XXIII. *An Account of an Apparatus applied to the equatorial Inſtrument for correcting the Errors ariſing from the Refraction in Altitude. By Mr.* Peter Dollond, *Optician; communicated by the Aſtronomer Royal.*

Read March 4, 1779.

THE refraction of the atmoſphere occaſions the ſtars or planets to appear higher above the horizon than they really are; therefore, a correction for this refraction ſhould be made in a vertical direction to the horizon.

The equatorial inſtrument is ſo conſtructed, that the correction cannot be made by the arches or circles which compoſe it when the ſtar, &c. is in any other vertical arch except that of the meridian, becauſe the declination arch is never in a vertical poſition but when the teleſcope is in the plane of the meridian.

To correct this error, a method of moving the eye-tube which contains the wires of the teleſcope in a vertical direction to the horizon has been practiſed; but as the eye-tube is obliged to be turned round in order to move

move it in that direction, in the different oblique poſitions of the inſtrument, the wires are thereby put out of their proper ſituation in every other poſition of the inſtrument, except when it is in the plane of the meridian; for the equatorial wire ſhould always be parallel to the equator, that the ſtar in paſſing over the field of the teleſcope may move along with it, otherwiſe one cannot judge whether the teleſcope be ſet to the proper declination, except at the inſtant the ſtar is brought to the interſection of the wires, which is only a momentary obſervation.

The method I have now put in practice for correcting the refraction of the atmoſphere is by applying two lenſes before the object-glaſs of the teleſcope; one of them convex, and the other concave; both ground on ſpheres of the ſame radius, which in thoſe I have made is thirty feet. The convex lens is round, of the ſame diameter as the object-glaſs of the teleſcope, and fixed into a braſs frame or apparatus, which fits on to the end of the teleſcope. The concave lens is of the ſame width, but nearly two inches longer than it is wide, and is fixed in an oblong frame, which is made to ſlide on the frame the other lens is fixed into, and cloſe to it. Theſe two lenſes being wrought on ſpheres of the ſame radius, the refraction of the one will be exactly deſtroyed by that of

the other, and the focal length of the object-glaſs will not be altered by their being applied before it; and if the centers of theſe two lenſes coincide with each other, and alſo with that of the object-glaſs, the image of any object formed in the teleſcope will not be moved or ſuffer any change in its poſition. But if one of the lenſes be moved on the other, in the direction of a vertical arch, ſo as to ſeparate its center from that of the other lens, it will occaſion a refraction, and the image will change its altitude in the teleſcope. The quantity of the refraction will be always in proportion to the motion of the lens, ſo that by a ſcale of equal parts applied to the braſs frame, the lens may be ſet to occaſion a refraction equal to the refraction of the atmoſphere in any altitude. If the concave lens be moved downwards, that is, towards the horizon, its refraction will then be in a contrary direction to that of the atmoſphere, and the ſtar will appear in the teleſcope as if no refraction had taken place.

There is a ſmall circular ſpirit level fixed on one ſide the apparatus, which ſerves to ſet it in ſuch a poſition, that the centers of the two lenſes may be in the plane of a vertical arch. This level is alſo uſed for adjuſting a ſmall quadrant, which is fixed to it, and divided into degrees, to ſhew the elevation of the teleſcope when directed to the ſtar; then the quantity of refraction anſwering

ſwering to that altitude may be found by the common tables, and the concave lens ſet accordingly, by means of the ſcale at the ſide, which is divided into half minutes, and, if required, by uſing a nonius, may be divided into ſeconds.

It muſt be obſerved, that when a ſtar or planet is but a few degrees above the horizon, the refraction of the atmoſphere occaſions it to be conſiderably coloured. The refraction of the lens acting in a contrary direction would exactly correct that colour, if the diſſipation of the rays of light were the ſame in glaſs as in air; but as it is greater in glaſs than in air, the colours occaſioned by the refraction of the atmoſphere will be rather more than corrected by thoſe occaſioned by the refraction of the lens.

A drawing of the refraction apparatus is added, which may ſerve to give a more clear idea of it. See plate IV.

EXPLANATION OF THE PLATE.

AA, The circular braſs tube, which fits on to the end of the teleſcope.

BB, The oblong concave lens in its frame, which ſlides over the fixed convex lens.

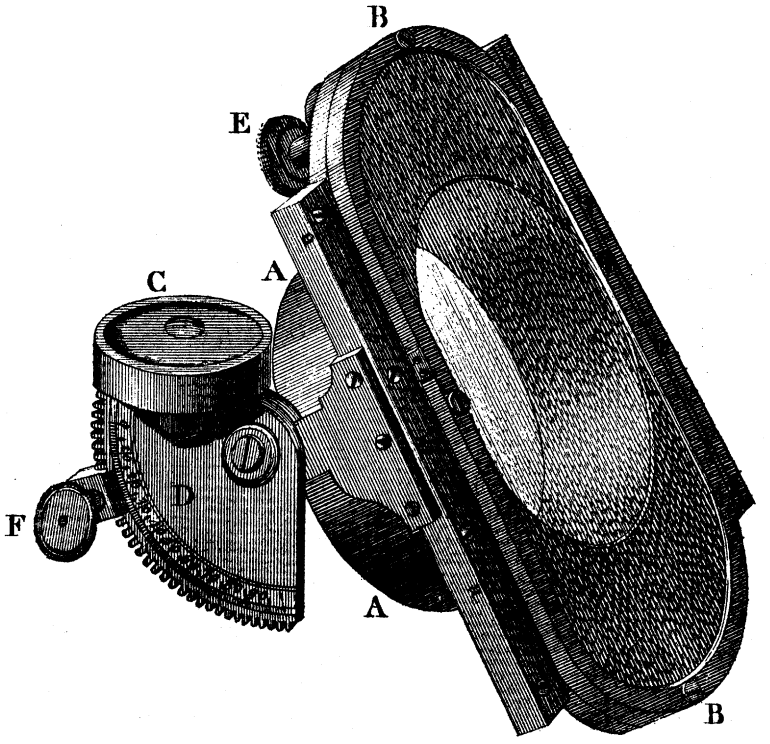
C, The circular ſpirit level, which ſhews when the oblong lens is in a vertical arch.

D, The quadrant to which the ſpirit level is fixed, for ſhewing the angular elevation of the teleſcope.

E, The milled head fixed to a pinion, by which the whole apparatus is turned round on the end of the teleſcope, in order to ſet the oblong lens in a vertical arch.

F, Another pinion for ſetting the quadrant to the angular elevation of the teleſcope. By means of theſe two pinions the air bubble muſt be brought to the middle of the level.

aa, Is the ſcale, with diviſions anſwering to minutes and half minutes of the refraction occaſioned by the concave lens.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