let it be recollected, that in moderate rest actions 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 *o*I, or *bi',* we diminiſh their mutual inclination ; and conſequently the mutual inclination of the rays G*a, Go,* G*b',* 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. See Optics, n⁰ 100.

The general method is as follows : Let *o* be the object- glaſs (fig. 14. A) 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 *bie* equal to BTE, 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 Hc parallel to GC, cutting GD in *g* ; draw *gf* perpendicular to the axis, and *e* parallel to GE ; draw *eb* perpendicular to the axis ; draw Dδ parallel to GC, and δ*d* 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 ΟH 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 (see Optics 100). 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 the image f*g.* 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 f*g,* this conſtruction cannot be uſed for the teſeſcopes 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 (ſig. 14. B). 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 1/8th 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 = 1/3rd 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. Huygens recom­mends the proportion of 3 to 1 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 — 1/2eF,* 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 teſeſcopes, generally employed this proportion ; and we ſhall preſently ſee that it is a very good one.

It has been already 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 heterogencous 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 (cæteris paribus) by the lens *be;* and it is poſſible that the difference may be ſuch that the red and violet rays diſperſed at H may be render­ed parallel at *b,* or even a little divergent, ſo as to unite ac­curately with the red ray at the bottom of the eye. How this may be affected, by a proper ſelection of the places and figures of the lenſes, will appear by the following propoſition, which we imagine is new, and not inelegant.

Let the compound ray OP (fig. 15. A) be diſperſed by the lens PC ; and let PV, PR be its violet and red rays, cutting the axis in G and g. It is required to place an­other lens RD in their way, ſo that the emergent rays Rr, Vv*,* ſhall be parallel.

Produce the incident ray OP to Z. The angles ZPR, ZPV, are given, (and RPV is nearly = ZPR/27) and the intersections G and *g* with the axis. Let F be the focus of parallel red light coming through the lens RD in the op­poſite direction. Then (by the common optical theorem), the perpendicular Fρ will cut PR in ſuch a point ρ*,* that ρF will be parallel to the emergent ray Rr (ſee Optics, n⁰ 252 — 256), and to Vv. Therefore if ρD cut PV in *u,* and *uf* be drawn perpendicular to the axis, we ſhall have (alſo by the common theorem) the point *f* for the focus of