

ART. XXVII.—*A New Declination Instrument*; by C. C. HUTCHINS.

THE declination is the only magnetic element that the engineer and navigator wish to know, and it is hoped that the apparatus to be here described will be found as useful and much more simple than commonly employed in finding it. Reference to the figure will make the following details plain.

We have a telescope of 1-inch diameter and 6-inch focus. Upon the telescope tube are two carefully turned bronze rings upon which the telescope rests in a light cradle C-D. The cradle is suspended with floss silk from a torsion-head H.

The telescope hangs in a box upon which are mounted two level phials. One side of the box is of glass and is removed by a convenient knob K.

A rod runs the length of the box and bears two hook-like supports A-B. When the rod is revolved by means of a lever at the eyepiece end, and the lever slipped over a catch at O, the supports then lift the telescope from its cradle and support it. The eyepiece of the telescope projects through one end of the box, where it is covered with a cap to protect it from air currents. Before the objective is a plate-glass window.

The whole is mounted upon a small divided circle reading to minutes. The socket of the circle may be made to fit the ordinary engineer's tripod.

The peculiarity of the apparatus lies in the telescope, whose tube is made of steel and is magnetized. It was found that a very satisfactory tube could be made by case-hardening a piece of ordinary bicycle tubing, and magnetizing. The eyepiece of the telescope has a single wire at its focus.

The operation of the instrument is as follows:—

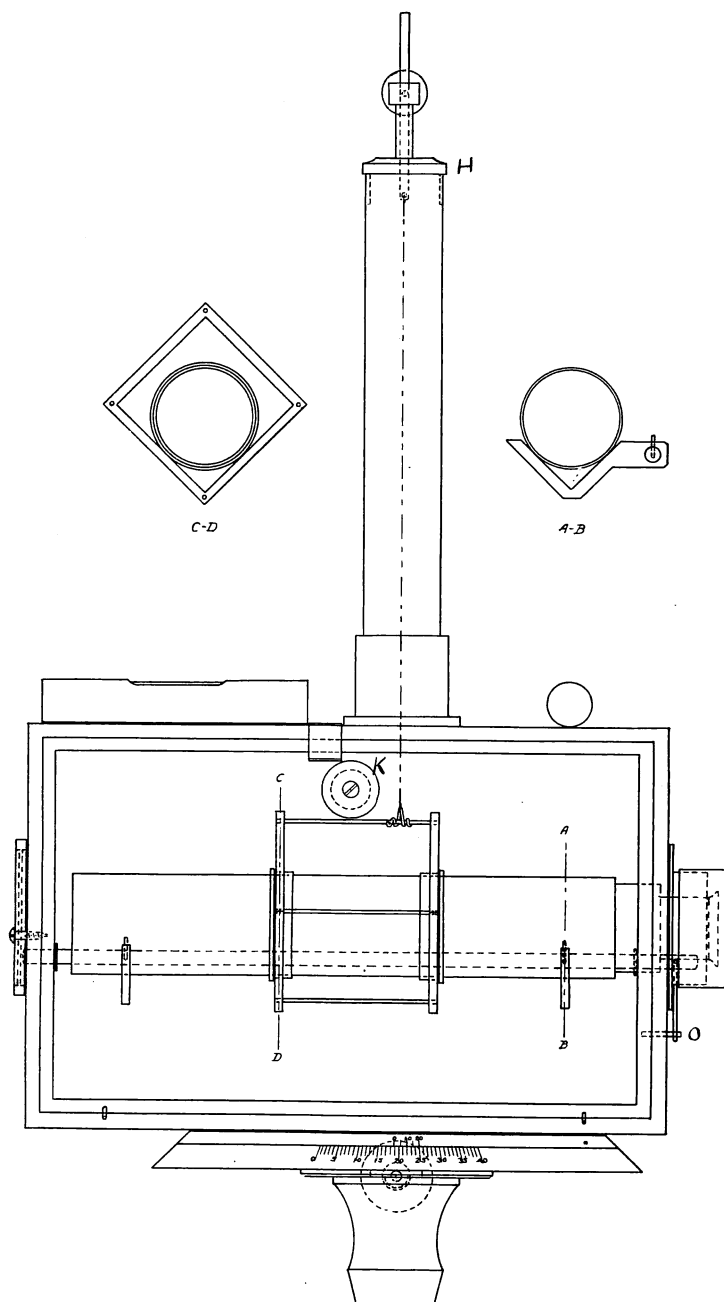
It is set up on a meridian line. About 200 feet away, and in the approximate direction of the magnetic meridian, is placed a horizontal scale divided to inches, with bold marks.

The telescope being removed from the box, a brass tube of the same weight is substituted, and the torsion head is rotated until the suspension is free from torsion. The telescope is replaced and the box being rotated until it points to the distant scale, the excursions of the vertical wire are observed, and its point of rest found in the usual way. This observation is repeated after rotating the telescope  $180^\circ$  in its cradle.

This eliminates the effects of parallax and the lack of coincidence of the magnetic and telescopic axes.

The mean of the two points of rest is found; the telescope

FIG. 1.



lifted from the cradle to the supports A-B and the circle rotated until the eyepiece wire marks the mean point of rest. The circle is now read, and a pointing being made upon the meridian mark, the change in the circle reading is the declination sought. The declination is rarely wanted closer than the nearest minute, in fact considering the rapidity with which it changes is not obtainable to less than that amount, and experience has shown that an apparatus of the above dimensions is needlessly large for that degree of accuracy.

A telescope of four inches length would doubtless do as well, and thereby the whole would become very compact and portable.

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