On the Metric System of Weights and Measures, and its proposed Adoption in this Country. *By* SAMUEL BROWN, F.S.S., *Vice-President of the Institute of Actuaries.*

THE great advantages, social, commercial, and political, which would attend the use of one system of weights, measures, and coins throughout the world, have generally been admitted, but as generally considered impossible. Such a result is frequently deemed to be merely the dream of a visionary, or the speculation of a philosopher, who has no practical knowledge of the world, and is incapable of appreciating the difficulties which stand in the way of accomplishing so desirable an object. It must be granted that the difficulties are great. There are prejudices to be overcome, ignorance to be enlightened, national pride to be vanquished, and, in many cases, trade customs, the growth of ages, to be abolished, before one nation can combine with another, much less several nations agree together, to adopt a common system. Yet, in spite of all these obstacles, the present century has witnessed such great changes in the old practice, and all tending towards a uniform standard, that I propose to give a brief sketch of the present position of this question, and to show what has been done and is doing to carry on a work so important to the social condition of any country, and to the free interchange of its produce or manufacture with other countries.

It would occupy too much space and time to go far back to show the various systems which have been used, aud the causes of the changes proposed or carried out. It will suffice for my present purpose to date only from the period of the Great Exhibition of 1851, to state what changes had been then effected, and what progress has since been made towards the realisation of this "dream" of a universal system. For that Great Exhibition, in itself and as the parent of others, so fruitful in results beneficial to the whole world, we can never be sufficiently grateful to the illustrious Prince Consort, to whose persevering energy and far-seeing intellect its success was mainly due, whose labours in the cause of social science have been the more appreciated, as his quiet and unobtrusive influence had been silently and imperceptibly turning the attention of the nation to the defects in our social system, and to the state of isolation in which, in many respects, we stood in regard to foreign nations.

The Great Exhibition naturally forced upon the public mind the question now under consideration. It was impossible to compare together the produce of the world's industry till the measures, weights, or values were reduced to a common system. Simple as it may seem, this was impossible at the time, because there was no system recognised by this country which would be admitted by others as a common standard. The consequence was, that some of the greatest advantages proposed by the Exhibition were lost; manufacturers particularly versed in one branch of trade might, by their special knowledge and with many laborious calculations, compare their own articles as to relative cost and value with those of other countries, and take hints for their improvement; but the general public could only entertain a sort of confused and indefinite admiration. Values and quantities were reckoned by all sorts of different standards, and true estimation and measurement were out of the question. The task of translating foreign monies and reducing foreign weights and measures to our own was, however, an essential part of the duties of the jurors; and, at the close of the Exhibition, the Society of Arts, which had been so mainly instrumental in carrying into effect the great idea, presented a memorial to the Lords Commissioners of Her Majesty's Treasury, pointing out the advantages of a decimal system of computation. They urged the great importance of uniformity in measures, weights, and coins in different countries, as increasing international commerce and facilitating scientific research; and, with great justice, argued that if any change were to be made it would

be desirable at once to adopt that which would bring us into direct communication with foreign nations, thus obviating the inconveniences of a second change. They alluded to the metric system of weights and measures, which had already been adopted by several of the nations of Europe. Complete sets of the measures, weights, and coins of this system were sent by the Government of France to the Great Exhibition, one of which was purchased by Mr. Henry Johnson, and presented to this Society, in whose museum it still remains.

Up to this time the metric system was but little heard of or understood in this country, but having been thus and with such authority introduced to the notice of the public, it may be well to consider what claims it has upon our attention above other systems, and what was the cause of its popularity amongst a body of men who could have no motive in recommending it but the progress of social improvement and the real interests of the public.

What then is the metric system of weights and measures, and how came it to be first introduced?

Long previous to the French Revolution the confused state of the ancient weights and measures in France had attracted attention, and efforts were made to reform them. But it was not till 1790, when the Constituent Assembly passed a resolution desiring the King to obtain the co-operation of the English Legislature for the determination of a natural unit for weights and measures, that the question began to be vigorously taken up. It was at first proposed that an equal number of Commissioners from the Academy of Sciences and our Royal Society should meet and ascertain, at some suitable parallel of latitude, the length of the seconds pendulum; but this proposition was not agreed to, and the French Academy proceeded by themselves. They decided that all the multiples and subdivisions should be decimal; and that the units of surface, capacity and weight, should all depend on the unit of length. Commissioners were appointed, comprising the names of the eminent mathematicians Lagrange, Laplace, Borda, Monge, and Condorcet, to discuss the whole question. To get rid of the objections of national prejudice, they eventually decided to take a unit deduced from the dimensions of the earth, as being of universal application. They fixed that the unit of the whole system should be the ten-millionth part of the arc of the meridian between the equator and the North Pole; and in order that no doubt of its accuracy should be entertained, a new measurement of the earth was undertaken, to be conducted by the astronomers Delambre and Mechain.

These geodesical operations were carried on for a period of ten years, and the personal adventures of the savants and their assistants, amidst the passions and prejudices of a sanguinary revolution, and in countries desolated by war, would make a volume of exciting interest. The arc to be measured extended from Barcelona to Dunkirk, and was afterwards prolonged to Fromentera, one of the Balearic Isles, near the coast of Spain. When the measurement was completed, delegates were invited from all the nations of Europe, including Great Britain, to assist in the reduction of the calculations, and decide on the several units of capacity and weight. The rivalries of war, unhappily, prevented this country from joining in this work of peace, but representatives from the Netherlands, Sardinia, Denmark, Spain, Switzerland, and several states of Italy attended. The charge frequently made against the metric system, that it is merely national and peculiar to the French, is thus completely refuted. Though originating in France, and perhaps facilitated by the overthrow of ancient usages and local prejudices, it was proposed to the whole world, in the interests of commerce and science in general, and all nations were invited to discuss and agree to a common system.

The result of these deliberations was the fixing definitely the exact length of the metre. The square of ten metres, or 100 square metres, was made the standard of surface measurement, and called the "are." The cube of a tenth part of the metre, or cubic decimetre, was the standard measure for liquids, called the "litre." The weight of a cubic centimetre of distilled water at its maximum density was the standard for weight, and called a "gramme." We may leave out the "stere," used as the unit for solidity, which was a cubic metre, as not being required for international purposes. It was used in France for measuring the solid contents of stacks of firewood.

Such being the units, all derived from the "metre," the next step was to simplify the nomenclature of the multiples and subdivisions. This was done by prefixes, which are not French, but derived from the dead languages, taught in the schools of all countries, all the multiples being denoted by Greek, and the subdivisions by Latin prefixes.

Thus—

Greek.			
Deca . . .	was used for	10	times.
Hecto . . .	„	100	„
Kilo . . .	„	1,000	„
Myrio . . .	„	10,000	„

For the subdivisions, the prefixes were :—

Latin.		
Deci	. . . .	for $\frac{1}{10}$th part.
Centi	. . . .	,, $\frac{1}{100}$th ,,
Milli	. . . .	,, $\frac{1}{1000}$th ,,

These being prefixed to the respective names for each unit of length, surface, capacity, and weight, the whole system was complete. In acquiring it, the memory is taxed in the smallest possible degree, and it is, as a system of weights and measures, in all respects a marvel of simplicity and perfection. If this could be brought into universal use, all the complicated and numerous tables taught in the schools of different countries might be swept away, and the following brief table, common to all nations, be substituted in their place :—

	Length.	Surface.	Capacity.	Weight.
Myrio	10,000	..	..	10,000
Kilo	1,000	..	1,000	1,000
Hecto	100	100	100	100
Deca	10	..	10	10
UNITS.	Metre.	Are.	Litre.	Gramme.
Deci	·1	..	·1	·1
Centi	·01	·01	·01	·01
Milli.....	·001	..	..	·001

Whatever objections may be made to the use of the learned languages for names which are to be learnt and most extensively used by the poor and the ignorant, there can be no doubt that they give the greatest facility in acquiring the system. In any country in which this system is introduced, even if the old names of the nearest corresponding weights and measures should in popular use be applied to the new, it is very desirable that, in public and private schools, the original nomenclature should be taught, as the means of firmly fixing in the memory, with the least expenditure of time and labour, the entire system.

The advantages which this system possesses over others are almost visible on the mere inspection of the above table.

1. Its extreme simplicity. The learner has only to make himself acquainted with the dependence of the three units upon the metre, the basis of them all, and the prefixes, decimally increasing or decreasing values. There is nothing more to learn. By this simple process, we get rid of the necessity of committing to memory

all the cumbrous tables of weights and measures, which harass the minds of youth, take up so much of the valuable time of early life, and yet practically leave little behind that is useful thereafter. From an inquiry made amongst schools, by Mr. James Yates and Professor Leone Levi, it was ascertained, that for a boy to learn our present system of weights and measures, with all the branches of arithmetic thereon depending, would occupy nearly three years, whereas the probable time for a decimal system would be less than ten months.

2. Its decimal character. However ingenious may be some of the schemes propounded, and whatever advantages the duodecimal system may possess by the greater number of divisors, there is a growing feeling amongst all practical and commercial men, and in all countries, in favour of decimalizing the weights, measures, and coins. The power of rapid calculation, and the vast saving of time and labour, the use of tables of logarithms, which, if all fractions were decimal, could be readily applied to commercial computations, are a set-off against the greater facility of division by the present scale. In decimal fractions there is no difficulty in taking the $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$, $\frac{1}{16}$th, &c. It is in division by 3 and its multiples that the recurring decimals principally arise, but in business transactions these could always be taken to any desired approximation. All actuaries are in the habit of making their money calculations by decimals of a pound sterling, in which this difficulty is constantly met. But the difference of taking the next higher or lower figure is too small to be appreciated. The advantages of the decimal character of the metric system are admitted by many whose objections are only against the use of an international system as causing more changes than are necessary in the interior trade of this country.

3. I think, however, we may be prepared to admit that, considering the vast increase in our foreign trade, and the constant removal of restrictions on freedom of commerce, some sacrifices may justly be made of national prejudices, and even temporary inconvenience endured, to obtain a system of weights and measures in common with a large part of Europe and America. One of the greatest recommendations of the metric system is, that it is a final one, and that it is international. All other changes, however great improvements they may be on existing systems in any country, leave something to be desired, unless they also tend to bring nations together and facilitate their intercourse. Any country adopting the metric system finds itself at once in direct relation with several

important countries which have already taken the final step, and the united population of which cannot amount to less than 120 millions.

If the plan were not even so perfect as it is, it would be expedient and wise to adopt a system common to so many, rather than remain isolated and obstructive in a matter in which the interests of commerce are so much concerned.

It will be well to take a glance at the progress which the metric system has already made in the countries in which it has been wholly or partially adopted.

France.—The circumstances under which the metric system was introduced into this country, naturally prolonged the period of its trial before it could be made compulsory. The Board of Works adopted it from the beginning. The officers and shipbuilders in the naval arsenals used it by the permission, or rather by the authority, of the Government. But for a long period it was permitted to the people to continue their old system, and we know how difficult it is to eradicate ancient prejudices and to make popular even real improvements, until a new generation has learnt and practised them. Napoleon, for many reasons, allowed the usages of the old monarchies, and did not press on the people what had been introduced during a revolutionary period. The restored Bourbons also could not be expected to look with much favour on a system devised and introduced under the Republic. Thus the old system continued to be legal long after the new one had become known, and some confusion was the result. But under Louis Philippe, a law was passed, in 1837, providing for the full establishment of the metric system in 1840, and since then it has rapidly grown in favour, though the people still give, in some cases, the old names to the nearly equivalent values in the new system.

Belgium.—The French originally introduced the metric system into this country when they got possession of the Austrian Netherlands. The French nomenclature was changed when Belgium became united with the Dutch Netherlands, but again restored by a law passed June 18th, 1836, after she recovered her independence in 1830. But it was at a later period, by a law dated October 1st, 1855, that the verification and the form and series of weights and measures were definitively regulated. The series, both for weights and measures of capacity, was then represented by the figures 50, 20, 10, 5, 2, and 1, and the same with regard to money, so as to obviate the objection that the series was not sufficiently subdivided for the ordinary purposes of business. A law of July 9th, 1858, further

enforced the use of the unit of the metric weight, the gramme, in prescriptions and sales in chemists' shops. Although in some operations of business, as in the sale of stuffs, the ell is used, and although in the country peasants still keep, in some places, to the ancient measures of land, yet amongst the population generally the metric system is fully introduced. Not only is it exclusively employed in public documents, in the markets, in commercial operations, and in manufactures, but in every register and commercial writing, whether for wholesale or retail business, the francs and centimes and the metric weights and measures are exclusively employed. I owe this recent information of its progress in Belgium to M. Visschers, the distinguished social reformer, who gave evidence when in London before Mr. Ewart's Committee.

Holland.—In 1816 the metric system was introduced, and became law in 1819. But the former Dutch names were used for the nearest corresponding weights and measures, with the addition of the word "new," to distinguish them from the old. It is enforced in all commercial dealings, except in weighing medicines, in which we should have thought (as is admitted by the chemists of this country) its precision and minute subdivisions would have given it peculiar claims to be recognised.

Switzerland.—In this country a double system prevails, the German and French elements causing some opposition. Proportionate parts of the metre are used for the measures of length, the foot being 0·3 metre and decimally subdivided, and the unit of road measure being 4,800 metres. The unit of weight, also, is the half-kilogramme, or 500 grammes, but not decimally divided. No doubt the further improvement of the system here awaits the changes which Germany yet has to make.

Spain.—By a law of the 19th July, 1860, the metric system was to come into force on 1st January, 1859, although for part of the kingdom it commenced in 1853. The system was also extended to Spanish America and Cuba. Even so far back as 3rd January, 1851, the metre was ordered to be used in all announcements of sales of the national property. Count de Ripalda, who has taken an active part in the different statistical congresses in London and abroad, states that the Government are sincerely anxious for its full enforcement. The engineers, the artillery, the military and marine departments, have adopted it. The sales of houses and lands, and the public domains, are made by hectares and square metres. The Government has purchased 600 collections of standards, and is about to purchase more, that every large town may

have the means of verifying the weights and measures in use. On the railroads, the goods traffic is charged by kilometres and kilogrammes. Ships are about to be measured by the metric ton. Tables of the old measures, with the reduction into those of the metric system, from 1 to 1,000, have been published by authority. To this it may be added, that within a few months an advertisement appeared in an English journal, from the Spanish Government, for tenders for the manufacture of no less than 80,000 pieces in the metric weights and measures, for the supply of the interior and of the colonies. These proposals, it is thought, will be accepted by the French manufacturers.

Portugal.—The metric system was established by law in 1862, and a special department formed for carrying it into force. At the International Statistical Congress, held in Berlin last autumn, the Marquis d'Avila, the delegate from Portugal, gave an account of its progress in that country. By a decree of 14th December, 1852, the metric system was declared compulsory, ten years afterwards, throughout the whole kingdom. The Government had power to fix the successive periods at which the various parts of the system should come into force, which was not till six months after the respective standards had been distributed, and the necessary tables for reduction had been published. A Central Commission was charged with these preparatory labours. The Secretary of this Commission, S. Fradesso da Silveira, was authorised to purchase standards, verified at the Conservatoire des Arts et Métiers of Paris, and to study the practical working of the system in France and Belgium. His mission having terminated in 1855, special agents were sent throughout the country to make a comparison in each commune, with the aid of the municipality, between the old and the new standards, and a verified report of the results was deposited with the authorities, and also sent to the Central Commission. An elaborate Government publication not only contains the tables of all these results, but the tables of reduction of all the old measures into the new metric measures, and *vice versâ*, and the same for all the units of English and Portuguese measures. The General Department of Weights and Measures, which took the place of the Central Commission, made provision for teaching the new system of weights and measures in all public and private schools. The consequence of this active and zealous introduction of the system was that, instead of the ten years originally prescribed, the Government felt justified in ordering the new system, as to measures of length, to be enforced from 1st January, 1860, and as

weights to commence from 1st July, 1861. For the service of the Custom-houses, a law of 30th June, 1860, authorised the Government to publish a new tariff of duties in accordance with the new system, which was done in the same year, and the official statistics have since been given in terms of the metric system. The preparatory labours for the introduction of the metric measures of surface and capacity are already completed, and the whole system will in a very brief period be in full operation.

Greece.—The metric system was introduced by the law of 28th September, 1836, but the nomenclature is Greek. For weight, the unit called the mine is $1\frac{1}{2}$ kilogramme, and the talent has 100 minen, or 150 kilogrammes.

Italy.—In Sardinia and Lombardy the metric system has long been established, and since the union of the Neapolitan and other Italian states, the system is rapidly extending over the whole kingdom.

Austria.—The half-kilogramme, decimally subdivided, has been introduced in the collection of customs, and in the steamboat and railway traffic, without producing any inconvenience, and the florin is subdivided into 100 kreutzers, instead of 60. His Excellency, Baron von Czoernig, President of the Central Statistical Commission, reports that they are preparing for the introduction of the metric system in its entirety.

Germany.—As to the other states of Germany, a conference was held in 1860, at Frankfort, at which representatives from nearly all the German powers were present, and, after a careful consideration of the whole subject, they recommended the introduction of the metric system, as the best system of weights and measures for all Germany. At the International Statistical Congress, held in Berlin, in September last, very strong resolutions were passed, both in the section which was specially devoted to this discussion, and in the Congress itself, strongly recommending the metric system to be authorised by law in every country not now using it; that an International Commission should be formed to further its universal adoption; that it should be made compulsory in the shortest practicable period; that each Government should institute a Department of Weights and Measures to carry out the details of its introduction; and that wherever it is made permissive only, it should at once be legalized in the Customs, and taught in all the schools over which the State has any authority. As these resolutions were the result of a discussion in a section specially set apart for this purpose by the Preparatory Commission of the Prussian

Government for the regulation of the Congress, there can be little doubt that Prussia, although not represented at the Frankfort Congress on this subject, will not be behind the rest of Germany in this important reform of her existing system.

Russia.—Since 1858 considerable interest has been excited by the appointment of a Commission of the Imperial Academy of Science, whose report is in favour of the entire introduction of the metric system into the empire. M. Kupfer, the reporter of that Commission, who attended as a delegate from the Russian Government, at the meeting of the International Decimal Association held at Bradford in 1860 (and at which M. Michael Chevalier, the enlightened and eloquent advocate of free trade in France, presided), assured the meeting that if Great Britain would take the lead Russia was prepared to follow, and wholly adopt the metric system.

Sweden, Norway, and Denmark.—A new decimal system of weights and measures was introduced into Sweden in 1855, to be compulsory from the 1st January, 1863. But Mr. Ewart, in his able speech on the introduction of his Bill before Parliament, 1st July, 1863, stated that, at an important Scandinavian meeting for political economy, held on the 20th May preceding, at Gottenburg, at which nearly 500 persons, including members of the Swedish, Norwegian, and Danish Parliaments were present, a resolution was passed that it was expedient to adopt the pure metric system, both for measures, weights and coins, in all the Scandinavian countries. Since then the late King of Denmark appointed a commission to study and report on the question.

Besides these remarkable testimonies to the rapid progress and popularity of the metric system on the continent of Europe, we find it making an entrance into South America, by being introduced into Chili in 1848, in lieu of the old Spanish system.

Can we suppose, then, that Great Britain, claiming to be the foremost nation of the earth in social progress, in education, freedom of thought, and commercial enterprise, and to whom, on the latter account especially, any system which could get rid of the incongruities and confusion of her present system would be a peculiar boon, cannot accomplish what has been so easily effected by other nations? Is it to be believed that we are unwilling to encounter some temporary, even though great inconvenience, in order by one bold change to come at once into that great community of different nations which we have enumerated as possessing or taking active steps to possess a common system of weights and

measures so convenient for their internal trade and the interchange of their productions with other countries?

Few, perhaps, are aware of the silent but continued progress which has been made within a few years towards preparing the public of this country for the introduction of this system, and of the extent to which its advantages have been recognised. I proceed briefly to state a few leading facts; time will not permit the full details, nor to consider at present so fully as they deserve the other propositions advocated.

Commencing with the Great Exhibition of 1851, I have already mentioned the steps taken by the Society of Arts to draw the attention of the Government to the importance of a uniform and general system. Since then, from the earnest desire of the Council to promote the great objects of the Society, by giving facilities and encouragement to commerce, this hall has been frequently opened for discussions on this subject. The members of the International Decimal Association have met the delegates of the Institutions in Union at a special meeting, and debated the question fully. This was the more important, as the delegates, coming from all parts of the country, and representing the leaders of the industrial classes, would carry back their new ideas to be again discussed in their institutions throughout the kingdom, by the very class who suffer most under the anomalies of the present system, and would be the first to have to bear the inconvenience of a change. Yet the expressions of the speakers were almost unanimous in favour of the metric system, as being a change, although great, final in its effects.

Again, the Council of this Society have, on other occasions, granted the use of their room for the delivery of a series of lectures by Mr. Fellows, Mr. Hennessy, M.P., Mr. R. G. Williams, Mr. Yates, &c., on the inconveniences of the present system, the impediments to the introduction of the metrical system, and the legal and educational questions involved therein. These lectures were well attended, and very numerous invitations were sent out, and the proceedings well reported in the metropolitan and provincial papers.

I trust also that my feeble introduction of the subject this evening will be forgotten in the animated debate, by which the Council will feel their efforts to promote the interests of the public amply rewarded.

The most important step towards popularising the question was the formation of the International Decimal Association, which was

formed at Paris in 1855, after the Statistical Congress that had just been held there, and when the jurors and other influential persons attending the Universal Exhibition then at Paris were able to attend. No less than 150 persons of high intellectual or social position, interested in manufactures or commerce, were present, and the meeting was presided over by Baron James de Rothschild, the head of the greatest European banking house, whose pithy and eloquent speech summed up in the fewest possible words the advantages of a common system of weights, measures, and coins throughout the world. The Association then formed owed its origin principally to the efforts of Mr. James Yates, F.R.S., and the influential support of that public-spirited nobleman, the present Earl Fortescue. It is meant to be European, and to have branches in every country, but it is to the English branch, then established, that the growing interest of the public in this question is mainly due. Since then, no opportunity has been lost, by pamphlets, lectures, discussions, petitions to Parliament, deputations to the Government on all suitable occasions, at Statistical Congresses, at the meetings of the British Association or Social Science, at the Statistical Society and Institute of Actuaries, at the Chambers of Commerce, at Mechanics' Institutes, by interesting men of all classes and opinions, to promote a free inquiry into the question of unity of weights and measures, not for this country only, but one common to all other European nations. It would be interesting to trace all that has been done since the period of the Great Exhibition of 1851, but time and space do not permit, and we must briefly rest at the stage at which we have now arrived—Mr. Ewart's Committee and its consequences.

The Committee was appointed to inquire into the practicability of establishing a uniform system of weights and measures, with a view to facilitate our domestic and foreign trade. It was fortunate for the latter part of the inquiry that the Committee was sitting during the International Exhibition, when a number of foreign witnesses, men of science, merchants, and manufacturers, could give evidence of the improvement which the metric system had effected in other countries, and how the difficulties of introducing it could be overcome. The inquiry was eminently practical, and the conclusions unanimous.

The recommendations of the Committee were as follow:—

1. That the use of the metric system be rendered legal, though no compulsory measures should be resorted to until they are sanctioned by the general conviction of the public.

2. That a Department of Weights and Measures be established in connection with the Board of Trade. It would thus become subordinate to the Government, and responsible to Parliament. To it should be entrusted the conservation and verification of the standards, the superintendence of inspectors, and the general duties incident to such a department. It should also take such measures as may from time to time promote the use and extend the knowledge of the metric system in the departments of Government, and among the people.

3. The Government should sanction the use of the metric system, together with our present one, in the levying of the customs duties; thus familiarising it among our merchants and manufacturers, and giving facilities to foreign traders in their dealings with this country. Its use, combined with that of our own system, in Government contracts has also been suggested.

4. The metric system should form one of the subjects of examination in the competitive examinations of the Civil Service.

5. The gramme should be used as a weight for foreign letters and books at the Post-office.

6. The Committee of Council on Education should require the metric system to be taught (as might easily be done, by means of tables and diagrams) in all schools receiving grants of public money.

7. In the public statistics of the country, quantities should be expressed in terms of the metric system in juxtaposition with those of our own, as suggested by the International Statistical Congress.

8. In private Bills before Parliament the use of the metric system should be allowed.

9. The only weights and measures in use should be the metric and imperial, until the metric has generally been adopted.

10. The proviso in the 5th & 6th Wm. IV., c. 63, s. 6, should be repealed.

11. The department which it is proposed to appoint should make an Annual Report to Parliament.

In accordance therewith, a deputation, including several Members of Parliament, Mr. Ewart, Mr. J. B. Smith, Col. Sykes, and others, waited upon the Right Hon. Thos. Milner Gibson, President of the Board of Trade; but finding, as the result of the interview, that Her Majesty's Government were not prepared to introduce or support a Bill which would carry out the recommendations of the Committee, the Council of the International Decimal Association, with the support of the associated Chambers of Commerce and other public bodies, respectfully requested Mr. Ewart to introduce a Bill for that purpose. Strong reasons, however, were thought to exist against a merely permissive Bill, which, besides adding another to the many systems already in use, would allow all those who were unwilling to incur the expense and trouble of the change, or who objected to its being taught in schools or used in Government departments, to prolong almost indefinitely the period for its general adoption. The original draft was therefore altered to one

which made the metric system compulsory after three years, allowing the intervening period to prepare for the change, as we have seen has been the course in the legislation of other countries. On the 1st of July, last, on the second reading, a very animated and interesting debate took place. Mr. Ewart made an eloquent and powerful speech, and was supported by Mr. Locke, Q.C., Mr. Pollard Urquhart, Mr. Adderley, Mr. Baines, Sir M. Farquhar, Bart., Mr. Cobden, Mr. Bazley, Mr. Roebuck, Mr. R. Hodgson, Mr. J. B. Smith, Mr. Griffith, and Col. Sykes. The opponents were Mr. Henley and Mr. Hubbard. Mr. Milner Gibson opposed the Bill on behalf of Government on the ground that the people were not prepared for so great a change. The Chancellor of the Exchequer also objected to the compulsory character of the Bill, and some other members would have preferred a permissive Bill. Though the metric system was approved, by the second reading being carried by a majority of 110 to 75, it was considered by Mr. Ewart prudent to defer to the opinions so expressed, and it is hoped that he will, early in the approaching session, introduce such a measure as will secure the favour of the House, and allow the people of this great commercial country to become familiar at least with the merits and advantages of the metric system in actual practice. It is already used in some trades. Machine-makers, engineers, chemists, bear testimony to it. If once rendered legal, it is only a question of time how long the existing state of confusion, comprising ten legal systems of weights and measures, will remain. "Decimal grains, used for scientific purposes; troy weight, under 5 Geo. IV., c. 74; troy ounce, with decimal multiples and divisions, called bullion weights; bankers' weights; apothecaries' weight; diamond weights and pearl weights, including carats; avoirdupois weight, under 5 Geo. IV., c. 78; weights for hay and straw; wool weight, using as factors 2, 3, 7, and 13; coal weight;" would all give way to one simple and definite system, applicable and convenient for every trade transaction, large or small.

The information given before the different Parliamentary Committees, on the customary weights and measures in different localities, would be amusing, if it was not so serious and obstructive to internal trade. Soon after the British branch of the International Decimal Association was formed, it was resolved to collect information as to the variety of weights and measures in use in different parts of Great Britain.

"For this end, a circular was sent to municipal bodies, mechanics' institutions, chambers of commerce, and agricultural associations throughout

the country. The returns, classified in a table published by the Association, exhibit a very remarkable view of the discrepancies which are found in different localities of weights and measures under the same name. The linear measures of land, for instance, differ from 3 feet, used at Hertford, to the chain of 66 feet, used at Hastings, and include between these limits seventeen different measures in different places. In superficial measures of land, twenty-five varieties exist; and the acre itself varies from 4,840 square yards to 10,240 square yards. Wheat, oats, and barley, appear to be sold indiscriminately, by weight or measure, the bushel undergoing all sorts of changes in quantity, and giving place in some districts to the load of 3 or 5 or 40 bushels, of 5 quarters, 144 quarters, or 488 lbs.—to the bag, the stack, the boll, the comb, the windle, the hobbet, the strike, the stone, the barrel, the winch, all differing from each other. For the sale of butter there is the pound, which has in different places 16, 18, 20, 24 ounces, besides the pint, the dish, and the roll. Potatoes, pork, flour, and coals, are variously sold by weights or measures having no relation to each other. The measure of timber and brickwork would be equally unintelligible to inhabitants of different localities; and in wool and flax the stone differs from 16 to 24½ lbs."

Professor Leone Levi also says:—

"For measures of length we have the ordinary inch, foot, and yard. In cloth measure we have yards, nails, and ells. There are four different sorts of ells. For nautical purposes we have fathoms, knots, leagues, and geographical miles, differing from the common mile. The fathom of a man-of-war is 6 feet; of a merchant vessel, 5½ feet; of a fishing smack, 5 feet. We have also the Scotch and Irish mile, and the Scotch and Irish acre. There are several sorts of acres in the United Kingdom, and there are a great variety of roods. We have in almost every trade measures of length specially used in these trades. For the measurement of horses, we have the hand; shoemakers use sizes; and we are compelled to adopt gauges where the French use the millimetre. The gauges are entirely arbitrary. The custom of the trade is the only thing which would decide the question in case of dispute. For measures of capacity we have twenty different bushels. We can scarcely tell what the hogshead means. For ale, it is 54 gallons; for wine, 63. Pipes of wine vary in many ways; each sort of wine seems to claim the privilege of a different sort of pipe. For measures of weight we have about ten different stones; a stone of wool at Darlington is 18 lbs., a stone of flax at Downpatrick is 24 lbs., a stone of flax at Belfast is 16¾ lbs., but it is also at Belfast 24½ lbs., having in one place two values. The cwt. may mean 100 lbs., 112 lbs., or 120 lbs. If you buy an ounce or pound of anything, you must inquire if it belongs to Dutch, troy, or avoirdupois weight."

It is true that such discrepancies exist in defiance of existing laws, but they will never be effectually put down till one simple system is taught in schools, and a new generation has grown up after the old systems have been abolished.

Though the metric system appears to be in all respects distinct and opposed to our own, there are several points in which it would nearly accord with existing weights and measures. A metre, which

is the basis of all, corresponds to 39·37 English inches, about $1\frac{1}{10}$ yard; 1 pole or perch ($5\frac{1}{2}$ yards) = 5·029 meters, about 5 metres; 1 furlong (220 yards) = 201·165, about 200 metres; 5 furlongs = 1,005·822, about 1 kilometre; 1 foot = 3·048 decimetres, about 3 decimetres; the are = 119·5 square yards, nearly 120; the litre = 61·03 cubic inches, or 2·1135 wine pints, nearly 1 quart; the gramme = 15·434 grains; the kilogramme = 2·205 lbs. avoirdupois; the half-kilogramme = about 1 lb.; the ton = 1,015·65 kilogrammes, say 1,000.

Our exports to countries using the metric system have increased from £23,696,000, in 1847, to £55,242,000 in 1861, an increase of 133 per cent.; whilst to countries using the English system they increased only from £16,262,000, in 1847, to £24,211,000 in 1861, or less than 50 per cent. increase.

If the metric system be once legalized in this country we can hardly form an estimate of the immense benefits that would follow to the commerce of the world. Our colonies would naturally, and for their own sakes, adopt the system of the mother country, with whom their trade principally lies. India, which has no common system of weights and measures, but, under the varieties of native Governments, is full of incongruous and absurd systems, by which it cannot be doubted the labouring classes especially are exposed to false weights and trade frauds, might by our influence gradually find one simple system prevailing throughout the whole of those vast dominions. The Americans, who have long agitated this question, would not, we are assured by the American delegates who have been sent to our European congresses, hesitate to make the change. They are only deterred now by the disturbance that would arise in their large trade with this country as long as our present system continues. An impetus would be given to Russia and Germany to complete the work to which they are already half committed.

The expression in the old English statute, "that there should be but one measure and one weight throughout the land," might be expanded into the grander idea, which would then be almost realised, that there should be but "one measure and one weight throughout the earth." Commerce, the real harmonizer of nations, uniting them in the bonds of mutual interest and growing esteem, would then receive a still greater development than has occurred even in the last few years, diffusing everywhere the blessings of peace, and causing all nations to pause ere they precipitated each other into the calamities of war.