understood that a decent and somewhat permanent livelihood is at the command of those who enter upon the task of instructing youth, and the ranks of school teachers would be worthily filled. The matter should be earnestly considered by those who are entrusted with the management of the Common school system.—*Kingston Daily News.*

SCIENCE.

The Metric System of Weights and Measures.

A PAPER READ BY MR. C. G. K. GILLESPIE A. C. P., AT A MEETING HELD AT THE COLLEGE OF PRECEPTORS, LONDON.

(*Concluded.*)

The difficulties of the second class, though of less frequency in the earlier periods of study, become a serious obstacle in the more advanced stages, and in actual business are, of course, felt most heavily. In some cases the same name varies in the value it represents, according to the nature of the material weighed or measured; in others—and these are the most mischievous—the value is determined by local usage; so that the quantity known by a certain name in one place is found to be either more or less than the quantity bearing the same name elsewhere; and hence, an invoice expressed in terms of this denomination by whole numbers, bears a mixed or fractional value where it is received. Thus it becomes necessary to express such quantities in terms of some other denomination common to both localities; so that except for transactions within a narrow business circle, the higher name is practically useless, and is therefore an incumbrance. For example, there are no less than 27 measures for grain bearing the name bushel, varying in value from 45 lbs. to 168 lbs. We have 11 acres, of different values, varying from 4840 to 10,240 square yards; 10 different stones, from 5 to 32 lbs.; 6 roods of lineal measure from 16½ feet to 36 yards and 6 roods of square measure, from 30¼ to 1210 square yards.

I would fain have avoided the introduction of numerical details of this kind, knowing their wearisome character; but it is necessary for our purpose, not only to point out the defects and inconsistencies of the tables which every child is expected to learn, but further to show that in considering these we barely cross the threshold of a vast series of complexities. The rail and the telegraph, while they have so greatly extended our internal commerce, have brought us more into contact with these hindrances, and the result is a universal desire for reform; and the best means of bringing this about appears to be the adoption of a well-tried system, free from these defects, permissively legalised by Government, and widely introduced to public notice by being taught in every school throughout the kingdom. As has been already mentioned, the first step, in the form of a permissive Act, has been gained, chiefly, if not entirely, by the efforts of the International Decimal Association; the second, upon which certain and speedy success in a great measure depends, is, we trust, within our reach. It cannot be too strongly borne in mind that there are collateral advantages of considerable importance to be gained by teachers, as well as scholars, in the promotion of a system which promises such great saving of time and labour to both. As was well observed by Mr. James Yates, F. R. S., one of its most able and energetic supporters, in a paper read to the United Association of Schoolmasters,—"If the agency of the schoolmaster is absolutely necessary to carry into effect the views of our International Association, the Association will, in its turn, if successful, bestow an ample recompense on the schools by saving a vast amount of precious time, and superseding much irksome and unprofitable labour. If therefore, the object which I have in view shall be carried out, you and we shall confer reciprocal benefits. The schoolmasters will enable the advocates of decimal and international measures, weights, and coins, to diffuse their system; the advocates of this system, on the other hand, will contribute their part to make the task of the schoolmasters far more successful and agreeable than it is at present." That this promise is a reliable one, can be judged from the result of inquiries made by means of circulars forwarded in large numbers to schoolmasters throughout the country. These circulars, in a tabular form, were filled up with opinions of teachers as to the time to be saved by the use of the Metric System. The estimated saving of time in the teaching of arithmetic averaged about two years. It appears, as we all know, that children are stopped at the compound rules, which take up the greater part of their time; so that among the poorer classes, and in rural districts, where boys are sent out to work at an early age, they can learn but very little beyond the first four rules; and since there is a constant pressure on all our schools to get children of every grade out as soon as possible, arithmetic, the *sine quâ non*, absorbs the lion's share of attention, other branches of education being set aside to leave room for it. Were the decimal system adopted, compound rules would cease to exist, and the time thus saved could be devoted with profit and pleasure to subjects affording a higher mental discipline than that furnished, at so heavy a cost, by these exercises; for it is insisted by some, that they do supply a useful training of the kind. Most practical teachers will, I think, rather agree with the remarks made a short while back in this room by Mr. Hugo Reid, that the intelligent teacher explains to his pupils the reasons of the processes employed, as soon as they are capable of understanding them, thus fixing rules and principles in the mind, and aiding to develope and exercise the reasoning powers. He adds,—"For vast numbers of our youth, it is very important to do this with the rules of arithmetic. Their time for education is very short, and few subjects are within their reach which can be made a basis for any exercise of the reasoning faculty. Arithmetic is the only mathematics for the poor." As far as the processes of pure arithmetic are concerned, and so far only, can these views be carried out on our present system; while with the metric system as a basis, the introduction to concrete quantities forms a continuation and extension of principles and operations already familiar. In support of these statements, I will now, with your permission, refer to the diagram before you (Dowling's Synoptic Table), which exhibits in one view the leading features of the system, beginning with the quadrant = 1000 myriametres. The *metre* is then represented in several forms, suitable to different kinds of work. The double decimetre, or metric link, and the double decametre, or chain, are only one two-hundredth shorter than the English measures. They form examples of a leading principle, that each of the chief decimal divisions has its half and its double, a very important provision as regards matters of practice. The half-metre is almost identical with the unit of length used in India, and may be called the cubit of the system. The square, whose side is 10 metres, forms the *are*, the unit of superficial measure. The cubic decimetre is the content of the *litre*, the unit of capacity; while the cubic decimetre filled with distilled water at the temperature (4· 3' C.) of greatest density, forms the unit of weight, the *gramme*, whose English equivalent is nearly 15½ grains. Representations are also given, in their proper sizes, of the chief measures and weights, as employed for different purposes. It must be observed, that for the purpose of weighing 9 grammes, &c., the double weight is kept in duplicate, since 5+2+2=9. A table is given of the multiples and subdivisions; and it will be seen that the division of the metre into decimetres, centimetres, and millimetres, and of the gramme to the same extent, as well as their multiplication up to 10,000, affords the widest range for all purposes. Some of the measures nearly coincide with those now in use; as the *dekalitre* and its half, with our peck and gallon. The *millier* also deserves notice as being the ton of the system, and nearly equivalent to the English ton. It is the weight of a cubic metre filled with water. The *stere* is little used except in France for fuel, solid measurements being taken in cubic metres, &c.

A specimen metre has been prepared for school use, with the yard in juxtaposition. From this it is seen that its length is (within $\frac{1}{200}$ of and inch) 3 feet $3\frac{3}{8}$ inches; called by drapers, three threes.

I have ventured to submit to your notice a plan by which this system can be taught very thoroughly at a trifling expenditure of labour, and without the necessity of employing text-books. The following short table, containing the prefixes, with their respective values, in one column, and the five units, with their application, as well as the two additional measures of weight, can be copied by each scholar in a few minutes, and will be found amply sufficient to enable the class to follow and comprehend the teacher's explanation:—

Myria-	10000	Metre, length.
Kilo-	1000	Are, surface.
Hecto-	100	(Stere, solidity).
Deka-	10	Litre, capacity.
	1	Gramme, weight.
Deci-		
Centi-	·01	Quintal = 100,000 grm.
Milli-	·001	Millier (Ton) 1,000,000 grm.

I have also, by way of example, shown the working of an invoice on the two systems. The value of 75 cwt 2 qrs. 19 lbs., at £2. 6*s*. 9*d*. per cwt., is obtained by compound practice; while the same weight in metric equivalents, 38·44175 quintals, at the corresponding price of $4.58477 per quintal, gives the result, with equal accuracy and far greater dispatch, by simple multiplication, the process being further shortened by contraction.

It is, of course, evident that the teaching of this system presupposes a knowledge of decimal fractions, in some cases at an earlier stage