by a diminution of the other. What are called the *caustic curves* are the geometrical loci of the foci of infinitely slen­der pencils ; consequently the point G is very nearly in the caustic formed by a beam of light consisting of rays parallel to Io, and occupying the whole surface of the eye-glass, because the pencil of rays which are collected at G is very small. Any thing therefore that diminishes the mu­tual inclination of the adjoining rays, puts their concourse farther off. Now this is precisely what we want ; for the point G of the image formed by the object-glass is already beyond the focus of the oblique slender pencil of parallel rays *ia* and *i'b ;* and therefore, if we could make this focus go a little farther from *a* and *b,* we shall bring it nearer to G, and obtain more distinct vision of this point of the ob­ject. Now let it be recollected, that in moderate refrac­tions through prisms, two rays which are inclined to each other in a small angle are, after refraction, inclined to each other in the same angle. Therefore, if we can diminish the aberration of the ray *ai,* or oI, or *bi',* we diminish their mutual inclination, and consequently the mutual inclina­tion of the rays Ga, Go, *GlI,* and therefore lengthen the focus, and get more distinct vision of the point G. There­fore we at once correct the distortion and the indistinct­ness ; and this is the aim of Mr Huyghens’s great principle of dividing the refractions.

The general method is as follows. Let O be the object-glass (fig. 19) and E the eye-glass of a telescope, and F

their common focus, and FG the image formed by the ob­ject-glass. The proportion of their focal distances is sup­posed to be such as gives as great a magnifying power as the perfection of the object-glass will admit. Let BI be the axis of the emergent pencil. It is known by the focal theorem that GE is parallel to BI : therefore BGE is the whole refraction or deflection of the ray OHB from its former direction. Let it be proposed to diminish the aber­rations by dividing this into two parts by means of two glasses D and *e,* so as to make the ultimate angle of vision *bic* equal to BIE, and thus retain the same magnifying power and visible field. Let it be proposed to divide it into the parts BGC and CGE.

From G draw any line GD to the axis towards O ; and draw the perpendicular DH, cutting OG in H ; draw He parallel to GC, cutting GD in *g ;* draw *gf* perpendicular to the axis, and *ge* parallel to GE ; draw *eb* perpendicular to the axis ; draw Dδ parallel to GC, and *dδ* perpendicular to the axis. Then if there be placed at D a lens whose focal distance is D*d*, and another at *e* whose focal distance is *ef,* the thing is done. The ray OH will be refracted into H*b*, and this into *bi,* parallel to BI.

The demonstration of this construction is so evident by means of the common focal theorem, that we need not re­peat it, nor the reasons for its advantages. We have the same magnifying power, and the same field of vision ; we have less aberration, and therefore less distortion and in­distinctness ; and this is brought about by a lens HD of a smaller aperture and a greater focal distance than BE. Consequently, if we are contented with the distinctness of the margin of the field with a single eye-glass, we may greatly increase the field of vision ; for if we increase DH to the size of EB, we shall have a greater field, and much greater distinctness in the margin ; because HD is of a longer focal distance, and will bear a greater aperture, pre­serving the same distinctness at the edge. On this account the glass HD is commonly called the *field-glass.*

It must be observed here, however, that although the distortion of the object is lessened, there is a real distortion produced in the image *fg.* But this, when magnified by the glass *e,* is smaller than the distortion produced by the glass E, of greater aperture and shorter focus, on the un­distorted image GF. But because there is a distortion in the second image *fg,* this construction cannot be used for the telescopes of astronomical quadrants, and other gradu­ated instruments, because then equal divisions of the micro­meter would not correspond to equal angles.

But the same construction will answer in this case by taking the point D on that side of F which is remote from O (fig. 20). This is the form now employed in the tele­scopes of all graduated instruments.

The exact proportion in which the distortion and the in­distinctness at the edges of the field are diminished by this construction, depends on the proportion in which the angle BGE is divided by GC, and is of pretty difficult investiga­tion. But it never deviates far (never one eighth in opti­cal instruments) from the proportion of the squares of the angles. We may, without any sensible error, suppose it in this proportion. This gives us a practical rule of easy re­collection, and of most extensive use. When we would di­minish an aberration by dividing the whole refraction into two parts, we shall do it most effectually by making them equal. In like manner, if we divide it into three parts by means of two additional glasses, we must make each = 1/5 of the whole, and so on for a greater number.

This useful problem, even when limited, as we have done, to equal refractions, is as yet indeterminate ; that is, sus­ceptible of an infinity of solutions ; for the point D, where the field-glass is placed, was taken at pleasure ; yet there must be situations more proper than others. The aberra­tions which produce distortion, and those which produce indistinctness, do not follow the same proportions. To cor­rect the indistinctness, we should not select such positions of the lens HD as will give a small focal distance to *be ;* that is, we should not remove it very far from F. Huy- ghens recommends the proportion of three to one for that of the focal distances of the lens HD and *eb,* and says that the distance De should be — 2Fe. This will make *ei* = 1/2 eF, and will divide the whole refraction into two equal parts, as any one will readily see by constructing the com­mon optical figure. Mr Short, the celebrated improver of reflecting telescopes, generally employed this proportion ; and we shall presently see that it is a very good one.

It has already been observed that the great refractions which take place on the eye-glasses, occasion very consi­derable dispersions, and disturb the vision by fringing every thing with colours. To remedy this, achromatic eye-glasses may be employed, constructed by the rules already delivered. This construction, however, is incomparably more intricate than that of object-glasses ; for the equations must involve the distance of the radiant point, and be more complicated ; and this complication is immensely increased on account of the great obliquity of the pencils.

Most fortunately the Huyghenian construction of an eye­piece enables us to correct this dispersion to a great degree of exactness. A heterogeneous ray is dispersed at H, and the red ray belonging to it falls on the lens *be,* at a greater distance from the centre than the violet ray coming from H. It will therefore be less refracted, *cœteris paribus,* by