bulbs in moderate or bad visibility. The intensity of illumination in different parts of the beam at a distance of 30 feet from the lamp has been determined experimentally as follows :—

Power of Bulb. Watts	*Intensity of illumination. Foot-candles.*
1	1.3 — 2.1
6	1 — 6
12	10 — 17
24	12 — 26
36	9 — 17

It may be assumed that the higher figure for intensity of illumination would be available if, but only if, the lamp is accurately aligned. Owing to the greater spread of the filament, the 36-watt bulb under test actually gave no more illumination than a 12-watt bulb and has accordingly been excluded from the series.

The lamps have been run throughout off 6-volt accumulators, since replacement batteries of a suitable weight and capacity in this voltage were more likely to be available in motor garages than 12-volt batteries. They could, of course, be run off inert dry cells in conditions where periodic recharging of accumulators would be impossible, but in that case it would be inadvisable to use the higher-power bulbs. For work in the Highlands of Scotland a charging van was equipped with an *L*.32 "*Pioneer*" petrol-electric charging unit, and located in a mobile central pool for the supply of re-charged batteries. In the more thickly populated parts of the country, however, the light-keepers themselves arrange for supply of fresh batteries from motor garages, or battery service stations, by hiring a replacement until their own accumulator has been re-charged.

In order to provide a still more intense light in very bad visibility it has sometimes been found desirable to "boost" the light by applying as much as 12 volts to it. This involves, of course, a very short life for the bulb, but on occasions this may be much more economical than a protracted delay to observe a difficult ray. The life of the bulb may be prolonged by first warming up for 5-10 minutes on the normal voltage and then stepping-up two volts at a time without allowing the lamp to go out as the voltage is increased. This is done by using a split lead, one arm of which is connected to the higher voltage before disconnecting the other arm. The latter must, however, be disconnected almost immediately in order to avoid short-circuiting the extra cell.

RENQVIST-WITTING TIDE GAUGE

(as installed at the Port of Gdynia).
(Reproduced from the Polish H.O Publication entitled *Stacja Mareograficzna*).

The following description of the tide gauge as installed at the Port of Gdynia has been extracted from a summary description published in a pamphlet issued by the Polish Hydrographic Service entitled *Stacja Mareograficzna,* Warsaw, 1932.

The tide gauge installed at the station (Fig. 1 and 2) — of the RENQVIST-WITTING type — is composed of the following parts mounted on a cement pedestal (1.00 m. × 0.50 m. × 0.50 m.) located at the edge of the well :—

1) Float : (a cylindrical glass bell of the following dimensions : height 25 cm., diameter 50 cm.).

2) Recording Apparatus, comprising :—

a) Two horizontal wheels on a common axis ; the upper wheel having a helicoidal groove of one metre circumference to contain the wire supporting the float and containing another groove in which is wound the wire attached to the float counter-poise. The lower wheel is fitted with ten pencils spaced equidistantly (at 10 cm.) and numbered from one to ten to trace the curves (*) resulting from the movements of the float to the natural scale.

(*) The reading of the curves on the mareograph is accomplished by means of a glass plate on which are engraved two systems of lines ; the horizontal lines spaced 2 mm (heights) and the parabolic lines spaced at 12 mm (time).

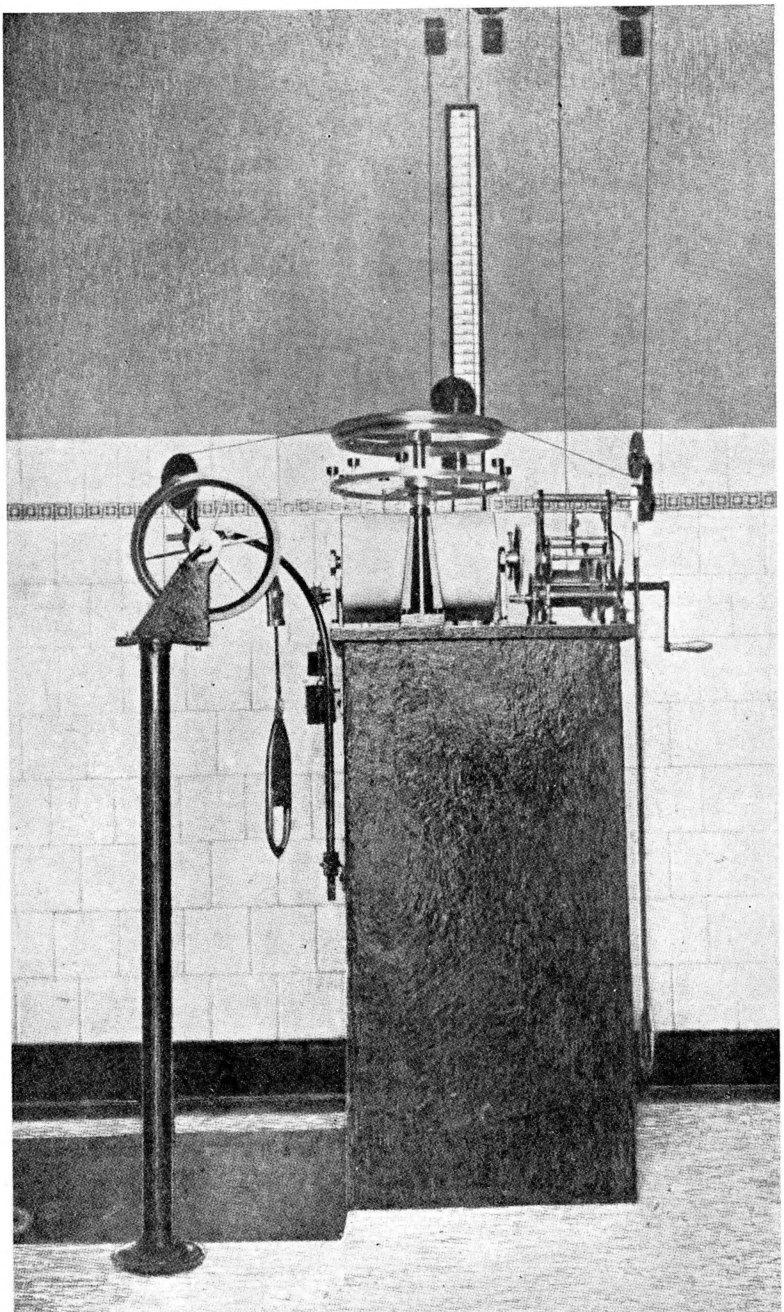

FIG. 1

Maréographe Renqvist-Witting

Appareil de Contrôle

Renqvist Witting Tide Gauge

Control Apparatus

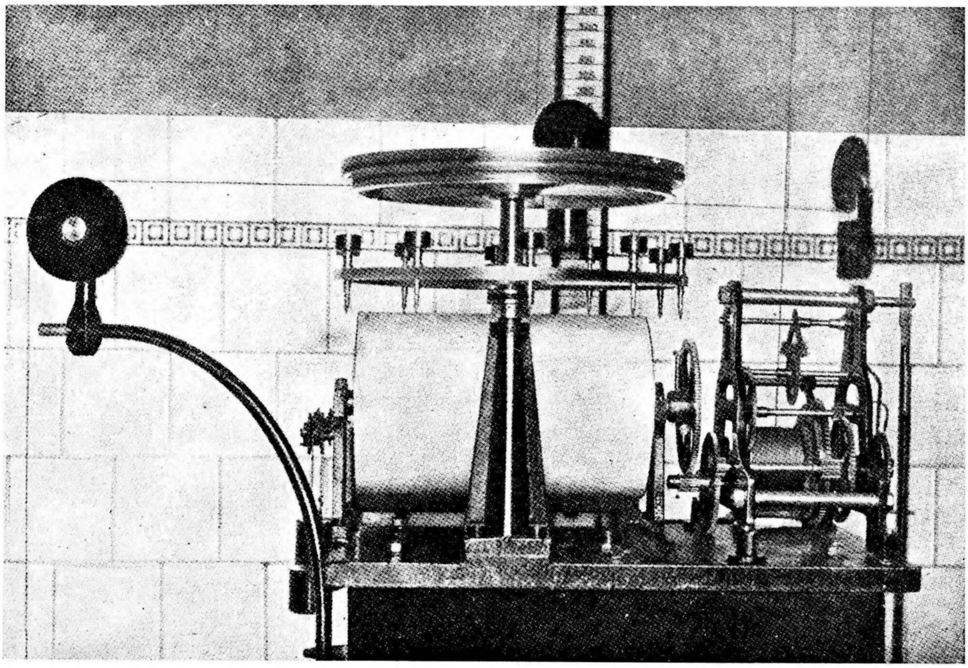

Fig. 2
Mécanisme d'horlogerie
Clockwork Mechanism.

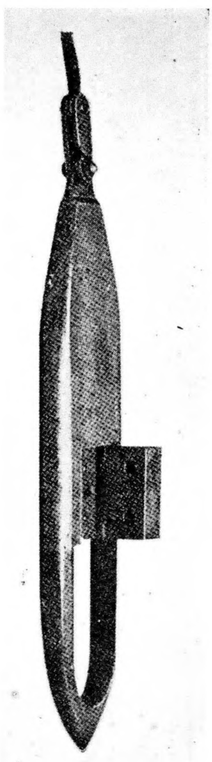

Fig. 3
Lentille
Pendulum bob.

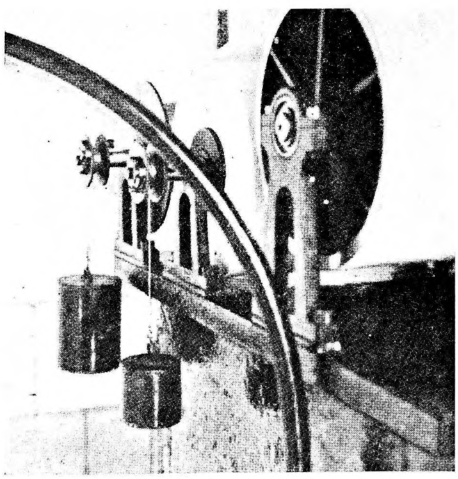

Fig. 4
Tambours à enrouler la bobine
Drums for winding paper.

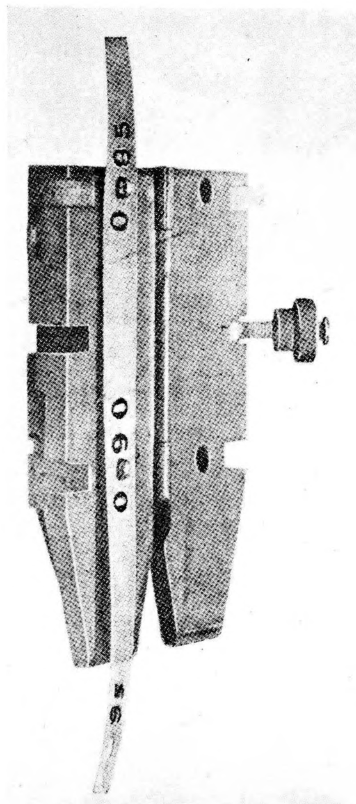

Fig. 5
Bande en bronze
Measuring tape.

b) Drums with horizontal axis (Fig. 4) of which two serve to wind and unwind the bobbin carrying the mareograph chart and a third whose axis is connected to the clockwork mechanism comprise the essential features of the recording apparatus. Its two extremities are bordered with short needles spaced equidistantly at 24 mm. which serve to pierce the paper roll (mareogram) at intervals of every two hours (1 mm. along the time axis is equivalent to 5 minutes).

3) The clock mechanism (Fig. 1 and 2) coupled to the axis of the recording drum is actuated by a pendulum and fitted with a wheel with 60 teeth corresponding to the minutes; the clock is wound once a week.

4) Control Apparatus (Fig. 1) used to check the instantaneous height of the water referred to the fundamental datum of the station by direct soundings obtained with a metal console. The measurements taken thus once or twice a week serve to connect the points on the mareogram (its zero) with a fixed level whose position with respect to external bench marks is known.

For the approximate determination of the position of the water level use is made of the counter-poise suspended from the float wire and of a permanent graduated scale on the opposite wall of the building. The check measurements are made with the aid of a bronze tape divided into semi-decimetric divisions (Fig. 5) unwinding from a pulley with horizontal axis and provided with a metallic pendulum bob (Fig. 3) at its lower end which acts on the control paper. The above paper has a fixed shape and dimensions, and is specially imbrued (**), being steeped in water, and the paper band thus delineates the height of the water by means of a darkened line.

NOTE. — For further details of this device see the article by Dr. H. Renqvist: *Der Wasserstandsdienst in Finnland* published in *Annalen der Hydrographie und Maritimen Meteorologie*, Vol. I, 1923.

(**) After having been steeped in a solution of iron chloride and dried, the paper is then treated with coat of powdered tanin.

A BATHYTHERMOGRAPH

by

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In the study of the homogeneous layer in the ocean, Rossby (1) found it desirable to have an instrument which would provide a continuous record of temperature against pressure in the surface layers of the ocean. A preliminary instrument named an "oceanograph" was constructed and used during the summer of 1934. The manifold uses to which such an instrument could be put presaged a widespread employment of the apparatus. This, however, did not come about because of certain inherent difficulties in Rossby's design. The record was made on a large smoked foil, and thus entailed the attachment of multiplying linkages to the actuating elements for pressure and temperature. Such multiplying linkages are uncertain in action in sea water, and, furthermore, the size of the instrument to accommodate them must necessarily be fairly great. At Prof. Rossby's suggestion, the author attempted to modify the oceanograph so that it would be more suitable for routine use. The modifications were made with the following aims in view:

(*a*) The instrument should if possible be small enough so that it can be lowered on an ordinary log line by hand if necessary, thus enabling it to be utilized on vessels not equipped with a hydrographic winch.

(*b*) The instrument should be sufficiently rapid in its response such that regardless of the rate at which it passes through the water no errors due to the lag of the thermometric element will be apparent.

(*c*) Care should be taken to eliminate hysteresis of the pressure element.

(*d*) The plates on which the record traces are made should be easily inserted and removed and easily evaluated.

(1) C. G. Rossby and R. B. Montgomery. «The Layer of Frictional Influence in Wind and Ocean Currents». Papers in Phys. Oceanography and Meteorology of the Mass. Inst. of Tech. & Woods Hole Oceanographic Inst., Vol., III, N° 3, p. 73.