Description and use of a new constructed equatorial telescope or portable observatory / made by E. Nairne.

DESCRIPTION

AND

USE

OF

A NEW CONSTRUCTED

EQUATORIAL TELESCOPE

OR

PORTABLE OBSERVATORY,

MADE

By EDWARD NAIRNE, LONDON.

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Deſcription and Uſe of a new conſtructed Equatorial Teleſcope or portable Obſervatory.

THE Inſtrument conſiſts of the following parts (ſee the annexed Plate); a mahogany triangular Stand A A A, and three adjuſting ſcrews B B B; a moveable azimuth Circle C, which is divided into degrees, and by a vernier index to every 6 minutes; above this azimuth Circle is the horizontal plate D, to the under part of which is faſtened the vertical conical axis E; on the middle of the upper ſurface of the horizontal plate, is placed a ground glaſs Level F, by which the plate D is ſet parallel, and the pillar E perpendicular to the horizon; from this plate riſe perpendicularly two quadrants G G, one of which is divided for the latitude into half degrees, and has a vernier index to 3 minutes; the equatorial plate H, with its hour circle, is ſupported by the two quadrants G G; its axis of motion (which is placed near the hours XII. XII.) paſſes through the centers of the quadrants, and carries the index I, pointing to the divided quadrant; the equatorial plate is divided into half degrees, and has a vernier index ſhewing every 3 minutes of right aſcenſion or 12 ſeconds of time; it is figured to ſhew both degrees and time; to prevent miſapprehenſion, it may be right to remark that the hours XII. XII. ought properly to have been placed according to the meridian line; they are here placed otherwiſe, for

the convenience of better ſeeing the meridian diſtance ſhewn by the vernier; On the upper part of the equatorial plate is the plate K; upon this plate K, are fixed the two ſupporters M M, which ſupport the axis N, under which is faſtened the ſemicircle of declination O, divided into half degrees, and has a vernier index ſubdividing it to 3 minutes; on the upper part of this axis, is fixed an achromatic Teleſcope P, which magnifies about 50 times; to the eye End of this Teleſcope, is applied a ſmall reflecting ſpeculum making an angle of 45° with the axis of the teleſcope, whereby objects that are in the zenith or any other altitude may be obſerved, without putting the body in any inconvenient poſition; to the under part of the axis N, is faſtened a braſs arm carrying the weight Q, which counterbalances the teleſcope, and the braſs work annexed to it; whilſt the weights R R counterbalance in like manner the whole of the inſtrument that is moveable on the equatorial axis, ſo that whatever poſition the inſtrument is put in, it will there remain, being perfectly balanced; the four motions of this inſtrument may, when required, be moved extreamly ſlow, by means of the indented edges of the circle and ſemicircles, and the ſcrews or worms to which the handles are fixed, *viz.* that for the horizontal motion marked S, called the horizontal handle, that marked T the handle of latitude, V the equatorial handle, and W the declination handle.

To adjuſt the inſtrument for obſervation, the firſt thing to be done is to make the horizontal plate D level, by means of the ſpirit level, and the three adjuſting ſcrews at the bottom of the ſtand; this being done,

done, move the equatorial plate either with or without the latitude handle, until the index on the quadrant points to the latitude of the place; and then the equatorial plate will be raiſed, to the elevation of the equator of the place, which is equal to the complement of the latitude (and which, if not known, may likewiſe be found by this inſtrument, as will appear hereafter); and thus the inſtrument is ready for obſervation. The manner of uſing this inſtrument for the following obſervations, I ſhall borrow in part from the words of the late ingenious Mr. Short, in his deſcription of his equatorial teleſcope *, which, however, differs eſſentially in conſtruction from this.

To find the Hour of the Day, and the Meridian of the Place.

Firſt, find from aſtronomical Tables, the Sun's declination for the day; and for that particular time of the day; then ſet the declination ſemicircle to the declination of the Sun, taking particular notice whether it is North, or South; and ſet the declination ſemicircle accordingly, you then turn about both the horizontal handle and equatorial handle, until you find the Sun preciſely concentrical with the field of the teleſcope; if you have a clock or watch at hand, mark that inſtant of time, and by looking upon the equatorial plate and vernier index, you will find the exact apparent time of the day, which, comparing with the time ſhewn by the clock or watch, ſhews how much either of them differ from apparent time; in this manner you find the hour of the day.

* Vide Phil. Tranſ. Vol. XL. p. 242.

To

To find the Meridian of the Place.

[The inſtrument remaining as in the laſt obſervation.]

You firſt move the plate K until the vernier on it cuts the 12 o'clock hour, and, diſcharging the ſcrew to which the declination handle is fixed, turn the teleſcope down to the horizon, and obſerve the point which is then in the middle of the field of the teleſcope, or cut by the interſection of the croſs wires, and a ſuppoſed line drawn from the center of this field, to that point in the horizon, is your meridian line, where a mark may be ſet up in order to preſerve it; you may likewiſe preſerve this line, by the azimuth circle, which being made moveable, ſhould be turned ſo as to bring the o of the azimuth plate to agree with its vernier, when the teleſcope is pointed to the meridian; this motion in the azimuth plate will be found very convenient, ſince you may thus recover the meridian line by it, and it will ſhew the exact azimuth of any object the teleſcope is directed to, without diſturbing any other part of the inſtrument: the beſt time of the day for making this obſervation for finding your meridian, is about three hours before noon, or as much after noon; the meridian of the place may be found by this method very nearly, and, if proper allowance be made for refraction, it may be found to great exactneſs; this line once ſettled will ſave trouble afterwards, and is indeed the foundation of all aſtronomical obſervations.

To find a known Star or Planet at any propoſed inſtant of time, whether in the day or night.

The inſtrument remaining rectified as in the laſt obſervation; ſet the declination ſemicircle to the declination

declination of the planet, at the propoſed inſtant, and bring the index of the equatorial plate, to point to the meridian diſtance of the ſtar or planet, at the propoſed inſtant if weſtward, or to the complement of the meridian diſtance if eaſtward of the meridian. (This diſtance is found by adding together the right aſcenſion of the Sun in time, and the apparent time of the day, and taking the difference between the ſum and the ſtar's right aſcenſion in time; when the ſtar's right aſcenſion in time is greater than the above ſum, the meridian diſtance will be Eaſt; when the ſtar's right aſcenſion is leſs than the ſum, the meridian diſtance is Weſt.) Having thus ſet the Inſtrument, look through the teleſcope, you will ſee the ſtar or planet; and if it ſhould afterwards get out of the field, you will eaſily recover it, by moving the equatorial handle only, provided the ſtar is above the horizon, becauſe the diurnal motion of a ſtar is parallel to the equator.

By this inſtrument moſt of the ſtars of the firſt and ſecond magnitude may be ſeen even at midday, and the Sun ſhining bright, as alſo Mercury, Venus, and Jupiter; Saturn and Mars are not ſo eaſy to be ſeen, in the day time, upon account of the faintneſs of their light, except when the Sun is but a few degrees above the horizon; in the ſame manner in the night time, when you can ſee a ſtar or planet, or any new phænomenon, ſuch as a comet, you may find its declination and meridian diſtance or complement thereof, by turning about the equatorial handle and declination handle, untill you ſee the ſtar, planet, or new phænomenon; and looking upon the equatorial plate, you find its meridian diſtance or complement

thereto, and upon the declination ſemicircle its declination. In order to have the other uſes of this inſtrument, you muſt ſet it to the hour XII on the equatorial plate, and to o on the ſemicircle of declination, and ſet the axis E perpendicular to the horizon, and then this inſtrument becomes an Equal Altitude Inſtrument, a Tranſit Inſtrument, a Theodolite, a Quadrant, an Azimuth Inſtrument, and a Level; the manner of applying it to theſe different purpoſes is obvious.

The following is one Example of its Uſes in finding the Altitude of any Object.

Set o of the ſemicircle of declination, to agree with o of its vernier index, and faſten it there; fix likewiſe the vernier of the equatorial plate to 12 o'clock, or o degrees; then, having ſet the axis E perpendicular, by means of the level F, turn the inſtrument about horizontally upon the axis E, and vertically upon the axis of motion of the equatorial plate, until the object appears in the middle of the field; and the index I will point out upon the quadrant G, the zenith diſtance of the object, the complement of which to 90° is its altitude; hence the greateſt or meridian altitude may be found, from which the latitude of the place may be deduced in the uſual manner.

THE END.