*i*BAB,cDA B «AB,—≈=. ThereforeRr» **X~***Ab ηn m* -f- » *m* 4- nandB∕=≈-Lt*m -j~ n*

This value of Bf is evidently = *b*B × bB × ((AB)/(pB + Ab)).

Now *b*B being a constant quantity while the glaſs B is the ſame, the place of union varies with ((AB)/(pB + Ab)). If we remove B a little farther from A, we increaſe AB, and ρB, and A*b,* each by the ſame quantity. This evidently diminiſhes B*f.* On the other hand, bringing B nearer to A increaſes Bf. If we keep the diſtance between the glasses the ſame, but increaſe the focal diſtance *b* B, we augment B*f,* becauſe this change augments the numerator and diminiſhes the denominator of the fraction ((bB × AB)/(ρB + Ab)).

In this manner we can unite the colours at what diſtance we pleaſe, and conſequently can unite them in the place of the intended field-glaſs, from which they will diverge with an increaſed diſperſion, viz. with the diſperſion competent to the refraction produced there, and the diſperſion *p × m + n* conjoined.

It only remains to determine the proper focal diſtancee of the field-glaſs and eye-glaſs, and the place of the eye- glaſs, ſo that this diſperſion may be finally corrected.

This is an indeterminate problem, admitting of an infini­ty of ſolutions. We ſhall limit it by an equal diviſion of the two remaining refractions, which are neceſſary in order to produce the intended magnifying power. This conſtruction has the advantage of diminiſhing the aberration. Thus we know the two refractions, and the diſperſion competent to each ; it being nearly 1/27th of the refraction. Call this q. The whole diſperſion at the field-glaſs conſiſts of q, and of the angle KgV of fig. 19. which we alſo know to be *= ρ × m* + n. Call their ſum *s.*

Let fig. 20. n⁰ I. repreſent this addition to the eye-piece. *Cg* is the field-glaſs coming in the place of *fg* of fig. 19. and Rg*w* is the red ray coming from the glaſs BR. Draw *gs* parallel to the intended emergent pencil from the eye- glaſs ; that is, making the angle Cs*g* with the axis correſpond to the intended magnifying power. Biſect this angle by the line *g*K. Make *sg : gq = s : q,* and draw *q*K, cutting Cg in t. Draw *tδ*D, cutting *gk* in δ*,* and the axis in D. Draw δD and D*r* perpendicular to the axis, Then a lens placed in D, having the focal diſtance Dd*,* will deſtroy the diſperſion at the lens *gc,* which refracts the ray *gw* into g*r.*

Let *gv* be the violet ray, making the angle *vgr — s.* It is plain, by the common optical theorem, that *gr* will be refracted into rr' parallel to δD. Draw *g***D***r'* meeting *rr,* and join *vr'.* By the focal theorem two red rays *gr, gv,* will be united in r'. But the violet ray *gv* will be more refracted, and will take the path *vv',* making the angle of diſperſion *r'vv' = q,* very nearly, becauſe the diſ­perſion at *v* does not ſenſibly differ from that at r. Now, in the ſmall angles of refraction which obtain in optical inſtruments, the angles *rr'v, rgv* are very nearly as *gr* and *rr',* or as gD and Dr', or as CD and DT; which, by the focal theorem, are as C*d* and *d*D ; that is, D*d : dc = rgv : rr'v.* But D*d : a*C — Dδ : δ*t, — sg : gq, = s : q.* But *rgv = s;* therefore r*r'v — q, = r'υv',* and *vv'* is parallel to *rr,,* and the whole diſperſion at *g* is corrected by the lens Dr. The focal diſtance *Cc of Cg* is had by drawing C parallel to Kg, meeting R *g* in ϰ, and drawing ϰ*c* perpendicular to the axis.

It is eaſy to ſee that this (not inelegant) conſtruction is not limited to the equality of the refractions w*gr,* 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. 365. col. I. 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 ſee, that in this ſolution ſome quantities and ratios are aſſumed as equal which are not ſtrictly ſo, in the ſame manner as in all the elementary optical theorems. The paralleliſm, however, of *vv'* and r*r'*may be made accurate, by puſhing the lens D*r* nearer to *Cg,* 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 fιiding 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. 20. N⁰ 2. 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, 2⁰05' *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 Aa = 0,775 Bb = 1,025 Cc = 1,01 Dd = 0,799 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 ſrom 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 oſ 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