Metrology.*

OPPOSITION TO THE METRIC SYSTEM.

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At the December meeting of the American Society of Mechanical Engineers held in New York in 1902, a paper in opposition to the metric system was read by Mr. F. A. Halsey, and published in Vol. XXIV of their Transactions, together with the discussions thereon; also the report of a committee appointed to consider this subject, which gives a summary of arguments on both sides. In the preparation of Mr. Halsey's paper he received the assistance of Mr. S. S. Dale, also an opponent of the metric system, and editor of the *Textile World-Record*.

The arguments of the British system† are summarized (628) thus: 1. The change of system is a task of enormous difficulty. 2. The adoption of the M. S. involves the destruction of all mechanical standards. 3. The prosperity of foreign trade does not require the M. S. 4. The bill before Congress is a compulsory measure, so far as relates to those who do business with the government. (The bill for the governmental use of the M. S. was the cause of the discussion.) In reply, it is not denied that the transition period in which we now are will in its progress be attended with some inconveniences, which are greatly exaggerated, and which would be minimized by adopting the M. S. as rapidly as possible so as to shorten the period of transition. The advocates of the M. S. believe the benefits would ultimately greatly exceed the cost of the change. Mr. H. denies this, and that constitutes an issue between us.

The second statement is a very loose and indefinite one, as several meanings belong to the word standard. Its principal

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† In the following brief review of this paper citations are marked by page numbers in brackets, and for brevity the customary system is denoted by the letters B. S., for British system, and the Metric system by M. S.

meaning refers to the international meter and the imperial yard, fundamental standards for the two systems respectively. These would not in any way be affected. The second meaning may be the patterns or templates used in making parts of machines, which are constantly abandoned or altered to suit trade requirements, and as new ones are constantly being made they would be made to metric measures, and that is all of this feature. Finally we are told (434) that we are "tied irrevocably to the past" by our screw threads.* Well, we have four principal pasts—the Whitworth or English past, the Sellers or American past, the Swiss or watch system, and the international system. The last two are exclusively metric; the watch system is entirely universal, being used by both English and American watch makers. The international system of screw threads was prepared by a commission of German, Swiss, French and Belgian engineers, in 1898, after several years of discussion and preparation. This system is known as the international system, or I. S., and has been adopted and is in actual use in the government construction in continental Europe, the workshops of Schneider & Co., at Creuzot; the shops at Fives-Lille, etc. As this system, just started, comes into use, the Whitworth thread, hitherto employed in Europe will be abandoned. It must not be forgotten, it is not the Sellers or American system of screws that is used in Europe, it is the Whitworth or English system, and Continental Europe has never used or proposed to use the American system. The question of screw threads is not to be settled from the standpoint of any one nation alone, but for the whole world, and the American system has not now and never had the slightest chance of being universally adopted. We have one system for iron pipe, another for brass pipe, one for machinists' bolts and another for carriage bolts and none for hose couplings or hydrant fittings, etc.

The third point is the prosperity of foreign trade. On this point the United States consuls who are on the ground all say that it would be a benefit. Mr. Halsey says not. Who is likely to know most about it?

*This paper is part of a pamphlet in which this subject is treated at greater length.

Finally, no doubt the legislation in favor of the metric system would make it compulsory on those doing business with the government. If it did not it would not be of any value. In most cases the change will not cause any inconvenience to anybody, notably in the mint and postoffice, where it is already partially in use. The government can do many things without loss or injury that would be difficult for private individuals, and it would make the whole people familiar with the system, of which many are now ignorant.

Mr. Halsey's summary does not fully represent his paper, which is mostly a labored effort to show that old measures are still in use in metric countries (424); that the M. S. offers no advantages (445), and as an economic factor is worthless (451); that decimals are less useful than vulgar fractions (448), and that the B. S., by the industrial supremacy of the Anglo-Saxon, may be forced on the rest of the world (626). The use of old measures is chiefly an evidence of ignorance and inertia, of which we have less in this country than in Europe. Let the M. S. be taught in the schools and used in government transactions, and we shall soon have it in general use by the educated classes. The ultimate extinction of the old measures will be sure and rapid in proportion to the intelligence of the people. The M. S. has conquered its present position by displacing other measures, and it is certainly no argument against it that the displacement is not quite complete. Fifty years ago the M. S. was unknown to the masses of English-speaking people; today the literature of England and America is full of it. Of all the branches of human knowledge, physics and chemistry are most important to the working man. Every text book published on these subjects is now in part or wholly in the metric system. The work done in the laboratories is done in this system, the articles in all the journals containing the results of original research are published in this system. A decent education in the kind of knowledge most useful to the hand worker can not be got except through the metric system. Now, since no one has the boldness to say the M. S. is not adequate for all purposes for which any system of measures can be used, and since the M. S. is here to

stay, and is increasing in use among the nations, and among English-speaking nations, the best thing possible is to hasten the complete use of the M. S. and get rid of the inconveniences of a mixture as soon as possible. The statement (433) that there is no saving of time for school children is wrong: the old units have disappeared from the schoolhouse in most metric countries. The neglect of many of our school boards to see that the M. S. is taught in the grammar schools is criminal. In childhood dimensions are most easily fixed in the mind, and the neglect of the M. S. in early education throws an additional and unnecessary burden on the first years of high school or college life. It is not merely that a large amount of actual saving of time is made in the greater ease of memorizing the M. S. over the B. S., but the clearer ideas conveyed by it in the relations of matter dealt with by physical science make a knowledge of it a distinct gain in a successful practical use of knowledge. The statement (445) that the contents of a tank of water or the weight of any volume are determined by the same method in both systems is not true. Specific gravity is the ratio between the weight of a volume of water and that of the same volume of any substance—which number can never exceed 22, and for most cases is between 0.5 and 8 (wood and iron). With only this number, the weight of any body of known dimensions can be given, while in the B. S. the weight per unit, usually a cubic foot, must be learned in addition, involving usually two or three figures. This table is entirely dispensed with in the M. S. Many of the examples selected to show the advantages of the B. S. are sophistries. The sawed wood (413) is entirely metric; the 216 millimeters used (447) is as likely in actual practice to be 2.5 decimeters, and could then be calculated more easily than the $8\frac{1}{2}$ inches used; the potatoes (497) given in kilograms can be read instantly in tons if a larger unit is desired, etc. The B. S. is one of the greatest obstacles at present to the improvement of education in this country, and every child will be greatly benefited when the M. S. comes into use, no matter what trade or profession he may follow. And this is one answer to the constant demand made as to how the M. S. will benefit the textile industry. The tables accompany-

ing this article show twenty-eight different systems of marking yarn. The international system proposes to substitute one. It is no matter whether all of these systems are in use in one branch or not, they are a part of the present condition of the textile industry. The English dealers in yarns themselves propose to adopt the international system in the way recommended, these tables being published by a yarn dealer. They say the M. S. will be adopted by England, and they are quite likely to know as much about it as the editor of the *Textile Record*, or anybody in this country. Dyeing is a part of the textile industry, and dyeing is entirely dependent on chemistry, and in chemistry the M. S. is universal. The empirical dyer, who knew no chemistry, is giving place to the man trained in our technical schools, where they must learn the M. S., and in this way the M. S. is entering into and is necessary to the textile industry.

The constant and extensive use of decimals of an inch in machine construction has practically disposed of the old objection to the M. S., that a decimal ratio was not so useful as vulgar fractions; and the ready use of vulgar fractions in the laboratory with the M. S. wherever desired render puerile all this class of objections to the M. S. In the practical use of the M. S. the 1,000 factor is most employed, as 1,000 milligrams to 1 gram, 1,000 millimeters to 1 meter. Now the following fractions are readily used:

1.....1000	1/5200	1/20.....50
1/2.....500	1/8125	1/25.....40
1/3.....333	1/10.....100	1/50.....20
1/4.....250	1/16.....62.5	

One-third fits in this table as well as in the binary, and the one-sixth and one-twelfth only are left out, against which we have the fifth, tenth, twentieth, twenty-fifth and fiftieth.

(To be concluded in January.)