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THE NECESSITY OF THE SUPERVISION OF WEIGHTS AND MEASURES.

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Statistical results and deductions therefrom are based upon the assumption of the uniformity of the units, the uniformity of the standards of measurement. When these deductions or results are of a very general character and no close degree of accuracy is intended this assumption may be safe. There are many phases of commercial activity in which there is little or no uniformity of standards and there exists a greater degree of heterogeneity than was formerly true in physical or chemical work where it was often difficult to interpret or repeat certain investigations because of the lack of knowledge of what the standards were.

In the ultimate analysis, practically every transaction of barter or trade is based upon some standard of quantity. How many cubic feet of gas? How many kilowatt hours of electricity? How many miner's inches of water? How many tons of coal? How many acres of land? How many bushels of certain farm produce? All of these questions must be answered in terms of quantity. It would seem, therefore, highly important to have definite, uniform, reliable, consistent standards by which transactions, wholesale or retail, are gauged. This is particularly true in a democratic form of government where there is still in the minds of many a confusion of liberty and license. There are many, even some in exalted position, who decry any form of necessary restraint. The framers of the constitution of the United States when defining the powers of Congress very properly provided for the establishment and enforcement of uniform standards by placing in the same sub-section and in the same sentence with its power to coin money the power to establish the use of standards of

weight and measure. This covers the subject completely, as every standard for whatever use is some form of measure. Congress has never availed itself of this power, except in a single instance, namely, the establishment of the Troy pound for the purpose of coinage, although it has legalized many suggestions that have been made.

Commercial electrical standards in the main have been unified and in a number of instances legalized. The various electrical associations of America and Europe have by national and international conferences brought about a more or less definite uniformity of standards, although there are still a great many very faulty instruments used for the measurement of these quantities. Unfortunately such instruments are often placed in the hands of those who have no knowledge of their manipulation and thus give unreliable results; yet, on the whole, in electrical fields the instrumental, or measurement side has approximately kept pace with production. In most of the cities there is a regulation of the electrical meters in use. Furthermore the production of electrical energy is in the hands of a limited number who are more or less closely checked unofficially by those who have a technical knowledge or interest in the subject of electricity.

Gas has been the subject of control by the states for a great many years and there is a large degree of uniformity in the standards by which gas is sold. There is, however, no systematic or rigorous inspection of gas meters by competent officials, although this would be highly desirable. Furthermore, the inspection of the gas meters is in many cases of secondary importance to the inspection of the heating and lighting qualities of the gas, which are the two factors which should be primarily considered.

The measurement of water has been and is today an example of the greatest lack of uniformity and lack of accuracy in methods of measurement. Statistics of water supply in cities are largely a matter of guess work except in those instances where reliable meters are used. The majority of cities still sell water by the so-called "flat rate," and the con-

sumption per individual or per square foot of property in any particular section is not known, though such data is of great importance in the consideration of the size of distribution mains alone. The water sold for irrigation purposes is measured largely by the "miner's inch" and the absolute lack of reliable methods of measuring water in the open ditch has been the cause of a great deal of litigation and a great deal of injustice. There is today no satisfactory instrument or set of instruments for measuring this very important and highly expensive commodity.

In this paper I do not wish to take up data relative to other forms of measurement than those of the simplest kind, namely, the fundamental units of length and mass used in the everyday transaction of trade. That there is no intelligent or systematic supervision of the weights and measures which is perhaps the most necessary and simplest form of supervision is rather remarkable. That there is a necessity for intelligent legislation upon the subject by the Government of the United States and coöperation among the individual states can be readily seen by considering some of the legal weights in pounds per bushel of various commodities. Of apples 50 lbs. are required for a bushel in New Jersey and Ohio, and only 45 lbs. in Idaho and Washington; 57 pounds constitute a bushel of onions in Wisconsin, New York and fourteen other states, while 52 pounds constitute a bushel in Massachusetts, 50 pounds in Rhode Island and 48 pounds in Indiana; 60 pounds constitute a bushel of pears in Florida and 45 pounds in Oregon; 60 pounds constitute a bushel of potatoes in New York and 56 pounds in the neighboring state of Pennsylvania. Statistics as to the number of bushels of a certain commodity, even by legal weight in the individual states, are an unfair and unreliable basis of comparison.

The manufacturers of various food products have within recent years acquired the habit of putting up their commodities in a manner which though, perhaps, it may be claimed to be superior from the standpoint of sanitation is far from being conducive to accuracy as to quantity. They have used bottles,

jars, boxes, cartons, pails, all of which vary with the individual manufacturer and are absolutely indefinite; though, unfortunately, they are still used for the purpose of stating the production in terms of quantity, especially, by the dealer who is selling the commodity. As an example, the majority of dealers claim an annual sale of so many pounds of lard, placing the so-called No. 5 pail of the packers as "5 lbs." of lard which introduces an error of about 12 per cent. inasmuch as a No. 5 pail contains only about 4 lbs. and 6 ozs. of lard. The same applies to butter sold in pails and a good deal that is sold in prints, also prepared meats in glass jars or tin cans, crackers in packages, or breakfast foods and cereals in cartons. This should be extended properly to a number of bottle goods, such as a great many syrups, oils and beverages, some so-called "quarts" of olive oil being less than a quart by 46 per cent. Various brands of beer sold in bottles contain only 13 ounces to the pint instead of 16 ounces. Any data, and a good deal of the data are still given in terms of quantity, based on the assumption that these bottles or packages are of a certain definite quantity necessarily give unreliable results. This is not the time nor the place to enter into the further very important question of unfair competition produced by such methods of handling commodities or the question of loss to the public or in how far this enters into the high cost of living.

Aside from the above considerations there is a very interesting phase of the correctness of the apparatus used in the final transactions of trade, namely, in the hands of the retailer selling directly to the consumer. In order to ascertain the prevalence of incorrect weighing and measuring devices, incorrect weights, scales and capacity measures, an investigation was made testing such devices along the main thoroughfare of trade in the City of New York. The following tables give the results of such inspection in the Boroughs of Manhattan and the Bronx.

Business.	Number of places visited.	Scales.							Otherwise Faulty.
		Correct.	Faulty.						
			Fast.			Slow.			
			Loss to Customer.			Loss to Dealer.			
			3%	10%	X	3%	10%	X	
Grocers.	39	24	14	13	7	.....	1	.....	11
M. markets....	84	119	17	39	16	.....	4	.....	2
Fish.....	29	24	4	4	28	3	2	.....	5
Miscellaneous..	152	42	20	28	39	1	1	.....	38
Totals.....	304	209	55	84	90	4	8	.....	56

Correct, 209. Percentage of total41.30
 Incorrect, 297. Percentage of total58.70
 Percentage of total that causes a loss to the customer.....56.32
 Percentage of total that causes a loss to the dealer..... 2.37

Business.	Number of places visited.	Weights.							Otherwise Faulty.
		Correct.	Faulty.						
			Under.			Over.			
			Loss to Customer.			Loss to Dealer.			
			3%	10%	X	3%	10%	X	
Grocers.....	39	17	73	14	3	1	.....	.....	.....
M. markets....	84	.....	.....	.....	.....	.....	.....	.....	.....
Fish.....	29	.....	.....	.....	.....	.....	.....	.....	.....
Miscellaneous..	152	27	5	5	2	6	.....	.....	.....
Totals.....	304	44	78	19	5	7	.....	.....	.....

Correct, 44. Percentage of total.....28.75
 Incorrect, 109. Percentage of total.....71.25
 Percentage of total that causes a loss to the customer.....66.66
 Percentage of total that causes a loss to the dealer4.59

Business.	Number of places visited.	Measures.							Otherwise Faulty.
		Correct.	Faulty.						
			Under.			Over.			
			Loss to Customer.			Loss to Dealer.			
			3%	10%	X	3%	10%	X	
Grocers.....	39	9	2	3	17	.....	.....	.....	.....
M. markets.....	84	1	.....	2	8	.....	.....	.....	.....
Fish.....	29	.....	.....	.....	.....	.....	.....	.....	.....
Miscellaneous ..	152	18	10	15	36	.....	.....	.....	35
Totals.....	304	28	12	20	61	.....	.....	.....	35

Correct, 28. Percentage of total.....17.94

Incorrect, 128. Percentage of total.....82.06

Percentage of total that causes loss to the customer.....82.06

Percentage of total that causes loss to the dealer..... 0

The results of the investigation of the conditions in the other Boroughs were similar. Briefly summarizing for the whole of New York City: 617 places of business were visited, 1,227 scales, 1,219 weights, and 511 measures were tested. Thirty-four and nine tenths per cent. of the scales were 10 per cent. or over short, 15.7 per cent. of the weights were 10 per cent. or over short, and 50.1 per cent. of the measures were 10 per cent. or over short. These shortages are of vast economic interest to the purchasing public in their daily consumption of food, and at the same time show the necessity of an efficient supervision so as to reduce the error in order to get reliable statistics as to the amount of such consumption. It must be borne in mind that in not 5 per cent. of the cases is allowance made by the vendor for the inaccuracy of the weighing or measuring device. The above data only take into consideration the actual falsity of apparatus and do not take into consideration the actual apparatus which would still further increase the percentage of inaccuracy.

A similar investigation of the apparatus used by public institutions for checking the quantity of supplies received, upon which checking is based directly the payment of the

same, revealed the fact that in twelve city charitable institutions in New York City about 49.16 per cent. of the scales and 16.96 per cent. of the weights were incorrect and of nine state charitable institutions 52 per cent. of the scales were incorrect and 40 per cent. of the weights. Such inaccuracy must necessarily be to the detriment of the city or state or to the detriment of the one furnishing supplies. Any data as to the amount of supplies consumed would necessarily be incorrect.

Some of the ordinary daily articles of consumption are assumed to be of a certain definite quantity. Butter, particularly when sold in prints is always quoted as "per pound," and statistics on the production of butter by creameries are in the form of so many pounds per annum. In many cases these prints of butter present a shortage of one ounce, or $6\frac{1}{4}$ per cent., which in itself is a fair percentage of profit. Investigation of forty-four creameries in the State of New York showed that the percentage of the total of all of the prints tested, namely, 435, was 1.26. These represented creameries in different sections of the state and all the weighings of the butter were made while the prints were still dripping wet so that there could be no claim of shrinkage. If this same percentage holds throughout, which is fair to assume, it would make considerable difference in the statements of the total production of butter.

Another article of daily consumption in which the consumer is vitally interested is milk which for assumed sanitary reasons is being more and more largely sold in bottles. In order to test the accuracy of bottles, treating them simply as measures, and testing bottles of twenty-one milk dealers, it was found that 60 per cent. of the quart bottles and 83 per cent. of the pint bottles and 61 per cent. of the half-pint bottles were short, varying from a small amount to a maximum shortage of 2.6 per cent. for quart bottles and 7.8 per cent. for pint bottles.

Bread which is regulated in practically every other country is with the exception of a few isolated instances not regulated in the United States, there being no standards as to what constitutes a loaf of bread. As a result loaves of

bread are of all possible sizes. Taking, of course, only those which are made of wholesome material it was found that of bread baked in forty-eight different bakeries 45.2 per cent. were under 14 ounces which was the size claimed by a number of bakers to be standard size for a loaf of bread; 83.3 per cent. were under 16 ounces, the 16 oz. being claimed to be the standard size of a loaf of bread by the majority of the consumers and the retailers. Another very interesting fact was developed,—that in many of the larger bakeries it is cheaper to purchase two five cent loaves of wheat bread than one ten cent loaf, in short—that the bakers give a larger quantity for ten cents when distributed in two loaves than when put in one loaf.

Without giving further data relatives to the shortages that occur in the sale of coal, wood, thread, dry goods, tobacco, liquors, etc., it seems very necessary that the federal government should exercise the authority given it by the constitution to regulate the weighing and measuring devices used in interstate commerce and that the individual states should exercise their police power in supervising and regulating the measuring and weighing devices there used, as well as to establish standards of quantity and standards of measurement.

The objectors to any form of regulation or supervision of this kind all declare it to be paternalism and interference with the liberties of the people, but it is an incontrovertible fact that the people have a right to such supervision and that the individual cannot and should not have to protect himself by individually checking the standard of measurement, whatever it may be, whether, the electricity consumed, the gas burned or the accuracy of the physician's thermometer or the quantity of coal delivered or the quantity of food supplies purchased.

Some of the figures in the foregoing have been changed so as to incorporate the results of further investigations. It is worthy of note that since writing the above the legislature of the State of New York has passed broad legislation which will result in an efficient and systematic inspection and supervision of the weights and measures used in trade.