will not indeed be ſo much deflected from parallelism as the violet ray, which naturally accompanies the red ray to *r,* be­cauſe it falls nearer the centre. By computation its diſper­ſion is diminiſhed about 1/7th.

In order that *gv* may be made parallel to *r* after re­fraction, the refraction at *r* muſt be ſuch that the diſperſion correſponding to it may be of a proper magnitude. How to determine this is the queſtion. Let the diſperſion at g be to the diſperſion produced by the refraction at r (which is required for producing the intended magnifying power) as I to 9. Make 9 : I = *ff'* : f'C, = fC : CD, and draw the perpendicular Dr' meeting the refracted ray *rr* in *r'.* Then we know by the common focal theorem, that if f' be the focus of the lens Cr, red rays diverging from g will be united in r'. But the violet ray *gv* will be refracted into *vv'* parallel to *rr'.* For the angle *vr'r : vgr =* (ulti­mately) *fC :* CD, = 9 : 1. Therefore the angle *vr'r* is equal to the diſperſion produced at r, and therefore equal to *r'vv',* and *vv'* is parallel to *rr'.*

But by this we have deſtroyed the diſtinct viſion of the image formed at fg*,* becauſe it is no longer at the focus of the eye-glaſs. But diſtinct viſion will be reſtored by puſhing the glaſſes nearer to the object-glaſs. This makes the rays of each particular pencil more divergent after refraction through A, but ſcarcely makes any change in the direc­tions of the pencils themſelves. Thus the image comes to the focus *f',* and makes no ſenſible change in the diſperſions.

In the common day teleſcope, the firſt image is formed in the anterior focus of the firſt eye-glaſs, and the ſecond image is at the anterior focus of the laſt eye-glaſs. If we change this laſt for one of half the focal diſtance, and push in the eye-piece till the image formed by the object-glaſs is half way between the firſt eye-glaſs and its focus, the laſt image will be formed at the focus of the new eye-glaſs, and the eye-piece will be achromatic. This is easily ſeen by ma­king the usual computations by the focal theorem. But the viſible field is diminiſhed, becauſe we cannot give the ſame aperture as before to the new eye-glaſs ; but we can ſubſtitute for it two eye-glasses like the former, placed cloſe together. This will have the ſame focal diſtance with the new one, and will allow the ſame aperture that we had be­fore.

On theſe principles may be demonſtrated the correction of colour in eye-pieces with three glaſſes of the following conſtruction.

Let the glaſſes A and B be placed ſo that the poſterior focus of the firſt nearly coincides with the anterior focus of the ſecond, or rather so that the anterior focus of B may be at the place where the image oſ the object-glaſs is formed, by which ſituation the aperture necessary for tranſmitting the whole light will be the ſmalleſt poſſible. Place the third C at a diſtance from the ſecond, which exceeds the ſum of their focal diſtances by a ſpace which is a third pro­portional to the diſtance of the firſt and ſecond, and the fo­cal diſtance of the ſecond. The diſtance of the firſt eye- glaſs from the object-glass muſt be equal to the product of the focal diſtance of the firſt and ſecond divided by their ſum.

Let Oo, A*a,* B*b,* C*c,* the focal diſtances of the glaſſes, be O, a, *b, c.* Then make AB — *a* + b nearly ; BC = b + c + b2/(b + c); OA = bc/(b + c). The amplification or magnifying power will be = ob/ac; the equivalent eye-glaſs = ac/b; and the field of viſion = 3438'((Aperture of A)/(foc. dist. ob. gl)).

Theſe eye-pieces will admit the uſe of a micrometer at the place of the firſt image, becauſe it has no diſtortion.

Mr Dollond was anxious to combine this achromatiſm of the eye-pieces with the advantages which he had found in the eye-pieces with five glaſſes. This eye-piece of three glaſſes neceſſarily has a very great refraction at the glaſs B, where the pencil which has come from the other side of the axis muſt be rendered again convergent, or at leaſt parallel to it. This occaſions conſiderable aberrations. This may be avoided by giving part of this refraction to a glaſs put between the firſt and ſecond, in the ſame way as he has done by the glaſs B put between A and C in his five glaſs eye­piece. But this deranges the whole proceſs. His inge­nuity, however, ſurmounted this difficulty, and he made eye­pieces of four glaſſes, which ſeem as perfect as can be de­sired. He has not publiſhed his ingenious inveſtigation ; and we obſerve the London artiſts work very much at ran­dom, probably copying the proportions of ſome of his beſt glaſſes, without underſtanding the principle, and therefore frequently miſtaking. We ſee many eye-pieces which are far from being achromatic. We imagine therefore that it will be an acceptable thing to the artiſts to have precile inſtructions how to proceed, nothing of this kind having appeared in our language, and the inveſtigations of Euler, D’Alembert, and even Boſcovich, being ſo abſtruſe as to be inacceſſible to all but experienced analyſts. We hope to render it extremely ſimple.

It is evident, that if we make the rays of different colours unite on the ſurface of the laſt eye-glass but one, commonly called the fi*eld-glass,* the thing will be done, becauſe the dilperſion from this point of union will then unite with the diſperſion produced by this glaſs alone ; and this increaſed dilperſion may be corrected by the laſt eye-glaſs in the way already ſhown.

Therefore let A, B (fig. 19.) be the ſtations which we have fixed on for the firſt and ſecond eye-glaſſes, in order to give a proper portion of the whole refraction to the ſecond glaſs. Let *b* be the anterior focus of B. Draw PB*r* through the centre of B. Make AMB = AB : BK. Draw the perpendicular K*r,* meeting the refracted ray in r. We know by the focal theorem, that red rays diver­ging from P will converge to *r* ; but the violet ray PV, be­ing more refracted, will croſs R*r* in ſome point *g.* Draw­ing the perpendicular *fg,* we get f for the proper place of the field-glaſs. Let the refracted ray R*r,* produced back­wards, meet the ray OP coming from the centre of the object-glass in O. Let the angle of diſperſion RPV be called *ρ,* and the angle of diſperſion at V, that is, *r*V*v,* be *v,* and the angle VrR be *r.*

It is evident that OR:OP *— p : v,* becauſe the disperſions are proportional to the sines of the refractions, which, in this caſe, are very nearly as the refractions themſelves.

Let Bπ^Γ or ~υ or Εέ) ^3e ma^e — τn∙ Then ∙n = OR ∖ ∕>B *t>P>Jmp ;* alſo *p : r —* BK : AB, = *b* B : A *b,* and *r ~p.*

or, making —*— n, r — np ∙,* therefore *v : r = m : n, =*

*-.~ =pB∙.* A *b.*

The angle R *g* V = *g* V *r* ~|~£ r V — *p. m* -j- *n* ; and R^V : Rrv = lct : R^> *or m η : n* — Rr: Rι^, and R» = Rr —-—.But Rr is ultimately = BK — AB*sn-j-n*