ATLAS - RADIOLOG
A RADIO POSITION FINDING EQUIPMENT FOR DEPTH SURVEYING

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A brief history of the development of the Atlas-Radiolog, a recently developed apparatus which we hope will find a wide range of application in all kinds of hydrographic survey work, was given in a lecture in Hamburg last October and was reprinted in the International Hydrographic Review (1). I will therefore confine myself here to the basic theory of operation of the system and give additional details regarding the equipment itself.

The Radiolog in the version here presented is designed for combination with the Atlas Survey-Type Echo Sounder, Model 645 or 646.

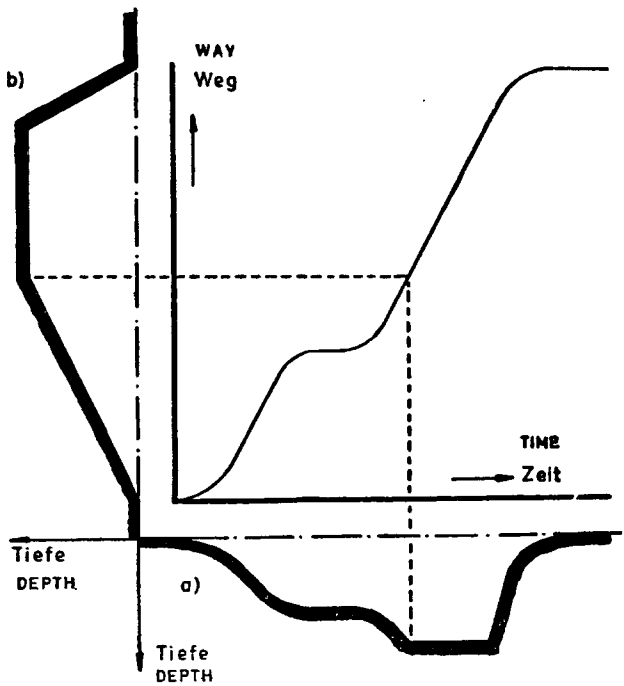

Fig. 1.

Depth Profiles
(*a*) Speed of paper constant
(*b*) True profile.

(1) A Radio Position Finding Equipment for Depth Surveying, Vol. XXXIV, No. 1, May, 1957.

In ordinary Echo Sounders the measured depth is recorded on a special paper while the paper is advanced at constant speed. Thus the horizontal axis of the plot is proportional to time. This can be accepted as being also proportional to the distance covered only when the survey vessel is proceeding at constant speed. In all other cases the depth profiles obtained by this method must be corrected (Fig. 1).

The object of the Atlas-Radiolog in combination with the Atlas Survey-Type Echo Sounder is to give true profiles, i.e. plots of depth versus distance covered automatically. The *Radiolog* solves the task of measuring the distance covered by radio waves, whereas the *Echo Sounder* measures the depth by conventional means of underwater echo sounding.

A shipborne master station transmits VHF signals via an omni-directional antenna to a shore-based portable relay station which receives the signals via a similar antenna. In the relay station the frequency of the signals is doubled and after sufficient amplification the signals are modulated by a low frequency of 400 c/s and retransmitted via the same antenna. They are received back at the master station and here a phase comparison between these signals and those originally transmitted, which are also locally frequency-doubled, is carried out. The result of the phase comparison while the survey vessel is moving is a very precise indication of the distance covered since the beginning of the survey. (Fig. 2).

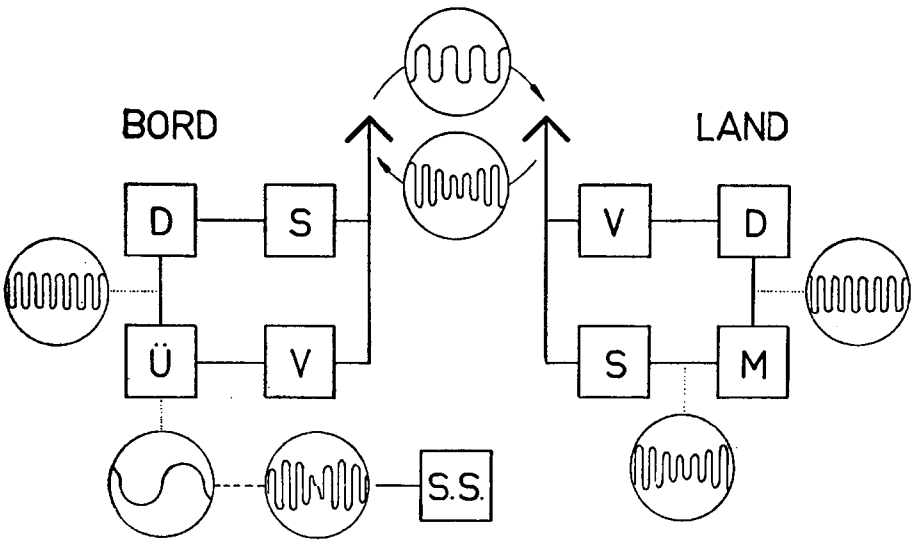

Fig. 2.
Principle of Radiolog.

The output of the phase comparison circuit is fed to a servo amplifier which controls a servo motor system so that the shaft of the servo motor rotates according to the distance being covered.

Fig. 3 shows the master station (closed). As there are no external controls on this unit it can be installed at any convenient place of the ship.

Fig. 4 shows the interior containing :

VHF-receiver, antenna filter, dual channel audio frequency amplifier, crystal controlled VHF transmitter, servo amplifier, power supply.

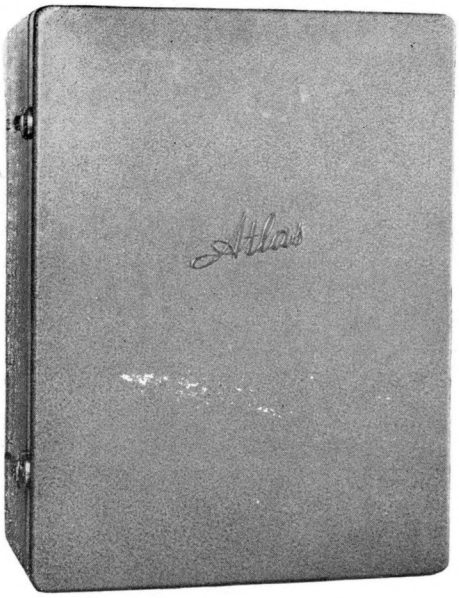

Fig. 3.
Shipborne Station (closed).

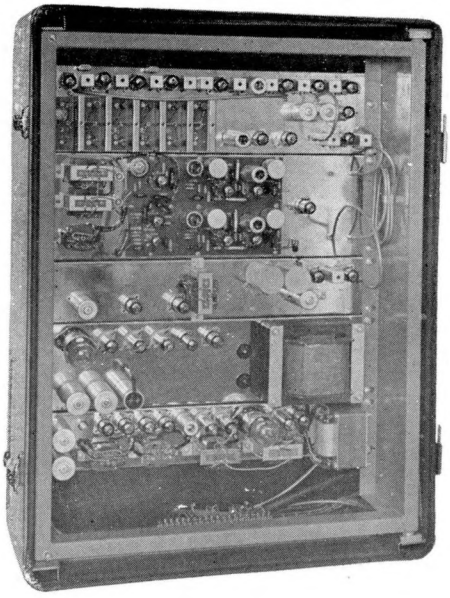

Fig. 4.
Shipborne Station (open).

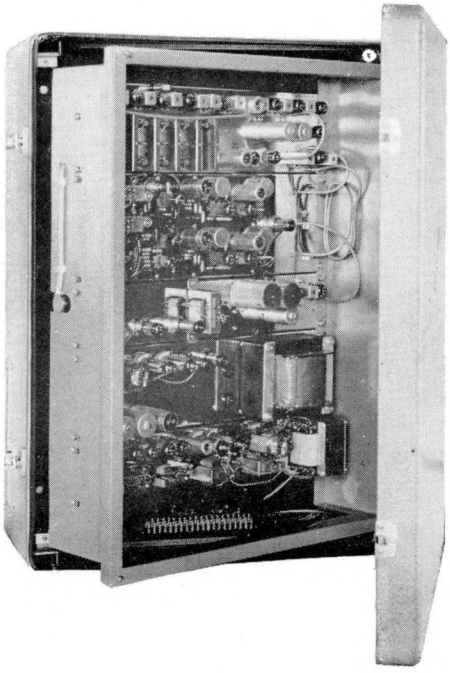

Fig. 5.
Shipborne Station (Service Position).

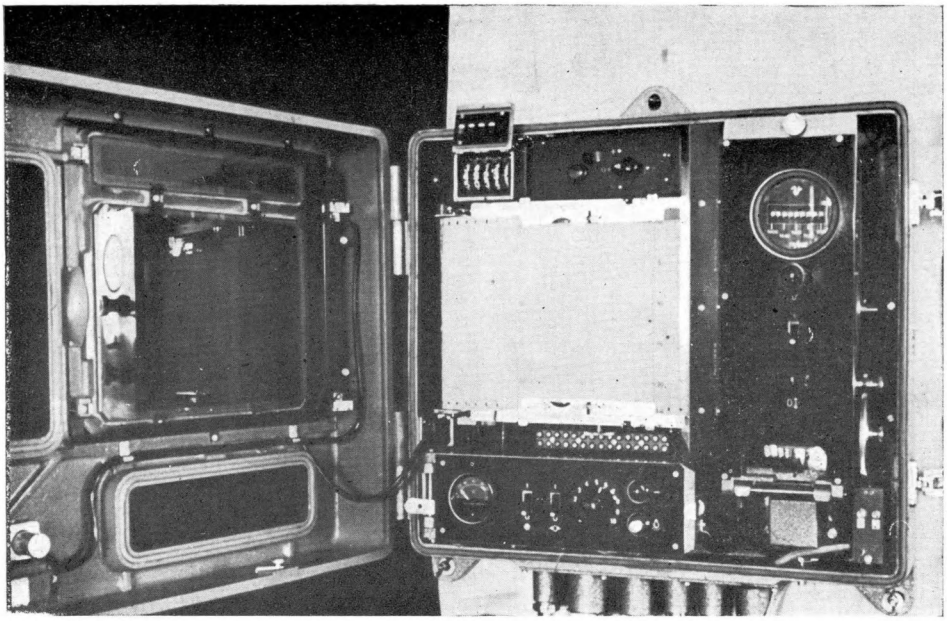

Fig. 6.

Recorder.

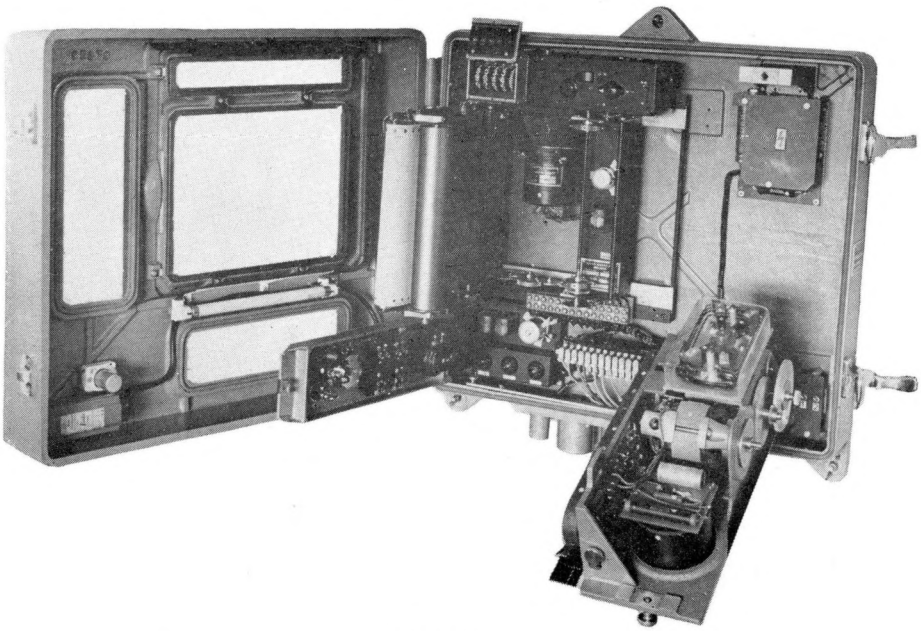

Fig. 7.

Paper support and echo sounder parts swung out.

Fig. 5 shows how the complete chassis can be swung out for any service required.

The servo motor system with its applicable gears is a part of the recorder. This recorder, designated as the Atlas Echolog, is a modification of the ordinary echo sounding Indicator Echograph. In the Echolog the servo motor system's function is to drive the paper transport according to the distance being covered.

Fig. 6 shows the interior of the Echolog :

Paper support, echo sounder part with speed correction.

Fig. 7 shows the same with the paper and the echo sounding parts swung out.

The servo motor system may clearly be seen. The gear box has a 4-position switch :

1) Paper drive with constant speed (choice of 3" or 6" p.m.). In this position the echo sounder can be used in the conventional way without information from the Radiolog. The paper is always moved from the marking stylus on the right hand to the left hand side.

2) The paper transport is controlled by the Radiolog (choice of scale 1/1000 or 1/500). This position is used to drive the paper from right to left when the distance between master and relay station is *increasing*.

3) In this position the paper drive is stopped whereas the mechanical counter which is coupled to the servo motor remains in operation.

4) The paper transport is again controlled by the Radiolog. This position allows recording when the distance between master and relay station is *decreasing*.

The mechanical 5-digit counter which is operated in positions 2 to 4 is not reversible. It always adds when the distance increases and always subtracts when the distance decreases. The counter is calibrated in meters, the last continuously running digit indicating decimeters. The counter can be preset to any desired initial value by hand. It can be reset to the preset value by pressing a button. Moreover, the counter generates different distance lines on the recording paper every 10 and 100 m respectively. These distance lines are related to the preset value of the counter. This is essential for all survey work as the recorded profile can be directly related thereby to fixed measuring points ashore.

A push button type warning lamp indicates any possible fading during the measurement which may happen at the maximum range on account of heavy interference due to reflections.

The relay station has been designed for one-man-portability (Fig. 8) and for 8 hours of daily operation.

The acid-and alkali-resistant glass fiber reinforced plastic box contains all the electric circuits required for carrying out the above-mentioned functions (Fig. 9).

This unit has no external controls except the « on - off » switch, so that it can be operated by unskilled personnel. For giving orders from ship to shore, alternate two-way communication is included in the system. As the same frequencies are used for measuring and communication, it is recommended that the relay station operator be allowed to speak only after receiving a call from the master station. Otherwise he would disturb the measurement.

As the system has no identification, this means that the initial distance between master and relay station is not given by the Radiolog, and must be measured once at the beginning of measurements by other means, for instance by an optical range finder. Normally the counter will then be preset to this distance, whereupon the master and / or the relay station may change their distance at will, the correct value being indicated by the counter.

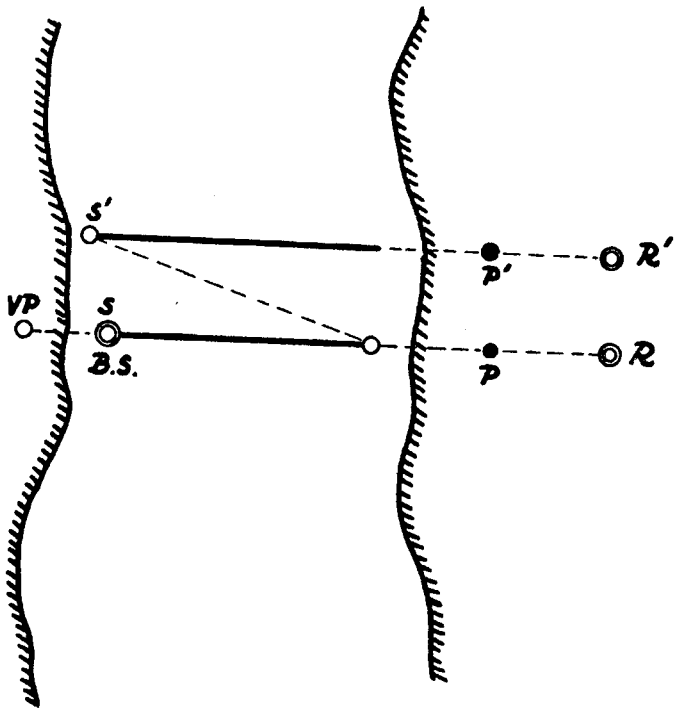

Fig. 10.

Procedure for Taking River Cross-Sections.

A current procedure for taking river cross profiles is the following (Fig. 10) :

The relay station is sited on a known reference point ashore (VP). A ranging rod together with the antenna of the relay station or two station rods (P and R) form a bearing line. The distance between the relay station and the master station is measured by a range finder. Then the recording of the profile is started as soon as the survey vessel has moved into the bearing line (S). When the first profile is finished the vessel goes over to the beginning of the next profile (S' = S prime). In the meantime the relay station and the ranging sticks are also moved to the next site and so on.

A profile can also be measured starting from the other side of the river and *approaching* the relay station. Of course profiles taken in this manner are like a mirror image when compared with those taken by the first direction.

To avoid confusion, however, subsequent profiles should be made in one direction only.

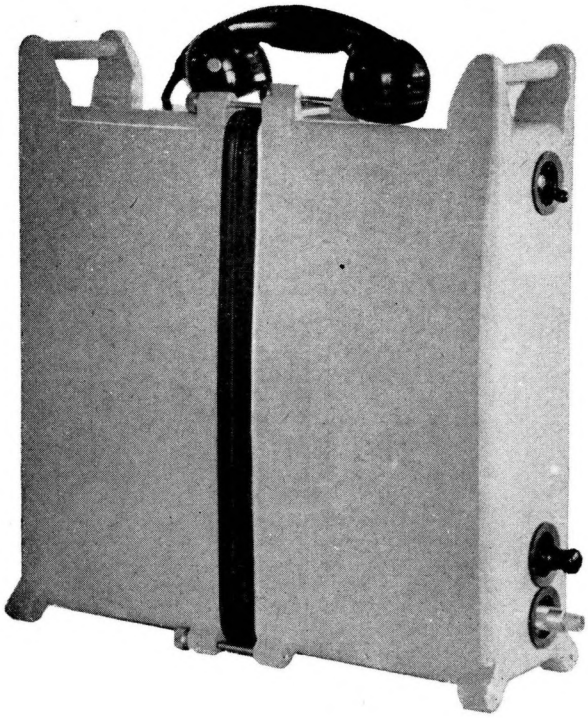

Fig. 8.

Relay Station.

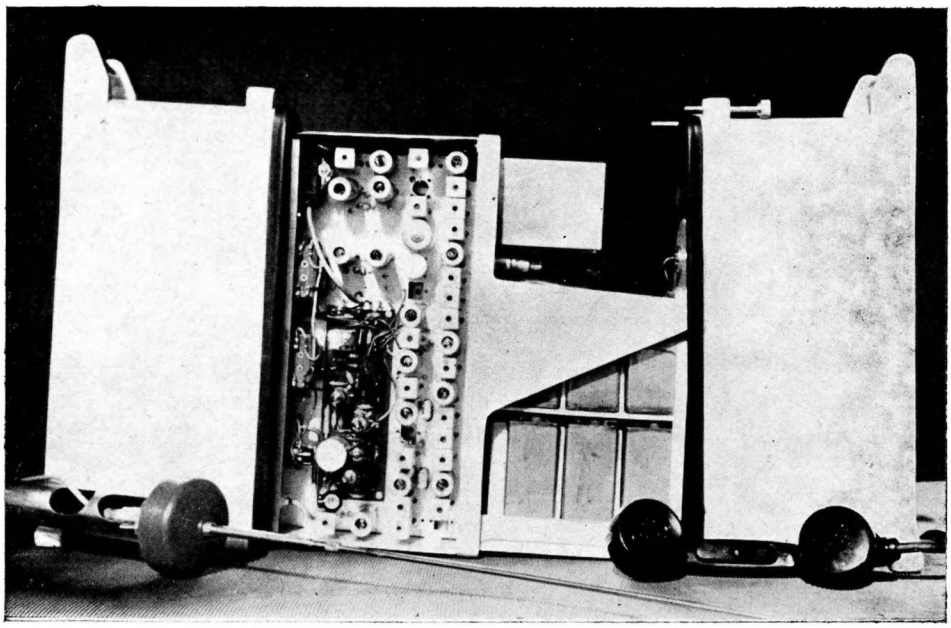

Fig. 9.

Relay Station (open).

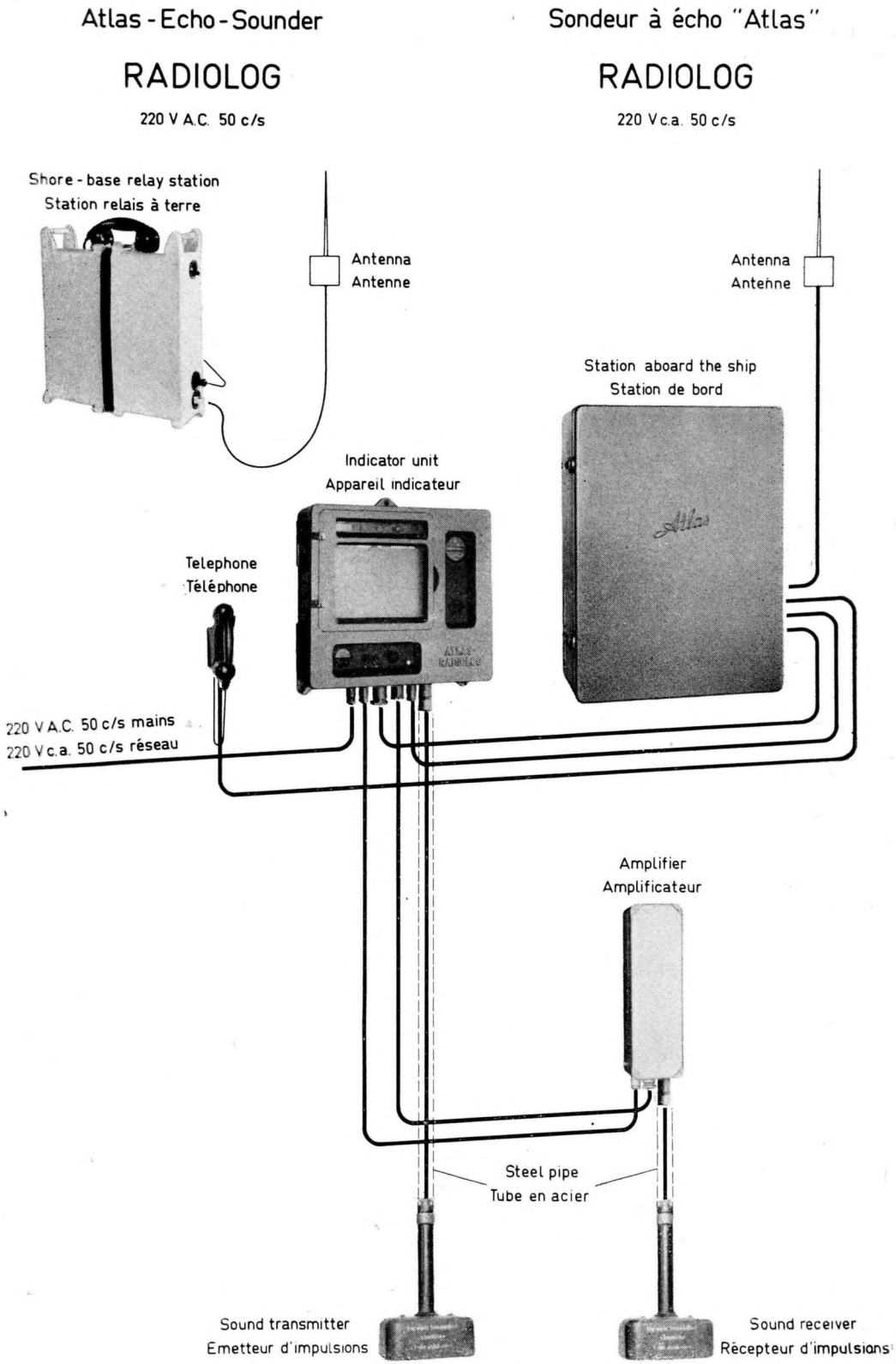
Atlas - Echo - Sounder
RADIOLOG
220 V A.C. 50 c/s
Sondeur à écho "Atlas"
RADIOLOG
220 V c.a. 50 c/s
Shore - base relay station
Station relais à terre
Antenna
Antenne
Antenna
Antenne
Station aboard the ship
Station de bord
Indicator unit
Appareil indicateur
Telephone
Téléphone
220 V A.C. 50 c/s mains
220 V c.a. 50 c/s réseau
Amplifier
Amplificateur
Steel pipe
Tube en acier
Sound transmitter
Emetteur d'impulsions
Sound receiver
Récepteur d'impulsions

Fig. 11.

There is a very simple method of checking the proper operation of the system. Starting at some point with the master station, making any closed loop whatever and returning to the starting point must bring back the counter to the initial value. This has been done very often and after covering a loop of some kilometers the error was less than one meter, thus indicating the very high relative precision of the measurement.

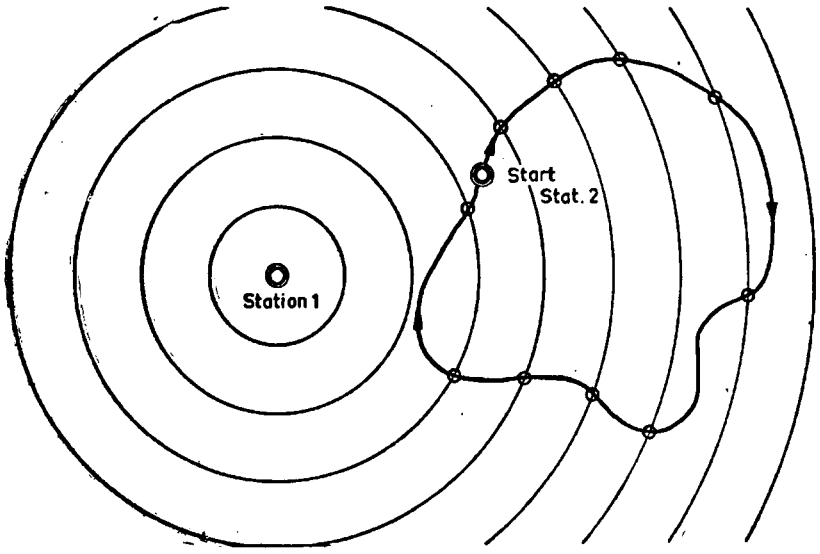

Fig. 10a.

Check of Proper Operation of Radiolog.

Fig. 11 shows the combined units needed for making true profile recordings.

The system can be also extended for measuring in two dimensions using a modified master and two relay stations, but as this is still in an experimental stage it will not be discussed here.