INSTRUMENTS

OBSTACLE - DETECTOR, MODEL S. F. R. — D. 16

Communicated by the *Société Française Radio-Electrique*)

The following are a few details of a Radio-electric Detector invented by Mr. PONTE.

This appliance is constructed by the *Société Française Radio-Electrique*, 79, Boulevard Haussmann, Paris (VIII[e]) and 55, Rue Greffulhe, Levallois-Perret, (Seine). By means of the system described an obstacle may be detected at a distance of 7 kilometres (4.2 miles) ; a fishing-boat may be detected at 3 km. (1.8 miles) and a buoy at 1.5 km. (0.9 miles). The Society will forward on request descriptive notices of the apparatus with information as to range obtained.

I. *PRINCIPLE OF THE DETECTION :*

The method of detection is based upon the property possessed by ultra-short waves, namely, that of being suitably diffused by an obstacle. As revealed by our investigations, it would seem that the nature of the obstacle (metallic, dielectric, semi-conductor, etc...) has no marked effect on the results.

As a consequence, if (Fig. 1) a transmitter of ultra-short waves *E* sends out a pencil of waves which reaches the obstacle *O*, the latter diffuses waves of the same wavelength which can be received by a receiver *R*. Besides, if all direct reception from the transmitter by the receiver (direct course *ER*) is avoided, reception at *R* will be nil so long as no obstacle intervenes : thus the presence of an obstacle will be detected by the functioning of the receiver.

In addition, since ultra-short waves possess the property of being easily concentrated both at emission and at reception, the direction of the obstacle (*EO* or *RO*) can be obtained with an accuracy corresponding to the narrowness of the pencil.

.The functioning of the system is independent of atmospheric conditions (rain, fog, etc...).

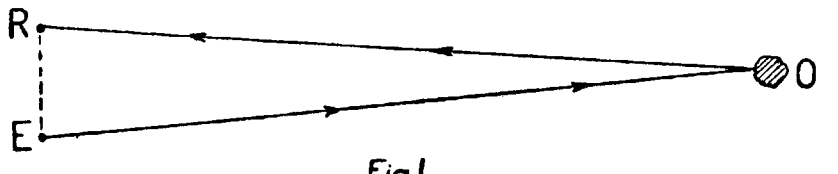


Fig.1

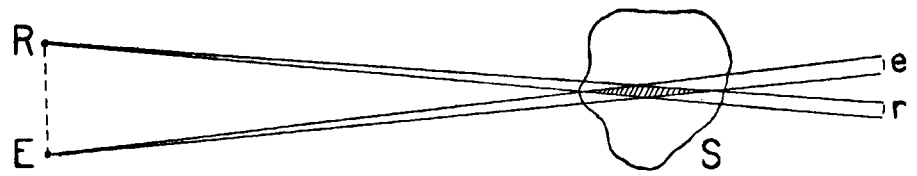


Fig.2

II. *PRINCIPLE OF THE APPLIANCES :*

The preceding paragraph shows that the system should be capable of ***revealing the obstacle and indicating its bearing.***

This object may be attained with ultra-short waves of about 16 centimetres, i.e. the shortest waves which, up till now, it has been found possible to produce. Their advantage lies in the possibility of easy concentration in very narrow pencils, with an angle of a few degrees, by means of small-size reflectors. The determination of the direction of the obstacle thus becomes possible, the sharpness of the diagram of the

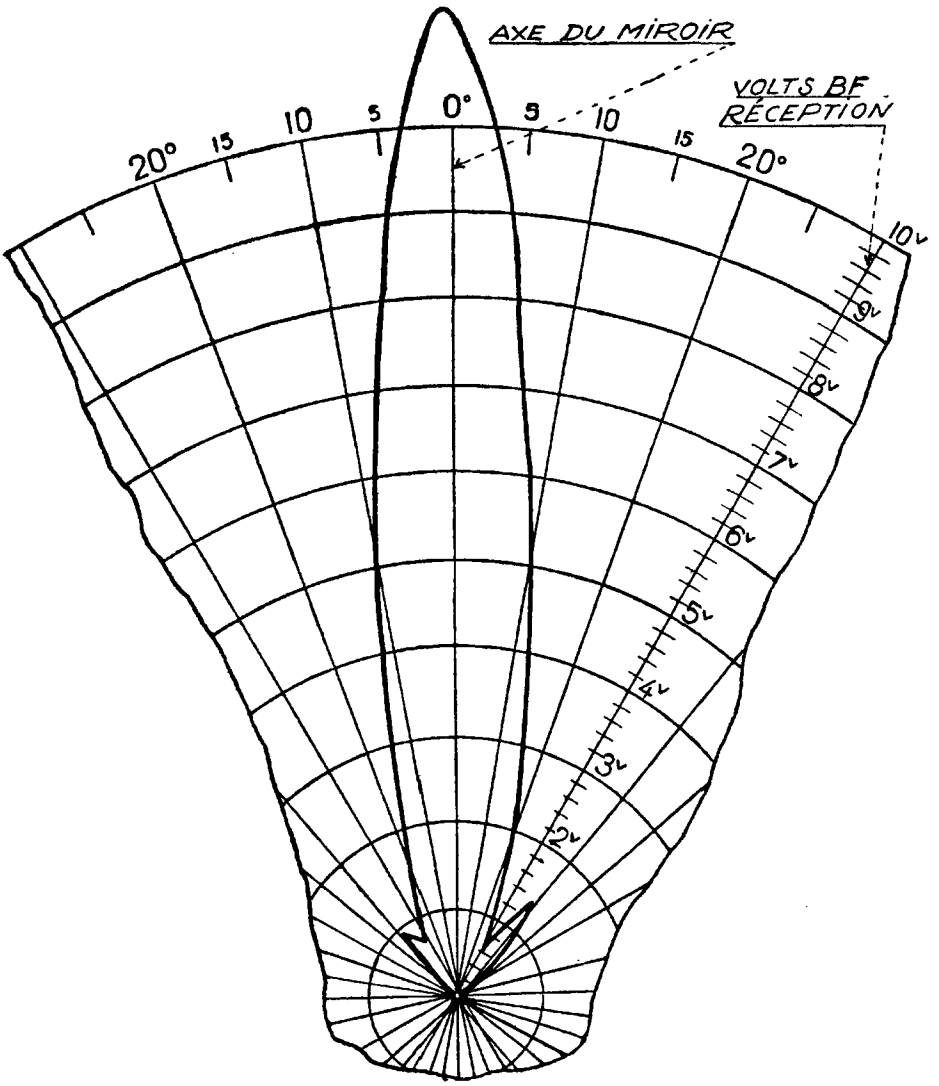
receiver indicating the direction to within a few degrees (about five). At the emission, the power which it is possible to engender on these waves is feeble — a few tenths of a watt. To have great range, therefore, the pencil must be concentrated at the emission also. The zone common to the emission-reception groups is thus fairly limited and, in order to *reveal* an unknown obstacle, the zone to be examined must be covered by a system of "sweeping". For instance, if (Fig. 2) it is a question of examining an area of horizontal section *S*, the pencils will be concentrated in the horizontal zones *e* and *r* and a system of "sweeping" by the pencils must be made to cover the whole region *S* through the common part *S*. The speed of exploration by "sweeping" will depend on the speed of displacement of the suspected obstacles.

The directed pencil of 16 cm. waves sweeps space over an angle of 40° on both sides of the ship's course; this pencil is reflected by the obstacle and the reflected radiation is detected by means of an appropriate receiver.

III. *SUMMARY STUDY OF THE APPLIANCES:*

1) *Transmitter:*

The transmitter consists of an oscillator producing 16 cm. waves, modulated to 800 cycles.



SKETCH II.

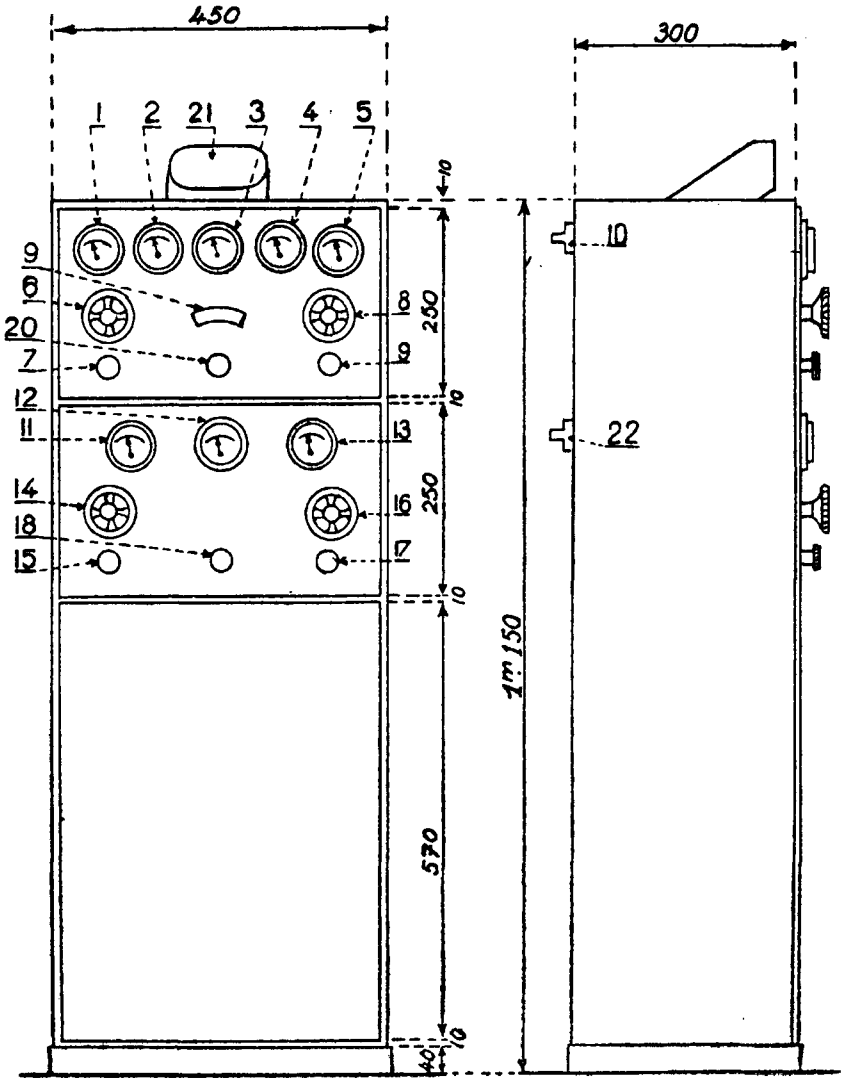
The oscillator makes use of the property of triode grid lamps for the production of very high frequency oscillations.

The lamp under consideration oscillates on a 16 cm. wave-length, the grid attaining a potential of + 250 volts and the plate a potential of about − 70 volts with reference to the filament. The energy supplied is transmitted to an aerial of quarter wave-length, 4 cm. long. This aerial is definitely tuned to the length of wave transmitted and placed inside the glass bulb. Photograph N° I shows the appliance as a whole. The lamp is situated inside a parabolic mirror of 12 cm. focal length so that the point *A*, for which there is a current anti-node on the aerial, is placed in the focus of the mirror. Photograph N° II shows the lamp inside the mirror.

The size of the mirror aperture is 75 cm.

The diagram of the transmitted pencil was constructed experimentally; the annexed figure (Sketch N° II) represents this diagram. The field is reduced to half its value for a rotatory angle beyond the maximum at 8°. The angle of the pencil may thus be considered as 16°. This angle has been considered the most suitable, for in these conditions the movements of the vessel do not influence the functioning of the appliance.

The grid potential is suitably tuned to a frequency of 30 kilocycles which itself is modulated to 800 periods per second so that reception may be audible.



III. SKETCH IV.

The transmitter is fed by a continuous current of 110 volts by means of an 110 volt alternator and a stabilised transformer. (Photograph N° III).

2) *Receiver :*

The receiver consists of a high frequency electric lamp similar to the transmitter lamp.

This lamp acts as a detector on the reaction principle.

In this case also the aerial is placed within the glass bulb and the whole is situated inside a parabolic mirror similar to that used at the emission.

The current detected by the high frequency lamp is transmitted to an amplifier and the reception is accomplished by means of a telephonic listener and a visual indicator. (Indicator lamp).

Reception of the 50 kilocycle frequency and comparison of it with this same frequency at the emission, permit an idea to be obtained as to the distance of the obstacle from the appliance, this being due to the presence of a cathodic oscillograph.

Current is supplied at 110 volts by an alternator followed by a stabilised transformer.

The whole system of modulators and receiving amplifiers, and of the various indicator devices is shown in Sketches Nos III and IV.

3) *Mechanical ensemble for the "sweeping" of space ahead of the ship.*

The transmitted pencil must sweep an angle of 40° on both sides of the vessel's course, the receiver mirror must follow the movement of the transmitter projector. We have therefore constructed an apparatus the sizes of the parts of which are shown in Sketch N° V.

Control of the sweeping system may be either automatic, by means of a motor *M*, or by hand with a wheel placed on the instrument-board. A clutch *D* permits one or the other of these controls to be used at will; this clutch is automatically let in when an obstacle is detected and at this moment the signal lamp lights up.

By means of another clutch, a hand-worked device may be employed, when the instrument is not in use, to turn the mirrors so as to diminish the hold of the wind on them.

DÉTECTION D'OBSTACLES

Légende

ETAGE EMISSION

1. Voltmètre Grille.
2. Milli Grille.
3. Voltmètre Modulation.
4. Milli Plaque.
5. Voltmètre Plaque.
6. Réglage Chauffage Filament Lampe H.F.
7. Appoint Chauffage Filament Lampe H.F.
8. Interrupteur Général d'Emission.
9. Réglage Tension Grille.
10. Départ Alimentation H.F.

ETAGE RÉCEPTION

11. Voltmètre Grille.
12. Milliampèremètre Grille.
13. Milliampèremètre Plaque.
14. Réglage Chauffage Filament Lampe H.F.
15. Appoint Chauffage Filament Lampe H.F.
16. Interrupteur Général Réception.
17. Réglage Tension Grille.
18. Ecouteur.
19. Indicateur de Position des Obstacles.
20. Lampe Indicatrice de Détection des Obstacles.
21. Viseur Oscillographe.
22. Départ Alimentation H.F.

OBSTACLE DETECTION.

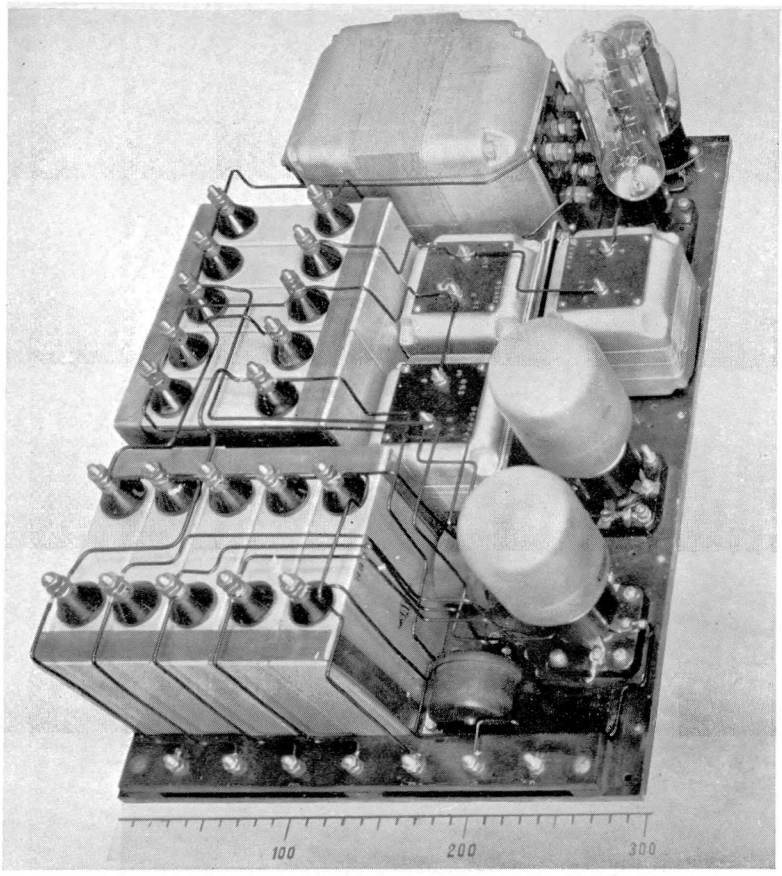
Legend.

TRANSMISSION STAGE.

Grid Voltmeter.
Grid Milliammeter.
Modulation Voltmeter.
Plate Milliammeter.
Plate Voltmeter.
H. F. Lamp Filament Heating Control.
H. F. Lamp Filament Heating Supply.
Emission Circuit Breaker.
Grid Tension Control.
H. F. Supply Distribution.

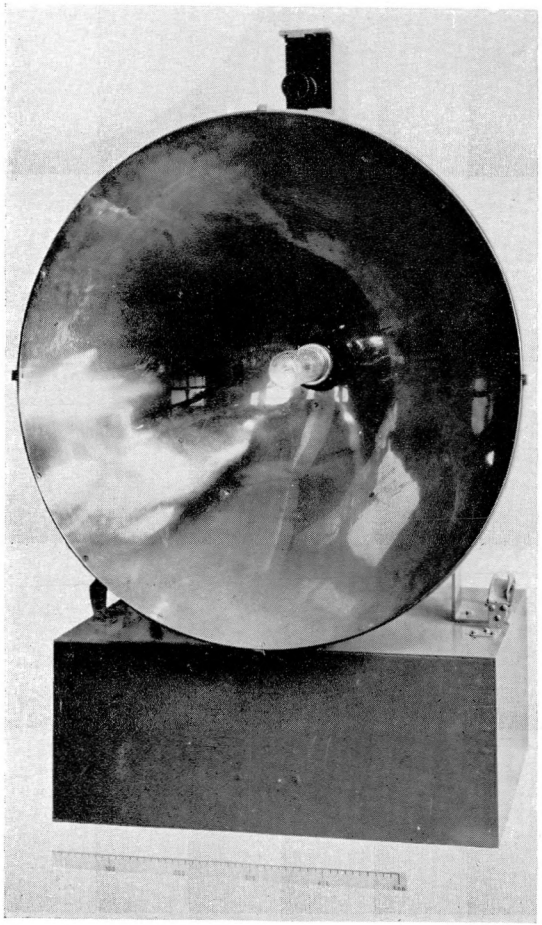
RECEPTION STAGE.

Grid Voltmeter.
Grid Milliammeter.
Plate Milliammeter.
H. F. Lamp Filament Heating Control.
H. F. Lamp Filament Heating Supply.
Reception Circuit Breaker.
Grid Tension Control.
Telephone Receiver.
Obstacle Position Indicator.
Obstacle Detection Indicator Lamp.
Oscillograph Finder.
H. F. Supply Distribution.

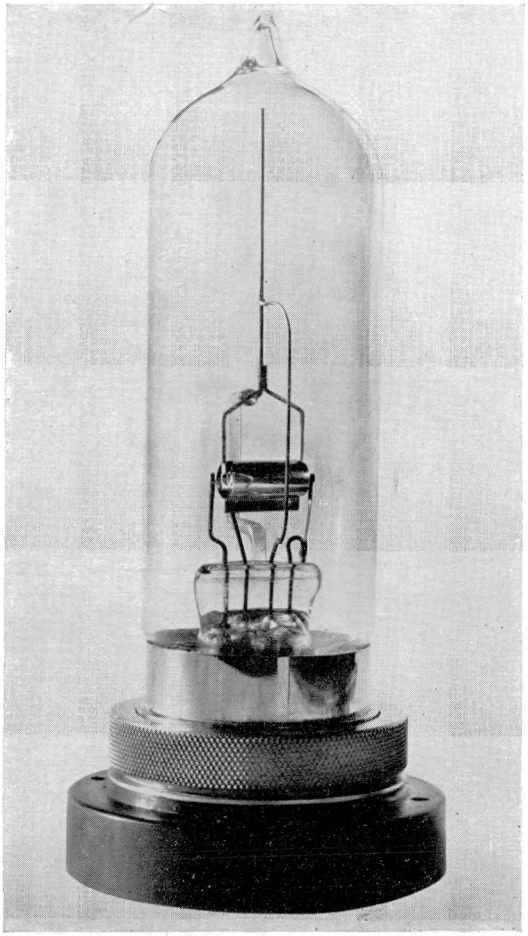


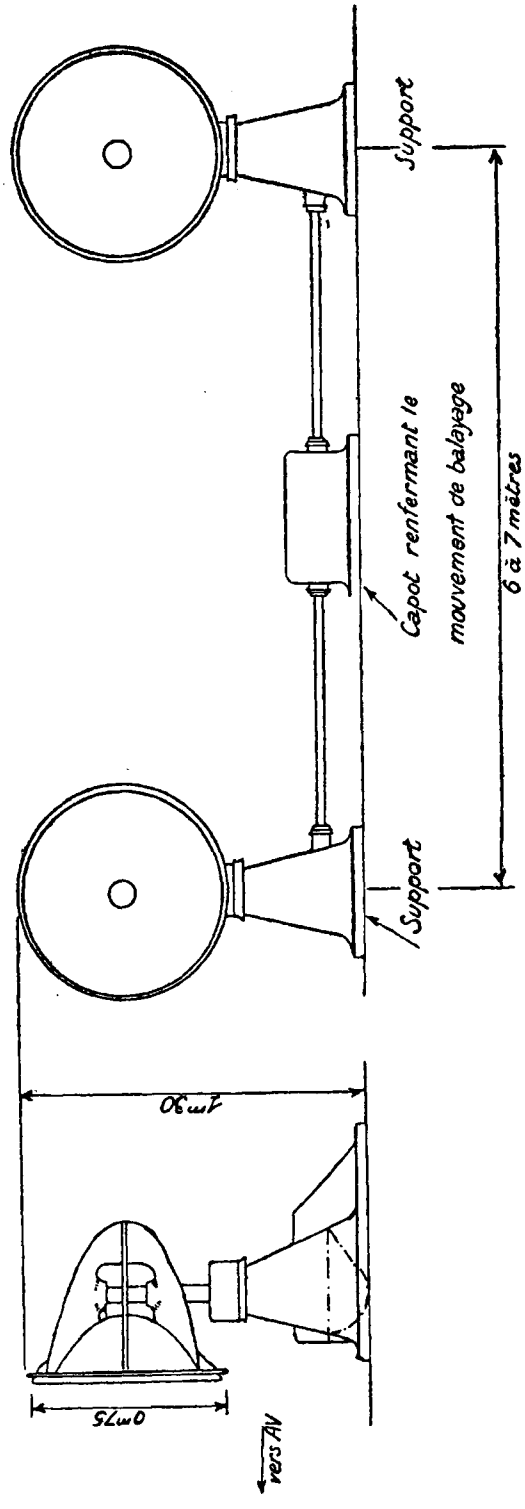
PHOTOGRAPH I.

PHOTOGRAPH II.



PHOTOGRAPH III.




Support
Capot renfermant le
mouvement de balayage
6 à 7 mètres
Support
0m,75
vers AV

SKETCH V:

IV. *TESTS CARRIED OUT AND RESULTS OBTAINED :*

The object of these tests was the adjustment of the parts and the verification of estimated ranges.

The results were as follows :–

The transmitter apparatus and the receiving apparatus carry an aerial fitted with a cylindro-parabolic projector, the pencil of waves has an effective angle of 7°. The transmitting and receiving instruments were mounted independently of each other on board ship at a height of some 8 metres above sea level; the distance between the two instruments was about 6 metres. The projector of the transmitting group was directed towards the coast and the projector of the receiver could be shifted so as to record the reflected wave.

The voyage was as follows :– Havre - Dunkerque - Rotterdam - Antwerp - Havre. The first series of tests was made while the coast was at distances varying between 3 and 7 km. (1.8 and 4.2 miles).

The transmitted pencil of waves was directed towards a point on the coast. By suitable orientation of the receiver the reflected wave was found. In directing the receiver on each side of the point aimed at by the transmitter, reception of the echo was lost at a difference of angle of the order of 5°.

The same tests were continued in the same conditions, and echoes on the coast were received up to a distance of 10 km. (6 miles).

With the same device a few echo tests were made on ships, and it was possible to distinguish and fix them to distances of some 7 km. (4.2 miles).

A device was then constructed by means of which the two projectors could be oriented at the same time towards the obstacle to be revealed.

The two projectors were connected to a shaft *A B* which could turn in two bearings situated at the ends. The two projectors *P1* and *P2* were on axes and a copper screen prevented the direct radiation of the transmitter aerial to the receiver aerial.

With this device, echoes from ships situated at distances of some 7 km. (4.2 miles) were received.

At the height at which the aerials were placed, sea-waves did not give sharp echoes capable of falsifying the observations.

Tests carried out from a point of the coast situated at St Marc near St Nazaire allowed us to detect the buoys in the entrance to the harbour channel of St Nazaire when at about 3 km. distance (1.8 miles), as well as the Tour du Charpentier at 5 km. (3 miles).

These first tests have thus demonstrated the fitness of the material to reveal obstacles up to distances of from 7 to 10 km. (4.2 – 6 miles) and to give their bearings to within less than 5 degrees.

Similar tests have been made on board other ships and have yielded identical results.

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Note. — The *Compagnie Générale Transatlantique* intends to carry out further trials with the PONTE Detector during the year 1936 on board the liner *Normandie.*

THE INSULATING WATER BOTTLE.

AS USED IN THE BRITISH HYDROGRAPHIC SERVICE.

1. The *Insulating Water Bottle* is used for measuring temperatures and collecting samples of water at moderate depths. As a general rule it is not used at depths greater than 500 fathoms.

2. *Construction.* It consists of a metal cylinder *A* (see figure), open at each end, which slides freely on the tubular guides *B, B'* by means of holes in the flanges *P, P'*. It contains a number of concentric cylinders also open at each end.

The guides are connected at the bottom by the metal plate *C* which carries a draw-off valve *V* and a number of rubber washers *D*, and at the top by the plate *E*.