ON AN
INTERNATIONAL CALCULATING SCALE
FOR OPHTHALMOLOGICAL PURPOSES.

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ALTHOUGH the metrical system of numbering lenses has been unanimously adopted by the Congress of Ophthalmologists of 1875, and the International Medical Congress of the same year, I believe it is yet the exception to find an English oculist prescribing, or an English optician supplying, glasses according to that measurement. Believing, however, that this system has certain advantages, and that since it has been adopted by other European nations we shall follow them, I have caused the scale to be made, which I beg to bring before the Society, as a means of facilitating the introduction of the system into England.

It consists of six calculating tables, viz. the metrical system (Dioptrics), the French system, the German system, and the English system of numbering lenses, and two tables giving the presbyopia and the accommodation present at certain ages.

M. Javal, of Paris, was, I believe, the first to adapt the

system of calculation, by means of a sliding rule, to the purposes of ophthalmology. He, twelve years ago, had a scale made with the numbers corresponding to the old French system engraved on it, so that the usual additions and subtractions of that system could be made. This scale has been enlarged, so as to meet the requirements of the metrical system, and the German, English, and metrical scales calculated according to their respective measurements. We have thus not only the calculations of fractions in any one scale, but also at a glance a comparison of any one system with any of the other systems, and the resolving of the product of any calculation into the system required. (See diagram.)¹

The following calculations can be rapidly made.

The *addition* of the fractions or integers of the four systems is made as follows. The arrow of the sliding scale corresponding to the system in which the number is calculated, is placed opposite to the smaller fraction or integer, and the figure opposite to which the larger fraction stands in the same system is the product of the calculation. For example, if it is desired to add $\frac{1}{18}$ th to $\frac{1}{9}$ th, the arrow on the sliding scale being placed opposite to the 18 on the fixed scale, 9 on the sliding scale will be found opposite to 6, which is the answer.

The *subtraction* is made by placing the smaller fraction on the sliding scale opposite to the larger fraction in any one system, and noting to which figure the arrow stands opposed. For example, to subtract $\frac{1}{18}$ th from $\frac{1}{9}$ th, the 15 on the English sliding scale being placed opposite to 3 on the English fixed scale, the arrow will be found to stand against $3\frac{1}{2}$, which is the remainder.

Any power given in any of the systems can be added to, or subtracted from, any of the other systems and the

¹ The diagrams (Figs. 1 and 2) represent the two sides of the scale; they are the actual size in breadth, but only about a third of its length, the original measure extending to above 20 on the dioptric scale, and being eighteen inches in length.

D	0.25 0.50 0.75 1 1.25 1.50 1.75 2 2.25 2.50 2.75 3 3.25 3.50 3.75 4 4.50 5 5.50 6 6.50 7 8	DIOPTRICS
F	0.25 0.50 0.75 1 1.25 1.50 1.75 2 2.25 2.50 2.75 3 3.25 3.50 3.75 4 4.50 5 5.50 6 6.50 7 8	FRENCH
F	0.25 0.50 0.75 1 1.25 1.50 1.75 2 2.25 2.50 2.75 3 3.25 3.50 3.75 4 4.50 5 5.50 6 6.50 7 8	FRENCH
D	0.25 0.50 0.75 1 1.25 1.50 1.75 2 2.25 2.50 2.75 3 3.25 3.50 3.75 4 4.50 5 5.50 6 6.50 7 8	DIOPTRICS
G	0.25 0.50 0.75 1 1.25 1.50 1.75 2 2.25 2.50 2.75 3 3.25 3.50 3.75 4 4.50 5 5.50 6 6.50 7 8	GERMAN
G	0.25 0.50 0.75 1 1.25 1.50 1.75 2 2.25 2.50 2.75 3 3.25 3.50 3.75 4 4.50 5 5.50 6 6.50 7 8	GERMAN
D	0.25 0.50 0.75 1 1.25 1.50 1.75 2 2.25 2.50 2.75 3 3.25 3.50 3.75 4 4.50 5 5.50 6 6.50 7 8	DIOPTRICS

FIG. 1.

D	0.25 0.50 0.75 1 1.25 1.50 1.75 2 2.25 2.50 2.75 3 3.25 3.50 3.75 4 4.50 5 5.50 6 6.50 7 8	DIOPTRICS
E	0.25 0.50 0.75 1 1.25 1.50 1.75 2 2.25 2.50 2.75 3 3.25 3.50 3.75 4 4.50 5 5.50 6 6.50 7 8	ENGLISH
E	0.25 0.50 0.75 1 1.25 1.50 1.75 2 2.25 2.50 2.75 3 3.25 3.50 3.75 4 4.50 5 5.50 6 6.50 7 8	ENGLISH
D	0.25 0.50 0.75 1 1.25 1.50 1.75 2 2.25 2.50 2.75 3 3.25 3.50 3.75 4 4.50 5 5.50 6 6.50 7 8	DIOPTRICS
E	0.25 0.50 0.75 1 1.25 1.50 1.75 2 2.25 2.50 2.75 3 3.25 3.50 3.75 4 4.50 5 5.50 6 6.50 7 8	ENGLISH
P _R	0.25 0.50 0.75 1 1.25 1.50 1.75 2 2.25 2.50 2.75 3 3.25 3.50 3.75 4 4.50 5 5.50 6 6.50 7 8	PRESBYOPIA
A 75 70 65 60 55 50 45 40 35 30		ACCOMMODATION

FIG. 2.

product reduced to any system required. Thus, a French myopic patient may bring to an English oculist a French minus lens of $\frac{1}{7}$ th, which suits him for distance, and asks for a weaker lens on the metrical system to use at a given distance, say eighteen inches. By placing the 18 on the sliding scale of the French system opposite to 7 on the fixed scale of the same system, the arrow will be found opposite 3.25 of the metrical system, which is the glass he requires to place his punctum remotum at eighteen inches. Or, should an English oculist wish to give a patient with a hypermetropia of $\frac{1}{10}$ th a glass to suit his presbyopia of fifty years according to the metrical system, the arrow of the English sliding scale is placed opposite to the 40 of the presbyopic table, the age at which presbyopia is supposed to commence, and the amount corresponding to the age of fifty, viz. 2 dioptrics read off. The same arrow is then placed opposite to 10, the amount of the hypermetropia on the English fixed scale, and the 2 on the dioptric sliding scale will be found nearly opposite to 6 of the dioptric fixed scale, which is the number required to suit his hypermetropia and presbyopia combined.

Calculations combining the tables for presbyopia and accommodation, which have been calculated so as to correspond with the recent tables of Donder's, with any of the other tables given, can be quickly made. The examples given above will sufficiently explain this.

Any one already in possession of a set of lenses can see at a glance the number of the metrical or other system to which any lens corresponds, and may thus prescribe lenses according to the metrical system, though using trial lenses corresponding to any other system.

The ophthalmoscope accompanying the scale, which was shown at the meeting and which I described elsewhere in 1873, has had metrical lenses introduced, instead of those of the English system. By using single glasses thirty powers are at command, while by combining the glasses over one hundred different powers are obtained, ranging

from 18 to $\frac{1}{4}$. The same points of an ophthalmoscope are preserved, which I formerly considered necessary, viz. a small mirror which allows of a near approach to the eye; a large aperture of about $3\frac{1}{4}$ millimètres in the mirror to prevent any stenopæic action; the aperture having a knife edge and being carefully bevelled off so as to prevent any sign of a tunnel, which is apt to cause a reflex and limits the field of vision; the close apposition of the lens to the aperture for the same purpose; an easy revolution of the discs containing the lenses, but not by means of the finger on the periphery, which prevents the observer going close to the eye; and fair sized lenses in the discs.