DEPARTMENT OF COMMERCE
BUREAU OF STANDARDS
George K. Burgess, Director

REPORT OF THE TWENTY-FIRST NATIONAL CONFERENCE ON WEIGHTS AND MEASURES

ATTENDED BY REPRESENTATIVES FROM VARIOUS STATES

HELD AT THE BUREAU OF STANDARDS
WASHINGTON, D. C., MAY 22, 23, 24, AND 25, 1928

MISCELLANEOUS PUBLICATIONS, BUREAU OF STANDARDS, No. 87

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PRICE 35 CENTS

Sold only by the Superintendent of Documents, U. S. Government Printing Office
Washington, D. C.

UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON
1928

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New Haven	William P. Tyler, sealer of weights and measures, Middlebury.

DELAWARE

Governor's representatives	Mrs. J. A. Bernstein, weights and measures committee, Consumers' League of Delaware, 604 Hillcrest Avenue, Wilmington.
	Mrs. William A. Hart, weights and measures committee, Consumers' League of Delaware, Delaware Avenue and Riverview, Wilmington.
	Mrs. Petricha E. Manchester, executive secretary, Consumers' League of Delaware, 816 Ford Building, Wilmington.
	Mrs. Robert H. Maris, chairman, weights and measures committee, Consumers' League of Delaware, 1102 West Tenth Street, Wilmington.

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John L. F. Keenan, inspector of weights, measures, and markets, District Building, Washington.
George C. Wright, inspector of weights, measures, and markets, District Building, Washington.

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City: Miami — W. H. Green, sealer of weights and measures.

GEORGIA

City: Atlanta — Richmond Paul, inspector of weights and measures, Police Department.

ILLINOIS

City: Chicago — William F. Cluett, chief deputy inspector of weights and measures, room 608, City Hall, Chicago.

INDIANA

State — I. L. Miller, commissioner of weights and measures, Statehouse Annex, Indianapolis.

KENTUCKY

City: Louisville — Samuel F. Fox, chief inspector of weights and measures, City Hall.

MAINE

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James T. Everett, inspector of weights and measures, City Hall.
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	Henry Slitzer, laborer-assistant, division of weights and measures, City Hall.
	Charles Zuschlag, inspector of weights and measures, City Hall.
County: Washington	D. Frank Miller, inspector of weights and measures, Boonsboro.

MASSACHUSETTS

State	Francis Meredith, director of standards, Statehouse, Boston.
City:	
Boston	James A. Sweeney, sealer of weights and measures, City Hall Annex.
Cambridge	Felix C. McBride, sealer of weights and measures, City Building, Brattle Square.
Holyoke	Hervey L. Antil, sealer of weights and measures, City Hall.
Springfield	William Foster, sealer of weights and measures, room 9, Administration Building.
West Newton	Andrew Prior, sealer of weights and measures, City Hall.

MICHIGAN

State	Peter D. Dukesherer, director, bureau of foods and standards, Lansing.
City:	
Detroit	George F. Austin, Jr., assistant supervisor, bureau of weights and measures, 1300 Beaubien Street.
Flint	C. C. Schafer, sealer of weights and measures, 607 Beach Street.
City and County: Saginaw	George W. Mahn, sealer of weights and measures.

MISSOURI

State	Roy H. Monier, warehouse commissioner, 324 Board of Trade, Kansas City.
City: St. Joseph	J. M. Martin, license inspector.

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State	Harold A. Webster, commissioner of weights and measures, Statehouse, Concord.

NEW JERSEY

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	Elliott B. Holton, assistant superintendent of weights and measures, Trenton.
	Harry S. Provost, assistant superintendent of weights and measures, Trenton.
	Joseph G. Rogers, assistant superintendent of weights and measures, Trenton.
	A. W. Schwartz, assistant superintendent of weights and measures, Elizabeth.
City:	
Atlantic City	Harry H. Harrison, superintendent of weights and measures, City Hall.
Elizabeth	William J. Bender, superintendent of weights and measures, Harmonia Building.
Englewood	James E. Fitzgerald, superintendent of weights and measures, City Hall.
Jersey City	John S. Burke, superintendent of weights and measures, City Hall.

City—Continued.

Kearny	JOHN D. CASTLES, superintendent of weights and measures, Town Hall.
Newark	PATRICK J. CAUFIELD, superintendent of weights and measures, City Hall.
Trenton	FRANCIS J. BLACK, superintendent of weights and measures, City Hall.

County:

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Cumberland	WILLIAM B. HOLMES, superintendent of weights and measures, Bridgeton.
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Middlesex	JOSEPH FERTIG, assistant superintendent of weights and measures, 184 Livingston Avenue, New Brunswick.
Monmouth	ROBERT M. MARKS, assistant superintendent of weights and measures, Manasquan.
Morris	HENRY S. WORMAN, superintendent of weights and measures, Courthouse, Morristown.
Passaic	HARRY ROSENFELT, superintendent of weights and measures, Courthouse, Paterson.
Somerset	MELVIN H. CLEAVES, superintendent of weights and measures, Somerville.
Sussex	R. LEE SLATER, superintendent of weights and measures, Newton.
Union	ISAAC SEELEY, superintendent of weights and measures, Courthouse, Elizabeth.

NEW YORK

State	CHARLES J. REYNOLDS, director, bureau of weights and measures, 122 State Street, Albany.

City:

Mount Vernon	GUS SCHIMOLER, sealer of weights and measures, Police Headquarters.
Rochester	J. H. Stephenson, sealer of weights and measures, 34 Court Street.
City and County: Batavia and Genesee County.	E. C. MOULTON, sealer of weights and measures, Alexander.

County:

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NORTH CAROLINA

State	WILLIAM A. GRAHAM, commissioner of agriculture, Raleigh. O. P. SHELL, chief inspector of weights and measures, Raleigh. W. R. LEE, inspector of weights and measures, 1033 Greenwood Cliff, Charlotte.

OHIO

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- Columbus — M. A. Bridge, sealer of weights and measures, 152 East Rich Street.
- Toledo — William C. Wetfoth, sealer of weights and measures, 555 Erie Street.

OREGON

State — Seymour Jones, State market agent, Salem.

PENNSYLVANIA

State — Albert B. Smith, director, bureau of standard weights and measures, Harrisburg.
P. J. Casey, deputy inspector of weights and measures, Falls Creek.

City:
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- Harrisburg — George B. Nebinger, inspector of weights and measures.
- Philadelphia — Theo. A. Seraphin, district supervisor of weights and measures, 2017 Arch Street.
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- Dauphin — John E. Bowers, inspector of weights and measures, 13 South Third Street, Harrisburg.
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RHODE ISLAND

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A. H. Gibert, chief inspector, department of agriculture, Columbia.

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State — V. A. Bradley, superintendent of weights and measures, Nashville.

City: Chattanooga — Tom F. Mahoney, sealer of weights and measures, City Hall.

TEXAS

State — V. A. Stovall, chief inspector of weights and measures, department of agriculture, Austin.
W. T. Henrichson, meter inspector, division of weights and measures, department of agriculture, Austin.
J. A. Kinard, inspector, division of weights and measures, department of agriculture, Austin.

VERMONT

State	H. N. Davis, deputy commissioner of weights and measures, Montpelier.

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State	J. H. Meek, director, division of markets, 1030 State Office Building, Richmond. H. G. Coville, field representative, division of markets, 1030 State Office Building, Richmond.
City:	
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Roanoke	C. R. Vaughan, sealer of weights and measures.
County: Accomac	S. J. Stevenson, sealer of weights and measures, Accomac.

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State	Howard S. Jarrett, commissioner of weights and measures, Charleston. P. T. Sullivan, inspector of weights and measures, 1110 Fourth Street, Moundsville. P. R. Edler, inspector of weights and measures, 317 Laidley Street, Charleston.
County: Harrison	James Pickens, sealer of weights and measures, Clarksburg.

WISCONSIN

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Milwaukee	William F. Steinel, sealer of weights and measures, 421 Fifth Street.
West Allis and Wauwatosa	Erwin J. Rogers, sealer of weights and measures, West Allis.

OTHER DELEGATES, AND GUESTS APPEARING ON THE PROGRAM

Adams, Oliver C., president, southern division, The Great Atlantic & Pacific Tea Co., 2401 Walnut Street, Philadelphia, Pa.
Barrett, H. F., Buffalo Meter Co., Buffalo, N. Y.
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Bearce, H. W., Bureau of Standards, Washington, D. C.
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Burgess, Dr. George K., Director, Bureau of Standards, Washington, D. C.
Fairchild, I. J., Bureau of Standards, Washington, D. C.
Gould, R. E., Bureau of Standards, Washington, D. C.
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Griffith, C. P., chief engineer, S. F. Bowser & Co. (Inc.), Fort Wayne, Ind.
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Judson, L. V., Bureau of Standards, Washington, D. C.
MacLean, A. D., chief engineer, Pittsburgh Equitable Meter Co., 400 North Lexington Avenue, Pittsburgh, Pa.
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Peffer, E. L., Bureau of Standards, Washington, D. C.
Pienkowsky, A. T., Bureau of Standards, Washington, D. C.
Richard, C. L., Bureau of Standards, Washington, D. C.
Roeser, H. M., Bureau of Standards, Washington, D. C.
Smith, Ralph W., Bureau of Standards, Washington, D. C.

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Becker, Christian (Inc.): C. A. Becker, 147 Eighth Street, Jersey City, N. J.
Black & Decker Manufacturing Co.:
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H. L. Prince, testing engineer, Towson, Md.
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Daniel G. Milligan, vice president, Fort Wayne, Ind.
C. P. Griffith, chief engineer, Fort Wayne, Ind.
Buffalo Meter Co.: H. F. Barrett, 2917 Main Street, Buffalo, N. Y.
Buffalo Scale Co.: E. D. Gordon, chief engineer, 1200 Niagara Street, Buffalo, N. Y.
Chatillon, John, & Sons:
Edwin C. Smith, sales manager, 85 Cliff Street, New York, N. Y.
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J. George Hugel, 85 Cliff Street, New York, N. Y.
Correct Measure Co.:
C. C. Dimmette, 6227 Ninth Street NW., Washington, D. C.
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Daniel Line, superintendent service department, 115 East Lombard Street, Baltimore, Md.
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Standard Computing Scale Co.:
M. D. RIBBLE, superintendent of sales agencies, Detroit, Mich.
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Seraphin Manufacturing Co.: IDA U. SERAPHIN, secretary, 1314 North Seventh Street, Philadelphia, Pa.
Smith Scale Co.: DONALD DOUGLASS, sales representative, 265 West Spring Street, Columbus, Ohio.
Stimpson Computing Scale Co.:
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WILLIAM F. BOWEN, agent, 802 Tenth Street NW., Washington, D. C.
Tokheim Oil Tank & Pump Co.:
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W. M. FRAZIER, district manager, Baltimore, Md.
Toledo Scale Co.:
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CHARLES C. NEALE, special representative, Toledo, Ohio.
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Troemner, Henry: LEON DIEFENDERFER, foreman, 2436 Sharswood Street, Philadelphia, Pa.

Wayne Co.:
A. D. Carriger, director of sales, Fort Wayne, Ind.
R. A. Dempsey, district manager, 4030 North Broad Street, Philadelphia, Pa.
W. J. Powers, 4030 North Broad Street, Philadelphia, Pa.

GUESTS REPRESENTING ASSOCIATIONS OF MANUFACTURERS

Glass Container Association: Russell J. Miedel, Wheeling, W. Va.
Scale & Balance Manufacturers Association: Otis L. Williams, secretary, 17 State Street, New York, N. Y.
Waynesboro Manufacturers' Association: J. A. Knupp, secretary, Trust Building, Waynesboro, Pa.

GUESTS REPRESENTING RAILROADS AND WEIGHING DEPARTMENTS

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Bylsma, J. M., chief, weighing department, Western Weighing and Inspection Bureau, 1800 Transportation Building, Chicago, Ill.
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Milan, Lucille, assistant chief clerk, Western Weighing and Inspection Bureau, Kansas City, Mo.
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Welsh, R. C., general scale inspector, Pennsylvania Railroad, Harrisburg, Pa.

GUESTS REPRESENTING GOVERNMENT DEPARTMENTS

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Miller, J. C., skilled draftsman, Post Office Department, Washington, D. C.

OTHER GUESTS

Graves, W. A., Virginia.
Lyons, John F., weights and measures department, American Stores Co., Philadelphia, Pa.
Parker, John C., president, Lefax (Inc.), Philadelphia, Pa.
Rosenbauer, O. W., Standard Oil Co. (N. J.), 241 Pennsylvania Avenue, Washington, D. C.
Smith, James, 145 Main Street, Paterson, N. J.
Sullivan, J. R., Salt Lake City, Utah.

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ing, Bureau of Standards

REPORT OF THE TWENTY-FIRST NATIONAL CONFERENCE ON WEIGHTS AND MEASURES

HELD AT THE BUREAU OF STANDARDS, WASHINGTON, D. C., MAY 22–25, 1928

FIRST SESSION (MORNING OF TUESDAY, MAY 22, 1928)

The conference was called to order at 10.55 o'clock a. m. by Dr. George K. Burgess, president of the conference.

OPENING ADDRESS BY THE PRESIDENT, DR. GEORGE K. BURGESS

It certainly is a great pleasure to welcome so many of you here to-day to this, the twenty-first meeting of the National Conference on Weights and Measures. I am very pleased to see many familiar faces and also many new ones. I congratulate the conference on the fact that after 21 years it has now attained, so to speak, its majority. I think that the work of this conference during the past 21 years has been of very great use to the country not only in connection with specific work which we have done along the lines of weights and measures administration, but also in the general effect it has had on the various communities and on the public in general. An organization of this kind makes for the betterment of the country as a whole.

I would refer to the fact that the report of the twentieth conference was issued some time ago; doubtless all of you who were in attendance last year have ere this received copies.

I might also refer to the completion by the Bureau of Standards of the second Standards Yearbook. This has not yet been received from the printer, but I have a single copy which has been made up. In this second Standards Yearbook, emphasis is given to the activities on the question of standards in foreign countries to a greater extent than was the case in the first issue. I am sorry they are not available for free distribution, but copies can be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C.

I desire now to discuss with you certain activities of an organization known as the American Institute of Weights and Measures, which have been brought to our attention. You will, I think, be especially interested in several mimeographed letters and circulars sent out by this group, signed by the secretary thereof. The first of which mention may be made is addressed to various industrial and manufacturing concerns, and we have reason to believe that this letter was very widely circulated both to members and nonmembers of that organization. This letter opened by asking whether or not the

Official photograph of delegates and guests attending the Twenty-first National Conference on Weights and Measures, assembled at the entrance of the East Building, Bureau of Standards

person to whom the letter was addressed would be able to attend this conference which is described in the words "* * * the bureau has called a conference on weights and measures standards and has extended an invitation for anyone to be present."

Now invitations to this conference are extended by letter to State and local weights and measures officials throughout the United States, to manufacturers of commercial weighing and measuring devices, to representatives of railroads and weighing departments, and to a few others known to be especially interested in the activities of the conference or who are presumed to be interested due to their having attended a recent former meeting. Our personal invitations stop there. However, it has never been the policy of the conference to exclude anyone interested in attending, and this attitude has doubtless been expressed from time to time, always, however, we believe, coupled with a rather definite statement as to the character and purposes of the meetings so that no one would be induced to come only to find the meetings foreign to his interests. Exactly what is relied upon by the writer of the letter referred to, as a basis of the statement that we have invited "anyone to be present" is unknown to us. However, if anyone is in attendance here as a result of this letter we will say to him that he is welcome to our meetings and that we hope the proceedings will be of interest to him. Should he find, however, that the conference is of a different nature than he has been led to expect, of course for that we can accept no responsibility. We can only regret that his time and energy have been wasted. We take occasion to hope that no one will find himself in this position. If anyone has been misled into attending, he will at least know where to place the responsibility.

The letter under discussion proceeds to suggest that the conference will give the industrial and manufacturing interests an excellent opportunity to find out why the bureau is back of a bill introduced in the present Congress known as H. R. 7208 entitled "A bill to regulate and control the manufacture, sale, and use of weights and measures and weighing and measuring devices for use or used in trade or commerce, and for other purposes." As it happens, this opportunity will, in fact, be presented, since later in this address it is my intention to discuss this matter.

It is further stated that "It may be safely taken that the real purposes of the conference are to enable the bureau to obtain greater appropriations and to help the State and local authorities to secure Federal subsidies for State weights and measures administration through the bureau's assistance." It would be difficult to imagine a more inaccurate statement of the purposes of this conference. Of course the purposes of the conferences are nothing of the kind. The bureau certainly expects no increase in appropriations whatsoever as a result of this meeting; neither has any Federal subsidy to the States entered into our calculations, nor as far as we can recall, has such a proposal ever been made here. We may say for the benefit of those who are our guests for the first time if there be any such—our members and our usual guests are already fully cognizant of them—that the purposes of this meeting are the same as of the 20 preceding meetings of this organization. Succinctly expressed, these meetings are held to promote uniformity in weights and measures

supervisional activities in the United States, they are attended by weights and measures officials from all parts of the country, constructive actions of great importance to every State are taken as the result of the deliberations of the members, and their value has been amply demonstrated by experience. An examination of our program will serve to indicate the manner in which a typical conference functions to carry out these purposes.

The second letter from the same source is addressed to "Each State and local weights and measures official." Doubtless a considerable number of you—perhaps all of you—have received a copy. In this letter it is correctly predicated that each of you will be invited to this conference, the conference in this instance being correctly titled, and it is suggested to you that you ask the bureau certain questions, either on the floor of the conference or by correspondence. The first question refers to certain phases of the bill heretofore mentioned, H. R. 7208. This is the bill introduced into the present Congress as the result of a motion passed, practically unanimously, by the last conference to the effect that a special committee be appointed to draft a bill and secure its introduction into Congress to provide for Federal approval of type of apparatus. This special committee, under the chairmanship of Edward J. Maroney, of New Haven, Conn., the introducer of the conference motion, has complied with the mandate of the conference, and H. R. 7208 is the result of the efforts of this committee. The other questions are largely devoted to other Federal legislative proposals.

Whether any of the members of the conference have the inclination to ask the questions which it has been suggested that they propound, I do not know. I am rather of the impression that the members are very well posted, indeed, on the matters advanced, through full discussions which have been held at former meetings of this conference and elsewhere. However, as you will remember, it has been my custom at the last several conferences briefly to discuss legislation of interest to you introduced into Congress during the preceding year. Therefore the questions propounded in relation to proposed Federal legislation fall within the general scope of the matters I am accustomed to discuss. Especially H. R. 7208, which is the result of your own action, is naturally of peculiar interest to you and therefore deserves a larger share of attention than is usually allotted to legislative proposals. Therefore, without request from you, I will be pleased to take up at this time the matters concerning proposed legislation especially stressed in the letter referred to.

Before I do so, however, I desire to go a little more into detail in relation to the introduction of H. R. 7208 into Congress. In briefs submitted to the House Committee on Coinage, Weights, and Measures in relation to this bill by a man who has, in times past, represented the institute at this conference but whose name does not appear in its present list of officers, it has been stated or intimated that the Bureau of Standards has engineered this whole project for the purpose of its own aggrandizement, that the bureau is the only body interested, and that it is using the State and local men and the conference, as a blind behind which to hide its supposed machinations.

Perhaps some color has been lent to statements such as these by the fact that no one, except Mr. Holbrook and myself, strongly

supported the bill before the committee at the occasion of the last hearing, and both of us are, of course, connected with the Bureau of Standards. Of course, the reasons why we appeared were that we were on the ground, within call, that we were familiar with the provisions of the bill, and that we were requested to be present and testify at the hearing. In giving testimony we considered that we acted as agents of the conference to carry out a conference instruction. Speaking as director of the bureau and viewing the proposed legislation solely from the standpoint of any increased power to be acquired by the bureau I can say that I am entirely unconcerned, whether the bill be enacted or rejected.

As for the contention that the bureau engineered conference action and secured the introduction of the bill, this statement is not in accordance with the facts. The fact is that the introducer of the conference motion and chairman of the special committee on the bill introduced the motion without any consultation with or notification to the bureau that he contemplated such action. However, the statements alluded to above are specious ones, calculated to mislead the members of the committee as to the facts in the case, since to a certain extent Congress is bound to believe that when Government officials appear in favor of propositions tending to increase their duties, they are not wholly impartial witnesses. Therefore officials of the Government are always more or less at a disadvantage in giving testimony of this kind.

To return to the questions:

1. The first general question is in relation to the effect on your duties if H. R. 7208 is enacted; also whether the bureau means to continue your existence if the legislation is passed.

Since this is a far-reaching question involving the principles of the entire bill we might give at this point a résumé of its provisions which we believe is a fair statement of its contents.

Under the terms of H. R. 7208 the Bureau of Standards would be empowered to pass upon and to approve or disapprove all types of weights and measures for use in trade or commerce in the United States, this phrase being defined as we will see later. All types would be required to be approved which were so designed and constructed that they gave correct results, were reasonably permanent in their indications and adjustment, and did not facilitate the perpetration of fraud. Approved types would be certified and a designating mark assigned, which with certain exceptions would be marked on individual weights and measures manufactured; all weights and measures in use or in the process of manufacture at the time the bill took effect would be exempted from examination or marking. Appeals would be allowed to be taken from all decisions of the bureau, to the Secretary of Commerce and, in case his decision were adverse, to the Court of Appeals of the District of Columbia. Should the law go into operation, subject to the above exceptions, only approved types would be allowed to be made and sold for commercial use. Weights and measures being imported into the country would be within the purview of the act, and those which did not comply with the requirements would be refused admission.

Pursuant to the above authority to pass on types of certain weights and measures, the Secretary of Commerce would be authorized to

promulgate tolerances for such weights and measures and also specifications for the guidance of manufacturers; provisions are included designed to give manufacturers and State and local officials opportunities to participate in the formation of the tolerances and specifications.

The powers of the State and local jurisdictions to pass and enforce general weights and measures laws, to inspect and test all weights and measures in use in their jurisdictions, and to condemn all which are in error by more than the tolerances or which are otherwise defective or which are unlawfully used, are specifically preserved by the provisions of the bill. The power is also specifically granted to the States to enact legislation prohibiting the sale or use of weights and measures of types not approved in accordance with the provisions of this act. Upon the exercise of this power by any State, the officials of that State would be enabled to have all violations occurring in their jurisdictions settled in their State courts.

A penalty of from $20 to $500 to be recovered in a civil action brought in the name of the United States, would be provided for violation of any of the provisions of the act. It would also be provided that the Secretary of Commerce and State and local weights and measures officials would bring violations to the attention of the United States district attorneys for action thereon. The counterfeiting or the use without authority, of a serial designation would be made a misdemeanor punishable by a fine of $500 or by imprisonment for not more than one year.

In connection with this bill it is suggested by the writer of the letter referred to that you secure from the House Committee on Coinage, Weights, and Measures a copy of the full printed hearings on H. R. 7208 held on January 23, 1928. Long before the letter was written we considered that you would have a very real interest in this document, and accordingly the bureau took occasion to have one forwarded to each State weights and measures official, and to some of the local officials. To facilitate the obtaining of copies by all of you who have not as yet secured one we have obtained a new supply from the committee and they are now available for distribution. Since we can not supply everyone in attendance and are anxious that the widest circulation possible be given this document, we will request that these be reserved in so far as possible for those who do not already have a copy.

In our opinion this proposed bill is designed to secure uniformity of types of weighing and measuring apparatus for commercial purposes throughout the United States for the protection of the general public in their commercial transactions. This purpose would be accomplished by intrusting to the Federal Government the power to approve types of apparatus for use in trade or commerce, which are found to be accurate, reasonably permanent in their indications and adjustment, and not conducive to the perpetration of fraud, and by allowing only such approved types to be imported or to be sold or used for commercial purposes in the United States.

At the present time a few States and cities are practically exercising the power of regulation of type, either directly or through the medium of refusing to seal types which do not meet their approval. The result has been nonuniform and in some cases widely divergent

requirements with consequent hardship upon manufacturers and a very great economic loss without any corresponding benefit, since apparatus satisfactory for use in one jurisdiction should be satisfactory for use in all sections of the country, and vice versa. The very great majority of jurisdictions are not exercising jurisdiction over devices until after they have come into use, and as a result hardships are caused, since the condemnation of apparatus after it has been used ordinarily leaves the merchant no recourse against the manufacturer or dealer who sold him the apparatus. In general, he must be prepared to bear the loss of the old and go to the expense of procuring new equipment.

To allow apparatus to be made and sold for commercial use which will not thereafter be allowed in commercial use is an extremely uneconomic and wasteful method of procedure. Under the terms of the proposed bill such improper apparatus would be halted at its source with consequent savings all along the line.

This bill practically would not interfere at all with the present powers of the great majority of jurisdictions because the great majority are not exercising any direct jurisdiction along the lines covered by the bill. The present general powers and duties of the States along weights and measures lines are specifically and, we believe, adequately safeguarded by the provisions of section 11, and to this section we invite your particular attention.

In so far as your duties would be affected at all, they would be made somewhat easier to carry out since the very inferior types which have sometimes been sold for commercial purposes and which, no doubt, have caused you a disproportionate amount of time and trouble in the past, would no longer be available on the market for commercial use. This might well result in your having somewhat more time to cover your territory, and if this were the case it would be an excellent thing, since the great majority of weights and measures departments at the present time are undermanned. Opportunity would be afforded in such an event for you to engage more actively in supervisional work which is so important—work such as supervising the manner of sale of commodities; check-weighing or check-measuring packages of merchandise that have been delivered to a customer, that are ready for delivery to customers, or that are put up by the merchant in advance of sale; checking the quantity of package goods put up by the manufacturer; checking loads or deliveries of fuel, ice, etc.; investigating complaints of shortages or unfair practices; educating buyers and sellers in general, as to their rights and duties under the weights and measures laws; teaching the retail purchasing public—the ultimate consumers—how to buy and how to help in protecting their interests; and developing that healthy spirit of cooperation between the department and each of the several groups with which it deals, without which the greatest measure of success can never be realized.

While I think that I have been sufficiently detailed in the above and while it is no part of my present purpose to discuss the arguments advanced against the bill I can not refrain from quoting one statement made to the industrial and manufacturing concerns in the letter first mentioned by me. This statement is to the effect that the bill would authorize the bureau "to regulate and control every measurement made with every conceivable kind of measuring device, since nothing involving measurement is specifically excepted."

The basis of the claim that the bill covers "measurement" is probably due to the fact that there is what appears to be a typographical error in the bill in section 2 which begins "The Bureau of Standards is empowered to pass upon each type of weight or measurement manufactured, offered, or exposed for sale, or sold, for use in trade or commerce or used in trade or commerce, in the United States."[1] We have no doubt that this is a typographical error and it seems that this should be obvious since in phrases which appear to be of similar import throughout the bill, the words "weight or measure" instead of "weight or measurement" are always used. In fact, this is the case in the very next sentence which obviously proceeds to provide methods of handling the types over which jurisdiction is given in the first sentence. The statement quoted above, then, seems to me to be made with plain disregard of the provisions of the bill itself, taken as a whole. In our opinion the bill is not intended to regulate "measurement" at all—this jurisdiction is left exclusively to the State and local officials as I have suggested heretofore—but only to regulate the type of machine used in performing certain weighing or measuring operations.

We think that a natural inference from the above statement would be that every type of weighing and measuring device for whatsoever use, without exception, was intended to be included within the purview of the bill. This same idea is more definitely set out in another statement sent out by the institute, to which the name of the secretary is also appended, in the words: "But there is nothing in the bill which excludes mechanics' rules, micrometers, gauges, boiler-pressure or blood-pressure gauges, radio-battery testers, automobile speedometers, gasoline gauges, tailors' measures, electric meters, gas meters, water meters, taximeters, pedometers, exposure meters, protractors, ship-sounding apparatus, calorimeters, pyrometers, hydrometers, hygrometers, and wave meters, or in fact which specifically excludes anything at all." And in the same statement: * * * "everyone is interested in what the bureau has in mind in seeking authority to police every conceivable kind of device we use for producing articles dimensioned in terms of the standards of weight and measure."

There appears to us to be no excuse for such statements and we have already had occasion to state elsewhere that we consider them as "ridiculous and absolutely contrary to fact." The bill is designed to regulate only "weighing and measuring devices for use or used in trade or commerce" and section 1 (d) defines this term as follows:

> (d) The term "use in trade or commerce" shall be construed to include use in buying or selling goods, wares, or merchandise, or in barter or exchange; in determining charges for the carriage or transportation of freight, baggage, or express shipments; in determining wages, compensation, or charges according to the amount of goods or things made or produced, or amount of work or labor done or services performed; in compounding medicinal and other formulae individually submitted for this purpose; in determining weight or measure when a charge is made for the determination; and in all other similar cases.

In our opinion there can be no question that this language effectively eliminates all weights and measures which are for industrial

[1] Our assumption that this was probably a typographical error was correct, since during the conference Mr. Maroney showed us a typewritten draft in his possession which was supposed to be identical with the bill introduced, and in this the phrase was written "weight or measure."

and other noncommercial, as distinguished from commercial, uses. This constitutes a specific exception as to the "weights and measures" to be regulated, of the most fundamental and important kind. In other words, we think the bill certainly excludes by its terms very many of the devices enumerated in the list above quoted—certainly all except the ones which are intended for use in the buying or selling of commodities or service. If the bill does not generally exempt a multitude of weighing and measuring devices, then I do not understand the plain meaning of English words and phrases.

One other matter which I feel should be mentioned at this time is the fact that it appears that there has been a very widespread attempt to convince industrial and commercial concerns that H. R. 7208 is related to the metric system, and the very considerable opposition which has been engendered against the bill very largely rests upon a metric-system foundation. This is demonstrated by a study of the letters and telegrams against the bill printed in the report of the Committee on Coinage, Weights, and Measures, which make it evident that the majority of the persons sending these opposed the bill on account of their hostility to the compulsory adoption of the metric system.

At this time I will state that H. R. 7208 does not provide for the adoption of the metric system, or for the increased use of the metric system, or as an entering wedge for the metric system. In fact it is our opinion that this bill has nothing whatever to do with the metric system, directly or remotely, in any manner, way, shape, or form. I can not make that too emphatic. I am sure that any reasonable man, upon either a casual consideration or a detailed study of the bill, will be convinced that this conclusion is an absolutely accurate one.

In view of the above I think that there is no question that the major part of the opposition to the bill has been the result of misconceptions concerning it rather than opposition to the principles embodied in it.

The latter part of the question, which is concerned with whether this bureau means to continue your existence should this bill become a law, is so absurd as not to be worthy of comment.

In the tentative program of the conference you may remember that one of the program numbers consisted of a hearing on H. R. 7208 by the Committee on Coinage, Weights, and Measures, of the House of Representatives. Before this item was scheduled on the tentative program, Hon. Randolph Perkins, chairman of the committee, had kindly consented to schedule such a hearing to give the members of the conference an opportunity to express themselves in this relation. More recently, however, Congressman Perkins advised us that due to the prospective adjournment of Congress—it is probable that this will occur within a very short time—it was going to be a matter of very considerable difficulty to secure a quorum of the committee; and regardless of the evidence adduced at the hearing no committee action on the bill could possibly be secured at the present session. He, therefore, strongly preferred that the hearing be not held, but offered to print statements of members of the conference as a House document to allow them to record their sentiments in the record. In view of this it seemed preferable to me not to

urge holding the hearing, and, accordingly, the item does not appear on our printed program. Please note that the session to-morrow morning will be held at the Bureau of Standards, as usual.

2. The second question is, What will be the effect on your work of the passage of H. R. 8907, the baskets and hampers bill, and specifically in this connection, that provision of the bill by which the Secretary of Agriculture is given the authority to prescribe tolerances on baskets and hampers?

S. 2148 and H. R. 8907 are bills to fix standards for hampers, round stave baskets, and splint baskets for fruits and vegetables. Similar bills have been before Congress in previous sessions and have received extended consideration. The first bill of this general character was introduced in February, 1920. Revised bills have been introduced in every succeeding Congress, and twice have been passed by the House of Representatives and once by the Senate, but never by both Houses in the same Congress. Hearings were held on the present House bill in January and March by the Committee on Coinage, Weights, and Measures. On April 4 the bill was reported with an amendment to permit the use of the ⅝-bushel basket by farmers or market gardeners or others, "in gathering, delivering, and selling their products to canning, packing, or wholesale houses." The Senate bill was reported in February by the Committee on Agriculture and Forestry and recommended for passage without amendment. However, on March 5, an amendment to include the ⅝-bushel basket was introduced.

It will be of the greatest interest to you to hear that the bill was passed by the Senate on May 8 and on the 17th by the House and that it is now in the hands of the President for consideration.

It is our opinion that this bill has been carefully studied by weights and measures officials, and that it has had their almost unanimous support. It seems, then, that they must have been satisfied that it was proper for the Secretary of Agriculture to fix tolerances for those containers over which he is given a certain jurisdiction. If the final result is uniform tolerances on these containers throughout the country as a whole, doubtless this result will be highly satisfactory to you.

3. The third question inquires what has become of the standards representing the yard and the pound, in view of the fact that the primary standards of length and mass of the United States are the meter and the kilogram. The letter becomes somewhat involved at this point, but in the above connection you are requested to ask the bureau "to explain fully the reasons for whatever legislation against our customary standards it is sponsoring." We take it that an expression of the attitude of the Bureau of Standards toward the compulsory adoption of the metric system of weights and measures is desired.

A very full discussion of the standards of length and mass of the United States is contained in Miscellaneous Publication of the Bureau of Standards No. 64, History of the Standard Weights and Measures of the United States, by the late Louis A. Fischer, formerly chief of the division of weights and measures of the bureau, and secretary of this conference. For full information we can refer you to this source which is a veritable mine of information. Briefly, I may say at this

time that bronze yard No. 11 and the pound standard which were the primary standards of the United States before April 5, 1893, are now being safely maintained in the standards vault of the Bureau of Standards along with a number of other standards of historical importance. On the date mentioned—some eight years before the act creating the Bureau of Standards was enacted by Congress—meter No. 27 and kilogram No. 20 were recognized by the Superintendent of Weights and Measures of the Coast and Geodetic Survey, with the approval of the Secretary of the Treasury, as the fundamental standards of length and mass in the United States, and they have been so recognized ever since that date.

As to the attitude of the Bureau of Standards in relation to the compulsory adoption of the metric system, we may state this, as follows:

In relation to all proposals advocating the compulsory adoption of the metric system of weights and measures in the United States the policy of the Bureau of Standards is one of neutrality—neither to advocate nor to discourage. The whole subject of compulsory adoption is a highly controversial one and diametrically opposite views are being freely voiced. Most of these are matters of opinion and definite facts are very difficult to obtain. So many factors enter into the equation of compulsory adoption that the bureau is disinclined to make the attempt to evaluate it and thus throw the weight of its decision upon the one side or the other.

Therefore, I can say definitely and emphatically that the bureau is not advocating the adoption of the metric system for commercial or industrial uses whether by legislation or otherwise. Moreover it has never done so during the period that I have been director of the bureau.

Continuing the practice of giving a résumé of the bills in Congress which affect the work of the weights and measures officials or which are of particular interest to them, I will make brief mention of the purposes of these bills and the action taken upon them.

H. R. 487 proposes an amendment to the national food and drugs act for the purpose of preventing the slack filling of packages of food put up by manufacturers. The amendment seeks to prevent the use of packages of such form or shape as to deceive or mislead the purchaser as to the quantity of food contained in the package. The package must also be filled with the food it purports to contain. A few States already have such a law, and no doubt others will enact similar legislation. This bill was passed by the House on March 14.

H. R. 43 and S. 3831 propose an amendment to the law of 1916 establishing standard weights for the large and small barrel of lime. The amendment seeks to make it legal to place the name of the shipper of the lime upon the barrel or other package, in lieu of the name of the manufacturer, when desired. This bill was favorably reported to the House on April 4 and passed on May 7.

S. 2864 and H. R. 9040 are bills to establish the standard of weights and measures for wheat-mill, rye-mill, and corn-mill products. It is the purpose of the bill to standardize the size of packages of these products; 100-pound packages, multiples and certain submultiples thereof, together with certain odd sizes to meet trade conditions, are provided for. Hearings were held on the House bill by the Com-

mittee on Coinage, Weights, and Measures, and the bill was favorably reported without amendment, with the recommendation that the bill pass. The Senate bill was also reported by the Committee on Agriculture and Forestry with recommendation that it pass. The Senate bill was reported without amendment on March 6, and the House bill on February 29.

S. 811 and H. R. 181 are essentially similar in their provisions. Briefly, by the terms of these bills all clinical thermometers shipped in interstate or foreign commerce or imported into the United States are required to be inspected and sealed by the Bureau of Standards. S. 3401 and H. R. 13338 differ from the above, but are not dissimilar from each other. These bills provide for the testing by the bureau of domestic thermometers upon request, and of all imported clinical thermometers. However, all thermometers bearing designating marks placed thereon either by the bureau or by laboratories holding permits from the Secretary of Commerce authorizing them to use such marks, may be legally shipped in interstate or foreign commerce.

S. 872 and H. R. 10303 are bills in relation to the sale of cotton in interstate and foreign commerce, and provide for the sale of cotton by the true net weight of the bale, although the bills are very different in their general provisions.

S. 3011 is a bill for preventing the manufacture, sale, or transportation of adulterated, mislabeled, or misbranded linseed oil, turpentine, or paint, in interstate or foreign commerce. The bill provides among other things that the label on all liquid or mixed paints shall show the net measure of the contents of the container, and on all paste and semipaste paints the net weight or the net measure of the contents of the package.

H. R. 7191, authorizing the conveyance by the Secretary of Commerce of the land upon which our track scale depot is located at Chicago, Ill., upon the happening of certain contingencies, was passed by both House and Senate and was signed by the President. The act is known as Public, No. 281, Seventieth Congress.

Finally, H. J. Res. 10 relates to the use of the metric system and proposes that the Department of Commerce be authorized and directed to conduct a thorough investigation and study to determine the advisability of adopting the metric weights and measures for general use in the United States, and after the completion of the investigation, to carry out plans to encourage the use of the metric system.

I will leave on the table a file containing copies of all of the bills which I have mentioned and I would be glad to have you consult them at your leisure.

You may remember that at the last conference I reported that the construction work on the Bureau of Standards master track scale depot at Chicago would probably shortly begin; and in that connection that I hoped to be able to report to the conference this year that we had this very important station in operation. I am glad to be able to do so at this time. This depot is, in fact, in operation. I had the pleasure last week of signing the first two certificates for the first two scale test cars calibrated on our master track scale. Thus the country is now provided with equipment for the official testing of weights ranging in size up to 150,000 pounds. A paper

upon the subject of this master scale will be presented at this meeting.

I think that the executive committee is to be congratulated upon the program that has been arranged. An especial effort has been made in the preparation of this year's program to have papers presented by business men to represent the point of view of those with whom you come into contact, and I am sure you will enjoy hearing the papers of these representatives of business. This is, of course, primarily a conference of weights and measures officials, but weights and measures officials are human beings who in carrying out their official duties come in contact with other human beings, and these men with whom they have official relations are the very best friends to have, for cooperation is vital to your success.

That, ladies and gentlemen, constitutes all that your chairman has to present at this time.

ABSTRACTS OF STATE REPORTS[2]

ALABAMA

By H. L. Flurry, *Chief, State Division of Weights and Measures*

Mr. Flurry reported that the Alabama weights and measures law has been completely revised and made a part of the agricultural code of the State. The scope of the law has been extended, and it now embraces sales of service and includes provisions relative to sale of dry commodities, coal, and ice by weight, standard containers, public weighers, sale of lubricating oil, net-content marking of packages, standards for bread loaves, milk bottles, and regulation of type of commercial apparatus. Three inspectors have been added to the field force, and an equipment for testing large-capacity scales has been authorized.

CALIFORNIA[3]

By J. S. Casey, *Chief, State Division of Weights and Measures*

Mr. Casey remarked upon the very gratifying degree of coopera tion in California between the State division of weights and measures and the county sealers of the State, as a result of which the past year has shown steady progress along all lines of weights and measures activity. He mentioned particularly the efforts which have been made to effect the complete elimination of dishonest trade practices, a campaign in which marked progress has been made, but stressed the necessity for continuing attention along these lines.

CONNECTICUT

By Philip T. Pilon, *Deputy State Superintendent of Weights and Measures*

With the addition of six local weights and measures officials during the past year, Mr. Pilon stated that with one exception every county in the State now has a local officer, and that in this county an ap-

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

[3] This report was submitted through Thomas Flaherty and was read to the conference by him.

pointment is anticipated within the month. He reported excellent cooperation among local officials and the State department, and a very satisfactory character of supervision throughout the State. Vigorous efforts are being made by the State department to secure a special equipment for the testing of large-capacity scales, and success in this direction is anticipated.

DELAWARE

By Mrs. Petricha E. Manchester, *Executive Secretary, Consumers' League of Delaware, Wilmington*

Mrs. Manchester assured the conference that the efforts of the Consumers' League of Delaware to secure the passage of a comprehensive weights and measures law applying to the entire State would be continued, and that the bill which failed of passage at the last legislature would be reintroduced in 1929. In the absence of a legislative session since the last conference, no definite progress could be reported, but Mrs. Manchester expressed confidence that the desired legislation would be enacted at an early date.

DISTRICT OF COLUMBIA

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

Mr. Roberts reported that the effectiveness of his department has been increased by the appropriation of funds for an additional inspector, for increasing the salaries of employees of the department, for one additional automobile, and for the maintenance of a large truck for use in connection with the testing of large-capacity scales. He stated that the District Commissioners have indicated their willingness to transfer a truck for this use from another department, from which it appears that adequate heavy-testing equipment will shortly be in operation in the District.

FLORIDA

By W. H. Green. *Superintendent, Division of Weights and Measures, Miami*

Mr. Green reported that State supervision is limited to the examination of gasoline pumps, now carried on by the department of agriculture. In Miami active enforcement of a weights and measures ordinance passed in 1921 was begun in 1926, since which time the local division has exercised supervision over the gas, electric, and water meters, taximeters, gasoline pumps, and scales used in the city. The local personnel comprises the superintendent, three inspectors, and one clerk. This force is insufficient to cover the city properly, and additional funds are needed for adequate supervision.

ILLINOIS [4]

By Fred Benjamin, *State Superintendent of Standards*

Mr. Benjamin reported that 6 additional State inspectors have been appointed following an increase in appropriations, made by the last

[4] This report was submitted by mail to the secretary of the conference for inclusion in the conference record.

legislature, making a total of 14, and that these men are now being equipped to begin work. The State force covers all territory outside of cities of 25,000 or more, which have local sealers. There have been a few prosecutions by the State division for short-weight bread and coal and for failure to weigh empty coal wagons and trucks before loading; convictions upon pleas of guilty were secured in all cases started.

INDIANA

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

Mr. Miller commented upon the increasingly friendly relations between mine operators and employees as a result of the testing and inspection of mine scales in his State. He stated that the last legislature transferred jurisdiction over mine scales to the State department of weights and measures, and commended the mine-scale testing being carried on by the National Bureau of Standards. Local weights and measures officers in Indiana are also deputy State inspectors; within the next year or two it is expected that every county in the State will be served by local officials.

KENTUCKY

By Samuel F. Fox, *Chief Inspector of Weights and Measures, Louisville*

Mr. Fox stated that there is no State organization in Kentucky which exercises weights and measures supervision throughout the State. The city department in Louisville is well organized and active; having been in charge of this department but a few months, Mr. Fox said that he was not in a position to make a report covering the department's activities for the past year.

MAINE

By C. V. Fickett, *Sealer of Weights and Measures, Portland*

Mr. Fickett reported briefly on the work of his department during the year past, expressing the opinion that weights and measures conditions in Portland were good. He stated that during the year several prosecutions had been instituted, all resulting in convictions.

MARYLAND

By S. T. Griffith, *Chief, Division of Weights and Measures, Baltimore*

Mr. Griffith informed the conference that the Governor of Maryland was in sympathy with the establishment of a State department of weights and measures to carry on active supervision throughout the State, and that it was anticipated that the next legislature would take action to this end. Recently three additional counties have appointed inspectors, bringing the total to five; the Baltimore city department has assisted the new appointees in the matter of instruction and advice. There has been no new legislation during the year past.

MASSACHUSETTS

By Francis Meredith, *Director, State Division of Standards,* and James J. Sweeney, *President, Massachusetts Association of Sealers of Weights and Measures*

Speaking with reference to the activities of the State division, Mr. Meredith reported that during the past year the work has been largely of a routine nature, although the division has been unusually active. No new legislation was deemed essential, but the division supported the efforts of the retail bakers to have enacted a standard-weight bread law; this bill failed of enactment. Speaking for the local sealers of the State, Mr. Sweeney commended the personnel and accomplishments of the State division, and mentioned briefly some of the activities of the Boston department.

MICHIGAN

By Peter D. Dukesherer, *Director, State Bureau of Foods and Standards*

Mr. Dukesherer reported briefly to the effect that the work of weights and measures supervision in Michigan is progressing in a very satisfactory manner and that the best of cooperation prevails between the State bureau and the various city and county sealers of weights and measures.

MISSOURI

By Roy H. Monier, *State Warehouse Commissioner*

Mr. Monier stated that there is no department in his State charged with the duty of exercising general weights and measures supervision. The State Warehouse Commission inspects all grain scales at terminal points and supervises the weighing of grain and coal at such points. Difficulty is experienced when discrepancies exist between origin and destination weights, because the origin scales are not officially examined. Mr. Monier expressed the belief that general weights and measures supervision is of the greatest importance, and the desire to learn what other States are doing so that his own State may profit from that experience.

NEW HAMPSHIRE

By Harold A. Webster, *State Commissioner of Weights and Measures*

Mr. Webster reported an increase in the appropriations for the conduct of his department which will permit of more effective work being done. A new law applying to the sale of milk in the original container becomes effective this year. Considerable trouble has been experienced in regulating sizes of milk bottles, but the department has now ruled that the use of third-quart or other odd-sized milk bottles will not be permitted. The very great increase in the number of gasoline-dispensing devices and in the number of wayside stores has also given the department some concern.

NEW JERSEY

By J. Harry Foley, *State Superintendent of Weights and Measures*

In outlining the activities of the department during the past year, Mr. Foley mentioned particularly investigations on the weight of packages of tea and dried fruit, the enforcement of regulations relative to liquid measures, gasoline pumps, and wrapped bread, and the check-weighing of coal deliveries. He recommended that methods for checking deliveries of fuel oil be studied.

Comment was made upon the legislative program of the department, but one item of which was successful, namely, an amendment to the sale-by-weight law. The standard-weight bread bill will be reintroduced at the next legislative session.

NEW YORK

By Charles J. Reynolds, *Director, State Bureau of Weights and Measures*

Mr. Reynolds reported that weights and measures supervision in New York was proceeding along the same lines that had been followed in the past. He commented upon the organization of the State and local officials into an association, and extended an invitation for weights and measures officials outside the State to attend the next meeting to be held at Rochester.

NORTH CAROLINA

By O. P. Shell, *Chief State Inspector of Weights and Measures*

Mr. Shell described the efforts that have been made to perfect an organization under the weights and measures law passed in 1927. He stated that at the present time there are about 10 State inspectors in the field, active work having been started about February 1. Under the law fees must be collected for all tests, and the department must be financed from the fees collected. An effort will be made at the next session of the legislature to eliminate the fee system and place the department upon an appropriation basis.

OHIO

By M. A. Bridge, *Sealer of Weights and Measures, Columbus*

Mr. Bridge reported that weights and measures administration in Ohio is very well coordinated through the agency of three district associations of weights and measures officials which meet one day each month; a feature of these meetings is an afternoon session open to the public. The State department is now giving particular attention to the package law. New gasoline-pump installations are now being made in full compliance with regulations. It was recommended that the State law be amended to bring all sealers under civil service, and make provision for their attendance at district, State, and national weights and measures conferences.

OREGON

By SEYMOUR JONES, *State Market Agent*

Mr. Jones stated that for purposes of weights and measures supervision Oregon is divided into four districts with a deputy State sealer in each. The work is supported partly by State appropriations and partly by contributions from the counties according to population. Mr. Jones also outlined the grain weighing and inspection activities of the State, which are also under his supervision, whereby all grain which passes through Portland for domestic shipment or export is inspected, graded, and weighed under State supervision.

PENNSYLVANIA

By ALBERT B. SMITH, *Director, State Bureau of Standard Weights and Measures*

Mr. Smith described the policy of the bureau looking toward an increase in the efficiency of weights and measures supervision throughout Pennsylvania. He outlined the following legislative program which will be urged at the next session of the legislature: Bills to require the sale of bread by weight, to give the bureau supervision over person-weighing scales, to clarify the commodities act with respect to wrapped bread and pastries, to require the sale of certain commodities by weight only, and to provide appropriations for the purchase of equipment for the testing of large-capacity scales.

The CHAIRMAN. Before the luncheon recess I wish to say that of the several conferences over which I have presided I am sure there has been none in which the enthusiasm was so sustained as at this meeting. I anticipate that we will have throughout the week a most successful conference.

I regret that this afternoon I have to preside at another conference which was arranged some time ago, but I will be here to-morrow; I will ask Mr. Foley to preside at this afternoon's session.

(At this point, at 12.50 o'clock p. m., the conference took a recess until 2.20 o'clock p. m.)

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SECOND SESSION (AFTERNOON OF TUESDAY, MAY 22, 1928)

The conference reassembled at 2.20 o'clock p. m., J. Harry Foley, first vice president, in the chair.

ASBTRACTS OF STATE REPORTS—Continued

RHODE ISLAND

By Louis B. Jones, *Superintendent of Weights and Measures, Providence*

Mr. Jones reported that the Providence department was reorganized during 1927 with an increase in personnel and a consequent increase in the efficiency of the supervision exercised. The last legislature passed an act to prevent fraud by the substitution in a container of some other oil or gasoline than that specified thereon.

SOUTH CAROLINA

By J. W. Shealy, *State Commissioner of Agriculture*

Mr. Shealy reported that the weights and measures law of South Carolina is enforced by the State department of agriculture. He stated that at present there are but three inspectors, but that by June 1 seven more are to be added. The State is being divided into 10 districts and one inspector will be made responsible for each district. Much more efficient service can be rendered by this increased field force.

TENNESSEE

By V. A. Bradley, *State Superintendent of Weights and Measures*

Mr. Bradley reported that the work of the State division along weights and measures lines is hampered by a limited field force and the necessity that these men enforce not only the weights and measures law, but also the laws relative to food and drugs, sanitary inspection, and agricultural inspection. There has been no recent weights and measures legislation in the State, but at the coming session of the legislature some weights and measures bills may be introduced. Efforts have been made by distributors in the State to introduce the use of the third-quart milk bottle, but this has not been permitted.

TEXAS

By V. A. Stovall, *Chief State Inspector of Weights and Measures*

Mr. Stovall reported that after some difficulty an equipment for testing large-capacity scales has been secured; this consists of a truck equipped to handle four 500-pound weights. Mr. Stovall outlined

his last legislative program, which included bills providing for county sealers, and for the regulation of ice, coal, milk bottles, public weighing, sale of weighing and measuring devices, and marking of packages; all of these bills failed of passage. He also discussed a gasoline survey recently made in eight Texas cities.

VERMONT

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

Mr. Davis reported that the three men comprising the State department personnel are charged with carrying on supervision throughout the 246 towns of the State. The department has been unable to secure appropriations for increasing the force to a point where adequate supervision can be exercised. Convictions have been secured in a number of cases involving shortages of ice, coal, and butter. There has been no new legislation during the year.

VIRGINIA

By J. H. Meek, *Director, State Division of Markets*

Mr. Meek stated that the State department is concentrating upon a program of cooperation with the local sealers of the State with particular attention to the testing of large-capacity scales. Special attention has also been given to regulating the methods followed in the tobacco warehouses in the weighing of tobacco, and to standardizing the weight of the baskets used in this connection. Mr. Meek emphasized the need for uniformity of regulations, not alone among the local jurisdictions of a given State but also among the States themselves.

WEST VIRGINIA [5]

By Howard S. Jarrett, *State Commissioner of Weights and Measures*

Mr. Jarrett reported that much of the time of the State inspectors has been devoted to testing small scales and gasoline-measuring devices, the customary demand for the testing of coal-mine scales having been limited during the past year. The next legislature will be asked to provide for an increase in the number of State inspectors to care for increasing calls for tests. All dry measures have now been eliminated from the State, practically all sales of food necessities being on a weight basis.

ABSTRACTS OF REPORTS OF REPRESENTATIVES OF STATE ASSOCIATIONS OF WEIGHTS AND MEASURES OFFICIALS

INDIANA ASSOCIATION OF STATE, COUNTY, AND CITY INSPECTORS OF WEIGHTS AND MEASURES

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

Mr. Miller stated that the membership of the Indiana association is only about 30, but that very instructive and helpful meetings are held annually and are well attended. One day of the 1927 meeting

[5] This report was read to the conference by P. T. Sullivan.

was devoted to visits to the plants of the manufacturers of gasoline-measuring devices in Fort Wayne. This year's meeting of the association will be held at Anderson on June 13 to 15.

MAINE ASSOCIATION OF SEALERS OF WEIGHTS AND MEASURES

By C. V. Fickett, *Sealer of Weights and Measures, Portland*

Mr. Fickett reported that every sealer in Maine belongs to the association, but that owing to the difficulty of securing expense allowances the attendance at the meetings of the association falls far short of the 160 members. Meetings are held annually and every effort is made to have the programs of maximum assistance to those present.

MASSACHUSETTS ASSOCIATION OF SEALERS OF WEIGHTS AND MEASURES

By Hervey L. Antil, *Sealer of Weights and Measures, Holyoke*

Mr. Antil spoke particularly of the legislative program of the association before the present legislature. He stated that the association has actively supported a standard-weight bread bill sponsored by the Master Bakers Association of Boston; this bill was withdrawn. Action is still pending upon an amendment to the hawker and peddler act; this is being opposed by the association. Mention was made of another bill, upon which the association took no stand, providing that sealers of weights and measures test and seal all gas and electricity meters.

NEW JERSEY WEIGHTS AND MEASURES ASSOCIATION

By Joseph G. Rogers, *Assistant State Superintendent of Weights and Measures*

Mr. Rogers reported that all weights and measures officials of the State are members of the association, and that the annual meetings are very well attended. A general invitation was extended to attend the next meeting to be held at Atlantic City, September 5 to 8. Mr. Rogers spoke of the efforts of the association to secure the passage of a pension law for weights and measures officials which, though temporarily unsuccessful, will be continued; he recommended similar action to other associations.

NEW YORK ASSOCIATION OF SEALERS OF WEIGHTS AND MEASURES

By A. W. Corwin, *Sealer of Weights and Measures, Allegany County*

Mr. Corwin discussed the last meeting of the association held at Syracuse in 1927 which was attended by approximately 200, and extended an invitation to this year's meeting of the association to be held in Rochester, July 17 to 19. He mentioned the News Letter and the Bulletin issued by the association, and made some general comments upon the progress of weights and measures supervision in New York.

PRESENTATION OF GAVEL TO PRESIDING OFFICER

Mr. Ragland. I stated on the floor of this conference in 1925 that Virginia was the "Mother State of Presidents," and was also the "mother State of weights and measures laws"—the first weights

and measures law ever enacted in this new world was enacted in Richmond. We are also the "mother State of weights and measures officials." I am prepared to prove it. In 1623 Virginia passed the first weights and measures law; it was in part as follows:

* * * that there be no weights or measures used but such as shall be sealed by officials appointed for that purpose * * *.

That is the first that we have in the new world. It was passed by the general assembly of the house of burgesses. In 1665 Col. Lemuel Mason and Maj. Thomas Willoughby were appointed the first superintendents of weights and measures by the court of Lower Norfolk County.

Further than that I wish to state that Virginia also had the first prison. We had good behavior for a considerable time, but I find in reading Henley that this first prison was made out of logs hewn from the virgin forest and was called a calaboose. In 1796 the general assembly made appropriation for a prison, the corner stone of which was laid on August 12, 1797, and the building was completed four years afterwards at a cost of $30,000. This building was known as the Virginia State Penitentiary, and it has been said that when one was put in, the door was locked and the key thrown away. The design of this building was brought from France by Thomas Jefferson; it was horseshoe shape with dungeon cells under each corner.

The wood from which this gavel was made was taken from the floor of one of these dungeon cells in this building which was recently razed to make room for a new and more modern prison; the wood is certainly 128 years old, and it is in a wonderful state of preservation. I wish to present this gavel, Mr. Chairman, and I hope that it may be used in opening and governing this association, and that its voice will be obeyed by the members, for we endeavor to enforce the law with justice tempered with mercy.

In enforcing the weights and measures laws, which are not an excessive demand upon human conduct, it is our wish not to be overbearing, but to impose reasonable conditions and enforce them seriously and firmly, "slow, not fast—firm, not rigid."

Mr. Chairman, I present this gavel to you and through you to the National Bureau of Standards on behalf of the Virginia Weights and Measures Association. I hope it may be heard in a submissive manner by the members here.

The Acting Chairman. Mr. Ragland, on behalf of Doctor Burgess I gladly accept this gavel, and I am sure it will be properly preserved and used to good advantage.

BUREAU OF STANDARDS INVESTIGATION ON THE TRANSMISSION DRIVE FOR TAXIMETERS

By Ralph W. Smith, *Bureau of Standards*

The question of whether or not it is proper, from a weights and measures standpoint, for a taximeter in service to be actuated through a connection to the driving mechanism of the cab to which it is attached—that is, through a connection to the drive shaft or "transmission" of the cab—has been before this conference for several years. I believe it was first raised in 1925 by Mr. Austin, of Detroit, when he

mentioned that it was proposed in his city to use the transmission drive on a new fleet of taxicabs about to be placed in service. In 1926, in the discussion of the code of specifications and tolerances for taximeters prior to its final adoption by the conference, Mr. Holbrook, speaking for the conference committee on specifications and tolerances, of which he is chairman, said:

> In relation to the transmission drive, I might remark that these specifications do not forbid the transmission drive, and they do not specifically recognize the transmission drive; in other words, the specifications are silent on the subject as to how taximeters should be driven. Under these specifications the transmission drive might be adopted or the front-wheel drive might be adopted by the taximeter company. Of course, it is a fact that in a number of our larger cities ordinances are already in effect which specify how the taximeter shall be driven from the cab mechanism.

I might add that at that time, so far as I know, all such legal requirements as Mr. Holbrook mentioned were to the effect that taximeters should be driven from a front or nonpower wheel of the cab. Also, in this connection, I believe that I am correct in saying that the committee felt that it was without sufficient information at the time this report was made to warrant any recommendation either for or against the transmission drive for taximeters, and that this was the reason for Mr. Holbrook's explanation, quoted above, to the effect that this question was left open at that time.

It was also at the 1926 conference that Mr. Austin presented his paper on the "Transmission drive for taximeters," in which he reported satisfactory results from the operation of a considerable number of transmission-driven taximeters in Detroit during the preceding fall and winter months. At the same meeting recognition of the transmission drive was advocated by the representatives of several taximeter manufacturers who were present, who urged the advantages to the cab operators of this type of drive and expressed the opinion that the rights of the riding public would not be jeopardized thereby.

This matter was again brought up at the twentieth conference, held last year, when an opportunity was afforded for the presentation to the conference of any data which had been collected during the preceding year upon results from transmission-driven taximeters. Interesting reports supporting the transmission drive were made by representatives of two taximeter manufacturers, one of whom, J. W. Weibley, of the Pittsburgh Taximeter Co., specifically requested that the Bureau of Standards conduct an investigation into this entire question to determine, if possible, whether or not "the public interest suffers by a transmission drive for taximeters." The assistance of the manufacturers and the cooperation of cab operators were promised, and the bureau undertook to make the desired investigation and report its findings to this conference.

With this outline of the events and considerations leading up to our study of driving means for taximeters, I will proceed to a description of the equipment and methods made use of in our investigation, and will then present our results, with such conclusions as they appear to justify.

Having no precedents to guide us we were obliged to develop an original method. After careful consideration it was decided that the best procedure would be to compare directly the readings of dupli-

cate instruments actuated, respectively, from the front wheel and from the transmission of an automobile. In this way any differences of registration which might exist between the two instruments would be apparent, and knowing the relation between the registration of the front-wheel meter and the registration of the transmission meter for a given distance traveled under ideal operating conditions, it would be possible to determine for other operating conditions what proportion of the difference found to exist under ordinary or adverse operating conditions could be ascribed to the difference in the driving means.

Believing that normal taxicab operation differed somewhat from normal private-car operation it was also decided that observations upon instruments attached to taxicabs in regular service were essential. At the same time the impracticability of tying up a commercially owned taxicab while we were conducting extended experiments was at once apparent, so it appeared equally essential for a similar installation to be made upon one of our own cars, and mine was selected for this purpose. To distinguish subsequent references to my machine from references to the commercial taxicabs, I will speak of the former as the "Pontiac" in what follows. This arrangement for a private-car installation had the added advantage of providing for a series of observations to serve as a check or "control" for the observations on the taxicabs.

We also decided that the readings of the instruments should be made to the nearest tenth-mile on all long intervals observed and that in the preliminary tests to establish the initial relation between the two instruments, the registration should be determined to a precision corresponding to one wheel revolution.

We had in mind that in this study we wished particularly to secure data under adverse operating conditions; that is, with snow and ice on the streets, with wet streets, and so forth. It was thought that by beginning operations about October 1 we would have ample opportunity to get enough data under good operating conditions before winter conditions developed, and that thereafter we would secure sufficient data for our purpose under adverse conditions. In order to work out a definite routine for the preliminary tests and the collection of running data, so as to interfere as little as possible with the operation of the taxicabs when work should be started on them, it was decided that the first installation should be made on the Pontiac. Since in the case of the taxicab it was decided that it would be preferable to leave the front-wheel meter installation unchanged and install another complete taximeter connected to the transmission, taximeters were also used for the Pontiac installation instead of mileage recorders which were given consideration at first.

So that it may be clearly understood just how we expected to proceed with our observations, it seems advisable to interject at this point a brief outline of our plan which was worked out in its final details only after several conferences with the taximeter representatives and considerable experimental work carried on with their cooperation. We proposed to make the installations as already stated, and then carefully adjust the meters so that they would be as nearly correct in their registrations as practicable when the machine to which they were attached was operated on a straight course. Realiz-

ing that absolute accuracy would be out of the question, the next step was to be the determination of as accurate a figure as could be arrived at to represent the discrepancy remaining after adjustment, between the registrations of the two meters. The relation thus established would then be utilized in analyzing the results obtained by reading the meters at intervals thereafter during the course of regular operation of the vehicles. The " total miles " register of the meter was selected as the element to be relied upon for our readings, some of the considerations governing this selection being sensitivity, continuous operation during vehicle travel, freedom from interference as a result of meter-flag operation, etc. It was realized that such factors as vehicle loading, size and inflation of tires, etc., would affect the results, and it was decided in so far as possible to standardize these elements and to make corrections, based upon later special studies, for variable factors not susceptible of standardization.

This general program sounds fairly simple, but when we began our efforts to put it into effect we found it not so simple after all. Taking the first steps to this end about October 1, it was well along in December before the Pontiac installations were finally put into the desired condition and the preliminary tests completed. The first period of the Pontiac " running " observations began on December 22. This delay was due to a combination of causes, chief of which, perhaps, was the fact that we were more or less " feeling our way " for a time; then there were mechanical adjustments to be made, a number of subordinate studies were carried out on loading, tire inflation, etc., interruptions were caused by other necessary duties, and, lastly, it was necessary to await the completion of the survey of a testing course before final meter adjustments could be made. During this period, as, indeed, throughout the entire investigation, R. L. King, the Washington representative of the Pittsburgh Taximeter Co., gave us his closest cooperation and assistance, and it was through his extensive practical knowledge of taximeter operation that many troublesome problems were solved.

The testing course just referred to deserves, I believe, some special comment. We desired to have laid out a straight 5-mile course for our use in this investigation. This matter was taken up with the Commissioners of the District of Columbia, who agreed to have their highway department survey this course according to our suggestions. The zero of the course is at the north side of Scott Circle and the course, as completed, extends north from that point in a straight line for 5 miles. The first 2 miles are subdivided into fifth, quarter, and third mile intervals, and the last 3 miles are not subdivided, only the full mile points being marked; each of the points mentioned is designated by a circular bronze marker, identifying the interval from zero, these markers being anchored in the curb or in special stone monuments. There is a total of 24 of these markers. The reason for the subdivisions of the first 2 miles of the course, which we have not used in our work, was to provide an accurate means for the routine testing of taximeters by the taximeter companies and for future official use by the District government.

After the Pontiac was in final shape, work was started in equipping a commercial taxicab with two Pittsburgh taximeters, and this was completed, the preliminary tests made, and the cab released for

regular running on January 25. This cab will hereafter be referred to as "Cab No. 1." On March 17 another cab, which will be referred to hereafter as "Cab No. 2," was released for regular running, having been equipped with two mileage recorders in addition to its taximeter. These instruments were furnished and the installations made by the Ohmer Fare Register Co., whose local representatives assisted us in carrying out the preliminary adjustments and tests of the recorders. In the case of this cab we confined our observations to the duplicate recorders, one of which was connected to the cable which drives the taximeter and the other to a cable driven from the transmission; this type of installation was preferred by the manufacturer to the duplicate taximeter type.

Necessarily, in this investigation, we met one condition which we could not control, and that was the weather. We ardently hoped for bad conditions—snow, ice, and slush—which ordinarily we would be glad enough to avoid. But notwithstanding our desires, our share of snow in Washington last winter was very small, and what little we had lasted but a short time. To help compensate for this, the cooperation of J. A. Sweeney, city sealer of Boston, was enlisted, and he agreed to conduct the tests and make the necessary observations in connection with a taxicab installation in Boston similar to cab No. 1 in Washington, which installation the Pittsburgh Taximeter Co. also very generously made. The Boston cab will be referred to hereafter as "Cab No. 3"; it was released for regular running on March 9, and has seen some operation since then under bad road conditions.

With an outline of the actual sequence of operations comprising our testing technic, the description of our methods will be concluded. The cab is first seen to be provided with a good set of tires throughout, so that interruptions of the observations due to tire trouble may be minimized. A standard inflation pressure for the tires is decided upon, and drivers are instructed that this pressure is to be carefully maintained. Duplicate instruments, either taximeters or mileage recorders, having been installed so that binds are absent and all parts are working freely, the cab is now operated over the measured course. If the results of the first few runs indicate that a nearer approach to zero error may be brought about in the case of either instrument by a change of gears, such change is made at once. When it is indicated that no further improvement can be made in this way, the operation over the course is resumed for the purpose of establishing the relation which exists between the registrations of the two instruments when the cab traverses a given distance in a straight line. This relation is to be the basis for interpreting later results, secured on special studies or on regular running, and it is of importance that it be established with the greatest practicable precision.

In making these observations the cab is first spotted at the zero or other known point on the course.[6] The front wheel, which actuates the front-wheel instrument, is then jacked up and rotated as in forward cab motion, the wheel being stopped just as the next tenth

[6] In the observations made to determine the relation between the registrations of the two instruments it is not necessary that the distance traversed by the cab be known; however, the course being available, it is desirable to make these runs in even-mile multiples, preferably of the same length, so as to facilitate making the observations and simplify comparisons.

mile is turned up on the "total miles" register to which it is connected. This wheel is then rotated as before until the next tenth mile is registered, but with this difference, that the revolutions are now counted and the number of revolutions required to cause the change of a full tenth mile in the registration is recorded on the data sheet. This operation is repeated until a record has been made of the number of revolutions corresponding to each of 10 successive tenth-mile intervals.

The front wheel is then lowered and one of the rear wheels is jacked up, rotated as in forward cab motion, and stopped just as the transmission instrument records the next tenth mile on the "total miles" register. The number of revolutions corresponding to each of 10 successive tenth-mile intervals is then determined as explained above for the front wheel. This wheel is then lowered, and the cab is ready to be driven over the course for the first test run.

At the end of the test run the front and rear wheels are successively jacked up, rotated as in forward cab motion, and the number of revolutions required to cause the registration of the next tenth mile on their respective instruments is determined and recorded in each case, together with the new readings of the instruments. Now, by utilizing the information previously gathered relative to the number of wheel revolutions corresponding to one-tenth mile on the register, it is possible to evaluate the counted wheel revolutions at the conclusion of the test run in terms of mileage registration, and correct the final readings of the two instruments to correspond with their actual registration (as distinct from their apparent registration) at the time the cab stopped moving. Thus, instead of securing a result which might be in error by any amount up to a tenth mile, we are able to compute the registration of the meters to an accuracy of approximately two one-thousandths of a mile.

It should be mentioned here that the reason for counting and recording the number of wheel revolutions equivalent to 10 successive tenth miles, as previously described, instead of making a single count of the revolutions equivalent to one-tenth mile or to a full mile, is to learn whether or not the several tenth-mile intervals are the same with respect to wheel revolutions. If the counts for these fractional intervals are in substantial agreement, one-tenth of their sum is taken as the value in wheel revolutions corresponding to one-tenth mile of registration. However, if the counts for these intervals are not in agreement, corrections are applied in our computations to the observed number of revolutions for the particular tenth-mile intervals involved in the test runs, the corrections being made upon the assumption that the registration by the meters of 1-mile intervals will be consistent.

Having completed our first test run, as explained above, this is now repeated several times or until it is apparent that consistent results are being obtained. At the beginning of each run the registers of both instruments are set on even tenths, and at the end of each run the wheel revolutions necessary to produce the next tenth-mile indications are determined.

Up to this point the cab has been operated with the driver alone. Now several more runs are made, these being identical with the others except that two passengers are carried in the rear seat. We do this

in order to determine the difference in registration caused by the passenger load. We have been advised that the average number of passengers per trip carried by taxicabs is 1.7, this figure having been arrived at from records extending over considerable periods; also that on the average the live mileage of a taxicab—that is, the mileage over which paying passengers are carried—is approximately one-half of the total mileage traveled by the cab. On the basis of the foregoing information, an approximate correction factor for total mileage registration can be arrived at, to be used to compensate for the known effect of loading when analyzing the running data to be gathered later. This will be discussed in greater detail below, and data resulting from a special study of rear-seat loading on the Pontiac will be presented.

If the results of the preliminary tests outlined above are satisfactory, the cab is released for regular running, and thereafter observations are made from time to time on the readings of the two instruments. It is not infrequently impossible to locate a taxicab in service just when one wants to record a set of readings, and as a result there have been times when the desired readings could not be secured. However, our intention has been to make readings on the cabs under observation at least once a week, so long as the operating conditions remain uniform. In the case of a rain or snow, an effort was made to secure readings at the beginning and at the end of the rainy or snowy period so as to segregate the results produced under these conditions and avoid having them masked by being included in the results for a long period, during most of which, perhaps, good conditions prevailed. Readings on the taxicabs during regular running are made to tenth miles only; that is, we merely recorded the readings of the total-miles registers at the time the observation was made and did not jack up the wheels and count wheel revolutions to the next tenth mile as was done in the standardization tests. This is a satisfactory method, because on the relatively long distances traveled between observations on regular running, which have ranged from 101 to 975 miles, the error which is introduced by a fraction of a tenth mile is negligible, and the loss of time and the inconvenience to the cab operator which would follow if this error were to be eliminated are not considered justified.

On the Pontiac, however, all readings have been made to the nearest wheel revolution. Here we have inconvenienced no one but ourselves, and since in many of the special studies, made on travel over small distances, it was considered necessary to read as closely as practicable, this method was adopted as standard practice for all Pontiac readings.

At this point I wish to make plain to you our method of reporting our results in what follows. Having secured certain data, these are first computed to several decimal places; when these values are reported, however, we round off the figures to a lesser number of decimal places. In general, mileage readings are reported to thousandths of a mile and percentages to tenths; occasionally percentages are reported to hundredths in special cases or to avoid a zero value. It should be remembered in interpreting these results that in general they are based upon determinations in which several factors are necessarily involved, which factors cause some degree of uncertainty.

In our opinion, instrumental errors, errors resulting from very slight imperfections in installation, errors resulting from imperceptible or unavoidable deviations from a straight course during cab travel, and errors caused by other conditions not susceptible of control may frequently aggregate one or two tenths of 1 per cent, which is equivalent to about 5 or 10 feet per mile, and at times this error may be still greater. Nevertheless, following the accepted practice in such cases as this, our results will be reported as stated, with the understanding that the degree of uncertainty mentioned must be borne in mind in deciding from our results what effect follows from a given cause.

Another respect in which the Pontiac readings differ from those on the taxicabs is that I have made it a rule to throw both meter flags whenever I have carried passengers in the rear seat, in order to have a definite record of this condition; the distance traveled with rear-seat passengers has thus been registered on the meters as "live" mileage. We found that an extra front-seat passenger has no effect on the registration of either meter, so no record of these has been kept. In my efforts to keep from introducing conditions which would complicate analysis of our results I have tried, in so far as practicable, to eliminate back-seat passengers, but this has been unavoidable at times.

Proceeding now to the consideration of our results, I think it will be advisable to present first the results on some of the special studies incidental to the main investigation. Except where otherwise noted, these results were secured on the Pontiac.

To demonstrate the effect of a change of inflation pressure upon the effective rolling circumference of a tire a series of measurements was made with different tire pressures. The tires in question are balloon type, 29 by 4.75 inches in size, and at the time of these measurements had been run approximately 6,000 miles. Some determinations were made by measuring actual rolling circumference, while others were made by comparing meter readings. Thirty-five pounds having been adopted as the standard inflation pressure for these tires, it was found that, as compared with meter registration at standard pressure, a decrease of 5 pounds in the pressure (to 30 pounds) would increase meter registration by about 0.35 per cent; an increase of 5 pounds in the pressure (to 40 pounds) would decrease meter registration by about 0.45 per cent; and an increase of 10 pounds in the pressure (to 45 pounds) would decrease meter registration by about 0.75 per cent. The percentage difference caused by a given change in inflation pressure would, of course, depend to some extent upon the make and condition of the tire and the pressure range in which observations were made; it is also to be expected that high-pressure tires would have characteristics differing somewhat from balloon tires. These figures are of value, however, in emphasizing the necessity for close attention to tire pressure on public vehicles equipped with taximeters.

The effect of chains on the rolling circumference of a tire was found to be different from what might at first be anticipated. Measurements of rolling circumference made with a set of rather worn chains in place indicated that with the car moving very slowly the effective circumference was reduced about 0.3 per cent as compared with bare

tires. A comparison of meter readings under the two conditions with the car being operated at about 20 miles per hour indicated a difference in the same direction of about 0.2 per cent. It was learned by accident that under exceptional conditions it is possible actually to spin a tire inside a chain; it may be that in normal operation there is a fairly constant slippage between the tire and the cross links of the chain and that this accounts for the difference found between the effective circumferences of the same tire with and without chains attached.

As to the effect of passenger load on the Pontiac meters our results indicated a negligible difference in the readings of the front-wheel meter for any number of passengers up to four, exclusive of the driver, as compared with readings for driver alone. No observations were made on larger passenger loads. The readings of the transmission meter showed no change, as compared with driver alone, with 1 passenger in the front seat, but with 1, 2, and 3 passengers, respectively, in the rear seat the registration was increased by about 0.2, 0.5, and 0.8 per cent with a 35-pound tire pressure; with a 45-pound tire pressure the increase with 3 passangers in the rear was 0.7 per cent. On cab No. 1, having balloon tires inflated to 45 pounds pressure, the transmission-meter readings were increased due to a 2-passenger load, the difference in the relations between the two meters with and without passengers being 0.4 per cent; on cab No. 2, having high-pressure cords on both rear wheels with an inflation pressure of 60 pounds, the 2-passenger load likewise caused a change in these relations of 0.4 per cent.

It was suggested to us by a representative of one of the taximeter manufacturers that the registration of taximeters might be affected by frequent stopping of the cab, so we endeavored to determine whether or not this might be the case. At that time our testing course on Sixteenth Street was not finished, so a course beginning on Connecticut Avenue at the bureau grounds and extending about 6 miles north was chosen for the test; for convenience of reference this was designated as the "Kensington" course. This course had numerous right and left bends and road conditions made it necessary when traveling in one direction to make two 90° turns, one left and one right. Accordingly, the results on the "out," or north, runs were kept separate from the "in," or south, runs. With definite starting and ending points, and by exercising care in driving to avoid any unnecessary deviations from the route adopted, we felt that the several north runs represented very closely the same traveled distance, and that the same was true of the south runs. On the runs made "with stops" the car was brought to a complete stop every fifth mile throughout the runs. A comparison of similar runs made with and without stops indicated that when stops were made the transmission meter registered about 0.1 per cent less than on a continuous run. As indicated earlier, we consider this difference too small to warrant the conclusion that the observed effect may truly be ascribed to the difference in operating conditions.

In connection with observations made on the Sixteenth Street testing course an analysis of the results on the standardization tests made upon the Pontiac and cabs Nos. 1 and 2 revealed that there was a consistent difference between the registrations of the transmission

instruments on north and south runs. These standardization tests will be reported upon in detail later, but the condition in question is emphasized in the grouping of a part of the results in Table 1, below.

TABLE 1.—*Relation between front-wheel and transmission instruments as determined on north and south runs on Sixteenth Street testing course*

Machine	Registration of front-wheel instrument as compared with transmission instrument		Machine	Registration of front-wheel instrument as compared with transmission instrument	
	North runs	South runs		North runs	South runs
	Per cent	*Per cent*		*Per cent*	*Per cent*
Pontiac	+0.2	+0.4	Cab No. 1	−1.6	−1.4
Do	+.2	+.5	Do.[1]	−2.0	−1.8
Do	+.2		Cab No. 2	−.2	+.3
Do	+.1	+.2	Do	−.1	+.4
Do	+.1	+.3	Do.[1]	−.6	−.1
Do	+.1	+.4	Do.[1]	−.5	−.1

[1] Two passengers in rear.

It will be observed that on check runs for a particular machine under the same conditions, the agreement of the computed relations is very good, differences in but one series exceeding 0.1 per cent. Results secured on north and south runs, however, are consistently different, the registration on the transmission instrument being relatively less on south than on north runs. There are some grades on the Sixteenth Street course, and we believed the differences noted to be caused by these grades. Accordingly a special series of tests was recently made with the Pontiac, in which approximately 75 per cent of the distance traveled on each run was on a steep grade. The results follow:

TABLE 2.—*Relation between Pontiac meters as determined by tests made on steep grade*

Average speed (miles per hour)	Relation between instruments—front wheel as compared with transmission	
	Up grade	Down grade
	Per cent	*Per cent*
17	−0.8	+1.6
17	−1.2	+2.7
9	+1.1	+1.6
9	−.8	+3.2

The distance traveled on each of these runs was short—approximately 950 feet—and a difference of one counted wheel revolution at the beginning or conclusion of a run would introduce a greater error than on longer runs; in these observations this difference would be equivalent to approximately 0.8 per cent in the foregoing table.

Accordingly, a longer course was selected where we would have some pronounced grades and where we could drive more rapidly than is practicable within city limits; the results reported in Table 2 indicated that car speed might be a factor in the registration on hills, and we wished to exaggerate this factor. The course selected was on a paved road in the country where there were few curves but a considerable number of hills, with the elevation increasing as we traveled north; it was approximately 5.5 miles long. The results follow:

TABLE 3.—*Relation between Pontiac meters as determined by tests on hilly course at different speeds*

Average speed (miles per hour)	Relation between instruments—front-wheel as compared with transmission	
	North runs	South runs
	Per cent	*Per cent*
22	−0.1	+0.04
40	−.6	−.4

The results in these two tables point definitely to the conclusion that the registration of the transmission meter tends to increase on an upgrade; and, if we disregard the last group of results in Table 2, which for no apparent reason are out of line, on a given upgrade a further increase follows an increase in car speed.

On the runs reported upon in Tables 2 and 3 the registration of the front-wheel meter for corresponding runs showed good agreement.

On this same course a substantially level stretch a little over a mile in length was selected and a north and a south run were made. The meter relations computed from these results are, respectively, −0.5 and +0.1 per cent. On the north run the speed of approximately 40 miles per hour was somewhat higher than on the south run, and during the latter it was necessary to slow down several times because of other traffic on the road. Here again, overregistration on the transmission meter is indicated as a result of increased car speed, this time on a practically level course. It appears that this overregistration under discussion is probably due to a slight, but measurable, creep or slip of the tires under the increased torque or thrust incident to hill climbing and higher rates of travel, even on dry roads or streets. Comparative data were not secured on wet streets.

While awaiting the completion of the taximeter-testing course on Sixteenth Street we secured some data which are of value but which in their detailed form must be considered separate from later results because of a subsequent change in meter gears, made to bring actual meter errors closer to zero. These preliminary results are presented in Table 4, which follows. The runs made under dry conditions with and without stops, which have been previously discussed, are included in this tabulation.

In Table 5, which follows, are given in detail the results of the standardization tests on the Sixteenth Street testing course which were made on the Pontiac after final meter adjustment, and the results on similar tests made as a check just recently at the conclusion of our observations. The same tires were in the same positions at the end as at the beginning of our observations. There were occasional interruptions during the winter and spring due to punctures, but tires were always replaced in their original positions after repair, and if any considerable amount of running took place with the spare tire on a wheel readings for that interval have been excluded from our results. The percentages appearing in parentheses in connection with figures for meter registration in this table represent the errors on the several tests based upon the distances actually traveled on the course.

In Table 6 appear the results of observations upon regular operation of the Pontiac. In Tables 7 to 12, inclusive, are given the results of the standardization tests and of observations upon regular operation of cabs Nos. 1, 2, and 3. Following the tables brief analyses of the results are given in all cases where special comment seems advisable.

In the following tables the mean values are not weighted; that is, corrections have not been made to compensate for the differences in the distances traveled for the several observations. The mean values reported for bad road conditions are based on results secured under bad and partly bad road conditions.

TABLE 4.—*Preliminary data—Pontiac before final meter adjustment*

Character of running	Road condition	Meter registration		Registration of front-wheel meter as compared with transmission meter	
		Front-wheel	Transmission	Miles	Per cent
		Miles	*Miles*		
Test run, Kensington course [1]	Dry	6.112	6.048	+0.064	+1.1
Do.[1]	do	6.137	6.069	+.068	+1.1
Do.[2]	do	6.117	6.044	+.073	+1.2
Do.[2]	do	6.143	6.069	+.074	+1.2
Do.[1]	Medium wet	6.117	6.054	+.063	+1.0
Do.[1]	do	6.136	6.064	+.072	+1.2
Do.[1]	Snow, wet	6.127	6.061	+.066	+1.1
Do.[1]	do	6.137	6.080	+.057	+.9
Regular operation [3]	Snow, slush, wet	22.846	22.813	+.033	+.1
Do	Part wet	185.779	184.544	+1.235	+.7
Do	Dry	178.665	177.337	+1.328	+.7

[1] Without stops.
[2] With stops every one-fifth mile.
[3] There was considerable rear-wheel spinning due to efforts to negotiate a bad hill in the snow.

With one exception the foregoing results indicate that, as between good and bad road conditions, there is but little change in the relation between the registrations of the two meters, either on test runs or regular running. The exception noted is the ninth observation; here a difference is to be expected, due to the known spinning of the rear wheels in an effort to climb a grade through deep snow.

TABLE 5.—*Standardization tests, Pontiac, Sixteenth Street course*

Date	Distance traveled	Meter registration		Registration of front-wheel meter as compared with transmission meter	
		Front wheel	Transmission	Mile	Per cent
	Miles	*Miles*	*Miles*		
Dec. 19, 1927	4	4.015 [1] (+0.4)	4.006 (+0.2)	+0.009	+0.2
Dec. 20, 1927	[2] 5	5.007 (+0.3)	4.985 (−0.1)	+.022	+.4
Do	5	5.020 (+0.4)	5.010 (+0.2)	+.010	+.2
Do	5	5.021 (+0.4)	4.996 (−0.1)	+.025	+.5
Dec. 21, 1927	5	5.017 (+0.3)	5.004 (+0.1)	+.013	+.2
May 5, 1928	5	5.021 (+0.4)	5.018 (+0.4)	+.003	+.1
Do	5	5.022 (+0.4)	5.011 (+0.2)	+.011	+.2
Do	5	5.018 (+0.4)	5.013 (+0.3)	+.005	+.1
Do	5	5.018 (+0.4)	5.001 (+0.02)	+.017	+.3
Do	5	5.018 (+0.4)	5.013 (+0.3)	+.005	+.1
Do	5	5.017 (+0.3)	4.998 (−0.04)	+.019	+.4
Mean value					+.

[1] Figures in parentheses represent percentage errors.
[2] Less 50 feet.

The foregoing results indicate a very satisfactory degree of consistency. The small differences in the relation between the two meters on north and south runs have been previously discussed. (See pp. 29 and 30.)

TABLE 6.—*Regular operation, Pontiac*

Road conditions	Back-seat passengers for—		Meter registration		Registration of front-wheel meter as compared with transmission meter	
	Miles	Per cent of travel	Front wheel (miles)	Transmission (miles)	Mile	Per cent
Part wet	17	4.3	396.793	395.961	+0.832	+0.2
Dry	12	4.8	250.079	249.416	+.663	+.3
Part snow [1]	40	34.5	115.780	116.359	−.579	−.5
Snow—wet [2]	3	4.8	62.580	62.563	+.017	+.03
Dry	1	.7	133.654	133.252	+.402	+.3
Do	17	8.5	199.770	199.397	+.373	+.2
Do	18	11.2	159.547	159.090	+.457	+.3
Do	0	0	97.761	97.643	+.118	+.1
Wet	0	0	32.867	32.865	+.002	+.01
Part wet	8	3.4	233.842	233.564	+.278	+.1
Dry	15	6.7	224.471	224.203	+.268	+.1
Mean value, good road conditions						+0.22
Mean value, bad road conditions						−.03
Mean value, bad road conditions, with the third observation omitted						+.08

[1] Chains on for 2 days; some spinning of rear wheels.
[2] Chains on.
Last reading on May 3, 1928.

The elimination of the third observation from the computation of mean values in the foregoing table appears justified because of the known spinning of the rear wheels in a prolonged effort to climb a grade covered with snow, and because of the relatively large percentage of the distance included in the observation during which rear-seat passengers were carried.

In other observations it is believed that the effect of the passenger load may be neglected since rear-seat passengers were carried only a relatively small proportion of the total distance in each case.

The difference between mean results under good and bad road conditions is approximately 0.1 per cent. Considering the fourth and ninth observations, which include no running under good conditions, the difference due to bad road conditions amounts only to 0.2 per cent.

TABLE 7.—*Standardization tests, cab No. 1, Sixteenth Street course*

Date	Distance traveled	Meter registration		Registration of front-wheel meter as compared with transmission meter	
		Front wheel	Transmission	Mile	Per cent
	Miles	*Miles*	*Miles*		
Jan. 23, 1928	3	2.946	2.992	−0.046	−1.6
	3	2.946	2.989	−.043	−1.4
	[1] 3	2.949	3.010	−.061	−2.0
	[1, 2] 3	2.954	3.009	−.055	−1.8
Mean value, driver alone					−1.5
Mean value, 2 passengers					−1.9
Mean value corrected for 1.7 passengers 50 per cent of total travel					−1.7

[1] 2 passengers in rear seat.
[2] Plus 50 feet.

TABLE 8.—*Regular operation, cab No. 1*

Road conditions	Meter registration		Registration of front-wheel meter as compared with transmission meter	
	Front wheel	Transmission	Miles	Per cent
	Miles	*Miles*		
Dry	201.9	205.2	−3.3	−1.6
Part snow [1]	571.3	579.4	−8.1	−1.4
Snow and wet [2]	214.5	215.9	−1.4	−.6
Wet [2]	101.4	101.9	−.5	−.5
Mean value, bad road conditions				−.8

[1] Chains on two days out of five. Driver reported large amount of spinning on one occasion before chains were on.
[2] Chains on.
Cab removed from service to be rebuilt. Last readings made on Feb. 3, 1928.

The results on the second, third, and fourth observations in the foregoing table are not consistent with what was expected under the circumstances; with bad road conditions the registration of the transmission meter appears as less than under good road conditions. An effort was made to keep the tires on this cab properly inflated, and no accidents or abnormal conditions which might affect the registration of either meter were reported to us. It will be noted that chains were used during much of the travel under bad road conditions, but upon the basis of the observations made upon the Pontiac, which have been reported earlier, this should exaggerate rather than diminish the overregistration on the transmission meter; a difference exists, however, in that the rear tires on cab No. 1 were high-pressure cords whereas those on the Pontiac were balloons, but it is believed that the general effect of chains would be the same, although we have no experimental data to this effect.

The passenger load should also cause an increase in the registration of the transmission meter. Based on the assumption of a 1.7 passenger load 50 per cent of the time, and upon the passenger results reported in Table 7, this increase, as compared with standardization results with driver alone, would approximate 0.2 per cent; in other words, if the meters maintained in regular running the relation found to exist on the standardization tests, we would expect values of −1.7 per cent as the relation between the two instruments.

Without explaining the reasons therefor, it can only be said that the results in the preceding table do not show an increase of transmission-meter registration under any condition of regular running, as compared with the standardization tests.

TABLE 9.—*Standardization tests, cab No. 2, Sixteenth Street course*

Date	Distance traveled	Recorder registration		Registration of front-wheel recorder as compared with transmission recorder.	
		Front wheel	Transmission	Mile	Per cent
	Miles	*Miles*	*Miles*		
Mar. 17, 1928	3	3.043	3.049	−0.006	−0.2
	[1] 3	3.027	3.019	+.008	+.3
	3	3.043	3.046	−.003	−.1
	3	3.044	3.033	+.011	+.4
	[2] 3	3.043	3.060	−.017	−.6
	[2] 3	3.042	3.046	−.004	−.1
	[2] 3	3.041	3.056	−.015	−.5
	[2] 3	3.042	3.045	−.003	−.1
Mean value, driver alone					+0.1
Mean value, 2 passengers					− .3
Mean value corrected for 1.7 passengers 50 per cent of total travel					− .1

[1] Less 75 feet.
[2] 2 passengers in rear seat.

TABLE 10.—*Regular operation, cab No. 2*

Road conditions	Recorder registration		Registration of front-wheel recorder as compared with transmission recorder	
	Front wheel	Transmission	Miles	Per cent
	Miles	*Miles*		
Dry	645.2	638.7	+6.5	+1.0
Do	975.2	967.6	+7.6	+.8
Part wet	453.0	451.7	+1.3	+.3
Do	488.0	487.7	+.3	+.1
Wet	283.8	280.1	+3.7	+1.3
Part wet	377.3	370.9	+6.4	+1.7
Dry	598.0	591.1	+6.9	+1.2
Mean value, good road conditions				+.9
Mean value, bad road conditions				+.9

Last reading on May 5, 1928.

The same correction for passenger load applies in the case of cab No. 2 as in the case of cab No. 1; that is, 0.2 per cent. In other words, if the recorders on cab No. 2 maintained in regular running the relation found to exist on the standardization tests, we would expect values of −0.1 per cent as the relation between the two instruments.

The first four observations of Table 10 are consistent among themselves; the first two show a mean value of +0.9 per cent under good road conditions, and the next two a mean value of +0.2 per cent under bad road conditions, the difference being explainable on the ground of increased transmission registration in the second case. However, all of these values indicate a lower transmission registration than was found on the standardization tests.

Considering the last three results in the table, a still lower transmission registration is indicated. As in the case of cab No. 1, the running results on cab No. 2 do not show an increase of transmission registration under any condition of regular running, as compared with the standardization tests.

TABLE 11.—*Standardization tests, cab No. 3, Boston course*

Date	Distance traveled	Meter registration		Registration of front-wheel meter as compared with transmission meter	
		Front wheel	Transmission	Mile	Per cent
	Mile	*Mile*	*Mile*		
Mar. 9, 1928	1	0.993	0.974	+0.019	+2.0
	1	.991	.974	+.017	+1.7
	1	.990	.974	+.016	+1.7
Mar. 26, 1928	1	.994	.974	+.020	+2.1
Mean value, driver alone					+1.9

TABLE 12.—*Regular operation, cab No. 3, Boston*

Road conditions	Meter registration		Registration of front-wheel meter as compared with transmission meter	
	Front wheel	Transmission	Miles	Per cent
	Miles	*Miles*		
Snow, slush [1]	123.0	122.4	+0.6	+0.5
Wet [2]	106.8	107.4	−.6	−.5
Part wet [3]	234.8	229.7	+5.1	+2.2
Dry	161.5	163.9	−2.4	−1.5
Wet [1]	276.3	271.5	+4.8	+1.8
Dry	130.7	128.3	+2.4	+1.9
Do	174.3	171.9	+2.4	+1.4
Wet [1]	446.1	438.9	+7.2	+1.6
Dry	287.2	292.6	−5.4	−1.8
Mean value, good road conditions				.0
Mean value, bad road conditions				+1.1

[1] Chains on.
[2] Chains on four days out of five.
[3] Chains on one day out of four.

Last reading on Apr. 30, 1928.

Assuming the same passenger-load correction as for cabs Nos. 1 and 2, we arrive at a value of +1.7 per cent as the anticipated figure if both meters maintain in regular running the relation determined on the standardization tests.

In the foregoing table the fourth, sixth, seventh, and last observations represent operation under good road conditions; the fourth and last indicate a relatively large increase on transmission registration, while the sixth and seventh agree reasonably with the anticipated value of +1.7 per cent cited in the preceding paragraph. Con-

sidering results on operation under bad road conditions, the first and second observations show an increase in transmission registration of the character which might be expected under these conditions; however, the third observation shows a decrease in transmission registration, and the fifth and eighth observations are in practical agreement with the theoretical value for good conditions. The mean value for bad conditions indicates a lower transmission registration than does the mean value for good conditions. No explanation can be offered for these inconsistencies.

Upon the basis of the running results on cabs Nos. 1, 2, and 3, as compared with those on the Pontiac, it would appear that taxicab operation differs in one or more essential respects from private-car operation, and that contrary to expectation, this difference tends to result on the taxicab in greater relative registration of the front-wheel-driven taximeter in comparison with the transmission-driven taximeter installed on the same cab, whereas on the private car the opposite condition prevails. Perhaps on the taxicab in regular operation overregistration occurs on the front-wheel meter; perhaps it is underregistration on the transmission meter; perhaps the condition noted results from a combination of these causes. In our investigation we have not been able to make observations under the most adverse operating conditions. Also, it is freely admitted by all that under certain abnormal conditions it would be possible to produce decided overregistration on a transmission-driven taximeter through the agency of spinning rear wheels. But in any event our results do not indicate that on normal regular operation excessive overregistration is to be anticipated as a result of the transmission drive.

It is of importance to remember in this connection that the length of time is relatively short during which very bad street conditions prevail in our cities where taxicabs are used. I have even heard it said in all seriousness that in very bad weather the taxicab passenger should be entirely willing to pay any reasonable amount, over the normal fare, which might be registered by the meter as a result of the abnormal weather conditions, for the convenience of securing the desired transportation under those conditions. I do not subscribe to this rather extreme view, and believe that in all cases the driver should refrain from throwing his meter flag until the cab is away from the curb and on its way; if a careless driver parks in a snow-drift unnecessarily, I do not think that the passenger should be charged for getting him out.

Relative to other factors studied in this investigation it may be added that with the general use of balloon tires, chains are used very much less than formerly; very high speeds are rarely realized in taxicab operation; average passenger-load effects may be compensated for satisfactorily by conducting the road tests of meters with a suitable load in the passenger compartment of the cab; and as to proper and uniform tire inflation, this is of great importance whichever method of drive is used.

Moreover, in our opinion, the weights and measures official, in considering this question of the suitability of the transmission drive for taximeters, should give consideration not alone to the element of the mileage registration of a taximeter so actuated, but also to other factors which may be introduced by the proposed method of drive.

In this connection I am impressed especially by the claims advanced for the transmission drive to the effect that by its use unauthorized mechanical changes in the meter connections on the part of a dishonest driver or operator are greatly impeded, that the greater difficulty of access in itself will discourage many who otherwise might be inclined to attempt manipulation, and that the parts may be entirely inclosed and sealed in place so that should they be deranged the broken or mutilated seal will reveal this fact upon subsequent inspection. If these claims are well founded—and I believe that they are—they constitute a strong argument for the adoption of the transmission drive as conducive to a greater degree of protection to the riding public primarily, and in the second place to the reputable operator, either company or individual.

Another advantage claimed for the transmission drive is the reduction in costs for servicing cabs in operation, through the comparative freedom from cable breakages and the elimination of replacements of broken ring gears and worn-out star gears; since such repairs necessitate removal of the cab from revenue-producing operation for varying periods, a corollary advantage claimed is that cabs equipped with transmission-driven taximeters may be operated on the streets for a greater percentage of the time than cabs with meters driven from the front wheel. These claims appear to be justified by existing records of taximeter service stations and taxicab companies. It is to be anticipated that lower operating costs and greater revenue per cab would, through competition, eventually be reflected in reduced rates of fare for taxicab transportation.

The mechanical difficulties attendant upon a front-wheel installation on a cab equipped with 4-wheel brakes should also be mentioned, in which connection the added safety factor claimed for the 4-wheel-brake car should be kept in mind.

We are informed that in their advocacy of the transmission drive the taximeter manufacturers are motivated by no direct financial interest in this question, and that in so far as their volume of business is concerned it is a matter of indifference to them which type of drive is used for taximeters. Such tests as they have made and reported to us have indicated satisfactory performance of taximeters driven from the transmission.

Finally, we have the testimony of at least one weights and measures official, in whose jurisdiction transmission-driven taximeters have been in service for a considerable period, to the effect that their use has been entirely satisfactory from a weights and measures standpoint, and that no complaints of overregistration on these taximeters, which are operated in competition with meters driven from the front wheel, have been traced to the method of drive. In the District of Columbia both methods of drive are likewise in use, and we have not heard of any epidemic of complaints of overcharges, although, of course, these would not come directly to our attention.

In conclusion, I have to say that, in view of the results of the present investigation, considered in connection with the present tolerances for taximeters, it is the opinion of the Bureau of Standards that the transmission drive may safely be used for taximeters.

We wish to acknowledge and express our appreciation for the cooperation rendered the bureau in the course of this investigation

by the highway department of the District of Columbia in connection with the Sixteenth Street taximeter testing course, by the Boston department of weights and measures in connection with the collection of data in that city, by the Pittsburgh Taximeter Co. and the Ohmer Fare Register Co. in connection with the installation of the taximeters and recorders loaned for use in the investigation, by the owners of the taxicabs in Washington and Boston upon which the installations were made, and by the representatives of the several agencies mentioned, with whom we came into such frequent personal contact.

A NEW SCALE-TESTING DEVICE

By H. Warren Hem, *Engineer, Toledo Scale Co.*

Before attempting to describe the scale-testing device I will give a brief outline of other testing devices that have been made by the Toledo Scale Co.

We made our first portable scale-testing device several years ago; it is called, "a 1,000-pound compound beam scale-testing device." The machine consists of two aluminum frames, upper and lower, the upper frame carrying two scale levers. The lower lever, which is of 10:1 ratio, is connected to a lever or beam above it which is also 10:1 ratio, this 10:1 ratio at the nose pivot making a total ratio of 100:1. The capacity of this machine is 1,000 pounds, which means that with the total ratio of 100:1 it will require 10 pounds on the nose of this upper lever to offset 1,000 pounds on the scale platform. This upper lever or beam is also graduated up to 500 pounds capacity by 10-pound graduations. The lower beam is graduated to 10 pounds by 1-ounce graduations. This machine weighs approximately 50 pounds when ready to be carried about and is practically the same size as the average suitcase. The lower member of the frame is inverted and the top section, which is fitted with a carrying handle, is fastened securely to the bottom section.

This miniature "master scale," as we have called it, on account of the great accuracy obtained by it in actual tests and in comparison with standard test weights, has met with favor by our Toledo branch managers and service men who have had occasion to use it. This encouraged us to go ahead with the development of this form of testing device, and we built 10 of these machines for use by our service stations in various parts of the United States. These machines were used by us in industrial plants for testing portable scales and small industrial scales up to 1,000 pounds capacity.

Since the portable scale-testing device was proving itself reliable in different industrial plants throughout the country, it solved to a certain extent the problem of transporting test weights and dispensed with the vast amount of labor in testing out scales, thus materially speeding up the testing operations. Our next thought was for a testing device somewhat lighter and more readily adaptable for the testing of person-weigher scales and small platform scales used in the retail trade. In the business district where traffic is very much congested, such as the loop in Chicago, there may be three or four or possibly more scales to be tested in the same block and the problem of getting weights to and from the scales, as all of the sealers and

scale men know, is a very difficult one. These scales are generally equipped with dials ranging between 300 and 500 pounds and would require 500 pounds of test weights to take care of all of them to full capacity. These test weights are generally delivered in a small truck operated by two men and are unloaded on the curb and carried across the sidewalk to the scale. The truck is allowed to park only while loading or unloading; therefore, one man keeps driving the truck around the block while the other man is testing the scale, and the first can not stop his truck until the weights are again ready to be loaded on the truck and moved to the next scale. Even if the next scale to be tested is in the same block, thus involving a very short haul, the weights must be unloaded again and carried to the scale, this operation being repeated as many times as there are scales to be tested.

To overcome the difficulty of handling test weights in the manner just described, some concerns, so I am told, where they had several scales in the same block or in adjoining blocks, have gone so far as to place the test weights on a hand truck to be wheeled along the sidewalk to the various scales. This also is more or less troublesome and difficult, especially in the rush hours when the sidewalks are crowded.

The second scale-testing device designed to meet this condition is somewhat simpler than the first one described, and consists of a single beam or lever. Its length between the extreme end pivots of the beam is 25 inches, and in this condition the ratio is 10:1. The beam is equipped with a telescoping or sliding member, which, when extended, gives a length of 37½ inches between the end pivots, resulting in a multiplication of 15. This beam rests in the load stand which sets directly on the scale platform, and the beam is fulcrumed under the self-aligning bearing of the yoke; this yoke in turn is attached to the under edge of the platform of the scale base.

The machine is equipped with a sliding poise used for the fractional weights up to 10 pounds. There is a small platform or weight receptacle which supports the test weights sufficient in number to give a force of 500 pounds on the scale platform at a ratio of 15:1. The weight of this machine when packed in its carrying case is approximately 35 pounds, and it can be carried about very readily by the service man either on the street car or in an automobile. As stated before, we have found this form of the testing device readily portable, and are making general use of it in our scale-testing work.

A leading stockyards company official recently saw one of these smaller scale-testing devices in operation and the thought occurred to him: Why not use such a device, larger and of sufficient capacity, to test our large platform scales? We made a survey of the different methods of testing these scales and found that some concerns were using test weights ranging from 500 to 1,000 pounds each, mounted on small wheels to be rolled on and off the platform as desired. While these weights mounted on wheels were satisfactory for some installations inside of buildings where the platform and surrounding floor are level and smooth, they did not work so well on the larger scales which were installed outdoors and equipped with wooden platforms which were more or less uneven and offered considerable resistance to pushing the weights on and off the platform. Other companies were using a sufficient number of 50-pound test weights to equal the capacity of the scale, which is a very slow and laborious

method of testing; while other companies had weights of large denominations, such as 1,000 pounds, each to be handled by a crane or derrick which was mounted on the rear end of a motor truck in which the test weights are transported. Such a derrick is operated to place the weights on and remove them from the platform as desired while testing the scale.

Another novel method of handling large weights was the method used at the Buffalo stockyards. This equipment was fully explained in the April, 1925, issue of the Scale Journal. It consisted of eight 2,500-pound test weights, 8,000 pounds of 50-pound test weights, and 50 pounds of assorted small weights, and a specially designed 4-wheel truck. This weight-carrying truck was fitted with a small hand-operated derrick which could lift a 2,500-pound weight, and then the truck would be moved about and the weight deposited at the desired position on the scale platform.

Still another method was employed for testing scales for weighing livestock at South St. Paul. The stockyard company there provided some cylindrical weights of 6,000-pound capacity which had the appearance of a large lawn roller. These roller weights were moved from place to place between two wheels larger in diameter than the roller. These conveying wheels were mounted on a V-shaped frame. When these weights are drawn across the platform, parallel skids mounted on the scale platform come in contact with this roller weight, lifting it free of the conveying frame. The wheels are then removed from the platform and the weights, which are resting on these skids, are rolled by hand to their desired positions on the scale platform. This method of testing stockyard scales also appeared in the Scale Journal, under date of June 10, 1925.

Our new scale-testing device is used for testing scales such as motor-truck scales, stockyard scales, hopper scales, and other industrial scales, and has a maximum capacity of 20,000 pounds pressure at the point where the force of the device is applied. Referring to Figure 1, this device is shown mounted on one end of a scale platform shown as M. The timbers P and P are for the purpose of distributing the load over two or more platform girders. The frame N, which is made of cast steel to obtain maximum strength with a minimum amount of weight, is fitted with four leveling screws, R (it is necessary to level these but once for each setting of the device), and supports the fulcrum of main lever Q and intermediate lever X, which are also made of steel. The weighbeam AB, which is made of cast aluminum, fulcrums in the stand AD. The trig loop AE is permanently connected to the fulcrum stand by means of rods AU. The weighbeam, trig loop, and fulcrum stand form a separate unit, which is located on the frame N by means of tapered dowel pins, and may be carried or packed separate from the rest of the device to avoid the possibility of any damage to the knife edges. The weights AH weigh 1½ pounds each and each weight equals a 1,000-pound load on the scale platform. At AK is shown the frame of the specially designed twin screw jack of which AX is the operating worm that drives the gears AV which are resting on ball thrust bearings and operate the screws AM. These screws are joined at the lower end and support the length-adjusting screw AL. To the lower end of screw AL are connected the links, rods, and pins AO, AP, AS, and AQ. This

connection is adjustable for different depths of scale pits, and is connected at the lower end to the anchor *AR*, which should be installed in the pit when the scale foundation is built, on account of the load it must carry.

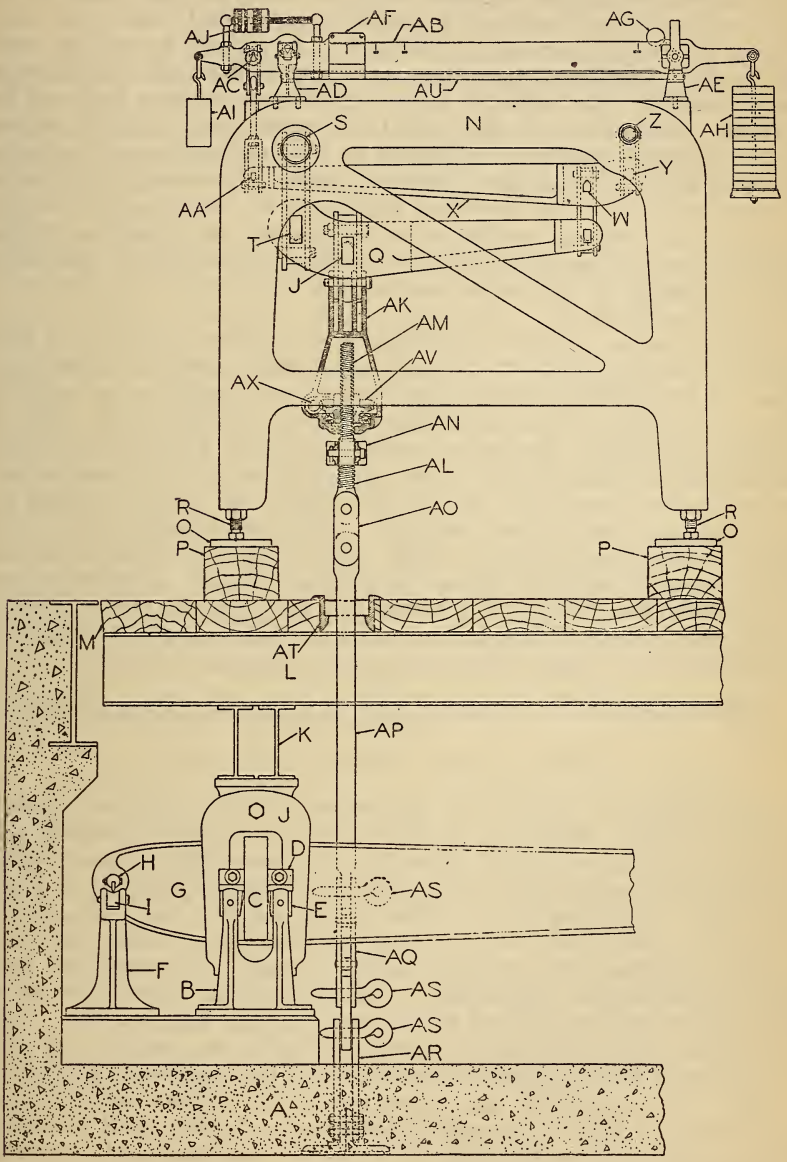

FIG. 1.—*20,000-pound, multiple-lever, scale-testing device*

In testing the scale the operation is as follows: The device is set in place on the scale platform and leveled. The connections between the testing device and the anchor in the scale pit are all made. The beam on the scale to be tested should be blocked to the center position

in the trig loop. The screw AX is then turned by means of a handle so as to produce a tension on the connections AP until the beam AB on the testing device balances in the center of the trig loop without any weights AH on the counterpoise. Then the beam on the scale to be tested should be balanced with the beam in the center of the trig loop and the beam on the testing device should then also be in the center of the trig loop. Then, if it is desired to test the scale for the first 1,000 pounds, place one weight AH on the counterpoise, turn the screw AX until the beam balances in the trig loop, set the poise out on the beam on the scale to be tested equal to 1,000 pounds, and if the scale is correct, the beams on both the scale and the testing device will be in the center of the trig loop. If the scale to be tested is not correct, then the fractional poise may be moved out or in until the beam is in balance and the error determined, or correction weights may be used on the scale platform instead of moving the fractional poise. Proceed in the same manner until the scale is tested to the capacity required.

A device such as shown in Figure 1 has been shipped to St. Paul. This device was equipped with an oil-operated jack, and due to the jack not being able to sustain its load a screw jack was substituted. This screw jack, which was the only one available that could be readily attached to the device, would apply but 4,000 pounds maximum pressure load on the scale platform, which was considerably less than the capacity of the device. However, the test using this load compared very closely with the actual test weights which were used in comparison with it. Since this test the new twin-screw jack which was previously described has been built and recently shipped for use with the device. We had hoped we would be able to give an actual comparison of the device up to its full capacity as compared to standard test weights, but are unable to do so at this time.

INSTALLATION OF BUREAU OF STANDARDS MASTER SCALE

By H. M. Roeser, *Bureau of Standards*

Mr. Chairman, ladies, and gentlemen, since it became generally known that the Bureau of Standards was installing a master scale at Clearing, Ill., a number of my friends from different parts of the country have inquired for information concerning Clearing, and some have even wondered why a place so apparently insignificant that they had never heard of it should be selected by the bureau as a suitable location for its master-scale station. Therefore, it seems appropriate at the beginning of this paper to say a few words designed to inform you just what kind of a place Clearing is.

Location.—The Clearing Industrial District comprises 3,000 acres, or approximately 5 square miles, suburban to southwest Chicago. It is under one ownership and management and is planned and developed for the definite purpose of creating a factory and warehouse center, and to provide ready for use the facilities and conditions essential to successful plant operation. Standard factory and warehouse buildings to suit individual requirements are erected by the district under term lease or purchase contract. The district is located on the Belt Railway of Chicago, in the ownership of which 13 trunk lines entering Chicago participate. The industrial section is exclu-

sively outside the city limits of Chicago and the residential section inside. I have been told that over 80 industrial plants are now located in Clearing and that the rate of accretion is over 20 per year. The Bureau of Standards Master-Scale Depot is located adjacent to the Chicago Belt Railway west yard just off Central Avenue. The official address is 5800 West Sixty-ninth Street.

In preparing this paper I have gone ahead on the assumption that you, as members of the conference, are interested more in the normal expansion of the work of the bureau than in the minute technical details of the master-scale design and construction. Therefore my remarks will relate to the history of the project, the circumstances of its development, its aim, and general reasons for being in existence.

History of the master-scale project.—The master-scale depot is one of the links in the control of a uniform standard of weighing in the transportation industry. Carload freight weighed for revenue purposes is weighed at approximately 12,000 different points in this country. The primary problem in which we as a Federal agency are interested is maintaining and distributing a uniform standard of weighing to these different points, and this, by the way, is a most important factor in the elimination of economic friction in interstate commerce. The purpose of the depot is fourfold, namely, (1) to maintain a station accessible to a maximum number of carriers for the calibration of railroad track scale test cars; (2) to maintain a station where standard test weights of large denomination, such as 5,000 pounds, 10,000 pounds, and upward can be calibrated for industrial plants, such as steel mills, which dispose of their produce principally on a weight basis; (3) to maintain a station where experimental work of public interest on commercial types of weighing machinery can be satisfactorily conducted; and (4) to maintain a headquarters centrally located where our field outfits can be serviced and recalibrated as occasion demands.

Different carriers maintain master scales totaling 20 in number, well distributed over the country. The idea of the operation of a master-scale depot by the bureau was conceived 12 or 13 years ago, and the scale itself was purchased about that time. At the time of purchase plans were under consideration for locating the depot either in the Washington Terminal or in Potomac Yards, near Alexandria, Va. Before the manufacturer's contract was completed, however, negotiations had been opened between the General Managers' Association of Chicago, and the bureau, to locate the plant in or near Chicago, where it would be immediately accessible to the 35 roads entering that city. The essential features of the project were that the carriers would furnish a site, trackage, and access, and the bureau would furnish the scale and a building properly equipped, and maintain them.

That serious administrative difficulties would be encountered in a transaction of this kind can well be imagined. Before these could be ironed out the country had entered the World War, whereupon the project was promptly dropped and forgotten. During the interval from the time of purchase until June, 1922, the scale was in storage in the manufacturer's plant. Its delivery was then accepted, and upon its receipt from the manufacturer it was stored

in a vacant shop building in the Washington Navy Yard. Two or three years ago negotiations for the location in Chicago were reopened and pushed to a satisfactory conclusion. Congress granted an appropriation, available in the 1927 fiscal year, of $50,000 for constructing and equipping the station. The terms of the agreement are based essentially on the plan previously mentioned, namely, the General Managers' Association of Chicago to furnish site, trackage, and access, we to furnish the scale, build the station, and maintain it. A construction contract was immediately placed and work was begun in the early part of last July.

Type of scale.—The scale is of 150,000 pounds capacity of the type known as the "plate fulcrum," built on the A. H. Emery patents by E. and T. Fairbanks & Co., St. Johnsbury, Vt. As you know, the plate-fulcrum type is distinguished from the common run of weighing machinery by having thin plates for the lever fulcrums instead of the conventional knife-edges and bearings. The design and fittings are thoroughly in keeping with a Federal project of this kind.

Building.—The building is a 1-story, brick, shop-type structure, 40 feet wide by 86 feet long by 30 feet high, containing two tracks for handling and storing cars in the shop, the master scale, a 10-ton electric crane, office and shop space, a fireproof vault, and miscellaneous shop machinery. It is well lighted, and comfortably heated. In general, it is snugly and compactly designed and sturdily built and with appropriate finishing touches should be in all respects a credit to this institution.

Pit.—In a job of this kind it is necessary that the foundation or pit be permanent, waterproof, and stable. In order to secure these features we worked into the design a floor slab 4 feet thick and side walls averaging 2 feet thick, of reinforced concrete with a bituminous coating on the outside and a waterproofing finishing coat on the inside. The pit walls are independent of the column footings of the building.

Installation of scale.—The work of installing the scale was begun on January 30 of this year. The Pennsylvania Railroad has specialized on the plate-fulcrum type of scale for a number of years and has trained and equipped men exclusively for the work of erection and maintenance of this type of scale. When we were ready to begin work that road, through the kindly interest of Mr. A. W. Epright, supervisor of scales and weighing, offered us our choice of a man from its force. Accordingly, Mr. F. M. Basler, scale erector for the road, whose sound capability and skill based on years of practical experience are very well and favorably known, was granted leave of absence and placed on our rolls to help us with the installation. Common labor was hired as occasion demanded from the otherwise unemployed around Clearing.

After unpacking, and a preliminary examination, the scale material was found to be in a remarkably good state of preservation, although it had been in storage for some 10 years.

Experience gained in connection with plate-fulcrum scales since the time of the design and manufacture of this scale, had clearly demonstrated the very important part played by the fitting of machined surfaces throughout the machine. When the machine was examined

in detail, with the requirements dictated by this experience in mind, it was indicated that a considerable amount of work in hand fitting of parts would be advisable. To accomplish this and to prepare the foundation for the main-lever supporting castings, nearly three months of painstaking hand labor was required. Controls were kept on this work by means of a 24 by 36 inch surface plate, some special levels sensitive to better than a thousandth, and a set of master parallels and straight edges.

Performance, and general conditions of use.—The work of installing the scale is substantially finished. We weighed our first test cars on May 5, and are prepared to certify these weights to within less than 1 pound, which, of course, is entirely satisfactory. The machine shows possibilities of a permanence and quality of performance hitherto practically unattainable, but I am sorry to have to report that up to the present time we have not been able to develop these possibilities to their fullest extent; fortunately, however, this has not prevented us from putting the station into satisfactory operation as mentioned above.

In this connection it must be remembered that we are dealing with a master track scale, not a commercial track scale, and that the adjustment tolerances on a scale of the first-mentioned type are only a small fraction of the tolerances allowed on the latter, varying, as they do, from 3 pounds on a 20,000-pound load, or 0.015 per cent, to 6.37 pounds on a 90,000-pound load, or 0.007 per cent. Therefore, the character of performance necessary is very different, and consideration must be given to errors which in the case of a commercial track scale would either never be discovered at all or would cause practically no concern. While it is true that a great many commercial track scales of the fulcrum-plate type have been installed in recent years and have performed in so satisfactory a manner that they have demonstrated beyond question the soundness of this type of scale, nevertheless this fact is not conclusive as to what degree of satisfaction can be obtained in the case of a master scale of the plate-fulcrum type. Since the 1st of May, then, we have been engaged in a patient search for impeding faults and studying the best manner of eliminating them. We have found, for instance, one method of eliminating some portion of our trouble, but I am not sure when we make the change whether we are really remedying a fault or introducing another fault whose effects compensate for some not yet located.

Our difficulties lie in a failure to make the scale maintain what we call its "multiple" under different conditions of loading. In short, this means that the scale will not indicate that a 100,000-pound load weighs exactly twice as much as a 50,000-pound load. It was suggested that the trouble could be corrected at the connection between the main and end extension levers, and while it was felt that it would be unfortunate to obtain a permanent adjustment in the manner described hereafter, it was decided to experiment in this way, pending redesign of certain parts which may eliminate some or all of the present difficulties.

The load fulcrums of the end extension levers are at right angles to the longitudinal axes of the levers, and are 1 inch high and 0.1 inch thick. As load is increased, the scale behaves as though the center of pressure of the force from the main lever tip were shifting

toward the butt end of the extension lever or in the direction of the thickness of the extension lever load fulcrum. A shift of about 0.002 inch would cause a variation of 10 pounds under 100,000-pound loads. The experiment mentioned above consisted in putting a bend in the plates by forcing the tops toward the butt of the lever. When this was accomplished the shift was reduced to some extent and the scale maintained its multiple more or less satisfactorily. It is interesting to know that the errors can be reduced in such a manner, and eventually such facts as this may assist us to a greater knowledge of this type of scale. However, with the recollection of three months' painstaking labor in perfectly setting up the machine, the disturbance of this condition in order to reduce weighing errors is not a happy thing to contemplate. The condition is paradoxical, in that theoretical and practical design requires the plates to be plumb, straight, and parallel to the end fulcrums. In the position described they are not in this condition. As suggested above, naturally our endeavor will be centered upon correcting the condition noted above in some preferable manner.

The eventual solution perhaps lies in a redesign of the fulcrum blocks and some of the fulcrums themselves, or it may involve some other modification. To determine what is the best procedure will require time and experimentation, and until that is finished about all we can do is maintain the optimism that the general appearance of the machine and knowledge of the soundness of its mechanical principles inspire.

In general, the machine is positive in action, sensitive to load changes, and free from outside disturbances. The beam action is practically ideal. The quality of performance that we hope to obtain is that which will enable us to weigh any load within the capacity correctly within better than 1 or 2 pounds, and to secure repetition within a tenth of a pound. The quality of repetition now leaves little to be desired, but the general accuracy must be improved before we can consider the machine altogether satisfactory.

In conclusion we may state that the above observations are made because it occurs to us that an account of the installation of our master scale would be incomplete without them. They will help to put you in a position to appreciate some of the difficulties which we have encountered. It is not to be supposed that we are at all discouraged as to our eventual success—we are not, by any means. We are confident that the machine is well conceived, well designed, and well executed, and that eventually its performance will be of the highest grade at present procurable. In this, as in other lines of endeavor where the highest accuracy is sought, complete success is hardly to be secured without conscientious and painstaking effort and study—at any rate, such is our experience.

NEW EQUIPMENT FOR TESTING HEAVY-CAPACITY SCALES IN NEW JERSEY

By Joseph G. Rogers, *Assistant Superintendent of Weights and Measures, State of New Jersey*

Mr. Chairman, ladies, and gentlemen, the testing of heavy-capacity scales has become one of the real problems of the weights and measures official. The conditions that prompted us to critically analyze

the matter in New Jersey and attempt its solution are common to all States. The development of motor transportation in keeping with this fast-moving age has revolutionized the heavy-scale industry and necessitated the installation of equipment with capacities greatly in excess of those heretofore known. The day of the 5 and 10 ton wagon scales is rapidly passing, if, indeed, it has not already passed. The most common types of installations of heavy scales in New Jersey at the present time range from 20 to 30 tons. To attempt the testing of equipment of this caliber with the complement of weights formerly employed by the average official would be folly. This led us to observe thoughtfully the scale-testing equipment used. Here were many available vehicles, touring cars and trucks, carrying 50-pound weights to any scale that was to be tested. Here were men unloading these 50-pound weights by hand, placing them laboriously on a single corner of the scale, and in turn moving these same weights to other corners of the scale to test the accuracy over all, according to the approved method of "spot" testing. Sometimes 40 of them were used, but more often less—it all depended upon the physical ability, disposition, and tendencies of the official. With the increase in transportation projects scale installations were increasing rapidly.

Something had to be done to speed up testing and to minimize the labor involved in this operation. We were faced with the necessity of replacing the inadequate, primitive methods of testing with more modern procedure. If there were no modern devices on the market, we would create some. Dimly we remembered that Alameda County, Calif., had taken steps with this end in view. We followed up this thought and were made conversant with what they had developed. They submitted brief specifications and photographs. We analyzed them; they were good. Why not, then, proceed along similar lines? We, first of all, decided that we wanted a truck with a short wheel base. Scale platforms vary in size, and as the total test load should include the weight of the truck, we wanted to include it in our tests and not merely apply the weights carried with the equipment. We then called in a truck-body builder, to whom we conveyed a general idea of just what we wanted. We were fortunate in striking the right man, who from the start took a deep interest in what we were trying to do and worked faithfully with us. So together we evolved what we felt would be a machine capable of filling our expectations. Having obtained an appropriation from our legislature after four years of consistently recommending the purchase of such an apparatus, we placed our order. The entire job as finally delivered to us consists of the following:

An Autocar chassis with a wheel base of 114 inches. It is a model 27, type "H," with a 4-cylinder motor. This chassis is equipped with single 5-inch tires in front and dual 5-inch tires on rear. Mounted on the chassis is a truck body 11 feet long from back of cab. The body is 44 inches wide, with sideboards 13½ inches high. The flooring is of 1⅛-inch hardwood, with a $\frac{3}{32}$-inch steel plate cover, supported on sills by nine crossbars well ironed. The top, of tanklike appearance, is constructed of steel plates supported by three 1¼ by 1¾ inch iron bows, with side openings and two rear doors. The height of top from bed to bottom of bows is 53¼ inches. Fas-

tened to top supports and extending the entire length of truck body is a 5-inch steel rail to provide for trolley chain block. This rail extends 2 feet out from the rear of the truck, and is hinged so that it may be folded back over the top. A 1½-ton capacity, Yale type, chain block with spur gear is used for handling the weights.

The complimentary equipment consists of a small hand truck, or "dolly," and test weights. The hand truck, which is used for carrying and moving the weights, is standardized to weigh exactly 500 pounds. The body of this dolly is constructed entirely of steel. The dimensions are 25 by 25 inches by 6 inches high. The front axle is attached to the body by a gooseneck to allow front wheels to turn. This hand truck has a detachable handle. The wheels are equipped with roller bearings and sleeves, and solid rubber tires. The dolly will readily carry 3,000 pounds of test weights and it is comparatively easy to move it about with this load. We have not taxed its capacity beyond this limit, as this weight is about all that a man would care to move around on a scale platform in making "spot" tests. The weights used are of cast iron; they are of block type, and each weighs 500 pounds. The dimensions of these weights are 8 by 11½ by 24 inches; they were cast with offset pieces on top at each end and recesses in bottom to allow for even stacking and to prevent the weights from sliding when piled one on another. They have an eyebolt in the top and a pocket for adjusting weight differences. These weights are ground smooth, but not machined. The figures and words "500 Pounds" appear on each weight.

The entire truck is painted a nice shade of gray, with blue striping and gilt lettering. Completed, it is a machine of compact beauty, showing tremendous strength from radiator to tailboard and evidencing an ability long to survive the heavy work required of it. Promptly it was nicknamed "The Spirit of New Jersey."

A ton of the conventional 50-pound weights supplement the 500-pound weights used with the truck. The side openings in the body of the truck are to facilitate the handling of the smaller weights on jobs where the larger weights may not readily be employed, such as in the testing of dormant platform scales in factories, etc., where we may at the same time be called to examine heavy-capacity scales.

The ease of operation of the chain block should be mentioned. This travels smoothly on the track at the top of the inclosed body, permitting the dolly and weights to be lifted from any position in the truck, brought to the rear, and lowered to position on the scale platform. The weights used in "spot" testing are placed in the dolly, which is designed to hold two weights side by side, and, through the ingenious dovetail construction of the weights themselves, permit a compact loading of the hand truck.

One man can handle the entire apparatus, though greater speed can naturally be obtained by using two men as well as lightening up on the labor involved.

The only possible improvement we can see that might be embodied in our equipment is that the hoisting arrangement be made motor operated. We have not as yet been able to determine how this can be done and yet retain the facility of movement of the chain block backward and forward on its track. There are motor-operated trucks in service having a boom arrangement for swinging the weights over

FIG. 2.—*New Jersey equipment for testing large-capacity scales*

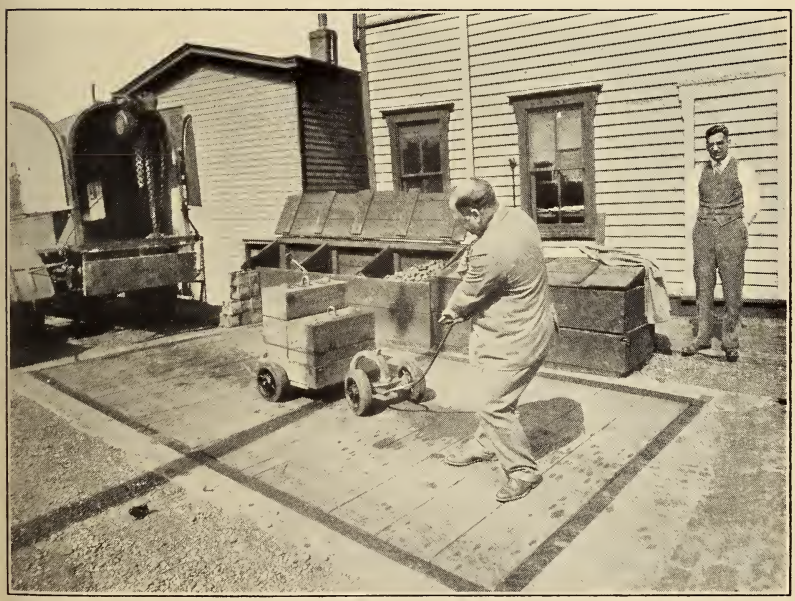

FIG. 3.—*"Spot" testing with mobile 3,000-pound testing unit—New Jersey equipment*

the side or rear of the vehicle, but this is not possible with the design of apparatus we are using. Our truck, we believe, offers advantages over vehicles of the open type that employ boom hoists. The weights are inclosed from the weather at all times and are consequently kept free from deterioration due to rust. This also applies to the dolly and the mechanical working parts of the apparatus. In addition our type of truck permits of more sturdy construction, steel being used throughout, which promotes long life of the equipment and makes possible a heavier weight in the truck itself which is designed to be included in the total test load applied to scales in testing.

The apparatus we have placed in service has proved its worth and has done everything expected of it. Its operation at the present time is confined to State-owned scales on our highways and at our State institutions, and to commercial scales that may be involved in controversies. It would be a physical impossibility annually to cover every heavy-capacity scale in the entire State of New Jersey with one unit, so our present operations of the equipment are necessarily limited. It is our purpose to endeavor to obtain one or possibly two more of these units. They could be employed to decided advantage. From the standpoint of economy and efficiency we favor State owned and operated equipment for heavy-scale testing. The argument has been advanced by those who have possibly not made a thorough study of the matter, that local officials should take care of their own work of testing heavy-capacity scales. In refutation of this it may be said that work of this description would not warrant a county or a municipality making the expenditure for equipment of the kind mentioned, due to the fact that the apparatus would not be kept constantly in service, and through inactivity would deteriorate and result in considerable loss. To this phase of the matter there are, of course, exceptions. Departments in large and populous cities and counties can well employ such equipment to advantage. As an instance of this, I might cite our city of Newark, where the local department keeps a crew constantly engaged on the work of heavy-scale testing. However, no State department should be without its own testing apparatus to assure proper attention to scales in the less populous districts. Equipment so employed by the State can be kept busy performing a necessary service in the interest of those who in their various commercial enterprises use scales of the heavier capacities. From this standpoint the use of proper testing equipment reacts decidedly to the economic benefit of all concerned. Under testing procedure quite common to-day, users of heavy-type scales have little assurance that their weights either in buying or selling are correct, and this is deplorable. Lack of sufficient and adequate equipment for doing the work is the cause, and without proper working facilities officials are quite powerless to perform other than very perfunctory inspections and tests of heavy-capacity scales now in use. It is a situation to which comparatively few officials apparently have adjusted themselves, yet it is generally recognized that some steps must be taken to keep up with this new demand of the times.

Our truck with its present equipment weighs 15,000 pounds. We are adding to our complement of the 500-pound weights an amount sufficient to bring our total weight up to 20,000 pounds. This amount

of weight should enable us to satisfactorily determine the condition of scales we are called upon to test.

The truck with its equipment as finally developed reached a price of $5,953. We were given a State discount of 10 per cent which made the net cost of the apparatus $5,357. The manufacturers should be able to offer a cost reduction in additional units. The experimental stages through which our equipment had to pass in its development naturally influenced the price finally paid; certain changes were found necessary as we went along, a condition quite common to projects of this kind.

It would be difficult to overestimate the value and importance of the apparatus to the work of weights and measures regulation. Two specific reasons arise in my mind which justify the expenditure so far as our State is concerned, and both involve law enforcement. One relates particularly to State-owned scales. Our State highway department has spent approximately $70,000 in installing heavy-capacity scales for the checking of vehicles on the highways in order to determine whether or not they are overloaded beyond the limits prescribed for the road weight of motor vehicles. It is essential that these scales be accurate, because the results of weighings made on them are frequently offered as evidence in courts of law when violators are prosecuted for overloading. It has heretofore been difficult for the State's legal forces to definitely prove whether or not the scales used in such weighings were accurate—and a good lawyer for the defense always raises this question where matters of quantity determination are concerned. The proof is now readily available and the courts are now very easily convinced that the scales employed are in proper condition for the work entailed.

The second instance relates to the use of heavy-capacity scales by local weights and measures men for the reweighing of such commodities as coal, etc., in transit between the merchant and the consumer. Our officials are very active in this respect. Some municipalities have their own scales for public use in charge of weighmasters. In one of these cities our local superintendent developed, as he thought, several glaring cases of short weight against coal dealers. He reweighed their loads on the city's scale and prosecutions were pending. Before proceeding with legal action, however, our official, a man careful in his methods, felt it advisable to assure himself of the accuracy of the device he was using. He called in the State department and we conducted a test only to find the city scale grossly in error—so the cases never came to trial, honest merchants were saved embarrassment, and the local official not exposed to ridicule.

The instances where the apparatus has been of benefit in connection with the testing of scales in commercial use are too many to enumerate. With our testing truck in constant service we expect to uncover many discrepancies in heavy-capacity equipment and eventually bring about a very clean condition in scales of the larger types. We all share the belief that it is just as important for heavy-capacity scales to be accurate as it is for the scales on the counters in stores. There is only a difference in quantities of the commodities handled. Errors in the larger scales reflect themselves all along the line, and the consumer eventually pays the price for these errors.

The healthy interest which seems so manifest everywhere in weights and measures channels at the present time as to the best methods to cope with the trying task of heavy-scale testing, bespeaks an assurance for the future that nothing will be left undone to promote the satisfactory conditions which we all agree should prevail.

The ACTING CHAIRMAN. This being the last number on the program this afternoon, a motion to adjourn is in order.

(A motion to adjourn was made and seconded, the question was taken, and the motion was agreed to.)

(Thereupon, at 4.55 o'clock p. m., the conference adjourned to meet at 10 o'clock a. m., Wednesday, May 23, 1928.)

THIRD SESSION (MORNING OF WEDNESDAY, MAY 23, 1928)

The conference reassembled at 10.20 o'clock a. m. at the Bureau of Standards, Dr. George K. Burgess, president, in the chair.

SUPERVISION OF GAS, ELECTRIC, AND WATER METERS IN TEXAS

By W. T. Henrichson, *Meter Inspector, Division of Weights and Measures, State of Texas*

Mr. Chairman, ladies, and gentlemen, I think it is advisable to state that this is not a technical paper but merely one which deals with the problems encountered in the administration of the weights and measures laws in Texas.

Activities of one particular gas company in an effort to raise their rates in one of the principal cities in Texas perhaps had more to do with the passage of a law regulating the testing of meters than any other one cause. In this particular city, a few months prior to the enactment of the State meter law, the gas company petitioned the city council for an increase in gas rates. After an exhaustive investigation the city council concluded that the gas company was not entitled to an increase in rates, that the existing rates were adequate to net a fair profit on the company's investment, and that the losses were not due to rates but to bad and uneconomical management. During the council meeting with the gas company's representative one member of the council suggested that there ought to be other ways for the gas company to increase their earnings besides increasing the rates. He no doubt had in mind increased efficiency and economy. The gas company acted on his suggestion and did increase their earnings. They speeded up every meter in the entire city and increased their gross receipts about 25 per cent.

Our present law, regulating the testing of electric, water, and gas meters, was passed by the thirty-eighth legislature in 1923. The fact that several bills were introduced in this legislature relating to the supervision of meters was evidence that the people were aroused and demanding protection. The bill which became the law provides a penalty for misreading a meter, overcharging customers, and using meters which register or show a greater amount of electricity, water, or gas than delivered. While the law gives protection to the customer, it also gives protection to the company engaged in the sale of electricity, water, or gas by providing a penalty for diverting electricity, water, or gas past a meter, or interfering in any manner with the proper action or registration of a meter.

The enforcement of the law was placed with the weights and measures division of the markets and warehouse department, which department, with all of its duties has since been consolidated with the department of agriculture. The legislature appropriated $4,000 to

pay for the necessary equipment to carry on the meter-inspection work. The following is a list of instruments purchased, including cost:

For testing gas meters:	
1 gas-meter prover	$250.00
1 portable test meter	40.00
1 flow meter, with necessary stoppers, thermometer, stop watch, etc	68.00
For testing electric meters:	
1 phantom load box with primary voltage of 110, 220, 440, and 550, and amperage range of 1 to 75	96.80
1 portable single phase watt-hour meter with double ampere scale and double voltage scale	119.64
1 direct-current voltmeter	57.00
1 millivoltmeter	39.00
1 10-ampere 200-millivolt shunt	14.40
1 50-ampere 200-millivolt shunt	22.80
1 500-ampere 200-millivolt shunt	52,80
1 portable direct-current rotating standard watt-hour meter, with necessary accessories	241.30
1 alternating-current rotating standard	120.00
1 voltmeter	57.00
For testing water meters:	
1 water-meter prover 1 portable water meter	302.62

Our total expenditure for testing equipment to enforce the meter law represents an investment of $1,481.36. This list does not include the miscellaneous items, such as tools, connections, and fittings.

In enforcing the meter law we employ four methods of procedure: Testing standards belonging to the various utilities; testing service meters on complaint; making routine tests; and checking bills to see if correct charges are made.

The standard tests consist of laboratory tests of standards belonging to the various companies. In making tests of a standard belonging to an electric company our customary procedure is to use a secondary standard and a phantom load box to supply the load. The company standard and the department standard are connected with current coils in series and potential coils in parallel with the load so that both meters measure the connected load. The registration of the company standard is then compared with the registration of the department standard. Tests are made on all voltage and amperage ranges, and on light load, which is about 10 per cent of the rated capacity of the meters, and on full load, which is full capacity of the meters. The standard is condemned if it does not check within one-half of 1 per cent correct. However, the company is permitted to continue using the standard, provided they take into consideration the error in the standard in testing service meters. If the standard is found in error in excess of 2 per cent, it is condemned for repairs.

As to a test of a standard gas-meter prover, in my opinion the most accurate way to make this test is with the standard cubic-foot bottle. However, we have found that if a cubic-foot bottle is carried about in a car it is more likely to be in error than the prover which we test. Our procedure in testing a prover is to examine it very carefully, and if it has no leaks, dents, paint bubbles, or anything in the bell to change its original volume, and if it checks our laboratory test or our own portable meter, we pass it as correct.

In testing the standards belonging to a company engaged in selling water their water-meter prover is tested by the use of a standard 5-gallon can, similar to the test cans used in testing gasoline pumps.

Next in importance to the standard tests are the tests made in answer to complaints made either by the consumer, a civic organization, the local government, or a utility company. During the past two years 1,235 tests have been made in adjusting bill disputes. If the complaint is on a gas meter, in the majority of cases the number and location of the meter are first obtained and then the meter is removed to the laboratory of the State or utility and tested with the meter prover. This procedure, of course, can only be followed where a gas-meter prover is available. It is very seldom that the portable gas meter is used in making a test on a complaint meter because of the many chances for inaccuracy. When a portable test is made in answer to a complaint and the meter tested appears to be in error, the meter in question is first removed and retested with the gas prover before a report is made. The testing of electric and water meters on complaint is made with a greater degree of ease than a gas meter, since neither has to be removed to be tested. The electric-service meters are tested similarly to the electric standard. The water-service meters are tested either with a portable water test meter or with a standard 5-gallon test can.

The routine tests consist of tests made on meters picked at random over the town and serve to give us an idea of the condition of meters in service and enable us to determine whether the meters are maintained within the degree of accuracy required by the department. In making routine tests, as a rule, 5 to 10 per cent of the meters in a city are tested. If our tests on these meters show a high percentage of accuracy our tests are concluded, but if we find the meters in bad condition and inaccurate, either fast or slow, the tests are continued. In some instances all of the meters in a particular locality have been tested.

In addition to the standard test, the complaint test, and the routine test, we have learned through experience that a good method of enforcing the meter law is periodically to check the bills as rendered to the customers to see if correct charges are made. Our procedure is to call on a customer, secure his bills for the past three or four months, and check them. Many adjustments have been made as a result of this work and hundreds of dollars saved the customers.

When a meter is found incorrect it is condemned for repairs and must either be removed and replaced by a correct meter or repaired within 24 hours. The inspection of meters differs from the regular weights and measures work, as our object in this work is to see that the utility companies test their meters accurately and maintain them correct, and that they bill their customers for the true amount at the correct rate. The department does not propose to do their test work for them, but to see that they do their work correctly.

We find, as a result of inspections made in Texas, that the chief causes for meters being inaccurate are incompetent men and neglect on the part of the utility rather than any deliberate intent to defraud. I found one small electric company that was mutiplying their meter readings by 2, although their meters were direct reading with the constant of 1. When I asked why they used a multiplier of 2 they

told me that it was necessary to arrive at a true amount of the electricity passing through the meters. On investigation I found the meters were being tested in such a position that the rotating disks did not turn freely and the additional friction made the meters appear 50 per cent slow. The small companies are the ones who neglect their meters. I found one small gas company that was on the verge of bankruptcy. After spending a week testing their meters I found that 25 per cent of the meters in service were dead and were not registering the gas flowing through them, and a much higher percentage were slow meters which were registering only a portion of the gas passing through the meters. The result of my inspection work showed the directors of this company just why they were not making any money and emphasized the importance of meter testing.

Most of the large corporations have well-established meter departments and test their meters at regular intervals and have both accurate standards and competent meter men. I found all the electric meters running an average of 25 per cent fast in a town served by a large corporation which owned properties in more than 150 towns in Texas. I had made previous inspections in a large number of other properties of this company and had found the conditions very satisfactory and I was reasonably certain that it was not the policy of the company to speed up their meters. The general manager personally investigated the case and later explained the situation by saying that his local manager had petitioned for an increase in salary and that his request had been denied on the grounds that the business of the local property did not justify an increase in the manager's salary, but that in the future, should the business increase, the manager would be entitled to a salary increase. The general manager suggested that the local manager increase his daylight load, extend his lines, add new customers, and increase the efficiency of the plant. The next month's statement of the property in question showed a 25 per cent increase in gross receipts. At the time the main office did not know the true conditions of the local property and concluded that the increase in gross receipts had been accomplished by legitimate methods. The company discharged their local manager, corrected their meters, and made suitable refunds to all the customers; this was all the department could reasonably demand.

Misreading of meters and incorrectly calculating bills is a frequent occurrence and has caused considerable trouble for the department. In one town the local company changed from artificial to natural gas and changed their rates from $1.70 per thousand cubic feet to 67½ cents per thousand cubic feet, plus a 50-cent service charge. The first month after the change about 2,000 bills were calculated at the old artificial-gas rate of $1.70 per thousand cubic feet. The department investigated the case and demanded that the gas company make refunds to the customers.

In settling a bill that has been rendered on an incorrect meter we act on the recommendations of the Bureau of Standards; that is, if a meter is tested and on investigation we find the meter has been tested, say, three months previous, and found correct, adjustment is made on the gas consumption over a period of one and one-half months, or one-half the time between tests. If half the time between tests is greater than six months, adjustment is made for only the last six months.

In the year 1924, the first year of the meter-inspection work, 30 per cent of the meters tested were found to be in error in excess of the 2 per cent tolerance, 16 per cent slow, and 14 per cent fast. In later years we have found conditions materially improved. These percentages, however, are not a true index of the condition of the meters, because the number of meters tested includes all of the complaint meters, and it is reasonable to conclude that these percentages of error are high. This also shows that a larger number of meters are slow than fast.

Records of the meters are taken as a basis for settlement of charges made between producer and consumer, as in the case of commodity where the weight or the record of the scale is taken as the basis for settlement. These records must be correct, and what constitutes correctness as required by law has given rise to considerable controversy. It is impossible to calibrate and keep the meters absolutely correct. Consequently, the commissioner established tolerances to avoid the multitude of adjustments which might be demanded for small inaccuracies and to take care of the mechanical defects of the meters. Settlement of a dispute over the accuracy of a meter should be based on perfect measurement and not upon the upper or lower extremity of the tolerance. For example, a customer asks that his meter be tested, and upon completion of the test the meter is found to be registering 8 per cent fast. The tolerance on this particular meter will be assumed to be 2 per cent. The company makes a refund on the basis of 6 per cent discount. In such a case the department of weights and measures would contend that the company was taking and claiming a commodity tolerance and was asking the customer to pay 2 per cent for service that had not been rendered. The principle of using the tolerance and not the correct measure as a basis is fundamentally wrong.

Most of the utilities that have been visited have shown a splendid disposition to cooperate. A few have been antagonistic. The former realize the importance of obtaining the good will and confidence of their customers and consequently welcome State supervision of meters and meter testing, because they realize that State inspection will help them to obtain the confidence that they desire. For example, a gas company called for an inspector to test a certain gas meter, and explained the situation with these remarks: "We have an accurate prover and competent meter men, and we are reasonably sure that our meters are correct; but the customer has no confidence in us or our test." In this case the meter was tested by the State inspector and the customer satisfied with the results. His confidence in the company was reestablished, for the finding of the State test was exactly like that of the company.

Some company officials are skeptical, declaring that the State is infringing upon the rights and privileges granted to them by charter, that the law is a harmful hindrance to them in conducting their business, and that the government not only regulates their rates but dictates how they should operate their internal affairs, such as the testing of their meters. The law only requires that the meters be correct—how the meters are tested, provided they are tested correctly, is left entirely in the hands of the individual company.

The weights and measures department has endeavored simply to maintain accurate standards, to see that the various companies accu-

rately and correctly test their meters, and test them often enough to guarantee that they are maintained correctly. The department has made it a policy to assist the honest utility company in their endeavors to serve the public. When we find a meter man testing the meter wrong, through ignorance, we endeavor to educate him to the correct methods of testing. If we find a company that is having an extraordinary amount of trouble in maintaining their meters correct, and we are confident that they are sincere in their efforts, we try to help locate the trouble and assist in correcting it. For example, I found one gas company where the manager was spending more money on meter maintenance than under proper conditions would have been necessary. I made an investigation and found that the diaphragms of the meters were being destroyed by sulphuric acid. I found that the raw gas was being delivered from the generator through a pretense of a scrubber direct to the holder. I pointed out to the manager that an oxide purifier was necessary and told him how and where to install it. After the installation of the purifier his meter-maintenance cost was materially reduced.

It is essential that the meter inspector be well qualified in both technical knowledge and experience, for he must contend with men who have spent their lives in the industry and know their meters. The State inspector is sent as an authority to settle controversies between producer and consumer, and I know from my own experience that the utility men take a delight in testing the inspector. If they have a peculiar condition which the ordinary meter man can not understand, that is the first thing referred to the inspector. There is a large number of makes, types, and designs of meters of which the inspector must have a working knowledge. He must have his subject well in hand if he expects to hold the respect of the utility men and uphold the dignity of the department he represents.

In the gas regulation there should be some provision to regulate the quality of gas. A B. t. u., or British thermal unit, is the amount of heat required to raise 1 pound of water 1° F. If a gas company makes their rate on a basis of 1,000 B. t. u. per cubic foot at standard condition, then a penalty or a revision of rates should be demanded if that company delivers gas containing less than 1,000 B. t. u. per cubic foot when measured under standard conditions. At first glance such a regulation might appear as foreign to meter regulation, but when you consider the effect of the substitution of a lean gas for a rich gas you will see the necessity of incorporating such a regulation in the meter law. To begin with, the gas meter is a volumetric measure, yet the commodity sold is available heat. The amount of available heat delivered depends upon the quantity and the quality. Consequently, if we are to protect the consumer, we should have supervision over the quality as well as the volume. In Texas there is no provision or authority for the weights and measures department to test for the quality of gas, and as a result we find that some of the gas companies increase their earnings by selling lean gas. For example, in a certain locality in west Texas the gas bills suddenly jumped up. The county attorney wired for an inspector to check the gas meters. After a thorough investigation we found that the meters were correct but that the gas company, whereas they had been deliver-

ing gas of 1,000 B. t. u. per cubic foot, were delivering gas of 575 B. t. u. per cubic foot. This was equivalent to speeding up all of their meters about 74 per cent.

DISCUSSION OF ABOVE PAPER

Mr. E. J. Rogers. I would like to ask the gentleman if he ran across any water meters which registered fast?

Mr. Henrichson. A water meter, if it is properly adjusted when it leaves the factory, and the packing is not too tight, will not speed up. However, if you change the gear ratio, you can speed it up by any percentage you want; that is, not in the meter itself but in the gears connected to it. Sometimes a water meter will speed up about 2 per cent due to the fact that the packing around the shaft was originally too tight. We have found only one or two fast by 2 to 3 per cent; as a general rule they never run fast.

SOME COMMENTS ON COOPERATION AMONG WEIGHTS AND MEASURES OFFICIALS

By J. H. Meek, *Director, Division of Markets, State of Virginia*

Mr. Chairman, members and visitors of the conference, as one whose experience and active service in the field of weights and measures activity has started since that of many of my hearers, I hesitate expressing my views and feelings as strongly as the existing conditions throughout the United States and the methods being used in rendering service to our people may justify. I also feel entirely incompetent of making complete and detailed suggestions for ways and means of correcting all defects and setting up an ideal system. However, I do consider it a great privilege to have the opportunity of expressing to you some of the thoughts that I have had while making a conscientious study of the existing conditions confronting those of us who are intrusted with the obligations, and given the privilege, of serving our people through performing service to them in the weights and measures field. I trust that expressions will be gotten from you as to what can be done to improve these conditions and best serve our people, looking forward to not only the year 1928 and such years as we can reasonably expect to hold the trust that is ours, but with a vision of the future when others may follow us. We hope that we will have performed our full duty and obligation to the people of our several States and those of the United States in making it possible for others to perform even a greater service to mankind than we can do now.

Please allow me to make it clear to you that what I shall say represents only my own impressions, thoughts, and beliefs, gathered, as I have in my humble way sought ways and means of serving the people in my State with the desire to help those in other States when possible. I hope that each of you will feel free to comment upon the suggestions that I shall make, but if serious criticisms are to be made I shall expect you to offer a better solution of the grave defects for which we are responsible. As individuals it is impossible for us to solve them; as a group it is possible. If we are divided, we destroy our own efforts; if we are united, we build on a firm foundation.

When the duties of the weights and measures office of the State of Virginia were assigned to me a few years ago, I began to study ways and means of performing the greatest service at the least cost. As one whose duty had been that of improving conditions relating to the marketing of agricultural products, which covered the entire field from producer to consumer, I had given only very general thought to specific weights and measures activity. I had the general impression that our grades and standards for agricultural products and ways and means of establishing and enforcing them—a new field, developed only recently compared to the weights and measures field—had only in a slight degree reached the perfection of uniform standard and application that was applied to the weights and measures field. However, after giving special study and comparing the standards used in the two fields, especially from a national standpoint, I am convinced that there is greater uniformity in the grades and standards for agricultural products, and certainly more uniform application, both as to interpretation and centralized authority over official representatives, than we find in the weights and measures field.

Without meaning to discredit in the least the wonderful work that has been done by this organization, by the National Bureau of Standards, and by State and local weights and measures officials, I must say that I can see little hope for material progress on an economic and efficient basis until Congress enacts legislation providing for more uniform and workable standards, with centralized authority for the application of national standards, tolerances, and methods of enforcing the requirements. I am certain some one is thinking now of that expression we often hear—"States rights." I believe in States rights, but I also believe in applying the term in a little different way to that in which we usually hear it used; that is, that the States have a right to expect from Congress assistance in such of their activities to serve their people as can not be properly carried out except from a national standpoint. In our desire to get uniform legislation in the States, uniform standards and application of standards, uniform interpretation and actions on the part of those engaged in weights and measures work, the more efficient and more sanguine of us will be disappointed until something more has been done from a Federal standpoint.

Our present systems of communication and transportation make it possible for the intermingling of individuals, the distribution of commodities and messages, and the average transaction in business, to be carried on over the entire United States quicker and to a larger extent than these activities were carried on within the average State back no further than the memory of those in my hearing goes. In this day of the radio, airplane, and electrical facilities, with other developments showing as great a change in their field as those just mentioned show in their particular fields, why should we, so to speak, travel in oxcarts, send messages on horseback, or paddle the little canoe over the water, in providing standards, tolerances, etc., and in getting uniform enforcement? It requires only a casual examination of the different State laws and the ways in which they are being interpreted and applied, to realize that we, as State representatives, are using obsolete and almost impossible methods to improve and correct conditions within our States.

As individuals it is impossible for us to solve the problem—that is, to get uniformity throughout the country. I can not go into details on these matters now, but I hope this conference will discuss the necessity and expediency of appointing a committee for the purpose of working out a definite and uniform national program for establishing standards providing uniform tolerances and uniform application. It appears to me that a Federal law providing for these standards and giving specific authority for establishing tolerances and uniform application of the standards and tolerances should be enacted. It might be provided that these be voluntarily accepted by the legislatures of the States for use within the States under Federal supervision, until adopted by the majority or by three-fourths of the States when they would become national in application. Such a plan, it seems, holds out some hopes for an ultimate solution for the many irregular, nonuniform, ineffective means now being used.

This is a matter that can not be rushed into; it requires careful study and extreme caution in every move. If we are to ever make progress along this line, we must start some time, and in order to save time—with the exception of life, the greatest thing man has at his disposal—let us consider seriously making a move in this direction now.

I have made this paper short, hoping that we would have discussion on the thought brought out and that I would draw out expressions from those in the conference, especially from those who are representing the different States as I represent the State of Virginia. By bringing about more uniformity, we can easily improve conditions considerably. However, unless we get some Federal laws, it seems almost hopeless for us to obtain the ultimate results that we, as conscientious servants of the public, should strive for in relation to the application of standards, since at present we have so many differing laws and requirements, applied in so many different ways.

The Chairman. Mr. Meek's very interesting presentation is before you and he specifically asked for discussion. [After a pause.] If no one cares to rise, we will proceed with the program.

PROMOTION OF INTEREST IN WEIGHTS AND MEASURES SUPERVISION BY ESSAY CONTESTS AMONG SCHOOL CHILDREN[7]

By James J. Dawson, *Inspector of Standards, State of Massachusetts*

It is a practice in the schools of many Massachusetts communities for the pupils to elect and appoint among their number a group of officials whose titles correspond with those of the regular municipal officials. To increase their knowledge of the duties of the latter it is customary to have the pupils selected accompany the authorized official whose title they acquired in the school election, on appointed days of the year. While interested in reading of these occurrences I have been disappointed to note that a pupil has never been selected as sealer of weights and measures.

However, the lack of information regarding the position of sealer of weights and measures on the part of the children is not confined to them alone. It is commonly known among weights and measures officials that the public has little or no knowledge of his duties,

[7] This paper was read to the conference by Francis Meredith, director of standards, State of Massachusetts.

believing generally that the sealer goes around with a weight in one hand and a seal in the other, applying both to a scale in the order mentioned. A case in point is that of a speaker at the last Massachusetts weights and measures convention, who stated that for some time he thought that the term "sealers" applied to seal fishermen.

This realization caused me to ponder over the possibility of bringing about a better acquaintance with the duties of a sealer. The idea of an essay contest among school children seemed to answer well, as it would not only interest the children, but would also attract the attention of their parents.

Accordingly, at the annual convention of the Massachusetts Association of Sealers of Weights and Measures, held at Salem in 1925, the following motion was adopted: That the chair appoint a committee of three to supervise and conduct a contest whereby the pupils of the eighth grade of the grammar schools in the place where the next convention is to be held, submitting the three best essays on the subject, "The value of a sealer of weights and measures to a community," will be awarded prizes not exceeding $25, such sum to be paid from funds of the association; said essays to be read and prizes awarded at a convenient time on the first day of the next convention.

The convention in 1926 was held at Hyannis, the essays were read and prizes awarded; but it was immediately seen that the children were too young to properly grasp the topic, and as a result the meeting adopted a similar motion, changed so as to provide that the contest be conducted among pupils in the senior grade of the high schools.

In 1927 the convention was held at the Massachusetts Institute of Technology in Cambridge. Prior to the closing of schools for the summer vacation the essay committee communicated with the superintendent of schools for the city of Cambridge and the diocesan supervisor of parochial schools, sending them a copy of the motion adopted and requesting their permission and cooperation in placing the matter before the pupils of the junior grade, as they would be in the senior grade at the time of the convention. It was learned at this time that there are numerous requests of a like character placed before the school authorities and that these are usually frowned upon; but merit was seen in acquainting the pupils with the duties of one of their city officials and permission was granted.

There were no special rules governing the contest, but it was stated that credit would be given according to the pupil's knowledge of the subject, originality, spelling, punctuation, etc. There were no restructions placed on the source of their information, but it was subsequently learned that their material was secured from the local sealer, parents, teachers, their own experiences, or books. In some of the schools a period was devoted to the subject of weights and measures.

The results were very gratifying. Over 600 pupils took part in the contest, but by prearrangement only 28 essays were submitted to the committee for judgment, the teachers having eliminated those that in their estimation would not merit an award.

It was no easy task for the committee to arrive at a final conclusion as to the three best essays submitted. All were very good and showed that considerable time and effort were used in their produc-

tion. In some cases, however, the pupils seemed to dwell more on the evolution of weights and measures, or the duties of a sealer, rather than on the value of a sealer to his community. Even in these cases, though it was rather astonishing to note the amount of facts compiled by them of which many of their elders are unaware, I venture to say that if some of our finance officials were cognizant of the value of a sealer as expressed in these essays the salary question would cease to be troublesome.

A few interesting excerpts might bear repeating at this time:

(*a*) * * * because we have a sealer of weights and measures. It prevents business wars and misunderstandings. There is no cheating or what is commonly known as "double dealing." It holds crime and disturbance in check. * * * Without a sealer the people would be always arguing with the storekeepers, the storekeepers with the wholesalers, and the wholesalers with the manufacturer. * * * It would result in a commercial war and perhaps worse.

(*b*) Perhaps the greatest of men is he who lays down his life for his fellow men, but certainly the next greatest is he who helps to preserve and safeguard their lives and rights. Such a man is the sealer of weights and measures.

(*c*) Although we may not realize it, the sealer of weights and measures guards us as a watchful nurse would care for her patient.

(*d*) The majority of the American public has little appreciation of the value to their community of that unknown character, the sealer of weights and measures. Many people do not know where this man holds forth, much less what his name is.

(*e*) The first sealer of weights and measures in Cambridge was put into office in December, 1671. His duty was to see that the beer quart, the wine pint, and similar measures were accurate.

(*f*) President Coolidge has said, "The great body of our tradesmen are honest and conscientious * * *." This is indeed true, but if they had no way of testing their scales they could not give accurate weight.

(*g*) The office of the sealer of weights and measures affects us in our homes and daily life in many different ways which we too often take for granted, giving little or no thought to the benefit we derive from his office.

(*h*) * * * Therefore, since the preservation of our country depends on order and justice in each community, I think that the sealer's office is one of the most important in the city.

On the first day of the 1927 convention, in the presence of the assembled sealers and other interested parties, the winning essays and three others deserving of honorable mention, were read and prizes of $15, $7.50, and $2.50 in gold were distributed personally to the three prize winners. The entire subject seemed to be entertaining and educational, and proved to be a fruitful article for newspaper publicity. The association enthusiastically voted to continue the feature at future conventions and increased the amount to be awarded as prizes to $35.

To other associations who may want to adopt the idea, a suggestion is offered. Where practical, it would seem well to refrain from advising the winners before the time allotted on the convention program, but to notify all the pupils that the winners will be announced at the meeting on a certain hour. This would probably tend to attract the pupils and possibly some of their parents to the convention hall where they could become more familiar with their officials, the duties of said officials, and weighing and measuring devices which are usually on exhibition.

The essay awarded first prize in the last contest is as follows:

THE VALUE OF A SEALER OF WEIGHTS AND MEASURES TO A COMMUNITY

There is not in the public service to-day an official whose duties touch more closely the practical side of man's material interests than the representative of government legally termed the sealer of weights and measures. Perhaps one of the greatest values of such an official lies in his ability to satisfy man's innate demand for some power to safeguard his rights, for some one who can assure him he is not being cheated in the everyday exchanges of life. This demand is ingenerated in Adam's descendants who have nursed the fear that they may be the victims of unscrupulous dealers, and suffer, in consequence, the deprivation of that which, according to the terms of the barter, is legally theirs. This nursed grudge of man against man had become so strong that governments in the course of time, for the harmony of society, found it devolving upon them to set definite standards for all measures and weights of value used in the bartering of goods. The duties of such an office loomed so large and the influence so far-reaching, that to-day every local government has provided for an officer upon whom it thrusts the burden of this important responsibility.

He is the common benefactor of the public in general, because the great mass of people must look to him as their intermediary where there is a question of doubtful measure or value. He tests all scales, regulates those which need adjustment, reweighs packed dry goods and food commodities, and examines all kinds of measuring instruments. His work in these various and important capacities renders him invaluable to the community in general, but more especially to the individual, because scales and measuring devices are most intimately associated with the pocketbook of the masses. His jurisdiction extends along the highways to the venders and peddlers whose scales he tests, to gasoline and oil pumps by the roadside where these necessities are dispensed. Even the scales of the jeweler come within the scope of his inspective duties, for in every possible instance where exchange of measurable values occurs he is the protector of the individual and the public against the trickery and fraud of unscrupulous tradesmen.

At least twice a year there is a general examination, and there seems to be no capacity in which his duties as a public servant are of more vital importance or of greater value than that which he fills in the laboratory of the chemist. The life, or at least the health, of many a patient may depend upon the accuracy of the weights or scales in the workroom where the prescription is compounded. Clinical thermometers also fall under his inspection, and it may be that hundreds of people owe not only much of their prosperity but perhaps their continued existence to the sealer of weights and measures.

Since the government has brought into being this most useful of public officials there has been a general advancement in business methods, for weights and measures are fundamental necessities of commerce, industry, and science, and play a most important part in all vital activities of life.

All the more imperative, then, is the need of a well-regulated, thoroughly organized system of recognized standards in the dispensation of materials which involve any form of weight or measure. The value of such a system can hardly be estimated, nor can the service rendered the public by the conscientious official who fulfills with exactitude his multiple duties, be properly measured or appreciated.

Mr. MEREDITH. The State organization in Massachusetts consists of a director of standards, eight inspectors of standards, and six clerks. Among the inspectors, Mr. Dawson, although the junior in years, has had the unique experience of having originally started as one of the earliest clerks and therefore he has grown along with the work and with the office, having gravitated from clerk to inspector, and has become not only the bureau laboratory man but also the clinical-thermometer expert. The idea of these essays by school children is original with him.

The CHAIRMAN. It is very interesting to see how Massachusetts is bringing the young people up to take an interest in the administration of weights and measures. It is a good illustration of what can be done.

COMMERCIAL STANDARDS

By I. J. Fairchild, *Bureau of Standards*

Responding to the question, "What is a commercial standard?" the director of the bureau recently replied, "A commercial standard is a standard that industry wants." The full significance of that reply can be developed only by a close examination of the output and methods of numerous standardization organizations, a subject far too complicated for presentation here. Suffice it to say, however, that the definition is excellent and well worth remembering, as there is every indication that the movement is gathering considerable momentum and will occupy much of the thought of those interested in obtaining for the consumer a full measure in both quantity and quality.

"Commercial standards" are standards which the producers want as a guide for fabrication, which the distributors want to stock, and which the consumers want to buy. The procedure for the establishment of commercial standards is a natural outgrowth of simplified practice, that great movement toward the elimination of waste in industry through the limitation of unnecessary variety or the restriction of needless diversification of types, sizes, colors, etc.

A number of the industries engaged in this primary process toward reduction of waste have found it desirable to establish standards of grade or quality as a part of the program, and have made these grades a part of the corresponding simplified practice recommendations.

Simplified Practice Recommendation No. 16 on Lumber established for the first time nation-wide grades of lumber and identified these grades by special grade marks, a most constructive service to the consumer and, by reflected service, to the producers and distributors themselves.

Builders Hardware, Simplified Practice Recommendation No. 18, with its standard finishes and specifications for many items, has a deeper significance than simplification alone. Similarly, I might mention Vitreous China Plumbing Fixtures, Simplified Practice Recommendation No. 52; Classification of Iron and Steel Scrap, Simplified Practice Recommendation No. 58; and several others.

The demand thus indicated is supplemented by almost daily requests from producers or associations for assistance in placing competition on a more equitable basis by the establishment of a specification or a standard, by further restrictions in an existing specification or by its wider application, and frequently these requests are accompanied by a plea for closer adherence and more rigid inspection.

Industry has long ago sensed the need for the wider application and use of specifications developed and approved by nationally recognized organizations. There are a vast number of organizations, more or less national in character, which prepare specifications or standards either from the viewpoint of the producer or consumer or both. These include the engineering, technical, and professional organizations, fire underwriters, trade associations, large consumer groups such as the railroads, and the United States Government.

It therefore appears that the demand for specifications and standards producing organizations has, to a large extent, been met.

The country as a whole is well equipped for the production of specifications.

Many of these bodies spend large sums in the development of specifications and standards and upon completion distribute them only to members or set a price upon the publication which may restrict its circulation. Others publish them as opportunity affords without regard to uniform style or do not print them at all. Few, if any, are organized effectively to promote and sell the standards for the purpose of bringing about a wider and more universal application.

It seems customary to consider the specification job complete when it has been prepared and published. Many technical organizations have realized for some time that something further should be done to put recommended specifications and standards into actual use, but very little progress has been evidenced along this line. It is believed that the distribution, selling, and servicing of specifications and standards are fully as necessary as the same functions applied to the marketing of any product if full benefits are to be made available to the greatest number of people.

To assist the technical organizations and also the producers and consumers in securing this result, the Bureau of Standards has formulated a general procedure under which nationally recognized specifications may be printed as official publications of the Department of Commerce and promulgated as "commercial standards."

The first step in the procedure is a specific request from some part of industry for the services of the Bureau of Standards looking toward the promulgation of a commercial standard. This service will be extended only upon definite request. Following such request, a preliminary canvass is made to determine the consensus of opinion regarding advantages and benefits of promulgating such commercial standards and the probable amount of cooperation which may be expected.

If there is ample prospect of full cooperation, a preliminary conference is arranged to survey available standards or to delegate the work of making such a survey. Occasionally this survey may be unnecessary, when it is demonstrated that a given specification is so generally acceptable that it logically forms the basis for consideration as the commercial standard in its field.

Acting upon the recommendations of the preliminary conference or the survey committee, an agenda is prepared for a general conference of industry, including producers, distributors, and organized consumers. Said agenda is then referred to the proper technical division of the Bureau of Standards for review to insure compatibility with present trend of progress in the art, or with recommendations resulting from research or tests, as well as recommendations supported by various technical societies. When this review has been completed and adjustments made as circumstances warrant, the agenda is then submitted to the committee of industry for review and authorization to call a general conference of all interests.

Following such authorization, the Bureau of Standards then forwards the agenda to all known manufacturers, distributors, and organized consumers, with an invitation to attend a conference at a specific time and place, usually Washington, D. C. This general conference considers what action is feasible and desirable regarding

further distribution, broader promulgation, and application of the recommended standard, and votes to establish it as a commercial standard.

The Bureau of Standards then disseminates the recommendations of the general conference with requests for written acceptances from each unit of the whole industry, including manufacturers, distributors, and organized consumers. We do not take the word of the representatives that the general consensus is final. Frequently those representatives find on returning home that their ardor has cooled somewhat and they may not be able to accept, so we ask for these written acceptances to make sure that they represent a substantial majority. Upon receipt of signed acceptances representing a satisfactory majority of production or consumption of a commodity by volume, the recommendations are published in uniform style as "commercial standards" and issued to all interested groups.

When approved by the industry, a certification plan is employed in connection with commercial standards by which manufacturers may certify to the consumer that their product is made in accordance with the commercial standard, thus assuring the small consumer that goods purchased will comply with the specification, without the necessity of his employing laboratory tests to prove the fact.

Provision for regular revision is made by the appointment of a standing committee to consider periodically any necessity for revision or extension of the commercial standard, in order that it may be kept constantly compatible with the progress in the art.

With the cooperation of the Bureau of Foreign and Domestic Commerce an opportunity is provided for the translation and official publication of the commercial standards in other languages as a basis for the extension of foreign commerce through our foreign trade representatives, particularly in those fields where potential foreign markets are known to exist.

You who have cooperated in the work on weights and measures have a better understanding than most groups regarding the activities of the Bureau of Standards. You realize fully that we have no legal authority to impose our will upon any section, group, or industry; that we desire no such authority; and, further, that the present progress toward uniformity of weights and measures regulation is largely a result of voluntary cooperation on the part of weights and measures officials of the various States and municipalities.

Similarly, in the establishment of commercial standards the bureau relies entirely upon cooperation, and in this field makes no suggestions relative to the standards except upon special request for advice.

Broadly speaking, the aim is to continue the same character of cooperative service in this field that is being rendered in simplification. The commercial standards unit is not designed to act as a standardizing body, nor to engage in the preparation of specifications. Its service is mainly promotional in character, since its chief mission is to get behind a standard or a specification which any industry or its related groups may want to promulgate on a nation-wide basis; to determine its eligibility for promulgation; to publish and broadcast it in the event the prerequisites of procedure have been met, including a satisfactory majority acceptance; to facilitate the

application of the certification plan for the assurance and convenience of the small purchaser; to provide means for periodical audits of adherence; and to cooperate with the Bureau of Foreign and Domestic Commerce in determining the desire of industry relative to translation and promulgation of such specifications as a basis for foreign commerce.

In order that you may carry away a fairly definite idea of this work, it might be well to go into at least one of the projects in some detail.

For this purpose we might select a commercial standard now in process of receiving final written acceptances, which may particularly interest weights and measures officials. This has reference to clinical thermometers. About 2,000,000 of these are sold annually in the United States, according to the best estimates. All of you are familiar with this instrument used by physicians, nurses, and mothers for registering body temperatures, and upon the accuracy of which the proper diagnosis of disease, and even life or death, may depend.

The commercial standard which has been drawn up by a committee of manufacturers, working in close cooperation with the Bureau of Standards, is more specific on performance requirements than that now in use for the purchase of this commodity by the Federal Government. The commercial standard provides tests to eliminate thermometers having important defects, the most prominent of which may be summarized as follows:

(*a*) Retreaters—those that do not hold their reading.
(*b*) Hard shakers—those which it is impracticable to shake down by hand.
(*c*) Short scales—where the graduations are too close together.
(*d*) Poor pigment—that which is removed by ordinary disinfectants.
(*e*) Entrapped gas.
(*f*) Inaccuracy.
(*g*) Not properly aged.
(*h*) Identification—a thermometer is a separate and distinctly individual instrument which should bear the maker's name and trade-mark and a serial number for complete identification.

The commercial standard proposes that every individual maximum self-registering thermometer sold or offered for sale to measure body temperatures shall have met all of the requirements therein specified, and shall be accompanied by a certificate which shall include the following statement:

_____
(Place) (Date)

We, the undersigned manufacturers, hereby certify that our registering clinical thermometer marked No. — will meet all of the requirements and tests as specified in the United States Department of Commerce Commercial Standard CS1–28 for Clinical Thermometers.

_____
(Company)

This commercial standard is indorsed by practically all of the manufacturers, the American Hospital Association, the National Association of Retail Druggists, the National Wholesale Druggists' Association, and many others, and it is expected that printed pamphlets will be issued within the next few months and given wide distribution. The manufacturers have also requested that the standard be translated into Spanish and Portuguese to assist in the development of foreign markets for this commodity.

Another commercial standard, sponsored by the National Association of Dyers and Cleaners, which has been disseminated for written acceptance, covers a petroleum distillate known as "Stoddard solvent" in use by dry cleaners throughout the country. This commercial standard, comprising a complete specification and methods of test, is designed mainly to reduce the fire hazard and at the same time to control unsaturated hydrocarbons so as to eliminate residual odor in garments after cleaning. The specification was prepared with the close cooperation and full indorsement of major oil refiners in the United States.

Still another commercial standard which has been circulated for written acceptance covers chain-link fence, copper-bearing steel, galvanized after weaving, a high-grade industrial and institutional protective fence.

General conferences have been arranged for two other projects in the commercial standards field, one on porcelain (all clay) plumbing fixtures popularly recognized under the titles of kitchen sinks, lavatories, laundry trays, bathtubs, etc., and another on steel pipe nipples. Approximately 26 other projects are in various stages of initiation and formulation.

You have doubtless noted that the main object for most of these projects is certification, by which the consumer may be assured of a minimum dead line below which quality shall not be permitted to fall. Lists of "willing to certify" manufacturers—that is, manufacturers who are willing to certify that their product complies with all requirements and tests of the commercial standard—are prepared by the Bureau of Standards and distributed to anyone upon request. The form and method of issuing certificates is left to the discretion of the individual manufacturer or the industry, and may be limited to specific shipments, may be carried on the invoice or label, or may be covered by a trade-mark used on the goods and supported by sufficient national advertising to establish its significance.

We are asked, "What police powers has the Bureau of Standards in connection with these certificates?" The answer is, "None." The bureau has no police powers in this regard and desires none. The certificate is directed from the producer to the consumer, and the Bureau of Standards assumes no responsibility in connection therewith. This does not mean, however, that certificates are not enforced, for in many cases manufacturers' associations will police the industry for compliance with the certificates and take such punitive action as may seem practicable or desirable, such as withdrawal of license for use of trade-mark, moral suasion, or reporting to the Federal Trade Commission in the event this becomes necessary as a last resort.

The consumers, too, assist in checking the certificates, particularly consumers who buy in sufficient quantity to warrant laboratory check or who employ their own inspectors for this purpose. For instance, the National Association of Dyers and Cleaners, representing consumers of Stoddard solvent, plans to check deliveries of this material and to issue to their members lists of producers known to comply with the commercial standard. It is clear from even a cursory examination of this plan that producers who expect to continue in business will not dare to issue fraudulent certificates.

Another question, "Why should the Government assist?" may be answered by reference to several public statements by the Secretary of Commerce, because these statements epitomize the best thought of our time relative to the subject and illuminate the proper relation of government to industry in this connection.

(1) "The public mind should be turned off national legislation as a remedy for all ills."

(2) "The arm of the Government can not operate to restrain evil without bringing about some instances of oppression."

(3) "The safeguard against invasion of government in business is that abuses shall be cured outside of government" (by vountary cooperation).

(4) "National character can not be built by law. It is the sum of the moral fiber of its individuals. When evils which arise from our growing systems are cured by live individual conscience, by initiative in the creation of voluntary standards, then is the growth of moral perception fertilized in every individual character."

(5) "With vision and initiative, then, voluntary forces can accomplish more for America than any spread of the hand of government."

(6) "The Government can best contribute through stimulation of cooperation with voluntary forces in our national life, thus preserving the foundation upon which we have progressed so far—the initiative of the people."

A PERIODICAL ON WEIGHTS AND MEASURES BY THE SEALERS' ASSOCIATION

By A. W. Corwin, *Sealer of Weights and Measures, County of Alleghany, N. Y., and Editor, Weights and Measures News*

The subject of this paper relates to a monthly periodical issued by the New York State Association of Sealers of Weights and Measures. Also, at the request of Secretary Holbrook, some information will be given regarding a similar publication issued by the Michigan State Sealers' Association. This is due to the fact that Will McGillivray, of Oscoda, Mich., who is the editor, is unable to be present at this conference.

It is an old saying that "The pen is mightier than the sword." Whether the pen is mightier than the test weights seem not to have been recorded, but if properly wielded the two will work well together. The New York State and the Michigan publications were started about the same time in November, 1926, and it is a significant feature that each originated independently, to fill a similar need, and both are at the present time continuing with apparently no thought of signing off.

The little publication issued by the New York State Sealers' Association should be regarded somewhat as an amateur effort, being edited by one of the sealers during evenings and at spare times, and the cartoons drawn by a young man who is a sophomore in college. The general purpose of the bulletin, or news letter, as it might be termed, is to increase the efficiency of the weights and measures work as follows:

By giving to the sealers all the information possible regarding their work.

By furnishing a medium for free exchange of the ideas of the different sealers—a "melting pot" of ideas, as we might say, to get the best from them all; for every sealer, we believe, has discovered in the endless multitude of details of his work something that would be valuable to the other sealers.

By continuing to give to the sealers throughout the year the inspiration and help of the State association.

By arousing and maintaining interest in our annual meetings and in the national conference.

The publication was named the "Weights and Measures News," a title broad enough to cover future development if it becomes desirable. It consists of from 6 to 12 mimeographed sheets, 8½ by 11 inches, single spaced. On the cover each month appears a cartoon or picture of some phase of the sealer's work, and a list of contents. It is believed that quite a share of the success of the publication is due to these cartoons on the front page. (At this point Mr. Corwin exhibited cover pages from several issues of the Weights and Measures News and a copy of the Michigan Sealers' Bulletin.)

It was feared by some that there might be a lack of news material after the first few issues. Experience during 19 months has developed no difficulty of this kind, and with the rapid development of weighing and measuring devices there is not likely to be a shortage of worth while material for a publication of this kind. It has been the policy to include only the information that the sealers do not get in any other way. The contents include an editorial on some phase of the weights and measures work and notes from the State bureau of weights and measures, furnished by the director, a digest of newspaper clippings pertaining to weights and measures from the papers of the State, a question box, letters written by sealers, etc.

We try to present the facts in an optimistic way; if a cloud has a bright side we try to look on that side. Of course no space is given to the airing of personal grievances. The general policy is constructive and we try to work in harmony with and help those who are really trying to make progress in the weights and measures work. The reason for making the publication a monthly rather than bimonthly is partially psychological, in that the lapse of two months is believed to give too much time for those responsible for its publication and the readers to lose interest. Also current items preserved for nearly two months could hardly be called news in this speedy age and would not go well with our title.

The publication is mailed to every sealer in the State whether he is a member of the association or not. No subscription is charged and no paid advertising is accepted. The expense is paid by the association and has amounted to about $175 per year. This of course does not include compensation for the editor.

Some would undoubtedly like to know what relations exist between the publication and the State bureau of weights and measures. A quotation will be given from a letter by Director Charles J. Reynolds of the State bureau:

I have received the Weights and Measures News issued by the State Sealers Association of New York State and want to compliment you as editor of same on its first and maiden edition. I will state if you continue along the same lines, that I do not know of anything that has happened in reference to the State Sealers Association in the past which will be more of a benefit and means of bringing them together.

The very best of cooperation has continued to exist with the State department.

Hon. Berne A. Pyrke, commissioner of the New York State Department of Agriculture and Markets, of which our bureau is a part, wrote on September 27, 1927:

I feel that I should write you expressing the pleasure which I derive in reading the monthly issues of the Weights and Measures News. While the preparation of this paper is no light task, I am sure that the time spent is productive.

It is important that there should be an interchange of information between the various sealers, in order that a harmonious and well-coordinated policy should obtain throughout the State. It is also important that all of the local sealers should have the benefit of any items of value developing in this department.

I am sure that Director Reynolds will take pleasure in keeping you informed as to all transactions of interest.

The cooperation given by the individual sealers has been very good. One sealer said: "We look forward to the coming of the Weights and Measures News more than any other paper that we receive. We keep every copy and read them over again when we have time during the winter." Another said: "It seems like getting a letter from an old friend."

The actual results obtained are of course difficult to estimate but probably are greater than show on the surface. By the very nature of their work many of the sealers are isolated from others in the same line of duty. The good results of their work are not always easy to see and extra effort often does not seem to be adequately rewarded. Working alone month after month it is the easiest thing in the world to get into a rut in the way of doing work and to get discouraged. A cheering bulletin coming to him once a month containing letters from men in the same line of work, telling how they solve their problems which are also his problems, may be like a ray of sunshine through a clouded sky to that man, helping him to be a more useful public servant, worth more to himself and his family, and happier in his work.

The following quotation is from a letter by Will McGillivray, of Oscoda, Mich., who is the editor of the Michigan Sealers' Bulletin:

In regard to the practicability of the plan we are following in issuing the bulletin: Briefly the Michigan Sealers' Bulletin is published by the Association of Sealers of Weights and Measures as a medium of exchange of ideas and assistance in cooperation for those who have to do with the commercial standards of the State.

A feature of the little publication is a directory of associate members, which membership at present is made up of about a score of scale, pump, and measure concerns. The publication of this directory in the bulletin is complimentary. No paid advertising is accepted. We endeavor to stress the fact that the privilege of associate membership is accorded all those who have interests in common with the aims of the association.

The publication is compiled and printed by a State inspector of the bureau of foods and standards, who does this work in connection with his other duties, so the cost is nominal. The officers of the association and others have taken an interest in the bulletin and as a result it has met with some favor. Of the last two issues approximately 250 copies have been mailed.

The first three or four issues edited by the secretary of the association were typed and the typing and mailing was done in the office of the State department. This was very satisfactory, but it was seen fit to discontinue this method.

In a former letter Mr. McGillivray writes:

We have an arrangement whereby the editor does all the work, both mechanical and otherwise, so that the cost is much less than it would be in the regular way. Ordinarily this would be about a $35 job of printing for each issue.

The Michigan Sealers' Bulletin is printed bimonthly and contains in addition to articles on weights and measures other items of current interest. It is well edited, nicely printed, and the Michigan Sealers' Association is to be congratulated on the success of their publication.

APPOINTMENT OF COMMITTEES, AND ANNOUNCEMENTS

The Chairman. The Chair appoints the following committees:

As the committee on resolutions, Howard S. Jarrett, of West Virginia, chairman; H. N. Davis, of Vermont; Albert B. Smith, of Pennsylvania; J. H. Meek, of Virginia; George W. Mahn, of Saginaw, Mich; Edward J. Maroney, of New Haven, Conn.; and William A. Payne, of Monroe County, N. Y.

As the committee on nominations, William F. Cluett, of Chicago, Ill., chairman; Francis Meredith, of Massachusetts; V. A. Stovall, of Texas; Harry S. Provost, of New Jersey; and Charles M. Fuller, of Los Angeles County, Calif.

There is another item which is of considerable importance which the Chair has been asked to bring to your attention at this time. You remember the paper given on Tuesday afternoon on the investigation of transmission drives for taximeters. The suggestion is made that opportunity be given at this time for expression of opinion on this question of the taximeter drive. The question will be taken up by the committee on resolutions, but if there are suggestions from the floor to be made to that committee, the Chair would be glad to hear from anyone on that subject. That is, with the permission of the conference; it is a little out of order. [After a pause.] If there are no suggestions from the floor that question will be taken up when it is reported by the committee on resolutions; then there will be an opportunity, of course, to discuss the resolutions.

(At this point J. Harry Foley, first vice president, assumed the chair.)

REPORT OF SPECIAL COMMITTEE ON CONSTITUTION AND BY-LAWS, AND DISCUSSION THEREON

The Acting Chairman. The next order of business, ladies and gentlemen, is item No. 16, the report of special committee on constitution and by-laws. I might say for your benefit that I was chairman of that committee, and I have asked the secretary of the conference to read the report.

Mr. Holbrook (reading):

Report of Special Committee on Constitution and By-laws

We, the committee on constitution and by-laws, make the following report, which is concurred in by a majority of the said committee, to this the Twenty-first National Conference on Weights and Measures.

The committee have studied the history of the question from its inception and have concluded that the introduction of the matter has tended toward the disruption of the conference and the destruction of that harmonious spirit which ordinarily existed and which we now enjoy in the operations of the conference.

Secondly, we are of the opinion that, since the duties and functions of the conference members are primarily administrative and of a regulatory and control nature, the conference is an administrative body and therefore needs no constitution and by-laws to direct or control its activities.

Thirdly, we are convinced that the adoption of a constitution and by-laws would not improve in any way the good will, high standard of efficiency, and harmonious functioning which the conference now maintains, and, on the contrary, it would lend itself to the building of a political atmosphere and the direction of attention away from the actual work for which the conference was organized. It is through the holding up before the various jurisdictions of the real and vital purposes and activities here that we are able not only to obtain the attendance here but to continually increase in adding new jurisdictions to our membership.

In view of these considerations we find no constitution and by-laws which would be conducive to the best interests of the conference and recommend that the conference continue as it is now operating. Further, we are of the opinion that the committee can not be of benefit to the conference in any other report and request you to dismiss the committee.

Respectfully submitted.

(Signed) J. Harry Foley, *Chairman*,
H. L. Flurry,
S. T. Griffith,
Wm. F. Cluett,
Committee on Constitution and By-laws.

Mr. Griffith. Mr. Chairman, I move that the report of the committee be approved and adopted.

(The motion was seconded.)

The Acting Chairman. You have heard the reading of the report of the committee. It has been moved and seconded that the conference adopt this report and accept it in its entirety.

Are you ready for the question?

Mr. Maroney. Mr. Chairman, I have no objection to accepting the report of the committee, but heretofore there has been a sort of an unwritten law here that your executive officers should be taken from a certain element—namely, State superintendents—and that the bone and sinew of this organization were not eligible for such positions. Is that so, that we can not take them from the rank and file—the subordinate membership of this conference?

The Acting Chairman. I have not heard of any such rule since the operation of this conference. Maybe the secretary can advise me as to any rule that calls for executive officers to be taken from State organizations.

Mr. Holbrook. That is a question which is entirely in the hands of the committee on nominations. There is no law or rule of the conference to that effect. The present treasurer of the conference is a city official, Mr. Austin, of Detroit.

Mr. Maroney. There was a ruling that no one could act as first or second vice president who was a subordinate. That ruling is important.

Mr. Holbrook. I do not know of any such ruling.

Mr. Maroney. That satisfies me.

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

REPORT OF SPECIAL COMMITTEE ON LEGISLATION, PRESENTED BY EDWARD J. MARONEY, CHAIRMAN

Mr. Chairman, a year ago this conference authorized that a committee be appointed by the chair to draft a bill and secure its introduction into Congress to provide for Federal serialization of

type of commercial weighing and measuring devices manufactured, sold, or used in the United States, or imported into the United States, this power to be exercised by the Bureau of Standards.

Bills formerly introduced into Congress were gathered together by your humble servant down in New Haven, Conn., and a new bill closely resembling the most recent one of these, which was introduced several years ago at the request of the Scale and Balance Manufacturers' Association, was prepared, and this was mimeographed and sent to every industry that was on the mailing list of our conference. I have replies which I propose to turn over to our secretary from some forty-odd corporations throughout the country.

I personally gave that bill to Congressman John Q. Tilson in New Haven and requested him to introduce it, and the Bureau of Standards and its officials had nothing to do in regard to its introduction in Congress.

To my surprise and consternation, after the bill was introduced in Congress, I found that we had self-appointed conservators over us in the form of an institute of weights and measures in New York City. They have even advised you by letter that in future they will be your conservators and protect you against this octopus, the Bureau of Standards—that they will take care of your jobs.

I want to say we are quite capable of cleaning our own house; and we have enough friends so that if it is necessary to have a conservator appointed they will take it to the probate court and have it done legally without the assistance of this institute.

May I also say that there is a gentleman in Boston—I hope he is here, because I would delight to say what I have to say, openly to him, but if he is not here I hope he will get the message—who has sent out that "bluebook" and some other articles that I very strongly resent. I want to say to him that if quoted properly in these articles he grossly and willfully misstated the facts when he attacked the officials of the Bureau of Standards. Prominent among those who would naturally be thought of in this connection was our late Louis A. Fischer, who died the same as any boy who went across the water and was shot—who fell on the street due to pernicious anemia resulting from overwork in the ordnance department of the War Department. Another such former executive of this bureau, the director, was taken away from us and is now the president of the Massachusetts Institute of Technology at Boston. Doctor Stratton was so big when he went to Massachusetts and attained his citizenship there that the governor of the State appointed him as one of the three citizens of that great Commonwealth to make up the committee to review the famous Sacco-Vanzetti case. That is how these men are thought of in the East, and it is high time that we ourselves took the initiative and told the world, and told these people, that we have confidence in the officials of the Bureau of Standards; and that we can take care of our own house and clean it if necessary.

I will not go any further into this, but I am submitting these letters, dated, signed, and sent to me, all in refutation of the false statements that the Bureau of Standards, or any official of it, had anything to do with the introduction of that bill into Congress. I thank you.

The Acting Chairman. Members of the national conference, I want to say, in passing, that I accept Mr. Maroney's report in the spirit in which he gives it, in the name of the conference; and I want to say that it is an excellent report and shows that Mr. Maroney has the interest of our conference at heart.

I thank you, Mr. Maroney.

AMENDMENT TO SECTION 21A OF MODEL STATE LAW

Mr. Holbrook. Section 21a of the model law reads, in part, as follows:

> It shall be unlawful to sell, except for immediate consumption on the premises, liquid commodities in any other manner than by weight or liquid measure, or commodities not liquid in any other manner than by measure of length, by weight, or by numerical count, unless otherwise agreed in writing by the mutual consent of the buyer and seller * * *.

At the time that that section was adopted a number of years ago the words "unless otherwise agreed in writing by the mutual consent of the buyer and seller" were added because some of the members of the conference feared that the legislation would be unconstitutional unless written contracts were exempted in this connection.

Now, the subject matter of the section—the method of sale of commodities—is very important, and it has seemed to a great many that the special proviso that the prescribed methods could be suspended by written contract, should not be included.

I think that we now have laws in enough States requiring specific methods of sale to make it reasonably certain that the courts will hold it is a proper function of the State legislature to determine how commodities shall be sold, whether by written or oral contracts, and that there is no necessity for making that exemption.

In reviewing this section before Handbook No. 11 was published it was decided that those words might well be eliminated, and in that section attention is called to the fact that this matter will be presented to the twenty-first conference.

Therefore at this time I move that in section 21a of the model law there be stricken out the words now appearing, "unless otherwise agreed in writing by the mutual consent of the buyer and seller."

Mr. Flaherty. I second that motion.

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

Mr. Holbrook. I might call attention to the fact that there is a supply of copies of three reports of the committee on specifications and tolerances on the desk, relating to matters which will come up to-morrow. If any delegates do not have copies of these and desire to study them before the questions are presented on the floor, they are here for you.

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

(Thereupon, at 12.35 o'clock p. m., the conference adjourned to meet at 10 o'clock a. m., Thursday, May 24, 1928.)

FOURTH SESSION (AFTERNOON OF WEDNESDAY, MAY 23, 1928)

TOUR OF THE LABORATORIES OF THE BUREAU OF STANDARDS

(The afternoon session of the conference comprised a visit to the various laboratories of the Bureau of Standards, with particular attention to the activities of the division of weights and measures. Delegates and guests were conducted in small groups, each under the guidance of a member of the bureau staff.)

FIFTH SESSION (MORNING OF THURSDAY, MAY 24, 1928)

The conference reassembled at 10.28 o'clock a. m., at the Bureau of Standards, Dr. George K. Burgess, president, in the chair.

The CHAIRMAN. I am very sorry, indeed, to have to announce that the Secretary of Commerce finds it impossible to be present to-day. He extends you his best wishes and congratulations on the splendid conference that you are having, but he finds it absolutely impossible to be with us.

WEIGHTS AND MEASURES ASPECTS OF CHAIN-STORE OPERATION

By O. C. ADAMS, *President, Southern Division, The Great Atlantic & Pacific Tea Co.*

Mr. President, ladies, and gentlemen of the conference, the officers of our company consider it a great honor to have been asked to come here and participate in this meeting. Weights and measures are a very important part of the conduct of our business. We are here because we welcome every opportunity to cooperate with the weights and measures officials in perfecting commercial practice to promote uniformity and freedom from error.

Weights in the sales of groceries are displacing the use of measures as an indicator of quantity; and the sale of commodities in sealed packages, packed in small units in quantities by machinery, has simplified distribution, eliminated waste, protected the product, and saved repairs on counter scales by reducing their use, and by adequate supervision the packer has improved the general quality of products and the accuracy of weights. We favor extending the practice to the sale of butter. Loose liquids are just as rare in our stores as loose dry commodities, for these also are generally favored when packed in the legally labeled, easily distributed units.

Our weighing equipments are not approved for purchase until the claims of responsible makers are given consideration. Experiments and painstaking study are made of type and accuracy. The assumption that the errors of weighing due to defective scales all favor the seller is wrong. If small leaks sink a ship, large leaks will hasten the operation; therefore, it is in the interest of the grocery business as a whole, and all concerned, that haphazard ways, rule of thumb methods, and everything slipshod are not tolerated in the operation of our stores.

Through systems of monthly stock taking and weekly reports we are able to judge efficiency, and the equipment of the stores is under a system of competent inspection. Almost everybody knows that the heaped-up, pressed-down, and running-over measure, and the baker's dozen have been shot to pieces by competition and efficiency. Provisions for exactness are in force in which if differences occur they

usually favor the buyer. The laws enacted and now in force to detect the tricky and unscrupulous, we consider protect us as well as the consumer. When all is said that can be said, in the last analysis the success of the chain store depends upon the loyalty and honesty of the men who manage the stores and who are intrusted with the sale of the goods and individual care of the equipment. We believe they are trustworthy and we have confidence in them. Every incentive to fair dealing is given—steady employment, living wages, life insurance, thrift encouragement, reduced working hours, and experienced supervision. Square dealing is exalted and the avenues of distinction in the company service are wide open. In our land, where honesty is the rule and real badness the exception, we frequently hear that everybody cheats, but it is not true, and we do not hesitate to say so after over 69 years in the line.

It is true that in times of peace armored cars are employed to guard the transport of money from place to place, but recently we had an example of one of these cars in some strange manner losing a very large sum of money en route. This was found by a poor man out of employment and returned intact to its owners. Honesty is everywhere; dishonesty is controlled. A breeder of dogs has stated that the females of a type were noted for the large number of their offspring and that the puppies varied in their characters. In some of them a wolf strain developed which was detected by their manner of drinking. Those which were thought worthy to be raised, lapped with their tongues in the manner of dogs; others sucked the fluids without lapping with their tongues, and were mercifully drowned in the interest of the public at large and the purity of the strain. Amid the extension of business and growth of population some attributed it to glands, others to cussedness. Badness may come, but we must wait for it to appear before we can punish it, having adopted every measure in reason to discourage it.

Primarily the policy of honest merchandising and fair values established by the company a great many years ago is lived up to rigidly as far as the president, board of directors, supervising forces, and organization down to the managers are concerned, and practically without exception managers and clerks who have been with the company for only a short training period, have this policy thoroughly drilled into them by the older managers and supervising force, who train them before they are allowed to wait on customers in stores.

In the second place, in order to be sure that no consideration of personal gain can enter into the minds of these men, we take the primary incentive away by paying better than a living wage.

It comes down to this point, then: What can we do to minimize the only other sources of possible short weights to customers—that is, human errors?

In the first place, to be certain to allow for the normal shrinkage that takes place in such items as potatoes, apples, onions, and similar bulk merchandise, we bill the stores at anywhere from 2 per cent to 10 per cent less than the original weight. In the case of marrow beans, pea beans, and bulk corn meal purchased by us in hundred-pound bags, we bill our managers for 99 pounds. New potatoes at the present time, which we buy in 165-pound barrels, we bill to our

managers at 160 pounds. Onions, which we buy in 100-pound sacks and 50-pound sacks, we bill to our stores at 95 and 45 pounds, respectively. Weights must be checked by the manager on receipt in his store and credit taken for any shortage above this amount, which, of course, we allow on the approval of the supervisor. It would be a splendid thing for us, and one which we are constantly striving for, if all our merchandise could be sold by the pound. I believe we have been the pioneers in selling bananas by the pound. We find that we have better satisfied customers when we sell them cabbage, turnips, onions, apples, and similar vegetables and fruits by the pound where the size is not graded. Oregon box apples and other graded fruits we, of course, sell by the dozen. We are obligated in a great many instances to follow local customs in this respect, but nothing could please us more than a uniform method of selling all of this merchandise by weight all over the country.

We touched briefly on the matter of credits. This is our method of allowing our managers to protect themselves against shrinkage in the stores, of merchandise that becomes unsalable, and any other possible shrinkage that the manager could have. It does two things: It stops any thoughts on the manager's part that he must cover himself by taking petty advantages of our customers; and you all know we could never be in business or build up the business we now enjoy, if we had allowed in any way these things to exist. In the second place, it allows us to determine more accurately the allowances for shrinkage that we should expect in the distribution of our more perishable merchandise, and gives us an accurate determination of the cost delivered over the counter to our customers.

Our organization is such that each store manager has his immediate supervisor visiting him in the larger cities at least once a day, and in our more scattered country territories not less often, as a general rule, than twice a week. It is the duties of these assistant superintendents, as they are called, to see that the scales and other store equipment are in proper working order, to inspect the merchandise for which credit has been taken because of short weight when received by the store manager, to allow credits for these short weights and other shrinkage that may occur, primarily, as you can see, because we must be sure, if we are to continue to hold our trade, that everything in our stores must be not only fit for consumption, but attractively good to eat.

It is necessary for us to weigh up in advance a great many articles, such as sugar, potatoes, beans, bulk corn meal, and other articles, depending on the size of the store and the popularity of the product, for our very heavy week-end business. We are particularly careful to furnish periodically copies of the State laws affecting the stamping of these packages with their net contents, etc., and this is done by means of follow-up letters from our office. In some cases, the States have printed cards which we are glad to use and which are usually tacked on the backs of our ice boxes so that the manager can have this constantly before him for ready reference. Our supervisors make it a practice to check up the weights of these weighed-up packages under the counter. I am very glad indeed to say that cases where we find the manager has intentionally put short weight in these packages, are very rare exceptions. Occasionally we do find men of

this type and, of course, their services are dispensed with. We owe our thanks for the discovery of several of these men to the local weights and measures inspector and we can assure you we deeply appreciate such cooperation. I think you will bear me out that we act quickly in a case of this kind. Our assistant superintendents check up the weights of weighed-up packages, the accuracy of scales, and the proper functioning of all of our other store equipment, the manager himself, of course, being the first one to report if there is anything wrong, as is natural for his own protection.

The subject of correct weights and proper functioning of store scales is a subject that is brought up weekly at the meetings of the assistant superintendents and field supervisors. In addition to this follow up by the supervising force we make it a point to remind the store managers through the medium of the letters they receive daily from the sales departments, of the basic policy of our company of square dealing, by impressing upon them that 16 ounces to the pound is the standard by which we conduct our business. For example, I have here a letter sent to our managers in Philadelphia under date of April 8, which reads as follows:

> Since our letter of a few days ago, we have had occasion to dismiss a manager who was not abiding by the company's policy of 16 ounces to the pound. Regardless of length of service or past performance, any manager who can not abide by his company's policy in this connection will be immediately dismissed. This is a final and definite ruling.

The manager referred to was, of course, an exception to the rule. I quote this merely to show you how strongly we try to impress our men with the ideas of strict honesty in weights and measures.

(At this point the speaker addressed the chairman.)

I am only going to touch briefly on the broad aspects of your department's splendid achievements in its campaign to eliminate waste. We can only say that we are enthusiastically behind your department and the other departments of the Government that are cooperating with you in this campaign. Last year we were very much pleased to follow up the recommendation of the Department of Agriculture, and I believe your recommendation, also, in connection with the odd-sized packages of sliced bacon and sliced beef, and discontinued them, and adopted the suggestion that the trade in general pack these two products in even fractions of a pound. And any further references or suggestions in this direction will be tremendously appreciated.

Any distributor of foods who seeks to advance his sales or the size of his markets must conform to the highest standards. Development is impossible if it is shackled to mediocrity. The A. & P. can point with pride to the confidence and respect built up by years of square dealing.

In closing, we thank you again for the eminently fair, honest, clean-cut way in which your local weights and measures representatives assist us in solving these problems. Quick action is always taken when we receive a report from your men that something is out of the way. I can assure you that nothing pleases us more than to have one of your inspectors give us a clean bill of health at our stores.

The CHAIRMAN. We are certainly indebted to Mr. Adams for his clear, straight-forward statement from the point of view of the dispenser of food commodities.

Is Mr. Lyons, of the American Stores Co., present? (There was no response.) Mr. Lyons was invited and he expected to be here.

REPORT OF COMMITTEE ON SPECIFICATIONS AND TOLERANCES ON SPECIFICATIONS AND TOLERANCES FOR GREASE-MEASURING DEVICES, PRESENTED BY F. S. HOLBROOK, CHAIRMAN

The members of the conference will remember that last year there was a paper given before the conference by Mr. Fuller, of Los Angeles, in relation to grease-measuring devices, a type of apparatus which was being tested in Los Angeles for the first time. Very serious defects resulting in much short measure of grease and transmission oil were discovered by Mr. Fuller, and the results were briefly presented in the paper mentioned.

A motion was then passed to the effect that the committee on specifications and tolerances take under consideration the question of grease-dispensing devices and, if possible, prepare a code of specifications and tolerances to apply to these devices, for the consideration of the conference.

Studies have been made during the year, especially in Los Angeles where the program of testing these devices has been continued and at the Bureau of Standards, where several of the devices were subjected to a very rigid test and investigation, and these data have been placed in the hands of the committee on specifications and tolerances.

The committee went into session last Thursday morning and has been working hard ever since. It has devised a code of specifications and tolerances for these devices which is now being placed in your hands for your consideration.

In accordance with the usual practice of the conference, this code is presented to you for tentative adoption only. It is intended that these provisions be carefully studied, and that their effect upon various devices now in use in the field be determined by you during the year. If so adopted, then in accordance with the usual custom this code will again come before you at the next conference for discussion, amendment, and final adoption.

Respectfully submitted.

(Signed) F. S. HOLBROOK, *Chairman*,
W. F. CLUETT,
A. W. SCHWARTZ,
C. M. FULLER,
I. L. MILLER,
Committee on Specifications and Tolerances.

DISCUSSION OF ABOVE REPORT

Mr. HOLBROOK. As the code is read over you will discover that much of the language used is similar to the language employed in the code on liquid-measuring devices. That seems very reasonable since these devices are not essentially different in their fundamental character from devices used at the filling stations in dispensing gasoline.

Now Mr. Fuller has prepared several lantern slides, and in order to open this matter, and that you may clearly have in mind what is being discussed, it seems advisable at this time to present these lantern slides before the code is taken up. They will be run through rather rapidly and explained very briefly.

(At this point Mr. Holbrook illustrated, by means of lantern slides, a number of devices of the character of those under consideration.)

Mr. Holbrook. Now, the code, a copy of which is in the hands of each of you, will be read section by section. As is usual in these codes, all specifications which the committee is recommending to be nonretroactive after the code is adopted are italicized.

The first item in the code is the definition. [Reading:]

Definition.—A mechanically operated grease-measuring and dispensing device, hereinafter referred to as a grease-measuring device, is a mechanism or machine adapted to measure and deliver grease or transmission oil by volume.

The Chairman. Is it the pleasure of the conference that we take this specification up section by section and then adopt it as a whole after we have finished with each section? As the chair hears no objection, we will adopt that procedure.

(A motion was made and seconded that this section be adopted; the question was taken, and the motion was agreed to.)

Mr. Holbrook (reading):

Specifications.—*1. Permanence. All grease-measuring devices shall be of such design, construction, and materials that they may reasonably be expected to withstand ordinary usage without impairment of the accuracy of their measurement, or the correct functioning of their operating or indicating parts.*

That specification has been recommended to be nonretroactive, because if devices are now in use which are considered somewhat too light to withstand usage over a long period of time, it certainly seems reasonable to leave them in use until they become inaccurate in service.

The Chairman. Are there any remarks on section 1?

(The section was duly adopted.)

Mr. Holbrook (reading):

2. Units of delivery. Grease-measuring devices shall have the following discharge capacities per stroke or per cycle of the primary indicating elements, and these only: One pint, a multiple of the pint, or a binary submultiple of the pint, that is, the quantity obtained by dividing the pint by the number 2 or a power of the number 2.

I would like to say a few words in relation to this: You will note that grease by weight is not considered in this specification. The grease-measuring devices under consideration are all designed to deliver grease by volume; they have no weighing element whatsoever. It is true, however, that in the past a pint has often been presumed to be equal to a pound, and doubtless there are many devices on the market which, while they measure in pints, indicate or register pounds of grease.

I have here a table prepared by the Los Angeles department, in which many greases in use have been included, to show the relations of pints and pounds. This indicates that some greases have been found which weighed 14¾ ounces per pint and other greases have been found which weighed 16¼ ounces per pint, a range between

the lightest and the heaviest greases of about 11¾ per cent. Now such approximations in the sale of grease would, in the opinion of the committee, be indefensible. Therefore, if these devices are graduated in pounds, they must be adjustable, to take care of the particular grease being dispensed at any particular time. That means in general that many grease-measuring machines are adjusted no longer to deliver exact pints but to deliver more or less than a pint according to the weight per unit volume of the grease being dispensed. The means of adjustment provided is often a by-pass. When by-passes are introduced into these devices it seems to be a fact that inaccuracies are also introduced in the registration, because when operated fast or slow, or when operated with a wide-open or a partly closed valve, or when operated at a higher pressure or a lower pressure—the pressure will almost always vary in a portable device—a greater or less percentage of the measured grease goes through the by-pass.

Whether or not it will be practicable hereafter to require the sale of grease by the pint instead of by the pound—the latter method, we understand, is the more popular method at the present time—we do not know; but from the standpoint of the devices in use delivery by liquid measure is certainly preferable.

One other point of importance in this relation is that many of these devices are sealed so that the mechanism can not be tampered with, and doubtless that is a desirable procedure. In such a case every time a change is made from one grease to another having a different weight per pint, it would be necessary to break the seals and readjust the device. The weights and measures official would then be obliged to retest and reseal the device. As a matter of practical enforcement, this would be extremely difficult. Therefore we present to you this proposition, that grease-measuring devices should register in pints rather than pounds so long as volume is the basis of the determination of quantity.

Mr. Sweeney. Mr. Chairman, I would like to ask Mr. Holbrook what effect weather conditions were found to have on deliveries. For instance, how was the discharge of grease from the device affected by cold weather?

Mr. Holbrook. It was found that some were not greatly affected by temperature. Others were seriously affected by low temperature. Some devices in which it was necessary to fill cylinders by means of pistons tending to create a vacuum, sometimes did not operate properly when the grease got very thick at low temperatures. That reminds me of one other argument against the sale of grease by the pound: The weight per unit of volume varies with the temperature.

The Chairman. Is there any further discussion?

(The section was duly adopted.)

Mr. Holbrook (reading):

3. Indication of delivery required. All grease-measuring devices shall be so designed and constructed that the initial zero condition and the amount delivered in terms of liquid measure shall be clearly and definitely indicated by automatic means, and the indications of any delivery shall take place only when the full discharge has in fact occurred.

The Chairman. Is there discussion?

Mr. Townsend. Mr. Chairman, am I correct in assuming that this specification, if adopted, would be retroactive?

Mr. Holbrook. You are correct.

Mr. Townsend. I might say, Mr. Chairman, that there are a great many grease pumps—hundreds and thousands of them—that are in use to-day, and that will be in use a year from now, that could have no indication such as is provided here. This type of device is used by the oil companies, has been bought in huge quantities, and has been more or less broadcast throughout the country. If a year from now this specification were adopted and made retroactive, it would have the effect of scrapping, I dare say, from three-quarters of a million to a million dollars' worth of equipment which would be in the field at that time.

I would, therefore, suggest that this specification, which is undoubtedly a good specification from many standpoints, should take its place with those which are not intended to be retroactive.

Mr. Holbrook. The committee gave that consideration. Next year it is possible that more specifications can be recommended to be made nonretroactive before the code goes into final effect. It may be that some plan can be worked out by which the whole code can be made nonretroactive.

Of course such a device as you mention, which has no registering means on it at all, to my mind is a very questionable one; it may be questioned whether it is a grease-measuring device at all. Certainly a device which shows no registration in terms of quantity is hardly a measuring device in the sense of measuring in terms of any known units; I think it is true that with many such grease-dispensing devices the grease is sold by a unit of measurement of unknown quantity known as the "shot."

It is sold at so much "per shot," meaning one operation of the device delivering an indeterminate amount of grease. In some instances it might be that those "shots" were a pound or a pint, or they might be more or less. Whether those devices are to be left in use depends upon the individual jurisdiction. We can not regulate how the jurisdiction will proceed. If they are satisfied with that method of delivery of grease and are willing to leave those devices in operation during the period of their useful life, that could be accomplished by a ruling that the device is not a grease-measuring device, and therefore does not come under the terms of this specification. There may be other jurisdictions where a so-called measurement of grease made in that manner would be considered unsatisfactory; such jurisdiction will proceed in accordance with the best dictates of its own judgment, I take it. Personally I would rather see this whole code made nonretroactive, but then there remains to be worked out what the various jurisdictions are going to enforce when they get in the field. From the standpoint of the committee, a nonretroactive code would be preferable because the committee is always faced with the decision, often difficult, as to what should be retroactive and what nonretroactive. If the whole thing could be made nonretroactive and the individual jurisdictions left to shift for themselves, I think that would be satisfactory to the committee.

Mr. Sweeney. I notice that the average indicator registers a total of 8 pounds. In case a delivery of more than 8 pounds is made, who is going to settle the dispute between the buyer and seller, one of

whom might claim a delivery of 10 pounds and the other contend that but 2 pounds had been delivered?

Mr. Holbrook. I think few disputes will arise over discrepancies of that magnitude. If they do arise, the arbitration of the sealer of weights and measures may be necessary.

Mr. Antil. The title of this specification is "Indication of delivery required." That is very good, but in these mechanically operated devices which have been sold, may not they show a pint delivered when nothing has been delivered? Is there any means of assuring the customer that he is getting full delivery by volume?

Mr. Holbrook. That is the purpose of the specification. If the indication is incorrect, the device will be condemned on the ground of noncompliance with the tolerance.

Of course, if you have in mind shortages due to exhaustion of supply, that same argument has been raised in the case of liquid-measuring devices in the past—that they will register when the tank is empty. A great deal of careful consideration has been given to that matter, and no solution except observation that the device is not delivering any liquid has been found; the committee is in the same position in the case of grease-measuring devices as in the case of liquid-measuring devices.

Mr. Fuller. Mr. Chairman, in answer to the objection raised by Mr. Townsend, I want to say that it has been possible in the case of devices in the field which have been found capable of delivering accurately, to place an inexpensive indicator thereon which will comply with all of these regulations and will show the customer what he is receiving.

Mr. Townsend. Mr. Chairman, of course, if a specification of this sort is made retroactive and causes the users of this equipment to junk their devices or to buy additional attachments for them, that would be a good thing for the pump industry, in which I am engaged. I say this to show that I have no personal ax to grind in this matter. But the situation is this: Year in and year out people have been permitted to buy that type of equipment, and even now, when we finish this session to-day and have given this code careful consideration, there will be still a year before we adopt it finally. In that year, I suppose, there will be probably a half-million grease pumps sold, which at the end of the year would be immediately condemned and junked if these specifications were not made nonretroactive. I say that is not just. That is not done in any law; no law was ever made retroactive. You can not do that and be fair, and I think this conference, which is a reasonable conference, should be satisfied with the progress which it makes year after year and should not penalize an industry or penalize the public because of the fact that we in this conference did not do this thing 10 years ago. That is the whole thing I have in mind and I would like very much to have the Chair consider a resolution at this time to make these specifications nonretroactive.

Mr. Fuller. Mr. Chairman, the only equipment that will be junked, necessarily, under the requirements of this specification is that which is incapable of giving the customer the full amount he pays for and which can not be provided with an inexpensive indicator. They therefore should be junked.

The CHAIRMAN. Let us consider the case of the State or city setting up for the first time its weights and measures jurisdiction. It certainly will have a lot of material to junk or scrap.

Is there any further discussion?

Mr. HOLBROOK. I might say that Mr. Townsend's contention that no law has ever been made retroactive is subject to certain exceptions that I think Mr. Townsend will readily admit. For instance, suppose a law is passed in a State establishing a department of weights and measures where none has existed before, and the law includes a provision that all milk bottles be accurate. In such a State there would be no disposition to pass inaccurate short-measure milk bottles until they were destroyed in normal course—to pass them during the period of their life. I think such a law would necessarily be retroactive in the case of devices which were not accurate within a reasonable tolerance.

The CHAIRMAN. Is there further discussion?

(The section was duly adopted.)

Mr. HOLBROOK (reading):

4. Sensitiveness. All grease-measuring devices shall be so designed and constructed that they can readily be operated to deliver each quantity for which a graduation, stop, or other indicating means is provided, within the tolerance on such amount hereinafter provided, and a volume of 1 pint shall be represented on the scale or dial by a length of not less than 1 inch.

The requirement that a pint be represented by a length on the scale or dial of not less than 1 inch is recommended, since if a lesser length were adopted a relative movement between the scale or dial and the indicator, equivalent to the tolerance, would be so small that it could not readily be observed, in which circumstance you would have a device in respect to which the weights and measures official would always be in doubt as to whether or not it was correct.

The CHAIRMAN. Are there any remarks or argument?

Mr. HARKS. Mr. Chairman, it seems to me that the 1-inch requirement presupposes the fact that a device will be of the meter type; but I can conceive of a positive-stop piston device, so constructed that at the end of the stroke of the piston a registering device would be operated.

Mr. HOLBROOK. The specification does not presuppose a meter; it has been written with all devices in mind. However, it seems that if a grease-measuring device had a positive stop for each quantity delivered, in such a case accuracy might be attained without the length of scale to a pint required here. There would be no objection to such a device. Therefore it seems that the specification might be amplified so as to specify that an inch travel is required only in devices where the relative movement of an indicator and a graduated scale is the sole or most sensitive means of determining the delivery. I think that would be a reasonable amendment to the specification.

If the committee does not object, I suggest an amendment to the effect that if a device is constructed so that at every point the delivery is determined by the operation of a mechanical stop, then such a device need not comply with the requirement as to the length of scale per pint. Such an amendment can be very easily worked out.

Mr. FULLER. I move the adoption of the amendment suggested.

(The motion was seconded.)

Mr. HOLBROOK. It would be preferable if we were not to be limited to the exact language suggested, but only to the idea expressed in that language.

The CHAIRMAN. If that is agreeable, the amendment will be worked out to cover in principle the statement made by the secretary.

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

Mr. HOLBROOK. I might say that I am not familiar with any such device on the market, but I can readily appreciate that such a device might come on the market. Of course, these requirements, in so far as possible, should cover any new devices which may be introduced; in other words, they should state principles.

(The section as amended was duly adopted.[8])

Mr. HOLBROOK (reading):

5. Constancy of delivery. The amounts delivered by any grease-measuring device shall not vary from the standard by more than the tolerances hereinafter provided (1) irrespective of the speed at which the device is operated, except that in the case of devices operated by air pressure, when operated at an air pressure lower than that specified by the manufacturer, the tolerance shall be applied in deficiency only—that is, the device shall not be deemed to be incorrect by reason of the tolerance in excess being exceeded during such method of operation—and (2) irrespective of the time elapsing between operations. *In the case of all devices operated by air pressure there shall be legibly marked on the dial of the air-pressure gauge, by special graduations or otherwise, the maximum and minimum working pressures recommended by the manufacturer.*

Now in the case of any device which holds a stored quantity of air under pressure, to operate the device, it is the intention that the device be operated within certain limits of pressure, as between 40 and 80 pounds, for instance. Now if such a device were to be operated at 35 pounds, the decreased speed of the delivery may often result in an incorrect delivery. Yet the manufacturer can do no more than to specify the limits within which he guarantees the accuracy of the device, and if those limits are reasonable ones, regulation must be used to detect a man who is operating at an air pressure outside the limits of those specified. Inasmuch as we understand that the result is usually an overmeasure delivery, it is highly improbable that they will be frequently operated in any such way.

(The section was duly adopted.)

Mr. HOLBROOK (reading):

6. Indicating and registering parts. Counters and graduated scales and dials used on grease-measuring devices to tally sales and deliveries to individual purchasers or to indicate the amount delivered when any portion of the cycle or stroke has been completed, shall be of such size and style and shall be so located and disposed that they may be easily read. *The graduations shall be of such character and arrangement that the major ones are more prominent than and are clearly distinguishable from the minor ones. In all types of grease-measuring devices which utilize a graduated scale or dial to indicate the amount of lubricant discharged, the width of the graduation marks shall not exceed 0.04 inch.*

7. *Pointers and indicators. All pointers and indicators which when used in conjunction with a graduated scale or dial, indicate the amount of lubricant discharged shall be so shaped that a correct and accurate indication is given. Such pointers and indicators are required to be symmetrical about the graduation lines at which they may stand and shall reach to the finest graduation marks; the width of the end of the pointer or indicator shall not be greater than the width of such marks.*

[8] The section in its amended form will be found in the appendix, p. 166.

8. Parallax. All grease-measuring devices in which the accuracy of the readings of any indicating mechanism is affected by parallax shall be so designed and constructed as to reduce to a minimum the errors due to this cause.

9. Graduated scales to be secured. When a grease-measuring device is provided with a graduated scale or dial, this shall be riveted or otherwise permanently attached to its supports.

10. Numbering of graduations. Figures defining the value of graduations shall be uniformly placed in reference to the graduation marks and shall be as close thereto as practicable, but shall not be so placed as to interfere with the accuracy of reading.

11. Lettering, graduations. All markings, instructions, figures, and graduations required under these specifications shall be of such size, design, material, and location, and shall be so applied or affixed, that they will not tend easily to become obliterated or illegible.

12. Movement of indicating element. All grease-measuring devices shall be so designed and constructed that the indicating element used in tallying deliveries to individual purchasers shall only be susceptible of forward movement by the mechanical operation of the device itself. The indicating element shall be returnable readily to a definite and clear zero indication before the next delivery is begun. Means shall be provided to prevent the indicating element from being returned beyond the zero indication.

13. Stops to be positive. When stops or other stroke-limiting devices are employed on a grease-measuring device and these are subject to direct pressure or impact in the operation of the device, such stops shall be of such construction that the permanence and security of their positions is provided for by a positive, nonfrictional engagements of the parts whose relative motions are to be prevented. Such stops shall be so designed and constructed that adjustment within the prescribed tolerances can be made.

14. Stop mechanism to be definitely positioned. All grease-measuring devices designed to deliver two or more different predetermined amounts by bringing into operation different stops or other means of defining the delivery, shall be so designed and constructed that the position for the proper setting of each stop is definitely and accurately defined, inadvertent displacement from this position is obstructed, and the delivery for which the device is set at any time is clearly and conspicuously indicated.

15. Provision for sealing. All devices adapted to be altered for adjusting or correcting the delivery of a grease-measuring device shall be of such construction that they can be sealed, either separately or together, in such a manner that the position of none of them can be changed without destroying the seal or seals.

16. Use of adjustments. No adjustment of the delivery of a defined-stroke grease-measuring device shall be permitted except that intended to produce a piston displacement per cycle of 28.875 cubic inches per indicated pint of delivery. Adjustments of piston displacement to correct for leaks, slippage, or other defects shall not be permitted.

17. Assurance of complete delivery. All grease-measuring devices shall be so designed and constructed that there shall be no means provided by which any of the measured lubricant can be diverted from the measuring chamber or the discharge line to the supply tank or elsewhere during the period of operation of the device. All valves in the supply line intended to prevent the reversal of flow of the lubricant shall be of such design and construction that their closure is automatically effected in the use of the device.

(As each of the above sections was read, it was duly adopted.)

Mr. HOLBROOK (reading):

18. Use limited to certain lubricants. Grease-measuring devices which will not give correct results except when used with lubricants having particular properties, shall be conspicuously, clearly, and permanently marked to indicate this limitation.

I understand that many of these devices will handle grease satisfactorily, but require a different setting or adjustment for handling transmission oil, and vice versa.

(The section was duly adopted.)

Mr. HOLBROOK (reading):

19. Fraudulent construction prohibited. All grease-measuring devices and all devices designed to be attached thereto and used in connection therewith shall be of such design and construction that they do not facilitate the perpetration of fraud.

(The section was duly adopted.)

Mr. HOLBROOK (reading):

20. Metric system. No specification contained in the preceding pages shall be understood or construed to prohibit the sale or use of grease-measuring devices constructed or graduated in units of the metric system.

The tolerances to be allowed on any grease-measuring device constructed or graduated in units of the metric system, shall be the same as those specified on similar apparatus of an equivalent size or at an equivalent capacity in the customary system.

That paragraph is always added to our specifications for commercial devices on account of the Federal law which provides that the metric system shall be legal in all commercial transactions.

(The section was duly adopted.)

Mr. HOLBROOK (reading):

TOLERANCES.—Except under special conditions as described in specification No. 5, the tolerances to be allowed in excess or deficiency on all grease-measuring devices shall be ⅝ liquid ounce on a delivery of 1 pint or less; for deliveries of more than 1 pint add ½ liquid ounce per indicated pint: Provided, however, That the manufacturers' tolerances or the tolerances on all new grease-measuring devices shall be one-half of the values given: And provided further, That these latter tolerances shall also be applied to all devices which are being retested after having been found incorrect and subsequently adjusted or repaired.

Those tolerances amount to about 4 per cent on the first pint and about 3 per cent on each pint thereafter. Our investigation seemed to prove that the devices, even those being developed at the present time, can not consistently deliver this commodity much more accurately than that.

Mr. HANNA. In the case of liquid-measuring devices the tolerances are expressed in cubic inches. I know there are still some places where there is confusion between ounces and cubic inches. Would it not be advisable in this tolerance table to use cubic inches for the sake of uniformity?

Mr. HOLBROOK. I think it is an excellent suggestion. We might use both—the number of cubic inches and the amount in ounces.

The CHAIRMAN. That can be added as an editorial correction.

(The section, as proposed to be amended, was duly adopted.[9])

The CHAIRMAN. The question is now on the adoption of these specifications and tolerances as a whole.

Mr. FULLER. I move their adoption as a whole.

(The motion was seconded.)

The CHAIRMAN. The understanding is, as is our usual custom, that these are to be adopted tentatively to come up for consideration for final adoption at the next meeting of the conference.

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

Mr. TOWNSEND. Mr. Chairman, could I ask the committee this question? They contemplate that there are different types of equipment for handling grease. These specifications deal with the type which you call a measuring device. Then there is another type,

[9] The section in its amended form will be found in the appendix, p. 168.

referred to by Mr. Holbrook as the device which delivers grease by "shots"; that is, for instance, in high-pressure lubricating-oil systems. Now these devices are purchased in large quantities and they dispense grease by the "shot." I am wondering if the committee contemplates that it will be necessary to put indicating means on those devices, or whether or not they will continue to be used and grease sold by the "shot."

Mr. Holbrook. I think that is something which the conference will be unable to regulate since I think the decision rests solely with the officers enforcing any particular law. I do not see how this conference can direct any State or local official to allow lubricant to be sold by the "shot," because if he does not think that is a proper method for the sale of lubricant, he will proceed to prevent such sales in his jurisdiction. Frankly, I do not see what the committee can do in that regard. As I see it, it depends upon the decision of the man who is entitled to enforce the weights and measures law as he sees fit to enforce it, for the State, county, or city.

Mr. Townsend. One thing I have in mind, Mr. Secretary, is the fact that in a great many places grease is sold according to a flat rate. You run your car into a garage and they make a flat rate for greasing—so much for the transmission, so much for the differential, so much for the chassis, etc. Now the differential of one car might hold 7 pounds of grease and the differential of another 5 or 6 pounds, but the flat rate is just the same. The man sells the grease and his services; he has to have so much for the time and so much for the material, and in many cases the time is much more valuable than the material, and so they sell it on a flat-rate basis. In such a station the equipment with the indicating means, from the standpoint of the operator or customer, would apparently be without any special benefit, as the rate covers the service and all the grease and lubricant needed to complete the servicing, whatever the amount is.

Mr. Holbrook. Let me say that the committee had in mind, in the first place, that grease devices such as are used in greasing the various cups around the chassis of a car, which deliver only a very small amount of grease at a time, would not be interpreted to be grease-measuring devices. In that case it is undoubtedly true that it is the almost universal practice to make a flat charge for servicing the car—greasing it throughout. The value of the grease used is unimportant; time is the important factor in the charge.

In the case of the filling of the differential and transmission I think that it is the more common practice to charge for the grease at a certain price per pound and to charge nothing for the service. These form two rather distinct types of service; and it is the idea of the committee that the device used in the first type would not come under these regulations; that the device used in the second type would. I presume, however, that if a service station used a grease-dispensing device without indicators and always made a flat charge for filling transmissions and differentials it would be concluded that he was not using a grease-measuring device as contemplated by these specifications.

Mr. Townsend. That is the point I wanted cleared up, because the popularity of the flat-rate system has increased very rapidly; and I think, since we are looking ahead on these specifications, that should be taken into consideration.

THE BUSINESS MAN AND THE WEIGHTS AND MEASURES OFFICIAL

By EDWARD L. GREENE, *General Manager, National Better Business Bureau (Inc.)*

Mr. Chairman, ladies, and gentlemen, before going into the actual topic of my paper it seems that an explanation of our organization itself might be in order.

The Better Business Bureau is an independent corporation supported by local business men, concerning itself with the investigation of advertising and selling matter. The National Better Business Bureau, of which I am a general manager, is the national headquarters of these local better business bureaus, of which there are 43, located largely in the principal cities of the country. Those local bureaus are financed by local firms interested in advertising and selling commercially. Our work has a very wide range, covering many commercial lines, and we have plenty to do. If the weights and measures ordinances were so thoroughly and accurately maintained that the better business bureaus would have no work to do in the way of cooperation, we would still have plenty to do, so that we do not need a job of correcting deceptive uses in weights and measures. We know you are expert in that and you are provided with the proper devices for use in testing these various measuring devices. However, we are interested in the law enforcement, realizing that no matter how well the ordinances are drawn with the idea of protecting the public, unless they are maintained they will not be very effective for that purpose.

Now, in outlining to you what I have to say, I am giving you, I realize, something concerning our local better business bureaus in their contacts with weights and measures enforcement in their particular communities.

The better business bureau movement represented in the National Better Business Bureau and 43 affiliated local bureaus, nationally located, presents an interesting development on the part of business to do its own house cleaning. The bureaus also provide the public with a comprehensive system of protection against fraud and deception. In the main, bureau operation concerns itself with two major fields of business—merchandise and financial. For the purpose of this discussion we will concern ourselves with the functions of our merchandise work and how it attempts to eliminate the deceptive use of false weights and measures. We have by no means covered the entire field wherein unfair practices, through the use of inaccurate weights and measures, may exist, but we have enough information to come to the conclusion that the situation is serious.

We wish at this time to state that we have received splendid cooperation from many of the officials of the weights and measures departments in local bureau cities. Likewise, the national bureau has received splendid assistance from the Bureau of Standards. An interesting side light on our activities in the weights and measures field is that practically all our work has been stimulated by complaints from the commercial world. We find the great mass of dealers are anxious to have regulatory practices established which will prohibit the use of false weights and measures. We are certain that uniform adoption of legislation which has been found by experience

to be practical will get widespread support from business men, thus making the maintenance of such legislation more effective.

We realize there is an infinite variety of possibilities for deception through the use of false weights and measures, and therefore many of the Government staffs will have to be increased to maintain a reasonable check up of such practices. To facilitate the Government staffs the bureaus gladly offer their cooperation.

It is customary for the better-business bureaus to issue bulletins on investigations which they have made, which are informative in character. Some of those are purely technical; their character depends upon the particular cases under investigation.

The Chicago Better Business Bureau has worked out an interesting program with local coal dealers. The bureau made a study of the conditions relating to the sale of coal for more than a year, and as a result of this survey has evolved a system of cooperation whereby the reputable dealers can receive systematic check-ups on their methods of sale. The bureau found among other things that carelessness on the part of weighmasters might result in serious embarrassment to the reputable dealer. Faulty scales, too hasty weighing, and failure to check the tare may result either in cheating the customer, and thus put the dealer in jeopardy of a short-weight ordinance, or the dealer may be the loser by delivering overweights. The check-up system now in use by this bureau works both ways—it protects the consumer and the dealer.

The system developed by the Chicago bureau proved so interesting to local coal dealers that 107 dealers authorized the bureau, by contract agreement, to allow the bureau's representatives to stop and reweigh their delivery trucks. Bureau representatives have been checking trucks daily since this system was inaugurated, and the results of these checkings are daily demonstrating their value to the reputable dealers.

From a list of 200 investigations the following information was obtained: 111 loads showed no appreciable variation when rechecked; 27 loads showed shortages ranging from 0.4 to 7 per cent; 34 loads were found to run from 0.3 to 2.6 per cent overweight; 14 loads were slightly underweight; and the same number were slightly overweight. Nevertheless, the bureau believes there is a serious short-weight problem existing in Chicago.

One dealer and his driver have been convicted on the charge of short weighing, and fined, respectively, $100 and $50. A tricky system of using two delivery tickets is one of the schemes the bureau is combating. This practice of providing drivers with two tickets, one showing the correct weight and the other the padded or incorrect weight, is a difficult scheme with which to cope. Dealers practicing the double-ticket scheme are wary, and their drivers appear to be carefully instructed to take no unnecessary chances. The bureau is giving publicity to this form of cheating, and it is expected that through the combined efforts of publicity, cooperation of law-enforcing officials, and its own investigations, this evil practice will be eliminated.

The bureau recently made a comprehensive check of authorized public weighmasters and registered scales and found that the majority of coal dealers were weighing their loads on properly regis-

tered scales operated by public weighmasters or their deputies, but there were a number of dealers who were using scales not properly registered to weigh their loads. Failure to weigh a load on a duly registered scale is a violation of the city ordinance.

The Chicago bureau also has made an investigation of weights and measures involving the sale of building materials, and reports many discrepancies between the actual weights and those for which the customers are billed.

From the Indianapolis bureau, one of the first bureaus to investigate coal weights, we learn that the bureau has had the best of cooperation from both the State and city weights and measures departments. This bureau employed a special operator for about 18 months to check the advertising and sale of coal in Indianapolis. The operator was deputized by the city weights and measures department and worked with an inspector of the department. With a specially equipped automobile, this bureau representative, accompanied by an inspector from the city department, shopped gasoline stations.

Another interesting investigation was made of mattress factories, resulting in the prosecution of seven manufacturers for mislabeling their mattresses, both as to weight and content. These are some of the instances which show the close cooperation the weights and measures department gives the Indianapolis bureau.

The bureau does not attempt to usurp in any way the duties of the city officials but merely lends its assistance in cases in which it is felt that better results can be obtained by combining forces. In the mattress cases, for instance, the weights and measures department was hardly equipped, and lacking in funds, to carry through the investigations on its own initiative. The bureau furnished a good part of the funds, as well as a special investigator, and followed through with the prosecutions. The bureau also issued bulletins to mattress dealers throughout the State in which it was mentioned that there was cooperation between the department and the bureau, telling the story of the investigations and requirements for mattress labeling. This had a fine effect in helping to clean up mattress labeling throughout Indiana.

In another case a local chain store had been caught a number of times with shortages in packages of bulk merchandise. Warning by the local weights and measures department did not remedy the evil, because the dealer felt it would be impossible for the city department to stop him, owing to the technicalities of the law. The records of the weights and measures department were turned over to the bureau. The bureau took the matter up with the dealer, letting him understand that such practices might be bulletined if not discontinued, with the result that the situation was cleaned up.

The Philadelphia bureau reports that it has limited its activities in this field to checking up on the sale of coal. The bureau was invited by local dealers to undertake an investigation in the sale of coal and advises that it unearthed a rather serious short-weight situation. An examination of the laws and the custom of selling fuel at different ton weights, indicates a confused condition. The bureau is preparing to issue a bulletin embodying recommendations to the coal trade, the acceptance of which, it is believed, will greatly

reduce the existing confusion in the trade and reflect a benefit to the consumer.

The St. Louis bureau advises that it has found a number of irregularities involving deception through false weights and measures. Several transgressors have been haled into court and others have been brought before the director of weights and measures, who has given the St. Louis bureau splendid cooperation. The St. Louis laws regulating coal delivery require a certificate known as a city ticket, which dealers purchase from the controller's office (city hall) at 3 cents each. One of these city tickets must be given on the delivery of anthracite coal or coke in any amount; on bituminous coal such a ticket must be furnished to the consumer on 25 bushels (1 ton) or more. Some of our coal merchants believe that this charge of 3 cents per ticket is an imposition on the trade and that it is discriminatory, as no other line of merchandise is taxed in this manner in the city of St. Louis. From information gathered, no other first-class city imposes such a penalty. The dealers claim that they get nothing in the shape of protection in return for the vast amount paid to the city in this instance. All scales and measures are inspected twice each year, for which a fee is charged, and if such fees were applied for the good of this weight and measure department only, more protection for the dealers might be had.

Some of the dealers feel that some system should be adopted that would enable the city to sell tickets for the delivery of coal in a manner that could be checked, and the bureau suggests this remedy: Have every dealer register as a coal or material dealer, for which a small fee might be charged; have the city issue tickets, original with 3 copies, separate colors, original to the customer, 1 copy for return to the dealer, 1 for the office or yard issuing same, and 1 for the department of weights and measures.

This would allow for a check-up on all the dealers and compel a uniform use of city tickets. This would create a fund sufficient for the department of weights and measures to keep and compile the records and check up with men trained at that work and help prevent anyone from using the " hidden-ticket " trick.

The Fort Wayne bureau held a conference of local coal dealers in the fall of 1923, with the result that the bureau undertook to investigate the sales methods of coal dealers. The bureau appointed a staff member, who was made a deputy to the local inspector of weights and measures, and has the legal authority to stop a truck delivering fuel any place in the city. Fort Wayne has a city ordinance that, among other things, requires the furnishing of the gross, tare, and net weights. If a distributor does not own his own scales he must use the city scales, and every delivery must be accompanied by a delivery ticket. Each dealer is checked every month and reports of the bureau's investigations are furnished to the dealers. The bureau has given publicity to its work in the coal field, so that the public is advised that coal weights are being constantly checked, with the result that it has stimulated consumer confidence in local dealers and made it practically impossible to perpetrate dishonest practices as to weights and measures.

The Fort Wayne bureau, aside from checking on coal, has also investigated the sale of gasoline with an especially equipped car so that the purchases could be accurately measured. The result of these

investigations was five convictions for selling gasoline at gallon shortages.

A representative of the Better Business Bureau of New York City informed us that he has learned of a practice by both dealers and producers of mixing pea and buckwheat with larger size coal, and that frequently a purchaser who wants a ton of nut or egg coal will receive a mixture containing 30 to 50 per cent of pea or buckwheat.

The Kansas City Better Business Bureau used the Bureau of Standards to obtain information on how to accurately measure the strength of fabrics.

The Salt Lake City bureau called our attention to the practice of mixing smaller eggs with larger eggs and selling them at retail for the regular price of full-sized eggs.

The Cincinnati bureau expects to work out a plan with local coal dealers to check their weights.

The Rochester bureau calls our attention to the short weights in package goods and the use of competitive short-weight containers of a deceptive size.

The Detroit and Milwaukee bureaus reported that they get splendid cooperation from the local weights and measures departments, and such cases coming under the jurisdiction of the city departments are cared for in an efficient manner by the city officials.

The national bureau recently learned of a practice in selling linen at sizes larger than the actual measurements. The national bureau, in cooperating with the New York City bureau, held two meetings with linen importers and recommended that actual measurements be used in marking the sizes on linen items. We have received a splendid reaction from the linen trade indicating their desire to cooperate with us.

The New York City bureau contacted with the representatives of the local weights and measures department, and was assured of its cooperation to maintain proper markings applied to linen.

Summarizing, I wish to advise those attending this conference that it is our desire to cooperate in every way possible with your departments. We believe that uniform legislation and ample appropriations for maintaining the law are essential to maintain public protection against fraud and the use of false weights and measures.

DISCUSSION OF ABOVE PAPER

The CHAIRMAN. Is there discussion of this interesting paper by Mr. Greene?

Mr. FLURRY. Mr. Chairman, I would like to ask the gentleman if the better business bureau has conducted investigations in regard to the slack filling of packages, either of foods or drugs?

Mr. GREENE. Our investigations have been more or less superficial, but it has been reported to us that containers frequently are not filled, that sometimes the weight on them is put in very small figures, that the size of the package or container indicates a larger content than is actually present, and that such packages are in competition with packages which do have a larger content. It is assumed that such slack-filled packages deceive the public; we have not gone into it to a degree where I could give you any comprehensive information, but from our contacts I know that such conditions exist.

Mr. SWEENEY. I would like to ask what is the idea of issuing several coal certificates, one going to the sealer, one to the customer, and one to the dealer himself? Is this to notify the sealer of every load being distributed?

Mr. GREENE. That is a recommendation of the St. Louis bureau. They believe that kind of a system would prove excellent in that there would be a record of every transaction, in the weights and measures department; the same record would be in the office of the concern itself, and the consumer would have a copy. Why they wanted it I do not know, but it would have a restraining effect.

Mr. SWEENEY. I might suggest to the representative of the National Better Business Bureau that you might consider the law which we have in Massachusetts, to the effect that a complete record must be kept by the dealer and that those records are open to the sealer of weights and measures at any time he sees fit to examine them. We have a system in effect in Boston whereby every three or four days an inspector visits the various coal offices where coal is sold and there is a thorough check up on deliveries; if we notice any particular person is buying odd weights, 1,700 or 1,800 pounds, or 3,600 pounds, we become suspicious and make an examination.

Mr. GREENE. I think what the bureau had in mind was the delivery where actual deception was planned. For instance, if a ticket were made out for 2,000 pounds and a check up showed 1,800 pounds, there would be visible evidence of fraud. I think what the St. Louis bureau had in mind was a check up that would remedy fraud and make the evidence immediately available.

Mr. SWEENEY. The laws of the majority of States require the net weights of the material and the weights of the vehicles to be shown on the tickets.

Mr. GREENE. Some of the tickets are very incompletely written out. The consumer is almost totally uninformed and will take coal in any manner; on the other hand, if carbons were going to the weights and measures department it would soon become evident if there were any laxity in the system.

STATEMENT OF EDWARD J. MARONEY RESPECTING A LETTER TO THE CHAIRMAN OF THE HOUSE COMMITTEE ON COINAGE, WEIGHTS, AND MEASURES

Mr. MARONEY. Mr. Chairman, may I have the floor, as a special privilege?

(The privilege was granted.)

Mr. MARONEY. I have a letter here, members of the conference, addressed to the chairman of the Committee on Coinage, Weights, and Measures of the House of Representatives. With your permission, I will read it.

DEPARTMENT OF WEIGHTS AND MEASURES,
BUREAU OF MARKETS,
New Haven, Conn., May 24, 1928.

Hon. RANDOLPH PERKINS, *Chairman,*
House Committee on Coinage, Weights, and Measures,
Washington, D. C.

DEAR SIR: In view of the fact that the hearing originally scheduled before the House Committee on Coinage, Weights, and Measures on H. R. 7208, "A bill to regulate and control the manufacture, sale, and use of weights and measures and weighing and measuring devices for use or used in trade or

commerce, and for other purposes," in connection with the meeting of the National Conference on Weights and Measures being held in Washington, D. C., May 22 to 25, inclusive, 1928, has been canceled, and in view of the further fact that the chairman of the said committee has courteously offered to have incorporated in the committee records on H. R. 7208 such expressions of opinion on the part of the weights and measures officials attending the National Conference on Weights and Measures, as may be submitted to him, the following statement is offered as setting forth the attitude of the undersigned State, county, and city weights and measures officials upon the bill in question:

We believe that the principle of Federal regulation of type of commercial weighing and measuring devices is sound and should be incorporated into law, with suitable reservations as to the powers and duties of the State and local weights and measures officials such as are provided by section 11 of H. R. 7208. We believe further that the enactment of this proposed legislation would react to the advantage of all parties concerned, and, speaking from the standpoint of officials charged with weights and measures supervision, we are strongly of the opinion that our enforcement of existing State laws and local ordinances on the subject of weights and measures control would thereby be strengthened and that a greater degree of protection would be afforded to our several communities than is the case at the present time.

In addition to indorsing the provisions of H. R. 7208, we desire to register with the committee our strongest disapproval of statements which have been freely voiced relative to this bill, to the general effect that the National Bureau of Standards has caused the introduction of this bill for improper purposes and that in addition this bill is intended to bring about the adoption of the metric system of weights and measures in the United States; such statements appear to us to have their foundation in a desire on the part of certain interests to discredit the Bureau of Standards, an institution in which the weights and measures officials of the United States have the utmost confidence, and which has consistently given weights and measures officials constructive cooperation in all matters relative to their official duties. We wish the committee to know that H. R. 7208 was introduced at the specific request of a special committee of the National Conference on Weights and Measures, appointed in 1927 pursuant to a motion to this effect made upon his own initiative by a member of the conference, and concurred in by the conference, and that the Bureau of Standards had no connection whatsoever with this action.

Respectfully submitted.

(Signed) Ed. J. Maroney.

Mr. Maroney. I am going to leave this at the registration desk in order that each of you may put your "John Hancock" on that paper.

In connection with that also I hope that those of you who find and spare the time to do this, will write personal letters to Congressman Perkins and that committee so as to absolutely repudiate the propaganda of unfairness toward the officers of the Bureau of Standards.

I thank you.

THE DEVELOPMENT OF INDUSTRY

By A. Bousfield, *Chief Engineer, E. & T. Fairbanks & Co.*

Mr. President, ladies and gentlemen, in presenting to you "The development of industry" it is not my intention to go into the technical details of any particular branch or the development of any particular type of machine. Nor do I intend to dwell upon the great monetary system which has been extolled to you, but rather to present to you some historic backgrounds which changed conditions of living in the ancient and the medieval world have made possible in the great development of industry.

The development of machinery and manufacturing methods has had a most important influence upon civilization and the development of the race. Manufacturing has largely dictated the character of modern business and modern life. Leadership in the ancient and the medieval world rested largely upon force, frequently ruthlessly applied. To-day world leadership rests with that nation which has best developed and applied that organized knowledge which we call science. Modern life is dependent upon manufacturing, so that all must have an interest in its fundamental conditions. As this great country sprang from a colonial empire, we must look far afield for the conditions which laid the foundations of our modern conception of life and caused the break from the medieval past.

To fully appreciate this transition we must stand at the threshold of the sixteenth century and briefly review that period of English history from 1485 to 1603, embracing the reigns of Henry VII, Henry VIII, Edward VI, Mary, and Elizabeth. Constantinople had long since fallen to the Turk. The Greek scholars had fled to Italy, and Florence had become the intellectual center of western Europe. Greek learning eventually reached England and we have the period of the Anglo-Saxon Renaissance and the Reformation, which came only after the disintegration of medieval society. In this great period of the world's history, ideals and society were reborn. The period began amid the decay of ancient forces and ended amid the advent of new elements which formed the foundations of modern life. After a desperate battle the Duke of Richmond literally seized the crown of England from the dust of battle at Bosworth Field and was subsequently crowned Henry VII. When he ascended the throne, feudalism was dead and baronage was a wreck. The dawn of the new era was to elevate the crown to unknown heights, as the nation gave its support to the most extravagant ideas of royal prestige and authority. However, this was the course by which the Anglo-Saxon race emerged from the darkness of the past to the modern conception of life.

It is interesting to note that during this reign the famous Winchester struck bushel was developed and standardized. This unit is to-day the standard of dry measure in the United States. This development showed a desire for a more accurate measure of commodities in the transactions of commerce.

When Henry VIII ascended the throne in 1509, he was free from medieval influence and felt none of his father's hesitation and by the spirit of the age he raised the kingship to lofty heights, but also permitted the development of the individual, as witness the spectacular rise of Wolsey. Henry regarded himself as king, pope, and emperor in his own realm. He, however, provided the leadership around which the discontent of the age could gather. It was part of Henry's greatness that he was able to understand his people and the current changes. A less resolute spirit would have been reconciled to Rome and allowed the rift of reform to sever the nation. To a great extent life followed the prince in ready compliance to his wishes, and in the great affairs of state Henry always consulted the great minds of the age that he gathered around him, irrespective of their lineage or origin. The blending of classes had the effect of raising the mass and teaching it to appreciate values. The diffusion

of education and printed books allowed the masses for the first time to read and understand what was going on around them.

During the short reigns of Edward VI and Mary there is little to record in the development of the nation, as the period is stained by bloody religious persecutions.

The long reign of Elizabeth from 1559 to 1603 marks the end of the period in which the foundations of modern life were laid. During this period the first glimmer of what we now term public opinion began to appear, and this was strengthened by the pamphleteers, the forerunners of the newspapers, which tended to mold a definite public opinion about current affairs, which later found expression in Parliament. The inception and development of a great colonial empire which meant so much for the expansion of the British race, created a demand for well-educated but practical men. This showed the weakness of the classical university system. Gilbert, therefore, started an academy to fit scholars for action. His program included civil government, finance, martial exercises, navigation, and surgery. During this period a leveling influence began to develop, and attention was directed in Parliament to the overremuneration of the few and the miserable wages of the workers, which left them unable to save for their old age. Hospitals were founded, and the care of the needy passed from the feudal lord to the villages and towns, a marked advance from the feudal system.

Until the latter part of Elizabeth's reign England as a naval power was far behind the other nations of western Europe. The search for wealth, the spirit of discovery, the development of a great colonial empire all tended to develop England's greatness on the sea. The modern conception of life dates from the reign of Elizabeth. The real break from the medieval past was made during the last of the sixteenth century. At the end of the period she emerged as a great world power, displayed in adventure and in discovery. Her literature was enriched by the works of Spencer, Marlowe, and Shakespeare. The science of government expressed itself in the development of public opinion and the power of Parliament which expressed it.

During this period the crafts and guilds were responsible for production, and while they attained great manual dexterity and had an important bearing on the civilization of the period, their accomplishments in the light of modern scientific methods seem trivial. We may now pass to the industrial revolution of a little over 125 years ago. Malthus wrote his famous essay in 1789 and established what is known among economists as the Malthusian theory. Briefly stated, it meant that population tends naturally to increase faster than the means of subsistence; and that if wars and pestilence do not intervene to reduce it, starvation will result.

Soon after this essay was written conditions began to improve. Up to this time everything had been produced by hand and the passing centuries had seen little improvement in production or manufacture. By the introduction of the steam engine and steam-driven machinery a marvelous change was effected. The transition from hand labor to machine production occurred, and we witness the dawn of the industrial revolution. The advent of textile inventions, mechanical power, and improvements in agriculture made possible the

great increase in the population of the British Isles. In 1800 the population was about 10,000,000; in 1900 it had risen to over 32,000,000, the increase being made possible by the development of manufacturing. New territories like the interior of the United States were opened up, and as population flowed into these localities it sent back a large supply of food and raw materials to the manufacturing countries. Basic inventions which enabled power to be used where heretofore hand labor was the only means of production made possible the development of manufacturing industries; notable among these are the steam engine, by James Watt, 1769, later perfected as a double-acting unit in 1782; the spinning jenny, by Hargreaves, in 1764; the spinning mule, by Compton, in 1779. Following this, the puddling process for making wrought iron was introduced. In 1807 Fulton invented the steamboat.

The idea of the steam locomotive was developed by George Stevenson in 1815, and the Stockton & Darlington Railway was opened in 1825 and used for the transportation of coal. In 1830 the Liverpool & Manchester Railway was formally opened, and was the first successful freight and passenger railroad in the world. With the possible exception of printing, no other invention will bear comparison with the steam locomotive in affecting the progress of civilization and the destinies of mankind. Stevenson sprang from very humble parentage and remained uneducated until he was able to earn enough money himself to pay for an elementary education. To him, however, belongs the honor of developing the steam locomotive to a high degree of efficiency, and thus changing transportation methods throughout the world. After the company had been formed for the construction of the Liverpool & Manchester Railway, they met with great opposition both from landowners and in Parliment, but eventually succeeded in obtaining the right of way. Stevenson was appointed chief engineer, with full discretionary powers to build the road, a most difficult work when we consider the meager facilities available at that period. He was also responsible, together with his son Robert, for the successful development of the locomotive that hauled the first train over the road and attained a speed of 29 miles per hour. The opening of this railway marked an epoch in the advancement of the race. It was witnessed by the Duke of Wellington, the victor of Waterloo and then Prime Minister of England, and Sir Robert Peel, Secretary of State. The run of 30 miles was made in a little over an hour. From that time on railroad construction spread rapidly all over the world and played an important part in the development of this great United States. The Baltimore & Ohio was started in 1831, and the Illinois Central out of Chicago in 1850. From 1851 to 1860, 21,600 miles of railroads were constructed, and in 1887 a peak was reached by the construction of 12,876 miles in a single year. This, however, was an economic fallacy, as the country could not be developed fast enough to support such a great expansion, and consequently great financial losses were incurred.

The American colonies remained agricultural till early in the nineteenth century, when manufacturing began to be developed. The development of transportation gave a great impetus to industry. It was not until after the Civil War, however, that the real industrial development of the country began. As late as 1880, only about 68,000

horsepower was used per million of population, in the manufacturing industries. In 1914 it had risen to about 230,000 horsepower. Today the United States leads the world as a manufacturing nation and produces about one-third of the world's manufactured goods, a condition attained largely through the development of machinery and manufacturing methods.

The automobile has been responsible for a great development in the machine tools, particularly those adapted to a single purpose and large production. The last 15 years has seen a tremendous development in production equipment and methods, and the handling of materials. Long and uninterrupted service has been attained by the use of ball bearings. Individual motor drives have eliminated overhead shafting to a great extent, which makes a cleaner and a lighter shop, and a better placing of the tools. Hopper and magazine feeds are becoming popular for repetition work. Milling machines have been developed to do a wide variety of work and to do it quickly and accurately. Multiple spindle drills are being extensively used and effect a great reduction in time and effort. Grinding machines and methods have been developed to a high degree of speed and precision. Threads on tap gauges and hobs are being ground. Internal grinding is extensively used in motor work. The centerless grinder is opening up a large field for itself. Broaching machines are being extensively used for many operations. Surface grinders are now available which are very powerful and accurate. Pressed metal is being extensively used and a great development has taken place in the manufacture of presses for this work. Heat treatment of steel has been greatly developed and control has been regulated by the use of precision instruments for registering the temperature. The old method of guess and try by color has gone forever.

The manufacture of scales embraces many of the operations and tools that are common to other lines of industry, others are special, requiring special equipment and a highly trained personnel.

(At this point Mr. Bousfield illustrated by means of lantern slides the application of modern machine tools and manufacturing methods to the scale industry.)

(At this point, at 1 o'clock p. m., the conference took a recess until 2 o'clock p. m.)

SIXTH SESSION (AFTERNOON OF THURSDAY, MAY 24, 1928)

The conference reassembled at 2.20 o'clock p. m., H. L. Flurry, second vice president, in the chair.

TESTING OF GASOLINE METERS IN THE FIELD

PAPER OF WILLIAM FOSTER, SEALER OF WEIGHTS AND MEASURES, SPRINGFIELD, MASS.

Mr. President, delegates, and guests, I have been asked to give a brief description of methods of testing meters used in the sale of gasoline at retail in the city of Springfield, Mass.; also to present some data from my files, obtained as results of tests made from time to time on occasions of special check up to determine whether or not the meter was a correct measuring device.

I might say at this time that the figures that follow in my written report are figures that have been gathered over a period of 10 years. They are records made for my own use and from my own files. The secretary found that we had them and asked me to present them in connection with this paper. I want to make it clear that none of them were taken for the purpose of preparing this paper.

With the exception of one installation, the first meters installed in Springfield for the sale of gasoline at retail, were installed in the summer of 1920. We now have 43 meters in use at 9 different stations. All are operated by air or hydraulic systems, with the exception of one unit containing two meters which are operated by rotary pump.

With the appearance of the meter as a measuring device in the gasoline service station, there arose in the minds of many persons a doubt as to whether or not it was dependable measuring equipment for use in the sale of gasoline in any quantity from 1 to 20 gallons to a customer. This doubt was not confined to competitors in the dispensing-equipment business but extended to consumers, inspectors, and sealers. The latter, of course, must satisfy himself before he can be justified in approval by sealing same. This required much observation and a great many tests. It was found that the meter would deliver accurately under uniform pressure, at full flow. If, however, the flow was retarded by means of partly closing the outlet nozzle, thus extending the time of delivery of a given quantity, an overmeasure would result, this overmeasurement frequently amounting to more than a quart on a 5-gallon delivery.

In explaining the method used by me in testing these meters I realize that this gathering is not a kindergarten class in the matter of testing devices; therefore it is unnecessary to cover every little detail, such as having pointer on zero, etc. The meter is installed on the system and enough liquid run through it to make sure it is free from air pockets, the hose being full and the flow of liquid

controlled at the nozzle. We use a 5-gallon field standard. If the first draw is within the tolerance, we continue drawing 5 gallons at a time, once around the dial, usually 20 gallons. All meters that I am familiar with are equipped with a by-pass so arranged that by opening up or closing same the total amount may be increased or decreased about 10 cubic inches either way. By this means any adjustment may readily be made within the scope of the by-pass adjustment. After being satisfied that the meter will deliver correctly at full head or, in other words, with the nozzle open to its full capacity, we then put it on extended time test. Prior to June of last year we gave a test of 5 gallons in 90 seconds; if the meter would deliver within the tolerances, it was sealed; if not, it was condemned. Since our last conference, of 1927, we have been testing according to the specification submitted at that time, which provides a minimum rate of 5 gallons per minute, testing until satisfied that the device conforms to the specification.

It has been argued by some representatives of the industry that there was no good reason why a meter should be given an extended time test or, in other words, that it should not be required to deliver accurately except at full capacity. To my mind, this contention is absurd. I believe weights and measures officials generally will agree with me in the contention that a measuring device that can not be used as such within a reasonable variety of conditions, should not be seriously considered for commercial purposes. Therefore I am firmly of the belief that the specification as amended at last year's conference is just and fair to the meter industry, to service-station operator, and to the consumer.

I understand there has been collected through the officials of the bureau a substantial amount of data that I believe will bear out my statement above, that the specification is fair and just to all concerned. The statement has been made to me that less than 1 per cent of vehicles using liquid fuel will not take the liquid into the fuel tank at a speed of 10 gallons per minute, or full head, without trouble. I can not agree with this statement, but for the purpose of the discussion we will assume it is true. The customer says to fill the tank. Even though the construction is such that it will take the full flow, the careful operator will naturally slow up the delivery as the tank gets nearly full, to avoid overflowing caused by escaping air, etc., clearly demonstrating that the meter should be capable of measuring within the tolerance at a reasonable variation of speed. Some consideration is due the oil company or filling-station owner, to protect him against the dishonest employee. If the hired operator of a filling station finds he can get an overmeasurement by reducing the flow, he is apt to resort to this method of delivery when serving his friends or in purchases for his own use. Therefore, I repeat, I believe the present specification No. 8 is fair to all interests. Following are copies of records taken from my files of some of the tests made within the last three years. These tests will show that meters are being built, not only capable of conforming to specification, but to do much better than required.

Original test made of a meter of the rotary piston type, installed at a filling station in Springfield. The meter was equipped with 1-inch hose and 1-inch nozzle. The original test was made by repre-

sentatives of the meter company. Officials present at test: Francis Meredith, director of standards, Inspectors Cummings and Gloster, Sealer Foster, and Deputy Sealers Kingsbury and Beebe. On the face of the meter was a statement reading as follows: "Accuracy guaranteed, 1 to 10 pounds pressure. Rate of flow, 5 gallons from 30 to 90 seconds. This type of gasoline meter approved by the director of standards for Massachusetts."

In this test and subsequent tests on this meter the nominal delivery was 5 gallons in each case. Subsequent tests were all made by Sealer Foster.

METER NO. 1, ORIGINAL TEST

Date	Delivery time	Number of observations	Range of errors
	Seconds		*Cubic inches*
Oct. 29, 1925	30	5	+½ to +1½
	45–50	2	+1 to +2
	60	2	−4 to −2
	68–86	5	−5 to −2
	112	1	+8
	124	1	+12
	147	1	+20
	160	1	+22

METER NO. 1, SUBSEQUENT TESTS

Oct. 30, 1925	30	4	−1 to +1
Nov. 3, 1925	30	4	0 to +2
Nov. 6, 1925	30	4	0 to +2
	58–67	3	−5 to −4
	115	3	+7
Nov. 9, 1925	30	3	−1 to 0
	60	1	−3
	200	1	+25
Nov. 16, 1925	32	5	0 to +1
Nov. 24, 1925	30	4	0
	55	1	−4
	105	1	+7
	170	1	+30
Nov. 30, 1925	30	4	0 to +1
Dec. 2, 1925	32	4	0 to +2
	47	1	−3
	75	1	+2
	135	1	−14
Dec. 14, 1925	32	4	−1 to +1
	70–80	2	−4 to −3
Dec. 16, 1925	36	4	−3 to −1
	42–48	2	−3
	59–76	4	−5 to −3

Tests on other meters of the same type and manufacture as the meter reported on above are summarized as follows, each test being on a different meter. Some of these were operated by air pressure and some by hydraulic pressure.

METER NO. 2, AIR-PRESSURE SYSTEM

Date	Nominal delivery	Delivery time	Number of observations	Range of errors	Pressure
	Gallons	*Seconds*		*Cubic inches*	*Pounds*
Mar. 4, 1927	5	37	4	−5 to −2	14–17
		----------	Adjusted.	----------	
		37	1	+3	
		----------	Adjusted.	----------	
		37	5	−2 to +1	
		52–73	3	−3 to −2	
		80–87	3	−5 to −4	
		117	1	−2	

METER NO. 3, AIR-PRESSURE SYSTEM

May 20, 1927	5	30	5	−4 to −2	----------
		83	2	−8 to −7	----------
		97	1	−8	----------
		105	1	−6	----------
		----------	Adjusted.	----------	----------
		30	5	+1 to +4	----------
		83–93	3	−1 to +1	----------
		112	1	0	----------
	1	6	5	−2 to +1	----------
		28–29	2	−1 to 0	----------
		33	2	−1 to +3	----------
		40	1	+5	----------
		76	1	+6	----------
		87	1	+10	----------
		93	2	+8 to +10	----------

METER NO. 4, HYDRAULIC SYSTEM

June 6, 1927	5	30	4	−2 to 0	----------
		80–92	3	−10 to −7	----------
	1	6	5	−1 to +1	----------
		16–20	6	−2 to +1	----------

METER NO. 5, AIR-PRESSURE SYSTEM

June 7, 1927	5	30	4	−2 to 0	15
		80–86	5	−10 to −7	
	1	6	3	0 to +1	
		17–19	4	−1 to 0	

METER NO. 6, HYDRAULIC SYSTEM

Jan. 6, 1928	5	39	8	−7 to +3	----------
		61–63	2	−2 to 0	----------

METER NO. 7, AIR-PRESSURE SYSTEM

Jan. 6, 1928	5	31	3	+2 to +4	10
		45	1	+2	
		60–62	2	0 to +1	

METER NO. 8, AIR-PRESSURE SYSTEM

Jan. 6, 1928	5	31	4	+1	14
		31	3	+2 to +7	
		34–39	4	+1 to +2	
		45–62	6	0 to +2	

METER NO. 9, AIR-PRESSURE SYSTEM

Date	Nominal delivery	Delivery time	Number of observations	Range of errors	Pressure
	Gallons	*Seconds*		*Cubic inches*	*Pounds*
Apr. 20, 1928	5	36 56	4 1	−1 to +1 −5	10

METER NO. 10, AIR-PRESSURE SYSTEM

Apr. 20, 1928	5	35 35 62	4 4 1	−5 to +5 −1 to +1 −5	10

METER NO. 11, AIR-PRESSURE SYSTEM

Apr. 20, 1928	5	30 58	4 1	−3 to −2 −3	---------- ----------

Original test made of a meter of the disk type installed at a filling station in Springfield. Meter was known as ¾ by 1 inch, maximum capacity 34 gallons per minute, and was operated by hydraulic pressure. This test was made by Sealer Foster, Deputy Sealer Kingsbury, and Inspector Gloster. Representatives of the oil company and of the meter company were also present. A tag attached read, "This meter guaranteed to meet the U. S. Bureau of Standards tests."

In this test and subsequent tests on this meter, the nominal delivery was 5 gallons in each case.

ORIGINAL TEST

Date	Delivery time	Number of observations	Range of errors
	Seconds		*Cubic inches*
Sept. 13, 1926	19	4	0
	33	1	−1
	42	1	+1
	56	1	+12
	63	1	+28
	76	1	+30
	78	1	+40
	89	1	+50

SUBSEQUENT TESTS

Sept. 14, 1926	19	4	−1 to +1
	40	1	+8
	44	1	+13
	46–47	2	+16
	57	1	+36
	70	1	+50
	81	1	+74
Oct. 1, 1926	22	6	−2 to +1
	50	1	+25
	70	1	+71
Feb 7, 1927	18–21	4	−7½ to −4
	35–39	3	−7 to −3
	55	1	+13
	71	1	+27
	80	1	+45
	104	1	+64
	111	1	+83
	139	1	+109

Test of another meter of same type and manufacture as above. This was ¾-inch meter with ¾-inch pipe to meter, 1-inch nozzle, and 1½-inch hose. Meter operated by hydraulic system. Sealer Foster and Inspector Gloster conducted the test and representatives of meter companies and oil company were present. In these tests the nominal delivery was 5 gallons in each case.

Date	Delivery time	Number of observations	Range of errors
	Seconds		*Cubic inches*
Feb. 27, 1928	28	1	+10
	27–30	2	−1½ to +1
	28	9	−3 to +1
	52–53	2	0 to +1
	54	1	+5
	56–59	6	0 to +4
	60–61	3	+5 to +9

On the same day the above meter was moved to a new location, installed on air-pressure system with ¾-inch nozzle, pipe, and hose, and again tested. Same officials present as in preceding test.

Date	Delivery time	Number of observations	Range of errors	Pressure
	Seconds		*Cubic inches*	*Pounds*
Feb. 27, 1928	28–31	12	−1 to +2	15
	50–57	4	−1 to 0	15
	58–61	8	0 to +5	15
	92–120	2	+30	15

Original test made of a meter of the disk type installed at a filling station in Springfield. This meter was the product of a different manufacturer than the two meters reported on immediately above. The meter was equipped with 1-inch connections and was operated by air pressure. This test was made by Sealer Foster, Deputy Kingsbury, and Inspector Gloster. In this test restricted flows were obtained both by reducing the pressure and by partially closing the delivery valve.

In this test and subsequent tests on this meter the nominal delivery was 5 gallons in each case.

ORIGINAL TEST

Date	Delivery time	Number of observations	Range of errors	Pressure
	Seconds		*Cubic inches*	*Pounds*
May 18, 1926	27	2	+2	14
	30–43	2	−3 to −2	14
	62	1	−6	14
	82–84	2	−1 to 0	14
	99	1	+3	14
	133	1	+28	14
	27–32	2	+½ to +1	16½
	41–46	4	−4 to −3	8½–10
	50–84	4	−4 to −1	7–7½
	97	1	−1½	7
	97	1	+1	4

SUBSEQUENT TESTS

Date	Delivery time	Number of observations	Range of errors	Pressure
	Seconds		*Cubic inches*	*Pounds*
May 21, 1926	28–32	6	0 to +2	15–18½
	63	1	0	17
	85	1	+4	17
	90	1	+8	17
May 25, 1926	26	6	+1 to +3	18½
	65	1	+2	18½
	92	1	+11	18½
	[1]			
July 19, 1926	31	7	+2 to +4	----------
	60	1	0	----------
	80	1	+2	----------
	60	1	0	----------
		Adjusted.		
	31	3	+1 to +2	----------
Aug. 9, 1926	32	6	+2 to +5	15
	85	1	+4	15
	145	1	+20	15
Aug. 27, 1926	28	4	+2	15
	100	1	+10	15
Sept. 9, 1926	26	6	+3 to +5	16
	105	1	+12	16
Sept. 14, 1926	30	4	+4 to +5	----------
	52–57	3	+1 to +3	----------
	63	1	+6	----------
	85–99	3	+10 to +14	----------
	[2] 30–38	2	+3 to +4	----------
	[2] 56	1	+9	----------
	[2] 66	1	+12	----------
Jan. 5, 1927	33	4	+2 to +3	----------
	49	1	+7	----------
	56	1	+11	----------
	62	1	+14	----------
	69	1	+18	----------
	78	1	+19	----------
	99	1	+30	----------
	125	1	+48	----------
	254	1	+116	----------

[1] The meter company cleaned the meter and installed a new register.
[2] In this observation 5-gallon quantities were drawn, the first 3 gallons at full head, the remaining 2 gallons slowly.

The Acting Chairman. We do not wish to limit discussion, but since our program is rather full for the afternoon we desire to conserve time. Therefore I would ask that you make notes of your questions as each of these gentlemen speaks, and ask those questions at the end of the rendition of all the papers, for the reason that succeeding papers may answer the questions raised by previous papers.

PAPER OF THEO. A. SERAPHIN, DISTRICT SUPERVISOR, BUREAU OF WEIGHTS AND MEASURES, PHILADELPHIA, PA.

Mr. President, delegates, and guests, a few meters for measuring gasoline had been in use in Philadelphia prior to 1914, the year our bureau was created. These were used in connection with an early type of hydraulic system. Since that time the use of meters has steadily increased with various types of dispensing systems, such as air, hydraulic, electric, and hand operated.

The early type of meter was very difficult to adjust for accuracy, there being no means provided for this purpose; the meter had to be

disconnected and then taken apart in order to change certain gears. It was about 1918 that suggestions were made to the manufacturers relative to this, with the result that a by-pass arrangement is now used which will permit or prevent a certain amount of gasoline from being recorded on the dial, depending upon what adjustment is necessary, after which this by-pass can be sealed with the regular lead and wire seal.

The general method used in testing meters in Philadelphia is very much the same as that used in testing piston and visible pumps, the testing being done principally with a 5-gallon field standard.

Within the past year or more the use of meter systems has increased quite rapidly. Various types of meters and metering systems have made their appearance in Philadelphia, and a recent survey made by our bureau showed that there were in use seven makes of meters, some makes having two or more different types or styles. These meters are used by nine different manufacturers of metering systems. Some of the meters and metering systems are much alike in principle and appearance.

In connection with this survey, tests for accuracy were made, using a somewhat different method from that used in testing piston and visible pumps. First, the field standards used were of the 1, 5, and 10 gallon capacities. Second, two or more tests of each size were made at full speed, or with the nozzle wide open. Third, two tests of each size were made at slow speed, or with the nozzle closed sufficiently to increase the length of time required to make delivery about five or ten times that of full speed. The time of each test was taken with a stop watch.

The results of these tests were as follows: First, the results obtained from the 1-gallon tests were not proportionately consistent with the 5 and 10 gallon tests, while the proportionate results between the 5 and 10 gallon tests were, in nearly all cases, quite consistent. Second, in all slow tests but one the meters showed an increase in delivery; these increases varied considerably, ranging from 1 per cent to 26 per cent increase on the 1-gallon tests, and from 0.2 per cent decrease to 9 per cent increase on the 10-gallon tests. Third, the fastest rate of full flow noted was 3.6 seconds per gallon, while the slowest full flow was 7.2 seconds per gallon. For some reason unknown to me, the meters having a rate of full flow of about 4.5 seconds per gallon seemed to show a better degree of accuracy. The rate of flow used on the slow tests ranged from 18 seconds per gallon to 40 seconds per gallon, there being naturally more or less difficulty in regulating the time by partly closing the nozzle by hand. Fourth, practically no difficulty was experienced in stopping the flow through the meter directly at the point desired. Fifth, a majority of the meters tested in this survey have been in use two years or more.

In making this survey the general description, size, and construction of reading dials were noted, and in the seven makes of meters there were 12 different diameters of dials, ranging from 1⅞ to 9 inches in diameter. Some meters had a single dial, and others had a dial within a dial with both hands operating from one center, while other meters had a smaller dial whose center was located between the center of the larger dial and its outer edge or circumference, one hand operating from each center.

There were varying sizes and types of dial hands, numerals, manufacturers' names, price charts, and other characters, which all tended to make easy reading by the purchaser more or less confusing, if not, in some cases, impossible. I therefore wish to take this opportunity to recommend to the conference for its consideration the advisability of having incorporated in the national specifications for liquid-measuring devices such additions as will bring about a standardization of all dials on meters used in the retail dispensing of gasoline, and possibly other liquids.

I know we all would appreciate a large reading dial with black dial hands and numerals of a clear and bold appearance with no other outstanding inscription, figures, or characters to interfere with instantaneous reading of the meter. If other reading matter must appear on dial, it would be well for same to be of a light red color and less conspicuous.

The above survey was made several months ago, and since that time I have received literature from a number of meter and metering-system companies, depicting numerous meritorious improvements of recent origin, but much to my regret I am unable to include comment upon them in this paper, owing to the absence of these new installations in Philadelphia.

PAPER OF FRANK BERKA, DEPUTY SEALER OF WEIGHTS AND MEASURES, CITY AND COUNTY OF LOS ANGELES, CALIF.

Mr. Chairman and fellow delegates, I have thought that in presenting my paper I would digress a little from figures and discuss some of the factors that we found in Los Angeles to influence accuracy in meter registering; and also present what we have done to remedy these conditions.

Gasoline meters first came under my observation about eight years ago. At that time we had quite a number of marine stations in operation in our county by the various oil companies, for the purpose of supplying gasoline, distillate, and Diesel oil to the motor-powered yachts and commercial boats.

The initial tests of the meters at these various stations disclosed the fact that something was radically wrong. A complete tabulation of the result of our tests showed average errors of about 5 per cent plus or minus. We came to the conclusion that either the meters were inefficient, inaccurate, and entirely inadequate as measuring devices, or that some other factor which up to this time had not been recognized, was affecting to a large extent the operation of these devices. A careful inspection and survey of all the installations was made, at the conclusion of which we felt quite certain that the installations were, to a large extent, if not wholly, responsible for the inaccuracy in measurement.

We obtained the hearty and willing cooperation of the engineering department of one of the oil companies for the solution of the problem. After about six months of intensive experimentation with various types of installation, we finally decided to put one to the acid test. This installation included an air filter or release which was placed in the line on the intake side of the meter and in close proximity thereto. Our first design of an air filter was rather a crude affair. This consisted of a pipe of a larger diameter than the supply line, capped at

the top, and with a faucet tapped in one-third of the distance from the top so that at regular intervals the operator could draw out liquid to see whether the air chamber was being filled with gas. The only trouble we found with this air filter was that it depended upon the human element to operate it efficiently, so some thought was directed to the development of one that would work entirely automatically. The type that was evolved consists of a cylinder varying in size, depending on the type of meter or size of installation for which it is intended, in the center of which is a baffle plate. The intake is at the bottom of the cylinder and the outlet is also on the bottom, but on the other side of the baffle plate. As the gasoline enters, the flow is upward over the baffle plate, and then down and out. At the level of the baffle plate a small valve is inserted, automatically to accomplish the filtration of air from the meter line.

The top of the measuring chamber of the meter was below the level of the air filter. The pipe from the discharge side of the meter was brought to the same elevation as the air filter and the discharge hose attached thereto. A sediment trap containing a screen of 80 mesh was installed next to the air filter.

By this arrangement we accomplished three things, very important in obtaining greater accuracy in measurement:

1. It was impossible to siphon the meter when the discharge hose was disconnected, as formerly was the case, thereby eliminating the formation of air pockets in the meter, which would affect the accuracy of subsequent deliveries.

2. As the air filter or release was placed above the meter, it very effectively removed the air and gasified portions of the gasoline which we always found present in the supply line and which, to a large extent, prevented the meters from measuring accurately. I think after my experience I am safe in drawing the conclusion that it is almost impossible for meters to register accurately unless some efficient means are provided for the removal from the line of gasified elements and any air that may have entered.

3. By means of the strainer we prevented any solid or sedimentary particles from getting into the meter. This we found very necessary on account of the very small clearances permissible in meter design.

To prove the adequacy and efficiency of this kind of installation, several meters of different types were selected and installed in the manner described. Our initial tests of these meters disclosed gratifying and satisfactory results. All the meters under test came well within the range of tolerance for normal speed of operation. By normal speed of operation I mean operation over the range of speed recommended by the manufacturers. After a period of several months these meters were tested again and the same results were obtained.

I mention these facts to you to lay great stress and emphasis upon the importance of adequate and efficient meter installations if the maximum accuracy is to be obtained from these devices. In other words accuracy curves plotted in the laboratories are based upon ideal conditions, and these do not necessarily represent what the meters will do when placed in actual operation in the field under varying conditions.

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I might add that not very long ago my attention was directed to an installation comprising six meters, of the retail type. Five were used to fill motor buses; it was a very accurate meter and very good results were obtained. The sixth meter of the same type, after laboratory tests showed it accurate, was placed as a check meter to check upon the gasoline placed in the storage tanks. The curves plotted with this meter were very erratic, and they did not seem to compare favorably with the results on the other five meters which were delivering gasoline accurately. I surveyed the installation and this is what I found: On the check meter they had used an air filter and a strainer, but the installation was so arranged that the air filter, strainer, and meter were on the same elevation and then a decided drop was made to the storage tank, with the result that every delivery through that meter resulted in the siphoning of the meter dry, causing air pockets and shortages on succeeding deliveries. We changed the position of the meter and air filter, and then the meter gave accurate results and checked the other meters.

I shall now speak very briefly upon our methods of testing gasoline meters in the field and shall not bore you with the minute detail of technic, with which you are familiar.

Our testing equipment, among other things, consists of four testing standards constructed in the 1, 2, 3, and 5 gallon sizes. These are of such design that the error of delivery for the ordinary ranges of error may be read on a graduated scale. These are used to test meters of a small rate of flow such as retail filling-station meters. Then we have a 50-gallon standard of a portable type mounted on rubber-tired wheels, and this is also of such construction that the error may be read on a similar gauge glass. This standard is used to test meters that have a higher rate of flow, such as meters of the 2-inch size; the 5-gallon measure is entirely inadequate for such tests. For meters of still higher rate of flow we employ an accurately calibrated compartment of a vehicle tank, of at least 200 gallons capacity. We employ these various sizes of test standards so that we can test meters at normal speed of operation.

As our technic in testing the various sizes of meters is the same, I shall describe the test of only one and for this purpose will choose the retail meter. Our average normal rate of full flow of these devices is 15 gallons per minute. For the purpose of test of this device we employ our 5-gallon standard. The meter is set at zero reading. Several initial deliveries of 5 gallons are made to determine the error, if any, of the device and also to determine whether or not the meter is complying with the elapsed-time test.

Sometimes in drawing gasoline, air is drawn from the air line. We usually make tests to determine whether or not the meter is drawing air or is affected to any large extent by air or gasified elements in the line.

Our next test is the one-minute test, which is made at a rate of flow of 5 gallons per minute. Several repeated tests at this rate of flow are made to see if the meter is consistent at this speed. The error, if any, at this speed is noted. Several tests then are made at the normal rate of full flow, which in these devices is about 15 gallons per minute. The errors, if any, are again noted at this rate of flow. If we find that the range of error between these two tests

is not greater than the tolerance, we then proceed to adjust the meter, if it is out of tolerance. It is our practice in the field to make the necessary adjustments on these meters at a mean rate of flow, which in this case would be about 10 gallons per minute. By this practice we are enabled to come within a closer degree of accuracy at the high and low rates of delivery.

We follow this procedure because if we attempted to adjust the meter at the outset and then tested it at the slow rate of flow and at the maximum rate of flow and found the range of error to be too large, all the trouble we had gone to in adjusting the meter would have been in vain.

After we have obtained an accurate reading on a 5-gallon delivery by means of this adjustment we make several more tests, until the entire range of the dial has been covered. If we find that the meter continues to deliver within tolerance on these repeated tests, the meter is sealed.

In the larger sized meters the same routine procedure is followed, with the exception that the minimum and maximum rates of flow for that particular type of meter are used.

PAPER OF JOHN H. STEPHENSON, SEALER OF WEIGHTS AND MEASURES, ROCHESTER, N. Y.

Mr. Chairman, delegates and guests, ladies and gentlemen, in Rochester we have about 350 gasoline stations with a total of about 1,680 liquid-measuring devices, among which are a number of meters.

Some time ago we made tests of three or four different meter stations to find out the accuracy of the meters. I obtained a number of very interesting results on what is called a double installation, which I tested by carrying on a simultaneous test of the two meters at one time. The results of the tests were as follows:

Results of tests on double-meter installations, consisting of two meters connected to same source of power through joint supply pipe

[5-gallon deliveries—Errors in cubic inches]

Meter	Slow rate of flow (5 gallons delivered in number of seconds noted)—simultaneous deliveries	Maximum rate of flow (5 gallons delivered in number of seconds noted)	
		Simultaneous deliveries	Successive deliveries
No. 1	(240 secs.) +116	(30 secs.) −8	(25 secs.) −7
No. 2	+116	−4	−2
No. 3	(90 secs.) +27	(25 secs.) −3	+5
No. 4	+17	−9	−2
No. 5	(180 secs.) +116	(30 secs.) +14	(30 secs.) −7
No. 6	+116	+3	−6
No. 7	(120 secs.) +25	(30 secs.) −2	(30 secs.) 0
No. 8	+20	−10	0
No. 9	(90 secs.) +40	(20 secs.) +4	(20 secs.) −3
No. 10	+37	−3	+2

Results of tests on double-meter installations, consisting of two meters connected to same source of power through joint supply pipe—Continued

[5-gallon deliveries—Errors in cubic inches]

Meter	Slow rate of flow (5 gallons delivered in number of seconds noted)—simultaneous deliveries	Maximum rate of flow (5 gallons delivered in number of seconds noted)	
		Simultaneous deliveries	Successive deliveries
	(90 secs.)	(20 secs.)	(20 secs.)
No. 11	+14	−5	+4
No. 12	+18	−3	−3
	(60 secs.)	(20 secs.)	(20 secs.)
No. 13	+10	0	−2
No. 14	+16	−4	0
	(75 secs.)	(30 secs.)	(30 secs.)
No. 15	+40	−4	0
No. 16	+36	−3	−4
	(90 secs.)	(30 secs.)	(30 secs.)
No. 17	+60	−5	−3
No. 18	+40	−4	0
	(60 secs.)	(30 secs.)	(30 secs.)
No. 19	+14	−10	−6
No. 20	+7	−7	−5
	(90 secs.)	(30 secs.)	(30 secs.)
No. 21	+30	+6	+3
No. 22	+28	−4	−4
	(105 secs.)	(30 secs.)	(30 secs.)
No. 23	+40	0	+5
No. 24	+38	−2	−2

Results of tests on multiple-meter installations, consisting of four meters connected to same source of power through joint supply pipe

[5-gallon deliveries—Errors in cubic inches]

Meter	Slow rate of flow (5 gallons delivered in number of seconds noted)—simultaneous deliveries	Maximum rate of flow (5 gallons delivered in number of seconds noted)	
		Simultaneous deliveries	Successive deliveries
	(270 secs.)	(45 secs.)	(35 secs.)
No. 25	+231	+20	+8
No. 26	+231	+6	0
	(120 secs.)	(35 secs.)	(30 secs.)
No. 27	+70	+20	+15
No. 28	+70	+6	+13
	(90 secs.)	(35 secs.)	(30 secs.)
No. 29	+40	+15	+10
No. 30	+47	+6	+9
	(60 secs.)	(30 secs.)	(30 secs.)
No. 31	+26	+8	+5
No. 32	+18	+5	0

In the city of Rochester we have had a new condition develop. We have what are called ramp garages, one of which has six floors

with a hydraulic-pressure gasoline meter installed on each floor connected to same source of power through joint supply pipe. Last fall I arranged for simultaneous tests on various floors, made on the strike of a bell, omitting the meter on the sixth floor, which was not in use. The results of this test were as follows:

Results of tests on ramp-garage installations, consisting of five meters installed on five floors, connected to same source of power through joint supply pipe

[Five-gallon deliveries—Errors in cubic inches—Delivery time 5 gallons in 30 seconds]

Floor	Simultaneous deliveries			Successive deliveries
	All floors	3 floors as noted	2 floors as noted	
First	+30	+12		+6
Second	−58		−9	+1
Third	−58	−12		−4
Fourth	−116		−11	−6
Fifth	−231	−8		0

This year we tested the system again and again condemned it.

The system stands there to-day and we do not know what to do with it. This concern is building another ramp garage of eight stories and there are more in construction. I do not know how to handle a system of this kind, that has a man on each floor to take charge of serving oil, grease, and gasoline to cars throughout the day; one man does not know what any of the others are doing and he does not know what he is giving. I would like to hear what can be done. I know the system will not work satisfactorily.

The Acting Chairman. Are there any questions which you desire to ask any of these speakers? If so, they are in order in the general discussion of this problem. (After a pause.) If not, we will pass to the next item.

TESTING OF GASOLINE METERS IN THE FACTORY

PAPER OF C. P. GRIFFITH, CHIEF ENGINEER, S. F. BOWSER & CO. (INC.)

Mr. Chairman and gentlemen, before attempting to tell you how we test our particular meter, it will be necessary for me to tell you very briefly something of its construction.

Our meter is provided with five vertical cylinders arranged in a circle. Each cylinder is provided with a piston employing a plunger leather similar to that used so successfully in measuring pumps all through the years. The five plunger rods are connected to a wabble plate. This plate is supported at its center by a ball-and-socket joint. One point on its circumference is in constant contact with a circular track. The wabble plate carries a drive arm which transmits a rotary motion to the crank shaft. The crank shaft carries a valve at its upper end, and also transmits a rotary motion to the dial or counter mechanism.

Each cylinder has a port that serves alternatively as an inlet and an outlet port. The space around the outside of the valve constitutes a common inlet chamber, while the space on the inside of the valve is

in direct communication at all times with the outlet port. The space in the bottom of the bowl is connected directly with the outlet chamber, thus providing a balanced-pressure condition throughout, except for the few ounces required to operate the device.

No calibrating gears are required with this meter. The nominal volume of the five cylinders has a fixed definite relation to the dial or countermechanism, so all we have to do in adjusting any meter is to increase or decrease the volumetric displacement of the five cylinders. To do this we simply turn the adjusting screw. If we turn this to the right, we lengthen the stroke of each of the five plungers; if we turn the adjusting screw to the left, we decrease the stroke of each of the plungers.

It will be seen from this brief description of the meter that it is a positive-displacement device. All of the liquid that passes through it is measured. This feature, together with the fact that pressures are balanced throughout, makes its operation accurate, independent of changes in operating pressure or rate of delivery. It may interest you to know that we are successfully marketing the devices and guaranteeing accuracy within one-half of 1 per cent for capacities as small as 2½ gallons per hour. This is a little less than 10 cubic inches per minute.

After these meters are assembled they are first run by compressed air simply to run in the bearings. They are then tested with gasoline and adjusted for accuracy. In this test the meter is first run on a fixed gravity head and must deliver a predetermined quantity per minute to check freedom of operation. It is then tested and adjusted by making a number of runs into a 50-gallon measure. Our allowable tolerance for this quantity is 15 cubic inches. This is approximately one-eighth of 1 per cent, or one-fourth of your accepted field tolerance. These tests are made under 12 pounds operating pressure at the rate of 20 gallons per minute. The next test is to run 1-gallon quantities at the rate of one-half gallon per minute under 12 pounds pressure. All runs at this rate must come within the accepted tolerances for new equipment to pass our inspection.

This is recognized as a severe test for a meter. However, our experience has shown conclusively that where parts and workmanship are up to standard, each and every meter will meet these exacting tests. We have in the past made additional runs at varying pressures and other rates of flow, but our experiments have proved this to be unnecessary. After these tests have been completed, the meter is sealed. A sealed cap is provided, completely covering the adjustment mechanism; this cap is sealed in position, using the standard accepted seal for this purpose.

The meter then passes on to the general assembly department, where the complete device is assembled. After the general assembly is completed, the device is given another test to see that all joints are gasoline tight. While on this test a number of 5-gallon quantities are measured, also a number of 1-gallon quantities at the rate of one-half gallon per minute. The allowable tolerances in all cases must be within one-half of your allowable tolerances on new equipment.

Our 50-gallon, 5-gallon, and 1-gallon measures are checked regularly every 30 days by our inspection department, using our master measures for this purpose, which in turn are checked from time to time by the Bureau of Standards.

PAPER OF A. ESSIG, CHIEF ENGINEER, NATIONAL METER CO.[10]

As gasoline is a valuable commodity, it is essential to have it sold at all times through some very accurate measuring device. Our company has endeavored to make a special study of the actual service conditions under which meters are required to operate. In this paper we shall endeavor to give a brief account of what we have accomplished.

We erected a testing outfit fully equipped with apparatus necessary to make the requisite determinations, and for accurately testing the meter. A supply tank of over 20 gallons capacity was elevated 12 feet above a horizontal outlet pipe line, into which the meter was connected. The supply end of this line issues from the bottom of the tank, and a wooden disk was allowed to float on the surface of the gasoline in the tank. The purpose of this disk was twofold: First, it kept the liquid from whirling in the tank by which air might have been drawn and delivered through the meter as the tank was emptying; and, second, it served to indicate the height of the liquid in the tank, through means of a pulley and a weighted strand. The tests were not started until the surge of the liquid in the supply tank, after being pumped back from the storage tank, had subsided, this being indicated by the strand connected to the float. A thermometer was suspended in the elevated tank, and another in a suitable well before the meter. Test pressure gauges were connected in the pipe line, before and after the meter, so as to note the static, as well as the actual pressure the meter was working under. The down-coming supply pipe was built up in sections, with suitable couplings, thereby providing means for tests to be made under different elevations of the tank, so that the effect of various supply pressures to the meter could be ascertained. Deliveries from the meter were discharged into calibrated and sealed standard measures, of 1 and 5 gallons capacity. The measures were emptied into the storage tank after each test, and pumped back into the supply tank for the next test.

The ¾-inch Empire meter was selected for special study and test. A brief description of the meter and its special features for gasoline service-station work are as follows: It is one of the positive displacement type, with an oscillating piston. It is provided with a special registering mechanism having a large dial face, two hands indicating 1 and 20 gallons per revolution, respectively, and a totalizer, which are employed to indicate quantities of gasoline sold, at independent and successive times. It also includes means for resetting the hands at the end of each sale or operation, to zero, so as to be in condition to properly indicate the quantity of gasoline dispensed at a succeeding sale. It will be understood that during the measuring operation the totalizer shows the number of gallons passing through the meter simultaneously with the operation of the hands, and that the reset operation of the hands by means of the key in the side of the register

[10] This paper was read to the conference by George D. MacVeagh.

does not alter the position of the wheels of the totalizer, the latter registering the total of all the operations performed. The meter is equipped with a by-pass compensator for adjustment of small errors.

The meter was placed in the horizontal portion of the supply line from the overhead tank and supported so that it would remain level, and in such a position that it could be easily observed. The average of a large number of nominal 5-gallon and 1-gallon deliveries passed through the meter with the valve at the gasoline hose nozzle controlled so as to obtain various periods of delivery, ranging from 5 gallons in 600 seconds to 5 gallons in 30 seconds, were used for plotting an accuracy curve of the meter. The tests on the two lowest rates of flow were made with 1-gallon deliveries only, and were multiplied by 5 so that they could be used with the other results. For purposes of comparison, and to make the results more apparent, a curve showing percentage of the error for each cubic inch on the 5-gallon measuring tank was also plotted. The average temperature of the gasoline used in the test, and its gravity as shown by a hydrometer, were used as a basis to determine the effect on the volume of the gasoline, from 30 to 120° F., and a curve of the results was combined, with the meter and tank curves in proper relation.

It is evident that definite conclusions can be drawn from results correlated in this manner, and they become apparent immediately. They show that this meter is peculiarly adapted, and responds accurately up to the manufacturer's tolerances, for speeds of delivery covering the range from 5 gallons in 120 seconds to 5 gallons in 30 seconds. While the meter shows an error much less than the allowable, on the majority of the rates in the above-mentioned range, it has a critical period, and by the application of suitable means we are capable of complying with the manufacturer's tolerances even at this point.

As the elevation of the supply tank was reduced, the effect of reduced supply pressure on the meter simply manifested itself by a reduction in the speed of delivery, and so long as this rate did not drop below the prescribed limits, the manufacturer's tolerances remained complied with.

While we make provision in the meter for screening foreign matter, if for some reason this should enter the measuring chamber it is apt to retard the motion of the piston if the supply pressure is small and can not build up sufficiently to flush or blow it out.

In making sales of gasoline at supply stations it is not only desirable but essential to the trade to expedite the delivery of the same, and it is therefore advantageous to have a suitable supply pressure to operate the meter at its maximum delivery on all occasions.

After plotting the temperature curve it was noted that for about 15° change in temperature from 60° F. there would be a difference of about 9.6 cubic inches in the volume, and since the specifications make allowance for this, we assume that consideration will be given to these factors in the field by the sealers when the meters are being tested. Where the climate is such that the temperature change is considerably different than the average and remains so for some time, it will be necessary to make adjustments in the position of the compensating valve or to change the calibrating gears.

Other sizes of the same style meter herein referred to were tested during this period of investigation, and while not so extensively, the results obtained proved conclusively that they have like characteristics and are perfectly suitable for service-station work.

We endeavor to use materials, especially in the construction of the measuring chamber which is the most important part of the meter, to resist any action of a chemical or corrosive nature, and we are aware of the fact that the specifications require that the liquid the meter is to be used for be marked on it, but we desire to make reference here to the condition of the gasoline passed through the meter. We have examined meters that have been returned to us for repairs and adjustment and have actually seen the effect of the liquid on the parts, such as corrosion by sulphur, carbon deposits, and gumming and sticking caused by benzol, which would naturally have some effect on the accuracy of the meter. While we are not attempting to make any excuse for the action of our meter under these conditions, we know that we can not eliminate this cause, and we simply desire to point out to the sealers that the errors sometimes found in a meter may come from this source, and the greatest effect on the meter would show in tests made in the field on the first delivery if the meter had been idle for some time before. We believe, however, that in our special study we have found the proper material that will stand up and measure accurately gasoline of such a nature.

In the course of the special tests on the ¾-inch meter we allowed it to stand idle for periods of one hour and six hours, and the results showed that it complied with the elapsed-time test requirements under specification No. 8. On this particular meter, after standing idle for 22½ hours, and with a change in temperature of 2 degrees, on the first delivery the difference in results obtained was negligible, and suffice it to say that it was within the manufacturer's tolerances. Even though such a result was obtained, we are inclined to believe that a liquid of the nature mentioned before will have some effect on the accuracy of the meter on the first delivery, after being idle for some time.

The experimental testing plant gave such satisfactory results that we decided to use it for testing all our gasoline service-station meters. We have added a meter-testing stand of our own manufacture, and the pipe from the overhead supply tank is connected to it. Provision is made on this stand to make every test on the meters which experience has shown may be desirable. It is so constructed that meters receiving routine tests can be loaded and unloaded rapidly before and after the tests. The routine tests of the meters are made on the minimum and maximum rates they are marked for, and occasionally on intermediate rates, and all results must come within the required manufacturer's tolerances before they are shipped. The data made available from our special study and our testing outfit place us in a position to test and furnish meters in accordance with the requirements of the actual service.

The Empire meter has been approved by weights and measures officials of several States, as well as by the Underwriters' Laboratories.

PAPER OF A. D. MacLEAN, CHIEF ENGINEER, PITTSBURGH EQUITABLE METER CO.

Mr. Chairman and gentlemen of the conference, although gasoline meters have been in use in retailing gasoline to automobiles for a number of years, it is only within the last few years that this type of dispensing has enjoyed a very rapid growth. The gasoline-meter system usually denotes that type of equipment in which the gasoline is forced through a retailing meter under sufficient pressure to deliver the gasoline to the motor-car tank at a satisfactory rate of flow. The initial pressure is usually furnished directly by a pump, or indirectly through air or hydraulic pressure.

In general, the gasoline meter used with such a system is an outgrowth in principle of the ordinary liquid meter, such as is used by municipalities for metering water to domestic consumers. The principle is either that of a nutating disk or of an oscillating piston. However, where an accuracy of plus or minus 2 per cent is sufficient in the water meter, it has been found desirable (and recommended by the National Conference of Weights and Measures) that meters for retailing gasoline must be accurate within about plus or minus three-tenths of 1 per cent.

The function of a water meter is simply to totalize the amount of water that is passed through it from the time of its setting. However, a gasoline meter must be provided with a clock mechanism which indicates the amount of each sale in such a way that both the operator and the purchaser can see it; it must be capable of being set back to a zero point at the beginning of each sale; it must totalize the amount run through each meter; and it is also desirable to have it indicate audibly each gallon sold.

It will be seen that the gasoline meter really has a large job to perform. Meters of the disk and piston types are really motors whose speed (which depends upon the amount of liquid going through them) is made to register. In a water meter the motor's only job is to drive the totalizing index. In a gasoline meter its functions are numerous, as described above, and the load it drives is considerably heavier than a water-meter load; therefore, the meter-registering mechanism must be carefully designed and accurately and sturdily built. Its initial testing at the factory must be careful, as well as the final inspection.

The type of service expected from a gasoline meter necessitates new testing methods. The normal water prover method used with ordinary liquid meters, or the weight method, are not flexible enough or sufficiently accurate for gasoline-meter work. It is only natural that the meter-manufacturing companies should adopt the standard test-can method which is normally used by sealers throughout the country. This method is especially desirable, in that just such a method is used in the field. The procedure is quite well known to all sealers and has proved entirely satisfactory for factory use. There are, however, a number of precautions which must be exercised, and the sealer, in justice to the equipment, the meter, and the operator, should understand certain of the limitations to which the entire system is subjected. It has been the endeavor of our company, the Pittsburgh Equitable Meter Co., to conform in every way possible to the methods recommended by the specifications and tolerances for

liquid-measuring devices adopted by the National Conference on Weights and Measures and recommended by the Bureau of Standards, at Washington, D. C., for the adoption of the several States, in June, 1927.

In making our tests we have endeavored to make our equipment for conducting them as nearly as may be like that found in actual service at the numerous pressure gasoline delivery stations in our country; that is, we have a suitable tank containing the gasoline under a pressure of approximately 15 pounds, equipped with an inlet valve adapted to pass gasoline at rates of 16 gallons per minute down to 4, a ratio of four to one, which was adopted by the bureau. To this valve the meter is attached, and on the outlet side of the meter the delivery hose is equipped with a quick-acting delivery faucet conveying fluid into a recognized standard graduated 5-gallon can.

The meter is first set at zero and the can emptied of gasoline. Then, as the meter test hand indicates 1 gallon for a complete revolution, it is necessary for it to make five complete revolutions in filling the standard graduated can. When the fifth revolution has been completed the operator notes the inches of gasoline in the can, above or below 5 gallons; if it is within 3½ cubic inches plus or minus—or the tolerances allowed—the meter is O. K. If, however, it shows in excess or deficiency of this amount, the by-pass is then closed or opened and the meter again tested; and so on until it comes within the requirements. This by-pass is put on in order to secure a degree of refinement in the adjustment that could not easily be made in the gearing, and so that the sealer in inspecting these meters at the gasoline stations can readily bring them within the tolerances. After he has done this he seals this by-pass valve, so that it can not be tampered with by the operator or by any unscrupulous person. The adjustment of this by-pass valve is also necessary to make the meter accurate where there has been a change in the specific gravity of the fluid being delivered.

The equipment is provided with an adjustable pressure regulator, so that the pressure of the metered liquid can be varied if necessary. A series of orifices can also be provided at the meter outlet, so that the rate of flow can be varied by changing the diameter of the orifice. With 15 pounds test pressure that is used normally the following table of orifice sizes can be used to obtain the various rates of flow, using kerosene:

Size of orifice, inches	Rate of flow, gallons per minute
No orifice	17.5
½	15.5
13/32	12.0
5/16	8
7/32	5.5
5/32	4.0

The sealers might take note of that. Sometimes it is hard to get a definite rate of flow. By changing the size of the orifice you can reduce the rate of flow and still keep the nozzle valve wide open.

Many factors must be watched in making tests: First, we have the question of rate of flow. The four to one ratio adopted by the 1927 conference did not specify the highest permissible maximum. Naturally, the manufacturer of a meter system can not afford to

provide a pump or pressure which will operate the meter at too fast a rate. The limit would seem to be that rate at which a car tank can be served without excessive foaming of the liquid and without a meter-hand speed that is too fast to permit accurate stopping by the operator. There are still on the road old cars which, due to the tank inlet construction, can not be served at a rate exceeding 8 gallons per minute. However, it is understood that new designs of cars all permit a fast rate of filling. From observation, 12 to 13 gallons per minute seems to be a good serviceable maximum rate. It does not require excessively large pumping equipment or excessively high tank pressure to serve at this rate. Also, the speed of the 1-gallon hand is such that the operator can make accurate stops.

The minimum rate of flow is specified as one-fourth of the maximum. This figure appears to be arbitrary and, to a certain extent, works a hardship on the meter manufacturer and somewhat affects the accuracy of the meter at the normal rates of flow. A disk meter has certain accuracy characteristics. At a certain rate of flow the meter has its "fastest" point; that is, if the rate of flow is increased beyond this point, or decreased below this point, the meter delivers slightly less per indicated gallon. In setting the meter for accuracy, it is necessary to see that at this fast point the error does not go above 3½ cubic inches fast in 5 gallons. If the required range of flow is greater, at the lower flow the meter is slow. If the flow is made low enough it may allow the low flow accuracy to drop below the 3½ cubic inch error which is permitted. At these very low ranges of flow meters do not repeat themselves as closely and, therefore, can not be relied upon with the accuracy that they can at slightly higher ranges.

This low flow is seldom if ever used, and because the meter adjustment is made to include it in the allowable plus or minus 3½ cubic inches, the meter is at the fast side of its limit in its operating range. If the adjustment did not have to be made at this very low rate of flow, it would not be necessary to set the fast spot so close to the 3½ cubic inch fast limit. Therefore the smaller we can make the range of flow for the test, the nearer dead accuracy we can approach for those flows at which the meter is normally used. It is entirely possible, and we do make all meters accurate within the limit of plus or minus 3½ cubic inches in 5 gallons and within the rate of flow of 4 to 1, providing the minimum is not too low. It would seem that a more satisfactory range from the point of view of all concerned, and one which appears to be wide enough for practical purposes, would be a range having a minimum of 7 gallons and a maximum of 15 approximately, or limited by the range of the equipment. This would give us, due to the accuracy curve of a disk meter, practically plus or minus zero at the normal filling range of from 10 to 12 gallons per minute. This does not mean that the manufacturer of a system should necessarily provide equipment that would sell at the rate of 15 gallons per minute, but simply means that the meter itself should be so constructed and tested that it comes within the prescribed limits at those flows of from 7 to 15 gallons per minute.

The matter of pressure under which tests are made is important. For a given system, naturally as the pressure is increased the rate of flow with wide-open nozzle is increased, which affects the test

in that it affects the rate of flow. We have run many tests that show that the variation from accuracy within a given flow range is increased as the pressure is decreased. This means that tests run at lower pressure than the actual operating pressure show greater inaccuracy than is obtained in actual practice. With air-pressure systems the maintenance of an even pressure by means of a good regulator makes for increased accuracy. In a pump system the pump should be designed to maintain the pressure as nearly constant as possible at all rates of flow. In connection with pump systems it is important to see that the by-pass valve is of good design. It should not leak nor should it vibrate. Many tests are made inaccurate, due to the faulty by-pass valve which allows the pressure to drop due to these causes.

The specific gravity of a liquid has an important bearing on the accuracy, as does the viscosity. For that reason each meter should be adjusted in the field for that particular liquid on which it is to be used and this can be accomplished by means of the by-pass. For instance, a meter which is accurate on kerosene whose specific gravity is 0.81 will register 15 cubic inches slower on 5 gallons when used on water.

Leaks in the piping, either ahead of or after the meter, are responsible for large errors, due both to the loss of liquid and to the introduction of air that spoils the accuracy of the meter. As much as 10 per cent error has been eliminated by correcting leaks that did not seem to be important.

The question of accuracy of the meter when it is subject to a number of starts and stops during a run is oftentimes brought up. However, we have demonstrated a number of times that there is no important variation from accuracy due to this cause. A meter that is dead accurate for certain rates of flow when allowed to run steadily does not vary from this accuracy when the run is made stopping every one-fourth of a gallon.

In making a number of tests on gasoline meters and in comparing meter accuracy especially with varying rates of flow, the use of plotted curves in which variation from the dead accuracy is plotted against rate of flow in gallons per minute is very valuable. These curves are visualized very quickly and the exact performance of the meter can be seen much easier than reading a column of figures. The fast and slow speeds of the meter can be easily seen and the amount of adjustment necessary to bring these values within the limits is apparent immediately. Also on successive tests the amount of variation is quickly visualized and if the test points do not coincide on the curve, it indicates that the meter does not repeat itself as it should. It would seem that a standard test blank which incorporates all the necessary information can be used by all sealers and in the blank form should be incorporated a space in which the accuracy curve of the meter can be plotted. This would be a real advantage in comparing meter performances and is a great timesaver. The use of such a test curve would not only standardize the methods of testing but would give the meter manufacturer, the system manufacturer, the sealer, and the operator a common basis when discussing the subject of meter accuracy and tests.

REMARKS OF H. F. BARRETT, BUFFALO METER CO.

Mr. Chairman and gentlemen, all this afternoon we have been hearing about meters. We have heard of their accuracy and of their inaccuracy, good points and apparently bad points, and I would like to try to take a few of these and bring them together, and leave with you, if I can, some sort of a picture of the problem in its broad aspects, considered necessarily from a manufacturer's point of view as I am representing a manufacturer of gasoline meters.

I believe I can safely say that the meter idea of dispensing gasoline has proved itself practical and that it is going on to a successful conclusion and widespread use for several very definite reasons.

For one reason it is a fast method of dispensing gasoline. You can deliver unlimited amounts without stop. For another thing the appearance is attractive; it can be fitted into the architecture of the station. Again, various stations report fewer men needed to run the station and the cost of most systems is moderate.

The future holds great development for this system, we are confident. The development of airports, in its infancy though it may be, has shown pretty well what can be expected with advanced systems of transportation in the future. I believe I am safe in saying that every United States Army airport in the country fuels airplanes through meters. At least there are so many stations and airports using them that I think the number which do not have them must be very, very small. They fuel planes from trucks, 50, 100, and 200 gallons at a time without stop, just as quickly as they can connect them up from the truck tank through the meter.

Meters certain of ready market are ready for distribution. But the final question, which is vital to any meter discussion, is that of performance. Performance is more than a matter of factory test; it is fundamentally the design and workmanship of the meter first of all. I think you will find that the factory test is conducted as carefully as possible by every meter manufacturer in the country, and in addition the meter is carefully retested by the companies who combine the meters with the rest of the equipment—but these tests merely check the result of design and workmanship.

The meter used in the majority of cases in this country is the disk type or its variation, the oscillating piston type. Various other types have been used, and tests seem to show that simplicity seems usually to find the most response.

There are three phases to the performance of meters: First of the phases is the performance at average service flow—the flow when you open the nozzle and fill any average car. You may have another performance at what is called by the Bureau of Standards the "minimum discharge rate," averaging about 5 gallons per minute. You also have another aspect, at excessively low flows. The protection of the station owner demands that there be some arrangement to protect the station owner from acts of his employees who might dribble gasoline very slowly through the meter and fill their own cars or those of their friends. We must guard against that. However, an error of 1 or 2 per cent at 1 gallon per minute or whatever this very low rate of flow is, will not be enough to induce the operator to try any crooked work. There have been used various

methods of avoiding errors resulting from low rates of flow such as packing the disk or piston with various packing combinations; when the meter is new they are fine, but when it is worn the parts work loose and allow dripping. This is particularly true with the dry type of gasoline, which is made at a low temperature, without the lubricating qualities that gasoline had six to eight years ago. As I said before, performance is largely based on design, and the design of meters has been substantially changed for the better within the past two or three years.

This afternoon you have heard of some remarkable inaccuracies, 1 quart on 5 gallons, and 1 gallon on 5 gallons. They are all true. It might be that the meters which did that are some that I have sold myself; I can not say. But the meters sold and built to-day are substantially different, especially in one particular point which is almost a paradox. Recent tests on meters of types now being generally made have shown that after a period of operation equal to two or three years in average service use, the meters will run better, more accurately, more smoothly than the day they left the factory. To go into the whys and wherefores of that would take entirely too much time; but we or any other meter manufacturer can easily substantiate that. For that reason a problem arises in connection with the present specifications for meters. The provision that the tolerances on brand new devices is only one-half that allowed on old devices, was designed to meet the problem of a type of measuring device which tended to grow inaccurate after a short period of use, before both the visible pump and the meter had progressed to the present point. We now have meters which will run for a long time with increasingly good results. Therefore, if a certain tolerance can be applied to new meters such as have been built in 1928 and will be built in the future, the same tolerance can be applied to those meters for years after they have been put in service.

Now, going back to this problem of average service flow—the flow on which 90 to 95 per cent of the gasoline sales are made—I wish to say that I have traveled a good many hundreds of miles throughout the country visiting cities in various States, stopping at stations with various systems, and talking with the operators and making tests to find just what they did do. I found an average rate of 10 to 13 gallons per minute.

The average sealer tests a meter at this delivery rate. If it runs all right at that rate he takes the rest for granted, because he knows that 95 per cent of the sales will be made at that rate and that a change in accuracy at some other rate, although it may be large when considered alone, when considered in the light of the total business done, is of little importance. Now it is easy to set a reliable gasoline meter to run within the manufacturers' tolerances of 3½ cubic inches on 5 gallons on flows approximating the normal service flow and that same tolerance can be maintained indefinitely. However, as Mr. MacLean has demonstrated here, compared with a normal service flow you are going to vary slightly at other rates of flow.

Therefore I want to present our case and our suggestion very briefly; it is this: A gasoline meter can reasonably be expected to run within the manufacturers' tolerance—3½ cubic inches on 5

gallons—at the normal service flow. It can also be expected to run within the tolerances on devices in use—twice the manufacturers' tolerances—at all other rates of flow above the minimum at present specified by the conference. But—not in all cases but in the marginal cases, which we must consider in making specifications—it is very difficult for the manufacturer to guarantee unconditionally that a meter will keep within the manufacturers' tolerances at all rates of flow. We can, however, very well, favor the tolerances now prescribed applicable to devices in use, twice the manufacturers' tolerances, and therefore, gentlemen, we have this suggestion to make:

That each meter used for determining the quantity of liquid delivered to an individual purchaser shall be adjusted to register within the tolerance for new devices at approximately the maximum rate of flow developed by the meter as it is installed. At all other rates of flow above the minimum specified by the regulations, namely, 5 gallons per minute, the tolerances applicable to devices in use shall be allowed. Below that minimum the tolerances shall be applied in deficiency only. These tolerances, if so arranged, could be applied to new and old meters alike throughout the life of the meter.

This would be stricter than the present tolerances in some ways, slightly easier in others; and the natural result would be that a situation which is now slightly confusing would be finally and once and for all cleared up.

The meter system of dispensing gasoline is an accomplished thing for practical purposes. It has arrived. I think the developments of the next six months will show that it is coming into wider use. This is the time, then, at which action can be taken which will clear up the entire situation, leaving no ground for objection on the part of any meter manufacturer that the specifications will be too strict or unfair. At the same time my proposal would be eminently fair and just to every service-station owner and operator, and to every man who drives a car and buys gasoline.

The Acting Chairman. Does H. W. Keith, engineer of the Granberg Meter Corporation, desire to make any remarks? [After a pause.] If not, we will proceed with the next item.

REPORT OF COMMITTEE ON SPECIFICATIONS AND TOLERANCES ON MODIFICATION OF SPECIFICATIONS AND TOLERANCES FOR LIQUID-MEASURING DEVICES, PRESENTED BY F. S. HOLBROOK, CHAIRMAN

You will remember that last year certain amendments to the code of specifications and tolerances for liquid-measuring devices were adopted tentatively with the usual recommendation that they come before the present conference for final consideration and adoption.

Your committee has carefully reviewed the additions and amendments made last year, and in the light of experience gained during the year and of comments submitted by manufacturers and officials, suggests modifications in some of the language employed. Minor modifications in two additional specifications are also recommended. The specifications as now recommended for final adoption were mimeographed and placed in your hands for consideration two days ago.

In accordance with our usual custom amendments are recommended to be made nonretroactive, and in order to give all manufacturers sufficient opportunity to make any changes in design, it is recommended that the amendments, except in one case specifically noted, be not put into force and effect prior to July 1, 1929.

(Signed) F. S. Holbrook, *Chairman*,
Wm. F. Cluett,
Chas. M. Fuller,
A. W. Schwartz,
I. L. Miller,
Committee on Specifications and Tolerances.

DISCUSSION OF ABOVE REPORT

Mr. Holbrook. It may first be in order to say a few words in relation to the enforcement date recommended. Although the specifications were tentatively adopted last year, nevertheless prior to this conference the manufacturers of liquid-measuring devices have not been able to ascertain the form which these specifications would take if, when, and as finally adopted by the conference. If they are finally adopted now, the manufacturers will be finally advised for the first time as to the regulations which will apply to their devices in the future. At this time they have a stock of devices on hand which have been made in good faith, and your committee is of the belief that the manufacturers should certainly be allowed to put them upon the market without hindrance. Again, some development work may be necessary before the new devices can be produced as a commercial proposition. The date suggested, namely, July 1, 1929, is approximately 13 months away, and in that time it is expected that the manufacturers can accomplish the desired results. Your committee believes that this is a reasonable length of time to allow and therefore the date of enforcement has been so specified.

The Acting Chairman. Unless there is objection heard from the floor we will proceed in the usual manner and consider each section as it is read.

Mr. Holbrook. Specification No. 5-a was tentatively adopted by the twentieth conference to read as follows:

5-a. Device to indicate when system is properly filled. All liquid-measuring devices other than those of the visible type shall be equipped with a device which will indicate whether or not the system is properly filled before a delivery is begun. This specification shall be construed to prohibit a check valve in the discharge line in such a position that the partial emptying of the system would not be disclosed, but not to prohibit a manually operated valve in the standpipe.

It is recommended that this specification be finally adopted, to be put into force and effect not prior to July 1, 1929, and to be nonretroactive.

Mr. Foster. Mr. Chairman, I would like to say a word about this date. When specifications were presented here at the meeting a year ago it served as a notice to the manufacturers that something of this nature would be required, to take effect on July 1 of this year. Many of the oil companies have taken that as the "handwriting on

the wall" to be prepared, and they are prepared and are putting out these devices at the present time.

In our case, in Massachusetts, the oil companies are perfectly satisfied and are willing to comply with that on July 1, 1928, and I can not see any reason to extend the time 12 months. We believe this date is entirely fair and proper.

The Acting Chairman. In Alabama we are in the same position that you are. Our regulations are already made to take effect July 1 of this year, but the passage of these specifications here will not in the least interfere with this plan. I do not see where there is any objection because it is a matter to be settled in the jurisdictions from which we come.

Mr. Griffith. Mr. Chairman, I might say that we have regulations laid down to become effective July, 1928, but we rely on the specifications passed in this weights and measures conference. The same thing is true in Maryland that Mr. Foster has stated concerning Massachusetts. Our operators and users of weighing and measuring devices are ready to go along with us, and have already gone ahead and are ready to install equipment under the provisions of these proposed specifications and tolerances.

Mr. Foster. Mr. Chairman, in relation to your remarks, of course it will not make any difference in your State or mine, but our not putting this into effect in 1928 may be misconstrued. We believe it a good thing. If there is no change or amendment of this particular section I see no reason why the time should be extended. We all anticipated it and were prepared to comply with the specification. The operators will be disappointed if we do not ask them to do it.

Mr. Holbrook. In the case of this particular section I do not believe that the argument is as strong for setting a date as far in advance as will be the case in other specifications to be read. This is because this requirement will probably not require the changing of the design of any devices, but will merely require the manufacturer to put a new attachment on his device. Now if the manufacturers, all of them, have those attachments ready to add, it probably is a fact that the date of enforcement need not be placed so far ahead. However, the committee considered the amendments as a whole and made the date the same in each case. The committee feels in relation to some of the other specifications that it is much more important to postpone the enforcement date than it is in the case of this particular one.

Mr. Foster. Mr. Chairman, in defense of the position I have taken, I move you, sir, that the date of the taking effect of this specification be July 1, 1928, instead of July 1, 1929.

(The motion was seconded.)

The Acting Chairman. The question is whether the effective date of specification No. 5–a shall be changed to July 1, 1928, from July 1, 1929, as now written.

(The question was taken and the motion was rejected.)

(It was moved and seconded that specification No. 5–a be adopted as read, the question was taken, and the motion was agreed to.)

Mr. Holbrook. Mr. Chairman, it has been developed by the vote that a considerable number of the weights and measures officials are not here. At this time I would ask those present if they think

it would be preferable to postpone the consideration of this report until to-morrow morning when a more general consensus might be obtained. To me personally, it is entirely immaterial, but it does seem rather unfortunate that matters of this importance are being considered by less than a full attendance. I may say, also, that had the committee not been upheld in the case of the vote just taken I would not have made this suggestion to postpone.

The ACTING CHAIRMAN. Is it fairer to proceed, or to wait?

Mr. FOSTER. I think it is fair to proceed. Let us clean up the business if we can.

Mr. SCHWARTZ. Mr. Chairman, I agree with Mr. Foster. The program was printed, and everyone knew these matters were coming up. I think we should go ahead. We only have a half day to-morrow, and we have a number of matters that are to come up then.

Mr. LEE. Mr. Chairman, I move that we proceed, and act on these specifications at this time.

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

The ACTING CHAIRMAN. We will proceed with the amendments.

Mr. HOLBROOK. Specification No. 8 reads as follows, the italicized portion of the third paragraph having been tentatively adopted by the twentieth conference:

8. Constancy of delivery. The amounts delivered by any liquid-measuring device shall not vary from the standard by more than the tolerances hereinafter provided (1) irrespective of the speed at which the device is operated, except that when operated considerably faster or slower than normal speed of operation the tolerance shall be applied in deficiency only—that is, the device shall not be deemed to be incorrect by reason of the tolerance in excess being exceeded during such unusual methods of operation—and (2) irrespective of the time elapsing between operations, subject to the conditions of the special elapsed-time test described below.

A special elapsed-time test shall be made to determine whether the device is satisfactory in respect to condition (2) above. In order to comply with this test the condition of the device shall be such that a period of nonuse of one hour shall not result in an error on the first delivery of the device after such period of nonuse greater than the appropriate tolerance allowable on the smallest amount which the device is designed to deliver, this tolerance being selected according to whether the device is or is not a new device; and a period of nonuse of six hours shall not result in an error on the first delivery of the device after such period of nonuse greater than 10 cubic inches, or in the case of a new device, 5 cubic inches.

"Normal speed of operation" shall be construed to mean that range of operating speeds which may reasonably be employed in ordinary commercial usage; in the case of meters used for the purpose of determining the quantity of liquid delivered to an individual purchaser, this shall mean operation within the limits of the discharge rates customarily specified by the manufacturer for the particular type of meter under test, *and all such meters shall be legibly marked to show their maximum discharge rates under normal conditions of installation and the minimum discharge rates and the maximum working pressures for which they are intended to be used:* Provided, however, That the maximum and minimum discharge rates so marked shall be in the ratio of at least 4 to 1, *and in the case of a meter installed for use in the dispensing of liquid at retail the maximum value of the minimum rate shall be 5 gallons per minute.*

NOTES.—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 0.6 per cent for each 10° F.

change of temperature, or about 1.1 per cent for each 10° C. change of temperature.

In applying the elapsed-time test outlined above 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.

It is recommended that the third paragraph of this specification be amended to read as follows:

"Normal speed of operation" shall be construed to mean that range of operating speeds which may reasonably be employed in ordinary commercial usage; in the case of meters used for the purpose of determining the quantity of liquid delivered to an individual purchaser, this shall mean operation within the limits of the discharge rates ordinarily developed under conditions of installation recommended or specified by the manufacturer for the particular type of meter under test, *and all such meters shall be legibly marked to show the maximum discharge rates under normal conditions of installation and the minimum discharge rates and the maximum working pressures for which they are intended to be used: Provided, however, That the value of the minimum rate shall not be greater than 5 gallons per minute.*

and that the following notes be added at the end of the specification:

All meters encountered in the field should be tested at the maximum discharge rate developed under the conditions of installation actually employed regardless of whether this rate exceeds or is less than the maximum discharge rate marked on the meter, and also either at the rate of 5 gallons per minute or at any lower discharge rate marked by the manufacturer.

It is recommended that the specification, with the above-suggested amendments, be finally adopted to be put into force and effect not prior to July 1, 1929, the italicized portion to be nonretroactive.

You will note several changes in that specification. The first important change is the elimination of the 4 to 1 ratio. The committee believes that while the 4 to 1 ratio may be, and doubtless is, of importance in the case of meters having a very large discharge rate, it is not nearly so vital in the case of retail meters.

There are two points at which it is especially desirable that the test be made on a retail meter. The first point is at the rate at which the device will deliver with the valve wide open, under the ordinary conditions of the installation adopted for the particular meter under test. If that rate be 20 gallons per minute, all well and good; if that rate be 30 gallons per minute or 10, 12, or 15 gallons, it should be tested at that rate. In other words, the weights and measures official is interested in determining whether or not the meter as operated by the service-station operator with a wide-open valve, will be correct.

The second important test point is at the rate at the lower end of the operating range. Exactly what that rate should be is, of course, a moot question; but it probably may be one definite figure for every retail installation. This would not be the result were the 4 to 1 ratio to be applied, for if a meter were capable of handling 20 gallons per minute, then the minimum rate of test would be 5 gallons per minute, while if the maximum were 12 gallons per minute the old specification would require that this meter be tested at 3 gallons per minute. Now there is no good reason why the second one should be tested at 3 and the first one at 5 gallons per minute. In the opinion of the committee they both should be tested at the same minimum rate, which rate should be a fair rate for operations such as are encountered in the field.

The question as to what this minimum test rate should be is an exceedingly perplexing one and it is one which has caused the committee very great concern ever since it met last Thursday morning. The committee has been working very diligently and has listened to a very great variety of opinions upon this point. It has been recommended that the minimum rate be reduced to a figure as low as 1 gallon per minute. It has been recommended that the minimum rate be raised to a figure as high as 10 gallons per minute. It has been recommended that the specification be left as it is. Now there you have quite a range of opinion. The same may be said in relation to the suggested ratios. The ratios asked for have been as high as 30 to 1, and they have been as low as 2 to 1. Some have desired that the present ratio be left unchanged.

For reasons which I have detailed, the ratio has been eliminated. It remained to fix a fair minimum rate. In the study of this question and in getting evidence to be examined by the committee, we have gone out in the field by ourselves, and through local and State officials who kindly consented to help us, and have studied the actual rates of flow employed in practice at various filling stations to-day. The data gathered have been plotted and I would like to show you some distribution charts which picture existing conditions.

While our slides are being arranged I will tell you upon what they are based and what they represent. In various parts of the country—in Springfield, Mass.; in Massachusetts outside the city of Springfield; in the State of New Jersey; in the city of Chicago, Ill.; in Los Angeles, Calif.; in Ohio; and in Washington, D. C.—officials have gone out to filling stations and have observed various deliveries to cars made in ordinary trade, noting the number of gallons delivered and the number of seconds utilized for the delivery; it was also noted whether the device was operated with the delivery valve wide open or partly closed, and a description of the automobile was recorded, the make, type, with or without a trunk at rear, etc. Since the desire was to obtain the rate of flow developed while the liquid was flowing freely, the elapsed time recorded, on wet-hose pumps and meters, was from the opening to the first closing of the discharge valve, and on dry-hose types from the opening of the discharge valve to the time when the liquid disappeared in the visible chamber or sight glass in case of a capacity delivery, or to the time that the liquid appeared to stop falling in the cylinder when the delivery did not consist of the full capacity of the device. Thus the time consumed in the delivery of the dribble flow or in hose drainage was not included in the figures obtained. When the material was sent to us, from the figures submitted each delivery was computed in terms of gallons per minute. From these figures the following charts were prepared.

(At this point there were shown by means of lantern slides 5 charts, 3 of which are reproduced herein, which graphically present the data collected on the speed of ordinary commercial deliveries of gasoline to motor cars from liquid-measuring devices. (See figs. 4, 5, and 6, pp. 134 to 136.) A general explanation of these charts is as follows:

The vertical lines erected on the horizontal line at the bottom of the chart represent deliveries of gasoline, each individual line being made up of all deliveries observed which were made at a certain rate

of flow expressed in terms of gallons per minute. Each line is positioned from left to right in the order of increasing rates of flow, and the first number immediately below each line is the number of gallons per minute represented by the deliveries assembled in that line. Each separate delivery represents an equal vertical height and thus the total height of each of the vertical lines is directly proportional to the number of deliveries made at the rate of flow represented by that line.

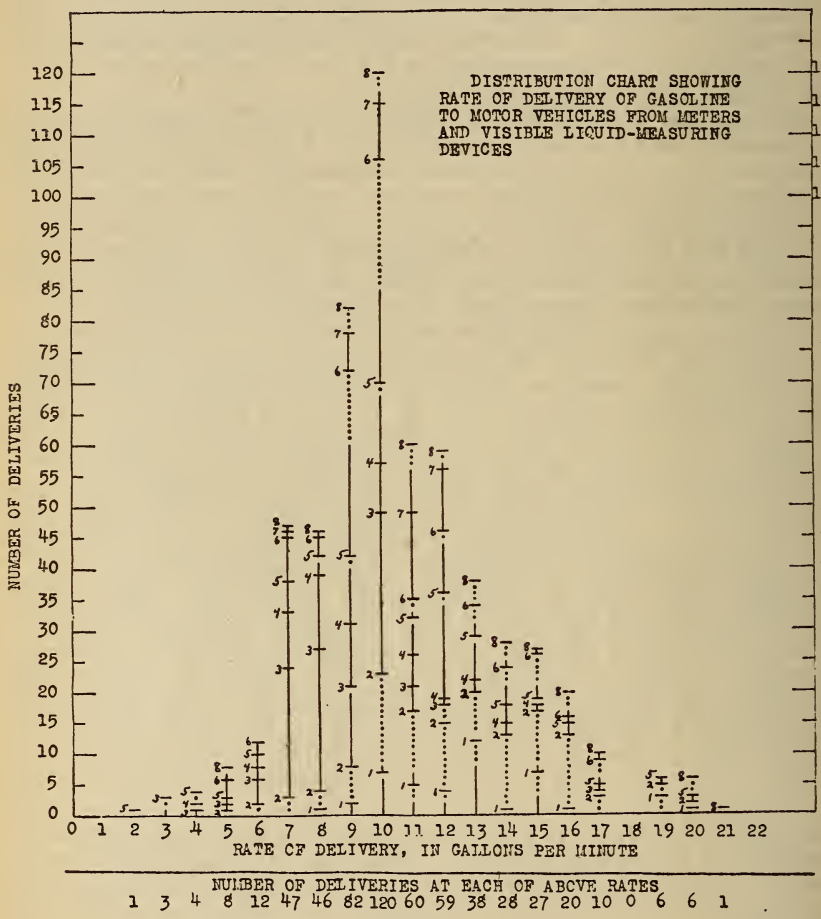

FIG. 4

The vertical series of numbers at the right and left hand edges of the chart is the scale which represents the number of deliveries. The position of the top of the lines in reference to this scale at once discloses the number of deliveries represented by each vertical line. For convenience the number of deliveries incorporated in each vertical line is given in the second horizontal line of numbers below the chart, each number having reference to the line erected above it.

In relation to the character of the individual vertical lines it may be said that the solid portions and the dotted portions of these lines

represent deliveries accomplished by meters and by visible liquid-measuring devices, respectively.

The numbers inserted opposite each of the short horizontal lines intersecting the vertical lines represent the jurisdictions in which the values were taken. Thus that portion of any vertical line below the short intersecting line adjacent to which is the figure 1, represents the number of deliveries observed in jurisdiction No. 1 at the rate of flow represented by the vertical line; similarly the distance

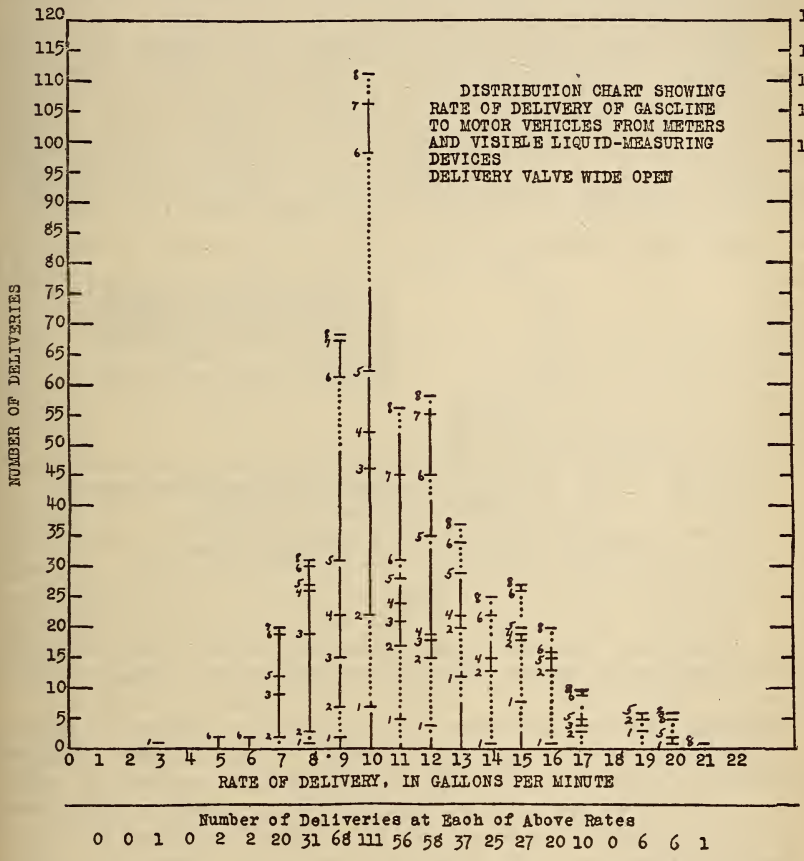

FIG. 5

between the short intersecting lines adjacent to Figures 1 and 2, respectively, indicates the number of deliveries at that rate reported by jurisdiction No. 2, between 2 and 3, the number by jurisdiction No. 3, etc. The numbers refer to jurisdictions as follows: 1, New Jersey; 2, Chicago, Ill.; 3, Springfield, Mass.; 4, Massachusetts, outside of Springfield; 5, Los Angeles, Calif.; 6, Philadelphia, Pa.; 7, Washington, D. C.; and 8, Ohio.)

Mr. HOLBROOK. A total of 578 deliveries were observed and recorded. These data are all collected on one chart. (Fig. 4.) Of the 578 deliveries, 481 were made with the delivery valve wide

open demonstrating that the cars involved would take gasoline at the full rate of flow of the device as installed. These deliveries are plotted separately. (Fig. 5.) The remaining 97 deliveries were made with the delivery valve partly closed, due to the fact that the operator deemed the car involved would not take gasoline at the full rate of flow of the device or for some other reason. These deliveries are also shown separately. (Fig. 6.)

You will notice that the largest number of all of the deliveries of gasoline is made at the rate of ten gallons per minute. One hundred and twenty deliveries, or about 21 per cent of the total, were at this rate. The average rate of all the deliveries was slightly above this figure, about 10.7 gallons per minute. This seems to demonstrate that the average device involved delivers at about this speed and that the average car will take gasoline at this speed without trouble. When those deliveries only, which were made with wide-open delivery valve, are studied it is again seen that the greatest number are at 10 gallons per minute although, of course, the average delivery is somewhat

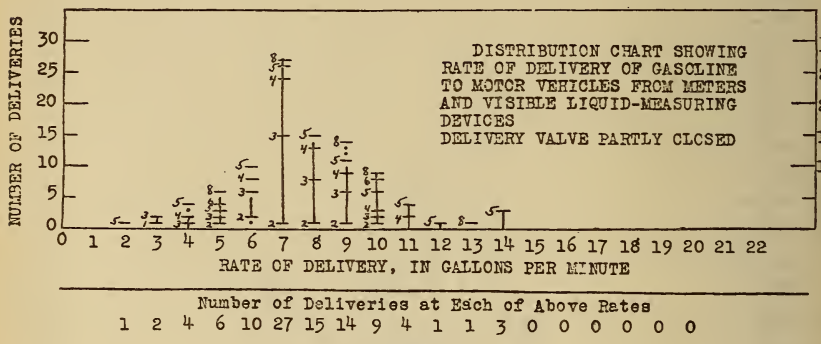

FIG. 6

faster than this since all those deliveries which were purposely slowed down are no longer included; this figure now becomes about 11.3.

When the delivery is made with partly closed valve, of course, the above figures are materially reduced. The majority of these deliveries were made at the rate of 7 gallons per minute; 27 deliveries, or about 28 per cent of this total, were made at this rate, while the average rate is somewhat more than this, about 7.7.

The next thing to which I desire to call your attention is a significant, interesting break between delivery rates of 6 and 7 gallons per minute. In other words there are a very much larger number of deliveries made at a rate of 7 gallons per minute than at 6 gallons per minute; in fact, the former are four times as numerous as the latter and there are more than one and one-half times as many deliveries at 7 gallons per minute as at all lower rates combined. The number of deliveries at 7 gallons per minute was such that the committee refused to consider the specifying of a minimum delivery of over 7 gallons per minute, because it is obvious that too many deliveries are made at this rate to make it safe to do so.

The committee debated long and arduously as to whether 5 or 7 gallons per minute should be accepted as the minimum rate of flow for testing meters. The committee was by no means unanimous and finally decided to include 5 gallons per minute in the report placed in your hands, for the reason that 5 gallons per minute was the figure accepted last year after debate was had upon the subject. As a supplement to the report it was decided that we would show you the data collected to assist you in arriving at a final decision.

In view of these data, it may be that some weights and measures official may desire to make a motion to the effect that the committee report be amended as it stands here, by substituting 7 gallons per minute for 5 gallons per minute. I think the matter is of such importance as to deserve a separate vote, and if this were to be done that question could be settled separately, before the paragraph as a whole is voted upon.

The ACTING CHAIRMAN. Does anyone wish to make such a motion?

Mr. FLAHERTY. Mr. Chairman, I wish to make a motion, as suggested by the secretary, that the report be amended by substituting 7 gallons per minute for 5 gallons per minute.

(The motion was seconded.)

Mr. HOLBROOK. The motion relates to the proviso, which reads: "Provided, however, That * * * *in the case of a meter installed for use in the dispensing of liquid at retail, the maximum value of the minimum rate shall be 5 gallons per minute.*" The motion is that the figure "5" be stricken out and "7" included in its stead; that instead of a test being made at a minimum delivery rate of 5 gallons per minute, it be made at a minimum delivery rate of 7 gallons per minute, or 5 gallons in 43 seconds. If adopted, it will make the specification less rigid. Your vote should be predicated upon your answer to the question, "Will the rights of the purchasing public be jeopardized if the minimum test rate be 7 gallons per minute instead of 5 gallons per minute in the case of delivery from a meter?"

The ACTING CHAIRMAN. Are you ready for the question?

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

(A motion was made and seconded that specification No. 8, as amended, be adopted; the question was taken and the motion was agreed to.)

Mr. HOLBROOK. Specification No. 19 was not amended last year, but is being brought up at this time for consideration.

It reads as follows:

19. Provision for sealing. All devices, adapted to be altered for adjusting or correcting the delivery of a liquid-measuring device, shall be of such construction that they can be sealed, either separately or together, in such a manner that the position of none of them can be changed without destroying the seal or seals: Provided, however, That this shall not apply to such devices as alter the deliveries to conform to different prices per gallon on such a liquid-measuring device as is described in the proviso of specification No. 4.

It is recommended that this specification be amended by adding, after the word "*device*" in line 2, the words "*or for changing the maximum delivery rate of a meter*," and that the specification with the suggested amendment be finally adopted, the added words to be put into force and effect not prior to July 1, 1929, and to be nonretroactive.

The addition of these words seems to your committee to be necessary. We have suggested that every meter should be tested at the full flow developed under the conditions of installation adopted; and you have approved this principle by the adoption of the note recommended under specification No. 8. Now you visit a meter station and find that under the air pressure or the pump adjustment adopted, the meter will deliver gas at a maximum rate of 12 gallons per minute. In testing for accuracy this rate of delivery is the maximum employed. It seems there certainly should be some means which will make it impossible for the service station operator, if so disposed, to procure a higher maximum rate of delivery, as by increasing the pressure, for instance, for it may well be that under the new condition the meter will deliver inaccurately. So this simply specifies that these devices which will change the delivery rate of a meter be sealed in place, so that the installation characteristics will remain the same after the test, as they were during the test.

Mr. Milligan. Mr. Chairman, if there is brought on the market a device which is capable of making deliveries at various speeds without affecting the accuracy of delivery, why should such a device be discriminated against by requiring the sealing of the pressure valve or whatever regulates the speed of the delivery? We have a meter that we can run at rates of 50, 40, 30 gallons per minute, or a half gallon per minute. Why should the operator of such a device call in a sealer every time anything goes wrong with the pumping device and the seal is broken?

Mr. Holbrook. Well, if a service-station operator knows that the weights and measures official is in the neighborhood and is about to test the meter, he may reduce the maximum delivery rate to a rate of 10 gallons per minute from some higher rate, by manipulation of the reducing valve on an air-pressure installation or by some other method of adjustment provided. Then under the method of procedure specified, the official should not test at a higher delivery rate than that found under the conditions of service—that is, 10 gallons per minute. Immediately after the official leaves, the reducing valve can be opened up or the other adjusting means manipulated so as to produce a flow of 20 gallons per minute, for instance. Under such circumstances how is anyone to know whether the accuracy of the delivery is affected? It is a fact, of course, that if the accuracy of the device is not affected we are entirely uninterested.

Mr. Milligan. But if it does not affect the accuracy of it?

Mr. Holbrook. Delivery curves have been exhibited here which indicate that varying the rate sensibly affects the accuracy of meters.

Mr. Milligan. That is on one type of meter.

Mr. Holbrook. The curve certainly did not apply to one particular make of meter only. Several companies manufacturing meters have shown me curves having somewhat similar characteristics.

Mr. Milligan. But I do not see why those who do not make that type of meter should be discriminated against.

Mr. Henrichson. I think the gentleman's point is well taken. The primary object of a specification in weights and measures is to obtain accurate measuring devices. If the change of the pressure does not affect the accuracy of the meter then there is no object in sealing this adjustment. In the case of a device directly changing

the registration, that should be sealed. I believe the specification should be so changed as to provide for such cases—the point of the gentleman should be considered.

Mr. BARRETT. I would like to ask how many meters you have had experience on?

Mr. MILLIGAN. I do not think the exact number of meters in the field is of any importance or consequence at this time. It is a question of the specification which is under discussion.

Mr. HOLBROOK. If an amendment is to be made it might be accomplished by supplementing the words proposed to be added, "*or for changing the maximum delivery rate of a meter*" with the words "*when this change tends to affect the accuracy of the deliveries.*"

Mr. HENRICHSON. Yes; that is right.

Mr. HOLBROOK. Then the official would have to determine in every case whether a change in rate was likely to affect the accuracy of the meter. If the officials are prepared to do that, I will suggest that such an amendment be made, speaking for the committee if they do not object.

The ACTING CHAIRMAN. Do I hear an amendment as suggested by the committee?

Mr. GRIFFITH. I will offer the amendment suggested by the secretary.

Mr. HENRICHSON. I will second the motion.

The ACTING CHAIRMAN. Are you ready for the question?

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

Mr. HOLBROOK. Specification No. 21–a was tentatively adopted by the twentieth conference to read as follows:

21–a. Auxiliary visible indicating devices. Whenever a liquid-measuring device of the visible type is so designed and constructed that measured liquid continues to pass through the discharge valve for an appreciable time (3 seconds or more) after the liquid has disappeared from sight in the glass-measuring chamber, then the device shall be equipped with an auxiliary visible indicating device, adjacent to the discharge valve and so constructed that it will indicate when any portion of the measured liquid has not been discharged through such valve at the time of the closing thereof: Provided, however, That in the case of any nominal delivery which is such that it does not cause the liquid to disappear from the chamber, the time interval mentioned above shall be measured from the time that the liquid apparently ceases to fall in such chamber.

Such auxiliary visible indicating device shall be so designed and constructed and so located and disposed that its indication is conspicuous and that, during the operation of the liquid-measuring device, it is clearly visible to and readable by, the customer. Whenever an auxiliary visible indicating device designed to indicate drainage of liquid and/or completeness of delivery shall be employed, whether or not it is required by the terms of this specification, it shall comply with all the above requirements.

It is recommended that the specification be amended by adding after the word "*indicate*" in line 7, the words "*after the completion of the delivery*", and that the specification with the suggested amendment be finally adopted, to be put into force and effect not prior to July 1, 1929, and to be nonretroactive.

I might say that the amendment suggested requires that this auxiliary indicating device shall indicate the fact in question, after delivery has been made; that the indication shall not be destroyed at the instant the valve is closed.

(A motion to adopt the specification as proposed to be amended was made and seconded, the question was taken, and the motion was agreed to.)

Mr. Holbrook. Specification No. 21–b was tentatively adopted by the twentieth conference to read as follows:

21–b. Time allowed for completion of delivery. All liquid-measuring devices shall be so designed and constructed, or so calibrated, that they will deliver into the hose, within the tolerances for devices in use, any nominal quantity which they are designed to deliver, within a period of 10 seconds after the main flow of liquid has ceased.

The main flow shall be construed to cease: In the case of a device of the piston type at the completion of the upward stroke of the piston; and in the case of a device of the visible type, at the time of the disappearance of the liquid in the glass-measuring chamber: Provided, however, That in the case of any nominal delivery which is such that it does not cause the liquid to disappear from the chamber, the time that the liquid apparently ceases to fall in such chamber shall be used in lieu of the time of the disappearance of the liquid: And provided further, That in the case of any liquid-measuring device equipped with an auxiliary visible indicating device such as is described in specification No. 21–a, any conspicuous change of indication in this device, such as a sudden drop in the level of the liquid, occurring after the major portion of the delivery has been completed, shall be used in lieu of either of the indications mentioned above.

All tests and calibrations shall be made on the basis outlined above, that is, the delivery valve shall be closed, or the operation of the liquid-measuring device otherwise discontinued, at the termination of the period of time mentioned above, and the amount which shall then have been delivered shall be taken as the full delivery of the device for the nominal quantity being delivered.

Note.—This specification shall be limited to apply only to liquid-measuring devices when used in the sale of motor fuels.

It is recommended that the first paragraph of this specification be amended to read as follows:

All liquid-measuring devices shall be so designed and constructed, or so calibrated, that on a nominal delivery of 5 gallons they will deliver this quantity into the hose, within the tolerance for devices in use, within a period of 10 seconds after the main flow of liquid has ceased.

and that the specification be further amended by striking out at the end of the last paragraph, the words "*for the nominal quantity being delivered.*"

It is further recommended that the specification with the suggested amendments be finally adopted, to be put into force and effect not prior to July 1, 1929, and to be nonretroactive.

That is a liberalization of the specification. The former specification required that any quantity that the pump was designed to deliver should be delivered within the tolerances in this 10-second interval. The specification now limits the test to the 5-gallon delivery only, so that the manufacturers will know in every case exactly what tolerance is to be applied, namely, 7 cubic inches.

The Acting Chairman. Is there any discussion of the specification?

Mr. Townsend. Mr. Chairman, I would like to propose that these words "*into the hose*" be changed to read "*into the delivery conduit*," the reason being that there are recent-model pumps that our company is putting on the market, in which we have changed the position of the delivery valve, or the point of cut-off, from the usual place outside of the glass cylinder to a position on top of the delivery tube. Now in effect that is simply moving up the point of cut-off and making the delivery tube a part of the hose.

Mr. HOLBROOK. Would it be satisfactory to say, "*into the hose line*," and define "hose line" as that portion of the delivery line beyond the shut-off valve, or to use some suitable wording to express the idea you have in mind? It seems unnecessary to introduce a new term, such as "delivery conduit."

Mr. TOWNSEND. That is the point.

Mr. HOLBROOK. I think that amendment satisfactory.

The ACTING CHAIRMAN. The motion will be put on the specification read, with the change to be worded by the committee on specifications and tolerances expressing the principle just stated by the secretary.

(A motion to adopt the specification as amended [11] was made and seconded, the question was taken, and the motion was agreed to.) [12]

Mr. HOLBROOK. Specification No. 22 reads as follows:

22. Shut-off valves in discharge line. No liquid-measuring device shall be equipped with a shut-off valve at the extremity of the hose or elsewhere in the hose line except in the case of devices designed and constructed so that they must be operated with the hose full of liquid at all times. In case such valve is used any other valve in any portion of the discharge line leading to this outlet must be so designed and constructed that it can only be closed off in one of the following ways: (1) By the use of some tool or device which is outside of and entirely separate from the measuring device itself, such as a wrench, screw driver, etc., but not an adjusting pin; or (2) by the destruction of a seal. In case the latter construction is used means must be provided so that a seal of the usual lead-and-wire type may readily be employed to seal the valve open and the manufacturer shall furnish his device with the valve sealed open; there shall be a metal tag or plate attached to the device adjacent to this valve handle clearly stating that the device should not be used unless the valve handle is secured by a seal.

This specification is not to be construed as allowing a shut-off valve in the hose in the case of devices in which the hose or any part thereof can be drained of liquid after the actual mechanical operation of the mechanism of the liquid-measuring device is discontinued, in any way except as follows: (1) by means of the mechanically operated valve; or (2) by delivering from the measuring device more than the full measuring capacity thereof during the actual mechanical operation of the mechanism thereof.

It is recommended that the first sentence of the first paragraph of this specification be amended to read as follows:

No liquid-measuring device shall be equipped with a shut-off valve at the extremity of the hose or elsewhere in the hose line unless the device is so designed and constructed either that it must be operated with the hose full or liquid at all times or that the fact that the hose is drained will automatically become an immediately obvious one to anyone observing the operation of the device.

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[11] The first paragraph as amended reads as follows:
"All liquid-measuring devices shall be so designed and constructed, or so calibrated, that on a nominal delivery of 5 gallons they will deliver this quantity into the discharge line on the delivery side of the discharge valve, within the tolerance for devices in use, within a period of 10 seconds after the main flow of liquid has ceased."

[12] COMMITTEE NOTE.—Since upon review following the conference the Committee on Specifications and Tolerances is convinced that the foregoing specification in its present form does not accomplish the purpose for which it was designed, the committee proposes for consideration at this time:

First, that the first paragraph of this specification be amended to read as follows:
"All liquid-measuring devices shall be so designed and constructed, or so calibrated, that they will deliver into the discharge line on the delivery side of the discharge valve, within the tolerances hereinafter provided, any nominal quantity which they are designed to deliver, within a period of 10 seconds after the main flow of liquid has ceased."

Second, that the following words be added at the end of the third paragraph of the specification: *"for the nominal quantity being delivered."*

It is the present intention of the committee to propose these amendments to the twenty-second national conference, which is to be held in May or June, 1929. This material is included here so that timely notice may be given to interested parties and full opportunity afforded to discuss the advisability of this action; such discussion will be welcomed by the committee.

and that the specification be further amended by adding after the word "which" in line 2 of the second paragraph, the words, ", without the fact being obvious to the observer,".

It is further recommended that the suggested amendments be finally adopted, to be put into force and effect immediately, and to be retroactive.

The reason these amendments are being recommended to take effect immediately is that there is provided a new method by which the manufacturer can accomplish the desired result. If he does not desire to take advantage of this he does not need to do so. If he desires to accomplish the result in this way he should be allowed to proceed in this manner at once.

The Acting Chairman. Is there any further discussion of specification No. 22?

(A motion to adopt the proposed amendments to the specification was made and seconded, the question was taken, and the motion was agreed to.)

Mr. Flaherty. I move that we adopt the report as a whole.

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

REPORT OF COMMITTEE ON SPECIFICATIONS AND TOLERANCES ON SPECIFICATIONS AND TOLERANCES FOR LUBRICATING-OIL BOTTLES, PRESENTED BY F. S. HOLBROOK, CHAIRMAN

A code of specifications and tolerances for lubricating-oil bottles was adopted tentatively by the twentieth national conference held last year. Under our usual procedure these come up for review and final adoption at the present conference. Your committee recommends that the code tentatively adopted last year be now finally adopted with one amendment, namely, the addition of one new specification to be numbered 2, designed to limit the maximum height of bottles. Mimeographed copies of the code, as amended, were distributed a day or two ago and are now in your hands.

Your committee recommends that this entire code be put into force and effect on January 1, 1929, to apply to bottles sold after that date, and that it be nonretroactive. In the meantime the official will doubtless enforce the same requirements which he has been accustomed to enforce up to this time in the elimination of bottles which are incorrect or which are of such construction that it is deemed that they should not be permitted in use.

In view of the fact that there is in general no practical means of determining the date upon which a bottle found in use has been put into use—unless the official has been accustomed to use a dated seal on all bottles in use—it seems that there must be fixed a date after which all bottles found in use must comply with these specifications. Your committee recommends that this date be not prior to July 1, 1930.

Respectfully submitted.

(Signed) F. S. Holbrook, *Chairman*,
W. F. Cluett,
A. W. Schwartz,
Chas. M. Fuller,
I. L. Miller,
Committee on Specifications and Tolerances.

(The code referred to above is as follows:)

SPECIFICATIONS AND TOLERANCES FOR LUBRICATING-OIL BOTTLES

NOTE.—These specifications and tolerances are to be put into force and effect on January 1, 1929, and are to be nonretroactive. However, after July 1, 1930, all bottles in use may be required to comply with these specifications and tolerances.

SPECIFICATIONS.—1. *Bottles used for the sale of lubricating oil shall be made of clear, uncolored glass and only in sizes heretofore specified under the heading "Liquid Capacity Measures." They shall be made to contain their indicated capacities at a temperature of 20° C. (68° F.), and they shall not be subdivided.*

2. *The overall heights of bottles of the various capacities shall not be greater than the values shown in the following table:*

Capacity of bottle	Maximum height [13] (inches)
2 quarts	12¾
1 quart	10½
1 pint	8¼

3. *Each bottle shall have its capacity clearly blown or otherwise clearly and permanently marked in or on the side of the bottle, and in or on the side or bottom the name, initials, or trade-mark of the manufacturer thereof.*

4. *Bottles shall be provided with a clearly defined graduation line blown or otherwise clearly and permanently marked in or on the bottle, and extending at least halfway around it, which indicates the correct capacity, and with the words "Fill to line" or a similar or suitable inscription clearly and permanently marked in or on the bottle and clearly referable to this graduation line. This line shall in no case be more than 0.10 inch in width and the bottom edge of the line shall define the top of the meniscus of the water which is used in the test of the bottle. This graduation line shall be placed so that it is at least one-fourth inch below the bottom of any metal top when this is screwed firmly into place. The capacity of that portion of the bottle above the bottom of the graduation line shall be at least 3 cubic inches.*

5. *When a bottle is equipped with a spout, this shall be so constructed that free and unobstructed drainage is provided. This specification shall be construed to require that there be an effective air vent in the spout and no shoulder or other obstruction tending to result in a trapping of the liquid being delivered. The spout shall not be over 6 inches in length [14] measured from the point of contact with the top of the bottle to the tip of the spout.*

TOLERANCES.—*The tolerances to be allowed on all bottles used for the sale of lubricating oils shall be in excess only and shall be the values shown in the following table. There shall be no tolerance allowed in deficiency.*

Capacity of bottle	Tolerance	
	Drams	Cubic inches
2 quarts	12	2.7
1 quart	8	1.8
1 pint	6	1.4

DISCUSSION OF ABOVE REPORT

Mr. HOLBROOK. We may first explain the reason for the dates of enforcement recommended by the committee in the above report.

[13] COMMITTEE NOTE.—Bottles are now being developed and produced in which the bottle and the spout are integral; for instance, a metal top may be permanently attached to the bottle, or the bottle may be so shaped as to include a glass spout. In such cases it seems that compliance with these specifications will be substantially secured when the over-all height of the bottle and the permanently attached spout, or the over-all height of a bottle blown integral with the spout, does not exceed the height specified in this table plus 6 inches, which is the figure given in specification No. 5 as the allowable height of a detachable spout.

[14] See footnote above.

Oil bottles in very large numbers are in use throughout the country and from time to time those bottles will be broken and replaced by others. All bottles purchased and sold after January 1, 1929, should comply with the specifications and tolerances adopted. After that date we will have in use bottles which were procured before the code took effect, not complying in all respects with the specifications, and bottles which were procured after the code took effect, which do—or should—comply with the specifications.

Now an oil bottle is a perishable piece of apparatus. We have all heard how small a number of trips a milk bottle makes before it is broken; oil bottles are in the same general category. Glass manufacturers have informed us that practically total replacement of bottles in use will occur within a period of a year or two. Therefore it seems proper that in the case of bottles already in use on January 1, 1929, the specifications that you are now using be enforced. On July 1, 1930, probably the very great majority of these will have disappeared from use. It will be reasonable, then, if the code is enforced in the case of all bottles found in use after that date, and to require that any bottles which do not agree with all the provisions of the code, be withdrawn from use.

In the second place we may explain the reasons underlying the recommendation of the committee that a new specification, No. 2, be added to the code as adopted last year, limiting the height of lubricating-oil bottles.

You will remember that last year we discussed at some length the fact that in the delivery of lubricating oil from bottles and measures, a portion of the measured quantity of oil would not be delivered, since it would adhere to the inside surface of the bottle. This is an important factor in the deliveries of this commodity. Since this oil retained adheres to the inside surface of the bottle, it will be apparent that the greater the surface per unit of volume the greater will be the percentage retained. It is also a fact that, in general, the greater the height of the bottle, the greater will be its interior surface.

Now here (exhibiting an oil bottle about 8½ inches high, excluding the spout) is an ordinary type of oil bottle having a capacity of 1 quart. It has a certain number of square inches of interior surface. Under standard conditions of drainage this bottle will retain a certain amount of oil. Here (exhibiting an oil bottle about 13½ inches high, excluding the spout) is another quart oil bottle. On account of the fact that this bottle is very much taller than the other, it has more surface than the first. As a result this second bottle will retain more oil and if both contain the same quantity of liquid, the shortage of its delivery will be greater.

The committee believes that the height should be regulated. We have arrived at the figures in the table by starting with the heights of milk bottles which have been approved by the manufacturers under Simplified Practice Recommendation No. 10, and adding 1 inch to accommodate the portion of the lubricating-oil bottle where the top is screwed down. As a result, under this specification the bottle can be shaped like a milk bottle up to the capacity point, and the distance from the capacity point to the top of the bottle may be 1 inch greater.

That is the only amendment made to the specifications as adopted last year, with which you are all familiar.

Mr. MIEDEL. Mr. Chairman, I represent the jar and bottle manufacturers. I really would hate to see you put in the maximum height of bottles and jars for this reason: If these specifications are passed, we feel that they never can be changed because they go to all sections in the United States; as the blue laws have never been repealed, we will never get this repealed. We have heard of glass that does not shatter; science is working on glass which will not bend. We are figuring on putting out a bottle which will eliminate the metal nozzle.[15] We have made some experiments and paid some money to do it. I think that tall bottle has a lot of merit. It will discharge its liquid quickly and it has no shoulder, and I would have to be convinced that it will actually retain any more oil than the other bottle.

Mr. HOLBROOK. Perhaps I can convince you. Experiments have shown that it does retain more oil. We have investigated the drainage characteristics of these two bottles. It is demonstrated that in the case of heavy oil this tall bottle retains a quantity 11 per cent greater than the quantity retained by the shorter bottle, under standard conditions of drainage. Eleven per cent in this case amounts to three-sixteenths fluid ounce.

Mr. MIEDEL. That is a little more than a dram. Under the tolerances which are allowed, which are perfectly all right, you can very easily take that up because the tolerances are in excess only. When you prescribe specifications for an oil can, you do not say how high it shall be, and really, I think you are rather discriminating against glass packages. We have it to fight all over the country and it is nothing new. I do not think you should prescribe the shape, as you are doing.

Mr. HOLBROOK. We can hardly be said to be prescribing shape. This limits height only. Neither have we any thought of discriminating against glass containers. We merely desire to secure as nearly full measure as possible in the case of lubricating oils.

Mr. MIEDEL. There has been a good bit of money spent for bottles and a good bit of money will be lost in bottles broken up, and so forth and so on, and you can not tell what is going to come out in the future. We think in so far as we are concerned from a glass standpoint, the most essential part is that the customer gets 32 ounces.

Mr. HOLBROOK. We fear that he will not get that from either of the lubricating-oil bottles shown. Even this shorter bottle retains, I think, 1⅝ cubic inches of heavy lubricating oil after being drained for a period of 60 seconds. All that the tolerances require is that the minimum bottle be correct. The customer can not possibly get 32 ounces out of a bottle having a capacity of exactly 1 quart if 1⅝ cubic inches of lubricating oil are retained on the bottle's interior surface.

Mr. MIEDEL. It is impossible to make all bottles alike. We are allowed a tolerance of 1 ounce in excess, and our average will be a little more than 32 ounces.

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[15] See footnote, p. 143.

Mr. J. G. Rogers. If this specification is not adopted they will soon be making more and more very long bottles. There will be no limit.

Mr. Miedel. There is a certain type of automobile to-day in which the oil goes in at the top. It is very hard job to get it in unless you have a very long nozzle. That is why they make these spouts long. I can not see why you should limit the height of bottles.

Mr. Flaherty. Mr. Chairman, I move you that the recommendations of the committee in relation to the addition of specification No. 2 be adopted.

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

(A motion was made and seconded, finally to adopt the report as a whole, the question was taken, and the motion was agreed to.)

FLOWERS IN MEMORY OF LOUIS A. FISCHER

Mr. Cluett. Mr. Chairman, I wish to move that the secretary of the conference be instructed to secure a suitable memorial wreath and place it upon the grave of our former secretary, Louis A. Fischer, on Memorial Day.

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

Mr. Cluett. Mr. Chairman, I would like to move that the secretary of the conference be authorized to make necessary expenditures in connection with the meetings this year and to draw upon the treasurer for the sum so expended.

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

The Acting Chairman. A motion to adjourn is in order.

(Thereupon, at 5.35 o'clock p. m., the conference adjourned to meet at 9.30 o'clock a. m., Friday, May 25, 1928.)

SEVENTH SESSION (MORNING OF FRIDAY, MAY 25, 1928)

The conference reassembled at 9.40 o'clock a. m., at the Raleigh Hotel, Dr. George K. Burgess, president, in the chair.

REPORT OF COMMITTEE ON SPECIFICATIONS AND TOLERANCES ON MINOR CHANGES IN CODES FORMERLY ADOPTED, PRESENTED BY F. S. HOLBROOK, CHAIRMAN, AND DISCUSSION THEREON

The main report to be considered this morning has been distributed and is in your hands. It is in the nature of some general clean-up work.

The first amendment to be suggested is in relation to tolerances on glass graduates. The glassware section of the Bureau of Standards believes that the tolerances on graduates should be changed in one respect. You will remember that while there are two classes of graduates, namely, those which are intended to contain and those which are intended to deliver, at the present time both of these classes of graduates take the same tolerance.

Now the testing of a graduate made "to contain" is very easy. A measured quantity of water is transferred to it and the error is read directly on a graduation line. That method, of course, can not be used in the case of graduates which are made "to deliver." In this case the graduate must be filled up to the graduation to be tested and then the quantity which is poured out of the graduate, under standard conditions, must be measured and the error of the graduate at the graduation in question determined. Now the drainage factor enters; the side walls drain differently according to the degree of cleanliness of the glass, the manner in which the graduate is manipulated, etc., and as a result the deliveries vary to some extent and the possibility of error in the test is greater than in the case of the test first mentioned. Therefore, the test can not be made as accurately in the case of the type designed "to deliver" as in the case of the type designed "to contain."

With the same tolerance allowed on both types of graduates and a larger probability of an error in the test in the case of the delivery graduates, the delivery graduates will, in effect, be allowed a smaller tolerance than the graduates that contain, because a greater proportion of the tolerance will be absorbed in the errors incident to the test. Now that fact is recognized in the testing of precision graduates at the bureau, and the tolerance is greater on graduates "to deliver" to compensate for these probable errors. That is also recognized in foreign standardizing laboratories where a larger tolerance is allowed to graduates "to deliver." This does not necessarily mean that the graduates "to deliver" will be more inaccurate, however.

The recommendation of the committee is that in our code of tolerances for glass graduates the tolerance on graduates marked "to deliver" be increased 25 per cent over the values given in the tables, which tolerances are to remain unchanged on graduates marked "to contain."

(A motion to adopt this recommendation was made and seconded, the question was taken, and the motion was agreed to.)

Mr. Holbrook. In the case of liquid-measuring devices the committee desires to renumber the first five specifications. That is for this reason: In our codes in general, the general definition is under a separate heading and is not numbered as a separate specification. In the liquid-measuring-device code the definition was numbered "1." We recommend that the definition be not numbered, that the number assigned to each of the first four specifications be reduced by one, and that specification 5–a be renumbered 5.

(A motion to adopt this recommendation was made and seconded, the question was taken, and the motion was agreed to.)

Mr. Holbrook. Now we come to the series of minor proposed amendments to codes of specifications and tolerances formerly adopted by the conference, a copy of which is in the hands of each of you.

Let me say that the edition of Handbook No. 1 containing these specifications and tolerances is exhausted, and very shortly a new handbook will be brought out containing the codes of specifications and tolerances up to date. That is very necessary because so many changes have been made since the last handbook was printed that it is practically obsolete in its present text.

In the review of the specifications and tolerances which has been made incident to reprinting, various places were found in which the text of the code, in the opinion of the committee, can be improved by slight changes in phraseology, and we have put before you in this mimeographed report a number of changes suggested.

You will note, as we go through this report, that in most cases there is absolutely no change in the meaning of the specification through the amendment proposed.

In the following, the suggested amendments to various specifications are presented in the following way: In each case the words bracketed and struck through are those which are in the present specification but which are recommended to be deleted therefrom; words underlined are those recommended to be added. It follows that in this report the underlining of words does not have the significance that the words in question are nonretroactive. In all cases the amendments take the same status as the original specification in which they are inserted.

It is considered that most of the changes are self-explanatory and that therefore but little explanation will be necessary and many changes will be read without comment.

LINEAR MEASURES

In the case of linear measures it is required by specification 6 that main graduations be plainly designated, but the term "main graduations" is not defined. That same condition existed in the case of graduates a few years ago and at that time a definition for

the term was included in the specification in question. We are now suggesting that this definition be included here also, as follows:

6. All graduations shall be clear and distinct, and the main graduations shall be plainly designated. * * * Main graduations are to be construed as those the value of which should be readily ascertainable in order to facilitate reading at any point.

It is recommended that this definition be included throughout whenever main graduations and similar phrases are included without being defined.

An improvement in phraseology will be accomplished by striking out the word "width" and inserting in lieu thereof the word "value" in specification No. 7.

7. Graduations shall not be greater in width than one-quarter of the [~~width~~] value of the smallest subdivision: * * *.

FABRIC-MEASURING DEVICES

It is believed the original meaning of specification No. 6 under this heading will be clarified by the following change:

6. Fabric-measuring devices shall be so designed and constructed that in any position which the length indicator or pointer and [~~the~~] scale or chart may assume in [~~its~~] their operation, there will be exposed to view a sufficient number of figures and graduations readily to permit the length indications of the device to be read correctly.

Specification No. 12 is struck through entirely for the reason that when all codes are printed in one document this specification need appear only once, at which time it will be stated that it refers to all codes contained in the publication.

[~~12. Nothing contained in the above specifications shall be understood or construed to prohibit the sale or use of fabric-measuring devices constructed or graduated in units of the metric system.~~

~~The tolerances to be allowed on fabric measuring devices constructed or graduated in units of the metric system shall be the same as those specified on similar devices of an equivalent size in the customary system.~~]

It is recommended that similar action be taken throughout the codes wherever this specification appears.

LIQUID CAPACITY MEASURES

3. Liquid measures shall be so constructed that the capacity is determined by a definite edge, plate, bar, or wire at or near the top of the measure. When one of the last three forms is employed the capacity shall be determined to the lowest [~~point~~] portion of such plate, bar, or wire.

VEHICLE TANKS

TOLERANCES.—The tolerances to be allowed in excess or deficiency on all vehicle tank compartments which are being tested by the weights and measures official for the first time to verify the accuracy of a capacity marked [~~thereon~~] by a manufacturer or user, * * * then the [~~compartment~~] marking shall be [~~re-marked~~] changed in accordance with the provisions of specification No. 7, * * *.

SCALES

GENERAL SPECIFICATIONS.—1. * * * When one reading or recording element of the scale is designed for auxiliary use only, such as a small bar and poise intended for use in determining weights intermediate between two graduations

on the principal bar of the beam, the weight value of this reading or recording element [~~need~~] is not to be included in the sum, provided that it does not exceed 2 per cent of the sum of the weight values of the remaining reading or recording elements. (Thus, a platform scale with the principal bar of the beam graduated to 100,000 pounds by 1,000-pound subdivisions and with an auxiliary bar graduated to 1,000 pounds by 20-pound subdivisions [~~may~~] is to be considered as having a nominal capacity of 100,000 pounds.) * * *

When these specifications were first prepared it was common to refer to the whole piece of metal shaped up to a sharp edge to transmit loads throughout the lever system of a scale, as a "knife-edge." The practice has now become common to refer to this piece of metal as a "pivot," limiting the use of the term "knife-edge" to the sharp edge of this part. Also, pivots are more usually secured "in" rather than "to" the levers.

4. All [~~knife-edges~~] pivots shall be firmly secured [~~to~~] in the levers.

6. All bearings shall be smooth and at least as hard as the knife-edges. For scales of more than 5,000 pounds capacity, the bearings shall be made of hardened and tempered steel. (The term "bearing" used in this [~~paragraph~~] specification refers to the entire surface which is designed to be in contact with [~~the edge of~~] a knife-edge or with a point bearing.)

The "nose-iron" of a scale is mentioned in specification No. 8, but the term is not defined. We feel that this should be done, as follows:

8. * * * A nose-iron is to be construed as a slidably mounted, manually adjustable pivot assembly designed for changing the multiplication of a lever.

It is recommended that this whole specification be made non-retroactive.

13. Each main weight graduation [~~on a beam~~] shall be so marked as to indicate the weight represented by the poise [~~at that point.~~] or other indicator. Main graduations are to be construed as those the value of which should be readily ascertainable in order to facilitate reading at any point.

21. When a scale[~~s are~~] is equipped with a beam, the position or oscillation of which is used to indicate the balance of the scale, the normal position of this beam shall be horizontal, and it shall have equal play above and below the normal horizontal position.

In the case of a scale tested with both increasing and decreasing loads it was always the intention of the committee to require that indications on increasing loads be within the usual tolerances, but this idea seems not to have been sufficiently expressed, and therefore specification No. 23a is clarified in this regard as follows:

23a. When tests are being made with both increasing and decreasing loads on any scale, the indications on all increasing loads shall be within the usual tolerances provided and also at any stage of the test the range between corresponding observations for increasing and decreasing loads shall not be greater than the sum of the tolerances in excess and in deficiency for the load in question. This specification is to be construed as applying only to automatic-indicating scales.

It is recommended that the same change be made in this specification when appearing elsewhere.

The practice of referring to the "sensibility reciprocal" of a scale as the "SR" is time-conserving and should be encouraged. It is therefore proposed to recognize it herein when the term is employed. The words stricken out at the end of the first paragraph are, in effect, unenforceable.

SENSIBILITY RECIPROCAL (SR).—The term "sensibility reciprocal" or "SR" hereinafter referred to is defined as the weight required to move the position of equilibrium of the beam, pan, pointer, or other indicating device of a scale a definite amount, at the capacity or at any lesser load. [~~the effect of friction in causing inconstancy of this position of equilibrium being eliminated.~~]

* * * * * * *

In the case of scales equipped with two indicators which move in opposite directions and oscillate with reference to each other to form a convenient means for determining the position of equilibrium of the beam, the [~~sensibility reciprocal~~] SR is the weight required to cause a separation of the indicators of 0.04 inch, measured in the direction of their movement.

PLATFORM SCALES

DEFINITIONS.— * * * (2) Its beam or other reading element is located at an elevation sufficiently low in relation to the weighing platform to be accessible and easily read when the scale is used upon a[~~n elevated~~-] table or counter.

9a. Counter platform scales whose weight indications are changed by an amount greater than one-half the tolerance allowed, when set in any position on a surface making an angle of 5 per cent or approximately 3 degrees with the horizontal, shall be equipped with a device which will indicate when the scale is level, and in no case shall any pendulum operating the scale be considered a leveling device. The scale shall be rebalanced at zero each time its position is altered during [~~this~~] the test contemplated by this specification.

It is recommended that the same change be made in this specification when appearing elsewhere.

10. All platform scales, except track scales, shall be so constructed that when a load consisting of test weights representing one-half or more than one-half of the capacity of the scale, and not exceeding such capacity, is placed so that its center of gravity lies over the points designated by circles in diagram No. 1, the error at each point shall not exceed the tolerance allowed for the load employed, given in the tolerance table in the column headed "On beam." If a load equal to one-quarter of the capacity is used, this shall be placed so that its center of gravity lies directly over the platform bearings designated by the circles in diagram No. 2, and the errors shall not exceed those indicated above.

EXPLANATION OF PRECEDING TABLE.—"Class A" scales include the following: Scales of the portable platform type; and also scales of the dormant or built-in type 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 railroad track, auto-truck, and wagon types; and also scales of the dormant or built-in type 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.

We have a class of devices for which tolerances have been adopted, referred to formerly as "portable devices designed for determining the axle loads on loaded trucks on highways." This term is so long as to be cumbersome. It is proposed to change this term to the term "wheel-load weighers" which is very much shorter and sufficiently descriptive of these devices.

[~~PORTABLE DEVICES DESIGNED FOR DETERMINING THE AXLE LOADS ON LOADED TRUCKS ON HIGHWAYS.~~] WHEEL-LOAD WEIGHERS

DEFINITION.—Wheel-load weighers shall for the purpose of these tolerances, mean portable devices designed for determining the axle loads on loaded trucks on highways, [~~NOTE.—These devices~~] and are designed and constructed solely for official use in the enforcement of traffic or highway laws.

COUNTER [~~BALANCES AND~~] SCALES

DEFINITION.— * * * It is to be noted, however, that those types embraced in the definitions of platform scales, spring scales, computing scales, cream-test and butter-fat-test scales, and prescription scales and balances are considered under their specific headings.

7. * * * In case such scales are provided with a trig-loop or graduated scale or arc or other suitable reference interval or point, the minimum total movement of the beam at such point shall be 0.4 inch if the [~~beam~~] distance from the beam-fulcrum to the reference means is 12 inches or less [~~in length~~] and 0.5 inch if the [~~beam~~] distance is over 12 inches. [~~in length.~~]

12. All counter scales shall be maintained in level.

It is recommended that the same change be made in this specification when appearing elsewhere.

STRAIGHT-FACE SPRING SCALES

DEFINITION.—A straight-face spring scale is a spring scale in which an indicator [~~or graduated face~~] is affixed to a spring without intervening mechanism and registers the extension of the spring on a straight graduated face.

Those are the minor changes believed by your committee to be advisable. It seems possible that a few more of the same character may be discovered before the material is sent to the printer. Therefore, in order to have the reprinted specifications in as good shape as possible, your committee suggests that, if the conference deems it proper, the committee be given the authority to make other slight changes of that character in other specifications, changes which will not affect the meaning but tend to clarify the wording. They ask that authority not with the idea that it needs to be exercised to any great extent, because we think we have picked up the great majority of advisable changes and have presented them in this report.

Mr. SWEENEY. Mr. Chairman, I move the committee at this time be empowered to make any changes that appear proper for a better presentation of the specifications.

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

The CHAIRMAN. Now the committee has brought in definite suggestions for amendments and the committee in effect moves the adoption of those amendments. Is there any discussion?

Mr. BRIGGS. It is proposed that under the heading, "Scales. General Specifications," specification No. 4 shall read, "All pivots shall be firmly secured in the levers." The former wording required them to be attached "to the levers." There is a distinction between "to" and "in." For instance, this would apply to nose-irons containing knife-edges where the edges are movable, and it might be argued that these were securely bound "to" the levers. I merely call attention to that particular thing since in this case you have a knife-edge that is entirely satisfactory in its operation.

Mr. HOLBROOK. The committee believes that usually the pivots are put in the lever part itself and are partially inclosed by the lever rather than being strapped on or attached by some extraneous means. This is believed to describe that idea more clearly.

Mr. BRIGGS. Another point is in relation to specification No. 10 in relation to tolerances to be applied in shift tests. In the original specification it was desired to require a certain accuracy in the ratio of the lever upon which loose counterpoise weights were to be used. The tolerances on the ratio were determined on the basis of what is necessary to secure an accurate construction; there is also a tolerance on the weights. The ratio was required to be accurate so that you could test the weights independently, also so that you could take

from stock standard weights and the scale would weigh accurately with those weights.

When the full-capacity scales were under consideration it was not possible to distinguish between the tolerance on the ratio of the levers and the tolerance on the weights, so the tolerances were lumped and expressed as one figure.

This new tolerance really permits a person to have a less accurate adjustment in the case of the scale using counterpoise weights. It seems to me that the tolerance on the shift test should be the same regardless of whether the lever system is continued up to a full capacity beam or to a beam utilizing counterpoise weights.

It is difficult to bring out that point clearly.

The CHAIRMAN. The chair would suggest that if you care to submit a statement to the committee they will be only too glad to consider your suggestion. They have the authority to make minor changes in clarifying the text.

Mr. BRIGGS. I will prepare something.

The CHAIRMAN. Is there any further discussion on the report? Are you ready for the question on the adoption of the report?

(The motion that the report be adopted was seconded, the question was taken, and the motion was agreed to.)

Mr. MEREDITH. Mr. Chairman, can you advise as to the approximate time when the next handbook will be available?

The CHAIRMAN. If the bureau has money I think we can send it to the printer by June 15. In that case, Congress not being in session, it may be possible to get it out in three months or less.

FLOOD CONDITIONS AS AFFECTING WEIGHTS AND MEASURES OFFICIALS IN NEW ENGLAND

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

Mr. President and gentlemen of the convention, according to a statement issued by the American National Red Cross, the November flood affected five of the six New England States. Maine alone escaped. In all, 69 towns suffered losses. Individuals who met with flood losses in these communities numbered 30,390. The calamity seemed to visit Vermont the hardest. There were 84 deaths from drowning and causes incident to the flood; 41 towns suffered property damages affecting 18,800 individuals; 300 buildings were totally destroyed and 1,247 damaged, resulting in a property damage of approximately $30,000,000.

In response to an appeal by Governor Weeks of Vermont, President Coolidge directed Secretary Herbert Hoover to make an early visit to the flood area. Within two weeks of the catastrophe Secretary Hoover had traversed the region worst affected and outlined a program of rehabilitation. The legislature was called in extra session and a bond issue of eight and one-half million dollars was authorized.

I presume you will say it is a far cry from a flood to weights and measures supervision. However, the conditions that existed in the flooded area in New England were such that officials of the weights and measures departments were called upon to help very materially in the rehabilitation work.

Before going into details it might be of interest to describe briefly the flood itself, which in some localities approached the deluge of Biblical history. The villages in our New England States are located in many instances in the valleys, on streams that drain the surrounding country. It commenced to rain during the evening of November 3, and rained continuously and violently November 4 and 5. By the evening of November 4 the usual mountain streams and brooks had become raging torrents, washing out many bridges and roadways. The rivers that took care of the drainage of this territory became veritable lakes, with a current of a velocity that swept everything before it. The merchants in the flood area were warned by radio, telephone, and local fire alarms; as soon as the water began to fill their cellars they carried merchandise to the floors above, only to have it swept away by the rushing waters. Water very quickly rose 10 or 12 feet, flooding the first and second floors, in many instances driving people to the roofs of houses, to be taken off later by rescue parties. Not until the water receded could the extent of the damage be in any measure realized. Merchants going back to their places of business, if they still remained, found in most instances a total loss. Had it not been for the airplanes, automobiles, and radios, suffering would have been very great, for there was no train service and wire communication was cut off. It seemed for a time that the destruction was beyond repair.

My own city faced a food shortage, and a commission was appointed to dole out provisions as in war time and the Red Cross took care of clothing and sheltering the afflicted. It was at this point that the weights and measures officials, working with police and commissions, were of much assistance. Nearly all weighing and measuring devices used in trade were put out of commission. Calls for inspectors and sealers of weights and measures to assist in putting apparatus in shape to be of some service until new could be bought or the old ones repaired, were constantly coming to the office. Inspectors were first sent to the places most in need, and post offices, coal sheds, and creameries were given aid. Tolerances were discarded and almost anything was used as an emergency measure. Merchants' apparatus that went through the flood in most cases was found very inaccurate. Computing scales suffered from charts being wet and buckling, throwing them out of alignment. Spring scales were susceptible to rust and dirt. The scales that seemed to go through the ordeal best were the equal-arm balance and portable platform scales. Scales of these types could be taken apart and the pivots, bearings, and poises cleaned, and be made to function properly and accurately.

The weights and measures department of Vermont has had the satisfaction of being of real service in this catastrophe and I believe their services have been appreciated by the public as a whole. It will be some time before conditions are back to normal, but with the same courage that prompted the Pilgrim Fathers in Massachusetts to overcome the trials and discouragements of those early days, the men and women of New England have set about the task of rehabilitation and I predict that there will arise from the flood-stricken area a bigger and better New England.

The CHAIRMAN. Does anyone wish to ask Mr. Davis any questions? If not, we can proceed to the next item, "Citation by weights and

measures officials of important court decisions in their jurisdictions," which in some of the past conferences has been productive of very considerable interest.

The Chair is not informed as to whether there are items to be presented. If there are any that you wish to put in the record, either verbally at this time or by correspondence later, we would be glad to hear from you about them either now or in writing.

Mr. Fox. Mr. Chairman, I have some cases against coal dealers in Louisville. These cases were called yesterday, and in regard to one of them I would like to get in touch with the Bureau of Standards, and will send in the information.

NOTES ON DIGEST OF WEIGHTS AND MEASURES CASES

By William Parry, *Bureau of Standards*

Mr. Chairman and members of the conference, the bureau has realized for a number of years that there is a great need among weights and measures officials as well as among the attorneys charged with the prosecution of violations of the weights and measures laws, and others, for a publication dealing with the weights and measures cases which have been decided by the courts having published records. Such a book would also be of service in legislative reference and other libraries, as well as in various lines of business. Up to a short time ago opportunity had not been found to start the preparation of a publication along the line indicated. However, the time seems to have come when this work may be systematically pursued and brought to completion. Consequently work on this project has been commenced and considerable material has already been gathered.

We feel that the field of usefulness for such a book has been greatly broadened during the past decade. It is now common for the official appointed to enforce the weights and measures laws to enter the work elected for a term of years, or upon the still more favorable basis of civil service. As a consequence, a high type of official is attracted to this position and he goes about his duties with a view to rendering the best possible service. He puts the whole of his energies into the work, and desires to administer it with vigor and fairness, and in a systematic and intelligent manner. The position is thus being brought to a higher plane, and occupied by one who is being recognized as an important public official; to him are intrusted responsible public duties of importance to all members of society. With an official of this type in charge of weights and measures work, it it to be expected that he desires to learn all he can concerning the matters with which he has to deal, and consequently the law comes in for a large share of his attention and study. It is therefore opportune that a publication of the type and scope here contemplated should become available to the official, and it is believed that it will be of great assistance to him in his work and that its value will be reflected in no mean way by the character of the service rendered by him.

To meet the needs of the weights and measures official, who is not necessarily trained in the law and who does not, except perhaps in rare instances, have available for his use a reference law library, such a book should be rather complete in itself. It is our intention

that the subject matter be sufficiently stated in presenting a particular case, to give the official a clear idea not only of the legal aspect of the case, but of all the circumstances surrounding it, so that he may be able to apply the principle of law involved to a similar set of circumstances which may arise in his own jurisdiction.

The exact form in which the subject matter will be treated has not as yet been definitely decided upon. There are two methods of presentation which lend themselves to the treatment of the material in hand, and either one of these might be used in the preparation of the proposed book. One is the case-book method, with comment upon the subject matter presented. If this method were used the material could be divided into chapters according to its nature. Comments at the beginning of each chapter would consist of a general statement regarding the law on the subject. Leading cases pertaining to a given subject would be presented and set forth at sufficient length to give a complete and clear idea of each case. There would also be included, or sufficiently referred to, cases holding a contrary view, and also cases adversely decided on account of circumstances or conditions requiring differentiation and a different conclusion. It would not, of course, be practicable or desirable to give in complete form all cases in all the States which were very similar in legal principle and consistent in the decision rendered; but citations would be carried to all such cases so that an official in consulting the book would always be able to find cases in his own State on the subject discussed, if such cases existed.

Another plan of presenting the subject matter would be the usual textbook form. This method of treatment would be in the form of a general treatise, and besides an exposition of the law as embodied in weights and measures cases, it would include other phases of the law of interest and service to the weights and measures official and directly applicable to weights and measures law, but which are not illustrated by decided cases in the field of weights and measures. This form of presentation deals more with the principles of law involved and these are illustrated by reference to leading cases decided by the higher courts. Such a treatment would necessarily be very much more extensive, and would require a great deal more research, time, and labor in its preparation than the method first mentioned. It would also be necessary for the reader to make greater use of books containing reported cases. For these reasons it seems probable that the material will be presented in the former rather than the latter form.

It is the general intention that the book include reference to all cases on weights and measures in so far as they can be located, from the foundation of our Government to the present time, which have been decided by the Supreme Court of the United States and the highest courts of the various States as well as in other Federal and State courts having published records. A number of cases will also be selected from among those tried by the Federal courts under the national food and drugs act, in order to bring out the various features of this act pertaining to the marking of the net quantity in terms of weight, measure, or numerical count on package goods, such as the character and sufficiency of the marking, the minimum shortages upon which prosecutions have been sustained for different classes of commodities, the defining of package goods as illustrated

by concrete examples, the meaning of the term "original package," etc., the status of goods shipped in interstate commerce, and the general interpretation and construction of the act.

The legal aspects of subjects such as the following will be treated in the proposed publication, whatever may be the form of presentation:

Constitutional authority over weights and measures, effect upon the States of Federal power when dormant, concurrent jurisdiction, etc.

Police power, in its application to weights and measures supervision, extent and reasonableness in restricting personal and property rights, alienation or abridgment by contract, etc.

The weights and measures official, his duties, authority, responsibility, etc.

The inspection and test of apparatus, and its confiscation, and destruction.

The sale of commodities by false or untested apparatus, or by insufficient weight or measure.

The responsibility of owner for giving false or insufficient weight or measure, and his responsibility when sale is made by an employee.

The validity of laws requiring sale by particular methods, such as the sale of dry commodities by weight.

The sale of particular commodities, such as bread, coal, cotton, hay, grain, milk, wood, etc.

The marking of the net quantity on packages.

Interstate commerce, in its relation to package goods—showing when packages cease to be subject to interstate commerce laws, when they become subject to State laws, etc.

Special containers and fixed standards, such as hampers, barrels, baskets, boxes, etc.

Customs and usages, showing the extent of use necessary to establish a recognized custom in a particular instance, limitations of customs and usages with respect to statute law, etc.

City and municipal ordinances, their scope, relation to State legislation, appointment of inspectors, power to prescribe penalties, etc.

Public scales, right of city to establish and maintain, extent of use which may be required, the rights of private weighers, etc.

Mine scales, legality of their compulsory use to weigh coal at mines, test of same, etc.

Fees and their legality.

It is the intention to list cases to which reference is made, in different ways. One list will include all cases in a particular State, under the name of the State. The cases will also be classified under subjects, bringing together all cases pertaining to a given subject. A third arrangement will be an alphabetical one. These different arrangements will serve useful purposes. The first mentioned will enable a person to find in one place all the cases decided in his own State. He might then readily become familiar with these cases. The second arrangement, by subjects, will place at hand all the cases on a particular subject, so that an official may make a study of them for the purpose of becoming familiar with the subject in general, or in deciding whether to bring legal action in a case under con-

sideration by him. The third list will enable a person to find a given case when he has the name only.

The number of cases relating to weights and measures are very few as compared with many other legal subjects. Up to the present time about 400 cases have been listed, exclusive of those decided by the Federal courts and the Supreme Court of the United States. The searching has not yet been completed, and thus it is not expected that this number includes all the cases which have been reported in the States, but undoubtedly the very large majority are included in the list.

I shall not attempt to give a résumé or analysis of the cases thus far found, but instead I have prepared a mimeographed list of the cases with an explanation in a few words, or a single word, as to the subject matter. This list you may take home with you and look it over at your leisure. It is believed that this will provide much more definite information and be in a more useful form than any discussion that could be made within the scope of a paper of this sort. It might, however, be of interest to mention a few classes of cases which seem to be of especial importance.

Probably the largest number of cases on a particular subject deals with the sale of coal. The difficulty experienced by the purchaser in ascertaining whether full weight has been delivered, and various requirements for checking the weight on public scales, are among the factors contributing to the large number of cases in relation to this commodity. Other factors include faulty scales, delivery tickets, reweighing in the course of delivery, foreign substances in the coal, etc. Cases on these points will be found in the list referred to.

Also a large number of cases have arisen under laws requiring the sale of bread by weight. Among the most important of these are the ones coming before the United States Supreme Court from the States of Illinois and Nebraska.

A line of cases of particular interest to the merchant are those dealing with the question of collection of accounts based upon sales of merchandise made with unsealed or fraudulent weighing or measuring devices. Cases of this sort have been noted in several States. The decisions generally hold that no part of the amount of such sales may be collected, but in one State the law permits three-fourths of the account to be collected.

Several cases have been noted where a contract based upon a recognized custom of trade can be set aside if there be a statute governing the matter. On the other hand, another case, decided by the Missouri Court of Appeals, shows that where money has been paid on the contract with a full knowledge of the facts, under a mistake of the law, the money can not be recovered in the absence of fraud, imposition, undue influence, or the like.

There are a number of cases dealing with the question of the conclusiveness of the certificate of a weighmaster. In some instances the law has attempted to make such a certificate conclusive evidence, but the courts have held such laws unconstitutional on the ground that they attempt to exclude evidence attacking the validity of the weighmaster's certificate.

In general it may be said that on account of lack of opportunity to pursue the legal phase of weights and measures work, the knowledge of the average sealer is largely based upon experience gained

in actual prosecution or by personal contacts. A careful study of the weights and measures cases will bring him increased knowledge of the legal phases of his work; it should open to him an enlarged view of the extent and possibilities of his position, create a greater sense of responsibility in the matter of administering the laws, and a clearer insight into his rights and privileges, permitting him to act with greater assurance and certainty in the discharge of his duties. For instance, as suggested heretofore, if a sealer desires to bring a prosecution, a careful study of cases involving similar circumstances would yield valuable information for his guidance in his resort to the courts so that he would be reasonably certain that the interpretation of the law made by him would be sustained by the court; conversely, he might be prevented from being led into a matter which had already been adversely decided by the courts. Again, the book should be of value as a guide in the drafting of legislation, so that reasonable certainty would be assured as to the constitutionality of the proposal, definiteness of the meaning of its provisions, and certainty of its scope and effectiveness.

In conclusion it may be stated that the securing of greater knowledge on the part of the sealer along the lines of the subject under discussion, will tend to produce a higher grade of service, and it should be a source of satisfaction to himself to have increased knowledge on so important a phase of his work. Naturally such knowledge will not go unnoticed by other officials of his city or by the public in general. This situation will naturally redound to the benefit of the sealer in a higher valuation of his service and in greater esteem and prestige.

DISCUSSION OF ABOVE PAPER

The Chairman. Are there any comments on Mr. Parry's paper, or are there any suggestions regarding the type of publication? You remember it is not finally decided what form the book shall finally take. If any of you have any suggestions that you wish to make this morning, or later, he would undoubtedly be glad to receive them.

Our reporter, Mr. Knauss, says there is another publication which is now coming out, of which four volumes have already been issued, dated January, 1928. It is "Municipal Corporations," by McQuillan, and in Volume III of that seven-volume set there is considerable material relating to the legal aspects of weights and measures supervision.

Mr. Sweeney. Mr. Chairman, I think this paper by Mr. Parry is a very good one, but in talking to him I referred to him a case not mentioned, that of Moneyweight Scale Co. *v.* Felix McBride. I think it might be a very good idea if the Chair would ask the various delegates to communicate to Mr. Parry decisions, if any, which they discover are omitted, when they look over the list.

The Chairman. Mr. Sweeney's suggestion is a very good one. I suppose there may be some in this room who know of such cases not included in the list. I hope they will get in touch with Mr. Parry in this relation.

Mr. Foster. Mr. President, I think you will find that the reference presented by Mr. Sweeney is in the list that has been handed out to the various delegates.

Mr. Sweeney. I beg your pardon, Mr. Chairman, but the case I had reference to was the civil-service decision of the courts in reference to Mr. McBride.

REPORT OF COMMITTEE ON NOMINATIONS, PRESENTED BY WILLIAM F. CLUETT, CHAIRMAN, AND ELECTION OF OFFICERS

Mr. Chairman and delegates, your committee on nominations in preparing this report has had in mind the resolution that was passed at the last conference to the effect that so long as the executive committee remains at the present number no two persons from the same State shall serve on the committee at the same time.

Your committee on nominations respectfully submits the following names of members of the conference as nominees for officers and members of the executive committee for the ensuing year, the officers to serve as ex officio members of the committee:

President, George K. Burgess; first vice president, H. L. Flurry; second vice president, Francis Meredith; secretary, F. S. Holbrook; treasurer, George F. Austin; members of the executive committee, all of the officers ex officio, M. A. Bridge, W. F. Cluett, H. N. Davis, C. V. Fickett, Thomas Flaherty, J. H. Foley, William Foster, S. T. Griffith, H. S. Jarrett, T. F. Mahoney, E. J. Maroney, I. L. Miller, W. A. Payne, B. W. Ragland, G. W. Roberts, A. B. Smith, W. F. Steinel, V. A. Stovall, H. A. Webster.

(Signed) W. F. Cluett, *Chairman*,
Francis Meredith,
Harry S. Provost,
V. A. Stovall,
Charles M. Fuller,
Committee on Nominations.

The Chairman. The Chair will ask Mr. Cluett to take the chair.

(Mr. Cluett assumed the chair.)

Mr. Schwartz. Mr. Chairman, I move you that the report of the committee be received, the nominations closed, and the secretary directed to cast the ballot of the conference.

(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.

Doctor Burgess resumed the chair.)

The Chairman. Speaking for all who have been elected, I will say we will do our very best to make the next conference as good as this one, and I must say that will be quite a task.

REPORT OF COMMITTEE ON RESOLUTIONS, PRESENTED BY HOWARD S. JARRETT, CHAIRMAN

Mr. Chairman and members of the conference, your committee on resolutions has the following resolutions to submit, and moves their adoption:

TRANSMISSION DRIVE FOR TAXIMETERS

Whereas an exhaustive investigation has been made by the Bureau of Standards, assisted by Mr. James J. Sweeney, city sealer of Boston, Mass., and reported to this conference, in relation to the accuracy of registration of taxi-

meters when driven from the transmission as compared to the accuracy obtained when the taximeter is driven from the front wheel; and

Whereas this investigation has demonstrated that only slight discrepancies are found between the two methods of operation, whether under good or bad road conditions, and it is thus indicated that the rights of the public using taxicabs will not be jeopardized by the use of the transmission drive instead of the front-wheel drive now more commonly employed; and

Whereas it is a fact that in the case of the transmission drive the expense of the servicing of the meter installation is materially reduced and new meters will not become inoperable nearly so often in service, thus resulting in a decrease in overhead costs and a greater reliability of service: Therefore be it

Resolved, That this Twenty-first National Conference on Weights and Measures, held in Washington, D. C., May 22–25, 1928, hereby declares its conviction that there is no objection from a weights and measures standpoint, to the operation of a taximeter from the transmission, and that operating economies may be effected thereby.

(The resolution was duly adopted.)

Mr. JARRETT. The next resolution is as follows [reading]:

UNIFORMITY IN WEIGHTS AND MEASURES REQUIREMENTS

Resolved, That a committee of five be appointed by the president to work out ways and means to bring about more uniformity in relation to weights and measures requirements and methods of enforcing them, and a report be made at the next conference.

(The resolution was duly adopted.)

Mr. JARRETT. The next resolution is as follows [reading]:

APPRECIATION TO THE DIRECTOR AND STAFF OF THE BUREAU OF STANDARDS

Resolved, That the sincere appreciation of the Twenty-first National Conference on Weights and Measures be extended to our president, Doctor Burgess, for his interest and guidance in the deliberations of the conference, and we gratefully acknowledge the advice and cooperation of our presiding officer and his able staff, who so courteously rendered assistance at all times.

Mr. CLUETT. All in favor of this motion signify it by saying "aye"; contrary "no." Carried.

The CHAIRMAN. Thank you, gentlemen.

Mr. JARRETT. This next resolution is a little premature, but we understand that we are to be received by the President at noon, and so we have included a resolution relating thereto, as follows [reading]:

RECEPTION BY PRESIDENT COOLIDGE

Resolved, That the National Conference on Weights and Measures acknowledge and record their deep appreciation for the courtesy extended by the Chief Executive of the United States, President Calvin Coolidge.

(The resolution was duly adopted.)

Mr. JARRETT. The next resolution is as follows [reading]:

APPRECIATION TO THE PRESS

Resolved, That the appreciation of the Twenty-first National Conference on Weights and Measures be extended to the press of the country for the reports of our proceedings which have been accurately stated and carried to the public throughout our several jurisdictions.

Mr. SCHWARTZ. Mr. President, if I may be permitted to speak on this resolution, it appears that one of the morning papers had an article which attributed to J. Harry Foley, first vice president of

this association, a statement which was, in fact, made upon the floor of the conference by E. J. Maroney. I mention this matter so that there may be no misunderstanding in this relation.

The CHAIRMAN. The Chair has not seen that publication.

(The resolution was duly adopted.)

Mr. JARRETT. The next resolution is as follows [reading]:

STEPHEN G. PLANT

Whereas it has pleased Almighty God in his wisdom to remove from us our beloved friend and associate, Stephen G. Plant, county superintendent of weights and measures of Mercer County, N. J., and a member of this conference, a man of sterling worth and an energetic and efficient official: Therefore be it

Resolved, By the Twenty-first National Conference on Weights and Measures assembled in Washington, D. C., May 22–25, 1928, that we express our deep and sincere grief at the loss of our colleague; and be it further

Resolved, That a copy of this resolution be sent to the family of the deceased with our assurance of our deep sympathy with them in their great bereavement.

The CHAIRMAN. I think we should pass this resolution by a rising vote.

(The resolution was duly adopted by a rising vote.)

REPORT OF TREASURER, GEORGE F. AUSTIN [16]

Gentlemen of the conference: I herewith submit my report as treasurer of the National Conference on Weights and Measures for the year ending May 21, 1928:

Receipts:		
Balance on hand May 23, 1927		$161.95
Received through fees from delegates		101.00
Total receipts		262.95
Disbursements:		
Ralph Smith, for delegates' badges	$5.00	
Messenger service	5.00	
Candy for stenographers	10.00	
Cigars for reporter	9.70	
Flowers in memory of Mr. Fischer	10.00	
George F. Austin, for receipt blanks	.70	
Total disbursements		40.40
Balance on hand May 21, 1928		222.55

Respectfully submitted.

(Signed) GEORGE F. AUSTIN, *Treasurer.*

(A motion was made and seconded that the report of the treasurer be accepted, the question was taken, and the motion was agreed to.)

GENERAL DISCUSSION OF SUBJECTS OF INTEREST BROUGHT UP FOR DISCUSSION BY DELEGATES

Mr. SWEENEY. Mr. Chairman, in reference to the taximeter transmission drive, it is a fact that the ratios of the various cars are different, and necessarily the reduction boxes which are used under the meters are different in so far as the gearing is concerned. I would suggest that it might be well, if possible, for the Bureau of Stand-

[16] In the absence of George F. Austin this report was presented by George F. Austin, jr.

ards to obtain these ratios from the various car manufacturers, and compile a list showing the various combinations of gears that are used in the reduction boxes.

The CHAIRMAN. The Chair suggests that if the information would be useful and could be promptly secured it might be included as an appendix to this report.

Mr. E. J. ROGERS. Would it be possible to hold the conference one week or two weeks later?

The CHAIRMAN. The secretary states that the dates of meeting are in the hands of the executive committee. If you wish to bring up that question, you might address the executive committee. However, if there is any consensus of opinion among those present the committee would be glad to have it.

Mr. HOLBROOK. The selection of the last full week in May for the conference has been largely on account of the weather. We usually get good, mild weather at this season of the year. On the whole, this conference has, I believe, been blessed with excellent weather. Of course, as far as those of us who live in Washington are concerned, we have to be here anyway so that we are entirely unaffected; but occasionally in the past delegates have had occasion to criticize Washington weather on account of the heat, even at this date; of course, the later the conference is held the more probable it is that warmer weather will prevail. That is the reason for the date being pretty well standardized at this time of the year. However, it is to be recognized that the railroads offer a material reduction in rates from far western points after a certain date, and that the delegates can not take advantage of it during this week. It would undoubtedly stimulate interest and attendance from the far West if a postponement could be effected to about the first week in June.

The CHAIRMAN. It seems to the Chair that it is fair to raise the question informally in the meeting. I will put it this way—this is purely informal: Is there objection on the part of the delegates to meeting a week later?

A DELEGATE. Mr. Chairman, a postponement of one week would bring the conference into the week containing Memorial Day. Two weeks later would seem to be the logical time to have it.

The CHAIRMAN. This matter will be very carefully considered by the executive committee.

SUGGESTIONS FOR PROGRAM OF TWENTY-SECOND CONFERENCE

The CHAIRMAN. Are there any suggestions from the floor relative to the program for next year's meeting?

The Chair has two: First, since the question of grading by color is coming very much to the front, we might ask Mr. Priest, of the Bureau of Standards, to give a paper on color standardization. There are a great many food products, paints, and textiles which are graded by color, and a statement on that type of work might be of interest.

Second, following what we have had on the questions of the relationship of the business man to, and the legal aspects of, weights and measures supervision, I think it might be well to ask a representative of the Federal Trade Commission to give something from their point of view on weights and measures activities.

Mr. Schwartz. Mr. Chairman, I have just one thought. Some of the most important subjects have been put on the afternoon program, and sometimes the attendance has been rather small when those subjects have come up for consideration. For instance, late yesterday afternoon the report of the committee on specifications and tolerances was considered by a rather small attendance. To my mind a representative attendance should be present to act on those important projects. If the program could be arranged to have some of those important matters brought into the morning session when there is usually a large attendance, I think that might prove a benefit. That is just by way of suggestion.

Mr. Austin. Mr. Chairman, inasmuch as the suppression of fraudulent practices does not entirely rest on the testing of equipment and apparatus, I think if an item dealing with the means employed by the various departments for the suppression of fraudulent practices is incorporated in next year's program, you will find many ideas brought out which will be generally beneficial to all of us.

The Chairman. As I have already stated, if you do not think of anything at the present moment, but something occurs to you later, we will be glad to have you write us relative to the 1929 program.

A motion to adjourn is in order.

(A motion to adjourn was made and seconded, the question was taken, and the motion was agreed to.)

(Thereupon, at 11.15 o'clock a. m., the Twenty-first National Conference on Weights and Measures adjourned sine die.)

APPENDIX

TENTATIVE SPECIFICATIONS AND TOLERANCES FOR GREASE-MEASURING DEVICES, ADOPTED BY THE TWENTY-FIRST NATIONAL CONFERENCE ON WEIGHTS AND MEASURES, MAY 24, 1928

FOREWORD

The Twenty-first National Conference on Weights and Measures adopted the following code of specifications and tolerances for grease-measuring devices tentatively, in accordance with its usual custom. It will accordingly be reviewed by the committee during the coming year, and will be offered for final adoption at the next conference. In the interim, officials, manufacturers, users, and all other interested parties are invited to submit to the committtee any suggestions and criticisms which may occur to them, in order that the code may be revised, if necessary or advisable, before it is presented for final adoption. Such comments may be addressed to the chairman of the committee on specifications and tolerances, National Conference on Weights and Measures, or to any member of the committee, which is as follows:

F. S. Holbrook, Bureau of Standards, Washington, D. C.
William F. Cluett, chief deputy inspector of weights and measures, City Hall, Chicago, Ill.
Charles M. Fuller, city and county sealer of weights and measures, Los Angeles, Calif.
A. W. Schwartz, assistant State superintendent of weights and measures, Elizabeth, N. J.
I. L. Miller, State commissioner of weights and measures, Indianapolis, Ind.

DEFINITION.—A mechanically operated grease measuring and dispensing device, hereinafter referred to as a grease-measuring device, is a mechanism or machine adapted to measure and deliver grease or transmission oil by volume.

SPECIFICATIONS.—1. *Permanence. All grease-measuring devices shall be of such design, construction, and materials that they may reasonably be expected to withstand ordinary usage without impairment of the accuracy of their measurement, or the correct functioning of their operating or indicating parts.*

2. *Units of delivery. Grease-measuring devices shall have the following discharge capacities per stroke or per cycle of the primary indicating elements, and these only: One pint, a multiple of the pint, or a binary submultiple of the pint, that is, the quantity obtained by dividing the pint by the number 2 or a power of the number 2.*

3. Indication of delivery required. All grease-measuring devices shall be so designed and constructed that the initial zero condition and the amount delivered in terms of liquid measure shall be clearly

and definitely indicated by automatic means, and the indication of any delivery shall take place only when the full discharge has in fact occurred.

4. *Sensitiveness. All grease-measuring devices shall be so designed and constructed that they can readily be operated to deliver each quantity for which a graduation, stop, or other indicating means is provided, within the tolerance on such amount hereinafter provided, and whenever any scale or dial is at some point or points or at all points the sole or most sensitive means of determining the amount of lubricant discharged, a volume of one pint shall be represented on such scale or dial by a length of not less than 1 inch.*

5. Constancy of delivery. The amounts delivered by any grease-measuring device shall not vary from the standard by more than the tolerances hereinafter provided (1) irrespective of the speed at which the device is operated, except that in the case of devices operated by air pressure, when operated at an air pressure lower than that specified by the manufacturer, the tolerance shall be applied in deficiency only—that is, the device shall not be deemed to be incorrect by reason of the tolerance in excess being exceeded during such method of operation—and (2) irrespective of the time elapsing between operations. *In the case of all devices operated by air pressure there shall be legibly marked on the dial of the air-pressure gauge, by special graduations or otherwise, the maximum and minimum working pressures recommended by the manufacturer.*

6. Indicating and registering parts. Counters and graduated scales and dials used on grease-measuring devices to tally sales and deliveries to individual purchasers or to indicate the amount delivered when any portion of the cycle or stroke has been completed, shall be of such size and style and shall be so located and disposed that they may be easily read. *The graduations shall be of such character and arrangement that the major ones are more prominent than and are clearly distinguishable from the minor ones. In all types of grease-measuring devices which utilize a graduated scale or dial to indicate the amount of lubricant discharged, the width of the graduation marks shall not exceed 0.04 inch.*

7. *Pointers and indicators. All pointers and indicators which when used in conjunction with a graduated scale or dial, indicate the amount of lubricant discharged shall be so shaped that a correct and accurate indication is given. Such pointers and indicators are required to be symmetrical about the graduation lines at which they may stand and shall reach to the finest graduation marks; the width of the end of the pointer or indicator shall not be greater than the width of such marks.*

8. *Parallax. All grease-measuring devices in which the accuracy of the readings of any indicating mechanism is affected by parallax shall be so designed and constructed as to reduce to a minimum the errors due to this cause.*

9. Graduated scales to be secured. When a grease-measuring device is provided with a graduated scale or dial, this shall be riveted or otherwise permanently attached to its supports.

10. *Numbering of graduations. Figures defining the value of graduations shall be uniformly placed in reference to the graduation marks and shall be as close thereto as practicable, but shall not be so placed as to interefere with the accuracy of reading.*

11. *Lettering, graduations. All markings, instructions, figures, and graduations required under these specifications shall be of such size, design, material, and location, and shall be so applied or affixed, that they will not tend easily to become obliterated or illegible.*

12. *Movement of indicating element. All grease-measuring devices shall be so designed and constructed that the indicating element used in tallying deliveries to individual purchasers shall only be susceptible of forward movement by the mechanical operation of the device itself. The indicating element shall be returnable readily to a definite and clear zero indication before the next delivery is begun. Means shall be provided to prevent the indicating element from being returned beyond the zero indication.*

13. *Stops to be positive. When stops or other stroke-limiting devices are employed on a grease-measuring device and these are subject to direct pressure or impact in the operation of the device, such stops shall be of such construction that the permanence and security of their positions is provided for by a positive, nonfrictional engagement of the parts whose relative motions are to be prevented. Such stops shall be so designed and constructed that adjustment within the prescribed tolerances can be made.*

14. *Stop mechanism to be definitely positioned. All grease-measuring devices designed to deliver two or more different predetermined amounts by bringing into operation different stops or other means of defining the delivery, shall be so designed and constructed that the position for the proper setting of each stop is definitely and accurately defined, inadvertent displacement from this position is obstructed, and the delivery for which the device is set at any time is clearly and conspicuously indicated.*

15. *Provision for sealing. All devices adapted to be altered for adjusting or correcting the delivery of a grease-measuring device shall be of such construction that they can be sealed, either separately or together, in such a manner that the position of none of them can be changed without destroying the seal or seals.*

16. Use of adjustments. No adjustment of the delivery of a defined-stroke grease-measuring device shall be permitted except that intended to produce a piston displacement per cycle of 28.875 cubic inches per indicated pint of delivery. Adjustments of piston displacement to correct for leaks, slippage, or other defects shall not be permitted.

17. Assurance of complete delivery. All grease-measuring devices shall be so designed and constructed that there shall be no means provided by which any of the measured lubricant can be diverted from the measuring chamber or the discharge line to the supply tank or elsewhere during the period of operation of the device. All valves in the supply line intended to prevent the reversal of flow of the lubricant shall be of such design and construction that their closure is automatically effected in the use of the device.

18. *Use limited to certain lubricants. Grease-measuring devices which will not give correct results except when used with lubricants having particular properties, shall be conspicuously, clearly, and permanently marked to indicate this limitation.*

19. Fraudulent construction prohibited. All grease-measuring devices and all devices designed to be attached thereto and used in

connection therewith shall be of such design and construction that they do not facilitate the perpetration of fraud.

20. Metric system. No specification contained in the preceding pages shall be understood or construed to prohibit the sale or use of grease-measuring devices constructed or graduated in units of the metric system.

The tolerances to be allowed on any grease-measuring device constructed or graduated in units of the metric system, shall be the same as those specified on similar apparatus of an equivalent size or at an equivalent capacity in the customary system.

Tolerances.—Except under special conditions as described in specification No. 5, the tolerances to be allowed in excess or deficiency on all grease-measuring devices shall be 1¼ cubic inches (about ⅝ liquid ounce) on a delivery of 1 pint or less; for deliveries of more than 1 pint add 1 cubic inch (about ½ liquid ounce) per indicated pint: Provided, however, That the manufacturers' tolerances or the tolerances on all new grease-measuring devices shall be one-half of the values given: And provided further, That these latter tolerances shall also be applied to all devices which are being retested after having been found incorrect and subsequently adjusted or repaired.

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