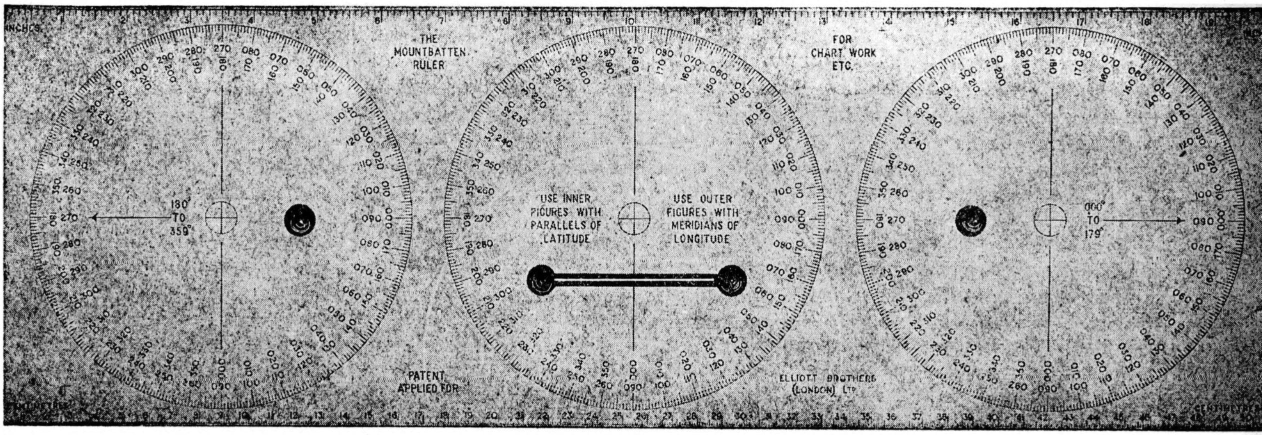

INSTRUCTIONS FOR USE :

To lay off a true course or bearing from a given point on a chart.

Place the centre of one of the roses on the nearest convenient parallel of latitude or meridian of longitude and turn the ruler until the desired graduation cuts the parallel or meridian. Then slide the ruler along the parallel or meridian, keeping it approximately at the same angle, until it reaches the given point. A slight final adjustment must then be made.

To measure a course or bearing already laid off on a chart.

Lay one edge (preferably the upper edge) along the line already drawn on the chart. Slide the ruler along this line until the centre of one of the three roses cuts the nearest convenient parallel of latitude or meridian of longitude. A slight final adjustment must then be made before reading off the course or bearing.

To use the ruler on a chart containing no meridians of longitude or parallels of latitude.

Although comparatively rare, such a situation presents no difficulties, since all charts are bounded by straight lines which can be used in conjunction with one of the end roses. The width of the standard chart does not exceed 28 inches, which the ruler is designed to embrace.

In the even rarer event of a chart exceeding 28 inches and containing no engraved parallels of latitude or meridians, it will be necessary to draw one near the centre of the chart. This can be done quickly, using the ruler for this purpose.

PROGRAMME FINDER FOR USE WITH PRISMATIC ASTROLABE.

(Extract from article by W. HORSFIELD and W. A. ERRITT in the *Empire Survey Review*, No. 21, Vol. III - London, July 1936 - page 398).

Hydrographic Review Vol. XII, No. 2, November 1935, contains, page 116, a description of the COOKE 45° prismatic astrolabe. The following description of the mechanical programme finder developed for use with this instrument is extracted from the above-mentioned article in the *Empire Survey Review*.

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In order to work out a programme of observations for any night a mechanical programme finder is used. This consists of an aluminium plate on one side of which are plotted 540 stars with northern declinations and on the other side 416 stars with southern declinations. The plate may be thus described as a double planisphere. Fitting over this plate and swivelling round its centre are ten separate celluloid quadrants corresponding to the numbers 0, 1, 2,... 9. These correspond to the latitude of the place of observation: thus, if the observation is to be taken in latitude 7°, –7°, –17°, –27°, etc., we employ the quadrant with these numbers thereon.

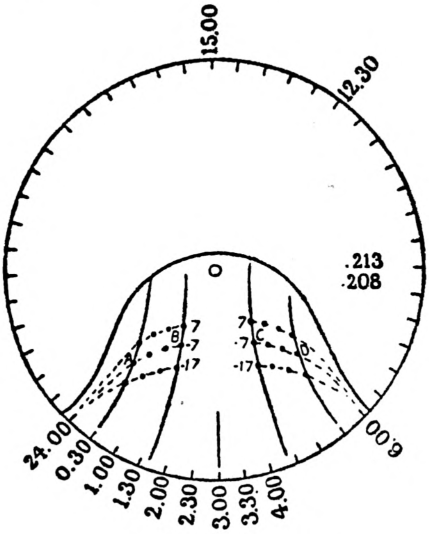

Fig. 1. Planisphere.

In Fig. 1 the heavy numbering refers to the marking on the aluminium plate and the light numbering to that on the celluloid quadrant. It will be seen that the outside of the plate is divided into hours and half-hours of sidereal time, these being subdivided into smaller units of 2 minutes each. The numbers 208, 213 are the numbers of the stars in a catalogue supplied with the device; against these numbers the positions of the stars are exhibited by dots on the plate, as shown in the Figure. The reading of the quadrant in sidereal time in the position drawn in the Figure is 3.00 hours.

If we are in latitude 7° south and are reading the north side of the plate, then the applicable marking on the quadrant is that opposite –7°, and vice versa. Then the series of dots forming a curve opposite –7 will be the arc of the heavens which will be swept out by an astrolabe (having a prism of 45°) at 3 hours sidereal time if it is swung round in azimuth.

As we only require the middle 30 degrees in each quadrant, we are only concerned with the portion of the curves which come in the two horn-shaped areas. These correspond to azimuths as follows:–

	For the northern half of the plate.	*For the southern half of the plate.*
A.	300°	120°
B.	330°	150°
C.	30°	210°
D.	60°	240°

The distances between *A* and *B*, and *C* and *D* are further divided by dots into 2 degree intervals. Consequently as the sector is rotated till the arc *A B* or *C D* comes over a star, the sidereal time can be estimated to the nearest minute or half-minute and the azimuth to the nearest degree; these approximations are sufficiently accurate to prevent a mistake in the identification of a star save in exceptional cases, such as when, for example, it happens to be one of a cluster like the Pleiades.

In making out a programme it is best to work out the sidereal time at which it is proposed to start observing. The quadrant is then put on the northern half of the plate at this time and moved progressively forward, and the time and azimuth at which the appropriate arc of dots cuts the successive stars over a period of 5 or 6 hours are then noted. The same procedure is carried out with the southern side of the plate, and a final list is compiled with the north and south stars placed in the correct order of time, the name of the star and its magnitude being taken from the star list. It is best to confine the observations to stars of greater magnitude than 4, since the image of a small star reflected off the mercury is very dim, especially when the mercury has become slightly oxidised. At the same time it is as well to jot down all the stars and select those to be used during the course of the observations, since there may be clouds in some quadrants during part of the time and in other quadrants there may not be any stars of high magnitude.

A perfect series of observations consists of 4 stars observed in a short interval; one in the north, one south, one east and one in the west quadrant , since, *on the assumption that the refraction is the same in each quadrant,* then the difference between the true and assumed altitude in the east and west stars will cancel out and give a true longitude, while the north and south stars will when combined give a true latitude. This is not strictly true, of course, unless the azimuths are also corresponding, i. e. say 40°, 140°, 220°, 320°, but the errors introduced if the azimuths do not exactly correspond will be exceedingly small.

A further point of considerable importance is that notably greater accuracy is obtained if a series of 8 or 12 stars is observed on 5 or 6 nights than if 20 or more are observed on two nights; this applies more particularly if the chronometer is giving a poor rate between time signals. In the event of the chronometer not giving a constant rate between signals, there will be an error Δt in the observed time of transit of a star which will give an error of Δt in the longitude and of $\Delta t \cos \phi \sin A$ in the latitude. If, however, the observations are taken over several nights, these errors will tend to cancel out since the times are separately determined instead of being dependent on one another.

ALUMINIUM MOUNTED TOPOGRAPHIC SHEETS.

Paul A. SMITH, Jr., Hydrographic and Geodetic Engineer,
U. S. Coast and Geodetic Survey.

The distortion of the sheet has been one of the most serious handicaps in plane-table surveying. Various schemes have been attempted to eliminate distortion of paper sheets due to changes in relative humidity. Plain polished aluminium, grained surface aluminium and painted aluminium sheets have been used in very humid climates. Clear and opaque celluloid were used in wet climates but these sheets are subject to distortion about as much as paper. For a number of years the U. S. Coast and Geodetic Survey used a cloth mounted sheet. The width of this sheet is the same as the length of the plane-table board and it is attached to the board by long clips, rolling the surplus length of the sheet under the plane-table. This sheet, made of a high quality paper, mounted on cloth, has given satisfactory results when carefully seasoned prior to use in the climate in which it is to be used. The plain or grained surface aluminium sheets are not easy to work on and erasures are difficult to make.

The U. S. Geological Survey for many years has used the cloth mounted paper, except that one sheet of drawing paper is mounted on each side of the cloth, with the grain of the two sheets of paper at right angles to each other. However, when it was necessary to have the field sheets retain perfect scale, the U. S. Geological Survey began, about thirty years ago, to mount drawing paper on each side of zinc sheets, and about eight years ago began to use thin aluminium sheets, the principal advantages of the latter being weight and ease of cutting to join sections of field sheets. Recently the U. S. Geological Survey has been using thin aluminium sheets coated with white Duco paint, finding, after many experiments, that three or four applications of white Duco under-coating gave better results than flat white lacquer. These sheets are coated with an automobile spray gun and the work is usually done in automobile paint shops, where the personnel are most experienced in such work. Some excellent work has been done on these painted aluminium sheets. Similar sheets were prepared in the U. S. Coast and Geodetic Survey for several special projects but paper on aluminium, as later described, was selected in preference to the painted aluminium.