salts, and also some other substances, which produced dis­persions proportional to that of glass, with respect to the different colours.

And thus did the result of this intricate and laborious investigation correspond to his utmost wishes. He pro­duced achromatic telescopes which seem as perfect as the thing will admit of ; for he was able to give them such apertures, that the *incorrigible* aberration arising from the spherical surfaces becomes a sensible quantity, so as to preclude farther amplification of the eye-glasses. We have examined one of his telescopes. The focal distance of the object-glass did not exceed 17 inches, and the aperture was fully 31/2 inches. We viewed some single and double stars, and some common objects, with this telescope ; and found, that in magnifying power, brightness, and distinct­ness, it was manifestly superior to one of Mr Dollond’s of 42 inches focal length. It also gave us an opportunity of admiring the dexterity of the London artists, who could work the glasses with such accuracy. We had most dis­tinct vision of a star when using an erecting eye-piece, which made this telescope magnify more than a hundred times ; and we found the field of vision as uniformly dis­tinct as with Dollond’s 42-inch telescope magnifying forty- six times. The intelligent reader must admire the nice figuring and centring of the very deep eye-glasses which are necessary for this amplification.

We now proceed to consider the eye-pieces or glasses of telescopes. The proper construction of an eye-piece is not less essential than that of the object-glass. But our limits will not allow us to treat this subject in the same detail. Our readers will find abundant information in Dr Smith’s Optics concerning the eye-glasses, chiefly deduced from Huyghens’s fine theory of aberration. At the same time, we must again pay Mr Dollond the merited compliment of saying, that he was the first who made any scientific appli­cation of this theory to the compound eye-piece for erect­ing the object. His eye-pieces of five and six glasses are very ingenious reduplications of Huyghens’s eye-pieces of two glasses, and would probably have superseded all others, had not his discovery of achromatic object-glasses caused opticians to consider the chromatic dispersion with more attention, and pointed out methods of correcting it in the eye-piece without any compound eye-glasses. They have found that this may be more conveniently done with four eye-glasses, without sensibly diminishing the advantages which Huyghens showed to result from employing many small refractions instead of a lesser number of great ones. As this is a curious subject, we shall add what may be suf­ficient for making our readers fully acquainted with it, and content ourselves with merely mentioning the principles of the other rules for constructing an eye-piece.

Such readers as are less familiarly acquainted with opti­cal discussions will do well to keep in mind the following consequences of the general focal theorem.

If AB (fig. 15) be a lens, R a radiant point or focus of incident rays, and *a* the focus of parallel rays coming from the oppo­site side ; then,

1. Draw the perpen­dicular *aa*' to the axis, meeting the incident ray in *a',* and *a'*A to the centre of the lens. The refracted ray BF is parallel to *a'*A ; for R*a*' : *a*'A (= R*a* : *a*A) = RB : BF (= RA : AF), which is the focal theorem.

2. An oblique pencil BP*b* proceeding from any point P which is not in the axis, is collected to the point *f,* where the refracted ray BF cuts the line PA*f* drawn from P through the centre of the lens: for Pα' : *a*’A = PB : B*f*, which is also the focal theorem.

The Galilean telescope is susceptible of so little improve­

ment that we need not employ any time in illustrating its performance.

The simple astronomical telescope is represented in fig. 16. The beam of parallel rays, inclined to the axis, is made to converge to a point G, where it forms an image of the lowest point of a very distant object. These rays de­cussating from G fall on the eye-glass ; the ray from the lowest point B of the object-glass falls on the eye-glass at *b ;* and the ray from A falls on *a ;* and the ray from the centre O falls on *o*. These rays are rendered parallel, or nearly so, by refraction through the eye-glass, and take the direction *bit,* oI, *ai.* If the eye be placed so that this pencil of parallel rays may enter it, they converge to a point of the retina, and give distinct vision to the lowest point of the object. It appears inverted, because the rays by which we see its lowest point come in the direction which in simple vision is connected with the upper point of an ob­ject. They come from above, and therefore are thought to proceed from above. We see the point as if situated in the direction Io. In like manner, the eye placed at I sees the upper point of the object in the direction IP, and its middle in the direction IE. The proper place for the eye is I ; if brought much nearer the glass, or removed much farther from it, some or the whole of this extreme pencil of rays will not enter the pupil. It is therefore of import­ance to determine this point. Because the eye requires parallel rays for distinct vision, it is plain that F must be the principal focus of the eye-glass. Therefore, by the common focal theorem, OF : OE = OE : OI, or OF : FE = OE : EI.

The magnifying power being measured by the magni­tude of the visual angle, compared with the magnitude of the visual angle with the naked eye, we have *o*I*p*/*o*O*p* or *o*IF/*o*OF for the measure of the magnifying power. This is very nearly = OE/EI or OF/FI.

As the line OE, joining the centres of the lenses, and perpendicular to their surfaces, is called the axis of the telescope, so the ray OG is called the axis of the oblique pencil, being really the axis of the cone of light which has the object-glass for its base. This ray is through its whole course the axis of the oblique pencil ; and when its course is determined, the amplification, the field of vision, the apertures of the glasses, are all determined. For this pur­pose we have only to consider the centre of the object-glass as a radical point, and trace the process of a ray from this point through the other glasses : this will be the axis of some oblique pencil.

It is evident, therefore, that the field of vision depends on the breadth of the eye-glass. Should we increase this, the extreme pencil will pass through I, because O and I are still the conjugate foci of the eye-glass. On the other hand, the angle resolved on for the extent or field of vision gives the breadth of the eye-glass.

We may here observe, by the way, that for all optical in­struments there must be two optical figures considered. The first shows the progress of a pencil of rays coming from one point of the object. The various focuses of this pencil show the places of the different images, real or vir­tual. Such a figure is formed by the three rays AG*ai*,