This formula gives, in terms of the inclination δ, the variable value of the distance to be given an imaginary thread of the reticule in order that the distance S remain proportional to the intercepted length on the staff.

On the other hand, in a general way, we have:

$$\Delta h = l \frac{\cos(\delta + \varepsilon) \sin \delta}{\sin \varepsilon}$$

and in the HAMMER-FENNEL Tacheometer the condition has been imposed that $\Delta h = k_1 l$

whence $$\tan \varepsilon_1 = \frac{\sin \delta \cos \delta}{k_1 + \sin \delta}$$

and $$a_1 = \frac{\sin \delta \cos \delta}{k_1 + \sin \delta} f \qquad (2)$$

This formula gives, in terms of the inclination δ (positive or negative), the variable value of the distance to be given an imaginary thread of the reticule in order that the difference of height Δh remain proportional to the length intercepted on the staff.

For the HAMMER-FENNEL Tacheometer Model No. A 350 the following values have been given the constants in equations (1) and (2).

$$f = 334.78 \text{ mm.}, \quad k = 100, \quad k_1 = 20$$

which give for a and a_1 numerical values which serve to make the graticular diagram of Fig. 2.

As a result of the swinging of the telescope about its horizontal axis O and of the eccentricity OC of the deflecting prism, the values of a and of a_1 must be protracted from circle ZZ of radius $OC = r$ which represents the zero.

Constructively we have taken $r = 30$ mm.

Curve DD (Fig. 2) is obtained by carrying from the centre O, for each inclination of δ, the vectors $r + a$ inclined by δ; and the $+HC$ and $-HC$ curves are obtained by carrying from the centre O the vectors $r + a_1$ inclined by $\pm \delta$ with reference to the vertical OC.

This construction is made on a large scale and then reduced by photography, in order to obtain the diagram of the reticule.

Through the agency of the reflecting prisms (Figs. 3 and 4), the image of the diagram becomes visible in the left half of the field of view. The whole of the right portion of the field remains available for sighting.

The missing vertical thread in the graticule plane of the HAMMER-FENNEL Tacheometer is replaced by the vertical edge of the prism P_2 (Fig. 4) which cuts sharply the image of the diagram in the eyepiece. It is brought into contact with the longitudinal edge of the staff.

The horizontal thread is replaced by the zero-curve ZZ at its point of intersection with the vertical separation. This point must be made to coincide with the zero on the staff, specially marked at exactly 1.4 m. from its base by means of 2 heavy short black lines inclined to one another and easily distinguishable.

The staff is 4 metres high when unfolded; it is provided with a spirit level, two handles and struts to help to hold it truly vertical.

The reader will find fuller information in Professor Georg SCHEWIOR's pamphlet entitled *Tachymeter Hammer-Fennel*, 66 pages, 57 illustr., Kassel, 1930.

THE "ADDISON-LUARD" COURSE AND WIND CALCULATOR TYPE "D".

This appliance is specially designed for use in transoceanic aircraft flying; by its means the navigator can solve all velocity triangles concerned with the effect of the wind on his machine without the necessity of actually plotting these triangles. If the wind is already known, the instrument immediately shows the relationship between Course, Air

Speed, Track, Ground Speed, etc., while if the wind is unknown, the instrument enables its speed and direction to be quickly calculated from the results of Drift Observations.

The instrument consists of a circular base the upturned rim of which is divided from 0° to 360°. Four arms, each with a cursor sliding along it, represent the four vectors involved, viz. (1) Air Course and Air Speed ; (2) Track and Ground Speed ; (3) Wind and Wind Speed ; and (4) Datum Ship Course and Datum Ship Speed.

The accompanying photograph gives the details of the instrument among which may be noted : (1) The Air Course arm, which is formed with a saddle sliding round the upper edge of the upturned flange of the base. The position of the Air Course arm is read by means of the divisions engraved on the inner face of the flange, against which the sighting blade is placed.

The cursor representing Air Speed, i. e. the speed of the aircraft through the air, slides on the Air Course arm.

(2) The Track arm is situated in a plane below that of the Air Course arm but is located with respect to the same circumferential degree graduations on the inner face of the flange. The saddle of this arm is graduated in degrees of *drift*, these being read by means of the sighting blade carried by the Air Course arm.

The Ground Speed cursor slides on the Track arm, and is provided with slots which permit the cursor to be visually linked with the other elements of the apparatus.

(3) The Wind arm is pivoted at the centre of a small independent graduated circle which is itself mounted on the Datum Ship Speed cursor and which is also connected with a sliding member beneath the base in such a way that, although the graduated circle may be displaced with respect to the axis of the base, it cannot rotate about that axis. The Wind arm carries the Wind Speed cursor.

(4) The Datum Ship Course arm revolves about the centre of the base, and its position is read in conjunction with the reciprocal degree scale engraved on the bottom of the base. The Datum Ship Speed cursor slides, together with the Wind degree scale, on the Datum Ship Course arm.

All the arms are graduated in units of *knots*. The Air speed and Wind speed cursors are interconnected by linkwork, the main pivot of which has a circular sighting aperture which is, in use, brought exactly over the intersection of the slots of the Ground Speed cursor. Independent clamps are provided for locking respectively the Air Course arm, the Air Speed cursor, and the Track arm. The upper and larger clamp beneath the base simultaneously locks the Datum Ship Course arm and the Datum Ship Speed cursor, while the lower and smaller clamping screw simultaneously locks the Wind arm and Wind Speed cursor.

In addition, a pair of time and distance scales, in the form of circular arcs, respectively engraved Miles and Minutes, are arranged to slide on the upturned flange of the base. These are engraved with scales figured from 20 to 200. The inner Minutes scale is engraved with a readily distinguished arrow at 60 so that, when the outer scale is moved along till the figure corresponding to the Ground Speed is opposite the arrow, the distance covered in a given number of minutes can be read off on the outer scale opposite the mark corresponding to the number of minutes and vice versa.

It has been considered unnecessary to enter in this article into details concerning the method of use of this appliance designed to solve the various problems of aircraft navigation ; these may be found in a pamphlet published by the makers, Messrs. Henry HUGHES & Son, Ltd., 59 Fenchurch Street, London, E. C. 3.

A complete description of the ADDISON-LUARD Tablet Calculator will also be found in the *Revista General de Marina*, Madrid, December 1929.

SOMETHING NEW IN METALLIC MIRRORS.

(Extract from the Journal of the Franklin Institute, Philadelphia, June 1934, page 708).

A new type of metal-front mirror has been recently developed by Dr. H. W. EDWARDS, physicist in the University of California at Los Angeles. In the manufacture of this