About eighteen years ago your Council attempted to carry out this same idea of standardisation, and proposed that of 1·5 in. for the substage, and 0·92 and 1·35 in. for the tubes of eye-pieces.

It was a foregone conclusion, however, that those gauges could never have been adopted by the trade, because, with regard to the substage, we have seen that it had already been standardised in this country, and manufacturers did not see any sufficient reason why they should incur the expense and inconvenience of changing the gauge of their substage for one that not a single maker was using.

With regard to the two gauges for eye-pieces, the smallest, viz. 0·92 for the eye-piece tube, made it too large to enter any Continental Microscope; 1·35 in. was too small to give a maximum field with a Wenham binocular, and too large for a small binocular to be sold at a popular price; manufacturers therefore could not adopt either of these gauges. The thanks of the Society are due to Mr. Conrad Beck for the assistance he has rendered to the Council in this matter.

With regard to our accounts, Mr. Vezey most kindly consented to act as Treasurer, and by doing so has enabled the Council to lay before you the year's accounts duly audited as is customary at our Annual Meeting.

The Aplanatic Immersion Front.

We will now pass on to the Address; and I am going to ask you to kindly bear with me for a short time while I endeavour to explain a few points which will conclude the subject already dealt with in my two former Addresses.

You will no doubt remember that the subject was divided into three parts, and that one which was called the middle portion came first, and the first portion second; so this, the last, will be the only one in its proper place. Before beginning, permit me to point out that, as in my previous Addresses so also in this one, nothing either new or startling will be brought before you, and the subject will be treated, as before, in a practical rather than in an academical style. To exhaust any one of these divisions more space would be required than could reasonably be allotted to all three Addresses together; therefore each must be regarded only as a very fragmentary presentation of the subject.

The simplest part of all Microscope lens construction is the aplanatic oil-immersion front; it is, I fear, nevertheless very imperfectly understood by microscopists as a whole, or even by many of those forming the brass and glass contingent. Strange to say that, although so important, it has not, so far as I am aware, been dealt with in the whole range of microscopical literature except in a single instance, on which occasion it was so ably handled by Sir G. Stokes that it would not now have been taken up again had the point of view been the same. Sir G. Stokes' paper was one of the

Combining (i.) and (ii.), we obtain

$$r = \frac{\mu p}{\mu + 1}, \qquad \text{(iii.)}$$

$$r = \frac{q}{\mu + 1}. \qquad \text{(iv.)}$$

From (iii.) we have $r = \mu (p - r)$; but $p - r = \mathrm{C\,O}$

$$\therefore \quad \mathrm{C\,O} = \frac{r}{\mu}.$$

From (iv.) we have $q - r = \mu r$; but $q - r = \mathrm{C\,V}$

$$\therefore \quad \mathrm{C\,V} = \mu r.$$

Now, in the two triangles H C O, H C V, we have the included angle at C and the side $\mathrm{H\,C} = r$ common to both, and the sides $\mathrm{C\,O} = \frac{r}{\mu}$ and $\mathrm{C\,V} = \mu r$ both determined; therefore the remaining sides

$$\left.\begin{array}{l} \mathrm{H\,V} = r\sqrt{\mu^2 + 1 - 2\mu\cos \mathrm{C}} \\ \text{and} \\ \mathrm{H\,O} = \frac{r}{\mu}\sqrt{\mu^2 + 1 - 2\mu\cos \mathrm{C}} \end{array}\right\}^{*}$$

$$\therefore \quad \mathrm{H\,V} = \mu\,\mathrm{H\,O}.$$

Let $\mathrm{H\,O} = a$, then $\mathrm{H\,V} = \mu a$, and $r \sin \mathrm{C} = a \sin \theta$, and $r \sin \mathrm{C} = \mu a \sin \phi$.

$$\therefore \quad \mathrm{Sin}\ \theta = \mu \sin \phi.$$

When the lens is a hemisphere, then H C becomes perpendicular to the axis, and $\tan \theta = \mu$, and $\cot \phi = \mu$.

Although it is outside the subject in hand, it is interesting to note that these two triangles are similar,† therefore the angle $\mathrm{C\,H\,V} = \theta$, and $\mathrm{C\,H\,O} = \phi$. Again, because C H is the normal, C H V is the angle of incidence, and C H O that of refraction; and as $\sin \theta$ has been proved equal to $\mu \sin \phi$, therefore $\sin \mathrm{C\,H\,V} = \mu \sin \mathrm{C\,H\,O}$, which proves the aplanatism of the lens, when the condition that $q = \mu p$ is fulfilled, because it is true wherever the point H may be placed on the curve A H. The limit is reached when V H is a tangent to the curve, i.e. when θ is a right angle.

We will now take a practical example to illustrate the use of the above formulæ. Let it be required to construct an aplanatic front for an oil-immersion objective of N.A. 1·3; let $\mu = 1 \cdot 5$.

* The above is the common formula for the solution of the third side of a rectilinear triangle, when two sides and the included angle are given, viz.—

$$c^2 = a^2 + b^2 - 2\,a\,b \cos \mathrm{C}.$$

† Euclid, Bk. vi. Prop. 6.