

## A Battery-Call Telephone for use in Incendive Atmospheres.

ELECTRICAL apparatus designed to prevent ignition of inflammable vapours in the surrounding atmosphere has in the past been intended primarily for use in coal mines, since coalmining, almost alone in industry, provided situations where electrical apparatus was required and such vapours were present. With the growth of industries in which highly-inflammable gases either occurred or were employed, and with the increasing use of electrical appliances in such industries, attention became directed to the design of apparatus which could be certified as safe for use in atmospheres containing gases other than that chiefly encountered in mines—methane (fire-damp). The Mines Department of the Home Office have for some time employed pentane (petrol vapour) as the medium for testing electrical apparatus submitted for their certification and it is hoped that research at present proceeding will reveal other gases which may be taken as typical of groups of gases encountered in industry.

Telephones, no less than electrical apparatus in general, have been the subject of special study to render them suitable for use in dangerous situations. A range of such instruments, certified for use in inflammable atmospheres, was described in Vol. 5, No. 2, 1935 of this Journal by an article which defined also the modern conception of safety measures as expressed

in apparatus termed "intrinsically safe". The differences between apparatus *intrinsically safe* and *flameproof* were then given and may be summarised here. Equipment is certified as flameproof when gas ignited by a spark within the equipment cannot pass to the outer atmosphere without traversing paths of prescribed dimensions which ensure adequate cooling. Intrinsically safe apparatus, on the other hand, is incapable of producing a spark of sufficient heat content to ignite an inflammable mixture.

The telephones already referred to are both flameproof and intrinsically safe since they are developments of types which had been of a flameproof construction giving general robustness. A new instrument, however, has now been added to the range and has been designed to be intrinsically safe only, since intrinsic safety obviously suffices under all conditions of external atmosphere provided that intrinsically safe electrical apparatus be used throughout and the strength of structure normally associated with flameproof construction be maintained as a safeguard against rough usage.

A further respect in which the new telephone differs from those already described is the important one of the method of calling, the hand-generator of the magneto-calling type being displaced



**Fig. 1.—**Battery-call Mining Telephone Cat. No. K8090 (before particulars of certification were added to cover).

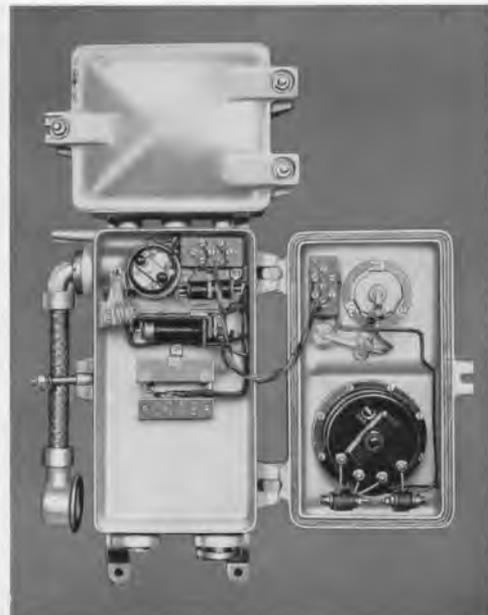
by a calling key and local battery. The advantages of the battery-call telephone will be referred to as the features of the design which give rise to them are considered.

The telephone (G.E.C. Cat. No. K.8090) is illustrated in Fig. 1. It consists of a case cast in an aluminium alloy to a British Standard Specification and finished in grey enamel. The properties of the metal enable accurate castings to be made of considerable strength and low weight. The set incorporates a standard British Post Office type receiver and transmitter, the former fitted with a flexible listening tube and the latter built into the cover. Also fixed to the cover are a high-frequency hooter and calling key. The use of a hooter gives a much better signal than is obtainable from the usual trembler or magneto bell, since the high-frequency note has considerable penetration. Flanges

to the hooter deflect the sound waves and give an effective signal over a wide area. The convenience of a key as a calling device is increased by the pattern of knob, which is of generous proportions.

The battery is housed in a separate compartment bolted to the main casting, the covers for both being fitted with hemp packing to render the instrument watertight. The wires from the battery compartment pass into the main compartment through a simple watertight gland, whilst for the line wires two alternative glands are provided, one for armoured cable and the other for rubber cable.

In the interior (Fig. 2) are mounted the receiver, anti-side tone induction coil, switch, relay and condenser, together with terminals for the line wires and leads to an extension bell, if the latter should be required. The induction coil is similar



**Fig. 2.—**Open for inspection.

to that employed in the Gecophone anti-side tone circuit, and its use is an obvious advantage in an instrument likely to be in service in noisy situations. The switch, operated when the listening tube is raised, is of a robust pattern and designed to minimise possibility of surface current leakage. The relay, as a potential source of sparking when the circuit of its coil is broken, is fitted with a copper slug which dissipates in eddy currents the energy of the back-e.m.f. Fixed to the inside of the cover are two metal rectifiers, the purpose of which is one of the interesting features of the circuit operation.

The circuit diagram is given in Fig. 3. Calling is effected by operation of the key, which connects the local battery to the line. In the called telephone, relay L responds and at contact L1 operates the hooter. Current over the line has therefore to operate only the relay, whereas in the magneto telephone, ringing current received is required to operate the bell. The strength of signal in the latter case thus varies with line resistance and number of instruments connected, but is independent of both in the battery call telephone, provided that the line current is sufficient to operate the relay. With twenty telephones in parallel on a 50 ohm line, all relays will operate when a 24 volt battery is applied.

A spark-quench circuit across the hooter is provided by a dry-plate rectifier in

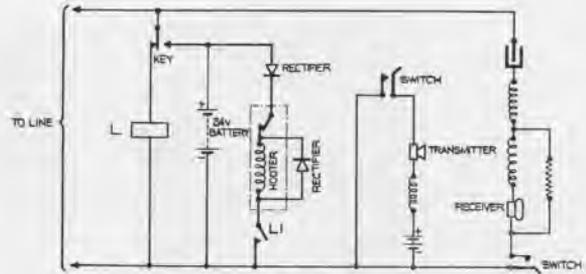


Fig. 3.

parallel with the coil, giving a closed circuit in which the energy of self-induction is dissipated. To achieve this effect it is necessary that current through the coil when battery voltage is applied be in a given direction. This is ensured by the rectifier in series with the coil.

The battery for calling over the line and for operating the hooter is of the primary type having a nominal terminal P.D. of 24 volts. A special 24 volt battery (G.E.C. Cat. No. L.4900) has been designed and is certified by the Mines Department as intrinsically safe since special means have been incorporated to limit the current under short-circuit conditions to a safe value. As already mentioned, the battery is accommodated in the upper case, which also houses a separate 3-volt battery energising the transmitter circuit.

With development work complete and manufacture now proceeding, it is anticipated that this new telephone will meet a need not only in mines but in other situations where danger from explosion exists or robust construction and water-proof properties are required.

