and S1 referring to the 15' prism, R2 and S2 to the 9' prism and R3 and S3 to the 3' prism.

For a rising star the correct sequence is
R1, R2, R3, (reverse) S3, S2, S1.

For a setting star the order is
S1, S2, S3, (reverse) R3, R2, R1.

Telescope. — This is a standard telescope of 13 mm. aperture and × 25 magnification. It is easily detachable for cleaning and stowing.

The present price of this instrument, one of which is on view in the International Hydrographic Bureau, is £102.10.0.

MICROMETER STATION POINTER.

The following is a description of the Micrometer Station Pointer manufactured by H. Hughes & Son, Ltd., London.

In using an accurate station pointer of the older types in which the angle settings had to be made by verniers, working was slow and could not usually be carried on for very long owing to eyestrain. The vernier setting was also distinctly slow.

In the present instrument the verniers have been abolished and the angles can be set more rapidly and with much greater ease by means of the micrometers provided in place of the verniers. The micrometers read to single minutes and are easily read by the unaided eye.

The micrometers are thrown into or out of gear by thumb and finger pieces, the thumb and finger pieces serving also to move the arms round in setting the angles without lifting the instrument from the chart table.

The instruments are supplied with open centres or if preferred with raised centre and interchangeable pricker and pencil.

The usual extension arms are supplied and the attachment of these arms has been improved in detail.

When in use, the act of grasping the thumb and fingerpiece releases the clamp, the arm is moved round to the approximate angle without any alteration of the grip, the act of releasing the grip clamps the arm and a quick touch on the micrometer head finishes the exact setting of the angle. This arrangement gives the greatest possible accuracy, speed and ease of operation.

One of these instruments is on view at the International Hydrographic Bureau.

THE PRATT PROTRACTOR AND PLOTTING SCALE.

From an article in the *United States Naval Institute Proceedings*, Washington, December, 1934, p. 1740.

Mr. Herbert Pratt, a student at the University of Southern California, has invented an instrument which will enable the navigator not only to project the line of position but also to plot the line of position in his work-book or on any blank sheet of paper for any latitude from the equator to 60° north or south. The accuracy attainable with this instrument is the same as that obtained on Hydrographic Office plotting sheets 3000. Both the scales of the Pratt plotting scale and of the Hydrographic Office 3000 charts are the same, i. e. 4 inches to 1° of longitude. As the illustration depicts, it is similar in shape to an ordinary protractor. Its dimensions are 8 × 8 inches, with a thickness of 1/8 inch. The small size of this plotting scale will permit its being carried between the leaves of any workbook.

The longitude scale is at the foot of the protractor, along the lower edge, and reads from zero to 60 minutes from right to left; the latitude scale is engraved on the right hand vertical side of the protractor; it is divided in minutes, from 0 to 60, and its length corresponds to MERCATOR's projection at latitude 60°.

On the periphery of the protractor is a progressive graduation from 0 to 60° of latitude, with centre at the lower angle of the protractor, the use of which is shown by Fig. 2. The zero division of this graduation forms an angle of 30° with the vertical scale of latitude, and its 60° division coincides with the horizontal edge of the protractor.

The instrument further includes the graduation in degrees of an ordinary protractor, the centre, however, not being at the bottom corner of the protractor, but about 1/4 inch along the edge representing the latitude scale. These divisions are marked anticlockwise from 0 to 90°, 90° to 180°, 180° to 270° and 270° to 360° respectively.

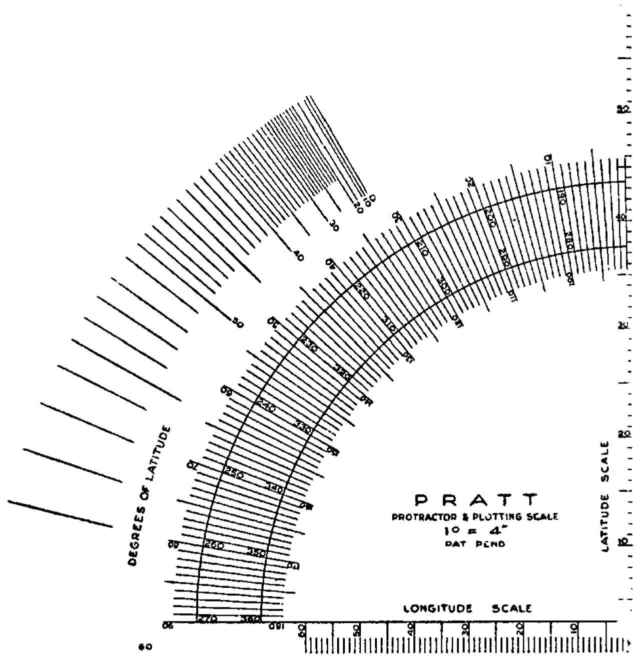

Fig. 1.

Suppose we wish to plot an altitude line for, say, the star Vega: the D.R. position being Lat. 32°00' N., Long. 121°48' W., azimuth 263°; intercept, 25' away. To plot the projection we draw the horizontal line *AC* (Fig. 2), on which we lay off a length *AC* equal to 1° of longitude, using the fixed longitude scale of the protractor. Then we draw the perpendiculars *AB* and *DC*, representing longitudes 121° and 122° W. To obtain the increased or MERCATOR latitude, the protractor is so placed that the lower angle coincides with the point *A* and so that we read, along *AC* produced, a latitude equal to 33° along the peripheral scale of degrees of latitude. The point *E* is then marked on the paper, where the 60' division of the latitude scale falls, and from this point we draw *EB* parallel to *CA*, which determines the points *D* and *B* corresponding to latitude 33° N., on the meridians 121° and 122° W. respectively.

To complete the construction, taking the even latitude of 32° as D.R. latitude (Fig. 3), we use the longitude scale of the protractor to plot the point *G*, corresponding to the longitude 121°48' W., on *AC*.

Then the azimuth is drawn. For this purpose, the inner division of the protractor is used conjointly with the meridians of the plot, taking care to make the actual centre of the usual protractor divisions, which as already stated is about 1/4 inch above the

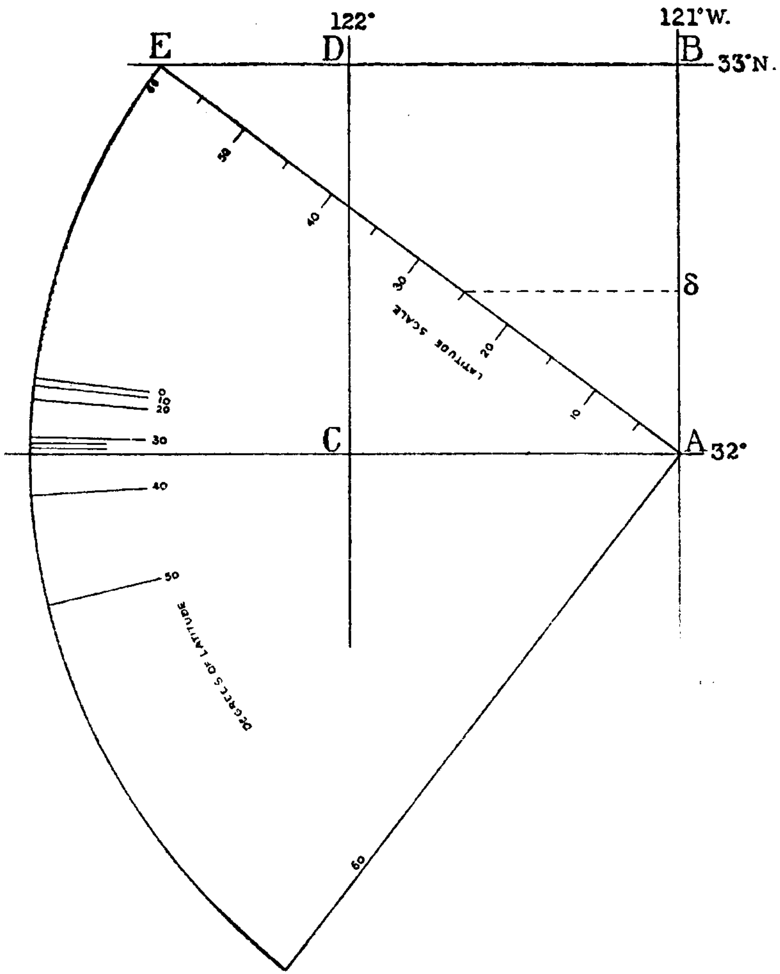

Fig. 2.

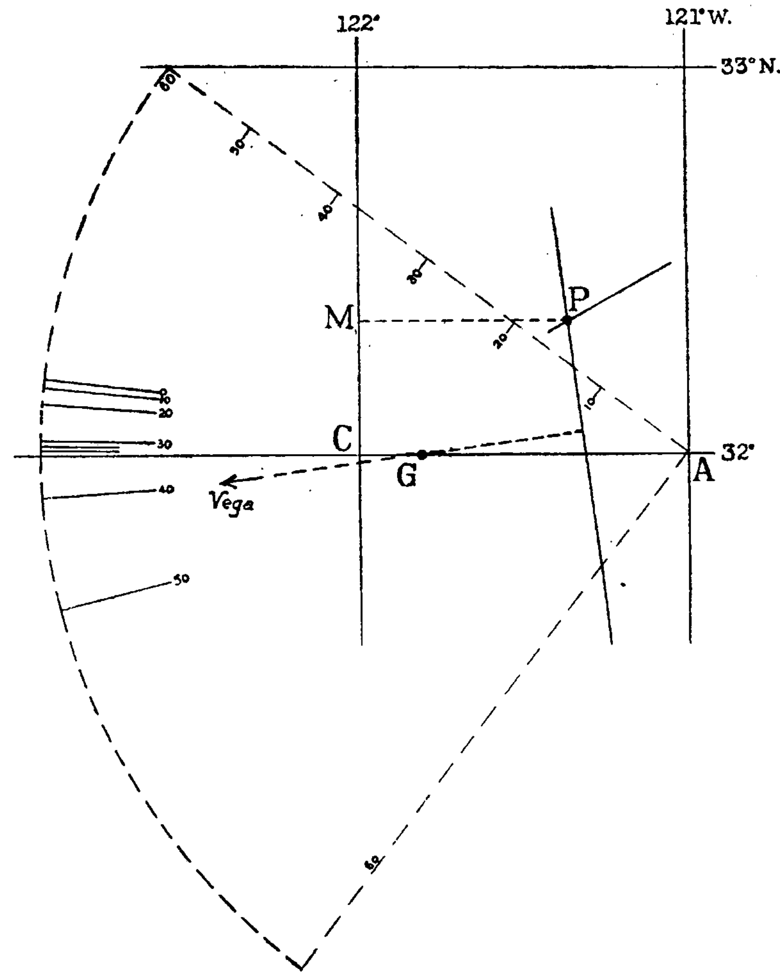

Fig. 3.

THE PRATT PROTRACTOR AND PLOTTING SCALE. — LE RAPPORTEUR PRATT A ÉCHELLE DIVISÉE POUR PORTER LE POINT.

bottom edge, coincide with the meridian. This operation is so familiar to seamen that we shall not describe it here, but Fig. 3 shows the great benefit of the anticlockwise division of the protractor, whichever quadrant is concerned.

Having thus obtained the line representing the azimuth it is only necessary to determine the intercept on the latitude scale of the plot. For this purpose, returning to Fig. 2, this distance will be laid off along the latitude scale, 25' in the case under discussion, and by drawing through the point 25 of this scale a line parallel to *CA*, we obtain the intercept *Aδ* which we need only lay off in the required direction, with a pair of dividers, before drawing the altitude line perpendicular to the azimuth.

Suppose after drawing two altitude lines (Fig. 3) we wish to determine the latitude and longitude of the fix *P*. The longitude (121°23') is measured directly on the plot by the fixed longitude scale of the protractor; to obtain the latitude of the point *P* we can use the PRATT protractor by placing it as shown in Fig. 3, reading the latitude (32°21') on the latitude scale of the protractor at its intersection with the line *PM* drawn parallel to *AC*.

H. B.

A.M.L. POSITION LINE SLIDE RULE

(Bygrave Slide Rule)

(Communicated by HENRY HUGHES & SON, Ltd., sole licenced manufacturers, 59 Fenchurch Street, London, E.C.3.)

This slide rule has been designed to calculate the altitude and azimuth of a celestial object as it would be seen from a given point on the earth's surface at a given time.

Theory of the Method

The three points — the Pole, the observer's position, and the sub-solar (or sub-stellar) point — determine a spherical triangle, sufficient elements of which are known to enable an unique solution to be obtained; this triangle is usually solved by direct logarithmic calculation or by the use of special tables based on logarithmic functions.

In order to solve the triangle by a slide rule it was necessary to re-arrange the formulae involved in the solution so that each step involved not more than four logarithms or three numbers.

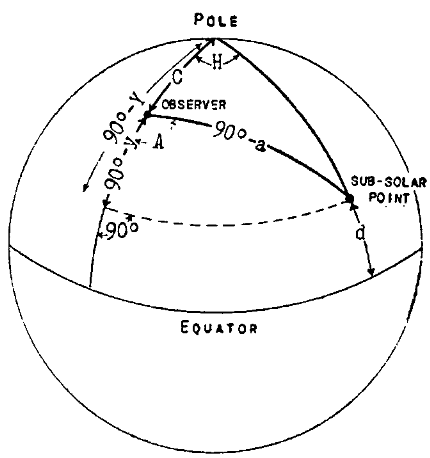

FIG. 1

H = Hour Angle.	*C* = Co-Latitude.
A = Azimuth.	*d* = Declination.
l = Latitude.	*a* = Altitude.

Dotted Line — Perpendicular from Sub-Solar point to Observer's Meridian.