results. Also special care was taken to secure data on scales in various classes of service. As a result scales are represented which were being used in weighing the following materials, among others: Freight, paper, meats and meat products, dairy products, brass and copper, metal bearings, wire, nails, rivets and similar metal products, chains, etc.

Some of the scales were very well installed and were used under favorable conditions, while others were necessarily installed under very unfavorable conditions, as on stringers over water on wharves, in places where there was excessive vibration, etc. Under our definitions of "inside" and "outside" scales ("Class A" and "Class B"), numbers of the scales tested would take each classification. Some of the scales had been recently put into service, while others had been in use for a number of years.

On account of all the above we believe that this investigation discloses representative conditions, such as may well be met by the ordinary inspector of weights and measures in his work in the field in cities where the scales receive more or less regular attention. It is possible that in some outlying districts the scales, on the whole, might not receive the care and attention which is available in cities like Philadelphia, New York, and Chicago, and that the average error might be somewhat greater. This is a surmise, however, since it has not been demonstrated to be the case.

The results of the investigation have been arranged in tabular form, and are given below. The various scales are grouped according to their dial capacities and minimum graduations. The total number of scales of each group tested is shown in the third column. The succeeding columns indicate the number of scales found to have a maximum error up to and including 1 pound, greater than 1 pound but not in excess of 2 pounds, greater than 2 pounds but not in excess of 3 pounds, and so on.

Tabulated results of investigation on automatic indicating scales.

Dial.		Total scales.	Number of scales with errors not greater than—							Scales with errors of over 20 pounds.
Capacity.	Minimum graduation.		1 pound.	2 pounds.	3 pounds.	4 pounds.	5 pounds.	10 pounds.	20 pounds.	
5,000	5	1	0	0	0	0	0	1	0	0
3,500	5	2	1	0	1	0	0	0	0	0
2,500	5	13	1	4	3	3	0	1	0	1
2,000	5	18	0	3	2	2	2	4	3	2
2,000	2	5	1	1	1	2	0	0	0	0
1,000	5	32	2	6	7	2	4	9	2	0
1,000	2	1	0	0	1	0	0	0	0	0
1,000	1	15	7	5	2	0	1	0	0	0
1,200	1	1	1	0	0	0	0	0	0	0
500	1	2	1	0	1	0	0	0	0	0
500	½	4	2	1	0	0	0	0	1	0
400	2	2	0	2	0	0	0	0	0	0
400	1	1	0	0	0	0	0	1	0	0
350	½	1	1	0	0	0	0	0	0	0
250	¼	1	1	0	0	0	0	0	0	0
200	1	1	0	1	0	0	0	0	0	0
200	½	3	1	2	0	0	0	0	0	0
200	¼	3	2	0	0	1	0	0	0	0
125	¼	1	0	1	0	0	0	0	0	0
Totals		107	21	26	18	10	7	16	6	3

In addition to the above tabulation as shown it will doubtless be profitable to consider the percentage of these scales which would be passed or rejected should the system of tolerances as proposed in this report of the committee be put into force and effect.

For the purpose of this consideration the scales have been grouped as "inside" and "outside" scales, although on examining in detail the data accumulated in the present investigation it appears that the distinction which would operate in the ordinary case between the tolerances for outside scales and the tolerances for inside scales does not have its full usual effect. This is on account of the relations between dial capacities and their minimum graduations in the scales encountered of the respective classes, the value of the minimum graduations on the "outside" scales usually being considerably greater than the value of the minimum graduations on "inside" scales, and thus the tolerance on the former class would be automatically increased regardless of whether such scales were installed as "inside" or "outside" scales.

Sixty-seven of the scales examined were classed as outside scales. If the tolerances were adopted in full as proposed, then 61 per cent of the scales would pass the tolerance and 39 per cent would fail to pass. However, if the tolerances were to be adopted without the special proviso included in relation to scales used exclusively in the weighing of freight, then only 36 per cent of the scales would pass, while the remaining 64 per cent would fail to pass.

For scales classed as inside scales it was found that 35 per cent of the scales would pass the tolerances proposed and that 65 per cent of the scales would fail to pass. If the tolerances were doubled, then 70 per cent of the scales would pass and 30 per cent would fail to pass.

In considering the outside scales it is reasonable to assume that the number passing would be reduced if the scales had been tested in greater detail. It is, therefore, safe to figure that the actual number of scales passing under the proposed tolerances will not exceed the figures found for the data given here.

With these results before your committee and these facts in mind, the task of fixing proper tolerances appeared as one of the greatest difficulty.

It may be advisable here briefly to state certain general considerations which your committee believes should be kept in mind and which we have endeavored to fulfill when tolerances are being determined upon.

In the fixing of any tolerances for a commercial weighing device, it is felt that there are two prime requisites which must govern: First, the tolerance must be small enough so that substantial accuracy of weighing will be obtained, the rights of the seller and the buyer will be adequately safeguarded, and unconscionable advantages can not be secured by anyone tampering with the device to cause it to give indications which are not exact but which are within the tolerances. Second, the tolerance must be workable, so that a sample of the product, well designed, carefully constructed, properly installed, and well maintained, will receive the seal of the inspector. Any device which will not fulfill both of the above requisites, in view of all the circumstances of the case, would seem to be not a proper device to be allowed in commercial use.

The persons or interests establishing tolerances must be held responsible for procuring the above results in every case. When these fundamental essentials are fulfilled, other considerations of expedience should be taken into consideration. It is believed that a device should not be allowed a tolerance in excess of what is normally required, since the greatest reasonable accuracy should always be obtained. Conversely, we consider that a useful or convenient device, or one possessing advantages peculiar to its own type of construction, should not be thrown out of use arbitrarily by the fixing of tolerances within which it can not be built or maintained. When a properly interested party to a tolerance recommends for consideration a system of tolerances, as, for instance, on heavy-duty automatic in-

dicating scales, there are three possible courses which can be pursued in relation to such a recommendation. The tolerance recommended may be decreased, it may be increased, or it may be accepted as a proper and satisfactory one. Taking the specific case of the recommendations of the manufacturers of these scales it may be said: First, that there was no disposition on the part of this committee to decrease values contained in the recommendations since tolerances already well recognized were being requested. Second, your committee felt that it would be at fault if it recommended to this conference larger tolerances than were requested by the great majority of the manufacturers, since it was felt by your committee that a general increase was not to be desired, inasmuch as it might tend toward jeopardizing the substantial accuracy of weighing which has been stated to be the first requisite. As to the second indispensable requirement, namely, the workability of the tolerances, the committee has had, and still entertains, some doubt as to the present ability of the manufacturers to turn out a product which will consistently conform to the tolerances proposed, but no great emphasis will be placed upon this at this time, since it is certainly not to be anticipated that the interests actually engaged in producing the scales would advocate a tolerance which is so small as to be beyond their ability to meet.

Some of the manufacturers urge that if these automatic scales are not being constructed or maintained so as to weigh accurately then they must be improved upon. This is certainly a commendable attitude, and such a determination would seem certain to result in the production of a better average product.

Therefore, as to scales hereafter to be produced by the manufacturers and put into commercial service, the committee is placing before you for your consideration a system of tolerances having as a basis the tolerances now allowed on beam scales.

Since beam scales and automatic scales differ in particulars essential in the determination of the tolerances, some changes in the provisos have been found necessary. In the case of beam scales the minimum tolerance to be applied to any scale is the value of the minimum graduation on the beam. In the case of automatic indicating scales the minimum graduation on the dial should not always be accepted as the minimum tolerance since often such minimum graduation has a very much larger value than the minimum graduation on the beam of a corresponding beam scale. A familiar instance of coarse dial graduations is the 1,000 or 2,000 pound quick-weighing dials used on coal-tipple scales at the mines, these usually having a minimum graduation of 50 or 25 pounds. A minimum tolerance of 50 or 25 pounds would, of course, be out of all reason. Therefore, the minimum dial graduation is not the factor selected to fix the minimum tolerance when a particularly coarse graduation is employed. Instead, when the dial is divided into less than 500 parts, it is provided that one five-hundredth of the dial capacity should be the value of the minimum tolerance to be allowed.

One other point may be mentioned here. It seems that when a dial is not graduated to finer subdivisions than 1 pound, a tolerance of less than 1 pound is a somewhat unnecessary and unreasonable one. Therefore, in such case a minimum tolerance of 1 pound has been proposed in the case of such dials.

The tolerances on ratio, on beams, and on loose counterpoise weights have been fixed at the same values as in the present tolerances on beam scales since similar considerations appear to govern in both classes of scales. When "built-in" or unit weights are employed in combination with a ratio it is provided that the combination should take the same tolerance as a beam.

As to scales already in use somewhat different considerations govern.

While in theory there seems to be no definite reason why such scales should not be governed by the same tolerances as are to be presented, nevertheless, as a matter of practical expediency and justice, it may be found necessary or advisable to allow somewhat more liberal tolerances in the field. These scales have been bought and used in good faith, they represent a considerable investment of capital, they have heretofore been allowed in use with the consent of the official, and will often be found to bear his seal, although certainly not a majority of them will comply with the tolerances to be presented.

Your committee has given attention to this phase of the situation in an endeavor to decide whether separate tolerances could be presented for these scales such as twice the tolerances to be suggested for scales hereafter to be put into use, but has decided against this step since often the conditions of the individual case must govern the decision.

While it is realized and freely admitted that this is not a solution of the problem, nevertheless it is believed to be necessary to leave the matter thus. It is possible that in the discussion which will follow this presentation of the case, there may be found to be such a consensus of opinion among the delegates that a reasonable conclusion, fair and satisfactory to the several interests, can be arrived at, although in the light of its own experience your committee has little hope that such will be the case.

Your committee would advise that if the tolerances presented herein are adopted, they should not be considered as being the final act of the conference upon this subject. There would seem to be no reason why a determined effort should not be made to enforce them in the case of scales hereafter installed, and if enforcement can be effected, a very satisfactory increase in accuracy of weighing by automatic means will have been secured. Attempts to enforce them in the case of any official should only be abandoned if their enforcement is, in his judgment, demonstrated to be an impossibility.

In relation to scales already in use it would be our recommendation that great care be exercised in putting them into effect and that if after a careful survey of his district it appears to any official that great and unnecessary hardship would be the result of enforcement in general or in particular cases, he use his best judgment as to whether or not they are immediately to be put into force, or as to the best manner of putting them into force.

An uncompromising attitude on the part of the officials at this time would not seem to be in order and in our opinion the officials should lend their cooperation in the further development of this type of scale.

The committee will be very pleased to receive statements from officials or from other interested parties concerning results arising from enforcement or concerning probable results of enforcement, if they are not actually put into effect, in their jurisdiction or on scales under their control. Material of this nature will be of very great value both to the committee and the conference if a review of the matter is found to be necessary at a future date.

In relation to scales used exclusively in the weighing of freight your committee feels again that there are special considerations which must be given attention. Very many of these scales must in the very nature of things be installed under extremely unfavorable conditions. Selection of a proper place of installation, unfortunately, can not always be made; often only one place is available and this necessarily must be the one selected. For instance, in New York City, Philadelphia, and other cities located on a water front, freight is delivered and must be weighed along the docks. The scales must be installed on the docks over the water. Separate foundations for the scales is a virtual impossibility, inasmuch as the water and mud may perhaps be of very great depth. Therefore, the levers may be placed, for instance, on heavy stringers under the floor of the dock, housed as well as is possible with boards and tar paper. However, when a boat or lighter bumps the wharf, the whole scale may be violently shaken; effects of inevitable moisture are necessarily present; level conditions are difficult to maintain; and electric tractors and loaded trucks may often be drawn across the scale platforms.

All such conditions have their effect in decreasing or endangering the accuracy of the weighing device and indicate a need for somewhat more liberal tolerances. Fortunately, the service being charged for on a basis of the weights determined is a relatively cheap one. Even with our freight rates higher than formerly the cost of transporting the commodity is still, we think, on the average very much smaller than the value of the commodity itself. If this be the fact it is not entirely unreasonable to grant to a freight scale a somewhat larger tolerance than to the scale otherwise used in industry.

With all these facts in mind your committee has included in its report, and suggests for discussion, a tolerance on freight scales of twice that presented for other heavy-duty automatic indicating scales.

Finally, your committee does not feel that it can close this report without calling attention to the fact that many large users of these scales request delay in the action of this conference on this subject until the whole question can be more thoroughly considered and discussed. They feel that it has not, as yet, been developed to the point where definite action should be taken. Mr. Hadley Baldwin, of the American Railroad Association, who is chairman of the subcommittee on scales, a subcommittee of the yards and terminals committee of the American Railway Engineering Association, which also acts as a subcommittee for the American Railway Association on technical matters relating to scales, and thus represents many large users of heavy-duty automatic scales, in a recent letter explains this attitude. This letter reads in part as follows:

> My attention has been called to a recommendation for the adoption of tentative tolerances for automatic indicating dial scales of 500 pounds capacity

and over. * * * It appears to me that this is a subject on which our committee representing the railroads should have reasonable opportunity for deliberation before any action is taken. * * * I would like to suggest that * * * this question be held open until our committee can give it due consideration rather than have the tolerances as now proposed adopted at this conference.

Below are given the tolerances which your committee proposes and these are presented for the consideration of delegates to the Fifteenth Annual Conference and of manufacturers and users of these scales:

TENTATIVE PROPOSED NONRETROACTIVE TOLERANCES FOR HEAVY-DUTY AUTOMATIC INDICATING SCALES.

DEFINITION.—A heavy-duty automatic indicating scale is a scale of a total capacity of 500 pounds or more in which is embodied or to which is attached a self-acting mechanism, the capacity of which may be equal to or less than the total capacity of the scale, through the agency of which the indicated or recorded weights of variable loads may be obtained. This classification does not include scales which automatically weigh out commodities in predetermined drafts, such as automatic grain hopper scales, packaging scales, etc.

NOTE.—The tolerances herein presented for consideration are, as is stated above, not intended to be applied strictly to scales already in use.

These tolerances are not to be construed as applying to railroad track scales, whether or not automatic indicating devices are embodied in or attached to such scales.

TOLERANCES.—The tolerances to be allowed in excess or deficiency on heavy-duty automatic indicating scales shall be the values shown in the following table: Provided, however, That the tolerances on the dial or reading face on all these automatic indicating scales shall in no case be less than the value of one of the minimum graduations on the dial or reading face, or one five-hundredth of the capacity of the dial or reading face, whichever is less, except, that on such of these scales as have a minimum graduation of 1 pound or more on the dial or reading face such tolerance shall not be less than 1 pound. The tolerances on any beam or beams with which the scale may be equipped shall be the same as those specified above, except in cases where the value of the minimum graduation on any such beam is less than that of the minimum graduation on the dial or reading face, or one five-hundredth of the capacity thereof, whichever determines the minimum tolerance on the dial or reading face, in which cases the minimum tolerance on any such beam shall be the minimum graduation on any beam with which the scale may be equipped. The minimum tolerance to be allowed on the ratio or the multiplying power of the scale shall be the same as the minimum tolerance allowed on the beam. And provided further, That the manufacturers' tolerances or the tolerances on all new heavy-duty automatic indicating scales shall not be greater than one-half of the values specified above.

The tolerances to be allowed on heavy-duty automatic indicating scales used exclusively in determining weights for the sole purpose of fixing charges for the transportation of freight shall be twice those specified above.

Load in pounds.	Tolerance, class A.		Tolerance, class B.	
	On ratio.	On dial or beam.	On ratio.	On dial or beam.
	Ounces.	*Ounces.*	*Ounces.*	*Pounds.*
50	½	1	.....	.....
100	1	2	.....	.....
200	2	4	.....	.....
300	3	6	.....	.....
400	4	8	.....	.....
500	5	10	10	1¼
600	6	12	12	1½
		Pounds.	*Pounds.*	
800	8	1	1	2
1,000	8	1	1	2
1,200	10	1¼	1¼	2½
1,500	12	1½	1½	3
1,800	14	1¾	1¾	3½
	Pounds.			
2,000	1	2	2	4
2,500	1¼	2½	2½	5
4,000	2	4	4	8
6,000	3	6	6	12
8,000	4	8	8	16
10,000	5	10	10	20
12,000	6	12	12	24
16,000	8	16	16	32
20,000	10	20	20	40
24,000	12	24	24	48
30,000	15	30	30	60
40,000	20	40	40	80
50,000	25	50	50	100

NOTE.—The values given in the above table are the same as those adopted by the Eleventh Annual Conference for platform scales of the beam type, and incorporated in Bureau of Standards Circular No. 61 and Handbook No. 1.

EXPLANATION OF PRECEDING TABLE.—"Class A" scales include the following: Scales of the portable platform type; and also scales of the self-contained or dormant and built-in types which are installed inside of a building having side walls and roof, which protect the scale from weather effects and from sudden changes of temperature.

"Class B" scales include the following: Scales of the motor-truck and wagon types; and also scales of the self-contained or dormant and built-in types, which are not installed inside of a building having side walls and roof, and which are exposed to weather effects and sudden changes of temperature.

NOTE.—The latter effect, since it causes the condensation of moisture on the scale parts, often has as serious results on the condition of the scale as have weather effects.

The values in the columns with the headings "Tolerance," "On ratio," are to be applied to the ratio or multiplying power of such scales with which loose counterpoise or "bottle" weights are used, namely, those which are manually applied and removed and are not an integral part of the scale mechanism.

The values in the columns with the headings "Tolerance," "On dial or beam," are to be applied to those parts of such scales not requiring the use of loose weights; for example, the dial, a beam, or "built-in" automatic or semiautomatic counterpoise or unit weights, namely, those which are automatically or mechanically added and are an integral part of the scale mechanism and not designed to be detached therefrom.

TOLERANCES ON WEIGHTS.—The tolerances to be allowed on loose counterpoise or "bottle" weights used on heavy duty automatic indicating scales shall be the same as those specified for such weights used on beam scales.

CONCLUSION.

Discussion of this subject will doubtless be of advantage at this time and we believe that it should proceed. However, whether or not tolerances are to adopted at this conference rests solely with the delegates. If it is believed that further study is necessary or desirable before action is taken, and that, therefore, the adoption of tolerances should be postponed, such a disposition will certainly be entirely satisfactory to the committee.

(Signed) F. S. HOLBROOK,
W. T. WHITE,
WILLIAM F. CLUETT,
Committee on Specifications and Tolerances,
Annual Conference on Weights and Measures.

Mr. HOLBROOK. This is the final draft of our report. It was sent out some 10 days or 2 weeks ago in mimeographed form, and only one or two changes have been made in it since that time. There are a number of copies of this material available for the use of the delegates.

(During the presentation of the above report H. A. Webster, first vice president, assumed the chair.)

DISCUSSION OF ABOVE REPORT.

The ACTING CHAIRMAN. What is the pleasure of the conference?

Mr. REICHMANN. I rise, Mr. Chairman, because I introduced the resolution last year in relation to these scales. We have all heard the very fine report of the committee on specifications and tolerances. It is constructive in every respect.

I move you, in order to bring this before the conference, that if it is agreeable to the committee we request the Bureau of Standards to send out a typewritten copy of that report, together with these tolerances, for study, and request all the members of this conference, and all other weights and measures officials, to send in suggestions. This is, as indicated by the report of the committee, a very important proposition and one that should be taken up very, very carefully.

If we can have a copy of that report it will be of great aid, because this subject is one which will take considerable study, and as I understood from what the chairman of the committee said, the report is intended as a basis—if I am not right, I want to be corrected—that this is simply a suggestive proposition and that they are looking for further light on the subject. Is that right?

Mr. HOLBROOK. Yes, sir.

Mr. REICHMANN. It is a very important subject, and it is going to take a year or two to boil this thing down to anything that is equitable and fair, not only from the commodity standpoint and the instrument standpoint, but also from the economic standpoint.

Therefore I make the motion I have presented.

Mr. Holwell. I suggest as an amendment that this committee be continued in its work and report at the next conference.

Mr. Reichmann. It will automatically do that. But I am anxious that every sealer should get a copy of that very excellent report which is the basis of these suggested, preliminary conclusions.

(The motion was seconded, the question was taken, and the motion was agreed to.)

Mr. Maroney. In making your tolerance, have you considered errors caused by wind when the levers of the scale are put under the dock over the water?

Mr. Holbrook. The committee has considered the question of the effect of wind upon these scale levers under the docks. That was one of the considerations that led us to suggest that freight scales take a somewhat larger tolerance than ordinary automatics in industry.

May I make one more suggestion? The resolution adopted last year referred to automatic scales of 500 pounds or more, and the committee has confined its present investigation to scales having a capacity of 500 pounds or more. The committee in its investigations has found that probably a majority of scales which may be called heavy-duty automatic scales have a capacity of something less than 500 pounds. If the question is to be put over until next year, I think that scales of greater capacity than the ordinary counter scale, but of less capacity than those which the committee has considered, should also be investigated by the committee.

Mr. Reichmann. I move that the committee be asked to report on scales having a capacity of 100 pounds or over.

(The motion was seconded.)

Mr. Barron. I would like to amend the motion to cover all portable scales and all automatic scales not of the counter type.

Mr. Reichmann. With the consent of my second I will accept that amendment.

(The question was taken, and the motion as amended was agreed to.)

EXPERIENCES IN TESTING LEATHER-MEASURING MACHINES.

By John J. Cummings, *Chief Inspector of Standards, State of Massachusetts.*

"There's nothing like leather" has been a familiar expression for many generations, and may now be regarded as a truism or self-evident fact. The uses of leather are many and varied. It enters largely into the manufacture of boots and shoes, coats and jerkins, traveling and shopping bags, upholstery work, and bookbinding. In spite of the great commercial importance of the problem little, if any, attention has been given to the determination of accuracy of leather-measuring devices in the majority of the States, possibly because these devices do not enter into direct relationship with the ultimate consumer like those scales and measures used more commonly in trade.

According to the Census of Manufactures for 1920, there were 681 leather-manufacturing establishments in the United States, having a total output valued at $928,668,200. Of these establishments 131 were located in Massachusetts; 94 in New York; 92 in Pennsylvania; 73 in New Jersey; 30 in Illinois; 28 in Michigan; 25 in Wisconsin;

24 in Ohio; 21 each in California and Virginia; 18 in Delaware; 17 in West Virginia; 11 in North Carolina; 10 each in Kentucky and Tennessee; 9 each in Indiana and Maine; 7 each in Connecticut, Maryland, Missouri, and New Hampshire; 6 in Minnesota; 5 in Oregon; 3 each in Georgia and Texas; 2 each in North Dakota, Rhode Island, Vermont, and Washington; and one each in Alabama, Colorado, Louisiana, South Dakota, and Wyoming.

Of the output of these factories approximately $578,959,100 worth, or 1,157,918,200 square feet, were sold on the basis of area measurement. In many instances inaccurate measurements have resulted in a material loss or gain to the leather manufacturer or to the purchaser who uses leather in the manufacture of boots and shoes or other products. At the annual meeting of the National Boot and Shoe Manufacturers' Association, held at New York in January, 1917, the committee on upper-leather measurements reported the following experimental measurement:

> A number of skins were measured through a machine of the latest type and immediately remeasured by a machine of the latest type produced by another manufacturer, both machines being operated at the same speed and by the same operator. The respective measurements showed a variance up to 3 feet per dozen skins. To a shoe manufacturer using 20,000 dozen skins per year this variance would represent an approximate profit or loss of $40,000.

Aside from its importance from the manufacturer's standpoint, accurate measurement of upper leather is of vital interest to every shoecutter, as he is supplied with what purports to be a certain number of square feet of leather, out of which he is expected to cut a definite number of pairs of shoes, and his tenure of service is largely dependent upon his ability to perform this task.

Although the matter is of nation-wide importance, Massachusetts appears to be the only State which has made special statutory provision for the testing and operation of leather-measuring devices. In 1913 the legislature of that State enacted legislation requiring measurers of leather to secure a certificate of fitness from the commissioner of weights and measures (now the director of standards), and penalizing the sale of leather which had not been measured by a sworn measurer. It also provided for semiannual testing and sealing of leather-measuring devices by local sealers of weights and measures and empowered the director to make such rules and regulations as he may deem necessary to secure the greatest possible accuracy in their use. Under this authority the director of standards has established a maximum operating speed for power-driven devices. Since the enactment of this law many disputes, some arising in other States, have been referred to the Massachusetts division of standards for settlement. In one of these cases, involving patent leather manufactured in New York and sold to a Maine shoe manufacturer, a deficiency of 8.03 per cent was determined, settlement being made upon that basis.

In 1916 disputed leather measurements had become so common that the National Boot and Shoe Manufacturers' Association and the National Association of Tanners each appointed a committee on leather measurements, to act jointly in an endeavor to solve the problem, and I was named by the head of my department to cooperate with this joint committee. Our preliminary investigation and comparative tests of various measuring devices only served to

emphasize the urgent necessity of uniform specifications and tolerances to be observed in the manufacture and operation of these devices and of proper forms of templates or test sheets to be used in determining their accuracy. As the problem was of national importance and required technical training and ability of a high order for its solution, Director S. W. Stratton, of the U. S. Bureau of Standards, was called upon for assistance and he assigned Mr. F. J. Schlink, then associate physicist of the bureau, for an investigation of the methods and machines employed in determining the area measurement of leather.

In January, 1917, Mr. Schlink started this work, and continued it until the following April, when the entrance of the United States into the war required all of the facilities of the bureau to be devoted to military work for the time being. In August, 1918, Mr. Schlink again took up the work for a short period, some additional tests having been made in the meantime by the Massachusetts officials. For various reasons, principally the lack of available funds, the Bureau of Standards has not completed the investigation begun in 1917. Important and suggestive data obtained at that time, however, have been compiled and published in Technologic Papers of the Bureau of Standards, No. 153, issued April 24, 1920. The results of the bureau's investigation contained in that publication include a discussion of the principles of construction and operation of the various leather-measuring machines in common use, with an analysis of the sources of error in the "wheel" machine, including the width of tires, spacing of wheels, overrun of wheel work, effect of thickness of leather measured, and lost motion in the transference chains. Illustrations of the various types of machines are also included.

The amount of variation in measurement commonly found in the operation of the usual measuring machines is shown by comparative measurements of five calfskins, measured on five different machines, the exact area of the skins being determined by means of a planimeter. The average errors found in the operation of these five machines extended over the wide range of 4.4 per cent in excess to 0.1 per cent in deficiency.

In attempting to determine the accuracy of leather-measuring machines, rectangular test sheets having an area of 5, 10, 15, and 20 square feet are commonly used, the material for these test sheets being common building paper, 3 feet in width. Test sheets of this form were first designed by the manufacturers for use in calibrating their machines and are now universally used by operators and weights and measures officials in determining the accuracy of the machines from time to time. Comprehensive tests have shown that neither the material nor the shape of these sheets is adapted for the purpose intended, and the results of investigation of the subject in England agree with those of similar investigations in this country in pointing to the conclusion that these machines should be adjusted by the manufacturer, in the first instance, and thereafter tested for accuracy by means of templates having a periphery approximating the irregular outline of the skins or side leather to be measured and varying in thickness in accordance with the thickness of the leather. In connection with the investigation by the Bureau

of Standards, M. Sasuly, of the bureau, suggested and prepared an outline of improved form which is illustrated and described in Technologic Paper No. 153. Experiments with this form of test sheet indicate its superiority over the form now in use. Until a proper material for its construction is determined upon, however, its use will necessarily be limited, as the numerous angles in its contour make it easily tearable and thus rendered unfit for further use.

Manufacturers of leather-measuring machines have at all times been fully advised as to the results of various tests, showing sources of error and suggesting possible remedies. One of the sources of error to which attention was directed was the variance due to imperfections in the linkwork of the chains which operate to translate the motion of the measuring gears into rotation of the index hand on the reading dial. One type of machine has since been improved by substituting a brass ball bead chain, such as is used on electric lights, for the double-link iron chain previously used. Apart from this, no material change appears to have been made by any manufacturer.

Competition in the manufacture of leather-measuring machines is necessarily limited, owing to the comparatively small number for which a market may be found. As previously stated, there are but 681 leather-making establishments in the United States, and a number of these produce only sole leather, which is sold by weight and not on an area-measurement basis. While a few of the larger shoe factories might profitably use a leather-measuring machine in the cutting room, it is probable that 1,500 would be the maximum number of machines necessary to supply all demands in the entire country. These machines are of substantial construction and may be used for many years, so that the annual demand for new machines is not sufficient to attract new competitors in that field alone. Thus, while a single machine may determine the measurement of more than a million dollars' worth of leather per annum, competition between manufacturers of leather-measuring machines alone can not be depended upon to produce measuring devices of such accuracy as the unit price per square foot and total value of leather measured would demand.

Specifications and tolerances for practically all other forms of measuring devices have been prepared and promulgated by the members of this conference in the past few years. Similar action appears to be necessary in order to secure a proper degree of accuracy in the measurement of leather, and I would suggest that the representatives present from leather-producing and shoe-manufacturing States cooperate to that end.

While all who are interested in the subject should read the technologic paper to which previous reference has been made, a brief nontechnical description of the leather-measuring machines in common use, and of the methods employed in their test, is given herewith. It should be understood that, in measuring leather, the area is figured in square feet and fractions thereof not less than one-fourth of a square foot, the measurer ignoring remaining fractions of less than one-eighth and including, as an additional one-fourth square foot, any remaining fraction greater than one-eighth.

Hand racks.—Although used in few factories at the present time, for many years leather was measured by the use of a hand rack composed of four strips of wood joined together at right angles so as to form an oblong rack or frame, the inner edges of which usually measured 6 by 4 feet, thus covering an area of 24 square feet.

Small holes were bored through all sides of this frame at intervals of 6 inches, and strong cords were passed through these holes and stretched across the frame from end to end and from side to side, thus dividing the rack into squares each covering an area of one-fourth of a square foot.

In measuring with this device it is easy to determine the exact measurement of that portion of the leather which is covered by the quarter-foot subdivisions, but the measurer must estimate the area of the irregular-shaped edges or skirtings of the skin which can not be completely covered by the squares.

The accuracy of these racks may easily be determined by the sealer with a standard tape, and they may be sealed by stamping with the half-inch steel dies.

Pin machines.—The first leather-measuring machines which came into general use were the so-called "pin" machines, a few of which are still used, although none have been manufactured for some years. These may be described as a frame rotatable on a pivot or knife-edge at one end and attached at the other end by means of a cord to the mechanism of a suspended spring balance. The frame is composed of parallel wooden strips perforated at equal intervals. Through each of these perforations is suspended a metal pin having an eye or head to keep it from dropping entirely through the orifice. The frame is supported above a table made up as a grid of wooden strips extending perpendicularly to the pivot about which the suspended frame turns. The construction of the frame is so related to the length of the pins that the lower ends of all the pins stand at the same level and pass into the slots formed by the longitudinal strips making up the table, when no leather is on the table.

When all of the pins hang through the slots in the table, the weight of the pins is carried by the suspended frame, and the spring balance is in equilibrium under the load. If, however, a skin or side of leather is placed upon the table and the frame lowered so that it is parallel and close to the table, those pins below which any portion of the leather lies are raised, by contact with the leather, through the holes in the frame in such a manner that their weight is no longer carried by the frame. The frame being thus relieved of their weight, the spring balance which carries the outer end of the frame changes its reading proportionally to the number of pins which have been lifted, the several pins being so adjusted in weight that each exercises the same turning effort about the fulcrum pivot of the frame; in other words, the weight of the pins in each row is inversely proportional to the distance from that row to the axis about which the frame turns. The spring balance is graduated in a reverse direction and in such intervals that the readings are given directly in square feet of area.

In testing, the frame should first be carefully examined to see that none of the pins are bent so as to interfere with their passing freely through the orifices and that all are in proper position.

The frame should then be balanced with the pointer on the dial indicating the 0 mark. This may be accomplished by adding or removing balance weights, which usually consist of iron washers suspended upon a metal pin on the edge of the frame farthest from the fulcrum.

The machine may then be tested by placing 5-foot, 10-foot, and 15-foot standard test sheets alternately upon the machine in different positions, always at an angle with the rows of pins, so as to bring as many of the pins as possible into play, noting each reading upon the dial. Many of these machines are equipped with a 30-foot dial, although their capacity is limited by the area of the table of the machine upon which leather is placed while measurement is being determined. In such cases all graduations on the dial in excess of the actual measuring capacity of the machine should be eliminated by painting that portion of the dial. If the test is satisfactory, a paper seal should be placed on the dial or, if conditions are such that this will not adhere, a metal seal may be used.

Power machines.—As the saving of time is an important factor in modern manufacturing establishments, the hand rack and pin machine have been quite generally superseded by power-driven machines.

In construction, practically all of these machines are based on the principle that if, in an irregular area, uniformly spaced parallel lines are laid off over the entire surface, the area of the figure is given approximately as the product of the sum of the lengths of these ordinates by the constant distance between them. In all of the power-driven machines now in use the ordinates are measured by a series of gears which are rotated by engagement with pinions carried on the shafts of uniformly spaced narrow rollers, each gear being engaged only at such times as the corresponding measuring roller or wheel is raised by introduction under its periphery of the leather or other material to be measured. So long as the sheet of material is passing under a given roller, the corresponding gear is rotated and the amount of such rotation is proportional directly to the length of that straight line in the area which the measuring wheel has traversed. The sheet of leather or other material is propelled through the machine and under the measuring wheels by a power-driven roller which extends across the full width of the machine underneath the row of measuring wheels.

The travel of the several gears (or, in some cases, segments of gears), which have each moved through an angle proportional to the middle ordinate in the corresponding elementary strip of material, is totalized by a system of chains passing over pulleys mounted on levers, the lever system being so arranged that the contribution of motion due to the winding up of the individual chains on the drums of the measuring gears is transmitted in reduced amount, but in equal reduction for every chain, to a single rack or segmental gear driving a pinion. To the spindle of this pinion is fastened the pointer or indicator which shows the area of the material directly in terms of square feet.

In brief, then, the lengths of the several parallel ordinates are measured by the motion of uniformly spaced wheels, and the amount of motion of these several wheels is totalized by a lever system and

through a suitable rack and pinion movement is indicated upon a dial.

In testing, always make certain that the hand on the dial points to 0 before test sheets are used. The position of the hand can be changed, if necessary, by turning to the right or left the knurled nut or thumbscrew which is found on the adjusting block of the weight beam.

The pointer being at 0, pass test sheet through the machine at an angle of 15° to 20°, beginning at one end and gradually working up to the other, so that all gears will be brought successively into use.

Repeat the operation, using the different sizes of test sheets until the machine has been tested to its full capacity, observing whether the correct measurement is recorded upon the dial at every trial. You will readily note the failure of any particular gear wheel or segment to perform its function by observing the movement of the same. Should any of these gears fail to revolve when test sheets are passing through, the fault lies in the distance between the segmental gears and the pinions on the hubs of the measuring wheels. This can be readily remedied by means of the thumbscrews or adjusting nuts which control the lengthening or shortening of the space between the pinions and gear wheels or segments. Before adjusting see that there is not an accumulation of dirt on any of the measuring wheels, as this would have the same effect as leather passing between the feed roll and measuring wheels. In some types of machines these thumbscrews are situated on the back of the machines, while on others they are placed on the side nearest the operator. The segmental gears should be set as near to the pinions on the measuring wheels as is possible without touching.

If in using a test sheet an appreciable variation is shown on the dial when the sheet is passed through the machine at different points, as, for instance, if a 5-foot test sheet shows a gain when measured on one end of the machine and a loss when measured on the other end, it indicates that the scale lever is not correctly balanced, and the machine should be condemned for repairs.

If a uniform error, either in excess or deficiency, is shown when a test sheet is passed through the machine at different points, it shows that the adjusting block on the weight beam is not in proper position. This may be remedied by loosening the middle screw in the adjusting block and increasing the distance between the block and the fulcrum if the error is one of excess, or reducing this distance if the error is one of deficiency.

While it is well that the sealer should know something of the methods of adjusting these machines, he should, as a rule, refrain from attempting any but the most simple adjustments, such as that of the pointer on the dial or the distance between the gears and the pinions on the shafts of the measuring wheels. Paper or lead seals should be used in sealing machines of this type.

The following rules and regulations have been issued by the director of standards for Massachusetts under statutory authority, to be observed in the operation of leather-measuring machines propelled by power.

1. Never turn the machine backward.
2. Never pull the leather back after it has entered the machine.
3. Be sure to return the dial hand to 0 after measuring each piece.

4. In measuring skins or side leathers always feed the butt first into the machine.

5. In feeding wrinkled or baggy stock, check it sufficiently in the center, as it passes through, to allow its passing straight.

6. Keep the large gears as near the pinions on the measuring wheel hubs as is possible without touching. This is of the utmost importance, especially on thin stock.

7. Oil the clock spindle lightly; oil the wheels once in two weeks; oil the feed rolls every day.

8. Test the machine twice a day at least, with test sheets of known area and of different sizes.

9. The later types of power-driven machines—that is those having *whole* geared wheels rotating by engagement with pinions carried on the shafts of uniformly spaced narrow rollers—should never be operated at a speed greater than 55 revolutions per minute. Those having a segmental gear, instead of the whole wheel, may be operated at a maximum speed of 65 revolutions per minute. On account of the difference in circumference of the feed rolls this regulation is designed to assure approximately the same *surface speed* in operating all machines. No machine shall be sealed as correct if operated at a speed greater than that prescribed herein.

10. A copy of these rules and regulations shall be conspicuously displayed near each leather-measuring machine whenever such machine is in operation.

Observance of the foregoing rules and regulations serves to eliminate those errors which result from faulty methods of operation of power-driven machines. Other errors, the remedies for which may involve some changes in construction, still remain to be considered. As I have already pointed out, competition between American manufacturers can not be depended upon to bring about the changes necessary to secure greater accuracy and constancy in the readings of measuring devices of their manufacture. From information at hand, however, it appears that foreign manufacturers of leather-measuring devices are preparing to invade this field in the immediate future. There are already two distinct types of German-made machines in limited use in this country and, to be frank, both of these appear to show marked superiority over the machines of domestic manufacture. One of these German machines was included in a number upon which comparative tests were made, and showed a greater degree of accuracy and less variation in its readings than any of the other power-driven machines. Under these circumstances, uniform specifications, rigidly applied, may be absolutely essential in order that American manufacturers may successfully meet this threatened foreign invasion.

ANNOUNCEMENTS.

The Acting Chairman. The Chair announces the appointment of the following committees: Committee on resolutions, A. W. Schwartz, New Jersey, chairman; I. L. Miller, Indiana; J. M. Mote, Ohio; Charles M. Fuller, Los Angeles County, Calif.; and W. F. Steinel, Milwaukee, Wis. Committee on publicity, George M. Roberts, District of Columbia, chairman; H. N. Davis, Vermont; and William Foster, Springfield, Mass. Committee on nominations, W. F. Cluett, Chicago, Ill., chairman; A. A. Greer, Michigan; W. T. White, New York; and A. W. Schwartz, New Jersey.

Mr. Schwartz of the committee on resolutions desires to request that any member of the conference who has a resolution to present kindly put it in writing and have it in the hands of the committee

as soon as possible, so that the committee can consider the resolutions and be prepared to present them to the conference at the proper time.

Mr. Holbrook. Copies of the report of the committee on specifications and tolerances on tolerances for fabric-measuring machines are now available. Therefore the opportunity is presented to study these before this subject comes up later.

ABSTRACT OF REPORT OF REPRESENTATIVE OF MASSACHUSETTS ASSOCIATION OF SEALERS OF WEIGHTS AND MEASURES.

By John E. Davis.

Mr. Davis presented the greetings of the association, and directed particular attention to amendments made by the association to the specifications for liquid-measuring devices adopted by the conference. These require the use of positive stops for each quantity which the device is designed to deliver, a plain statement of the maximum capacity and the value of each intermediate stop, and in the case of piston-type devices, a clear automatic indication of the total number of gallons delivered up to at least 15 gallons. He explained the reasons for these changes and asked the indorsement of them by the conference.

(It was moved and seconded at this point that the conference adjourn. The question was taken, and the motion was agreed to.)

(Thereupon, at 4 o'clock p. m., the conference adjourned to meet at 10 o'clock a. m., Thursday, May 25, 1922.)

FIFTH SESSION (MORNING OF THURSDAY, MAY 25, 1922).

The conference reassembled at 10.20 o'clock a. m. at the Bureau of Standards, Dr. S. W. Stratton, chairman, presiding.

PROPOSED UNIFORM ADOPTION OF THE 2,000-POUND TON FOR COAL.

Mr. CLUETT. Mr. Chairman and gentlemen, I have received a telegram from the National Retail Coal Merchants' Association, in which is announced the passage of a resolution requesting that a 2,000-pound ton be made uniform throughout the United States. In order to get this properly before the conference, I would like to read the telegram at this time:

CHICAGO, ILL., *May 22, 1922.*

WILLIAM F. CLUETT,
Raleigh Hotel, Washington.

Following resolution adopted Saturday, May 20, by National Retail Coal Merchants' Association:

Whereas much confusion exists from lack of uniformity in weights and measures of coal in and between various States, 27 States specifying 2,000 pounds as constituting a ton; 1 State, that of New Jersey, providing for the use of both the gross ton of 2,240 pounds and the net ton of 2,000 pounds; 18 States not defining the number of pounds in any way; and the United States Government in all its purchases, as well as the States of Maryland and Pennsylvania, employing the gross ton; and

Whereas there is an annual conference of weights and measures officials of the United States meeting May 23–26 at Washington: Therefore be it

Resolved, That we, the delegates to the National Retail Coal Merchants' Association, this day in convention assembled, urge that the delegates to the above-mentioned conference on weights and measures take steps leading to the adoption by Congress of the 2,000-pound unit of weight as applying to coal; and be it further

Resolved, That member organizations in the States not now recognizing 2,000 pounds as a legal ton be urged to foster legislation which will make such quantity of 2,000 pounds the recognized unit of sale.

Letter follows.

HOMER D. JONES,
President, American Retail Coal Merchants' Association.

I would like to have this referred to the resolutions committee, in order that it may be taken up and the consensus of opinion of the conference obtained.

The CHAIRMAN. It will be so referred.[1]

Mr. MARONEY. I want to say that in Connecticut we have taken care of that by having it specifically stated that coal shall be sold by avoirdupois weight only, and the tons have been eliminated.

WHOLESALE DELIVERIES OF GASOLINE, WITH SPECIAL REFERENCE TO VEHICLE TANKS.

By W. T. WHITE, *Director, Bureau of Weights and Measures, State of New York.*

The following facts and statements are presented to you as a result of a survey made of the methods employed in the wholesaling of gasoline, particularly in New York State. This investigation was made to determine the general practices in the sale of gasoline, special

[1] See page 124 et seq. for proposed resolution and discussion thereon.

attention being given to the four following methods: First, by buckets from truck or wagon tanks; second, by gauge stick in storage tank; third, by barrels or drums; and fourth, by use of compartments as measures.

In connection with each of the above four methods, the following factors had to be considered: Accuracy, ease of checking by purchaser, safety, speed, attitude of oil companies, attitude of weights and measures officials, attitude of station operators. Special emphasis had to be placed on the first factor, namely, the accuracy feature, for a number of other factors again enter—accuracy of calibration, permanency, filling (as foam, carelessness, etc.), draining, spillage, and correct tally system.

A total of 74 separate observations were made in about 35 cities and villages. The tanks examined were manufactured by six different concerns. A total of 115 tanks were examined, and while I am on this subject I may say that the largest capacity compartment found was 660 gallons and the smallest was 45 gallons. There were the regulation Heinz varieties, namely, 57, between the extremes just mentioned. Only 33 of these 115 tanks had a definite capacity of either 100, 200, 300, 400, or 500 gallons. The remainder had odd capacities, such as 102 gallons, 153 gallons, 201 gallons, 310, 420, 511, and 615 gallons.

To make general statements as to tank deliveries, I will state that the retailer was generally found to be very lax in his observations and methods of purchasing, generally taking the deliveryman's word as to the capacity of tanks, though some did check up by gage sticks supplied by the manufacturer of the underground tank they were using or by the use of a homemade gage stick notched off by themselves.

Very few station operators or gasoline retailers did take the time to make observations to determine whether or not the compartments of the tanks were filled, nor did they make special effort to observe whether or not buckets were properly filled or drained when this method was employed. Another observation made by the inspectors conducting the survey was that it is generally necessary for the wholesaler when filling the delivery tanks to have them in a level position. In some cases specially built platforms are used for this purpose, yet it was found that the draining of the tank compartments requires that the wagons or trucks be on at least a slight incline toward the drain opening of the compartments in order that a complete drainage may be made.

Observations were made to determine just how completely compartments would drain under normal conditions, and the following notations were made: In the first instance, there was found to be a remainder of 1 pint; in the second instance, one-fourth pint; in the third, 2 quarts; in the fourth, 10 cubic inches; and I feel safe in saying that as an average, there is about one-half pint left under the very best conditions.

As opposed to delivery by compartments or tanks, there is a great deal of bucketing; that is, delivery by supposedly definite standard measures, usually of 5-gallon capacity. Some retail dealers prefer this method as a precaution against dishonest drivers, claiming that it affords a better means of checking amounts delivered. It was found that the wholesalers as a rule instruct the drivers to hose out

all full compartment purchases, and to bucket out in case of less than full compartment purchases, or, where requested to do so, to bucket the entire purchase. It has often been suggested that this method entails much spillage. However, we found that this is hardly true; but it was noted that the drivers do not wait for complete draining of cans, and our investigation shows that there is often left from 5 to 15 cubic inches of gasoline in the buckets. However, by far the greatest majority of wholesale dealers object to the bucketing method, claiming that the hosing or compartment method is safer, speedier, more accurate, etc. It is also a fact that some cities will not allow the bucketing of gasoline, and I will mention now that New York City will not allow the sale of gasoline by either buckets or tank deliveries, but does require it to be delivered in barrels or drums.

As to speed, tests were made and the following observations are presented: By the bucketing method the average shows a rate of 6 gallons per minute as against 15 to 20 gallons per minute by hose, or about two to three times faster by the hose method. It was also observed that in a large number of cases the buckets in use were found to be dented.

Another factor in the sale of gasoline might well be referred to at this time. Referring to the expansion of gasoline, it is claimed that there is a variation of about 1 per cent plus or minus, on a 20-degree change in temperature, taking 60° F. as a standard. Tests also showed that where the average outside temperature was 70 to 75° F. the gasoline in the tank underground was about 58 to 62° F.

Now with reference to gage sticks, we found some being used with more or less accuracy. However, in other cases various readings were obtainable, depending upon the method and care exercised in inserting the sticks, which resulted in possible variations of from 10 to 20 gallons. In one case the graduations were 40 gallons per inch on the stick.

The data obtained relating to the drum or barrel method were furnished by Commissioner Holwell, of the mayor's bureau of weights and measures of New York City. Only drums or barrels are used in New York City, the city fire department being a factor in this case, as the regulations forbid the transportation of gasoline otherwise than by steel drums. These drums have a capacity generally of approximately 55 gallons gross. In every case, however, about 1 gallon is drained off after filling to allow for expansion so that generally they hold 54 gallons net. This system is looked upon with favor by practically all concerned in New York City, the most important reason being, I presume, the safety feature. The average time for emptying a drum is 4 minutes, and to this must be added one minute for making connections for drainage.

It will be remembered that the occasion of this investigation was that the conference desired the committee on specifications and tolerance first to decide whether or not tank compartments might be used as measures for the wholesale deliveries of gasoline, and second, if such a method was found desirable, to prepare specifications and tolerances on these vehicle compartments, so that the interests of the sellers and buyers might be adequately safeguarded.

Upon the results of the above investigation, the question first propounded is, in the opinion of the committee on specifications and tol-

erances, to be answered in the affirmative. In other words, the committee believes that if proper specifications and tolerances are prepared and adopted the delivery of gasoline by whole compartments, using the compartments as measures, will be a satisfactory method of sale which can safely be approved by the weights and measures official. One of the indispensable requisites, of course, would be the testing and sealing of these compartments by the weights and measures official.

As a member of the committee I may say that the committee would like to get an expression from the conference as to whether it is the consensus of opinion of the conference that tank compartments may be so used. If our conclusion meets with the approval of the conference, then the committee will proceed during the coming year to prepare specifications and tolerances for these vehicle tank compartments.

DISCUSSION OF ABOVE PAPER.

The Chairman. You have heard this very interesting paper bringing up a subject in which we are much interested. Mr. White has asked for an expression of opinion on one or two points.

Mr. Fuller. I know that the use of tank compartments as measures, especially on the Pacific coast, is becoming almost universal, and I think it would be a good idea if the committee on specifications and tolerances would look into this matter and prepare some adequate data for us to act upon at the next conference. I would like to put that in the form of a motion.

(The motion was seconded.)

Mr. Barron. Investigation made in the past two years in Minnesota proved to us that tank compartments and tank wagons when properly made and used under proper conditions are safer, more accurate, and more efficient in every way than the present little 5-gallon tin buckets with which we have had so much trouble.

The question of drainage is easily taken care of by putting two or more openings leading to the drainage pipes, so that whichever way a tank inclines it is bound to drain. The pipes themselves can be inclined and drained under everything but abnormal conditions. With a definite line to draw to, a tank of large capacity can, in my opinion, be made to deliver more accurately than the present methods. With permanent construction we get away from dents and bulges with which we are so familiar in the 5-gallon can.

I would ask the gentleman if he would amend his motion to the effect that the committee be instructed by this conference to proceed to draw specifications for old tank compartments now in use and more rigid specifications for new equipment, which can easily be built at little additional expense to meet full requirements.

Mr. Fuller. That amendment is agreeable to me.

Mr. Goodwin. This is a very perplexing question and of vital interest in my State. We have no regulation now, practically speaking, so that the man who buys gasoline from tanks is not protected. I have some doubt about the accuracy of compartment tanks, but with great care I think it is possible to get along with them. I can readily see how a tank delivery can be made so that it will fully drain. I think an outlet from either end of the compartment will perform that office.

I am very glad to hear the report on this matter, as I was very anxious to get something that would be of benefit to my State.

(The question was taken, and the motion was agreed to.)

ADDRESS BY HON. ALBERT H. VESTAL, CHAIRMAN, COMMITTEE ON COINAGE, WEIGHTS, AND MEASURES, HOUSE OF REPRESENTATIVES.

Mr. Director, delegates to this conference, ladies and gentlemen: I assure you now in the beginning that I am going to speak under the five-minute rule. I know that will meet with your approval.

I want to say one or two things relative to this Bureau of Standards, one of the great activities of the Government. The truth about the business is that the people of the country do not really know what the Bureau of Standards is. When I say that, I think I say it advisedly, that the general public really does not know much about this great activity of the Government, and the fact is there are many Members of Congress who do not know much about it. By that I do not mean that they could not learn something about it, but they are busy in other lines.

This bureau has grown up here, and they really have not paid the attention to it that they should, and therefore they do not know really what it means to the Government. They have learned more in the last few years, during the war, of the value of the work of this bureau, and I think they are beginning to realize its importance, and will in the future pay more attention to it than they have in the past.

I am a great believer personally in standardization. There are two or three classes of people that differ with us along this line. We have one class of people in the country that do not believe in standardization at all. The fact is they seem to feel proud of the fellow who is able, for instance, to manufacture or have manufactured a container that holds 13 quarts so constructed that it looks as though it holds 16 quarts, and to put it over on the public. We have one class of people who think that that fellow ought not to be interfered with at all because he is a bright fellow—and he is a bright fellow. In a great many instances measures that tend to deceive and defraud the people are being sold openly in the market.

Then we have another class of people that believe in standardization, but are afraid of Federal legislation. They are afraid that it might take away from the local weights and measures people of the different States a lot of their rights. They are afraid that we might build up a great Federal machine that would interfere with the States, and that is one thing that we must be very careful about.

My opinion about it is that we ought to have Federal legislation upon all of these great subjects of weights and measures; we ought to have Federal legislation, but the enforcement provisions of those measures should be left to all the States in the Union. When you do that you get away from this proposition of building up a Federal machine, a centralized authority. But let us get the authority for standardization, and let the enforcement provisions remain with the weights and measures officials in the different States. It seems to me that would get away from the objections of the people that are afraid of too much centralization of power.

I said a moment ago the people were beginning to realize the need of standardization and the importance of this great bureau. I have three or four letters from which I want to read a few lines showing the different attitudes of the manufacturers of this country relative to a bill that was introduced by Colonel Tilson in 1917, before I became chairman of the Coinage, Weights, and Measures Committee—a bill to regulate and control the manufacture, sale, and use of weights and measures and of weighing and measuring devices.

I understand from the director of the bureau that when this bill was first introduced it did not meet with the approval of the manufacturers—at least there was not any effort made by the manufacturers to put this bill across and have it become a law. The manufacturers seemed to be afraid of it. The time has come now when nearly all the manufacturers of the country are writing me insisting that this same bill, with practically no changes in it, be introduced and passed as soon as possible.

I have a letter here from the Scale and Balance Manufacturers' Association that is very interesting. They say:

A committee consisting of Mr. Hinsman, president of the Howe Scale Co.; Mr. La Forge, manager of sales for the Fairbanks Co.; Mr. Williams, secretary, and the writer, president of the Scale and Balance Manufacturers' Association, recently called on Dr. S. W. Stratton, Director, Bureau of Standards, in connection with certain legislation which we suggested be passed in the interests of the manufacturers and users of scales and weighing machines. The measure which we stand prepared to support is one practically covered by what was known as the Tilson bill, No. 2878, April 13, 1917. At that time the Scale and Balance Manufacturers' Association was not organized and the manufacturers now members of the association did not support the bill. As an association we now stand ready to give it support, and as our association consists of 75 per cent of the scale producers of the United States we will be of some assistance in getting the bill passed.

It seems as though there has been quite a change of attitude toward Federal legislation along this subject. The letter continues:

We might explain in passing that the object of this bill is to secure a Federal enactment which will establish tolerances, specifications, and serialization, and take the matter out of the hands of the bureaus of weights and measures of the various States, which bureaus are not properly equipped with the necessary apparatus and have not the scale knowledge to decide on all the details necessary to the proper manufacture and use of scales and weighing machines.

I am not going to say that the local weights and measures people of the different States are not properly equipped or do not have scale knowledge sufficient to pass upon these propositions. But what may be made a standard or a tolerance in one State may be different from a tolerance or a standard in another State, and that is the trouble with the whole business.

I have another letter here that points out that very thing, from a manufacturing concern at Chicago:

As scale manufacturers, we are particularly interested in the success of the Tilson bill. We are at this time in correspondence with three different States, West Virginia, Pennsylvania, and Massachusetts, in regard to one of our scales which has met the approval of the department of weights and measures in nearly all of the States. In the three instances referred to, the matter in question is not the same, and in neither of the three States are the same features being disputed. You will see by this how necessary it is to have scales standardized so that a scale that is acceptable in the State of Pennsylvania will also be acceptable in the State of California. Under present conditions we must take up the matter with each State independently, and it is not only expensive but causes delays and works great hardships on our clients.

So the whole matter may be summed up in this, that it is not a question of the scale knowledge of the different local weights and measures people of the States in this particular instance, but it is a question of getting a standard in one State that will be the same in every other State in the Union.

This may be a little far-fetched, but to my mind there is just as much common sense in having the State of Massachusetts, for instance, enact a statute that 95 pennies will make a dollar, and the State of Connecticut that 98 pennies make a dollar, and the State of Rhode Island that 100 pennies make a dollar, as it is that one State shall say this certain thing shall be a standard, and a neighboring State say that another thing shall be a standard. It seems to me there is just as much sense in one thing as in the other. I do not understand why we can not by Federal legislation make a standard for everybody and then make everybody live up to it.

There has been in the past the question of constitutionality involved in this, but that is all eliminated now. The question has not come up since I have been in Congress. I am sort of a baby Member. I have not been here very long. But the first question that came up was the question of constitutionality of these measures. They first thrashed out on the floor whether Congress and the Federal Government had the right to do these things or whether it was a matter entirely for the States. I think that question was practically settled when the standard barrel act was before Congress. That proposition was thrashed out and decided at that time, and the authority of Congress to pass Federal legislation of this kind has never again been questioned.

So now it is a question merely of educating the people to this proposition of standardization. You would be surprised at the attitude of some Members of Congress relative to this matter. As I said a moment ago, they feel that if some fellow or some State can put it over another State it is all right. But it is all wrong. It does not make for economy; it does not make for efficiency. If we have a Federal standard law standardizing weights and measures, it will not only make for efficiency, but it will make for economy, and it will make it much easier for the local weights and measures people throughout the United States to enforce the law, because in every city they will know exactly what the standard is.

I said it makes for economy. It does, because it increases the territory of the manufacturer for the sale of his machine or his scale or his sacks or his containers, whatever they may be. For instance, I am trying my best now—it is not a question that comes directly under this bureau—but I am trying my best to get a measure passed in the House standardizing certain hampers and baskets. It was really a revelation to Members of Congress when I brought in on the floor of the House, during the general discussion of the measure, the great number of the different sizes and kinds of containers that are being used in the United States. We have something like 74 different sizes of hampers, and under the bill that we are trying to pass we eliminate 68 of them. Just think about that. Sixty-eight are eliminated. You can see what it means to the manufacturers of hampers. They do away with all these forms and they make a certain number of sizes which will take care of all conditions. It makes a standard for them throughout the country so that a manufacturer

of hampers in the State of New York, for instance, can ship to any State in the Union. As it is now, in some of the States manufacturers can only make certain hampers for certain things because they would be of no value in any other State. So it would increase the territory in which the manufacturer may sell his product.

It seems to me that in the elimination of these unnecessary sizes, the consumer in the end is going to be the one to profit, because he will get the correct weight, he will get the correct measure, and if the manufacturer has a standard so that he may manufacture cheaper that ought to be reflected in the price to the consumer and help all along the line.

I wanted to say these few words to you about my opinion on this great bureau and the work that it is doing. There is not any question in my mind but that these conferences that are being held here are among the most important conferences that have been or will be held in the city of Washington, because you get together and you talk about these things. The fact is that when you talk about them and discuss them, in every instance you practically get together upon these propositiins, and you go out and you do not have any fights over the country relative to these things.

Gentlemen, I said I was going to talk under the five-minute rule, and I am going to yield back the rest of my time to the next speaker. I thank you very kindly.

The CHAIRMAN. I am very sure we are glad to have heard what Mr. Vestal has said. He has touched upon many points that we have been discussing from time to time, especially that point of the constitutionality of Federal legislation. That is one which always comes up and on which we welcome any light whatever that can be secured.

It is gratifying indeed to know that we have a chairman of the Coinage, Weights, and Measures Committee who has so much interest in this work. I am glad to have heard what he has said about this conference. He is right. It is even stronger than he suspects. I have been astonished more and more each year at the way in which you come together and discuss these things, get information and take notes, and go back home taking with you useful information to help you in the exercise of your duties. That was the original object of the conference.

I am sure I express the feeling of every one of you when I say that we are sincerely grateful to Mr. Vestal for coming here this morning. We thank you very much.

PENNSYLVANIA SERIALIZATION LAW.

By W. B. McGRADY, *Chief, Bureau of Standards, State of Pennsylvania.*

Mr. Chairman, Mr. Congressman, ladies and gentlemen, my talk is sandwiched in a very peculiar position. When I was asked to prepare this paper I prepared two copies; I had a carbon copy in my pocket last night, and it seems that Congressman Vestal stole all my thunder.

Many of you will recall that the paper read by myself at the last conference stated that the Pennsylvania Legislature, just then adjourned, had made four amendments to the weights and measures

laws then in force in Pennsylvania. I am more than pleased to inform you that the amended sections are functioning to the entire satisfaction of the Pennsylvania inspectors of weights and measures. One of those amendments I will explain later on.

During the same session of the legislature, two new laws were placed on the statute books: Act 414, which gave the bureau of standards eight additional State deputy inspectors; and Act 187, the so-called Serial Bill, to regulate and control the manufacture, sale, offering for sale, giving away, and use of weights and measures and of weighing and measuring devices, in the Commonwealth of Pennsylvania; providing for the approval and disapproval of such weights, measures, and devices by the bureau of standards; and prescribing penalties.

I believe it is customary for one representing a State at these conferences, to give some expression of his views on current questions relative to weights and measures. At this time, I can report progress for five years more for Pennsylvania, as the electors of Pennsylvania, on the 16th instant, renominated James F. Woodward for the office of secretary of internal affairs.

The standing of Pennsylvania in weights and measures is not generally realized. I believe the department of internal affairs, under which the bureau of standards operates, is one of our most important State agencies and that the strengthening and broadening of its work should continue in every particular that will tend to aid the betterment of honest weights and measures. Secretary Woodward has taken a great interest in weights and measures work, and is very much enthused; always ready to arbitrate any questions that may arise and is familiarly known as "Pennsylvania's 16 ounces to the pound secretary." You surely know what that means. During the period I have served under Mr. Woodward as chief of the bureau of standards he has given me *carte blanche* with only one admonition—a square deal for everyone.

The Pennsylvania bureau of standards has pledged itself to a definite program of work, and is endeavoring to achieve real results; it can succeed completely only when it has the earnest cooperation of all the State, city, and county inspectors of weights and measures in Pennsylvania, along with the aid that the manufacturers of weighing and measuring devices can offer through their various agencies. It can not do everything that everyone wants done. It can not always be right. It can not always be popular, but it can always be honest and fearless. And I ask inspectors, merchants, and manufacturers alike before you criticize look into the mirror and ask yourself whether you have done your full share; whether you are in possession of all the facts or just one side of the story; whether the bureau did not act with good judgment; and whether it is fair for you to condemn when others are doing their best in an organized, efficient, and loyal manner to promote better weighing and measuring devices for our State.

Getting down to the title of this paper on the program, I will state that I am very well pleased with the position that approximately 95 per cent of the manufacturers of weighing and measuring devices have taken relative to Act 187. There have been some few objections, which will ultimately be worked out to the satisfaction of all concerned; for my mind is open to any good suggestion that may be of-

fered. There is safety in consultations—many minds are better than one. There will be no hasty or ill-considered official act on my part to mar a clearly balanced survey of every situation. I have waited, studied, and listened until I am convinced that Act 187 will demonstrate that manufacturers of weighing and measuring devices, and inspectors of weights and measures can cooperate with each other instead of hampering the activities of each other.

It is not the intent or purpose of the sponsors of Act 187 to impose any hardships, added expense, or to hinder, or put to any annoyance the manufacturers of weighing and measuring devices. I know, and every level-headed inspector knows, that most manufacturers who place their products on the market want them to function properly, just as much as the person who pays his cash for the instrument. The chief argument which seemed to have been in the minds of the lawmakers in framing Act 187 was that the promiscuous sale of faulty weighing and measuring devices in the State of Pennsylvania must be stopped, as it was detrimental to the best interests of approximately 9,000,000 inhabitants of the State. It has already stopped the sale of double-end and tall dry measures which were shipped into Pennsylvania from other States.

We have disapproved cardboard ice-cream containers marked $6\frac{1}{16}$ fluid ounces, and others of like character; oyster pails holding approximately 50 cubic inches, made to resemble a liquid quart; graduated liquid measures and tin liquid measures that a pressure of thumb and forefinger would dent just as deep as you wished; scales that weighed 15, 16, or 17 ounces for a pound, just as the spirit moved them; counter tacks that a former attorney general ruled were linear measures. Hundreds of various baskets and hampers have been tested, and we have found round stave baskets marked "$\frac{7}{8}$ bushel" that only contained 24 quarts; 10, 12, 14, and 16 quart peach baskets that were from 16 to 64 cubic inches in deficiency; hampers that were both long and short; splint baskets that ran anywhere from one pint to one quart in deficiency; and many other types of baskets that were either plus or minus, as well as many other faulty devices too numerous to mention. All these were formerly permitted to be sold in Pennsylvania under the existing laws.

Getting back to the manufacturers who were asked to submit their products either by models of small sizes or by cuts, blue prints, or specifications, I am sorry to state that a few refused to submit their products. At this time I do not think it would be amiss to say that if any of those manufacturers have a representative here I will be obligated to them if they will carry the tidings back to their concerns that the Pennsylvania bureau of standards is not worrying whether they submit their products or not, but when Act 187 gains momentum their sales agents in Pennsylvania may do the worrying; for if any laws pertaining to weights and measures can be willfully disregarded, then honest weights and measures are in peril, for you know that law is the will of the people and written law is the result of public sentiment. I will cooperate to the limit in anything which promises to make it most difficult to violate the law. The Pennsylvania bureau of standards is committed to the continued extension and proper enforcement of the weight and measure laws, but with a common-sense interpretation of the same, because we have

reached the stage where technicalities must be pushed aside and practical policies instituted.

Serialization of weighing and measuring devices is not new; it was not born over night—as far as I know, it was first brought to light in New York City in the year 1912. During the second session of the Sixty-third Congress, H. R. Bill No. 16876 was introduced on May 27, 1914, by Mr. Ashbrook, and on January 18, 1916, Mr. Ashbrook introduced H. R. Bill No. 9323 during the first session of the Sixty-fourth Congress; those bills were identical. I will, for the sake of brevity, dwell only on one section of those bills; namely, section 7, which reads in part as follows:

> That the district courts of the United States shall have jurisdiction of all offenses under this act committed within their respective districts, and it shall be the duty of each United States district attorney to whom satisfactory evidence of the violation within his district of any of the provisions of this act shall be presented by any duly authorized weights and measures official of the United States, or of any State, Territory, or the District of Columbia, to cause appropriate proceedings to be commenced and prosecuted in the proper court of the United States without delay for the enforcement of the penalties provided for herein.

Later, on February 20, 1917, another serial bill was introduced in the second session of the sixty-fourth Congress by Mr. Tilson; namely, H. R. Bill No. 20996, to control and regulate the manufacturing, sale, etc., of weights and measures. I will again pass over the various sections, except section 11, which reads in part as follows:

> That it shall be the duty of each United States district attorney to whom the Secretary of Commerce shall report any violation of this act, or to whom any weights and measures officer or agent of any State, Territory, or the District of Columbia, shall present satisfactory evidence of any violation, to cause appropriate proceedings to be commenced and prosecuted in the proper courts of the United States, without delay, for the enforcement of the penalties.

Act 187 of the laws of Pennsylvania is a verbatim copy of H. R. Bill No. 20996 except section 11.

As I stated before, I will take up one of our amendments passed in the last session of the Pennsylvania Legislature; namely, Act 444, of July, 1913, section 3 of which reads in part as follows:

> Each person who shall directly or indirectly, or by his servant or agent, or as the servant or agent of another, violate any of the provisions of this act, shall be guilty of a misdemeanor.

Under this section, before it was amended last year, if an inspector had occasion to enter information against any offender he would have to enter the information in the county courts. Those courts are always congested, and at times cases would be continued for months. What would happen under sections 7 and 11 of the United States bills, that met defeat in Congress? Now in Pennsylvania we have a summary conviction law, which simplifies matters; if the defendant is not satisfied, the courts are open for his appeal.

It is not my intention to criticise our esteemed chairman or the National Bureau of Standards. I recognize them as the fountainhead of weights and measures. In sponsoring Act 187 for my State I did so that Pennsylvania might follow ideas and suggestions that emanated from Washington, but I do not agree to the penal sections of the bills just quoted, in which the United States district courts would have entire jurisdiction over us and take away our police power. I will here prophesy that if sections like section 11 of the

Tilson bill are ever written into our laws there will not be many minor violations noticed by the average inspector in the field, for a violation of to-day will almost be forgotten when called for trial on account of the congested conditions already noticeable in the United States district courts. Again, a merchant who believes he is within his rights, may be guilty of some minor violation of the weights and measures laws. Is it fair to that merchant, who has toiled for years to acquire the little business he now owns, to be brought into the United States district court on some technical violation of the weights and measures laws which will probably take him miles to the town where the United States courts are sitting, with the added expense of attorney fees attached to such cases, when 99 per cent of such cases can be straightened out before your local alderman or magistrates and justice satisfied?

Relative to sections 7 and 8, of Act 187, there has been some slight criticism. Section 7 reads:

> The Bureau of Standards shall register and give a serial number to each type of weight or measure or weighing or measuring device submitted and approved as provided in this act, and shall issue, from time to time, descriptions of such approved types, giving serial number of each type, copies of which shall be furnished to all weights and measures officials.

Section 8 reads:

> From and after one year after this act takes effect, it shall be unlawful to manufacture, offer or expose for sale or sell or give away, for use in trade or commerce, or to use in trade or commerce, any weight or measure or weighing or measuring device which does not have cast, stamped, etched, or otherwise marked thereon, in such manner as may be prescribed by the rules and regulations authorized by this act, the name of the manufacturer and the serial number of the approved type to which it belongs: *Provided, however,* That, whenever it shall appear to the satisfaction of the Bureau of Standards that any type of weight or measure or weighing or measuring device is such as to render it impracticable to mark it as required by this section, the said bureau shall furnish a certificate to that effect to any manufacturer applying for the same, and such weights and measures and weighing and measuring devices need not be marked as required by the provisions of this section.

Some inspectors have written to me that they are in favor of standardization without the serial number. Well, you may as well not bother about standardization without a designating mark for the inspector in the field to follow.

Another suggestion came from a manufacturer to send out bulletins to the inspectors of what is approved and what is disapproved. A happy thought while it lasts—but I am inclined to believe this method would transform a good field inspector into a careless filing clerk and curtail his efficiency as an inspector of weights and measures. This idea would be a happy solution if the products of the John Brown Scale or Measure Co. were all approved or disapproved. A letter would inform the inspector and he could carry this in his head. But suppose the John Jones Scale or Measure Co. submitted 25 different types, and 15 were approved and 10 not approved. This would necessitate the inspector to carry the John Jones bulletin, and many more, to determine what to inspect and what was not approved.

Another thought on this: In some cities and counties when the officials appointing inspectors of weights and measures go out of office—sometimes on account of political differences—many times the inspectors "lose out" and new men take their places. These would then have to go through this mass of bulletins, whereas a scale or

measure with a number and stamp of approval would be sufficient to inform them that the scale or measure was subject to inspection.

In defense of a serial number of some type or other, I would like to ask, "Why does Uncle Sam print and issue all his paper money in series?" "When awarding medals of honor to his boys who made good 'over there,' why does he describe them as follows: 'Sergt. John Scale, Co. A, 110th U. S. Infantry, 55th Brigade, 28th Division'?" "Why do all the States require a serial number for automobiles?" "Why do you number your bank checks?" "Why are policemen or street-car conductors given numbers in sequence?" One answer to all—to get the number before you, in case you need it, and if there were no numbers to designate the above-mentioned you would at once know there was something radically wrong.

Another question came up from the manufacturers' side, but, I am delighted to state, from only a very small number; namely, the serial number would add to the cost of production. No doubt of this, but the added cost is not as great as they claim. I have made inquiries and can say that the cost would not be more than from 1 cent to 7 cents on each scale, according to the output of scales and the manufacture or purchasing of transfers, escutcheons, etc. But the manufacturers must realize that the merchants and consumers must be protected, and the percentage of protection will be far greater when buying or selling over a standardized weighing and measuring device than over the many faulty devices now in use.

Some manufacturers complain, and I believe justly, that if other States enact laws and follow in the footsteps of Pennsylvania, as Pennsylvania has followed New York City, and make it mandatory that their serial number must be placed on weighing and measuring devices, there will not be room on a scale or measure to place all the letters and figures required, unless the manufacturers will make each State's consignment separate. Personally, I stand with the manufacturers for a universal seal, stamp, or device that will inform the inspector in the field just what he may seal; this stamp, seal, or device to be recognized from coast to coast. I believe this can be accomplished, either by giving this over to the National Bureau of Standards, or by a meeting of the scale and other manufacturers and State superintendents and inspectors from our larger cities, although I can readily see a drawback to the last suggestion, but not of a serious character.

Some inspectors fear that the U. S. Bureau of Standards will eventually have a bill introduced into Congress, with the backing of a powerful committee from the manufacturers of weighing and measuring devices, giving the U. S. Bureau of Standards supervision over the inspectors' work. Personally, I believe the U. S. Bureau of Standards is the proper place to standardize weighing and measuring devices, but to stop there. The penal sections, already cited by me, of bills that failed to meet the approval of Congress in 1914, 1916, and 1917, if placed in any new proposed legislation by the U. S. Congress, should meet the same fate as the Ashbrook and Tilson Bills. And it would not be out of place for you gentlemen who are inspectors of weights and measures to keep in touch with and procure copies of such proposed bills, as the phraseology may be such as would lead you to the top of the mountain and have pointed out to

you the promised land of ideal laws of weights and measures that lay in the valley below, but as you retrace your footsteps you may discover that you are only a figurehead inspector of weights and measures shorn of your powers. Consult your Congressman on those bills—he perhaps may be deeply engrossed with other bills pending in Congress, and give the bills we are vitally interested in only a passing glance. Explain your views regarding the penal sections, and you may rest assured that State rights and other influences will keep those sections out of any new legislation.

Before closing this paper, I have a thought that I would like you as inspectors of weights and measures to ponder over; that is, of secondhand dealers and repairmen of scales, etc., who make a specialty of repairing all kinds and makes of scales—a sort of cure-all; if one dose does not cure, bring back the scale for a second dose. I believe there should be some sort of a registration whereby the inspectors of weights and measures could compel these repairmen and secondhand dealers to register, the same as plumbers, electricians, stationary engineers, and other craftsmen that are now all compelled to register in various cities and counties. The form of registration I have in mind would not apply to any manufacturer of scales, his agents, salesmen, or service men. And while on this subject another idea presented itself; namely, that no inspector of weights and measures should be allowed to solicit or deal in any shape, form, or manner in weighing or measuring devices during his term of office.

HISTORY OF LEGISLATION IN RE APPROVAL OF TYPE.

By F. S. Holbrook, *Bureau of Standards.*

Mr. Chairman, Mr. Vestal, and members of the conference, after I heard Mr. Vestal speak here this morning I concluded that Mr. McGrady's situation on the program was the most unfortunate that could be conceived, because anyone following as fine a speaker as Mr. Vestal is always at a disadvantage. But after hearing Mr. McGrady's paper I have concluded, in fact, that my position on the program is even worse than his, because while Mr. McGrady claimed that Mr. Vestal had stolen some of his thunder, they both have stolen all of mine.

However, I will speak briefly on the subject contained in the title and then I would like to say a word or two in relation to what Mr. McGrady has had to say, because I think he misunderstands the section of the Tilson bill which he has criticized.

Federal approval of type of apparatus, the subject of this paper, may be stated to be, in brief, the principle that the examination of the design of apparatus to be used in commercial transactions involving weighing and measuring should be made and the design approved by the United States Government, reserving to the State and local governments the power to test and seal commercial apparatus, to enforce all State laws and local ordinances in regard to accuracy of apparatus, to regulate the manner of sale of commodities, to detect fraudulent practices, to prosecute offenders, etc.

For a considerable period of time several years ago there was a great deal of discussion concerning Federal approval of type of com-

mercial weighing and measuring apparatus and a great deal of sentiment favorable to the adoption of this system in the United States. There was considerable agitation of this subject, bills were introduced into Congress, hearings were had before the Committee on Coinage, Weights, and Measures of the House, and at one time a favorable report on one of the bills was made to the House of Representatives. This agitation continued up to the time of the war. Then, very properly, legislative matters such as these were promptly forgotten, and for some time only matters concerning the successful prosecution of the war received the serious attention of Congress. After the conclusion of the war so many matters of grave moment had accumulated and were clamoring for attention that Congress has been exceedingly busy, and the matter of Federal approval of type of apparatus has remained in the background.

Recently, however, great interest is again being evinced in this subject on account of action being taken by various parties directly concerned, and the conference has been requested to place this subject upon its program for consideration. Many of the officials here to-day were not present at previous meetings at which this subject was discussed; others doubtless do not have clearly in mind the various actions which have been taken in the past. If the subject is to be considered anew, it seems appropriate that former steps should be reviewed. Therefore, it has fallen to my lot to appear before you briefly to discuss the "History of Federal Approval of Type of Apparatus." Let me say at once, however, that the word "history" is entirely too impressive a word properly to describe the chronology of events which I will attempt briefly to outline.

Approval of type of apparatus in commercial use by central Government authority has long been in effect in most foreign countries. For instance, the board of trade in England operates under an act first passed in 1904; in Germany the law seems to have been passed in 1869, and in other foreign countries laws establishing this system of procedure have long been in effect. But in this consideration it is my purpose only to consider the efforts which have been made to establish approval of type in this country.

Since the subject of Federal approval of type in this country in its inception antedated my connection with the bureau and my experience with this conference, I have searched the reports of the earlier conferences to find where it was first mentioned in the proceedings. The first meeting was largely an experience and organization meeting, and no mention of the subject is discovered. The honor, therefore, seems to go to Mr. George H. Pettis, who preceded Mr. Goodwin as State sealer of weights and measures of the State of Rhode Island. On the occasion of the second conference, Mr. Pettis said:

> In Great Britain the board of trade has control of the weights and measures of the Kingdom. Now, * * * how are we going to proceed in this * * * testing and sealing, etc., unless the authority comes from headquarters—from the Government at Washington. * * * It seems to me that the Government of the United States should regulate these measures, and they should all be alike.

Mr. Goodwin last year told us that he wanted it on the record that Rhode Island, although the smallest State in the Union, was the pioneer in advancing the subject of correcting liquid-measuring

devices so that they could not function when there is danger of fraud. Mr. Goodwin should thank me, and no doubt he will do so, for bringing forward the fact that Rhode Island was also the pioneer in advocating the subject now under discussion.

Later in the meeting of the second conference a resolution was passed directing the appointment of a committee to draw up a model set of laws to be submitted to the conference at its next session. This committee consisted, I think, of Messrs. Palmer, of Massachusetts; Pettis, of Rhode Island; Thomas, of Ohio; Reichmann, of New York; Hazen, of Vermont; and Doctor Stratton and Mr. Fischer, ex officio.

At the third conference, held in 1907, the bill was presented by the committee. Section 4 was as follows:

> No weighing or measuring device shall be used for the purpose of trade until the type has been approved by the National Bureau of Standards. Any type so approved may be used anywhere in the United States: *Provided*, That nothing in this act shall prevent the State or local inspector from condemning such device if its operation should be defective.

In discussing this clause, Mr. Fischer said:

> If the bureau or some department of the National Government does not have this authority, then a type of machine may be permitted in one State and not in another.
>
> That would be a great hardship for the manufacturers and greatly complicate their business.

In view of subsequent events those words seem almost prophetic.

An amendment was incorporated in the section to the effect that "monthly bulletins giving a description of any weighing or measuring device approved by the National Bureau of Standards shall be sent to the State officer of weights and measures of each State." The section as amended was then unanimously adopted by the conference.

Here, then, we have the genesis of the record of the desire for Federal approval of type of apparatus in this country.

The matter of approval of type was not overlooked at the fourth conference in 1908, but received a further impetus by the adoption of a resolution reading as follows:

> *Resolved*, That the National Conference on Weights and Measures, in session in Washington, D. C., on December 17 and 18, 1908, realizing the enormous number of defectively constructed scales of weight and measure, strongly urges that appropriate legislation be enacted by Congress, making it a misdemeanor to manufacture, use, sell, or offer for sale a type of scale, weight, or measure that had not been proved at a careful investigation by the Bureau of Standards, Department of Commerce and Labor.

We may now proceed more rapidly and merely mention in passing some of the more important items of interest in connection with this subject.

It was agitation such as the above which caused the introduction of a bill into Congress designed to carry the suggestions of the members of the conference into effect. The first bill of which a record is found was bill H. R. No. 22156 of the Sixty-first Congress, introduced March 2, 1910, entitled "A bill to prevent the manufacture or use of dishonest or fraudulent weighing or measuring appliances in commercial transactions," introduced by Mr. McKinley, of Illinois. This bill provided that it should be unlawful

to manufacture or ship in interstate commerce any weighing or measuring device of such design or construction as to indicate incorrect weights, measures, or prices based upon incorrect weights or measures. This bill was quickly followed by the Lafean bill, introduced March 16, 1910, which was not greatly dissimilar in its provisions.

In the Sixty-second Congress Mr. McKinley again introduced his bill on April 5, 1911, and in the same Congress, on July 18, 1912, Mr. Cary introduced a bill on the same subject, this latter being entitled "A bill for the establishment of a uniform system of weights and measures in the United States," this bill consisting of one section only. This bill was again introduced the following year and again in 1915.

By this time the subject was more generally understood, and in 1914, and again in January, 1916, Mr. Ashbrook, then chairman of the Committee on Coinage, Weights, and Measures of the House of Representatives, introduced the most pretentious bill which had been evolved up to that date and which became very well known, indeed, under the title of the "Ashbrook bill." This bill established as the standard of weights and measures for the United States the weights and measures of the customary system and of the metric system on equal terms. It then proceeded to authorize that the Bureau of Standards should approve the various types of weights and measures which might legally be used in the United States, reserving to the duly authorized weights and measures officials the testing and verification of all weighing and measuring devices. Mr. Clapp, of Minnesota, at about the same time introduced a similar bill in the Senate, No. 5810 of the Sixty-fourth Congress.

In the meantime the conference had not been idle. In the seventh conference a resolution indorsing the principle contained in the various bills mentioned—the approval of type principle—was adopted. In the eighth conference, Mr. Walsh, then commissioner of weights and measures of New York City, was on the program and gave a paper on the "Federal regulation of weighing and measuring apparatus," in which he explained an ordinance passed in the city of New York requiring the city officials to approve the type of apparatus and describing its successful operation. Notwithstanding this, he declared it to be his opinion that—

> I believe that the control of the mechanism of weighing and measuring apparatus should be with the National Government, and so let it be known to all weighing and measuring device manufacturers—

and proceeded to point out the reasons for his attitude, this despite the fact that his city had already exercised the power and that in his city the experiment was successful in its operation. There was adopted a resolution of the conference confirming Mr. Walsh's stand in this matter.

At the tenth conference, under the subject of "legislation," there were calls for a discussion of the Ashbrook bill and the bill was consequently taken up and received careful attention, at the end of which the conference indorsed not only the principle involved but also the provisions of the Ashbrook bill itself.

In the spring of 1916 the Ashbrook bill was put on for hearings before the Committee on Coinage, Weights, and Measures of the

House of Representatives, and after deliberation this committee issued Report No. 394 with the recommendation that it pass, saying:

> Your committee, therefore, unanimously favor the passage of the bill with the amendments, and believe that it will be of benefit to the people and will not work a hardship on either the manufacturers of weighing devices or the merchants who use them.

The bill was not successful, however. At that time, while it had the enthusiastic support of the great majority of weights and measures officials, the manufacturers largely remained neutral in their attitude toward it, only one or two declaring they were definitely opposed to it and a similar number announcing they were heartily in favor of it.

The following year Mr. Tilson introduced a bill based upon the Ashbrook bill, but containing certain changes designed to improve it, among these being the making specific of reservations of authority to State and local weights and measures officials, which were understood in the original bill, and the specific exemption of all apparatus already in use, etc. This bill was introduced in 1917. Then came the war and, as mentioned heretofore, Congress has been too pressed with other business to consider such subjects as this, and, consequently, no legislation has been attempted.

At the last conference a resolution was adopted indorsing the principle of Federal approval of type. And here this portion of my record ends.

It seems that when Federal approval of type is being discussed it should be mentioned that Maine now has a law upon the statute books which provides that it shall be unlawful to sell, offer for sale, or give away any scale or other weighing or measuring device within the limits of the State of Maine until the same shall have been approved by the National Bureau of Standards, Washington, D. C. This, very apparently, is a State attempt to bring about a Federal approval of type. The Bureau of Standards, however, has been in a position such that no attempt to enforce this bill could be made. At the present time the bureau does not approve or disapprove of any type of weighing or measuring device. While many types of weights and measures and weighing and measuring devices are inspected and tested at the bureau and reports thereon issued to the manufacturers, this work is done and these reports issued solely with the purpose of increasing the bureau's knowledge of the devices in the field, and of assisting the manufacturer to a knowledge of what his product will do, and how he can further improve it, if improvement seems possible, so as to bring better devices to the people of the United States.

Reports are always issued as confidential material for the information of the manufacturer and they must not be otherwise used by him. However, the bureau reserves the right to supply, upon request, a copy of the report on a device to any State officer, because the bureau feels that in its function of acting as a clearing house on weights and measures matters it should place in the hands of the State officials material of use to the State officials that may come to its knowledge.

Just a word now in relation to the penalty section of the Tilson bill. Mr. McGrady has apparently assumed, as I understood his

remarks, that were the Tilson bill or the Ashbrook bill, or any similar bill, to be passed, it would take all violators of weights and measures laws into the Federal courts—that these minor violations which he spoke about and which can be satisfactorily negotiated in the police courts or in county courts would then have to come to the Federal courts for decision.

If that were the meaning of the Tilson bill or the Ashbrook bill, there would be no more determined opponent of the bill than I. But that is not the expression of the bill at all.

The bill provides that a violation thereof shall be prosecuted in a Federal court. That is very true. But that refers only to a specific violation of the provisions of the bill itself. Now, the bill itself requires, very briefly, that only such types of apparatus as are approved by the Bureau of Standards may be allowed to be sold in the country for commercial uses. If a piece of apparatus of a type which has not been properly approved by the bureau is sold in the United States, then that is an offense against the bill, and that is prosecuted in the Federal court. But in so far as the accuracy of any individual piece of apparatus is concerned, the State and local weights and measures officials have entire jurisdiction. They will continue to seal or condemn as accuracy or inaccuracy is developed just exactly as they do at the present time.

If they find a faulty weight or a faulty measure, or one which does not deliver the proper weight or measure, then they take their cases, under their State laws or local ordinances, into the present specified courts and prosecute just the same as they have always done. If they find fraudulent practices, if they find that commodities are not being sold in the manner provided by State regulations, all of those offenses are brought before the courts at present having jurisdiction.

The only character of action which may be brought into the Federal court is one which is not made an offense at the present time—that is, the sale or use of a piece of apparatus which, being required to be approved by the Bureau of Standards as to type, has not in fact been approved by the Bureau of Standards as to type. This point is very clear. The bill provides that any violation of this act shall cause the offender to be summoned in a certain way, and it is obvious as a matter of law that this Federal act could not require that the violator of a State act or a local ordinance should be brought into a Federal court.

As I have said, were the wording of the bill, or were the intention of the bill otherwise, certainly the Bureau of Standards would have no sympathy whatever for the legislation and would have appeared before the Committee on Coinage, Weights, and Measures against the legislation. But when it is emphasized that the only prosecutions which are to be brought into a Federal court are for the sale or use of a piece of apparatus which, being required to be approved as to type by the Bureau of Standards, has not been so approved as to type, the objections to the bill mentioned must largely vanish.

I thank you for your attention.

Mr. Richmond (representing the Scale and Balance Manufacturers' Association). Mr. Chairman and gentlemen, unfortunately Mr. Brooks, the president of our association and the man to whom this subject was assigned is unable to be here, and he telegraphed me

in Buffalo and asked me to come down and present his paper for him. That explains my appearance. Coming along at this place on the program in this line of subjects, I feel that my position is even worse than that of Mr. Holbrook.

MANUFACTURERS' ATTITUDE TOWARD APPROVAL OF TYPE.[5]

By P. C. Brooks, *President, Scale and Balance Manufacturers' Association.*

We all know that the Constitution of the United States confers upon Congress the authority to "fix the standard of weights and measures," and that many years ago Congress partially exercised this authority by causing to be distributed to each of the States certain weights and measures, which were then adopted by individual State enactment, thus becoming the legal standards.

In welcoming the delegates to the first weights and measures conference, Director Stratton, referring to a compilation of the weights and measures laws of different States, said:

> A mere glance at this volume which is before you will show that the different States have enacted laws without regard to each other. In many cases adjacent States have laws just different enough to encourage fraud on the part of those dealing with the public. Furthermore, in many States the laws are not enforced, and I fear that this is true in a large majority of them. However, the country is now awakening to the necessity for uniform laws pertaining to weights and measures.

This Annual Conference on Weights and Measures, then, owes its origin, growth, and establishment as a permanent and influential body to some very direct evidence which had come to the Bureau of Standards that confusion and loss, and perhaps fraud, were a good deal more widespread than was generally known, and that this condition was a natural result of inadequate laws, or in some cases to nonenforcement of existing laws, but as much as anything else to the absence of any central governing authority.

Out of the discussions which took place at the first and succeeding annual conferences, there grew very widespread activity. As was anticipated and desired, those who had come to the conferences as delegates spread their interest among others, and the craft very quickly began to regard their work with increased respect and responsibility. Among the earliest proposed reforms was some form of Federal supervision, and reference was made in connection with such proposals to the fact that the principal countries of the world had such national laws and that these laws in some cases went into rather minute details as to the construction of scales as well as to their general qualifications. As none of the proposed Federal measures seemed to satisfy all of the conditions, influence was brought to bear upon the individual States, and a great many State laws were enacted closely following a model prepared under supervision of the Bureau of Standards with the aid of the conference on weights and measures. Under these laws many States created or organized efficient weights and measures departments, equipped themselves with modern and well-designed appliances for field inspection work, and by all means available endeavored to remove faulty weighing and

[5] This paper, prepared by Mr. Brooks, who was not in attendance at the conference, was presented to the conference by Mr. T. L. Richmond.

measuring appliances from use in trade. The same causes which had set these things in motion lead, as a matter of course, into other fields, as, for instance, the inquiry made by the Interstate Commerce Commission into railway methods, resulting in the reorganization of departments and agencies having under their supervision the weighing of grain and similar commodities.

There can be no doubt that all of these activities resulted not only in the improvement of weighing apparatus, but in the condemnation and destruction of false weights, measures, and scales, extensive revision of weighing methods, and the elimination of many fraudulent practices. A further beneficial effect was found in the dissemination of practical information as to the use and care of scales. A great many people who had used scales for a long time, but who had never given them any serious thought, awoke to a realization of the fact that there were good scales and scales that were not so good, that good scales could be installed in such a way as to limit their efficiency, and that good scales could be kept in good weighing condition for a long time by the use of improved installation and maintenance methods.

There has, perhaps, never been a time when every scale manufacturer has not striven to sell scales of the highest quality that users could be induced to buy. With no single legal authority establishing any kind of a standard, the responsibility for setting up a standard of some kind and of then demonstrating to users that it was an adequate standard, rested upon the scale manufacturer. Naturally enough the varying requirements of scale users and the wide divergence of ideas as to design, construction, and installation, together with competitive conditions, made it impossible to establish any one standard. Each manufacturer made and sold in his own way what he thought was best adapted for each particular service, or, failing in this, what each customer or each particular industry insisted upon—usually determined by price considerations. This, of course, was not a healthy or profitable condition for the manufacturers.

The advent of reasonably uniform State laws appeared to afford some improvement and the increasing knowledge of scales, the interchange of information among and between manufacturers, inspectors, users, and others interested, standardized and stabilized the business generally. From the manufacturers' standpoint, there has been little, if anything, to criticize in the improvements, refinements, or restrictions that have been established through the operation of definite laws or of specifications which have been prepared by competent and experienced bodies, but which do not have behind them any legal authority. But the situation of the manufacturers to-day is precisely that stated in 1912 by the late secretary of the weights and measures conference in discussing a Federal bill then pending. He said:

> It is perfectly obvious, I think, to all of you that we can not have each of the 48 States saying, perhaps, independently of the others, just what types are proper. The manufacturers could not submit to that, and it seems perfectly apparent that some central bureau must have that authority.

The manufacturers have been submitting with such patience as they could muster, feeling that no added difficulties should be placed

in the way of those who were endeavoring to find the right solution. Their situation, however, has been about like that of the chameleon on the Scotch plaid. While such laws as have been enacted by the several States are fairly uniform, scales have been persistently demanded by users in some States having no definite laws, which are not admitted in other States in which adequate laws and strict enforcement exist. The administration of existing laws has been entrusted to various bodies and there results wide divergence as to the application and interpretation of certain provisions. A further embarrassing situation for the manufacturers of scales is found in the existence of supervising agencies in certain trades. These agencies are without legal authority, but their standing in their several trades is such that their rulings are generally accepted. It would not be a difficult matter for scale manufacturers to bring their designs and their manufacturing methods into conformity with the requirements of any reasonable law, provided that law established one uniform standard for all service within its jurisdiction. Of course, some expense would be created which would probably be reflected in increased costs. It is extremely difficult, however, to meet, in addition to the varying requirements of foreign markets, the apparently unnecessary range that is now called for because no means exists whereby one agency is even empowered to say that certain kinds of scales, known to be inadequate, shall not be manufactured or offered for sale.

It is, perhaps, fortunate that none of the earlier Federal measures which were proposed were enacted into laws, but due largely to the intelligent activity of the Bureau of Standards in cooperation with the weights and measures conference, the subject has been in the minds of many men. A great deal of data has been gathered, a great many experiments have been tried, and to-day we know a great deal better what needs to be done and how it should be done than we did a few years ago.

The approval of types of scales before they may be offered for sale will probably not accomplish all that should be done, but it will furnish the foundation for more comprehensive legislation; it will definitely remove from scale users of a certain class the temptation to purchase scales that are not properly designed and manufactured, and it will relieve the manufacturers of the responsibility of deciding whether such scales should be manufactured or not.

By reason of its capable supervision, its exceptional personnel and technical equipment, and its possession of the most complete data in existence respecting the design, construction, and use of scales, there is no agency so well equipped to pass upon the types of weighing and measuring apparatus as the Bureau of Standards; and, believing that the first step in the direction of Federal supervision should not be longer postponed, the conference on weights and measures and the Bureau of Standards may feel assured that scale manufacturers recommend the passage of H. R. 2878 now pending, and further pledge their hearty cooperation in carrying out the provisions of this measure should it be enacted.

RELATIONSHIP BETWEEN WEIGHTS AND MEASURES OFFICIALS, MERCHANTS, AND MANUFACTURERS.

By J. J. Holwell, *Commissioner, Mayor's Bureau of Weights and Measures, City of New York.*

One goal which mankind has been striving for since the beginning of time, and for which men have made sacrifices, has been justice—"the giving to every person exactly what he deserves; to everyone as much advantage, privilege, or consideration as is given to any other."

The closer we come to a clearer understanding of the principles of justice the nearer we approach the desired goal, a state which Plato described, "every part doing its own work and not interfering with others."

The weight and measure official to-day is clothed with exceptional authority and has great powers in his hands. When properly used, this power finds its secure resting place in justice where such powers are delegated through law. In the use of such powers the weight and measure official determines by his course of action whether he is using them to promote justice, or whether he abuses his powers to the commission of unjust acts.

With the wonderful increase in population and commerce made by America within the life of the present and preceding generation, the position of the weight and measure official has developed into a very important one. From practically an obscure and unimportant office in the community, the office of weights and measures has advanced to a point where its incumbent must possess not only a knowledge of his own duties but he must possess the necessary tact and understanding to deal fairly and justly with those merchants and manufacturers with whom he has official relations.

The weight and measure official of to-day is imbued with the same spirit which actuates the vast majority of the public officials of America, namely, the desire to perform real service to the public. He knows, or should know, that because he possesses large powers, he should not use them to harass and hinder the operations of the reputable merchants and manufacturers, but that one of his principal functions is to cooperate with them and to correct those things that are not in compliance with the law. He should concentrate his efforts upon that class of merchants or manufacturers which deliberately attempts to break or evade the law, because such men are a menace to the business, commercial, and industrial life of this country. Such types, if permitted to continue, not only make it impossible for honest competitors to do business but their activities result in the mulcting of the purchasing public.

A factor which has notably contributed its share toward elevating the standards of American commerce during the last quarter of a century is the splendid cooperation and service rendered by the manufacturers of weighing and measuring apparatus. To the men responsible for the investment of capital and organization, to the inventive geniuses who have created such wonderful devices for weighing and measuring commodities, to the intelligent and energetic men who have traveled all parts of America to explain the advantages to be gained through the use of such devices by the merchant, the manu-

facturer, and the consumer, a debt of gratitude is owed by the American public for their invaluable services.

While admiring the service rendered by the manufacturers of weighing and measuring devices, the weight and measure official should not establish any relation with such manufacturers whereby through his aid and help sales are made of a particular manufacturer's device. Such interest is apt to prejudice a weight and measure official in favor of or against a certain make of apparatus, while his activity in promoting the sale of a device in which he is financially interested frequently impairs his effectiveness and lowers his standing among his associates and with merchants and manufacturers. The successful weight and measure official must be impartial; he must refrain from expressing his views publicly when asked for them by merchants who are in the market to purchase certain types of apparatus. Any apparatus which is manufactured by a reputable firm and which has been approved by competent weight and measure officials as conforming to the standards should be satisfactory to him. He should not pick out a particular piece of apparatus to the exclusion of all others, but should permit the merchant himself to determine what apparatus best suits his needs and requirements.

In my experience as commissioner of weights and measures for the city of New York—a post which has enabled me to meet hundreds of merchants and manufacturers, both large and small—I believe the overwhelming majority of the merchants and manufacturers in the United States to be honest. I believe that they are law-abiding citizens, and that they do not deliberately attempt to misrepresent the weight or measure of a commodity which they handle. I have invariably found those with whom I have had official relations only too willing to cooperate and to make such changes as I directed. It is through such cooperation that the weight and measure officials of this country can render the most effective service to the public. It is a mistaken policy to prosecute a reputable merchant or manufacturer without first giving him the opportunity to correct the condition complained of. He may be entirely innocent of any intent to break the law or he may be the victim of a dishonest employee. If he fails to follow advice, more drastic action can be taken. A weight and measure official, after all, has recourse to means which can always insure that his orders will be complied with.

A weight and measure official to-day in America occupies in many ways both the position of a prosecutor and a judge. He should possess a character that is above suspicion and reproach. He should be honest, energetic, considerate, tactful, and just. He should weigh his action before proceeding against an individual or firm, not only for what it means to the individual or firm that is publicly exposed, but for the influence of his act upon the community. An unwise weight and measure official can do much harm in ruining the reputation of a reputable merchant or manufacturer, and he can also deal a blow to the prosperity of a city or town in which he operates by leading its inhabitants to believe its business men are cheats and that it is no place to do business in.

In every city and town there are merchants who are both friends and bankers. Over their counters such men form lifelong friendships. They are ready not only to extend credit, but they have been known to advance loans with no interest payments attached to them. They have tided over many families during periods of illness, distress, and unemployment. They are not profiteers or lawbreakers. They go to make up the great middle class—the backbone of America. To willfully disobey the law is foreign to their natures; to publicly expose them for some infringement of the law is a willful act.

The weight and measure officials and the reputable merchants and manufacturers in America are all engaged in the work of serving the public. It is only through the performance of their respective parts that the public is justly and equitably served. In establishing proper relations with the merchants and the manufacturers, the weight and measure officials of the United States can accomplish more in raising the standards of commerce, in furthering the prosperity of the Nation, and in rendering genuine and efficient service to the public.

DISCUSSION CONCERNING PLACE OF NEXT MEETING.

The CHAIRMAN. Mr. Reichmann has asked for opportunity to make a statement at this time.

Mr. REICHMANN. Several of the delegates here have asked me to introduce a resolution to the effect that the conference meet next year at Atlantic City. I see a number of difficulties in the way of such a proposition. At present it does not affect me, but from past experience I would say that it is difficult to get the powers that be to delegate some one to attend a meeting at a watering place, because it is considered simply a junketing trip.

I would like to introduce a resolution to be submitted for consideration to the program committee as to whether it would be desirable or advisable to attempt to have the next year's meeting for the first day or first two days here and the last two days in Atlantic City.

Mr. CLUETT. I would like to suggest that in place of referring that to the program committee it be referred to the executive committee.

Mr. REICHMANN. I accept the amendment.

The CHAIRMAN. I think that is a good suggestion, and if there is no objection this resolution will be referred to the executive committee.

Mr. TOWNSEND. Mr. Chairman, I have listened with considerable interest to the discussion this morning dealing, among other things, with those regulations that come out of the Federal Government in relation to measuring devices.

The CHAIRMAN. It might be well to discuss this matter now. I will leave the meeting in the hands of the vice president, Mr. Webster.

(H. A. Webster, vice president, assumed the chair.)

Mr. TOWNSEND. I was going to suggest that you give us either a few minutes now or after luncheon.

The Acting Chairman. We will proceed to the discussion.

Mr. Townsend. Mr. Chairman, this matter is, I think, of great importance to the manufacturers of measuring devices. I had anticipated asking the conference for a few minutes to talk about it at this time and to express the attitude of the gasoline-pump manufacturers. There are, however, so many delegates absent, and I think we should have the opinion of all, that I would like the indulgence of the chairman to postpone this matter until after lunch.

(A motion was made and seconded to postpone the discussion.)

Mr. Schwartz. Mr. Chairman, I want to call the attention of the delegates to the fact that our program as prepared is a full one and will take all the time there is this afternoon. There was opportunity offered for discussion of this matter at the time it was up earlier this morning, and I do not see why advantage was not then taken of that opportunity.

Mr. McGrady. I think this is a proper subject and a proper time for discussion, but we can not cover it in a few minutes, and therefore I hope the motion will prevail and the discussion be postponed until after lunch.

(The question was taken, and the motion was agreed to.)

(At this point a motion to adjourn was made and seconded. The question was taken, and the motion was agreed to.)

(Thereupon, at 12.20 o'clock p. m., a recess was taken until 1.30 o'clock p. m.)

SIXTH SESSION (AFTERNOON OF THURSDAY, MAY 25, 1922).

The conference reassembled at 1.30 o'clock p. m., H. A. Webster, vice president, presiding.

REPORT OF COMMITTEE ON SPECIFICATIONS AND TOLERANCES, ON TOLERANCES FOR BREAD LOAVES, PRESENTED BY F. S. HOLBROOK, CHAIRMAN.

The committee on specifications and tolerances was requested by the Fourteenth Annual Conference to investigate the question of proper tolerances for loaves of bread upon the basis of the model bread bill adopted by the last conference, and to submit to the present conference a report of its findings. The investigation has been conducted, the data collected have been carefully analyzed, and the following tolerances on the net weight of loaves of bread are based upon the results of this work.

TOLERANCES.

A tolerance of 2 ounces per pound in excess and 1 ounce per pound in deficiency shall be allowed on the weight of individual loaves of bread when such weight is determined at any time up to the time that the bread is declared by the seller to be "stale" bread and sold as such.

A tolerance of 1½ ounces per pound in excess and one-half ounce per pound in deficiency shall be allowed on the average weight of 10 or more loaves of bread of the same nominal weight and the same brand or kind, when such average weight is determined at any time up to the time that the bread is declared by the seller to be "stale" bread and sold as such: Provided, however, That there shall be no tolerance in deficiency in those cases in which the weights of loaves of bread, sold or to be sold by a baker to a retailer for resale, are determined at any time up to and including the time of delivery to such retailer, or in which the weights of loaves of bread, sold or to be sold at retail by the baker, are determined at any time up to six hours after removal of the bread from the oven.

Nothing in the above shall be construed as rendering the baker responsible for any shortages in the weights of loaves of bread in the hands of a retailer, determined more than 24 hours after the time of the delivery of the bread to such retailer, whether or not such retailer is selling the bread as "stale" bread.

Respectfully,

(Signed) F. S. Holbrook,
W. T. White,
Wm. F. Cluett,
Committee on Specifications and Tolerances,
Annual Conference.

DISCUSSION OF REPORT ON TOLERANCES FOR BREAD.

Mr. Holbrook. Copies of these tolerances are now in your hands. It may be of interest and value briefly to explain the manner in which the investigation was conducted and the facts upon the conclusions stated are based.

It may be said first that through the activity of Messrs. White and Cluett of the committee a very large amount of work was done in determining the weight of the loaves of bread being manufactured in a number of small cities in the State of New York and in the city of Chicago. Several thousand loaves were weighed and the results were put in convenient form for determining what the proper tolerances on loaves of bread should be.

The committee believes that several things in relation to these tolerances are fundamental:

First. A fairly liberal tolerance should be allowed upon the weight of individual loaves, in order to cover, in so far as possible, reasonable accidental variations which may take place in any baking.

Second. A more rigid tolerance should be established on the average weight of a number of loaves, since if proper efforts are being made to produce a loaf of definite weight the average weight should fall close to the desired value.

Third. In arriving at the above figures the effects of natural shrinkage must be given due consideration if loaves are to be weighed at different intervals after removal from the oven. However, it is believed that the tolerances should be so devised and stated that some apportionment of this shrinkage among the interested parties can be made in the enforcement of them.

The data taken in the city of Chicago included the results of reweighing several thousand loaves. The following method of taking the results was employed:

Visits were made to five bakeries, which may be denominated "large" bakeries, and a great number of loaves weighed either immediately after removal from the oven or within one hour thereafter. In several instances a number of these loaves (usually about 25) were laid aside and again reweighed from 16 to 22 hours later. In some cases loaves in the form of dough were weighed when cut ready for the oven and again after baking.

Ninety-nine small bakeries were also visited and about 12 loaves of the same kind weighed in each. Here no attempt was made to weigh the dough, nor was it essential for the purposes of this investigation to weigh the bread at any specified time after baking.

In both the large and the small bakeries loaves of various kinds and sizes were weighed, the data, of course, being kept separately. Weighings were made to the nearest one-fourth ounce.

Charts showing the distribution of the errors on each size and kind of bread were prepared as follows: For each bakery visited the mean weight of the loaves of the same size and kind examined was determined, after which the variation, either plus or minus, from this mean weight was computed for each individual loaf. These data were then assembled into charts, large and small bakeries and different sizes and kinds of bread being considered separately. In the charts the vertical lines represent groups of loaves. The height of

each line corresponds to the number of loaves represented by that line; the position of each line indicates the error; that is, the distance of the line to the right or left of the zero point indicates the variation of the loaves represented by that line from the average or mean weight of the batch from which each loaf was taken. Thus in the upper chart in Figure 1, for example, representing 1-pound loaves

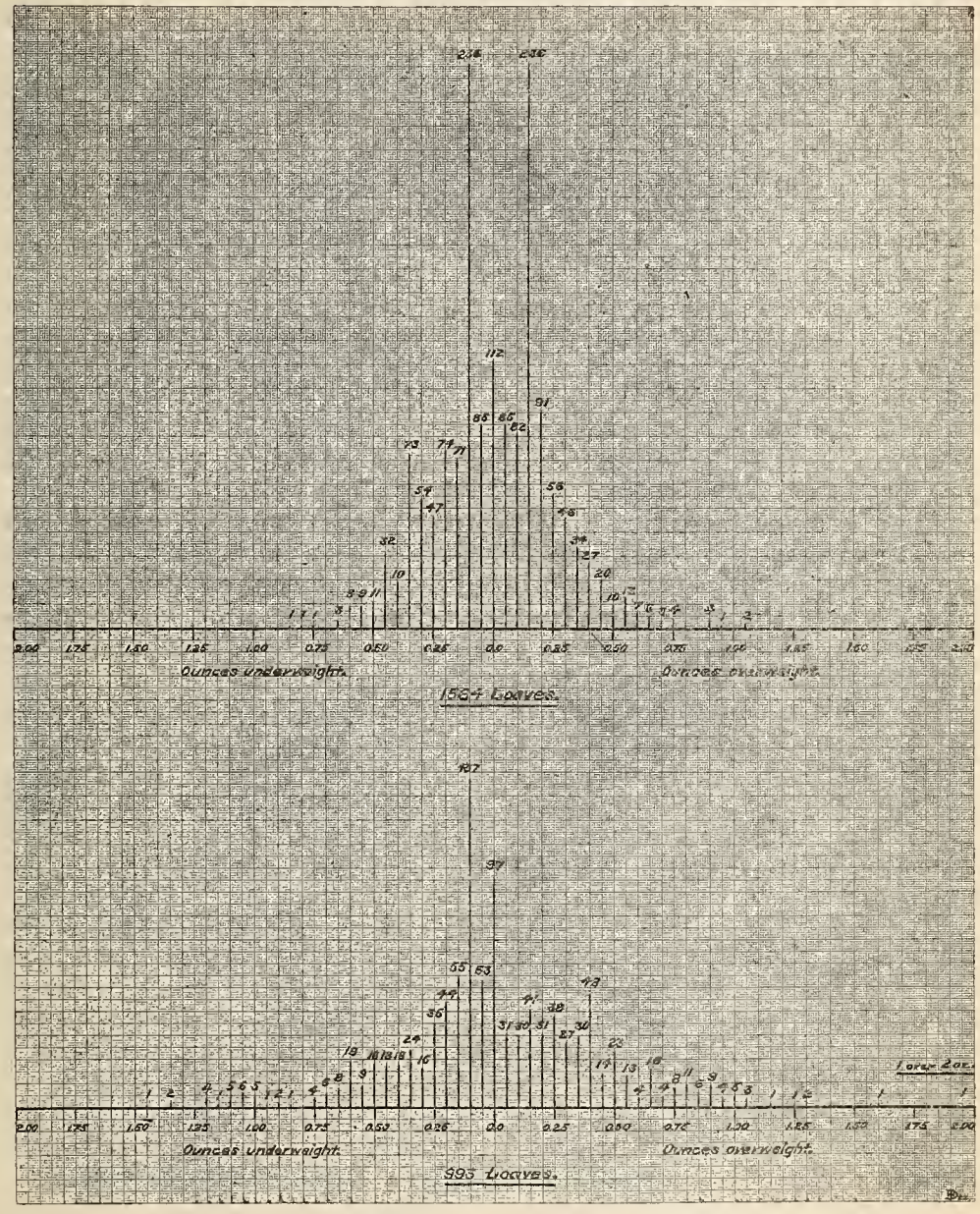

FIG. 1.—Analysis of variations in weights of loaves of bread.

of white bread from large Chicago bakeries, we find that out of a total of 1,564 loaves examined the weights of 112 loaves agreed with the mean, 85 differed from the mean by +0.05 ounce, 82 by +0.1 ounce, 236 by +0.15 ounce, 91 by +0.2 ounce, 56 by +0.25 ounce, etc.; while in the other direction 85 loaves differed from the mean by —0.05 ounce, 236 by —0.1 ounce, 71 by —0.15 ounce, etc.

This method of assembling the data shows the results in graphic form and the "distribution" of the errors is at once apparent. Such an analysis eliminates the effects of shrinkage and shows the degree of uniformity which is being obtained in the weight of the loaves.

These charts are shown in Figures 1 and 2. The upper chart in Figure 1 presents the results of weighing 1,564 1-pound loaves of white bread weighed in "large" Chicago bakeries.

In this case 112 loaves, or 7 per cent of the total, corresponded to the mean weight; 1,175, or 75 per cent, are within a tolerance of $\pm\frac{1}{4}$ ounce (a range of 0.5 ounce); 1,501, or 96 per cent, would comply with a tolerance of $\pm\frac{1}{2}$ ounce (a range of 1 ounce); and 1,555, or 99.4 per cent, fall within a tolerance of $\pm\frac{3}{4}$ ounce (a range of $1\frac{1}{2}$ ounces). The lightest loaf was 0.85 ounce underweight and the heaviest loaf was 1.05 ounces overweight.

The lower chart in Figure 1 gives the results of weighing 993 loaves of white bread in 99 "small" bakeries.

In this case 97 loaves, or 10 per cent of the total, corresponded to the mean weight; 592, or 60 per cent, were within $\pm\frac{1}{4}$ ounce (a range of $\frac{1}{2}$ ounce); 829, or 83 per cent, were within $\pm\frac{1}{2}$ ounce (a range of 1 ounce); 920, or 93 per cent, were within $\pm\frac{3}{4}$ ounce (a range of $1\frac{1}{2}$ ounces); and 964, or 97 per cent, were within ±1 ounce (a range of 2 ounces). It will be seen that the same degree of uniformity of product is not obtained by the small as by the large baker.

The top chart in Figure 2, representing 385 $1\frac{1}{2}$-pound loaves baked in large bakeries, shows that 279, or 72 per cent, were within $\pm\frac{1}{4}$ ounce; 358, or 93 per cent, were within $\pm\frac{1}{2}$ ounce; 383, or 99.4 per cent, were within $\pm\frac{3}{4}$ ounce; and 385, or 100 per cent, were within ±1 ounce. The heaviest loaf had an error of 0.60 ounce and the lightest loaf had an error of 0.90 ounce.

The middle chart in Figure 2, representing 318 $1\frac{1}{2}$-pound loaves baked in small bakeries, shows 22, or 7 per cent, of the total on the mean; 168, or 53 per cent, within $\pm\frac{1}{4}$ ounce; 247, or 78 per cent, within $\pm\frac{1}{2}$ ounce; 280, or 88 per cent, within $\pm\frac{3}{4}$ ounce; 293, or 92 per cent, within ±1 ounce; and 302, or 95 per cent, within $\pm1\frac{1}{2}$ ounces. Again it appears that the small baker is not producing as uniform a product as the large baker.

Rye bread did not show essentially different results, as shown in the bottom chart in Figure 2. Of 507 loaves, the majority of which were of the $1\frac{1}{2}$-pound size, weighed in the shops of "small" bakers, 52, or 10 per cent, fell exactly on the mean; 254, or 50 per cent, were within $\pm\frac{1}{4}$ ounce; 391, or 77 per cent, were within $\pm\frac{1}{2}$ ounce; 442, or 87 per cent, were within $\pm\frac{3}{4}$ ounce; and 485, or 96 per cent, were within ±1 ounce.

It would seem from the above figures that if a range of from 1 ounce to $1\frac{1}{2}$ ounces per pound were to be allowed at any definite time this should be sufficient to cover accidental unavoidable variations from the mean. It seems that bakers using reasonable care can succeed in placing practically all their loaves within this range. While the data on the small bakers in Chicago indicate that this result is not always being obtained at the present time, nevertheless a further analysis of the figures shows that a large majority of the small bakers are actually obtaining such results and the large ranges are largely due to the product of a small percentage of them. This being the

case there can be said to be no hardship imposed in requiring a few careless or inefficient bakers to improve their methods so as to obtain as good results as are being obtained by their more careful competitors.

In regard to shrinkage, it may be said that figures indicate that shrinkage on unwrapped bread may amount in 24 hours to 1 ounce per pound, or even more. By adding from 1 ounce to $1\frac{1}{4}$ ounces to

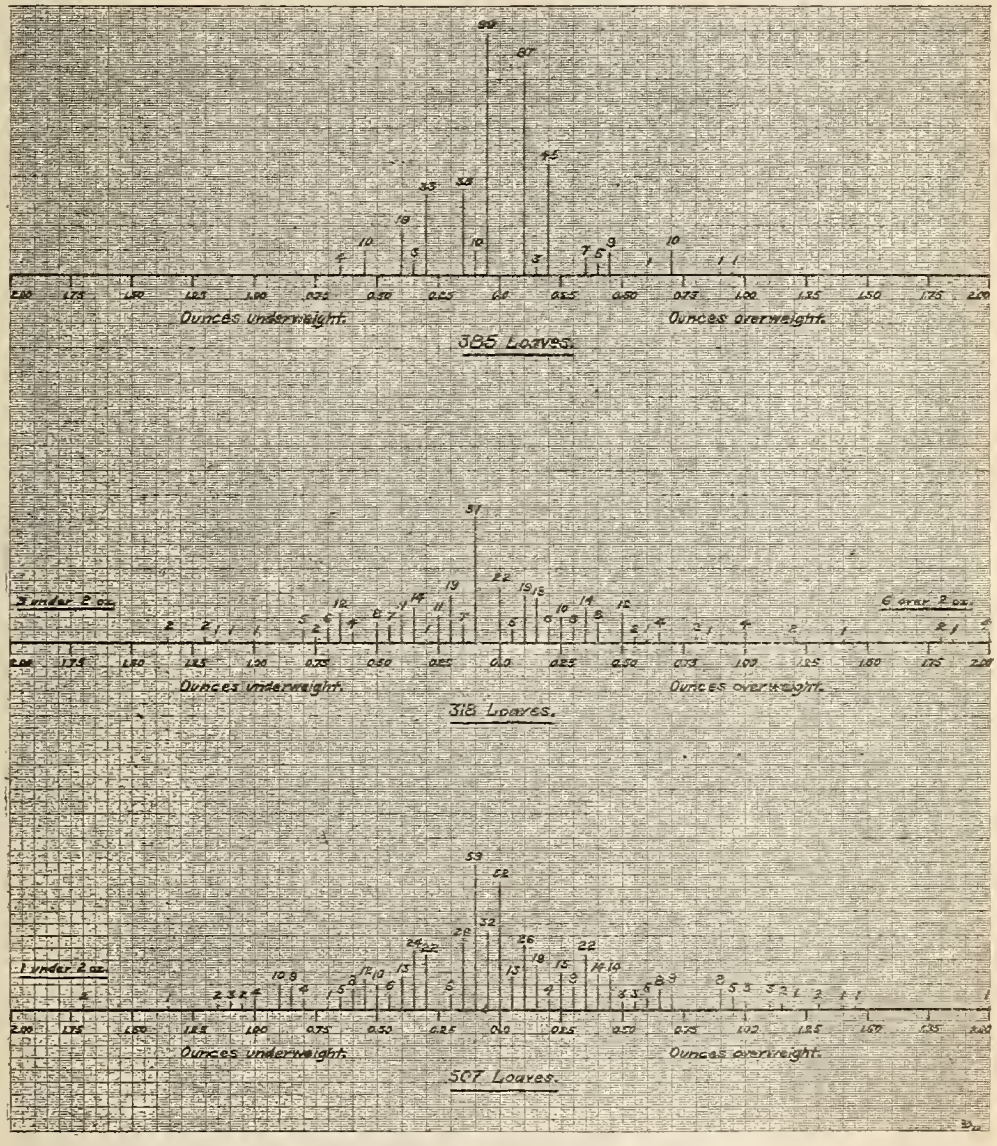

FIG. 2.—Analysis of variations in weights of loaves of bread.

the range indicated above, to be reasonable for normal variations, we have a range of from 2 to $2\frac{3}{4}$ ounces.

Finally, from baking to baking and from day to day it is probable that the baker will not be able exactly to arrive at the mean weight at which he aims. By adding one-fourth ounce for this effect our ranges will be increased to from $2\frac{1}{4}$ to 3 ounces.

We conclude then that were 3 ounces per pound to be allowed it would be liberal for all purposes and no possible hardship would

be done to any baker. Accordingly, a range of 3 ounces per pound has been incorporated in the tolerances as the range of the tolerances for the individual loaf. However, the committee would not feel justified in allowing one-half of this total amount in deficiency, since we feel that a hardship on the consumer, through the delivery of short weight, might result. Therefore, a tolerance twice as great in excess as in deficiency has been decided upon, which results in an excess tolerance of 2 ounces, while the tolerance in deficiency is 1 ounce. By fixing upon this larger tolerance in excess we make it reasonably easy for all to comply with the tolerance without taking an unconsionable advantage of the user of bread. At the same time we feel this distribution of the tolerances is a fair one, since it seems probable that very few, if any, bakers will have to take advantage of the large tolerance in excess; in other words, 18-ounce loaves will seldom, if ever, occur, since, in general, the baker will probably be able to reduce the sizes of one or more of the variables which have been used in computing the above range. Especially will bakers who wrap their bread be able to operate within less than the excess tolerance allowed, since our investigation of the shrinkage on bread after wrapping indicates that this shrinkage is much smaller than the figures used above.

It is obvious that the average weight of a number of loaves (such as 10) can be made to fall much closer to a zero error than the weights of individual loaves, and in this case very small tolerances only would be required were it not for the fact of shrinkage. Even when this is considered it appears that the deficiency tolerance can safely be reduced to one-half ounce. Such a tolerance in deficiency even on the average loaf is necessary to take care of bread held in the hands of the retailer for some hours before delivery to the consumer under our theory of apportionment of shrinkages explained hereafter. In the case of the excess tolerance this again has been made liberal, so that no baker may have any difficulty in keeping his average loaf within the proper range, and we feel that no baker need produce at any time an average loaf 1½ ounces heavy. However, should he do so certainly no injustice to the consumer can result.

In considering the subject of shrinkage as applied to tolerances the committee has proceeded upon the ground that a portion of the shrinkage should be borne by the baker, especially since much of it occurs before the bread leaves his hands. Likewise we are of the opinion that part of that shrinkage should be borne by the consumer.

In apportioning the shrinkage, then, we feel that the baker should be required to put into the hands of the retailer loaves of bread which average full weight at the time of delivery to him. Nor does this seem to be at all an impractical proposition. A baker knows the usual time consumed before the bread reaches the retailer and should have no difficulty in ascertaining the rate of shrinkage of the bread produced by him and can make an average allowance accordingly. In case certain bread will normally reach the retailer at a much later time than the average, as when it is shipped to another city, for instance, the baker knowing the conditions surrounding the delivery will be able to tell approximately at what time the bread will reach the retailer's hands. With this in-

formation at hand the baker should be able to insure that the bread put into the hands of all retailers will average full weight.

These are the considerations which have caused your committee to include the clause reading:

> Provided, however, that there shall be no tolerance in deficiency in those cases in which the weights of loaves of bread, sold or to be sold by a baker to a retailer for resale, are determined at any time up to and including the time of delivery to such retailer.

The above clause covers the case of the baker whom we have denominated the "large" baker—the baker who normally sells his bread through the retailer. We have yet to consider the case of the baker who sells his product at retail on the premises where produced, or from his own vehicles. We have considered that for the application of tolerances the large baker and the retail baker should be put as nearly as possible on a par. To accomplish this, it is necessary to provide that the average weight of the loaves baked by the baker selling on his own premises must also be at least full weight for a certain period after baking. The question arises as to the period after baking within which the small baker or any baker selling on his own premises must have his loaves of bread average full weight. Inasmuch as we believed that the large bakers' loaves of bread will often reach the retailer within six hours after the bread is baked, therefore, for the purpose of application of tolerances this period of time has been set in the case of the baker selling on his own premises. This provision will, we believe, result in requiring both classes of bakers to bake loaves of bread of the same average weight. This explains the reason for the clause reading:

> There shall be no tolerance in deficiency in those cases * * * in which the weights of loaves of bread, sold or to be sold at retail by the baker, are determined at any time up to six hours after removal of the bread from the oven.

The reason for the last paragraph only remains to be explained. The model law declares that its provisions apply up to the time that the loaf is declared to be "stale" bread and sold as such. There would be no justice in holding the baker of the bread responsible if the retailer of the bread holds his bread for sale for a considerable length of time without declaring to the consumer that the bread was "stale." In consideration of the fact that bread will usually be delivered to a retailer at least once in every 24 hours, the committee has considered it is reasonable to provide that, whether or not at the end of 24 hours from the time the retailer receives his bread, he declares it to be stale bread, nevertheless, 24 hours after the wholesaler has delivered the bread to him, the wholesaler—the baker—ceases to be responsible for the loaf. After that if the bread is kept for a longer period than that, and still is sold without a declaration that the bread is stale bread, the shortage, if there be any, must be the responsibility of the retailer. This has been expressed in these words:

> Nothing in the above shall be construed as rendering the baker responsible for any shortages in the weights of loaves of bread in the hands of a retailer, determined more than 24 hours after the time of the delivery of the bread to such retailer, whether or not such retailer is selling the bread as "stale" bread.

So much for the report of the committee and the data and reasoning on which it is based.

CONFERENCE COMMITTEE ON BREAD LEGISLATION AND TOLERANCES.

Mr. Holbrook. There is one other matter which I desire to propose at this time before the report is discussed, since it may have a bearing on your action. The committee on specifications and tolerances has been informed that the representatives of the baking industry are anxious to get together with the committee for the sake of considering tolerances on bread and, more than that, further considering a proper standard bread law.

No suggestion has been made that the standard bread law already adopted by this conference is not a proper one, but the joint meeting is proposed to see if an agreement can not be reached on a bill which will be wholly satisfactory to this conference and to the baking industry. If such an agreement could be reached—if an entirely satisfactory bill could be decided on by both parties—the bickering and animosity that have occurred in many instances would be at once ended, and the way clearly pointed out by which bread laws could be readily obtained in the various States of the Union. As long as the bakers are on one side of the fence and the conference is on the other, just so long will there be a difficulty in obtaining standard bread laws, and this difficulty will be felt by both the bakers and the members of the conference.

We will grant that the bakers have not had reasonable opportunity to study these tolerances as presented to this conference. This is for the very good reason that the committee only very recently came to a conclusion in the matter, and while they were at once placed in the hands of several representatives of the baking industry we do not consider that they have had proper opportunity to study them and get their arguments in shape.

Therefore, as in the case of the bread bill, the representative of the bakers, who has approached the committee, has not suggested that these tolerances are not perfectly right and proper, but he has suggested that in the time granted him he has not as yet been able to come to a conclusion as to whether the tolerances are right and proper or not. And for that reason he suggests the plan, which suggestion I have in turn just transmitted to you—that at some time in the near future the committee be authorized to sit in conference with the bakers, representatives of the industry, and a strenuous attempt made to get into harmony. If we can not get into harmony, nothing is lost except the time of the members of the committee. If we can get into harmony, a very great deal is gained.

If this meeting were to be held and some changes deemed satisfactory by the committee were found to be proper and necessary in these tolerances, and some similar changes were found to be necessary in our standard bread bill, it would in the normal course be necessary to report back to this conference at its meeting next year the conclusions of the committee with the committee's recommendations that certain changes be made.

That is a very good mode of procedure, indeed, except that one year's delay is caused, and a year's delay at this time is a serious consideration, because many of your legislatures are meeting in the fall; the subject of bread before the legislatures is a very common one at

the present time, and if we delay the matter of a proper bill and proper tolerances beyond the time of the meeting of the next sessions of the legislatures, we will not be making the progress that might otherwise be made.

This committee, therefore, is proposing the following, in addition, for your consideration:

If some amendments to the bread law and, perhaps, also some amendments to these tolerances were to be thought advisable by the committee as a committee, then the committee could submit to you by mail any such information in order that you may take a mail vote as to whether the committee's suggestions are concurred in. Such a mail vote conceivably could be completed within two or three months after the conclusion of this conference, and if the result were favorable to the agreement the members of the conference would be prepared to go ahead all together and obtain a proper bread-loaf law at the coming sessions of the legislatures.

DISCUSSION OF REPORT ON TOLERANCES FOR BREAD—Continued.

Mr. CUMMINGS. I would like to ask Mr. Holbrook a question—whether the committee has considered the advisability or necessity of establishing separate tolerances on unwrapped bread, or separate tolerances for bread according to the degree of hardness with which it is baked, for instance, Vienna bread compared with milk bread?

Mr. HOLBROOK. No. I think such tolerances would be unsatisfactory in involving entirely too much detail.

Mr. CUMMINGS. In that case, I think these tolerances, which have been reported, are too high in some cases and too low in some others.

Mr. HILL. Did you ask the bakers how many ounces of dough they took to make a 16-ounce loaf of bread?

Mr. HOLBROOK. If the baker sends to the retailer a 16-ounce loaf of bread, the number of ounces of dough in it is of no concern to the committee.

Mr. HILL. Do you know how much it takes?

Mr. HOLBROOK. I think 18½ ounces to the pound is a very close figure.

Mr. HILL. I will tell you that whenever they put in the oven full 17 ounces of dough it is going to come out 16 ounces.

As to shrinkage afterwards, in 24 hours a 16-ounce loaf of bread will lose something like an ounce, but in six hours it will lose very little, not more than about a quarter of an ounce.

Mr. HOLBROOK. The committee's information does not check with yours, Mr. Hill, because the committee has found that more than 17 ounces of dough must be put in to bake a 16-ounce loaf. And the committee is also of the opinion that more than one-quarter of the 24 hours' shrinkage occurs in the first six hours; that the shrinkage is more rapid while the bread is fresh, and the bread shrinks at a slower rate as the bread gets stale.

Mr. MARONEY. In view of the fact that no action has been taken on the report, and to bring it before us for action, I move you, sir, that the report of the committee on tolerances be laid on the table indefinitely. I am surprised that a committee would come in here with any such tolerances on bread, taking the facts and figures as

just shown on the charts presented. The average tolerance needed, in view of the facts that were shown, is not over three-eighths of an ounce. They should have mixed their own bread and baked it, as we did to obtain the tolerances which were allowed at the time the war was on.

(The motion was seconded.)

Mr. HILL. On that question, just one word, please. I agree with the gentleman who has taken his seat. I believe when we buy a thing that is supposed to contain 16 ounces, we should receive 16 ounces.

(The question was taken and the motion was agreed to.)

REASONS FOR STANDARD-WEIGHT LOAVES OF BREAD AND ENFORCEMENT OF OHIO STANDARD-WEIGHT BREAD LAW.

By JOHN M. MOTE, *Assistant Chief Inspector of Weights and Measures, State of Ohio.*

It seems fitting at this time to review and summarize the principles underlying the movement for standard-weight bread loaves, in order to crystallize thought on this important question. At the same time mention may be made of the principal arguments advanced by the opponents of this movement.

Standard-weight loaves for bread may be considered from two viewpoints: First, that of standardization or simplification in its broad sense. Second, that of standardization as applied specifically to bread. The advantages to be anticipated from standardization or simplification in general are too well recognized to need recapitulation. This aspect of the question may be dismissed with no further reference than a quotation from the address of Hon. Herbert Hoover, Secretary of Commerce, before the Fourteenth Annual Conference on Weights and Measures. Referring to simplification in general and to bread weights in particular, Secretary Hoover said:

> That is not entirely a problem of enforcing honesty and protecting the consumer with respect to a return for the money he gives. It is also a question of simplifying the process of manufacture, and in simplifying the process of manufacture you are contributing to a lower production cost and protecting both producer and consumer. We are saving something out of national energies. Fractions of pennies saved to every household and in every industry accumulate to make the wealth and strength of the American people. For this next generation we must meet competition from Europe—competition in a lower standard of living as applied to production—such as we have never hitherto thought possible. We can meet that competition if we can increase the efficiency of our industrial machinery. We can meet it without lowering the standards of American living, because our people have a greater power of initiative; they have more genius for production and for distribution; they have the power of greater exertion and we can produce our goods on a basis that will enable us to meet any competitor and still maintain the standard of our living. We can only hope to do this, however, if we reduce the losses in our industries and in our distribution, and I know of no factor of that problem that is of more importance than standardization. You are more familiar than I, perhaps, with its many ramifications. It does not extend into the field of destroying style or quality or initiative or individualism. It does extend at once into the whole field of greater uniformity in dimensions. The tremendous waste that we have by the multiplicity of dimensions in standard articles would give us a great credit of national economy, if we could find a greater degree of simplification.

Considering the demand for standardization of weight, or, expressed in another way, simplification of commercial units as ap-

plied specifically to bread, it may be said that this is based upon the following reasoning:

In the intelligent purchase of any commodity, three elements must be considered; namely, quantity, quality, and price. For the purchaser to compare the values of different brands of the same commodity, it is necessary to consider each of these elements. It is well known that an individual can easily make a comparison where only two variables are to be considered, but whenever a third variable enters it is necessary for one of these variables to be eliminated before comparison can readily be made. As applied to loaves of bread, this means that if the weight of the various loaves is uniform, differences in quality can be compared directly. The additional price demanded for any additional quality is at once apparent, and a correct conclusion may be reached as to the relative merits of various brands.

While it is true that if either quality or price is uniform, the same conclusion may be reached, nevertheless, for various reasons these factors are not so readily susceptible of standardization. It will at once be recognized as a practical impossibility to standardize quality so that it will be at all times uniform among different bakers' products, nor would it seem advisable to fix anything except a minimum requirement in any case, since otherwise the incentive to bake a better loaf would be destroyed. In relation to standardizing prices, it may be said first, that elements beyond the control of law-making bodies operate to determine the price at which bread is sold. Moreover, both the price and apparent quality must in any event be brought directly to the attention of the purchaser, while the weight alone is the factor which may and usually will be overlooked. Therefore, it appears from all considerations, that the weight is the variable factor which should be eliminated from the equation.

During the period of war control of the bakers by the United States Food Administration it was clearly demonstrated that it was entirely feasible for bakers to bake loaves to a uniform size, and this is also admitted by the bakers themselves. This indicates that the proposal to standardize the weight of loaves of bread presents no difficulties of manufacture which may not readily be adjusted.

The principal arguments of the opponents of this movement appear to be, first, the claim that the baker would be deprived of that flexibility in his manufacturing processes which is essential for the protection of the interests of the purchasers of bread; and, second, the claim that a standard-weight loaf requirement is an unreasonable one, which unjustly discriminates against the baking industry. It is claimed that a loaf of fixed size allows them no flexibility to adjust the value which they give to their customers in agreement with the fluctuations in the prices of the ingredients which enter into the bread and in other manufacturing costs. It is assumed by those who advance this view that when the bakers' cost for a loaf of bread increases or decreases, a corresponding decrease, or increase, in the size of the loaf will be made and no change will be made in the price charged. This refers particularly to changes which would not justify a change of 1 cent in the price

of the loaf, but the claim is also made that the public objects to any change in the established price per loaf of bread and that it is preferable to change the amount in the loaf rather than the price in all cases. It is somewhat problematical whether or not the ordinary baker would exercise the constant and close scrutiny of his cost of production upon which the above argument is based, and whether or not the purchasing public would instantly benefit by slight decreases in the manufacturing cost, as is urged by those advancing this claim. Furthermore, events do not seem to justify the claim that the public objects to a change in the unit price for bread.

In connection with their claim that standardization of the weight of the loaf is an unreasonable requirement, the opponents of standardization express their willingness to label their bread with the true weight and say that when they have made a representation of the weight of each loaf, they have done everything that can reasonably be required of them. The disadvantage of this plan is that we would have on the market loaves of many different sizes, and the weights of these loaves would frequently be expressed in ounces and fractional parts of an ounce and all of the advantages cited above for the standard size loaf which facilitates ready comparison between different breads or, in other words, all of the advantages of standardization or simplification of units would be lost. It would really be necessary, under these circumstances, if a housewife desired to compare carefully two loaves of bread of different weights to compute the price per ounce, or per pound, for each loaf before she could proceed with her comparison. It is obvious that such a computation is entirely impracticable, especially where fractions of ounces are involved in the weight of either loaf. Numerous cases might be cited in which it is shown that experience with the standard-weight requirement for loaves of bread has proven satisfactory to the bakers and won the approval of the purchasing public. In this connection, it will probably be sufficient to mention the resolution recently adopted, unanimously, by the Indiana Bakers Association, which resolution, according to the Bakers Review, was an expression of satisfaction with the operation of the standard bread-weight law of Indiana and offer of assistance and benefit of experience to other States attempting to settle this quesion.

Eight months ago the standard-weight bread law became effective in Ohio. We can not say that this law is perfect in every detail—very few laws are—but we can to-day realize the great benefits of standardization. Immediately after this law became effective scores of applications for an extension of time came to the State department, and an additional 90 days was granted the bakers to permit them to use up the unmarked wrappers which they had on hand. Every possible effort was made to secure compliance with the new law without resorting to legal procedure, and up to the present time there have been only seven bakers cited for prosecution. This statute also prohibits the return or exchange of stale bread, which is no real easy matter to enforce in face of the many plans that are adopted to evade it. It is probable that the next legislature will be asked to repeal the section of the law granting the law violator the privilege of a hearing before a prosecution is begun. On May 1 a questionnaire was mailed to city and county sealers of Ohio, making inquiry as to

the attitude of the public and the baking industry relative to the standard-weight provision, and every reply brought the answer of complete satisfaction to both the bakers and the general public.

We can not find that the standard of quality has in any way been lowered, due to standardization of weight. With only the two factors of quality and price to be considered, the purchasing public is well able to determine for itself the fairness of the prices charged.

With hearty cooperation of 98 per cent of the baking industry, and having the support of the general public, we can safely say that this is one of the best statutes enacted in Ohio in recent years.

DISCUSSION OF ABOVE PAPER.

Mr. Estes. What tolerance have you been using in the last year?

Mr. Mote. The law in Ohio states the tolerance shall not exceed 1 ounce per pound over or under the standard unit for single loaves and one-half ounce per pound over or under the prescribed weight on the average of 25 or more loaves. In order to start the law off and to have everything work as fairly as possible, we left the tolerance the law had specified as the maximum, and that is the way it is operating.

I am told that the provision in our statute to the effect that no greater tolerance is allowable over than under was requested by the bakers themselves. We are required to take an average of 25 loaves instead of 12.

CONFERENCE COMMITTEE ON BREAD LEGISLATION AND TOLERANCES—Continued.

Mr. Maroney. I move that the Chair appoint a committee from the floor, to include the director of the bureau and the secretary of the conference, to see if the manufacturing bakers of the country have something to say in relation to a standard loaf of bread that will be satisfactory to the committee as well as to them. I hope to see them make a report here to-morrow morning. If it does not satisfy us we will put that on the table.

(The motion was seconded.)

Mr. Allen. It will be impossible to bring a representative committee from the American Bakers' Association to meet with your committee by to-morrow morning. If possible, what the bakers would like to have is a committee appointed from the National Conference on Weights and Measures to meet with a similar committee from the American Bakers' Association to take this question up within the reasonably immediate future and report back. We believe that such a conference will be productive of some relief.

Mr. Maroney. The majority of the general assemblies will meet next January; many of them meet only biennially. That simply means that you will have this thing go over again for two years more. If these master bakers and their attorneys have anything to say to us, we want to hear it to-day and now, or we will extend the time until to-morrow morning. At any rate the gentleman making this suggestion is a representative of the baking industry, and thus the suggestion has no standing. If one of the members of the conference wants to offer an amendment that will postpone this for a

year or two years, then we will take that up, and I know what we will do to such an amendment.

Mr. ALLEN. I did not want this question delayed for a year or more. The proposition is to have a representative committee of this conference meet a representative committee from the bakers in the immediate future. The suggestion by Mr. Holbrook was that the report from that joint conference be immediately transmitted by mail to all the members of the conference. That would seem to be a reasonably fair proposition, and one that would be productive of some agreement.

Mr. MARONEY. Gentlemen who come here and ask for a conference with representatives of this organization have nothing in the world to lose by holding that conference, but everything to gain. We are willing to go to the master bakers of this country and put out our hands and say "We will help you to have a standard loaf of bread throughout the United States with a tolerance that is fair," but it is ridiculous to think we are going to procrastinate in this fashion.

The general assemblies of the country universally meet January 1. There are some that do not meet every year. If we have to wait for a report from this committee, let us say, a year from to-day, then many of you will not be able to make a report to your general assembly until nearly two years after that. I say if they have anything to say to us, gladly will we meet them and help them, but we will meet them 50–50. We want the report back to this conference to-morrow morning—not a year from to-day.

Mr. HOLBROOK. There are physical limitations which must be considered. You have said that the Director of the Bureau of Standards should serve on this committee. As it happens the Director of the Bureau of Standards is now in Philadelphia, or on his way there. Similarly, the representatives of the bakers are now, to-day, in Chicago or in New York, or in other places, which makes it physically impossible for them to be present here and now or by to-morrow morning.

Personally, I do not see how an agreement can be reached if there is to be no argument or no discussion on what has been proposed already. It might be gathered from Mr. Maroney's remarks that the committee has taken up with the master bakers these tolerances and brought in something that the bakers wanted. This is not the fact at all, because the material was not available to the bakers before it was available to the conference, and the baking industry has had no opportunity to consider it.

It is very possible the bakers might consider the reported tolerance too small; you apparently consider it too large. But at any rate it is the committee's own work. I personally stand back of that report absolutely. Mr. White has not been here during the discussion. I do not know whether Mr. Cluett has changed his opinion or not, but as far as I am concerned I think those tolerances are entirely reasonable, are entirely fair. I am convinced that a closer tolerance could not be generally met.

Mr. MARONEY. Will the gentleman confine himself to the question?

The ACTING CHAIRMAN. The point is well taken.

Mr. MARONEY. By way of explanation, Mr. Chairman, it is not my proposition to tie up a committee that goes from this floor, but I do

expect that they will report to these men here who have come from all parts of the country. I do not propose to have a poker game played, where this committee will make a report later and have it lie still for two years.

The Acting Chairman. Gentlemen, you have heard both sides of this question discussed. The only thing for me to do is to put this question.

(The question was taken.)

The Acting Chairman. The Chair is in doubt as to the result.

Mr. Cummings. I ask that the motion be divided. I would be in favor of the appointment of a committee, but I would not be in favor of the limitation of time.

The Acting Chairman. The question has been put. The last vote was very even, and the Chair is in doubt. I will ask for a rising vote.

(The question was taken by a rising vote, a count was made, and the motion was declared lost.)

Mr. Cummings. Mr. Chairman, I move that a committee of three be appointed to confer with a like committee of the baking industry to endeavor to agree upon some uniform bread law and also upon tolerances which will be satisfactory to both sides.

(The motion was seconded.)

Mr. Goodwin. This question which has been before the house is of vital importance just at this time, as we are contemplating a bread law in my State. I have listened to the report of the committee on tolerances on this subject, and I was greatly surprised that it should be cast aside as it was. I think our committee on tolerances has given us a good, comprehensive tolerance on bread, and I am sorry that it was not accepted by this conference. Was any time limit specified in the present motion?

Mr. Cummings. No. Mr. Chairman, if this committee finds it impossible to make a progressive report to-morrow, they can make a final report, either by mail to the delegates assembled here or to the next conference; that is perfectly satisfactory. You can not expect them to perform the impossible. They must get together with the other side.

(The question was taken, and the motion was agreed to.)

The Acting Chairman. The Chair will appoint Mr. Mote, of Ohio; Mr. Cummings, of Massachusetts; and Mr. Holbrook, of the bureau, to serve on this committee.

PROPOSED PROCEDURE FOR FIELD TEST OF FABRIC-MEASURING DEVICES.

By Ralph W. Smith, *Bureau of Standards.*

This report covers the results of the investigation made by the bureau in compliance with the request of the Fourteenth Annual Conference that the bureau prepare a simple and effective field-test plan for fabric-measuring devices.

The devices in question are designed to measure fabrics by passing them between rolls, and in considering a method of test it seemed proper that such a device should be tested for accuracy in a similar manner; that is, by passing material between the rolls

and observing the agreement between the length indications of the device and the lengths of material measured. The amount of material passed through the device may be determined in two ways: First, by removing the material and measuring it with a standard linear measure such as a steel tape; or, second, by graduating the material itself and reading the desired length directly upon it. The latter method possesses obvious advantages over the former, particularly as to the amount of time consumed in the test and the facility with which it can be made. It was therefore decided to develop the test along these lines if possible.

In this connection it may be said that the expedient of actually passing a steel tape through the machines was tried, but did not prove successful either when the steel tape was used alone or when it was used in combination with a strip of fabric.

The first necessity, then, was the selection of a suitable fabric to be used as the testing medium. The requirements for an ideal fabric for this purpose are that it shall be susceptible of making proper contact with the measuring rolls; that it shall not stretch under moderate tension; that it shall be unaffected by changes in atmospheric humidity; that it shall be durable; and that it shall have a surface which can readily be marked with definite and conspicuous graduations. The fabric used should preferably be at least 2 inches in width.

In an effort to approximate this ideal fabric as closely as possible an examination was made of samples of a variety of materials chosen for study because they appeared to possess the necessary characteristics. Included in these were—

	Width in inches.
Taffeta ribbon	3
Grosgrain ribbon	$2\frac{3}{8}$
Cotton belting (two varieties)	2 and $2\frac{3}{4}$
Silk belting	$2\frac{1}{4}$
"Fabricoid"	$1\frac{1}{2}$
Cloth measuring tape material	$1\frac{1}{2}$ and 3
Utility cloth	$2\frac{1}{2}$

Samples of these various materials are here, and these you may examine at your leisure. They are marked with their names, so that you can identify them without difficulty.

The preliminary tests on these materials consisted of marking them under moderate tension to indicate certain lengths determined by comparison with a bench standard. A somewhat greater tension was applied, the amount of stretch noted, and the tension relieved. The original tension was again applied and any change in length noted. On two subsequent occasions, after a lapse of several weeks in each case, the material was again measured at the original tension, and any changes in length noted.

A study of the data secured on these tests and a careful consideration of each material in respect to its suitability for use as a testing medium made it possible to eliminate the majority of the samples and select three samples which had given the best results up to that time. In this connection it may be said that excessive stretch, lack of pliability, wavy edges, tendency to crack, and the unsuitability of the surface for applying graduation marks were some of the factors upon which rejections were based.

The three materials selected for further study were utility cloth, grosgrain ribbon, and taffeta ribbon. Samples of these materials were then subjected to stretching tests on the fabric-testing machine in the textile section of the bureau and load-stretch diagrams obtained. Two series of tests were run, one at a relative humidity of 33 per cent and one at a relative humidity of 65 per cent, three samples of each material being tested under each condition mentioned. For the purpose of checking the preliminary work, tests identical with those just outlined were also run upon the two varieties of cotton belting which showed up poorly in the original examination.

The results of these stretching tests are shown in the following table, from which the relative utility of the fabrics tested for the purpose desired is at once apparent.

Results of stretching tests on fabrics.

Load (approximate) in kilograms.	Relative humidity.	Percentage stretch.				
		Utility cloth.	Grosgrain ribbon.	Taffeta ribbon.	Cotton belting, sample No. 1.	Cotton belting, sample No. 2.
	Per cent.					
1	33	0	0.35	0.05	0.8	0.85
1	65	0	.15	.25	.45	.85
2	33	0	.4	.9	1.5	2.5
2	65	0	.4	.9	1.2	2.0
3	33	0	.5	1.4	2.0	3.2
3	65	0	.5	1.5	1.9	3.1
4	33	0	.5	2.0	2.8	4.0
4	65	0	.7	2.15	2.9	4.0
5	33	0	.5	2.6	3.4	4.6
5	65	0	.8	2.8	3.6	4.8
6	33	0	.5	3.2	4.1	5.5
6	65	0	.9	3.5	4.3	5.7
7	33	0	.5	4.0	4.9	6.2
7	65	0	1.0	4.4	5.3	6.6

The maximum tension applied in these stretching tests was enormously greater than the tension to which fabric would normally be subjected in pulling it through a fabric-measuring device but the tests at the greater tensions served to emphasize the difference in the performance of the different materials under consideration. The tests at reduced tension gave results consistent with those obtained at greater tension except in one instance. At the lowest tension used the taffeta ribbon was "second best," while at all other points it was third in order of resistance to stretching. The taffeta used was light in weight, and it is to be presumed that a heavier grade of taffeta would have given better results. However, the sample used was of a grade which has been actually used in testing fabric-measuring devices and the data on this grade were, therefore, valuable as showing what this fabric would do in service. Moreover, the results obtained are unquestionably characteristic of taffetas in general.

These tests clearly demonstrated the superiority of utility cloth over all the other materials, this fabric showing no appreciable stretch at any tension used in the test at either degree of humidity. Since this material also possessed the other qualities requisite for a testing medium it was selected as the one best suited for this purpose.

The bureau contemplates supplementing the data already secured by observing from time to time a test strip of utility cloth which has been subjected to ordinary field use in the testing of fabric-measuring devices. In the event of any developments adversely affecting the suitability of this material for use as a testing medium for these devices a further report will be made to the succeeding conference. At present, however, we have every reason to anticipate that utility cloth, or similar fabrics manufactured by other companies, will give excellent service in the field. This material is, therefore, recommended to weights and measures officials for use in the testing of fabric-measuring devices in the field. However, it should be noted that, in the absence of what may be called field-performance data, the bureau can not say positively that a graduated strip of utility cloth will retain its accuracy indefinitely and it is, therefore, recommended that on those days on which fabric-measuring devices are to be tested the inspector compare his testing strip with a steel tape in the morning before starting out. This may quickly and easily be done and will guard against the use of a testing strip which may have developed errors since it was previously used.

The next step in the investigation was the preparation of a testing strip to be used in testing the machines. It was thought that a length of material great enough to test the ordinary retail machines, without having to remove the tape and again insert it, would be preferable, and, therefore, a strip of this material—the so-called utility cloth—40 feet long, was secured.

In graduating the tape or testing strip—those words will be used interchangeably—it is desirable that a clear interval be left ungraduated at either end, because in the test which is outlined it is sometimes more convenient to start with the zero at the left side of the machine rather than at the right side, in which case it becomes necessary to have some fabric project through the machine on the other side so that it may be grasped.

In graduating this tape the work was done in a manner which may be duplicated by any of you in the field. The strip was laid out on the floor, a steel tape was applied to it, and the strip marked with a pencil at the desired intervals. Incidentally it may be said that the steel tape is a necessary part of the inspector's equipment for this character of work.

After the intervals were marked on the strip, the graduations were applied by using a straightedge, and these graduations may be placed upon the tape either with pencil or pen. In case a pen is to be used it is preferable first to put the marks on with a pencil and ink them in later. However, the character of this material is such that it retains a pencil mark very well, so that it is largely a matter of preference as to how you actually mark the tape. It is of course necessary that these graduations be placed at right angles to the edge of the tape, and that they be accurately placed and properly indicated. Main and intermediate graduations should be distinguished by the lines being of different length.

It is recommended that the first yard, from zero to 1 yard, be graduated by inches, because many fabric-measuring devices are so graduated. After the first yard it is probably unnecessary to graduate so closely. Each yard up to and including 12 yards

should be shown, and in addition there should be a number of main subdivisions shown between 1 yard and capacity.

As to the smaller subdivisions which are to be placed upon the tape to enable the inspector to determine the errors of machines tested, one of two methods may be used. You may put on the tape graduations representing eighths or sixteenths of an inch; or you may apply on either side of the graduations in question a line indicating the tolerance, so that if the tape indication is within the tolerance lines, it shows that the machine is correct within tolerance at that point. If the latter plan is adopted it is suggested that these tolerance lines be of a color different from that used for the regular graduations.

The graduations should then be properly numbered in a manner similar to that followed on a steel tape, so that the graduations may be identified.

It is suggested that in placing graduations on the tape these be confined to something less than half of the width of the tape, so that if it is found that these graduations develop errors you may block them out and use the opposite edge of the tape for another series. In that way, using both sides of the strip, four series of graduations might be placed on the same tape successively should it become necessary to do so.

It appeared to be necessary to develop some method of keeping this long strip of material in proper shape. So I rigged up this little reel [indicating]. I made this, so I know anybody else can. It consists merely of a tin can with a hole in the center, a threaded brass rod through the hole, a wooden disk at either end of the can, and a smaller disk which can be used for a handle mounted at the end of the rod. It seems to work very well in keeping the tape in good condition, and for winding it up after use. I do not expect to patent this reel, so that anyone who wants to make one like it has my consent to do so.

In testing the ordinary fabric-measuring machine with a tape of this kind it is necessary to have a definite reading edge of some kind, so that the indications on the tape may be read with precision. It is suggested that an ordinary piece of sheet iron can be bent up into something like this form [indicating] with two right-angle bends, and that by sighting along the two edges thus formed the indications of the tape may be easily and accurately read.

Such an indicator may either be applied to the side of the fabric-measuring device each time it is desired to make a reading or it may be attached to the machine with a couple of rubber bands and left there during the course of the test. This indicator is not essential, although I think it will be found useful in many cases.

Before this investigation was started all of the manufacturers who make machines of this character, so far as we knew of them, and I think our records are complete, were notified as to what the bureau expected to do, and were requested to submit suggestions as to fabrics and methods of test, and also to submit samples of their machines, that these might be used in the investigation. Two manufacturers only complied with our invitation, and necessarily those two machines were used in working up this proposed test method. An effort was made, of course, to make our test method applicable to all ma-

chines, and so far as we know there is nothing in the proposal which is inconsistent with the test of other machines which we did not have under examination at the time. We also tried to make the method as simple as was consistent with accuracy, and also to make it include all of the features which should be examined.

The field-test method which is proposed is largely confined to a test for accuracy and specifications have not been considered, because at this time there are no specifications for these machines. It is, of course, essential that any specifications which may exist relative to machines of this type be complied with, and it should be a part of the test to determine this, just as it is a part of the test of any other piece of weighing or measuring apparatus, to see that the specifications affecting it are met. As developed, this method requires the passing of the tape through the machine only once, provided the tape is long enough to represent the capacity of the machine. The 12-yard tape recommended meets this condition in the case of most retail machines.

The test has been divided into two parts, the first part the preliminary inspection, and the second part the test proper. I will read the paragraphs in order, and will comment upon any which appear to require additional explanation.

PRELIMINARY INSPECTION.

1. Examine the rollers for parallelism when these are in position for measuring. (Use a flash lamp for this purpose.)

It is obvious that if the rollers are not parallel, correct indications are not to be expected. A very simple method of checking this is to apply a flash light to one side of the machine with the rollers ostensibly in contact, and observe from the other side as to how the light appears between the rollers. If the streak of light appears wedge-shaped, of course they are not in proper adjustment.

2. Operate the device until it indicates the first length for which value figures are given. Check the alinement of the value figures with the unit price figures and the alinement of the value figures in the window of the device.

3. Reset the mechanism at zero and observe that the device is properly "cleared" throughout. Observe the customers' indicator, if one is provided, as well as the operator's indicator.

4. Observe that all buttons, keys, levers, etc., function properly.

That is rather indefinite, and it is purposely so, because machines differ. For instance, if a machine has an attachment to predetermine the amount delivered, the functioning of that part of the machine should be observed at intervals during the test to see that it works properly. If there are other keys or levers, the inspector should observe that they are working satisfactorily. In other words, before the test is finished the inspector should satisfy himself that all of the parts of the machine are in proper working condition.

5. Whenever a value chart which has not previously been checked is encountered, check a sufficient number of the computations to establish the general accuracy of the values shown.

It is only necessary to do that once for each type of chart. It will ordinarily be possible to see the number on the chart which indicates

its general character, and all charts of that number may be assumed to be alike.

TEST.

NOTE.—In passing material through the device, care must be exercised to pass it through at right angles to the axis of the measuring roll, otherwise erroneous results will be obtained.

The fabric strip used in testing the device should have a graduated length (exclusive of an ungraduated portion at either end) of at least 12 yards, which will ordinarily permit the test of a retail machine to capacity without removing the testing strip and reinserting it between the rolls of the device. In any event, the testing strip should never have a graduated length of less than 6 yards.

Whenever it becomes necessary to remove and reinsert the testing strip in order to test the device to capacity, great care must be exercised to avoid introducing errors; the testing strip should be removed when its indication is some even yard and it should be reinserted so that it gives an indication of zero or some even yard.

6. During the progress of the test outlined below, attention should be given to the following:

a. The indications of the customers' indicator, if such is provided, should be checked at frequent intervals for agreement with those of the operator's indicator.

b. If the device is equipped with a totalizing meter, an "inventory indicator," or other similar part, a sufficient number of the indications of such part should be checked to determine that it is functioning properly.

c. At frequent intervals the alinement of the value figures should be checked as outlined in paragraph 2 above.

d. Observe that the parts work freely throughout the range of the device and that the tension is not excessive at any point.

7. Throughout the tests outlined below all of the indications of the testing strip or tape should be within the tolerance prescribed for the machine indication under consideration.

Starting with a tape indication of zero the device is operated until the machine indicates the measurement of a certain amount. The indication of the tape is then read, and that tape indication should be within the tolerance which applies to the amount in question. This is where the tolerance lines on either side of the tape graduations will be of assistance, since it is unnecessary to read exactly what the tape indicates, but is sufficient if the tape indication lies within the tolerance lines.

With paragraph 8, the description of the actual test begins.

8. Insert the graduated testing strip, hereafter referred to as the "tape," to give a zero reading. Establish a zero machine indication, then operate the device until the first subdivision of the yard is indicated by the device and observe the tape indication. If the point just tested is the 1-inch graduation, advance the tape until the first main subdivision (usually one-eighth yard) is indicated by the device and observe the tape indication. Advance the tape a few inches and then, reversing its direction, again cause the device to indicate the main subdivision just tested, observing the tape indication as before.

NOTE.—If it is found that for a particular indication of the device the tape indication is less when the tape has been run in a backward direction than when it has been advanced, this is evidence of backlash or lost motion in the

mechanism, and a constant minus error of this amount as compared with the tape indication when the tape has been advanced may be anticipated in all cases where the tape has been run in a backward direction. It therefore follows that, under these conditions, if the tape indication shows at any point in the course of the ordinary test (in which the tape is advanced) an error in deficiency almost equal to the value of the tolerance in deficiency, the reverse test as outlined in paragraph 8 above should be applied.

9. Advance the tape until the device indicates the next main subdivision of the yard and observe the tape indication. Proceed in this manner to test all of the main subdivisions of the first yard, repeating the test with the tape moving in a backward direction at least once as a check. Also test at several inch indications, if the device is graduated in inches, particularly at 12 and 24 inches.

10. Test at the 1-yard indication of the device, observing that the fractional and the main or even yard indicators agree in their indications. By operating the mechanism forward and backward through the necessary range observe that the main indicator changes its indication at such a point in respect to the position of the fractional indicator that the range throughout which a faulty indication is given, if any, is reduced to a minimum.

11. From this point to the capacity of the device test at each even-yard indication of the device on retail machines, occasionally testing subdivisions of the yard throughout this range. On wholesale machines in which the capacity is large, test at a sufficient number of points throughout the range of the device, including the capacity graduation, to establish the accuracy of the device.

12. Reset the mechanism at zero and observe that the device is properly "cleared" throughout. Observe the customers' indicator, if one is provided, as well as the operator's indicator.

Upon the retest of machines which have previously been tested, certain parts of all this may be omitted, such as the inspection for compliance with specifications, the examination of the chart values, and points of that character. But the general test for accuracy as outlined above is recommended as the procedure to be followed in every test.

This test, perhaps, seems at first somewhat complicated but it really is not so, and the complete test, which involves passing the testing strip through a machine but once, can be made in approximately three or four minutes.

It is suggested that the outline be studied to fix in mind the general character of the test, after which no difficulty should be experienced in following out the details.

I wish to add one thing to what I have already said. In developing this test we were able to secure material of suitable character for a testing strip from only one manufacturer. We are advised that there are several manufacturers making a similar material. The bureau contemplates getting in touch with these people, securing samples of the materials they manufacture, and subjecting them to tests similar to those applied to utility cloth, so that we can find out if there are other materials besides this one that will be satisfactory. The results of this examination will be made the subject of a communication to those who have attended the conference or will at least be presented to the succeeding conference so that if possible those interested may be advised of several sources from which to get material of this kind.

I may say that "utility cloth" is manufactured by the Special Fabrics Co., of Saylesville, R. I. They were asked at what price they would sell a strip of this material 40 feet long and 2½ inches in width, postpaid, to any inspector who might wish to purchase it, and they quoted a price of $1. This material is made in several grades, the one recommended being approximately seven thousandths of an inch in thickness.

(At this point Mr. Smith demonstrated the proposed test upon several fabric-measuring devices.)

DISCUSSION OF ABOVE PAPER.

Mr. REICHMANN. Mr. Chairman, are there no tolerances suggested by Mr. Smith in connection with this report?

Mr. SMITH. The report was confined to the investigation made in compliance with the request of the last conference that the bureau develop a field-test method. My understanding is that the question of tolerances was referred to the committee on specifications and tolerances and will be made the subject of a separate report.

Mr. REICHMANN. I have had a great deal of experience with these machines, of one kind and another, and even some that are not represented here, and this is a most admirable field test in every respect.

I move that the conference adopt this field-test method as the sense of the conference.

(The motion was seconded, the question was taken, and the motion was agreed to.)

(It was moved and seconded at this point that the conference adjourn; the question was taken, and the motion was agreed to.)

(Thereupon, at 4.10 o'clock p. m., the conference adjourned to meet at 10 o'clock a. m., Friday, May 26, 1922.)

SEVENTH SESSION (MORNING OF FRIDAY, MAY 26, 1922).

The conference reassembled at 10 o'clock a. m. at the Bureau of Standards, Dr. S. W. Stratton, chairman, presiding.

DIFFICULTIES ENCOUNTERED BY MANUFACTURERS OF PRECISION STANDARDS DUE TO NONUNIFORM REQUIREMENTS.

By W. L. Egy and L. C. Higbie, *representatives of W. and L. E. Gurley.*[6]

While we intended this paper to deal primarily with the manufacture of standards, I think you will see that there are difficulties regarding manufacture that are due to differing requirements of the various States, as indicated by the title on the program.

Our firm has been so closely identified in the early development of weights and measures through a number of men, one of whom is no more, that it feels more than a mere commercial interest in its further progress. We are hopeful that our effort to-day will be productive of discussion which will eventually result in one more step toward the standardization of the sealers' work.

This paper deals primarily with the manufacture of one-piece gold-plated weights with some reference to the manufacture and repair of nickel-plated weights. It will be impossible to even touch upon the length and volume measures in the short space of time allotted. It is hoped that the details of manufacture will not only be of interest, but will also give a better appreciation of what a weight standard is and the care and treatment it should receive. It is also hoped that this paper will leave with you a more sympathetic understanding of some of the difficulties which confront the manufacturer.

The fundamental principle underlying the design and manufacture of weight standards—and, for that matter, volume standards as well—may be given in the single phrase, "A weight should be its own guarantee of accuracy," or, in other words, it should show by its appearance at any time whether or not it is correct, assuming that it was made so in the first place.

Suppose you had two weights—one with a bright shining finish, no scratches or tool marks, and with the seal properly stamped; the other with a dull finish, with hammer marks, scratches, and cuts. Both weights were of the same accuracy when made, and may still be so, but which one would you put your faith in? Without a test you could not be sure of the second one, but the very appearance of the first one guarantees that it is still as correct as when made; that is, the weight is its own guarantee of accuracy.

There are a number of factors which might cause a change in the value of a weight, and we will try to keep these in mind throughout

[6] This paper was read by Mr. Egy, and was illustrated by lantern slides throughout.

this paper. The following may be mentioned as causes of change in a weight: (1) A piece of it may be removed, (2) it may be worn or broken, (3) it may gain weight by oxidation, (4) it may gain weight by the accumulation of dirt, (5) it may gain or lose gases, and (6) it may be tampered with and intentionally altered. If we should trace the history of weights through modern civilization, we would see how these various factors have been one by one eliminated, until today we are able to make weights that, if properly handled, will remain accurate within the necessary limits for a good many years.

These Burmese "duck" weights [referring to slide] are rather odd, but are neither good weights nor good copies of ducks. Many of us have seen the cast-iron block with the ring in the top, used in many communities not so long ago. The ring was often an open link and if it became lost no one was any wiser. Such weights have all the faults listed on the last slide. They were adjusted by drilling holes in the bottom or breaking off a piece, or, if too light, by pounding some lead in one of the holes. If some of the lead should drop out there would be nothing to show that the weights were light. Contrast with that the national prototype kilogram of platinum alloy, or a gold-plated weight, made of one piece of the most dense, uniform, and noncorroding material that can be used. This change was not accomplished in a single step, but has, of course, been a gradual development over a period of years. As our knowledge of weights has increased, the manufacturer has had to refine his methods of making them to meet the new demands.

We will now take up the manufacture of a one-piece gold-plated weight and see how the requirements enumerated above are met. We will also briefly compare this with the manufacture of other weights, the requirements of which are not so severe.

The material used is of the utmost importance. The Bureau of Standards has specified that it must have a specific gravity between 8.2 and 8.6, and it must be nonmagnetic. It must also be something that can be easily plated with a solid covering of gold. We use tobin bronze because it can be obtained with fewer holes and flaws than other available material. As most of you know, the impurities of a casting always rise to the upper part. Ingots are cast on end and we have made arrangements with the company which supplies our billets to cut them from the bottom of the ingot so that they may be as perfect as possible. Even with this care, however, the metal may show tiny microscopic holes which prevent the perfect plating of the weight.

The picture shows a billet for a 50-pound weight. It weighs about 80 pounds. This billet is first pounded all over with a heavy hammer to close up any of the little holes which may be near the surface. The first forming operation consists of turning the body to diameter. We always make the diameter of the bodies the same, so that the weight will fit the box made to contain it. If any variation in dimension is required, it is always made in the length of the body. After the weight is turned while still in the lathe it is given the first rough polish. The weight is then reversed in the lathe, care being taken not to scratch or mar the body, and the knob is formed by removing a large quantity of the metal from the billet. One of the primary requisites of a class A weight is that no part can be re-

moved without damaging the weight beyond repair, and for this reason the knob must be part of the same piece as the body. This not only requires time to remove such a large amount of material, but also a great deal of care. The shape must, of course, be made to agree very closely with the standard form, in order that it will resemble the other weights of the set, and also that it will contain the same quantity of metal. Since we are allowed only a 2-grain tolerance on a 50-pound weight, you will readily appreciate that not much variation can be permitted in the shape and size of the knob without making a difference considerably more than this 2-grain tolerance. The knob also is given the first preliminary polish while still in the lathe.

The weight is again reversed in the lathe and the bottom turned off. It is impossible to turn one of these weights simply to a given dimension and have it be of the correct value in weight. Those of you who are familiar with this class of machine work will, no doubt, agree that 1/1000 of an inch would be close work on this job, and yet an error of 1/1000 of an inch in the length of a 50-pound weight would make a difference of 50 grains in its value and you remember we are allowed only 2 grains. It is necessary, therefore, to carefully check the weight from time to time as the bottom is being turned off. The man will first make sure that his weight is oversize, then take it out and weigh it on a balance. He will then put it back in the lathe and turn off a little more from the cup part of the bottom and weigh again, repeating these operations until he has finally reduced it to the proper value, making proper allowance for buffing and plating. If turned too light it must be thrown away, as there is no way it can be brought up to weight again.

The weight must go to the engraving room where the denomination is marked on the top of the knob. This would appear to be a simple operation, but it is necessary that all of the lines in the figures and letters should be of uniform weight and also that there should be no false marks. If there were extra marks on the weight, no one could be sure whether these were in the weight before its adjustment or whether they had been put in by accident, or, in other words, there is no guarantee that the weight is still correct. The weight then goes to the buffing room, where all scratches and tool marks must be removed and where it is given a very high polish. You will remember one of the six faults shown on the second slide is that a weight shall not accumulate dirt. Few people realize the effect of polishing on the surface of the weight. There is little difference in the appearance of a weight with a high-grade finish and one not quite so good. Our tests have shown, however, that the better polish we can give a weight the less it will gain due to the accumulation of dirt. On one style of weight which we recently put through the factory the time spent on buffing the weight was 60 per cent of the total time required for making the weight.

You will no doubt realize from the picture that there is considerable physical labor involved in handling 50 pounds of metal and at the same time doing a fine high-grade job on its surface. Another thing which complicates this operation is the fact that the weight becomes too warm to be handled comfortably with the bare hands and additional time must be taken to allow the weight to cool off. And again on this operation the value of the weight must be care-

fully watched, but before it can be put on the balance a 50-pound weight must be allowed to cool for 10 to 12 hours in order to get any accurate value of it. Incidentally it may be mentioned that a bronze weight immediately after the buffing operation will be so nearly like a finished gold-plated weight in appearance that even the workman may have difficulty in distinguishing the difference between them. The weight must next be examined carefully with a microscope to see that the surface is in good condition and then it goes to the plating room. There it must be thoroughly cleaned with alcohol, potassium cyanide, hot and cold water, and given a strike coat of copper before going into the gold-plating bath. Enough gold is put on to make sure the weight will be too heavy when it comes out of the bath. All of the polishing on the gold surface is done by hand. After a light rubbing it is again weighed.

As we are now approaching the final adjustment of the weight, it is necessary to use great care in weighing. All of our fine weighing is done in the constant-temperature laboratory in the basement. That previously mentioned in this paper was done in a room adjoining the workshop and on comparatively rough balances. The weight is then gradually worked down to the correct value by repeating the operations of polishing and weighing. Of course every time it is put on the balance there must be a delay of several hours to allow the weight to cool to the same temperature as the room and balance. The weight is then set on the shelf for three months to see whether the plating is perfect. If any spots or stains should appear on the weight, due to imperfect surface or cleaning, the plating must be polished off and all done over again, when another three months will be required before the weight can be shipped.

Now, having taken all this trouble to make the weight correct and having the bureau's certificate that it is correct (for practically all of our gold-plated weights go through the Bureau of Standards for certification) the assurance of the owner at any subsequent date that the weight is still correct lies in its appearance. This means that a new weight must be so made that the slightest wearing or scratching of the weight or accumulation of dust or oxidation will show upon that weight. If we were to manufacture a weight which had any scratches or tool marks or false cuts on it, we could make the weight just as accurate, but the owner would not be able to distinguish these marks from any which might be made later. You will, therefore, appreciate the fact that the weight must be made as nearly perfect in appearance as it is possible to make it, and then so long as it has received no damage this very appearance assures that it is still as good as when first made; that is, it is its own guarantee of accuracy.

This short history of the weight does not begin to show the care which is taken to keep it in a perfect condition all the way through the factory. Every time the weight is picked up, even before plating, the man's hands must be free from grit, every time the weight is transported it must be very carefully wrapped in a special cloth which will not scratch, every time it is set on a table that table must first be brushed free from small particles, then covered with a clean piece of cloth or paper to be sure the weight will receive no marks.

In the manufacture of nickel-plated class C weights there are two main differences from the gold-plated weights. The material may be brass or steel, and when plated the job is done once for all. In the second place a means of adjusting is provided. Although the weights must be carefully weighed while being machined, they need be only approximate, the final adjustment being made by loading in the hole under the screw.

The same care in finishing or polishing, however, is taken in the manufacture of these weights as is used for the gold-plated ones; in fact it is possibly even more important that weights which are to be picked up in the hands have a higher polish than those which are handled with a hook.

Another important factor in the manufacture of class C weights is the manner of constructing the seal over the load hole. About a year ago this matter was taken up in detail with the Bureau of Standards, and since that time we have done a great deal of experimenting. After trying a number of different types of seals and methods of sealing, we have recently produced this one [referring to slide]. This drawing shows the relative dimensions of the thread, smooth section at the top, screw head, and lead seal before being crushed. This design is the result of careful calculation in addition to considerable time spent in driving in seals. The quantity of lead in the lip is just sufficient to fill the space under the edge of the screw head and in the thread up to a point level with the top of the screw. The top of the seal is curved enough so that when flattened out it will reach to the walls of the hole. By using the proper tools this design makes it unnecessary to do any more than simply flatten down the lead in the proper place. The other drawing shows the seal after having been forced into place. You will notice that the lead is gripped around the head of the screw and fills into the threads so that it can not be shaken or jarred loose. In driving in these seals it is important that no cracks be left along the edge which might accumulate dirt, and it is just as important that no thin edge be driven up along the sides of the holes which might become broken or lost. These seals can be very easily put in place with an ordinary flat punch and a light hammer. It is not even necessary that the punch be the same size as the hole if care is used. For factory work, however, we have special tools which prevent the seal from spreading until the lip has been forced down into its place. A second tool is used to flatten the top and a third to put in the letter G.

While it is impossible for these seals to come loose by accident or be removed without destroying them, they are very easily taken out when it is required to adjust the weight. This is done by forcing a screw driver down through the lead and into the slot in the screw, when both screw and seal may be easily turned out.

Weights which go through the Bureau of Standards are stamped on the seal with the official mark of the bureau, so that if the seal is tampered with the bureau's mark is destroyed. Other weights have in the past been sent out with a smooth, flat surface on the seal. Recently, we have adopted the practice of stamping the letter G on these seals, which shows whether or not the weight has been altered since we adjusted it.

It may be of interest to know how we maintain our weight values so that we know what a pound really is. We have four sets of standards. First, a set of "shop weights," which are used by the workmen for rough checking while the weights are being made. These are adjusted by a second set of nickel-plated "working standards," which are used for all adjusting except the final test of analytical weights. These working standards are in turn tested from time to time against a third set of "primary gold-plated standards," for which we have the certificates of the Bureau of Standards. These are kept locked in a vault and used only a few times a year. Still back of the gold-plated standards we have, as the last word, a kilogram weight which has been in our possession about 15 years and which was certified by the International Bureau of Weights and Measures in 1906 and by the Bureau of Standards in 1910 and is now again being tested by the latter bureau. We also have as auxiliaries to this kilogram, a 100, a 10, and a 1 gram, and a 100, a 10, and a 1 milligram weight. These all have the Bureau of Standards certificates. These weights are generally not used even once a year.

In addition to having these various sets to refer to, from time to time we will send one or two weights to the Bureau of Standards and get their correction on the weight, which furnishes us with a check on all our standards.

This probably seems like going to extremes, and that would be true if all the weights we made were to be checked by the Bureau of Standards or by a State department. Many of our weights, however, go directly to the user, and if they should be incorrect an injustice would be done to some one. And then, too, we make many weights in foreign units where perhaps no other standards exist. For such places it is imperative that our weights be correct without the possibility of a doubt.

We would like to go into details of boxing our weights, as we are rather proud of the work turned out by our cabinet shop, but time will not permit a discussion of that in this paper.

One of the problems the manufacturer has to face is the question of having stock on hand for immediate delivery. In the first place it requires a great many weights to be able to make up any given sets which may be ordered. Of course we try to keep some of the standard sets, which are most used, on hand, but so many orders are received for special or partial sets that it often prevents us shipping regular sets. This, however, is more a question of having boxes for special combinations than that of having the weights.

For instance, let us consider one of our regular sets which goes from 10 pounds to two 1/32 ounce by means of the regular 5–2–2–1 sequence, recommended by the Bureau of Standards. Now let us suppose we get an order for a set of weights from 10 pounds to two 1/16 ounce, and calling for only one 2-pound weight. The question is whether we shall make a box for that particular set which not only takes considerable time, but also makes the box cost a great deal more, or whether we shall leave one of the 2-pound holes empty, leave one of the 1/32-ounce holes empty, and rip the lining out of the other and bore it out to take the extra 1/16-ounce weight. If we make a special box for this set, we would not dare charge the cus-

tomer the full amount which it costs us, including the time of the engineering department, drafting room, planning department, and superintendent to make it, because the price would be excessive. We have, therefore, adopted the practice, if possible, of using regular boxs for such partial sets and leaving the extra holes empty. Other special sets which are ordered call for only one 2-pound weight and two 1-pound weights; others call for a 5–4–2–1 sequence instead of the regular 5–2–2–1 sequence.

It would appear that a few standard combinations could be adopted which would cover the entire field. In choosing a set or combination of weights there are two things to be considered, one is the ease with which weights may be added or subtracted to get any desired total and the other is that the owner should be able to check any weights in his set against some other weights or combination of that same set. The Bureau of Standards has gone into this matter rather thoroughly and their recommendations show that the 5–2–2–1 series is the best sequence.

Now if we take the avoirdupois sets of the knob type; that is, from 50 pounds to 1/32 ounce, only a few sets are necessary to cover the entire range which might be called for, viz, one set from 50 pounds down to two 1/32 ounces, another from 10 pounds down, one containing two 2 pounds and down, and one from 1 pound down. These sets, made in each class of weights, should cover the entire field of avoirdupois weights. If we could be assured that weights would be ordered in one of these particular combinations, or any other which might be adopted, we could go ahead and make up boxes and sets so that they would be ready for shipment when ordered.

We do not wish at this time to start an argument on weight sets and types nor even to recommend at this conference any particular standardization, but we do feel that it is entirely practical to leave the thought with you that some standard practice might be adopted along these lines. A great deal of work has been done by this conference and State organizations toward standardizing commercial apparatus and practices, such as berry boxes, bread loaves, gasoline pumps, etc., and the manufacture of your equipment would welcome similar steps.

This also applies to the type of weights as well as to the weight sizes or combinations. Some States require the working weights of the sealer to be tested by the State department. For such places the regular class C weight is suitable and, although not used to-day, it is the proper one to use. Sealers in other States, however, have no use for this weight and want a plain screw-knob weight, one which has no official recognition, and the use of which is not recommended by the Bureau of Standards. It is a fact, however, that there is more demand for these weights at the present time than all the approved types put together.

Now just a word regarding the proper care of weights. We receive many weights sent back for repairs, and it is discouraging to see the way they have sometimes been mistreated. We go to extreme trouble to make the weights fine and perfect, and our customers insist that the weights they receive from us shall be entirely free from all specks or scratches, but apparently many of them lose interest in this fine appearance once the weight has been

paid for. The proper repairing of weights is a question which is difficult to settle. A weight which contains deep dents and rust pits must be turned off until all of the marks have been removed. This means that considerable lead must be added in the load hole, and in many cases there is not room enough to load up to the proper weight again. If we simply clean off the rust and polish over the marks and dents the weight can probably be easily adjusted, but after it is out in the field no one can be sure from its appearance that these marks were not put in since the last adjustment. Usually when we receive weights which can not be put in first-class condition we refuse to make repairs. This causes some dissatisfaction because our customers feel that we are trying to force them to buy new weights, but, on the other hand, we do not like to have even repaired weights go out of our factory unless they fulfill all the requirements of standards. And, besides this, it costs almost as much to repair some of the weights as it would to make new ones.

These weights [referring to slide] were returned to us within the past month for repairs. Their values when received by us were as follows: 10 pounds —26 grains, tolerance 4 grains; 10 pounds —20 grains, tolerance 4 grains; and 5 pounds —1.5 grains, tolerance 3 grains. It is very likely that these weights were used by the sealer up to the time he returned them to us.

Suppose we should send a man into the sealer's office with a set of weights like those to use in testing the sealer's weights and tell him that his were wrong. It is doubtful whether any confidence would be placed in such a test. On the other hand, should a representative appear with a weight like this sample which has no scratches or marks and which is sealed and still bears the stamp on the seal, there would be very little doubt in any man's mind as to the accuracy of the weights used. It requires a great deal of care—in fact, extreme care—to keep weights in such condition when they are used daily in the field, but some men do take this kind of care of their weights and find it pays.

It is more important in the case of steel or iron weights to prevent them from being damaged than it is for brass weights on account of rusting after the coating has been broken. A nickel-plated steel weight will last a long time, providing the plating is not broken, but if *one* hole is made through the nickel, and air and moisture allowed to get to the iron it will only be a short time until the rust underneath the coating will cause it to peel off.

In a number of States it is the practice to stamp on the body of the weight with steel dies, cutting through the nickel. If the weight is then exposed to the elements it is only a short time until the weight is ruined. Ammonia fumes also cause trouble with nickel plating. Many sealers use old barns in which to store their automobiles, not realizing that nearly all such places have quite a little ammonia present, which in a short time attacks their nickel-plated weights. We have found many instances of weights going bad from this cause when the sealer insists that they have received no damage from his hands.

It is also the common practice in handling 50-pound, cast-iron weights to slide them along the floor, and a concrete floor makes a fairly good grindstone for cutting off the bottom of a weight. They

are also carelessly knocked together while being stacked, and this breaks off the corners. They are sometimes stacked in a room and left for weeks and months where the dust will accumulate on them. It is only necessary to lay a piece of newspaper over the stack to prevent this accumulation of dust and when uncovered they will be practically as clean as when put away. Many departments are located in the basement of buildings in rooms that are damp a good part of the year. If the weights are stacked on the floor in such places it does not require much time for dampness to accumulate under them and rust will start in. This can be easily prevented by putting a board on the floor before stacking up the weights.

There are many little things of this nature which a sealer can do to help raise the standard of our standards. It simply requires constant care and thought.

The CHAIRMAN. This most interesting paper shows how we can disseminate useful information of that kind. I am sorry that it is not followed by a talk on weights by Mr. Pienkowsky and other members of the bureau's staff. Few people realize what it means to keep standards in order and to go through the process of calibration or verification of the precision standards.

This paper recalls to mind the early days of the bureau, when we were discussing this question of standards. You will remember that up to that time this class of standards had been made by the Government and furnished to the States. It was apparent to us that we could not go on with that process, especially as we were anxious to have standard weights in the hands of the local sealers, and also manufacturers were asking for them.

We saw early that there was no use whatever to encourage and build up the work of the local sealer and get all of that started if there was not some place where he could secure his apparatus. There was no place at the time. Therefore, we asked the interested manufacturers to come and see us about this matter. The manufacturers of standards deserve great credit for the way in which they have built this up. They have been in constant communication with our weights and measures division. They have shown every disposition to build up this work in a way that would meet the needs of the State and city officials.

This paper also calls to mind the trouble we had in preparing the precision weights. They were originally brass weights, lacquered, and filled with lead. In trying to get away from certain difficulties encountered the method of gold plating was developed. I would like to have something better than gold. I would like to use platinum. Platinum would be a great deal better, and it is not so much more expensive. But as yet our chemists have not provided a suitable and convenient way of platinum plating.

After the gold-plating process was inaugurated it was found that the weights when put in a hot-air bath to dry lost weight and this loss continued for considerable periods of time. This was found to be because the weights were made of cast metal. Cast metal was always more or less porous, and this metal absorbed the plating solution. We know it also absorbed gases. So we tried a metal known as Tobin bronze, which is a wrought metal, very homogenous and very dense. That was the best alloy we could get at that time for these weights. There are other alloys now known which might per-

haps be somewhat better, but they would be very expensive. Tobin bronze makes a very practical, useful alloy, and is used for all precision weights that are gold plated.

EVAPORATION OF GASOLINE FROM DELIVERY HOSE OF LIQUID-MEASURING DEVICES.

By Ralph W. Smith, *Bureau of Standards.*

This investigation was undertaken at the request of the Fourteenth Annual Conference on Weights and Measures for the purpose of determining the amount of gasoline required to wet the delivery hose on a gasoline-measuring device or, in other words, the amount required to compensate for the amount of gasoline lost by evaporation from a wet hose when allowed to stand for a number of hours. The reason for such data is to enable proper corrections to be applied to the first delivery of a liquid-measuring device after standing for a considerable time to compensate for the gasoline used in wetting the hose, whether this delivery be a part of the so-called "time-elapsed test" or whether it be a part of an independent test.

It was at first decided to make the determinations incident to this investigation by a gravimetric rather than by a volumetric method, because it was felt that more accurate and dependable results could be secured by that method. Later on, however, on account of the entry into the determinations of certain factors which will be discussed later, it was decided to supplement the results first obtained by others secured by a volumetric method. The very close agreement between the results obtained by the two methods, as will be shown below, is gratifying and indicates that each method is a reliable one.

Throughout the investigation gasoline of the variety commonly supplied to motorists as ordinary low-test fuel was used.

In the gravimetric series weighings were made upon a large even-arm balance, using the substitution method of weighing. Weighing results were recorded to the nearest 10 milligrams and differences representing evaporation losses were later converted to cubic inches, rounded off to the first decimal, due regard being given in this conversion to the density of the gasoline used.

One end of each hose was closed by means of a rubber stopper and the weight of the dry hose obtained. The hose was then filled with gasoline, after which the stopper was removed and the hose allowed to drain for 10 seconds after the main flow had ceased. The stopper was replaced and the hose again weighed, after which it was hung up in the same manner as the hose would be hung up on a liquid-measuring device; that is, with the two ends of the hose upward and on an approximate level. One end of the hose being stoppered and the other open, there was the same opportunity for evaporation that there would be in a hose attached to a liquid-measuring device, with this difference, that in this investigation the filling nozzle customarily supplied was not attached to the hose and consequently the opening was somewhat larger than if the nozzle had been attached.

After a period of six hours the hose was again weighed to determine the loss from evaporation during the 6-hour period. Again, at the end of approximately 24 hours, the hose was reweighed to determine the loss from evaporation during this period. Immediately following this weighing the hose was again wetted as pre-

viously described and hung up as before. In these tests an effort was made to hang the hose where conditions would approximate those of an outside installation. This condition was secured by hanging the hose at one end of a corridor where there was a free circulation of air and where the temperature was that of the outside air. Except for one period of about three hours, the hose was exposed at no time to direct sunlight and care was taken to see that the hose did not become wet from rain.

Three sets of observations such as those described were taken and the results studied. A suitable comparison between the weights obtained indicated the loss that had occurred in the various 6-hour and 24-hour intervals. However, it was evident that there was a gradual absorption of gasoline into the hose, since each "weight after wetting" was greater than the preceding one and in no case was as much gasoline lost through evaporation as was gained upon filling.

These conclusions pointed the necessity for running another group of tests, and in order to eliminate as nearly as possible the variable factor just described each hose was filled with gasoline and allowed to remain filled for almost four days. They were then emptied and allowed to stand for 24 hours before the next series of observations was started. Thus, conditions which would obtain in the hose of a liquid-measuring device which was in regular use were duplicated. The method of taking the second group of observations was identical with the first in all respects. The results were much more consistent than those of the first group and were considered fairly satisfactory in most respects.

However, it was observed that atmospheric conditions, particularly an excessive humidity, had a marked effect upon the results obtained. Upon rainy days the evaporation loss appeared to be much less than on bright days and, while this might be anticipated, the magnitude of the differences was too great to be entirely explained upon the theory of retarded evaporation; in fact, in two cases the hose actually weighed more after standing for six hours than it did at the beginning of this interval. The conclusion which naturally followed was that the outer fabric covering of the hose absorbed moisture from the atmosphere, the hose thereby becoming heavier.

Of course, the observations which were obviously in error from this cause were discarded; but in spite of the relatively close agreement of the remainder some doubt seemed to be cast upon their accuracy, and it was decided to conduct a new series of observations by a volumetric method in which absorption of moisture by the covering of the hose need not be considered.

In the volumetric series, direct observations were made to determine, in each case, the volume of gasoline which remained in the hose and was not recovered when gasoline was passed through the hose after various time intervals.

At the beginning of each set of observations a valve was attached to one end of each hose, the valve was closed and the hose filled with gasoline from a 1-gallon field standard which had been filled to the zero mark. The valve was then opened and the gasoline allowed to run back into the gallon standard, the hose being drained for 10 seconds in each case. The difference between the amount of gasoline recovered and the original gallon was read directly from the gradua-

tions on the field standard. The valve was then removed from the hose, one end of the hose closed with a rubber stopper and the hose hung up with both ends elevated. This operation was repeated a number of times for each hose at intervals of 6, 18, and 24 hours, and some few observations were taken after a lapse of 42 and 48 hours.

Since, in following this method, any gasoline not recovered or otherwise accounted for is assumed to be retained in the hose, care was observed to wet with gasoline and drain for 10 seconds, all utensils used, including the valves, previous to each set of observations. It was also determined that corrections of one-fourth, one-half, and three-fourths cubic inch should be applied to results obtained on the three-quarter inch, 1 inch, and 1¼ inch hose, respectively, to correct for the evaporation taking place during the transfer of liquid.

In this series of observations the hose was hung up indoors where there was more or less circulation of air and where the temperature approximated that of summer. Owing to the season of the year at which this series was made (November–December) it was considered that indoor conditions were preferable to outdoor conditions for the purposes of the investigation and no effort was made to duplicate the conditions described above which obtained during the gravimetric series.

For the reason already given; that is, the absorption of gasoline in the hose itself, the results of the first group of gravimetric observations have been discarded and are not reported.

In Table No. 1 below is shown a summary of the results of the second group of gravimetric observations. The values shown represent the averages of the several values obtained upon individual observations.

TABLE No. 1.—*Average evaporation loss (gravimetric method).*

Size of hose.	Average loss in 6 hours.	Average loss in 24 hours.
	Cubic inches.	*Cubic inches.*
¾ inch	0.9	1.6
1 inch	1.6	3.3
1¼ inches	1.7	4.3

In Table No. 2 below is shown a summary of the results of the volumetric observations. The values shown represent the averages of the several values obtained upon individual observations.

TABLE No. 2.—*Average evaporation loss (volumetric method).*

Size of hose.	Average loss.				
	6 hours.	18 hours.	24 hours.	42 hours.	48 hours.
	Cu. inches.	*Cu. inches.*	*Cu. inches.*	*Cu. inches.*	*Cu. inches.*
¾ inch	0.8	1.3	1.8	.....	2.2
1 inch	1.8	2.7	3.1	3.2	3.5
1¼ inches	2.2	3.3	3.8	4.0	4.5

Comparison of the results obtained by the two methods for intervals of 6 and 24 hours shows very good agreement when the

many variable factors entering into an investigation of this kind are considered. It is indicated that the doubt originally felt as to the reliability of the gravimetric method was not justified. Therefore it appears that the nearest approach to true values for the evaporation loss sought is a mean arrived at by using the average results obtained by both methods, giving to each average a weight corresponding to the number of individual observations involved. Table No. 3 shows the values for the 6-hour and 24-hour intervals prepared on this basis, and for completeness includes those values obtained by the volumetric method for which there were no corresponding values obtained by the gravimetric method.

TABLE No. 3.—*Average evaporation loss.*

Size of hose.	Average loss.				
	6 hours.	18 hours.	24 hours.	42 hours.	48 hours.
	Cu. inches.	*Cu. inches.*	*Cu. inches.*	*Cu. inches.*	*Cu. inches.*
¾ inch	0.8	1.3	1.7	.....	2.2
1 inch	1.7	2.7	3.2	3.2	3.5
1¼ inches	2.0	3.3	4.0	4.0	4.5

In an effort to determine whether evaporation could be sufficiently retarded by closing both ends of the hose so that this factor might be neglected in connection with the time-elapsed test of a liquid-measuring device, several observations were made by the volumetric method with both ends of the hose plugged with rubber stoppers during the interval of standing. Comparing the averages of these observations with corresponding values in Table No. 3, it is found that the differences run from 0 to 0.34 cubic inch, the evaporation being very slightly less with both ends of the hose plugged than it was with one end open. It is, therefore, indicated that evaporation will take place from the hose regardless of the fact that both ends may be closed and that a suitable correction must be applied to eliminate this variable factor from the test of a liquid-measuring device.

The values given in the above tables are reported to tenths of a cubic inch. Obviously, these results must be simplified if they are to be useful to the inspector making tests in the field, and our problem, therefore, becomes one of simplification with the least sacrifice of accuracy.

In the first place, it appears that an interval of either 6 or 18 hours will usually be approximated in field work, wherefore it will be sufficient for us to consider evaporation losses for these two periods alone. In the second place, it is apparent from the values given in the tables that the evaporation loss varies directly as the size of the hose and the duration of the period of nonuse, so that our final figures should be larger the longer the period and the larger the hose. In the third place, certain conditions which will be met in the field will tend to increase the evaporation loss, so that it is indicated that in rounding off our values for field use the corrections to be applied should be increased rather than diminished from the values shown in the table.

Having in mind these various considerations, the corrections shown in Table No. 4 below are offered as representing a series of values which will be fair to all concerned.

TABLE No. 4.—*Corrections for evaporation loss from gasoline hose.*

Size of hose.	Correction.	
	6 hours.	18 hours.
	Cu. inches.	*Cu. inches.*
¾ inch	1	2
1 inch	2	3
1¼ inches	3	4

These corrections are so simple that they may be remembered easily, and confidence is felt that they will meet practically every need of the inspector of weights and measures.

METHOD OF TEST IN CONFORMANCE WITH SPECIFICATION NO. 8 FOR LIQUID-MEASURING DEVICES.[7]

By F. S. HOLBROOK, *Bureau of Standards.*

Specification No. 8 refers to constancy of delivery and provides in brief that for the protection of the user of a liquid-measuring pump and of the customer purchasing liquid therefrom the apparatus shall be reasonably correct under certain conditions, namely, when it is operated at different speeds and when it is allowed to stand for some time between operations. It is our experience that this specification, if enforced according to its provisions, will furnish adequate protection to the consumer and at the same time will not result in the condemnation of pumps which are in good mechanical condition.

The text of specification No. 8 is as follows:

Constancy of delivery.—The amounts delivered by any liquid-measuring device shall not vary from the standard by more than the tolerances hereinafter provided, irrespective of the speed at which the apparatus is operated, and, subject to the conditions of the special test described below, irrespective of the time elapsing between operations: Provided, however, That when a liquid-measuring device is operated faster than normal speed of operation the tolerance shall be applied in deficiency only; that is, the liquid-measuring device shall not be deemed to be incorrect by reason of the tolerance in excess being exceeded during such operation.

For the purpose of test, the condition of the device shall be such that a period of nonuse of one hour shall not result in an error of the first delivery of the device after such period of nonuse greater than the tolerance allowable on the smallest amount which the device is designed to deliver, and a period of nonuse of six hours shall not result in an error of the first delivery of the device after such period of nonuse greater than 10 cubic inches, or in the case of a new liquid-measuring device, 5 cubic inches.

NOTE.—In the special elapsed-time test described above, allowance shall be made for errors due solely to a change in volume of the contained liquid resulting from temperature variations alone, since an error of this character is unavoidable in the case of volumetric measurements of this kind when the apparatus is standing unused. This change in volume due to temperature variations is, however, small in amount for all ordinary variations of temperature, amounting in the case of gasoline to about 0.7 per cent for each 10° Fahrenheit change of temperature or about 1.3 per cent for each 10° Centigrade change of temperature.

[7] With the consent of the conference the reading of this paper was dispensed with, with the understanding that it would be incorporated in the report.

In applying the six-hour test it is recommended that the delivery be not made through a hose, since the amount of gasoline necessary to wet the inside of the hose will cause an additional shortage in the delivery.

TESTS AT VARIOUS SPEEDS.

A liquid-measuring device should, under the terms of this specification, be tested at several different speeds since various operators may manipulate the machine at various speeds and the test of the inspector should be broad enough so that any speed which might be adopted by the operator will not result in short measure. Three speeds may be recommended for test which may be designated as normal, slow, and fast. On the ordinary 5-gallon piston-type pump, normal speed may, in general, be said to be such a one that 5 gallons of gasoline will be delivered in from 20 to 30 seconds. When operated at a slow speed, the delivery might be made in about twice that time. When operated at a fast speed, the delivery can be made in perhaps half the time required by normal pumping.

At normal speed and at slow speed the delivery should be correct within the stated tolerances. When operated at a fast speed, the delivery should not be in deficiency by more than the tolerance allowed, but if the pump is found to deliver a quantity in excess, then the proviso adopted last year is to the effect that this excess delivery shall not be taken as a reason for condemnation of the pump. This possible excess is accounted for by the fact that when a large body of liquid is put in rapid motion, the inertia of the liquid is such that it may continue in motion momentarily after the turning of the crank is suddenly discontinued and as a result a small quantity of unmeasured liquid may go through the system before the valves can close against the action of the liquid. Inasmuch as the result is overmeasure and the operator can always prevent this error by cranking at a more usual rate of speed, and further since this excess measure is an extremely difficult matter to overcome, it is not believed that condemnation of the pump should result as mentioned above.

TIME-ELAPSED TEST.

The second paragraph of the specification is designed to eliminate from use pumps which are in poor mechanical condition resulting in the leakage of liquid back through the valves. It is first provided that during a period of nonuse of one hour there shall not result an error in the first delivery of the device greater than the tolerance allowable on the smallest amount which the device is designed to deliver. Since the tolerance on 1 gallon is 3 cubic inches, not more than 3 cubic inches should leak back through the valves during an hour of nonuse in the case of a pump designed to deliver a minimum of 1 gallon. If the pump is designed to deliver less than 1 gallon, then not more than 2 cubic inches should leak back during a period of 1 hour, 2 cubic inches being specified in this connection since this is the minimum tolerance allowed on any quantity. This 3 cubic inches or 2 cubic inches, as the case may be, should be allowed in addition to the normal error of the pump since this is an added tolerance designed solely to take care of the leakage which may normally occur, even when the device is in proper me-

chanical condition. When the device is allowed to stand 6 hours, the maximum allowable leakage is 10 cubic inches or almost 2 cubic inches per hour. This leakage should be prorated; that is, if the pump is allowed to stand 12 hours, twice 10 cubic inches should be allowed, while if the pump is allowed to stand only 3 hours, then only half of the 10 cubic inches should be allowed.

Piston type liquid-measuring pumps are so constructed that when one delivery is being made the next delivery is being measured, so that there is always in the pump a measured quantity of liquid ready for delivery. In common with other liquids, gasoline expands as it grows warmer and contracts as the temperature falls. On this account it is not considered proper to condemn a liquid-measuring device merely because the gasoline which has already been measured at one temperature has changed to some other temperature. Therefore it is provided that changes in temperature of the liquid while it is standing in a pump during an elapsed-time test shall be taken into consideration and allowance made therefor. In the majority of these pumps on the market the outlet, unless closed off by some valve, is open into the measuring chamber of the pump. Therefore, if the temperature of the gasoline falls, shrinkage of the liquid already measured takes place and a smaller amount is delivered at the end of the elapsed-time test than though the delivery had been made at once. Conversely, if the temperature of the gasoline rises, expansion of the measured liquid is the result; the excess volume will overflow the top of the standpipe and will be trapped in the loop of the hose—the hose being hung up in its usual position—and a larger delivery will be made.

To compensate for the above sources of error during the elapsed-time test, we would advise the following procedure:

Being careful to maintain a uniform, normal speed of operation, make several tests on the full-capacity delivery of the pump, determining and noting the error on each delivery and assuring yourself that each delivery is within the tolerance allowable and that you can uniformly operate the pump in such a manner that the range of the errors is small; that is, that the average error of all the deliveries will closely approximate the error on any individual delivery. Then make a final delivery, taking the temperature of this delivery and allow the pump to stand unused during the desired lapse of time.

By proceeding as above, the temperature taken will be that desired, namely, the temperature of gasoline which has just been raised from the underground tank. This is for the reason that when an amount of gasoline has been standing in the pump for some time, it may be of a different temperature than that which replaces it in the pump, and it is the temperature of gasoline in the pump at the beginning of test which is desired. Also by securing the passage of several full-capacity deliveries through the pump before taking the temperature, the metal parts of the pump in contact with the gasoline and the gasoline itself will have been brought to approximately the same temperature. In case the determination of the average error is not made immediately preceding the beginning of the elapsed-time test, the temperature should be taken not sooner than on the second of two consecutive deliveries to secure the desired temperature.

At the end of the time during which the pump has been allowed to stand idle, one delivery should be made, the error determined, and the temperature of the delivered gasoline again observed. Care should be taken to duplicate the operating speed adopted during the determination of the average error described above. The time that the pump has been allowed to stand unused should also be noted. The tolerance to be allowed on the latter delivery should now be the average error of the pump on the quantity delivered, plus an allowance for leakage based on the number of hours during which the pump has stood unused, plus or minus the correction in volume due to any temperature decrease or increase, respectively, using the figure given for the change in volume of gasoline in the note in specification No. 8 printed above.

It may be clearer if we assume a specific case. Suppose that on a 5-gallon pump several consecutive capacity deliveries at normal speed just before the pump is allowed to stand unused in an elapsed-time test show an average error of —5 cubic inches. The noted temperature of the last delivery is 65° F. Now the pump is allowed to stand 10 hours and another 5-gallon delivery is made. The temperature of this gasoline is found to be 50° F. What shortage on this 5-gallon delivery should be allowed under these stated conditions?

The allowable leakage under the terms of the specification is 10 cubic inches in six hours. Ten hours having elapsed in this test, the allowable leakage is ten-sixths times 10 cubic inches or approximately 17 cubic inches. The shrinkage of the gasoline is 0.7 per cent for each 10° F. change in temperature and for a drop of 15° the shrinkage is, therefore, fifteen-tenths times 0.7 per cent or approximately 1 per cent. This 1 per cent is to be applied to all the gasoline above the piston in the pump, since all this gasoline has been affected by the change in temperature and the entire shortage will occur on the first delivery. This total amount of gasoline above the piston is somewhat greater than the capacity of the measuring chamber itself. Suppose in the case of the pump under test that there are 6 gallons of gasoline above the piston. Then the shrinkage caused by the indicated change in temperature will be 1 per cent of 1,386 cubic inches or approximately 14 cubic inches. The total allowable shortage of the first 5-gallon delivery made after the period of nonuse of the pump will then be 5 cubic inches (the original average error of the pump on 5 gallons) plus 17 cubic inches (the allowable leakage in 10 hours) plus 14 cubic inches (the shrinkage of the gasoline due to the fall in temperature of the liquid) or a total of 36 cubic inches. This tolerance is to be applied only to the first delivery after the lapse of time allowed.

If the temperature difference is in the other direction—that is, if the temperature is higher after the period of standing than at the beginning—the procedure to be followed will be the same as that outlined above, but the computation of the allowable error will differ in one respect, namely, that the computed change in volume due to the temperature change is to be *subtracted* instead of added in computing the elapsed-time tolerance. Thus, assuming the same conditions as were described before, except that the temperature is 15° F. higher at the end of the period of standing than it was at the beginning, the 6 gallons of gasoline will have *expanded* to the amount of 14 cubic inches. The total allowable shortage of the first 5-gallon

delivery made after the period of nonuse of the pump will then be 5 cubic inches (the original average error of the pump on 5 gallons), plus 17 cubic inches (the allowable leakage in 10 hours), *minus* 14 cubic inches (the expansion of gasoline due to the rise in temperature of the liquid), or a total of 8 cubic inches.

If the deliveries have been made through a hose in both cases, the amount of liquid necessary in the case of the second delivery to wet the hose must also be allowed for, and to obtain this correction the table showing corrections for evaporation loss from gasoline hose given in the preceding paper, "Evaporation of Gasoline from Delivery Hose of Liquid-Measuring Devices" (see Table No. 4, p. 115), should be consulted. Assuming that the hose used in the above case was of the 1¼-inch size, this correction in the above example would be approximately 3 cubic inches. The total allowable shortage under these conditions might then be in the neighborhood of 40 cubic inches, or 11 cubic inches, respectively, in the above cases.

Thorough drainage of the hose on the last test before the lapse of time and on the first test after the lapse of time should be especially observed. If any gasoline has collected in the hose during the lapse of time, this is to be included as a part of the first delivery after standing. When the temperature has risen such collection of gasoline may and probably will have occurred, unless a considerable leakage exists, and it may even occur when the final temperature is lower than the original temperature, in which case it will indicate that some intervening temperature has been higher than that originally determined. If the hose has been removed for the purposes of the test, a receptacle for the collection of gasoline which may flow over the top of the standpipe during the test must be provided, and this receptacle should be of such a nature that evaporation of such gasoline will be reduced to a minimum.

If there is a globe valve in the standpipe of the pump, under no conditions is this to be closed off at any time during the test. If the standpipe is equipped with a check valve and this is tight, while many of the phenomena described above probably will not obtain, nevertheless, this test is of value and will reveal faulty conditions existing.

If upon a test made as above the pump is found to be in error by a greater amount than the full tolerance calculated as above, then it should be condemned on this test. If it is not in error by more than the allowable amount when all the proper indicated corrections are made, then it should not be condemned on this test.

We realize that all the above seems somewhat complicated, but in our experience it is all necessary to meet varying conditions that may arise. If all these factors are not taken into consideration, gasoline pumps might pass or fail according to the conditions under which the tests were made, such as a mere fluctuation in temperature, and we think that it will be readily admitted that such a result would be intolerable.

On account of complications it often appears that field inspectors do not make the elapsed-time test indicated above, and it is true that if it can not be made under proper conditions it may lead to erroneous conclusions and may thus do more harm than good. However, since this test certainly does much to protect the purchaser from inadvertent shortages due to leakages in the apparatus, it should be resorted to whenever practicable, and especially when leaky conditions

are believed to be present, so that purchasers may be protected against this state of affairs.

CONSIDERATION OF AMENDED SPECIFICATION NO. 10 FOR LIQUID-MEASURING DEVICES.

Mr. Holbrook. The committee on specifications and tolerances was given authority by the last conference to write a specification relating to nonparallel line scales, as incorporated in certain liquid-measuring devices, embodying proper restrictions with which such scales should conform. The material was to be included in the record of the last conference as an action of the conference without referring the matter back to the conference. However, the committee concluded it was preferable to refer it back to the present conference for ratification, and accordingly presents the specification to read as shown below. The material in brackets is the new material inserted by the committee. The portion of the specification in italics is intended to be nonretroactive.

It should be noted that the text of the revised portion is slightly different from the tentative text appearing in the report of the last conference.

No. 10. Pointers and indicators.—All pointers and indicators which, when used in conjunction with a graduated scale or dial, indicate the amount of liquid discharged or the value of the delivery at a predetermined price per unit of volume shall be so shaped that a correct and accurate reading is given. *Pointers and indicators are required to be symmetrical about the graduation lines at which they may stand: [Provided, however, That in the case of pointers and indicators used in conjunction with vertical scales having nonparallel graduation lines and in respect to the nonhorizontal lines on such scales, this requirement shall be waived if the pointers and indicators are so designed and constructed that, as the pointer or indicator approaches the correct indicating position in respect to any graduation line, only such portion of such graduation line as has not yet been reached by the index of the pointer or indicator or by a horizontal line extended forward from the end thereof shall be exposed to view and all other portions of such graduation line adjacent to the index of the pointer or indicator shall be automatically obscured.] Pointers and indicators which, when used in conjunction with a graduated scale or dial, constitute at some point or points or at all points the sole or most sensitive means of determining the amount of liquid discharged or the value of the delivery at a predetermined price per unit of volume, shall reach to the finest graduation marks, and the width of the pointer or indicator, or of the end thereof, shall not be greater than the width of such marks.*

The scale in question, as you all know, is of the type illustrated in Fig. 3. The indicator used up to this time has been a metal rod with a tapered point (such as is illustrated in connection with the scale shown at the left in the figure), and this point was supposed to be brought into coincidence with a graduation line to obtain the delivery represented by that line. This method of setting is illustrated at "a" in the figure. Last year the conference decided the objection was not so much to the scale itself as to the combination of the indicator and scale.

As the committee understood the objection of the conference it was to the effect that this indicator pointed to this line before the index of the indicator came into coincidence with the line, and that at a time when the indicator pointed to some portion of the line it might be considered by an operator or by a customer that the correct indication had already been reached although the point of the indicator

had not yet touched the graduation line. Such an incorrect setting is shown at "b" in the figure.

This specification as now worded requires that the indicator used in connection with a scale of this character must be so arranged in reference to the scale that before the intersection of the index of the indicator and the line the index does not point to any part of the line.

There is shown at the right in the figure one example of an indicator which will satisfactorily comply with the specification as

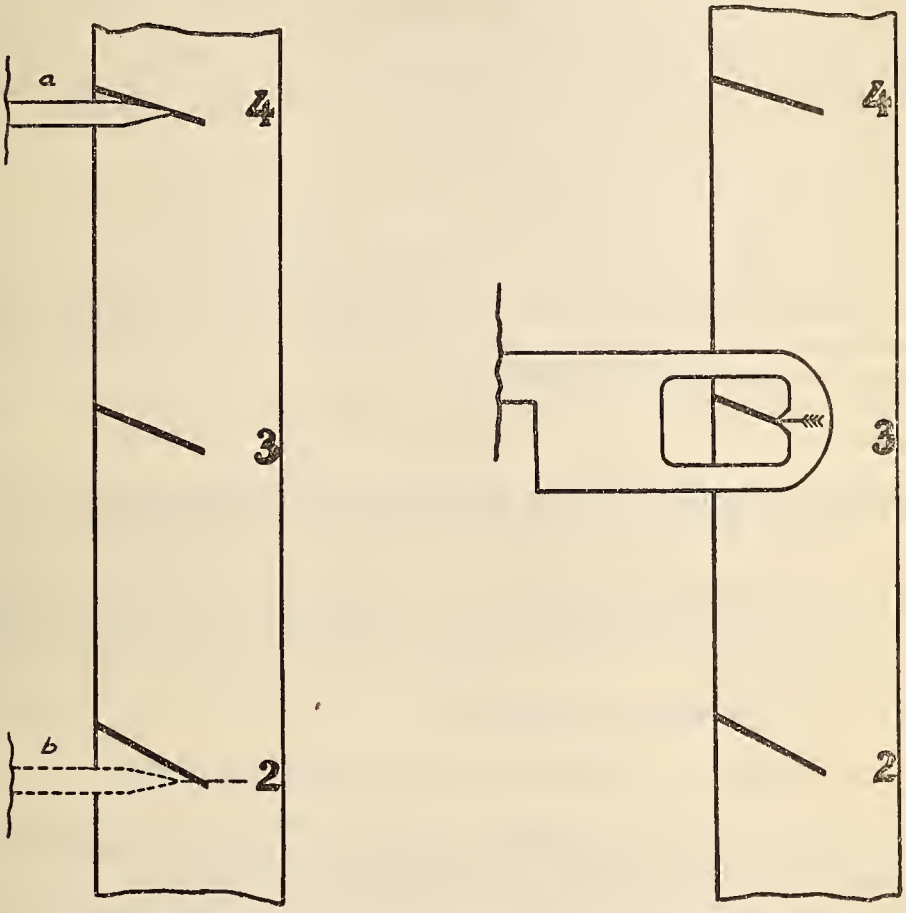

FIG. 3.—Indicators used with scales having nonparallel graduations.

written. A correct setting of the indicator on a graduation line is shown.

(It was moved and seconded that the specification as amended be adopted, the question was taken, and the motion was agreed to.)

ENLARGEMENT OF COMMITTEE ON SPECIFICATIONS AND TOLERANCES.

Mr. BARRON. If I may be allowed to interrupt at this time, there is one matter I wish to bring up. In view of the ever-increasing number of important questions coming before the committee on specifications and tolerances for consideration, I would move the committee on specifications and tolerances be increased by the addition

of two members to be named at this time by the conference, to assist in whatever way they may in carrying on that work.

The CHAIRMAN. That is a very good suggestion; that will make the number five.

(The motion was seconded, the question was taken, and the motion was agreed to.)

Mr. REICHMANN. In connection with this enlargement it strikes me that if we had the several members well distributed geographically it might perhaps be better than to have them all centered in one section. We formerly had a tolerance committee with one man from the Pacific coast and two from the East. I would like to place in nomination a man from the Middle West, the man who introduced this resolution, Mr. Barron, of Minnesota.

(The nomination was seconded.)

Mr. FLAHERTY. I nominate Mr. Fuller, of Los Angeles.

(The nomination was seconded.)

Mr. REICHMANN. I move the nominations be closed.

The CHAIRMAN. If there is no objection, there being but the two nominations, the secretary will be instructed to cast the ballot of the conference for Mr. Barron and Mr. Fuller. Those in favor will please indicate it by the usual sign.

(The motion was agreed to and the nominees declared to be duly elected.)

REPORT OF COMMITTEE ON RESOLUTIONS PRESENTED BY A. W. SCHWARTZ, CHAIRMAN, AND DISCUSSION THEREON.

Your committee on resolutions have several resolutions to present to the conference for consideration and action. If there is no objection I will read them one by one, and action can be taken after each one is read.

The first resolution is as follows:

RESOLUTION OF APPRECIATION TO THE SECRETARY OF COMMERCE.

Whereas the honorable Secretary of Commerce, Herbert Hoover, despite the many calls upon his time, generously delivered an address at this Fifteenth Annual Conference on Weights and Measures: Therefore be it

Resolved, That the conference express its thanks and appreciation to Secretary Hoover for the interesting and instructive talk as well as advice given on matters of deep interest to every weights and measures official.

(The resolution was duly adopted.)

Mr. SCHWARTZ. The next resolution reads as follows:

RESOLUTION OF APPRECIATION TO HONORABLE ALBERT H. VESTAL.

Whereas Honorable Albert H. Vestal, chairman, Committee on Coinage, Weights, and Measures, House of Representatives, favored the members of this Fifteenth Annual Conference with an address at the morning session, May 25: Therefore be it

Resolved, That the thanks of this conference be extended to the Honorable Albert H. Vestal for his inspiring, uplifting, and encouraging talk on the work of weights and measures officials.

(The resolution was duly adopted.)

Mr. SCHWARTZ. The next resolution reads as follows:

RESOLUTION OF APPRECIATION TO THE DIRECTOR AND STAFF OF THE BUREAU OF STANDARDS.

Whereas it is mainly due to the painstaking and tireless efforts of Director S. W. Stratton, and his assistants from the Bureau of Standards, that the officials of weights and measures here in conference assembled have been materially assisted in more efficiently performing the duties required of them in their various fields; and

Whereas each year's conference has more fully demonstrated to the representatives of the departments of weights and measures from the several States, the invaluable assistance and instruction rendered by the bureau in the many phases of the work discussed: Therefore be it

Resolved, That this conference express to Director Stratton and his assistants its deep appreciation and thanks for their kind services, for the pleasant entertainment provided, and for the marked success of this conference.

I move the adoption of the resolution.

(The motion was seconded, the question was put by Mr. Schwartz, and the motion was agreed to.)

Mr. SCHWARTZ. I declare the motion to be carried unanimously.

The CHAIRMAN. We appreciate this very much indeed. We are always at your service, and we do our best to make the conference an instructive one.

Mr. SCHWARTZ. The next resolution reads as follows:

RESOLUTION OF APPRECIATION TO THE FIRM OF WHITE & BOYER.

Whereas the firm of White & Boyer, of Washington, D. C., broadcasted a special musical program for the conference dinner on the evening of May 24: Therefore be it

Resolved, That this, the Fifteenth Annual Conference on Weights and Measures, express its appreciation of this courtesy and extend its thanks to the firm of White & Boyer for the concert which contributed greatly to the enjoyment of the evening.

(The resolution was duly adopted.)

Mr. SCHWARTZ. The next resolution reads as follows:

RESOLUTION OF APPRECIATION TO RADIO SECTION OF THE BUREAU OF STANDARDS.

Resolved, That this Fifteenth Annual Conference on Weights and Measures hereby express its appreciation of the radio concert which the radio section of the Bureau of Standards arranged for the conference dinner on the evening of May 24, and extend to the radio section of the bureau and to Messrs. Preston and Harmon its thanks for the delightful entertainment provided.

(The resolution was duly adopted.)

Mr. SCHWARTZ. The next resolution reads as follows:

RESOLUTION OF APPRECIATION TO EXHIBITORS OF APPARATUS.

Whereas manufacturers of weighing and measuring instruments and dealers in equipment used by weights and measures inspectors have gone to considerable expense in arranging and installing exhibits of their devices for inspection by the delegates to this conference: Therefore be it

Resolved, That the members of this conference do hereby express to these manufacturers and dealers who have exhibited and demonstrated their products here, their thanks and appreciation of the educational advantages thus afforded.

(The resolution was duly adopted.)

Mr. SCHWARTZ. The next resolution reads as follows:

RESOLUTION IN RE ADOPTION OF THE 2,000-POUND TON FOR COAL.

Whereas a resolution was adopted by the National Retail Coal Merchants' Association in session at Chicago on May 22 urging this Fifteenth Annual Conference on Weights and Measures to take steps for a uniform Federal 2,000-pound unit of weight as applying to coal sold by the ton: Therefore be it

Resolved, That this Fifteenth Annual Conference of weights and measures officials go on record as favoring a 2,000-pound unit of weight in the purchase or sale of coal by the ton and urge that Congress enact a law that will establish 2,000 pounds as the weight of a ton of coal.

To bring it before the conference I move the adoption of this resolution.

(The motion was seconded.)

Mr. CUMMINGS. I would like to ask whether or not the establishment of a uniform 2,000-pound ton would have any effect on the freight rates on coal, which are now based on the long ton.

Mr. SCHWARTZ. Your committee took into consideration only the telegram which was read here from the National Retail Coal Merchants' Association.[8] If a 2,000-pound ton were established by Congress, that would take care of itself, would it not?

Mr. HOWE. You must bear in mind that the legal ton, net weight of coal, in the District of Columbia, is 2,240 pounds.

Mr. SCHWARTZ. There are 27 States that have the short ton. In New Jersey we have the long and short ton, and in various other States they have the long ton only.

Mr. ROBERTS. One matter to which I would like to call attention in regard to reducing the coal ton from 2,240 pounds to 2,000 pounds, is that in certain sections of the country, for instance, in the District of Columbia, in the State of Maryland, and perhaps in some other States, the selling of 2,240 pounds of coal for a ton has been established for a great many years. In the District of Columbia, with which I am more familiar than with any other section, the law has required the sale of 2,240 pounds of coal per ton at least as far back as 1853, and perhaps still further back.

In regard to these localities, the question in my mind is this: If that established custom is suddenly changed by law, will it not cause many small consumers of coal, especially housekeepers, to be misled in the price? In other words, would it not enable the retail coal dealer to sell a ton of coal for $16, for instance, and deliver 2,000 pounds when he had a week before that sold a ton of coal for $16 and been required to deliver 2,240 pounds?

When the present weights and measures law for the District of Columbia was before Congress the retail coal dealers' association of the District went before the District Committee of the House and strongly urged that the weight of a ton of coal be 2,000 pounds. In preparing the law it was stipulated that a ton of coal in the District of Columbia should be 2,240 pounds. We did not want to change it because we thought it would result in the people being deceived.

I did not have very much help, but I went before the committee and urged that it remain at 2,240 pounds, and explained the reason. The committee unanimously decided to let it stand at 2,240 pounds, on the theory that if it were suddenly changed by law it would

[8] See p. 53.

enable the retail coal dealers, if they so desired, to sell the consumers in the District of Columbia a ton of coal, the consumer believing he was going to get the regular old-time ton of 2,240 pounds, and the dealer knowing he was going to deliver him only 2,000 pounds.

I believe myself that in cases of this kind it is better to allow the States to regulate it according to the established trade custom. Otherwise there would be much misunderstanding and much dissatisfaction, and, therefore, I do not believe that this conference should go on record in favor of any such proposition. I do not believe the coal dealer should be able to raise the price of coal by reducing the weight of a ton, any more than a baker should be allowed to raise the price of bread by reducing the size of the loaf, or that the butter dealer should be allowed to raise the price of butter by reducing a pound of butter to 15 ounces.

I think this resolution should be laid on the table.

Mr. LIVINGSTON. The State I come from produces almost all the hard coal used in Washington. The law requires that 2,240 pounds shall constitute a ton of hard coal, and 2,000 pounds constitutes a ton of bituminous coal. At all of our mines in Pennsylvania the men are paid on the basis of the long ton, and I think we would get in serious difficulty by adopting the resolution suggested by the retail coal dealers.

The CHAIRMAN. How do you account for the fact you use the two tons in your State?

Mr. LIVINGSTON. Our law requires it; it is in the statute. A ton of bituminous coal is 2,000 pounds and a ton of anthracite coal is 2,240 pounds.

Mr. CLUETT. I think this resolution is along the lines for which we are all aiming down here, and that is uniformity. This question of having different standards in different States is confusing, and it is not what we are striving for. My idea is that we are simply expressing our ideas along the lines of this telegram, that in these days there should be a uniform ton of 2,000 pounds all over the United States.

Mr. ROBERTS. Why do you not amend the resolution by suggesting that the ton be made uniformly 2,240 pounds? How do you think that would suit them?

Mr. CLUETT. We have no right to change their resolution.

(The question was taken on the motion to adopt the resolution, and the motion was lost.)

Mr. SCHWARTZ. The next resolution reads as follows:

RESOLUTION INDORSING UNIFORM REQUIREMENTS FOR MILK BOTTLES.

Whereas there seems to be a divergence of requirements affecting milk bottles in use in the several States and a desire on behalf of the manufacturers to have uniform laws regulating capacity, tolerances, markings, etc.: Therefore be it

Resolved, That this Fifteenth Annual Conference express itself in hearty support of the recommendations presented by the National Bottle Manufacturers' Association[9] and go on record as approving standardization as to volume, designating marks and number of manufacturer, and tolerance, and suggest that a law be drafted by the legislative committee of the conference for adoption by Congress to the securing of uniformity in the States.

(The resolution was duly adopted.)

[9] See p. 30.

Mr. SCHWARTZ. There are no other resolutions at this time.

Mr. BARRON. In view of the wide diversity of opinion on some of these questions such as standardization, etc., I move that the matter of Federal legislation as to serialization of type of weighing and measuring instruments and all other matters of standardization be referred to the executive committee of the conference to be placed on the program of the next conference for consideration.

(The motion was seconded, the question was taken, and the motion was agreed to.)

REPORT OF COMMITTEE ON SPECIFICATIONS AND TOLERANCES ON PROPOSED TOLERANCES FOR RETAIL FABRIC-MEASURING DEVICES, PRESENTED BY F. S. HOLBROOK, CHAIRMAN.

In accordance with the instructions of the last conference, the committee on specifications and tolerances presents tolerances for retail fabric-measuring machines. In relation to the question of specifications for such machines, the committee has to state that on account of the press of other matters, such as tolerances on automatic scales, tolerances on bread, etc., while some work was done on specifications for these machines, it was absolutely impossible to bring in a set which had received proper attention by the committee. Therefore these tolerances only are proposed by the committee at this time. They are as follows:

PROPOSED TOLERANCES.

The tolerances to be allowed on the delivery of retail fabric-measuring devices in excess (underregistration of machine) and in deficiency (overregistration of machine) to be applied on both increasing and decreasing registrations of the machine shall be the values shown in the following table: Provided, however, That the manufacturers' tolerances or the tolerances on all new retail fabric-measuring devices shall be one-half of the values given:

Machine indication.	Alternative A.		Alternative B.	
	Tolerances on delivery of retail fabric-measuring device.			
	In deficiency (overregistration).	In excess (underregistration).	In deficiency (overregistration).	In excess (underregistration).
Yards:	*Inch.*	*Inch.*	*Inch.*	*Inch.*
1	1/4	1/4	1/4	1/4
2	5/16	3/8	1/4	3/8
3	5/16	1/2	5/16	3/8
4	3/8	3/4	5/16	1/2
5	3/8	3/4	3/8	5/8
6	1/2	1	3/8	3/4
7	5/8	1 1/4	1/2	1
8	3/4	1 1/2	1/2	1
9	3/4	1 1/2	5/8	1 1/4
10	7/8	1 3/4	3/4	1 1/2
11	1	2	3/4	1 1/2
12	1 1/8	2 1/4	7/8	1 3/4
13	1 1/4	2 1/2	7/8	1 3/4
14	1 1/4	2 1/2	1	2
15	1 3/8	2 3/4	1	2

For machine indications of more than 15 yards add 1/16 inch in deficiency and 1/8 inch in excess per indicated yard.

Respectfully,

(Signed) F. S. Holbrook,
W. T. White,
Wm. F. Cluett,

Committee on Specifications and Tolerances,
Annual Conference.

DISCUSSION OF ABOVE REPORT.

Mr. Holbrook. In this report and in the following discussion, in connection with tolerances, use has been or will be made of the terms "excess," "deficiency," "underregistration," and "overregistration," and since a clear understanding of these terms is essential it may be well briefly to outline the sense in which they are used in this connection.

In the case of fabric-measuring devices we have a situation analogous to the ordinary scale used for selling. A "fast" machine is one which registers too much (overregistration) and which consequently delivers less (in deficiency) than is indicated by the machine. The opposite condition prevails on a "slow" machine; that is, it underregisters and delivers in excess of the amount indicated. It is, therefore, clear that "in excess" and "in deficiency" correspond to "underregistration" and "overregistration," respectively, the former terms referring to the delivery made by the machine, and the latter terms to the indications of the machine itself.

Thus, a fabric-measuring device which delivered 37 inches when the indicator registered 1 yard would be said to be delivering in excess or the machine would be said to be underregistering. It is only necessary to remember that "excess" and "deficiency" refer to deliveries and "underregistration" and "overregistration" to machine indications.

In brief explanation of this report it may be said that alternative A in the table allows a delivery in deficiency equivalent to the tolerance in deficiency now allowed on ordinary measures of length, and an excess delivery of twice this amount. It amounts to approximately three thirty-seconds inch per yard in deficiency and three-sixteenths inch per yard in excess. A minimum tolerance of a quarter of an inch is allowed either in excess or deficiency, and for machine indications of more than 15 yards one-sixteenth inch in deficiency and one-eighth inch in excess per indicated yard is provided for.

Alternative B in the table allows for deliveries somewhat smaller tolerances in deficiency than are at present allowed on linear measures, the deficiency tolerance being doubled for deliveries in excess. The values are such that the range representing the sum of the tolerances is about the same as on ordinary measures of length, but in this case they have been so arranged that the allowance in deficiency is one-half the allowance in excess. That is for the reason that it is believed that on fabric-measuring machines there is some possibility of a delivery of a slightly less amount of material than the machine indicates, for the reason that if any stretch at all occurs

in the fabric while passing between the rollers, then the delivery may be somewhat smaller than the indication of the machine. It seems that under such a condition of affairs, the excess tolerance of the machine should be somewhat greater than the deficiency tolerance of the machine to correct for such a tendency.

In this case, also, a minimum value of one-fourth inch either in excess or in deficiency is specified and for machine indications of more than 15 yards a tolerance of one-sixteenth inch in deficiency and one-eighth inch in excess per indicated yard is provided for.

Mr. Reichmann. We could have endless discussion on this very proposition, but in order to bring the matter to a head, I would move you, inasmuch as specifications have not yet been established on these machines, that the resolution which was introduced last year be continued over until next year, and that in the meantime alternative B be used as a set of tentative tolerances. There is not much difference between alternative B and alternative A, but alternative A appears, from my experience with fabric-measuring machines, to be ultra liberal.

(The motion was seconded.)

Mr. Cummings. If I understood Mr. Holbrook correctly, he stated that even if the machines were exactly accurate, short measurement would likely be given because of the stretch of the fabric; is that right?

Mr. Holbrook. No; we did not intend to make it as strong as that. Most fabrics will stretch to some extent. If the stretch is considerable on a fabric under the tension necessary to pull it through one of these machines, which, of course, is very slight, then I think it should be definitely stated that such a fabric should not be measured in these machines. However, we have said if there is a difference between indication of the machine and the length of the fabric delivered due to slight stretching of the fabric, then the delivery will incline to be short rather than over.

We can minimize that tendency just as we have done in other cases, by allowing a greater tolerance in excess than in deficiency. For instance, in adopting tolerances for liquid measures, we have considered that if a discrepancy occurs in these measurements it is likely to be caused by the measure being not quite full, even when attempt is made to get it full. Consequently, the tolerance in excess has been made larger than the tolerance in deficiency for these measures.

With the majority of fabrics which are measured in these machines the stretch will be negligible, and by ordinary field methods unmeasureable. But, nevertheless, the possibility of shortage is there.

Mr. Cummings. Assuming a nonstretchable material, such as has been exhibited to us here, in testing the machine I can not understand why any deficiency tolerance should be necessary, or at least no greater tolerance than is to be applied in testing an ordinary yard measure. I think that is three thirty-seconds of an inch.

Mr. Holbrook. Remember that both alternative A and alternative B do not in any case allow in deficiency on a machine a larger tolerance than is now allowed on a linear measure. Alternative A allows in many cases the same tolerance which is allowed on an ordinary linear measure in deficiency, or a tolerance slightly less than that.

Alternative B does not allow in deficiency on a linear-measuring machine as great an amount in deficiency as is now allowed on ordinary linear measures.

Mr. CUMMINGS. What is the tolerance on a 1-yard measure?

Mr. HOLBROOK. Three thirty-seconds of an inch.

(The question was taken, and the motion was agreed to.)

Mr. HOLBROOK. I now realize that I have made a misstatement of fact and would like to make a correction. It was said that this table never allows a greater tolerance than is allowed on a linear measure. That is not exactly correct. On amounts of 4 yards and up the tolerance is never greater. The minimum tolerance has been made a quarter of an inch, and that is greater than would be allowed on 1 yard, on a yardstick.

GENERAL REWORDING OF TOLERANCE PARAGRAPHS.

Mr. HOLBROOK. One other point that may be mentioned at this time is that ordinarily in the past we have used the wording with respect to tolerances that "the tolerances shall not be greater than the values shown in the following table." If we had said that the errors should not be greater than the values shown in the tables, we would have established a definite tolerance, but when we say the tolerances shall not be in excess of these values, it appears that we establish a maximum figure only and suggest that smaller values might be applied as the tolerances. It seems that a very much better wording would be that "the tolerances shall be the values shown in the table"; and I think that has been the intention of the conference in adopting these various values.

Therefore, the committee would like to make the suggestion that when the specifications and tolerances are reprinted that change in wording be made in each case.

Mr. REICHMANN. I move you, sir, that the change suggested by Mr. Holbrook be made.

(The motion was seconded, the question was taken, and the motion was agreed to.)

REPORT OF THE TREASURER, PRESENTED BY A. W. SCHWARTZ.

The report of the treasurer, submitted by Mr. Wanser, is as follows:

Balance on hand 1921 report		$119.35
Receipts:		
1921. Assessment of members	37.00	
		$156.35
Disbursements:		
Doing Printing Co. (delegate and guest tags)	$7.10	
G. G. Cornwell & Son (fruit for L. A. Fischer)	10.00	
Geo. C. Shaffer (flowers for L. A. Fischer)	5.00	
		22.10
Balance		$134.25

(Signed) FRANK WANSER,
Treasurer.

(A motion was made and seconded that the report be accepted. The question was taken, and the motion was agreed to.)

REPORT OF COMMITTEE ON NOMINATIONS, PRESENTED BY WM. F. CLUETT, CHAIRMAN, AND ELECTION OF OFFICERS.

Your committee on nominations respectfully submits to this conference the names of the following members to act as officers and members of the executive committee for the ensuing year:

President, S. W. Stratton; first vice president, H. A. Webster; second vice president, W. B. McGrady; secretary, F. S. Holbrook; treasurer, J. Harry Foley; members of the executive committee, all of the officers ex officio, W. T. White, R. F. Barron, A. F. Bove, W. F. Cluett, H. N. Davis, T. F. Egan, A. A. Greer, D. C. Hill, C. M. Fuller, J. J. Holwell, I. L. Miller, J. M. Mote, Francis Meredith, W. F. Steinel, G. M. Roberts, W. F. Goodwin, J. W. Richardson, G. F. Daugherty, George Warner, and Joseph J. Kelly.

(Signed) W. F. Cluett,
A. A. Greer,
W. T. White,
A. W. Schwartz,
Committee on Nominations.

Mr. Reichmann. I move that the secretary be instructed to cast the ballot of the conference for all of these nominations.

(The motion was seconded, the question was taken, and the motion was agreed to.)

(Accordingly the secretary cast the ballot of the conference for the officers and members of the executive committee, as nominated by the committee on nominations, and they were declared duly elected.)

(At this point Mr. D. C. Hill, of Dallas, Tex., submitted a report on work done in his city.)

MOTION TO INCORPORATE CERTAIN MATERIAL, AND OTHER MISCELLANEOUS MOTIONS AND ANNOUNCEMENTS.

Mr. Holbrook. There are several telegrams and reports on the secretary's desk that might be incorporated in the minutes, if that is the desire of the conference and it is found possible.

(It was moved and seconded that such material be incorporated in the minutes, the question was taken, and the motion was agreed to.)

Mr. Livingston. I would like to know if city and county inspectors are full members of this organization?

The Chairman. We have no very formal organization. First it was of State representatives, then the State representatives brought with them their local sealers, and there is where the matter stands at the present time.

Mr. Livingston. I think it is a useless proposition for a city or county inspector to come to this conference. We do not seem to have any part in it whatever.

The Chairman. We are very sorry indeed if that is your feeling. But you are always welcome.

Mr. Reichmann. Mr. Chairman, I move you that the second day of the conference next year be set aside primarily and solely for city and county weights and measures officials.

(The motion was seconded.)

The CHAIRMAN. It is a very good suggestion. As a matter of fact they have been recognized, have been asked to prepare papers, and there has been no distinction. But the Chair welcomes the motion.

(The question was taken, and the motion was agreed to.)

Mr. NEALE. Mr. Chairman, the exhibiting manufacturers want to go on record as expressing their appreciation of the courtesy of the Bureau of Standards, and particularly of the services of Mr. H. H. Dutton and his assistants, who have been so very kind and considerate to us in connection with the making of our exhibits.

Mr. DALE. Mr. Chairman, I have come here from Boston in response to an invitation which you sent to the American Institute of Weights and Measures. My particular interest and theirs is confined to two papers, one on the fundamental standard of length, the other on the metric system. I would like to know what disposition is to be made of them, whether they are to be brought up or whether they are to be presented in the record without reading. In the former case I should like to present a few remarks on both subjects; in the latter case I should like to file two memorandums on the same subject.

The CHAIRMAN. Mr. Dale, the program committee said that at the last meeting there was a request for some papers of this kind. My own reply to this was that I did not want to interject any controversy of that sort into these programs; that if these papers were to be purely explanatory and not advocating in any way the metric system, that I did not object to their being put on the program but only if there was time for them. Consequently the papers concerning the more pressing things in which this conference is concerned were given the right of way. I considered this as the courteous thing to do, because our own people very courteously agreed to withdraw.

Now I, as chairman, have not been willing to interrupt this conference, or set aside these other more important and pressing things, for any such controversy. If the conference wants to discuss these papers now, this session can be prolonged. It does not make a particle of difference to me. But we had first to get out of the way the business for which this conference came. With that explanation, the matter is entirely in the hands of the conference.

Mr. SCHWARTZ. To bring the matter before the conference, I move that these papers be omitted from the record. This is no time for discussion.

Mr. DALE. If this motion is agreed to I want to leave with the secretary two memorandums simply as a record by which I will be able to say that I have left the memorandums on the two subjects in which I am interested.

The CHAIRMAN. Do you want them included in the record?

Mr. DALE. I do; and, if necessary, I would be very glad to read them.

Mr. REICHMANN. If the papers in question are not included in the record I believe that while as a matter of courtesy and fairness to Mr. Dale he should be allowed to leave the papers, they should not be included in the record any more than the others. I will make a motion to that effect.

(The question was taken, and the motion was agreed to.)

Mr. REICHMANN. Now I make a motion that there be included in the record a statement that Mr. Dale appeared here with two

prepared papers, ready to read to the conference, but inasmuch as the other papers were not part of the record, his papers also are not included in the record.

(The motion was seconded, the question was taken, and the motion was agreed to.)

Mr. Goodwin. Mr. Chairman and gentlemen, I care not anything for personal honors, but I do feel that it is a signal honor to have my State represented on a committee of this conference. And I want in this manner to convey to the members of the conference my deep appreciation of this.

Mr. Holbrook. I would like to say that if delegates desiring to visit the laboratories of the Bureau of Standards will assemble in room 216 of the South Building, arrangements will be made for the inspection and for guides to explain the work.

(It was moved and seconded at this point that the conference adjourn. The question was taken, and the motion was agreed to.)

(Thereupon, at 12.20 o'clock p. m., the Fifteenth Annual Conference on Weights and Measures of the United States adjourned sine die.)

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