It is easy to see that this (not inelegant) construction is not limited to the equality of the refractions *wgr, Krr'.* In whatever proportion the whole refraction *wgs* is divided, we always can tell the proportion of the dispersions which the two refractions occasion at *g* and *r*, and can therefore find the values of *s* and *q.* Indeed this solution includes the problem in p. 167, col. 2, par. 2 ; but it had not occurred to us till the present occasion. Our readers will not be dis­pleased with this variety of resource.

The intelligent reader will sec that in this solution some quantities and ratios are assumed as equal which arc not strictly so, in the same manner as in all the elementary op­tical theorems. The parallelism, how­ever, of *vv'* and *rr'* may be made accu­rate by pushing the lens Dr nearer to C*g*, or retiring it from it. We may also, by pushing it still nearer, induce a small divergency of the violet ray, so as to pro­duce accurate vision in the eye, and may thus make the vision through a telescope more perfect than with the naked eye, where dispersion is by no means avoid­ed. It would therefore be an improve­ment to have the eye-glass in a sliding tube for adjustment. Bring the telescope to distinct vision ; and if any colour be visible about the edges of the field, shift the eye-glass till this colour is removed. The vision may now become indistinct ; but this is corrected by shifting the place of the whole eye-piece.

We have examined trigonometrically the progress of a red and a violet ray through many eye-pieces of Dollond's and Rams­den’s best telescopes, and we have found in all of them that the colours are unit­ed on or very near the field-glass ; so that we presume that a theory somewhat analogous to ours has directed the inge­nious inventors. We meet with many made by other artists, and even some of theirs, where a considerable degree of colour remains, sometimes in the natural order, and often in the contrary order. This must happen in the hands of mere imitators, ignorant of principle. We pre­sume that we have now made this prin­ciple sufficiently plain.

Fig. 28 represents the eye-piece of a very fine spy-glass by Mr Ramsden ; the focal length of its object-glass is 81/2 inches, with 11/10th of aperture, 2° 05' of visible field, and 15·4 magnifying power. The distances and focal lengths are of their proper dimensions, but the apertures are 1/2 larger, that the progress of a lateral pen­cil might be more distinctly drawn. The dimensions are as follow :

Foc.lengths A*a* = 0∙775, B*b* = 1∙025, C*c* = 1∙01, D*d* = 0∙79. Distances AB= 1∙18, BC =1∙83, CD= 1∙105.

It is perfectly achromatic, and the colours are united, not precisely at the lens *Cg,* but about 1/20th of an inch nearer the eye-glass.

It is obvious that this combination of glasses may be used as a microscope ; for if, instead of the image formed by the object-glass at FG, we substitute a small object, illuminated from behind, as in compound microscopes, and if we draw the eye-piece a very small way from this object, the pencils of parallel rays emergent from the eye-glass D will become convergent to very distant points, and will there form an inverted and enlarged picture of the object, which may be

viewed by a Huyghenian eye-piece ; and we may thus get high magnifying powers without using very deep glasses. We tried the eye-piece of which we have given the dimen­sions in this way, and found that it might be made to mag­nify 180 times with very great distinctness. When used as the magnifier of a solar microscope, it infinitely surpasses every thing we have ever seen. The picture formed by a solar microscope is generally so indistinct, that it is fit only for amusing ladies ; but with this magnifier it seemed per­fectly sharp. We therefore recommend this to the artists as a valuable article of their trade.

The only thing which remains to be considered in the theory of refracting telescopes, is the forms of the different lenses. Hitherto we have had no occasion to consider any thing but their focal distances ; but their aberrations de­pend greatly on the adjustment of their forms to their si­tuations. When the conjugate focuses of a lens are de­termined by the services which it is to perform, there is a certain form or proportion between the curvatures of their anterior and posterior surfaces, which will make their aber­rations the smallest possible.

It is evident that this proportion is to be obtained by making the fluxion of the quantity within the parenthesis in the formula at the top of col. 2, p. 151, equal to nothing. When this is done, we obtain this formula for *a,* the radius of curvature for the anterior surface of a lens : - = ⅜-- ~~^t~~ ~~nt~~ *a* 2m -f- 4

4- ~τ—-~~j^~~~i∖- -, where *m* is the ratio of the sine of inci- 2 *(m* -p 4) *r*

dence to the sine of refraction, and *r* is the distance of the focus of incident rays, positive or negative, according as they converge or diverge, all measured on a scale of which the unit is *n, =* half of the radius of the equivalent isos­celes lens.

It will be sufficiently exact for our purpose to suppose *m* + 3/2, though it is more nearly 31/20. In this case, 1/a = 6/7 + 10/7r = 6r + 10/7r. Therefore *a* = 7r/6r+10, and 1/b = 1/a - 1 = 1-a/a.

As an example, let it be required to give the radii of curvature in inches for the eye-glass *be* of page 164, col. I, par. 2, which we shall suppose of 11/2 inch focal distance, and that *ec* (= *r*) is 33/4th inches.

The radius of curvature for the equivalent isosceles lens

Si

is 1∙5, and its half is 0∙75. Therefore *r* = -A\* = 5; and v’ ∕ \*)

our formula is *a* = 7×5/6×5+10 = 35/40 = 0·875; and 1/b = 1-a/a = 0·125/0·875, and *b* = 0·875/0·125 = 7.

These values are parts of a scale of which the unit is 0·75 inch. Therefore

*a,* in inches, = 0∙875 × 0·75 = 0∙65525,

*b,* in inches, = 7 × 0∙75 = 5∙25.

And here we must observe that the posterior surface is concave ; for *b* is a positive quantity, because 1 — *a* is a positive quantity as well as *a ;* therefore the centre of sphe­ricity of both surfaces lies beyond the lens.

And this determination is not very different from the usual practice, which commonly makes this lens a plane convex with its flat side next the eye: and there will not be much difference in the performance of these two lenses; for in all cases of maxima and minima, even a pretty con­siderable change of the best dimensions does not make a sensible change in the result.