Battery-Call Railway Telephones

BATTERY-CALL Telephones find special application on Railway Systems. The natural development of the telephone network linking the various sections of the traffic-handling departments has followed these lines, because they best provide the particular class of service demanded with flexibility and economy. Thus special types have been developed to meet the requirements of various classes of circuits, operating conditions, etc., and these become known as Railway Telephones on account of their prime application.

Battery-Call Railway Telephones are made in various types ; with bell, or for use with external bell ; with single ringing key, or with two keys serving code and selective ringing ; with relays of various resistances for use on long distance and heavy omnibus circuits ; or designed for use in exposed positions and by inexperienced operators. These telephones are exceptionally robust and capable of long service even in unfavourable situations ; they incorporate those points of refinement and attention to detail resulting from close collaboration with the engineers of the Railway Companies coupled with Ericsson's unrivalled experience in this field. The instruments are designed to facilitate periodical maintenance inspection, and the moving parts are so arranged as to permit cleaning and adjustment should this be necessary.

For local working a typical instrument has a solid-back transmitter, " Bell " receiver, 100-ohm trembler bell and a ringing button which is fitted on the front of the case. The lightning arresters are fitted with Ericsson patent anti-dust and insulation step carbons. In general appearance this instrument is very similar to that shown in fig. 5, except that the transmitter is fixed direct to the front of the case as in fig. 4, and the position of the ringing button is as stated.

For economy of battery and the maintenance of good speech on long or heavily loaded omnibus lines it is necessary to use sensitive and comparatively high resistance relays for calling. Engineers usually find it convenient to adopt two standard resistances for use on their long circuits, chosen according to the type of circuit, etc. Some companies have adopted 1,000Ω and 5,000Ω, others 3,000Ω and 10,000Ω as being the most suitable. Although higher resistance relays can be supplied for special conditions, in general it is not economical to exceed 10,000Ω. As an indication of the relative impedance figures the following typical values, obtained at 800~ with 1.5V. impressed, are given.

1,000Ω	Relay	Z = 20,000Ω
3,000Ω	,,	Z = 65,000Ω
5,000Ω	,,	Z = 100,000Ω
10,000Ω	,,	Z = 125,000Ω

For traffic control there are two general types of circuits, namely, main control trunks, and local control.

Control trunks connect the various District Control Offices to the Divisional Control Office, and the efficiency must be kept as high as possible because the number of stations in bridge probably average six, with lines up to say, 150 miles in length, and also on account of the composition of the circuit which varies with circumstances.

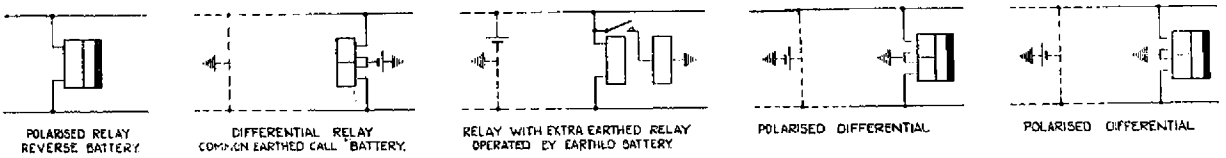


Fig. 1.—Various Methods of Selective Calling

The composition of three typical circuits employing instruments with 5,000Ω relays is tabulated below.

The varying conditions peculiar to railway routes, such as, tunnels, viaducts, congested industrial areas, etc., necessitate the introduction, at intervals, of cable sections into the aerial line.

	Circuit 1	Circuit 2	Circuit 3
	Miles	Miles	Miles
Total length ..	177	141	65
Length, 200 lb. aerial	162	139	52½
Length, 40 lb. MTLC cable ..	15	2	12½
Number of Cable Sections ..	30	17	28
Number of stations ..	8	10	5

Owing to heavy reflection losses, due to the numerous cable sections being irregularly inter-spaced and varying from 100 yards to a mile or more in length, high efficiency telephone instruments are essential.

Ringing is by loop battery with code calls for the ordinary control offices and reverse battery selective call for the main office.

Local control circuits connect the signal boxes, depots, etc., to the District Control Office. The circuits are much shorter, but are generally very heavily loaded, the average number of instruments being between 15 and 20, although as many as 35 stations have been connected in some cases, so that an instrument with a high resistance relay is required. Ringing is again by code call with loop battery. Where more than one selective call is required, as with two District Control Offices or an Exchange, any of the arrangements shown in Fig. 1 may be used. These are self-explanatory.

In some cases the traffic is so great that it is not possible to allow intercommunication between the sub-stations, and the circuit therefore is made " control only " by using polarised relays at the sub-stations and an ordinary relay at the control office as shown in fig. 2; or as in fig. 3, using a differential relay and earthed battery at the main station, the former being operated by earthing both lines with the call key at the sub-station. The sub-station instruments are code called from the main by loop battery to ordinary relays in the usual manner.

Instruments with relays are of various types to meet service requirements, but certain features are common to all types. Relays are usually placed on the inside of the hinged cover for accessibility, and are provided with dust covers.

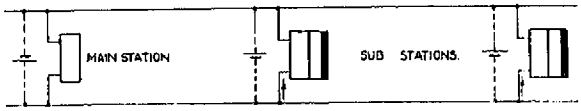


Fig. 2.—One Method for " Control Only " Circuits

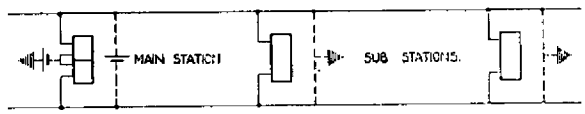


Fig. 3.—Alternative for " Control Only " Circuits

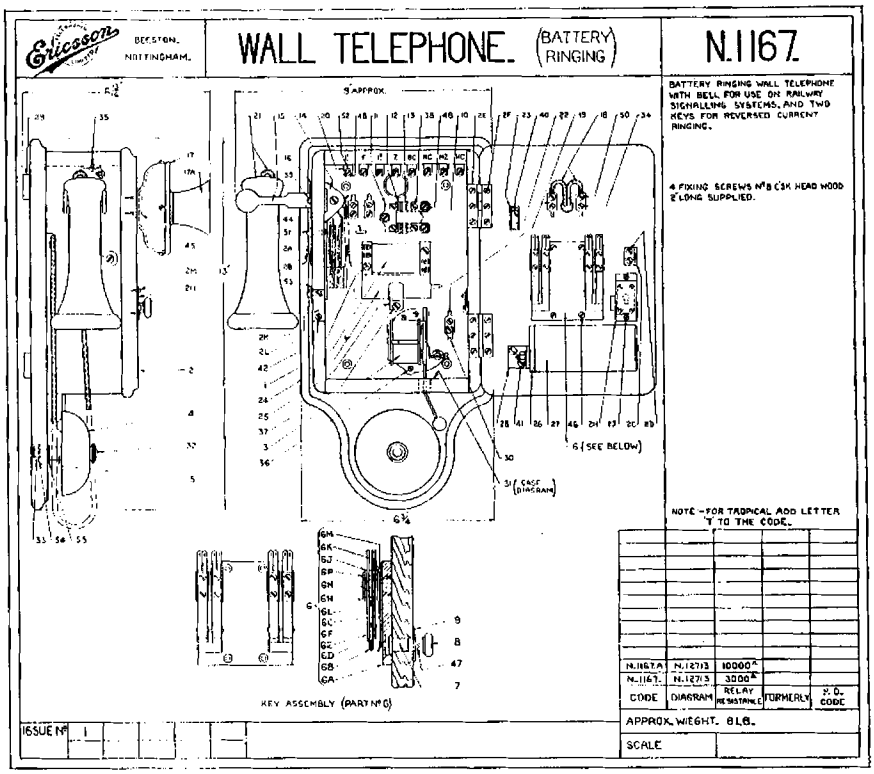
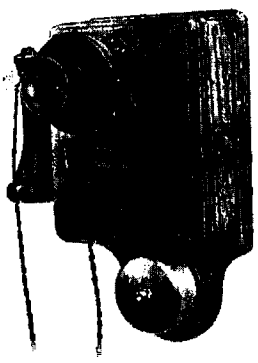


Fig. 4.—Assembly Drawing of a Railway Telephone

One type is shown in fig. 4 in the form of a drawing and is very similar to the local working instrument previously described, but a relay and two calling buttons are fitted. This style of assembly drawing, size 8" x 10", is supplied to customers so that they can readily refer to or order any of the component parts, by stating the code number of the particular instrument in use (given in the table at the bottom right-hand corner) and the number of the arrow-headed line pointing to the item required.

Another type for a similar service has a single three-position lever key which is used for calling instead of press-buttons; a watch pattern receiver and an underdome bell are fitted but lightning arresters are not normally provided.

Two instruments of note are shown in figs. 5 and 6. The former has a solid back transmitter, "Bell" receiver, latest type induction coil combining maximum efficiency with economy of space, and an underdome bell. The relay is normally 5,000Ω and is adjusted for an operating current of 2mA. The single ringing button is conveniently mounted on the right hand side of the instrument.



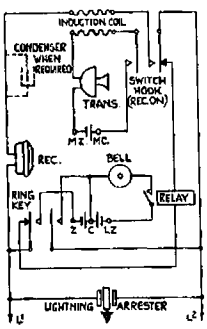
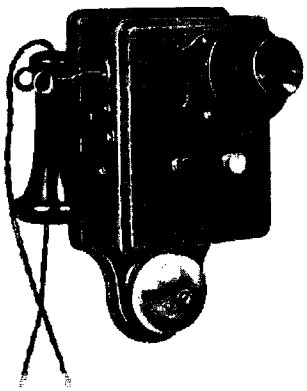


Fig. 5.—Single Button Telephone and Circuit



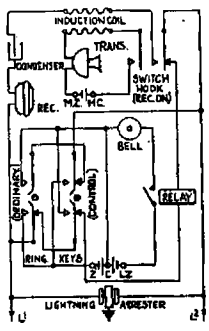


Fig. 6.—Double Button Telephone and Circuit

The latter has two coloured buttons on the front and the relay is either as just described for a code-called station or polarised for a selected station. The polarised relay carries twin dome contacts and is adjusted to operate on 2mA in the correct direction and not to operate with 15mA. in the reverse. Although the polarised and non-polarised relays do not mount on the same fixing centres, the mounted "relay and bracket" of either type is interchangeable.

For use with an external bell, a set very similar to Fig. 5 is available. It is fitted with a relay, also a single press key at the side but no bell. All these instruments have arresters with treated carbons.

The extension of automatic signalling has increased the demand for an extremely robust instrument for use by enginemen and others in normally unattended positions. Such a set must be consistently reliable, weatherproof, simple and immune from damage due to unskilled or rough handling.

In the instrument shown in fig. 7, the results of our long experience of heavy duty sets for use in mines and similar unfavourable situations have been embodied. A stout cast metal case houses the components, the connecting cable entering through a watertight gland to prevent ingress of moisture. The hermetically sealed replaceable capsule transmitter is mounted inside the front and protected by a grille. The receiver is also fixed inside the case and an extension flexible metal tube and earpiece are fitted externally. The flexible tube has a stout strain cable to prevent damage and a soft leather pad is fitted on the earpiece.

The ringing and speaking key is operated by a lever handle conveniently located on the right hand side of the case. The key with its cable arm is so arranged that it can be removed from its position and swung out for cleaning or adjusting the contacts without disconnecting the wiring from the key.

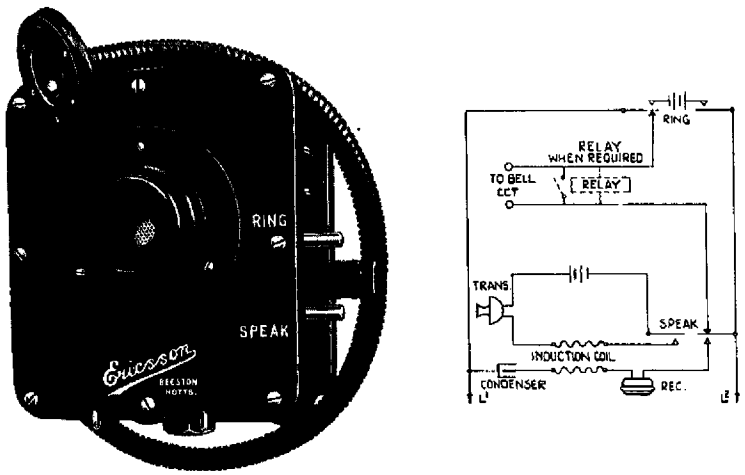


Fig. 7.—Metal Cased Telephone and Circuit

The induction coil and the receiver coils are impregnated to render them immune from the effects of moisture.

A relay can be fitted if required by removing the flat cover plate on the top and mounting the relay and a cover in its place. The wiring is so disposed as to render such a conversion a simple matter.

The case has two flat iron bars for mounting the instrument on a wall or on a wood frame. The front of the case is hinged on two rings and swings down when opened. The case is heavily enamelled black with the raised directions lettering picked out in white.

As in this publication it is only possible to give brief descriptions of the main types used in this important section of railway telephone communications, an outline has been given to indicate the general field of design.