a = — b, = — a', = b', = 0,530

a'' = 1,215

b'' = — 0,3046

P = I.

This is not a very good form, becauſe the laſt ſurface has too great curvature.

We thought it worth while to compute the curvatures for a caſe where the internal ſurfaces of the lenſes coincide, in order to obtain the advantages mentioned on a former oc­caſion. The form is as follows :

The middle lens is a double concave of flint-glaſs ; the laſt lens is of crown-glaſs, and has equal curvatures on both ſides. The following table contains the dimenſions of the glaſſes for a variety of focal diſtances. The firſt column contains the focal diſtances in inches ; the ſecond contains the radii of the firſt ſurface in inches ; the third contains the radii of the poſterior ſurface of the firſt lens and ante­rior ſurface of the ſecond ; and the fourth column has the radii of the three remaining ſurfaces.

|  |  |  |  |
| --- | --- | --- | --- |
| P | *a* | *b, a!* | *b', a", b"* |
| 12 | 9,25 | 6,17 | 12,75 |
| 24 | 18,33 | 12,25 | *25,5* |
| 36 | 27,33 | 18,25 | 38,17 |
| 48 | 36,42 | 24,33 | 50,92 |
| 60 | 45,42 | 30,33 | 63,58 |
| 72 | 54,5 | 36,42 | 76,33 |
| 84 | 63,5 | 42,5 | 89, |
| 96 | 72,6 | 48,5 | 101,75 |
| 108 | 81,7 | 54,58 | 114,42 |
| 120 | 90,7 | 60,58 | 127,17 |

We have had an opportunity of trying glaſſes of this conſtruction, and found them equal to any of the ſame length, although executed by an artiſt by no means excel­lent in his profeſſion as a glaſs-grinder. This very circumſtance gave us the opportunity of seeing the good effects of interpoſing a tranſparent ſubſtance between the glaſſes. We put ſome clear turpentine varniſh between them, which com­pletely prevented all reflection from the internal ſurfaces. Accordingly theſe teleſcopes were ſurprisingly bright ; and although the roughneſs left by the firſt grinding was very perceptible by the naked eye before the glaſſes were put together, yet when joined in this manner it entirely diſappeared, even when the glaſſes were viewed with a deep magnifier.

The aperture of an object-glaſs of this conſtruction of 30 inches focal diſtance was still inches, which is conſiderably more than any of Mr Dollond’s that we have seen.

If we ſhould think it of advantage to make all the three lenſes iſoſceles, that is, equally curved on both ſurfaces, the general equation will give the following radii :

*a =* + 0,639

a' = — 0,5285

a'' = + 0,6413

b = — 0,639

b' = + 0,5285

b'' = — 0,6413

This seems a good form, having large radii.

Should we chooſe to have the two crown-glaſs lenſes iſoſceles and equal, we muſt make

a = + 0,6412

a' = — 0,5227

a'' = + 0,6412

b = — 0,6412

b' = + 0,5367

b'' = — 0,6412

This form hardly differs from the laſt.

Our readers will recollect that all theſe forms proceed on certain meaſures of the refractive and diſpersive powers of the ſubſtances employed, which are expreſſed by m, m', *dm,* and *dm'* : and we may be aſſured that the formulae are ſufficiently exact, by the compariſon (which we have made in one of the cases) of the reſult of the formula and the trigo­nometrical calculation of the progreſs of the rays. The er­ror was but 1/60th of the whole, ten times leſs than ano­ther error, which unavoidably remains, and will be conſidered preſently. Theſe meaſures of refraction and diſpersion were carefully taken ; but there is great diverſity, particularly in the flint-glaſs. We are well informed that the manufacture of this article has conſiderably changed of late years, and that it is in general leſs refractive and leſs disperſive than formerly. This muſt evidently make a change in the forms of achromatic glaſſes. The proportion of the focal diſtance of the crown-glaſſes to that of the flint muſt be increaſed, and this will occaſion a change in the curva­tures, which ſhall correct the ſpherical aberration. We examined with great care a parcel of flint glaſs which an artiſt of this city got lately for the purpoſe of making achromatic object-glaſſes, and alſo ſome very white crown-glaſs made in Leith ; and we obtained the following meaſures :

m = 1,529

m' = 1,578

dm/dm' = 142/219 = 0,64841.

We computed ſome forms for triple object-glaſſes made of theſe glaſſes, which we ſhall ſubjoin as a ſpecimen of the variations which this change of data will occaſion.

If all the three lenſes are made iſoſceles, we have

a = + 0,796

a' = — 0,474

a'' = + 0,502

b = — 0, 796

b' = + 0,474

b'' = — 0,502

Or

a = 0,504

a' = — 0,475

a'' = + 0,793

b = — 0,504

b' = 0,475

b'' = — 0,793

If the middle lens be iſoſceles, the two crown-glaſs lenſes may be made of the ſame form and focal diſtance, and pla­ced the ſame way. This will give us

a = + 0,705

a' = — 0,475

a'' = + 0,705

b = — 0,547

b' = + 0,475

b'' = — 0,547

N. *B.* This conſtruction allows a much better form, if the meaſures of refraction and diſpersion are the ſame that we uſed formerly. For we ſhall have

a = + 0,628

a' = — 0,579

a'' = + 0,628

b = — 0,749

b' = + 0,579

b'' = — 0,749

And this is pretty near the practice of the London opti­cians.

We may here obſerve, upon the whole, that an amateur has little chance of ſucceeding in theſe attempts. The di­verſity of glaſſes, and the uncertainty of the workman’s producing the very curvatures which he intends, is so great, that the object-glaſs turns out different from our expecta­tion. The artiſt who makes great numbers acquires a pretty certain gueſs at the remaining error ; and having many len­ſes, intended to be of one form, but unavoidably differing a little from it, he tries ſeveral of them with the other two, and finding one better than the rest, he makes use of it to complete the ſet.

The great difficulty in the conſtruction is to find the ex­act proportion of the diſperfive powers of the crown and flint glaſs. The crown is pretty conſtant ; but there is hardly two pots of flint-glaſs which have the ſame diſpersive power. Even if conſtant, it is difficult to meaſure it accu­rately ; and an error in this greatly affects the inſtrument, becauſe the focal diſtances of the lenſes muſt be nearly as their diſpersive powers. The method of examining this circumſtance, which we found moſt accurate, was as fol­lows :

The ſun’s light, or that of a brilliant lamp, paſſed through a ſmall hole in a board, and fell on another board pierced alſo with a ſmall hole. Behind this was placed a fine prism A (fig. ιo.), which formed a ſpectrum ROV on a ſcreen pierced with a ſmall hole. Behind this was placed a priſm B of the ſubſtance under examination. The ray which was refracted by it fell on the wall at D, and the diſtance of its illumination from that point to C, on which an unrefracted ray would have fallen, was carefully meaſured. This ſhowed the retraction of that colour. Then, in order that we might be certain that we always compared the refraction of