PAPER READ BY THE BISHOP.

A meeting of the Royal Society of Tasmania was held on Tuesday evening, in the society's room, at the Museum. His Excellency the Governor presided, and there was a moderate attendance. An apology was read from Sir Adye Douglas, who was unable to attend.

The Secretary (Mr. A. Morton) read a circular letter from the Premier relative to the proposed celebration of the centenary of Tasmania.

The Mayor (Alderman Bennison) explained that he had discussed the matter with the Premier, and the latter stated that he had not yet received replies from all of the public bodies to whom the circular had been sent.

It was decided that the letter should be acknowledged, and that the Premier be informed of the society's willingness to co-operate in the movement.

Mr. T. Stephens presented to His Excellency, on behalf of the society, a volume of the proceedings of the society for the year 1902, which was the diamond jubilee of the Royal Society of Tasmania. The book contained a portrait of His Excellency.

His Excellency thanked Mr. Stephens and the members of the society for the presentation.

Dr. Naylor and Mr. K. L. Murray were elected members of the society.

THE DECIMAL SYSTEM, AS APPLIED TO WEIGHTS, MEASURES, AND MONEY.

(By the Bishop of Tasmania.)

My subject is one which would not be considered likely to arouse enthusiasm. And yet I hold that we should find ourselves decidedly enthusiastic on its behalf did we realise how practical and far reaching are the advantages which it has in view. My endeavour will be to show that I have warrant for holding this opinion.

It may be advisable to say a preliminary word or two about the obvious superiority of decimals, as such, in comparison with their rivals, vulgar fractions. The basis of our accepted scale of notation is the number ten. We derive it from the Arabs. It is not the only basis, for, apart from theoretical system of numeration, we find in our English tables of weights, measures, and coins, distinct applications of binary, duodecimal, and vigesimal factors. But the decimal basis is paramount, and governs not only the writing, but the language, of number. Reformers therefore unanimously turn to this basis when they devise plans for simplifying, methodising, unifying existing systems. When we come to divide the unit we may resort to fractions. So long as we are expressing whole numbers, we write them in a continuous line, giving a definite place to the units, tens, hundreds, and so forth. But when we write a fraction we break the line, and we introduce new methods for dealing with the numbers. But it is quite unnecessary thus to break the line. We have only to place what we call "the decimal point," and we can proceed as before, assigning their due places in the continued line to the divisions of the unit by ten, a hundred, a thousand, and so on. The operations for addition, subtraction, multiplication, and division thus remain unaltered. No new and complicated manipulations are called for, but merely certain easily learnt rules for dealing with the decimal point. Decimals, therefore, and not fractions, are the natural sequel to the study of whole numbers. They have the prior claim, both on logical grounds and on the ground of comparative simplicity.

Turning from these theoretical considerations, let us see how they find practical application in the matters before us. Nearly all the commercial communities of the old world have taken advantage of the merits of the decimal system to simplify their systems of weights, measures, and money. In these systems the unit, wherever it may be, is divided into tenths, hundredths, thousandths, or multiplied by ten, a hundred, or a thousand, and the resulting quantities are linked together into a definite whole by a simple but ingenious scheme of nomenclature. The French, with their usual love of clearness and order, have developed this decimal system most rigorously, and have set a standard which is fitted for universal adoption. I give the three principal tables which provide for all possible cases of measuring and weighing, whatever the material or the conditions may be, and however small or great the scale of operations.

Metric Tables of Measure and Weight.

Length.

Unit—The Metre: 39.37 inches.

Decimetre, Centimetre, Millimetre,

Metre,
Decametre, Hectometre, Kilometre.
Capacity.
Unit—The Litre: The volume of a cubic decimetre, a little less than the English quart.
Decilitre, Centilitre, Millilitre,
Litre,
Decalitre, Hectolitre, Kilolitre.
Weight.
Unit—The Gramme: Weight of a centimetre of water at 0 cent., 15½ grains Troy.
Deciligramme, Centigramme,
Gramme,
Decagramme, Hectogramme, Kilogramme.

For square and cubic measures, the metre and its parts or multiples may be squared or cubed, as in the case of English feet, yards, miles, etc. These beautifully inter-related tables almost explain themselves at a glance. I would merely draw your attention to a few of their principal features and merits. Note, in the first place, that the fundamental unit is the metre, which, like our yard, is now an arbitrary measure. It is employed to define both the litre and the gramme. There are only two other terms used; prefixes do the rest. In each table the prefixes are alike, and represent the same fractional parts or multiples of the unit involved. Those above the unit represent successively the tenths, hundredths, and thousandths of the unit. Those below represent successively the unit multiplied by ten, a hundred, and a thousand. The former set of prefixes follows Latin models, the latter Greek models; the two sets are thus sufficiently distinguished from one another, and are thus adapted for international use. We cannot wonder that this metric system has met with such wide recognition, not only for scientific and technical purposes, but as the working standards in the business life of well-nigh the whole of Europe.

The French coinage is also based on decimals. Taking the franc as a unit for purposes of calculation, the gold coins represent the value of 100, 50, 20, 10, or 5 francs. Among the silver coins, there are 5 and 2 franc pieces, the franc itself, and coins of the value of ½ and 1-5 of a franc. These are supplemented by bronze coins, which represent the division of the franc, the franc itself containing 100 centimes. The most usual of these coins are the 10, the 5, the 2, and the 1 centime pieces. We can perhaps best understand the system if we suppose our English sovereign to be divided into 10 florins, and the florin again to be divided into 100 centimes, the centime being thus nearly the equivalent of our present farthing. This supposition has also the interest of being one of the actual proposals for an English decimal coinage.

British Measures.

How terrible the contrast when we turn to our English tables. How we have to lower our heads with shame. Here are we, the greatest and most advanced of trading communities, saddled with systems of weights and measures which are the accidental outcome of centuries of casual developments, with no reason in them, no order, no method, no meaning. As children we struggle to learn them by heart. As soon as we leave school we begin to forget them. Most of us, except in the case of those tables which we happen to use in work or business, have to refer to printed authorities, or to skilled acquaintances, when we are called upon to calculate under their capricious rule. Do we want to measure a length? We toil painfully among leagues, miles (geographical, nautical, and ordinary), furlongs, poles, rods or perches, fathoms, chains, links, knots, yards, hands, feet, nails, ells, inches, till we are weary. Do we want to measure capacity? We must determine whether it is liquid or solid. If liquid, then we wade in a flood of tuns, pipes, hogsheads, barrels, kilderkins, firkins, gallons, quarts, pints (imperial and otherwise), gills, noggins, drachms, ounces, as they float past in tumbling confusion. If we want dry measure we jostle in the crowd of pecks, dry gallons and quarts, and the endless, but highly respectable, family of the bushels. For bushels trench also upon the province of the weights. And the learned tell us that a bushel of barley is 47lb. to 49lb., of coal is 80lb., of flour is 56lb., of malt is 40lb., of oats is 38lb. to 40lb., of rye is 55lb., and of wheat is 57lb. to 60lb. Do we want to weigh something? Then we wrestle, like intellectual Sandows, with tons, hundredweights (which are really hundred-and-twelve weights), quarters, pounds, ounces, drachms, pennyweights, grains, in motley array. There are further complications. A load may be 1,296lb. or 2,016lb., according to the kind of coal; the pound may be 16oz. or 12oz.; a stone may be 8lb. or 14lb., but in cheese 16lb., in glass 15lb., in hemp even 32lb. In dealing with wool the elastic stone is 14lb. for the grower, but 15lb. for the wool stapler. And so on, and so on. I do not know if Tasmanian apples have yet achieved the distinction of having a peculiar measure of their own. Even if this is not as yet the "case," the meaningless jumble of terms makes us pause to take breath. They are the belated outcome of British "common-sense": they tyrannise throughout the greatest Empire the world has ever seen. In spite of the space required, I cannot refrain from giving a few typical instances, because an appeal to the eye so powerfully reinforces the appeal to the ear. As a neat specimen of

what simple subtraction may become, take the following:—

	Miles.	Furlongs.	Rods.	Yards.	Feet.	Inches.
I.—						
From	1	0	0	0	0	0
Take	0	7	39	5	1	5

I leave you to find your own answer.

Let us take a fair specimen of calculations of price. I quote from a set of comparative sums—

II.—Give the cost of 215 tons 17cwt. 3qr. 9lb. at £9 11s. 6d. per ton.

Cwt.	T.cwt.qr.lb.	£ s. d.
20	215 17 3 9	9 11 6
4	20	20
80	4317	191
28	4	12
640	17271	2298 pence
160	28	

2240lb. per ton. 138177
138177
34542

483597
2298

3868776
4352373
967194
967194

1111305906

224,0) 111130590,6 (496118 pence
896

2153
2016

1370
1344

265
224

1950
1792 158 3

158 224 4

12 / 496118

20 / 4134,3-2

2067—3 Answer: £2,067 3 2¼

Ah, you say, but let us work it by practice.

III.—

215 tons at £9 per ton...	£1935	0	0
,, ,, ,, 10s. ,, ,, ...	107	10	0
,, ,, ,, 1s. ,, ,, ...	10	15	0
,, ,, ,, 6d. ,, ,, ...	5	7	6
	£2058	12	6

215 tons at £9 11s. 6d.	£2058	12	6
10 cwt. ,, ,, ...	4	15	0
5 cwt. ,, ,, ...	2	7	10½
2 cwt. ,, ,, ...	0	19	2
2 qr. ,, ,, ...	0	4	9½
1 qr. ,, ,, ...	0	2	4¾
7 lb. ,, ,, ...	0	0	7¼
2 lb. ,, ,, ...	0	0	2
	0	0	2
Answer	£2067	3	3

This method certainly saves figures. But the saving is effected at the cost of much advanced and sometimes trying mental work, and by much artificial condensation of statement.

Let us look at a similar calculation on the metric system.

Take the same sum as stated in terms of decimal weight and coinage.

IV. Give the cost of 219,817 kilos at £9—4fl—4c. per 1,000 kilos.

219.817
9.404

879268
8792680 Ans.: £2,067—1fl.—59c.
1978353

2067.159068

Note the conciseness of this calculation, its absolute simplicity, and its accuracy. For, with all their elaboration, the other two methods did not give results which were quite accurate.

Education.

After this comparative survey, let us try to realise what some of the practical effects would be if we were wise enough to adopt the decimal system. And first as regards the education question. We are beginning to feel the stress of foreign competition, and the value of education, primary, technical, and other, and yet we continue to waste the precious hours of school life on these needless and vexatious tables and calculations. Moreover, we put fractions before decimals, thus inverting, as I have shown, the natural and logical order. I feel that my lament on this score will go home to my hearers, unless they happen to have been born with a mathematical spoon in their mouths. For have not most of us suffered many things in our youth, and perhaps since, by reason of British arithmetic?

"Those vulgar Fractions broke our hearts,
And Practice drove us mad."

How many tears would have been unshed, how many causes of tears have been unfelt, if we had enjoyed the decimal system of weights, measures, and money! Educationalists draw for us touching pictures of the impressive simplicity of the arithmetic in the primary schools on the Continent of Europe, as compared with ours. And it is calculated by experts that under the metric system, children would save no less than one year of the time at present devoted to arithmetic—that is to say, they would save time sufficient to enable them to gain a fair knowledge of at least one modern language. And yet we profess to be keen in the cause of education, and to be earnestly solicitous for the welfare of the young.

Commercial Loss and Gain.

When we recall the results of the comparisons we have instituted, special comment on the commercial aspects of our subject is hardly necessary. It is only British pluck that carries us through. Think of the grievous waste of time in British counting-houses and commercial centres—a waste which is increasingly serious, in proportion, as the competitive strain is more keenly felt. The thought of the unweildy cumbersomeness of our methods in conducting our home trade is enough in itself to make us agitate for reform. But what shall we say when we consider its effects upon our foreign trade? Our customers, who use the metric system, are estimated at 483,000,000. There are few of these who understand quotations and specifications based on British standards. And we are warned by our Consuls and agents in every part of the world, that the consequent hindrance to our trade is very real, and very grave. These decimal-using folk will not, or cannot, afford the time to work out intricate sums, and will not risk the mistakes which so easily arise in reducing the hopeless confusion of British tables to the metric standards. Consequently, they too often turn from us to Germans and others, whose quotations are clear and plain. Should the British manufacturer make a desperate effort to adapt himself to both sets of conditions, he has to increase his clerical staff, sometimes he has to keep double sets of costly patterns, and in these, and many similar ways, to handicap himself in his power to compete in foreign markets. For, with the partial exceptions of Russia and the United States, Great Britain, with her dependencies, stands alone in her system among the great trading communities with whom she chiefly has to deal. As a good typical example of what is at stake at home and abroad, I will quote from a paper read in Lancashire:—"The raw cotton, say, is bought in America, and invoiced in pounds; the freight is charged per ship tons, whilst the Liverpool charges and railway carriage are calculated per ton of 2,240lb. All the charges in the mill are again calculated by the pound, and when the yarn is sold by the merchant, or sold direct by the spinners to foreign markets, it will probably be invoiced in kilos. The carriage to the port of shipment is again charged by tons, hundredweights and quarters, the freight again by ship tons, and the railway carriage in foreign countries by kilos, same as the duty, etc., and all these calculations have to be made by the spinner or merchant. What a change if everywhere kilos, and kilos only, were the basis of calculation. What a saving in cost and brain power!

Agitation for Reform.

The story of the agitation in Great Britain for reform on the lines of the metric system affords a striking example of British slowness and vacillation whenever the trouble of a change, however necessary and beneficial, has to be faced. The movement has been on foot among us for nearly 100 years, kept alive almost wholly by the zeal and perseverance of individuals and specially-constituted societies, hitherto without definite or solid success. Mathematical and scientific men have taken their own line, and for scientific, technical, and similar purposes the metric system is well-nigh supreme. But for trade purposes, save for certain departments of engineering, we are much where we were. At the same time there are signs of the growth of a more enlightened public opinion. In 1895 a Select Committee of the House of Commons itself recommended, "that the metric system of weights and measures be at once legalised for all purposes," that "after two years it be rendered compulsory," and that it be taught in all elementary schools, together with the early study of decimals. This committee received support from all manner of public bodies, city and borough councils, school boards, and the like. In 1898 the Commercial Department of the Board of Trade issued a most valuable report, containing, amongst other matters, a collection of "Opinions of H. M. Diplomatic and Consular officers" in regard to British trade methods. Extracts from 171 such opinions proved conclusively that "it is necessary for British traders to adapt themselves to the requirements of their customers." It is especially interesting to note that strong resolutions in favour of reform have come from such different and representative bodies as the National Union of Teachers, the Trades and Labour

Councils, the Manchester and Liverpool Chambers of Commerce, and even from one so official and correct as the Incorporated Society of Inspectors of Weights and Measures. Last, but not least, we record the fact that the Colonial Premiers at the late Coronation Conference passed a resolution that the metric system should be adopted throughout the Empire. And yet, with all this consensus of conviction and force of public opinion, nothing is done!

Objection to Change.

Granted that there will, of course, be temporary difficulty and friction, why should we dread it? Others have faced it —among the rest no less a nation than Germany, and that, too, in recent years. It is easy to exaggerate this difficulty. All the European countries, save Russia, have effected the change without any serious opposition or inconvenience. Are we less intellectually alert and capable than they? The permissive period (fixed by the committee, as we saw, at two years) would be spent by all alike, teachers, parents, children, shop-keepers, in learning and teaching. They would all have the compulsory enactment in view. And when it came, they would be ready.

Small Decimal Coins.

The only other objection of any force with which I have met, is the difficulty of adapting the smaller decimal coins to "retail trade." Some contend, and with a certain amount of force, that the poor lose by reason of the lack of binary divisions of certain decimal quantities. An example will show what is meant. Suppose that sugar is 25 centimes a pound, and that a small purchaser wants half a pound. Then either the shopkeeper must give way and accept 12 centimes, or the purchaser must pay 13 centimes. We know, from experiences of the fractional rise in prices which follows on a new tax, who will ultimately conquer. And it is asserted that the poor in some countries lose in this way 4 p.c. on their small purchases. This objection, however, is one of detail, and might easily be met. Moreover, it applies to coins only. And what is it, even at its worst, in view of the enormous mass of advantages that would be reaped by every section of the community?

Conclusion.

Into such details as this last I have not entered. I have limited myself to general considerations. My present object will have been attained if I have succeeded in reviving and extending your interest in a subject which must already have engaged the attention of most thinking people. I trust that the new century will not have advanced far on its adventurous career before the British Empire has proved that in this matter of a rational system of weights, measures, and money, her claims to sound sense and to commercial adaptability will have been justified by fearless and beneficent reform. A system admirable for its simplicity, its completeness, its scientific and logical homogeneity, and its practical utility, lies close to our hand. Let no national prejudice, no fear of change, deter us from making it our own.

At the conclusion of his address the Bishop was warmly applauded.

His Excellency said the adoption of the decimal system was one that should be taken up. The only opposition he had ever heard raised to the system was one emanating from bankers. Still he had never been able to discover what that objection was.

Mr. R. M. Johnston, in response to a request by His Excellency, offered a few remarks on the subject. He said if it were not for the decimal system he would not undertake to do the work with one hundred men as he now did with two or three. Success could as easily be achieved in battle by bows and arrows as in the world's computation by adhering to the English system. It was not the schoolmasters who were to blame, but the standards of the English Universities. He blamed the universities of England, who set up such standards. Mr. Johnston then gave an illustration of his own methods of calculation. Children were too often taught figures parrot fashion, instead of by reason. Too much time was wasted in the present methods employed, and deprived children of an opportunity of learning other subjects. A bill had been placed before the Federal Parliament for the adoption of the decimal system. In the interests of the children the change suggested by the Bishop should be brought about.

Mr. A. Thorpe said that children could not be equipped with the marvellous instruments Mr. Johnston possessed, and he had hoped that the more simple methods would have been explained. Children should be taught to reduce shillings and pence to the decimal equivalent of a pound. Tasmania might be able to start a movement to induce the authorities to adopt the system.

Rev. H. H. Anderson, in reply to Mr. Thorpe, said he would never think of teaching a boy to do a sum in compound interest in any other way than by the decimal system. He believed that during the next few years mathematical teaching in the schools would be very different from what it was to-day. They desired that the mass of unnecessary work should be removed from the children, and he thought the University of Tasmania might do something in the matter.

Mr. C. J. Atkins pointed out a number of difficulties that he considered stood in the way of the metric system being adopted.

Mr. A. Morton referred to the fact of the metric system being in use at the Sydney University, and quoted remarks made by Professor Liversidge on the subject. He hoped that the Royal Society of Tasmania would help the matter forward.

Mr. T. Stephens explained that some years ago he had tried to induce school teachers to bring under the notice of their scholars the advantages of decimal and metric systems. It would be no use teaching children the metric system if it could not be applied in commerce and daily life. They should not cease their efforts to keep the subject prominently before the people, and try and bring about its adoption. He moved—"That copies of the Bishop's address be sent to the Hobart and Launceston Chambers of Commerce, and to members of the Federal Parliament, with a request that they should use their influence to see that effect be given to the valuable advice and suggestions contained therein."

Mr. R. M. Johnston seconded the motion.

Sir Jno. Dodds referred to the objections raised to the adoption of the metric system, and quoted Professor Liversidge's remarks on the matter. When the interests of a large manufacturing country like England were likely to be effected by the proposed change it was easy to understand the objections raised.

The Bishop briefly replied.

The wording of Mr. Stephens's motion was amended by asking the University of Tasmania to co-operate with the Royal Society on the subject, and unanimously agreed to.

His Excellency said the paper was one of great interest, and he felt sure that all would be grateful for the information given. He moved a hearty vote of thanks to the Bishop.

The vote was carried by acclamation.