

the telephone circuit worked earth return and the power hum was found to be negligible in the telephone when suitably balanced condensers were used.

Results of Tests:

General: Receiving tests were made for a period of 11 days, from 29/9/37-9/10/37 using both horizontal and vertical aerials.

When transmitting on the horizontal aerial,

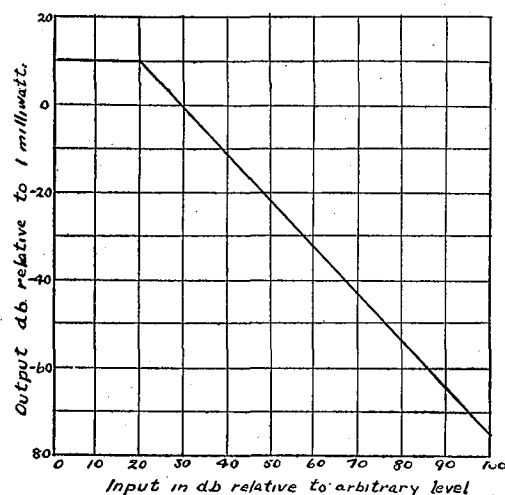


Fig. 8.—Super-regenerative Receiver Noise Level plotted against signal input.

the received level was approximately 30 db better on the horizontal than the vertical aerial. However, when transmitting on the vertical aerial, the received signal was only 10 db better on the vertical than the horizontal. Occasionally when using the vertical aerial for transmitting, the received signal was almost as strong on the horizontal as on the vertical aerial. This would indicate that a change of the plane of polarization was taking place—propagation favouring horizontal polarization.

Aerials: Horizontal polarization (horizontal aerials) proved to be consistently better than vertical polarization, the difference at all times being at least 20 db in favour of the horizontal. In preliminary theoretical investigations it was thought that the horizontal aerial would radiate a large proportion of the energy at high angles to the horizontal (the calculated maximum energy was at 18° to the horizontal). The high value of energy at an angle to the horizontal is caused by wave interference between directly propagated radiation and radiation reflected from the ground, and the above figure of 18° was obtained assuming a flat earth and perfect reflection from the earth. At Tanybryn, however, the ground sloped downwards away from the array and dropped suddenly about 100 feet out, so that the flat earth theory would not apply accurately, and an increased signal in the horizontal at the expense of high angle radiation would be expected.

Fading: The received signal varied in intensity throughout the day but the variations were in all cases of slow period and no distortion was noticed even when the received field was relatively low. At no period during the tests was there a complete absence of signal when transmitting and receiving on the horizontal aerials.

Fig. 9 shows a curve of received field intensity during typical listening periods, and it is of interest to note that the maximum variation expected due to transmitter fluctuations was approximately 1 db.

Effect of weather, time of day, etc.: During the period of the tests the weather had no noticeable effect, but it is possible that seasonal changes may be noticed. This will be investigated by long period observations on the channel.

The signal intensity at night appeared to be the same as during the daytime, the fading noticeable on broadcast and high frequency propagation being absent.

Summary: The tests indicated that communication is possible over distances greater than optical when using a frequency of approximately 40 megacycles per sec. but the long period reliability of such a circuit has yet to be established. The present intention is to instal at Stanley, Tasmania, a transmitter of 200-300 watts power and to take long period recordings

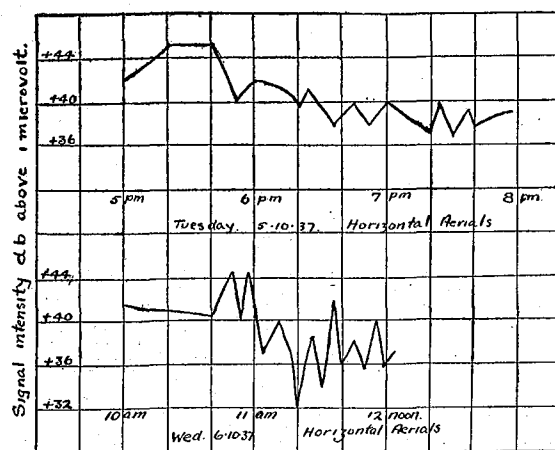


Fig. 9.—Variation of received signal intensity over typical listening periods.

of the field strength received in Victoria. The transmitter will be crystal controlled to prevent any appreciable frequency change, and the receiver will be a superheterodyne type in which the automatic volume control voltage will be used to control the current through a triode tube operating a recording milliammeter. Horizontal aerials will be used at both the transmitter and receiver.

Recently the transmitter and receiver were completed to provide an emergency service, but the tests will be continued.

A SUBMARINE CABLE TRACER

G. N. Smith.

It is almost a platitude to state that submarine cable repairs are expensive. It is therefore important that every effort should be made to facilitate repair work and to make best use of the time for which the repair ship is chartered. As bad weather is the principal cause of delay, any means of using this time to assist the repair is well worth while. This can often be done with the apparatus about to be described.

When a submarine cable is laid, its position is carefully charted and splice sheets are prepared to show the position of splices and the percentage of slack laid over various portions of the route. Owing to tides, currents and submarine disturbances, it is possible for a cable to be moved and so change its course or from similar causes it may be buried. Naturally, either of these effects would increase the time of grappling unless some means is available for detecting the true course of the cable from the repair ship. This facility is provided by the Submarine Cable Tracer which will also show the actual position of an earth fault, thus acting as a confirmation of shore tests. It is particularly useful when land sights are not available for navigation.

Such equipment has been developed by the Research Section of the British Post Office and has been applied to our own requirements for work in Bass Strait, both on the telegraph and telephone cables. The essentials are a low frequency generator and a pair of search electrodes

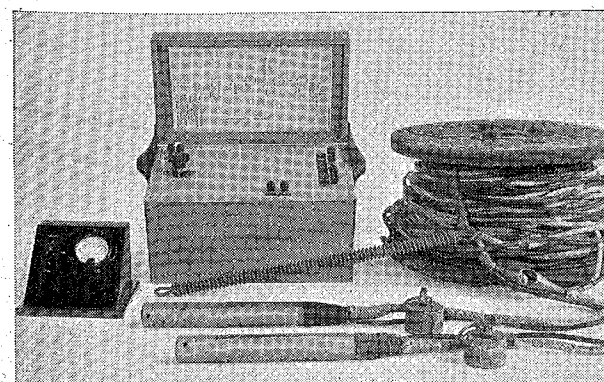


Fig. 1.—Cable Tracer Equipment.

to which are connected a tuned amplifier and galvanometer, these being shown in the photograph herewith. It has been shown that the lower the frequency, the greater the sensitivity of the method. A 16.5 p.p.s. generator with an output of 250 m.A. is connected to the cable and earth at the cable hut so that current paths follow the cable route between the hut and the earth fault (or earth connected to far end of cable) in a fashion similar to lines of force be-

tween two unlike magnetic poles. The paths may be considered as parallel to the cable except near the fault and there are equipotential surfaces perpendicular to these paths, the right angles to the cable.

Any two electrodes in the current path have a potential difference between them provided they are not both in an equipotential surface. The measurement of potential difference is consequently made along the line of these equipotential surfaces, the maximum deflection being obtained when over the cable. It is not necessary, however, in practice for the electrodes to be exactly along the line of the cable, any deflection up to an angle of 40 degrees being generally satisfactory. A correction is then applied to the reading by multiplying by cosine of angle of deflection.

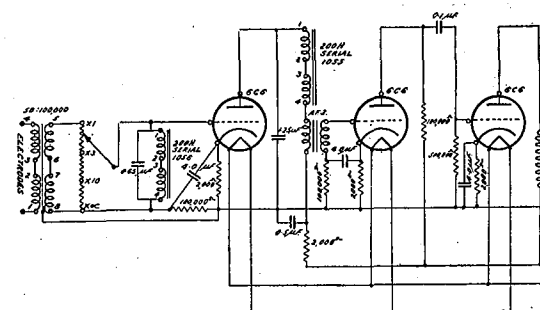


Fig. 2.

to reduce the observed reading to a deflection along the line of the cable. As the ship progresses along the cable towards the earth fault the deflections increase rapidly as the ship approaches and cease abruptly beyond it.

The electrodes may be towed "in line" at a distance of 10 fathoms behind the ship or, as is now preferred by the British Post Office, "abreast" of the ship by booms over the side so that they are in line at right angles to the ship. In the latter case it is necessary, of course, for the ship to cross and re-cross the cable approximately at right angles.

These electrodes consist of two brass rods, each 10 fathoms long, with a separation of 10 fathoms between electrodes. Electrical contact is maintained by means of cable-type connectors. In the case of the "in line" method the electrodes are connected to a draw-bar spring and the electrodes are weighted, thus preventing movements and consequent spurious deflections on the amplifier galvanometer. The British Post Office is now experimenting with electrodes which are deeper as the towing speed increases thus reducing the tendency for the electrodes to rise from the surface. It has been shown that the sensitivity of the method is independent of the depth.