drawing both glasses out a little, and the telescope is made perfect.

This improvement cannot be applied to the construction of quadrant telescopes, such as fig. 20. Mr Ramsden has attempted it, however, in a very ingenious way, which merits a place here, and is also instructive in another respect. The field-glass HD is a plano-convex, with its plane side next the image GF. It is placed very near this image. The consequence of this disposition is, that the image GF produces a vertical image which is much less convex towards the glass. He then places a lens on the point C, where the red ray would cross the axis. The violet ray will pass on the other side of it. If the focal distance of this glass be *fc,* the vision will be distinct and free from colour. It has, however, the inconvenience of obliging the eye to be close to the glass, which is very troublesome.

This would be a good construction for a magic lanthorn, or for the object-glass of a solar microscope, or indeed of any compound microscope.

We may presume that the reader is now pretty familiar with the different circumstances which must be considered in the construction of an eye-piece, and proceed to consi­der those which must be employed to erect the object.

This may be done by placing the lens which receives the light from the object-glass in such a manner that a second image (inverted with respect to the first) may be formed beyond it, and this may he viewed by an eye-glass. Such a construction is represented in fig. 23. But, besides many other defects, it tinges the object prodigiously with colour. The ray *od* is dispersed at into the red ray *dr* and the violet *dv. v* be­ing farther from the centre than *r ;* the re­fracted ray *vv'* crosses rr,, both by reason of spherical aberration and its greater refrangibility.

But the common day-telescope, invented by F. Rheita, has in this respect greatly the advantage of the one now described. The rays of compound light are dispersed at two points. The violet ray in its course falls with­out the red ray, but is accurately collected with it at a common focus, as we shall de­monstrate by and by. Since they cross each other in the focus, the violet ray must fall within the red ray, and be less refracted than if it had fallen on the same point with the red ray. Had it fallen there, it would have separated from it ; but by a proper diminu­tion of its refraction, it is kept parallel to it, or nearly so. And this is one excellence of this telescope ; when constructed with three eye-glasses perfectly equal, the colour is sen­sibly diminished, and by using an eye-glass somewhat smaller it may be removed entire­ly. We say no more of it at present, be­cause we shall find its construction included in another, which is still more perfect.

It is evident at first sight that this telescope may be improved by substituting for the eye-glass the Huyghenian double eye-glass, or field-glass and eye-glass represented in figs,. 19 and 20, and that the first of these may be improved and rendered achromatic. This will require the two glasses to be increased from their present dimensions to the size of a field-glass suited to the magnifying power of the tele­scope, supposing it an astronomical telescope. Thus we shall have a telescope of four eye-glasses. The first three will be of a considerable focal distance, and two of them will have a common focus at *b.* But this is considerably different from the eye-pieces of four glasses which are now used, and are far better. We arc indebted for them to Mr Dollond, who was a mathematician as well as an artist, and in the course of his research discovered resources which had not been thought of. He had not then discovered the achromatic object-glass, and was busy in improving the eye-glasses by diminishing their spherical aberration. His first thought was to make the Huyghenian addition at both the images of the day-telescope. This suggested to him the following eye-piece of five glasses.

Fig. 24 represents this eye-piece, but there is not room for the object-glass at its proper distance. A pencil of rays coming from the upper point of the object is made to converge (by the object-glass) to G, where it would form a pic­ture of that part of the ob­ject. But it is intercepted by the lens A*a*, and its axis is bent towards the axis of the telescope in the direction *ab.* At the same time, the rays which con­verged to G converge to *g,* and there is formed an in­verted picture of the ob­ject at *gf.* The axis of the pencil is again refracted at *b,* crosses the axis of the telescope in H, is refracted again at *c,* at *d,* and at *e,* and at last crosses the axis in I. The rays of this pen­cil, diverging from *g,* are made less diverging, and proceed as if they came from *g',* in the line *Bgg'.* The lens cC causes them to converge to *g',* in the line G"C*g'*. The lens *d*D makes them converge still more to G", and there they form an erect picture G"F" ; diverging from G'', they are rendered parallel by the refraction at *e.*

At H the rays are nearly parallel. Had the glass B*b* been a little farther from A, they would have been accurately so, and the ob­ject-glass, with the glasses A and B, would have form­ed an astronomical tele­scope with the Huyghenian eye-piece. The glasses C, D, and E, are intended merely for bending the rays back again till they again cross the axis in I. The glass C tends chiefly to diminish the great angle BH*b*; and then the two glasses D and E are another Huyghenian eye-piece.

The art in this construction lies in the proper adjustment of the glasses, so as to divide the whole bending of the pen­cil pretty equally among them, and to form the last image in the focus of the eye-glass, and at a proper distance from the other glass. Bringing B nearer to A would bcnd the pencil more to the axis. Placing C farther from B would do the same thing ; but this would be accompanied with more aberration, because the rays would fall at a greater distance from the centres of the lenses. The greatest bend­ing is made at the field-glass D ; and we imagine that the