Therefore let *h* expreſs this ſelected ratio of the two ra­dii of the crown-glaſs, making a/b *— h* (remembering always that *a* is poſitive and *b* negative in the caſe of a double con­vex, and *h* is a negative number).

With this condition we have I/b = b/a. But when we make *n* the unit of our formula of aberration, I/b = I/a — I. There*fore* I I/a — h/a, and I/a = I/(I — h). Now ſubſtitute this for I/a in the general equation, and change all the signs (which ſtill preſerves it = 0), and we obtain

C D τ, A B

√\* + à —. E — 1-z,- o∙

By this equation we are to find or the radius of the anterior ſurface of the flint-glaſs. The equation is of this *q* form px2 + qx + r = 0, and we muſt again make a = q/p, and t = r/p. Therefore *s* = D/c, and t 7τ×∖r

*p* C L-\ 'I — *n* A∖

— (V—7jR ~ EJ)· Then, finally, \*-=-i,→=yii≈-Λ

It may be worth while to take a particular caſe of this condition. Suppoſe the crown glass to be of equal convexi­ties on both ſides. This has ſome advantages : We can tell with preciſion whether the curvatures are preciſely equal, by meaſuring the focal diſtance of rays reflected back from its poſterior ſurface. Theſe diſtances will be preciſely equal. Now it is of the utmoſt importance in the conſtruction of an object-glaſs which is to correct the ſpherical aberration, that the forms be preciſely ſuch as are required by our for­mulae.

In this caſe of a lens equally convex on both ſides

I/a is = — I/b, I/2. Subſtitute this value for I/a in the general equation A/a2 — B/a — C/a'2 — D/a' + E = 0, and then A/a2 = A/4; B/a becomes B/2. Now change all the ſigns, and we have C/a'2 + D/a' — E — A/4 + B/2 = 0, by which we are to find *a'.* This in numbers is ∙ *~~l~~* ∙^-- — 0,6044 = 0. Then s = 0,3867, and t =

== — 0,4444. Then —-⅛∕ = 0,1933 ; *i* ∕a= 0,0374; and 4Λ5 8\* —∕ ≡≡≡fcx 0,6941 ; ſo that = 0,1933 n±s 0,6941. This gives two real roots, viz. 0,8874, and —— 0,5008. If we take the firſt, we ſhall have a convex anterior ſurface for the flint-glaſs, and conſequently a very deep concave for the poſterior ſurface. We therefore take the second or negative root — 0,5008.

We find I/b', as before, by the equation I/b' *= I/a' + u,* = 0,1046, which will give a large value of *b'.*

We had I/a = I/2

and I/b = — I/2

and I/P is the ſame as in the former case, viz, 0,1603.

Having all theſe reciprocals, we may find a, *b, a', b',* and P ; and then dividing them by P, we obtain finally

*a* = 0,3206

*b = —* 0,3206

*a' = —* 0,3201

b' = 1,533

P = I,

By comparing this object-glaſs with the former, we may remark, that diminiſhing *a* a little increaſes *b,* and in this reſpect improves the lens. It indeed has diminiſhed *b',* but this being already conſiderable, no inconvenience attends this diminution. But we learn, at the ſame time, that the advan­tage *must* be very ſmall ; for we cannot diminiſh *a* much more, without making it as ſmall as the ſmalleſt radius of the ob­ject-glaſs. This proportion is therefore very near the maxi­mum, or beſt poſſible; and we know that in such cases, even conſiderable changes in the radii will make but ſmall changes in the reſult : for theſe reaſons we are diſpoſed to give a ſtrong preference to the firſt conſtruction, on account of the other advantages which we ſhowed to attend it.

As another example, we may take a caſe which is very nearly the general practice of the London artiſts. The ra­dius of curvature for the anterior ſurface of the convex crown-glaſs is 5/6ths of the radius of the poſterior ſurface, ſo that h = 5/6. This being introduced into the determinate equation, gives

*a =* 0,2938

*a' =* — 0,3443

b = — 0,3526

*b = 1,1*474

As another condition, we may ſuppoſe that the second or flint-glaſs is of a determined form.

This caſe is ſolved much in the ſame manner as the for­mer. Taking *h* to repreſent the ratio of *a'* and *b',* we have I/a' = I/(I — h). This value being ſubſtituted in the general

1. A B C D \_\_. A equation . ~ 2 — ~ ÷ E \_\_ 0, gives us A/a2.

B τ, C D ~,. . e \_ — + ε - - r-r⅛ = o∙ This gives us for the final equation x14 r » 4 ί — *o1 s —* and *i —*

*t* c D ∖ 4 1 .

× (e- —-rιy-~ri and i = --'=fc √⅛ji-7.

We might here take the particular caſe of the flint-glass being equally concave on both ſides. Then, becauſe I/n' = — u, and in the caſe of equal concavities 2/a', = I/n', = — *u,* it is ſufficient to put —I/2 u for I/a. This being done, the equation becomes -  *~~f~* 4^ *~ſſ* + ∙t- — 0. 1 nιs

B . i f4Da-2Cu3 . This gives s = ∙^, and < =× 0" + -b√∙