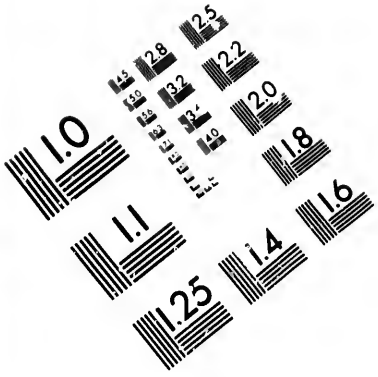

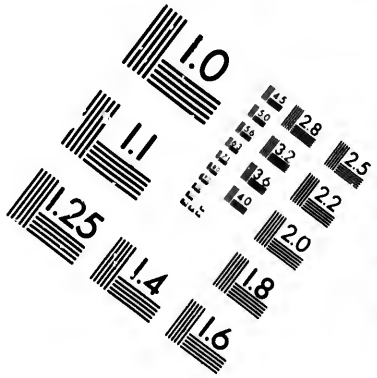

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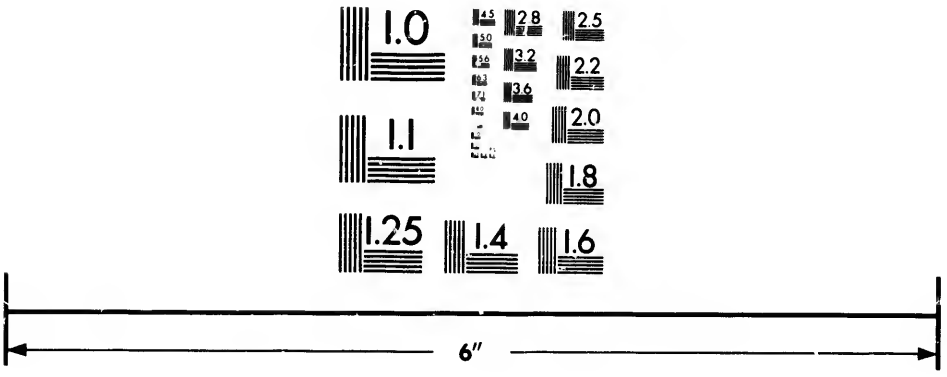

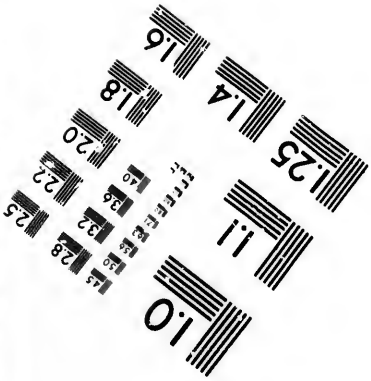

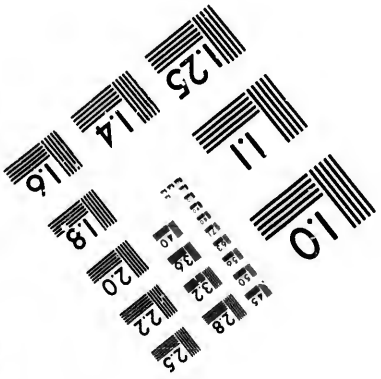

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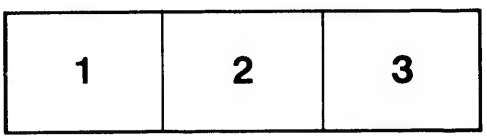

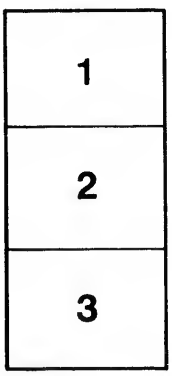

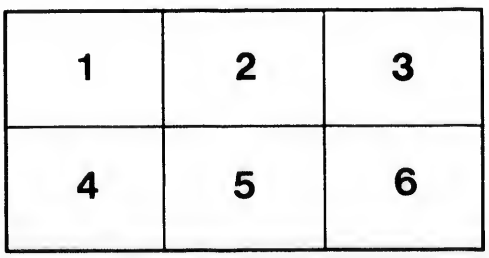

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SEE MAP ON NEXT PAGE.

Dr. Kane's, in 1854, spent that winter in the Arctic Circle, in latitude 78° 30'. The transcribed paragraphs are from the doctor's Notes, and are inserted on purpose to request a Student who may use the new Heliocentric Map to compare and trace the Ecliptic PLACE of the terrestrial pole for the day and month, noted by the doctor.

RENSSELAER BAY, October 11th.—The long staring day, which has clung to us for months past, to the exclusion of the stars, has begun to intermit its brightness; even Aldebaran, the red eye of the "bull," flared out into familiar recollection as early as ten o'clock, and the heavens, still somewhat reddened by the gaudy tints of midnight, gave us Capella and Arcturus, and even that lesser light of home memories, the Pole Star.

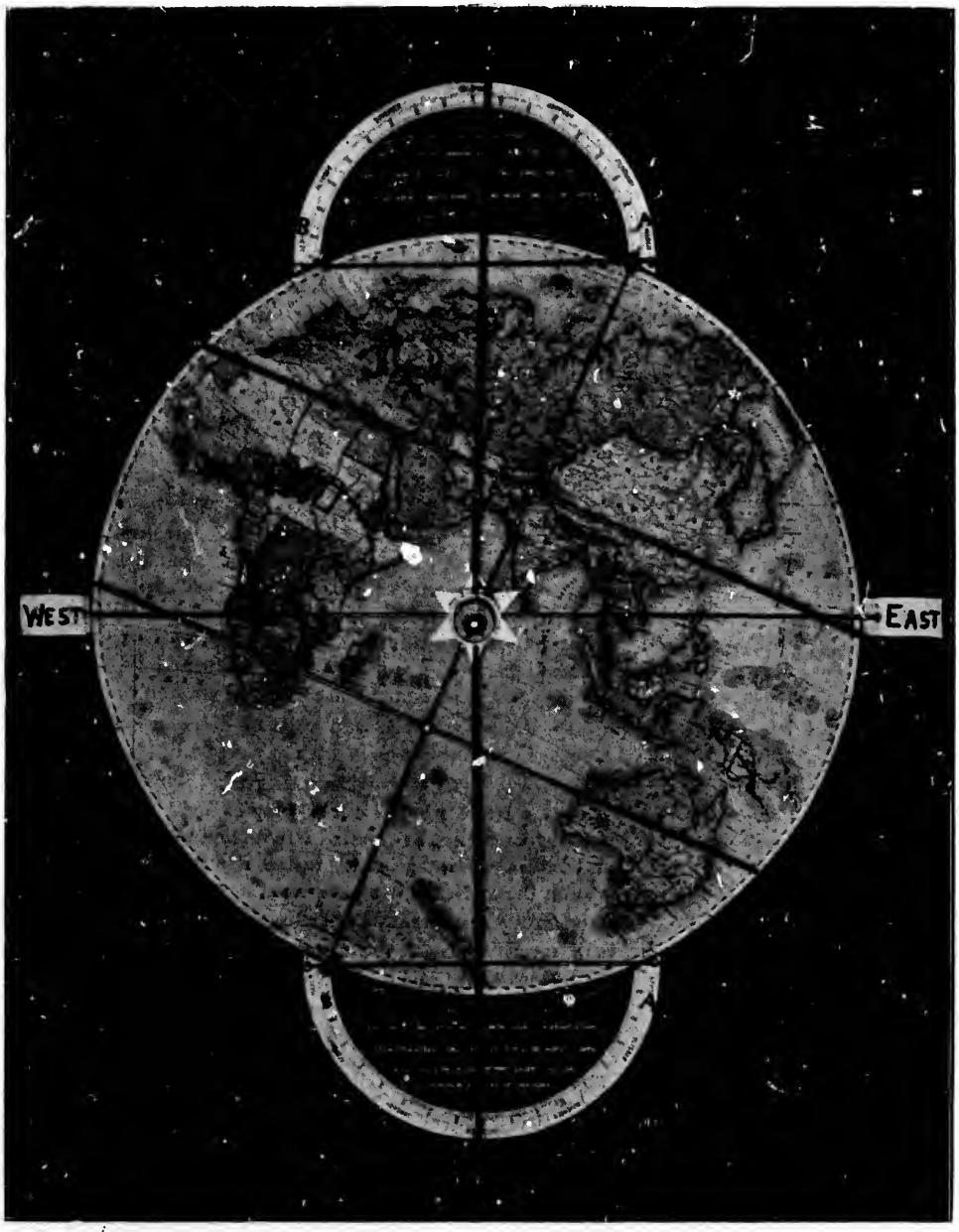
November 7th.—The darkness is coming on with insidious steadiness, and its advances can only be perceived by comparing one day with its fellow of some time back. We still read the thermometer at noonday without a light, and the black masses of the hills are plain for about five hours, with their glaring patches of snow, but all the rest is darkness. The stars of the sixth magnitude shine out at noonday. Our darkness has ninety days to run before we shall get back again ever to the contested twilight of to-day; altogether, our winter will be sunless for about one hundred and ten days.

November 19th.—Wishing to get on the south-west cape of our bay before the darkness set in thoroughly, I started in time to reach it with my Newfoundlanders at noonday, the thermometer indicating 23° below zero.

December 15th.—We have lost the last vestige of our midday twilight; we cannot see print, and hardly paper; the fingers cannot be counted a foot from the eye; noonday and midnight are alike; and except a faint glimmer in the sky that seems to define the hill outlines to the south on the meridian, we have nothing to tell us that this arctic world of ours has a sun.

January 21st.—First traces of returning light, the southern horizan having for a short time a distinct orange tinge.

February 21st.—We have had for some days the sun silvering the ice between the headlands of the bay; and to-day towards noon, I started out to be the first of my party to welcome him back. I saw him once more, and upon a projecting crag, nestled in the sunshine; it was like bathing in perfumed waters.


WEST
EAST

A Descriptive Manual

OF THE

EARTH'S DAILY

HELIOGENTRIG "SUN VIEWS"

OF THE

EASTERN AND WESTERN HEMISPHERES

ALSO THE

ILLUSTRATED STRUCTURE EMPLOYED IN THE DESIGN
TO SOLVE THE ANNUAL MOTIONS OF THE
TWO TERRESTRIAL POLES AROUND
THE ARCTIC AND ANTARCTIC
CIRCLES OF THE MAP.

By MUNGO TURNBULL, S.B.I.L.

1898:
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Heliocentric Geographical Science.

To possess a clear conception of the earth as one of the group of planetary bodies to which it astronomically belongs, is educationally very important but by no means easily obtained. The Copernican idea of making the sun the great standpoint of observation is the only sure modern astro basis of all true views of the solar planetary system, and many devices have been invented for the purpose of assisting the student to place himself instrumentally at the above point of view. Most of these appliances have been constructed on the belief that a cubic globe is a necessary part of the mechanical design. However if that plan and object is adopted to exhibit the earth on any considerable scale, the cost becomes a great obstacle to its general introduction into Schools. Therefore bearing on this prominent difficulty in the use of instrumental means, it has been almost entirely obviated by the present DEVICE, which renders it possible to make very effective use of the ordinary FLAT MAPS of the Eastern and Western Hemispheres of the earth's illuminated disc. Moreover it may be noted it is here where the new map derives one of its important properties, as the size of them may be increased indefinitely without greatly increasing the cost, and the larger the map the more effective will be the illustration.

In the history of Astronomy it is worth mentioning, especially to the lover of the Science, that the present subject, namely, the study of the earth's daily SUN VIEWS was one of the earliest branches of the Science which fell from the pen

of the late Richard Proctor, the great British Astronomer. He published a series of Maps for Schools of the Globe's Orbit Motion, for every ten or twelve days motion, consequently the present scheme in a great measure ranks only as a Science supplementary.

The present modern apparatus, with its additional appendages was constructed in 1897, for the British Association's meeting here, to exhibit the Queen City of Ontario's high appreciation of the honor conferred by the event, and the map was closely inspected scientifically by Lord Kelvin, one of its greatest members present. Also at the time, to help and finish the apparatus, the Board of Control contributed $50.

Moreover it may also be noted that the present High School Inspector of the High Schools of Ontario, has favorably alluded to its merits, and not merely to the scientific purpose of the Map, but also that there can be no question either of the originality of the device or of its practical educational value.

The apparatus is the invention of Mungo Turnbull, Toronto, who has been the designer of several well known large educational Terrestrial and Celestial Instruments. And they have been favorably regarded by the greatest Astronomers of the world, including the present Astronomer Royal of Great Britain. The cost of these instruments have been always a formidable obstacle to their popular use, but this is not the case with the present Heliocentric appliance, as by its use a pupil can obtain a clearer understanding of the earth, in all its different illuminated conditions, than by any former Map hitherto used.

It may be added further that the new process of investigating the earth's Sun Views derives here its highest value,

as the size of the Map may be increased to any extent without largely increasing the cost.

Now in this explanatory article we have to advance that to do successful school work with this Map, all the various mechanical factors placed on the two graduated semicircles, which is fixed stationary on the north and south cords of 47° should become familiar in all school class work, in order to handle readily and see clearly the true place of the two terrestrial poles, in their annual orbit motion around the Heliocentric projected place in the Arctic and Antarctic Circles. In the process of handling the Map a pupil must understand that by the precepts of the sphere the globes axis (Heliocentrically) with its two poles at each end, moves TWICE during the year from A to B as shown on the Chart, that line being the cord and arc of twice 23° 28′, the earth's axis angle to the ecliptic plane. In this place we have to point out that the next step to be attended to in the use of the apparatus, is to procure a permanent possession of the representative principles exhibited by each of the factors of the two graduated semicircles at the top and bottom of the circular map. In particular, notice first the presence of the longest wire, which is fixed firm to the top and bottom of the mounting. This appendage is the representative AXIS of the solstical plane, in which the earth's axis with its parallelism is constantly placed, and moreover where also all the celestial planetary synodical conjunctions take place in the heavens.

Another prominent material connection is placing immovable, a wire parallel with the ecliptic plane. It is shown in length to be twice the angle of the earth's axis on the Arctic and Antarctic Circles. Heliocentrically by using the precepts of the sphere, it can be demonstrated that both the north and the south poles of the earth, revolves twice annually on the

face of the above Zones of the Chart. Therefore as this aspect of the design forms one of the very foremost improvements of the new invention, we will close this part of the exposition by a few illustrations and problems taken from one of the finished Maps.

In the first place the author has a great desire to state that the principles of this scheme was first derived, and is founded, on Plato's recommendation, which recommends that all celestial and terrestrial quantities in this division of Science be undertaken through a graduated mechanism of Applied Geometry. Now the merest child in Geographical Science knows that the earth's axis with its two poles have an annual reciprocal six months sunlight and six months darkness. This terrestrial phenomenon is therefore one of the finest illustrations given by this device, for by the motion given on the face of the Map to the earth's axis and poles the operation optically becomes both striking and interesting even to the merest tyro on the subject. By the degrees of the northern and southern semicircles, the true position and place of each pole is obtained, as each degree stands for the orbit motion of the earth in every twenty-four hours time. Again, to solve problems of the different planetary conditions of the earth's sunlight and darkness, all that is required is to remember that if the north pole is moving from A to B, on the Map, the north pole is constantly in sunlight. On the other hand it will be observed that in the Southern Hemisphere the south pole has been moving from B to A in the southern total darkness. So to fix the earth's axis and both the poles at the exact spot on the Chart for any day in the calendar, the SINES and COSINES of the two semicircles solves that point.

We will now in closing endeavour to explain the following general problem in the use of the invention :

First, give an illustration of the earth's place on the Map at the Vernal Equinox (the 20th March) till its return again next year. It is well understood that this astro term Equinox implies equal day and night in every place from pole to pole of the globe, and in this illustration it may be instructive to keep in mind that the earth in its orbit motion in every 24 hours time, is in round numbers over 264,000 miles. Hence as the earth moves nearly one degree (59' 8.3") in its orbit every day, this circumstance shows how appropriate and beautiful the scale of Sines and Cosines comes in to interpret the true places on the Chart where the axial and polar phenomenon is placed at any day in the year.

For example, at the true point of the Annual Equinox in time which is computed every year by the four Astro Boards of Longitude, the pole of the Northern Hemisphere is just leaving its last six months motion through the northern shadow, and is entering the direct beams of sunlight. Its place Heliocentrically and Geometrically is now upon the very edge of the Map's disc, as shown by the cut. On the other hand in the Southern Hemisphere, examine the motion of the southern pole. At the same phenomenon we have been alluding to, the south pole has been plunging through the southern shadow of that hemisphere and will remain in it for the next six months. In fact, to a pupil, the educational properties of this Chart comes strongest out at the phenomenon of the Vernal Equinox, as at this annual epoch, the two poles is in the very orbit act of changing from either sunlight to darkness, or from darkness to sunlight as given on the Map.

We will now just add that it is greatly by illustrating optically the four seasons of the year by the projected motion of the axis and poles of the Map, that the importance of the device becomes so prominent, and in particular that

part of the process which is taken by the two graduated semicircles, fixed on the stand at the Arctic and Antarctic Zones on the face of the Chart, that a pupil gets fully initiated into the daily Sun Views of the earth.

Therefore, as the foregoing Heliocentric "SUN VIEWS" Chart is believed by several educational experts who have seen it, to be original and new in Germany, France, London, and Washington, in illustrating the annual terrestrial dynamics of the earth, and moreover claiming to be the means instrumentally in unison, as an auxiliary to the branch of knowledge on which it treats. The Inventor trusts it may take a useful position in the instrumental market to which it belongs and serve its purpose in the intellectual elevation of the HIGHER CLASSES in the Public Schools.

A. G. Gowanlock, Printer, 1266 Queen West, Toronto.