P. *a. b, a'. b', a", b''.*

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 31/5th 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 formula; 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 *dm* \_ 142 \_ ,

*ml* = 1-578 *dm, ~* 219

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.

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, are 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 dispersive powers of the crown and flint glass. The crown is pretty constant ; but there are 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. 12), which formed a spectrum R*o*V 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 refraction of that colour. Then, in order that we might be certain that we always compared the refrac­tion of the same precise colour by the different prisms placed at B, we marked the precise position of the prism A when the ray of a particular colour fell on the prism B. This was done by an index AG attached to A, and turn­ing with it, when we caused the different colours of the spectrum formed by A to fall on B. Having examined one prism B with respect to all the colours in the spectrum formed by A, we put another B in its place. Then bring­ing A to all its former positions successively, by means of a graduated arch HGK, we were certain, that when the in­dex was at the same division of the arch, it was the very ray which had been made to pass through the first prism B in a former experiment. We did not solicitously endea­vour to find the very extreme red and violet rays ; because, although we did not learn the whole dispersions of the two prisms, we learned their proportions, which is the circum­stance wanted in the construction of achromatic glasses. It