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No. 110 A MECHANICAL COORDINATE CONVERTER

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ABSTRACT

A simple device is described for mechanically converting spherical coordinates from one system to another.

A coordinate converter was made for use in the Polariscope balloon program to allow quick transformations of spherical coordinates. By setting positional data in one coordinate system, the operator can easily see the correspondig coordinates in another system. This makes possible, for instance, the immediate translation from the equatorial system to an altazimuth system.

Each system of coordinates is represented by two circles at right angles to each other. The horizontal system has a stationary base supporting a horizontal circle divided by 360° in azimuth. A stationary vertical circle graduated from 0° to 90° corresponds to the geographic latitude. In its plane slides a non-graduated circle, inscribed with a single white arrow. This circle holds the pivots of the second system of coordinates, which define hour-angle and declination, also in degrees. Over the whole arches the altitude circle whose base ring slides over the stationary azimuth circle. The altitude circle carries a sliding pointer that reaches inward to the declination circle.

In the figure the balloon latitude is set at 31°0 and the pointer at an object low (elevation 26°4) in the northwest sky (azimuth 311°); the corresponding local hour angle of 83° west, and northern declination of 47° can now be read from the inner coordinates. Another example, not shown here, is for an observation of Mars at 3:00 a.m. on 9 March 1967 Mountain Standard Time, for which the Air Almanac lists Greenwich hour-angle 104°6 and southern declination 10°2. At the time of the observation, made by the Polariscope 71-cm telescope, the balloon was located high over the Grand Canyon, at northern latitude 36°3 and longitude 112°9 west of Greenwich. To determine the elevation and azimuth, the latitude circle is first moved so that the arrow indicates 36°3. Next, the inner coordinate system is pivoted to read the "Grand Canyon hour-angle" of 112°9 − 104°6 = 8°3 east. The pointer is moved to indicate 10°2 south on the declination circle. One then reads the elevation (42°8) and the azimuth (168°8).

The converter's precision is about ±0°2. This requires careful machining of divided circles and precise alignment of the perpendicularity of the circles and of the location of the pivots.

Fig. 1 A Mechanical Coordinate Converter.