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 mirror a piece of glass and near it a piece of aluminium alloy are placed together in a large airtight enclosure. A high vacuum is then produced, the pressure in the chamber being reduced to one ten-millionth of its former value. The alloy is then electrically heated to a very high temperature, and readily evaporates into the extremely rarefied air. The metallic vapors find a rather free and unobstructed path over to the cool glass, where they condense to form a brilliant mirror.

This new type of reflector is known as the "pancro" mirror because it reflects all colors alike. What is more, the mirror reflects light with approximately 93 per cent efficiency. The common silver mirror, when operated from the metal side gives approximately the same efficiency with red light, but only 81 per cent with violet light. Viewed through glass, still lower efficiency is observed. The alloyed metal of the pancro mirror, which is amenable to a special heat treatment, thereby acquires great resistance to deterioration without appreciable loss in power of reflection. The open surface, unhampered by the usual glass refractions and absorption, gives properly colored, realistic images not seen hitherto by ordinary mirror gazers.

A CATHODE-RAY DIRECTION-FINDER FOR COLLISION PREVENTION

(Extract from the Report of the Radio Research Board for the period 1st January 1932 to 30th September 1933, H.M. Stationery Office, London, 1934, page 81).

The cathode-ray oscillograph has been used as the indicating element of a directional receiver. A notable advantage arising out of the instantaneity of response of the cathode-ray direction-finder is the facility which is offered for the directional reception of signals of very brief duration. This type of apparatus offers advantages in conjunction with beacon transmitters and other radio accessories to navigation and safety of life at sea. A particular application of the use of such short signals lies in the use of the arrangement as a direction-finder for short impulse signals for the prevention of collision at sea in conditions of fog and low visibility generally.

In the practical realisation of the scheme, which has not yet been tried at sea, it would be necessary that all ships in a fog area should emit every fifteen seconds, or at some similar widely-spaced interval, a short 600-metre signal, lasting not necessarily longer than 1/100 second. Such a signal could be emitted automatically and could, indeed, be superimposed on any other traffic sent out from the same ship. A ship fitted with a cathode-ray direction finder of simple type, limited range and fixed tune — located preferably in the chart room — could then receive such signals. During fog the receiver would be switched on and a more or less continuous watch kept on its indications. Signals received would cause sudden lines to appear on the oscillograph screen giving, by their directions on the screen protractor, the relative bearings of all emitting-ships within range of the receiver. In these conditions, if it is seen that the one transmitting ship produces a line *of constant direction and increasing length* (assuming both ships to be on steady courses at constant speeds), the two ships will collide unless course is changed to prevent it.

Since the duration of signals is so short and the times of emission from different ships bear no fixed relation to each other, two signals will not often coincide and, even in the presence of a considerable number of ships emitting such signals, the bearing of each source will be readily determinable. In the very rare case of exact coincidence between two signal impulses, the indication would be in the form of a parallelogram whose sides give the directions of the two ships.

Signals of this type would cause entirely negligible interference with communication on the same wavelength, being comparable to atmospherics of low numerical frequency of occurrence. The arrangement would thus afford a direct indication of possible collision in a form which could be easily observed, and would call for no interpretation or interpolation other than observation that a visible recurrent signal maintained a constant bearing and increased in length.

From the essential nature of this application it is clear that apparatus for the purpose must be small and light, easily accommodated and simple in operation. An appropriate specification of its performance is that it should produce a deflection, on the