



THE telephone is, by its design, a harmless instrument. Its potentials are low, and its current-carrying parts are enclosed and out of the user's reach. Unusual voltages and currents, if any are to be anticipated, are excluded by station protectors. Small sparks at contacts create no hazard in normal atmospheres. Occasionally, however, telephone service is wanted where an explosive atmosphere may be present, as in gas works, oil refineries, or chemical plants. For such locations, a telephone set of the manual type was developed some years ago. The switchhook contacts were enclosed in a small cylinder, the induction coil potted, the terminals protected, and other precautions taken. This set\* has proven entirely satisfactory, and later an enclosed dial was developed to make dial service also possible in explosive atmospheres. More recently, however, the demand for telephone service in places where explosive atmospheres exist has increased. It seemed desirable, therefore, to design a compact set that could be used for either manual or dial service. The 320 type telephone set, shown above, is the result of this work.

\*RECORD, June, 1934, p. 297.

## A Telephone Set for Explosive Atmospheres

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The principle on which the design is based is to install all of the apparatus except the handset, the finger-wheel of the dial, and the gongs in a strong and tightly closed housing. Although this housing is not gasproof, it is so strongly made that should explosive gases enter it and be ignited, the housing would remain intact, and the high pressures built up inside as a result of the explosion would escape

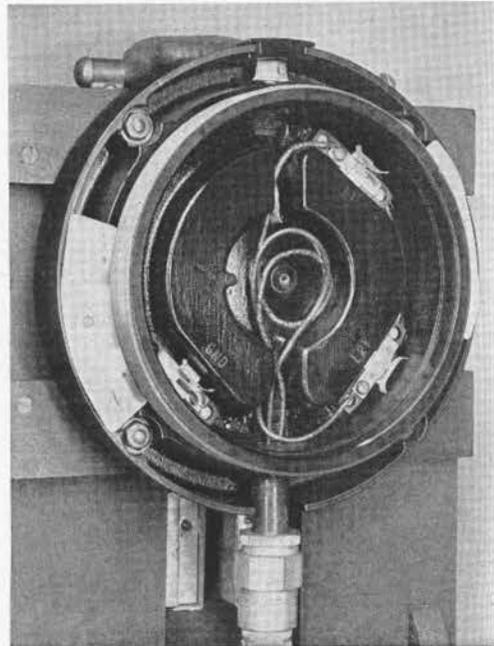


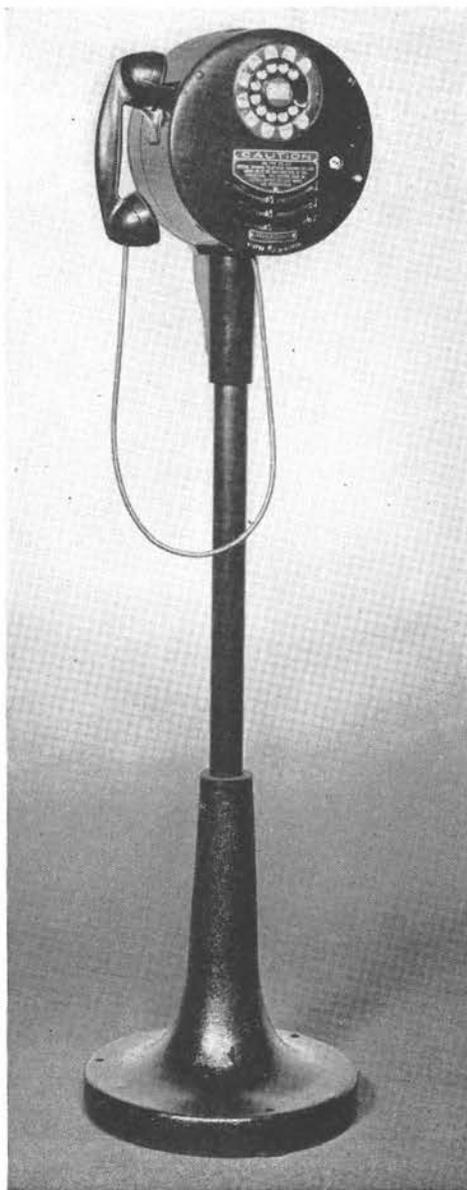
Fig. 1—The base of the new set provides termination for the wires and is designed to support the housing and to mount on a wall, either directly or by use of a backboard

over so long and restricted a path that the gas would be cooled below the combustion temperature before reaching the outside. A modified handset is also provided, and additional precautions were built into it so that during installation and maintenance explosions would not be created by sparks or arcs originating in the handset.

The set provided is cylindrical in shape and built in three parts: a base, a housing, and a face plate. The handset forms a fourth part of the complete set.

The base, shown in Figure 1, is designed for supporting the housing and for mounting on a wall, either directly or by use of a backboard, or on a pedestal-type support, shown in Figure 2. It also provides three spring terminals for the two line wires and the ground conductor, and a conduit entrance at top and bottom, into either of which the conduit carrying the wires may be screwed. Rigid conduit installed in accordance with the requirements of the National Electrical Code for hazardous locations must be employed, but none of it forms part of the set. The base carries an externally threaded annular projection to which the housing is screwed. It also carries two springs, which when compressed by the housing prevent lateral movement due to thread clearance. A small cavity in the center of the base provides space for storing slack wire, and is covered with a metal plate after the wires have been connected to the spring terminals.

The housing is of the same external diameter as the base and houses all the apparatus in a way to minimize unoccupied space and thereby reduce gas volume. As viewed from the back, it appears as shown in Figure 3. It

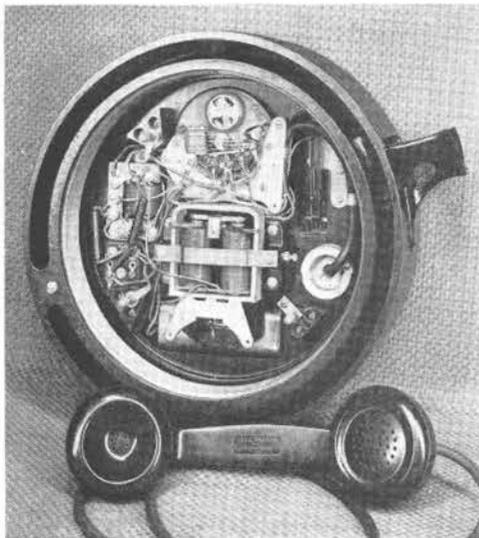


*Fig. 2—Where more convenient, the set may be mounted on a pedestal*

has an internal thread for fastening to the base, and three contact studs which make contact with the spring terminals when the housing is screwed in place. Although the wall of the housing is of ample thickness at all points, the front is of irregular shape

since it is designed to provide cavities for the various pieces of apparatus. It is hidden by the cover, however, and so the set presents a smooth appearance from the outside.

Both the dial mechanism and the ringer are within this housing, but the dial fingerwheel and the gongs and

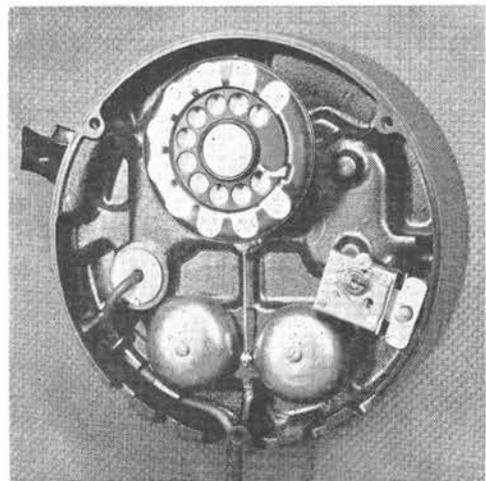


*Fig. 3—The housing includes all the apparatus, and screws to the base*

clapper of the ringer are mounted on the front of the housing as shown in Figure 4. The dial fingerwheel is carried on an auxiliary shaft passing through a long, close-fitting bearing, and inside the housing is connected to the regular dial shaft through a linkage member that compensates for misalignment of the two shafts. The clapper for the bell is operated through a similar shaft and bearing. While these bearings are not gas tight, their clearance is so small and their length so relatively long that burning gas, escaping under the pressure of an explosion within the housing, will be cooled below the ignition point before it reaches the outside.

A pin, used as a link between the handset-supporting hook on the outside of the housing and the associated contacts within the housing, passes through a similar close-fitting bearing.

The face plate, which is shown in the photograph at the head of this article, serves to conceal the irregularities in the front of the housing and to protect the fingerwheel and gongs. It is fastened to the housing by three screws, and is slotted over the gongs to let the sound out. It also covers the lock, which is mounted on the front of the housing. The bolt of the lock, when in the locked position, retains a long steel pin, which passes through the housing outside the ex-



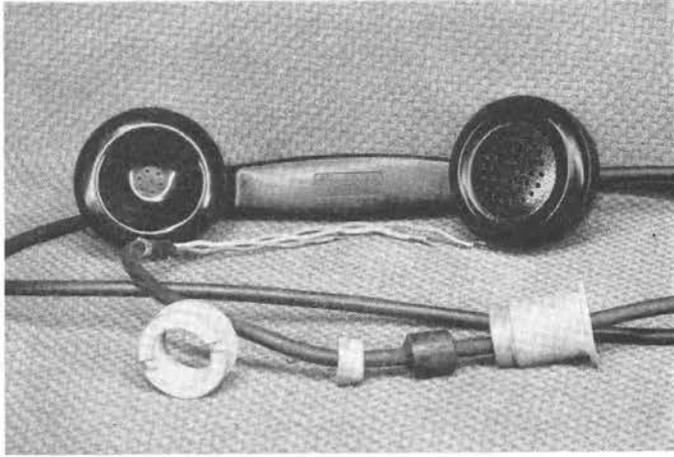
*Fig. 4—The gongs and dial fingerwheel are mounted on the front of the housing under or within the face plate*

plosion chamber, and into a recess in the base. With the pin in the locked position it is impossible to turn the housing, and thus it cannot be removed without unlocking.

In installing the set, the base is first fastened to the wall, the conduit run to it, and the wires pulled in and fastened to the spring terminals. The

housing is then screwed on, which brings the three contact studs on the housing into contact with the spring clips in the base. The length of these studs is made such that they will not engage or disengage the clips except when a sufficient number of threads are engaged to prevent flame passing to the outside.

The handset, shown in Figure 5, is connected to the housing by a rubber-insulated



*Fig. 5—The handset is connected to the housing by a rubber-insulated cord through a rubber-sealed clamp*

cord, which passes into the housing through a rubber-sealed clamp removable only with a special tool from inside the housing. The handset is of such construction that if gases seep into it and are ignited, no flame will be propagated to the surrounding atmosphere. To accomplish this a special transmitter unit is employed, and it, together with the receiver unit and cord, is so assembled in the handle that it is not feasible to replace them in the field. When any part of the handset becomes defective, therefore, the handset and cord assembly must be replaced as a unit. Since this requires the removal of the housing, the circuit to the cord is broken before the cord can be disconnected.

Since the set is designed to withstand an internal explosion, the base and housing are made of a high-tensile strength alloy and are strengthened

by stiffening ribs. In this way a large factor of safety is secured. Special finishes and treatment of the component apparatus and parts are used to minimize deterioration due to corrosion, since the places where these sets are used frequently have corrosive as well as explosive atmospheres. Resistors are shunted around the condensers in the ringing and receiving circuits to dissipate any charge that otherwise might remain on the condensers. This avoids the possibility of a spark from the release of the charge when the set is opened. Special fuse protection, which is always installed remote from the explosive atmosphere, has also been designed for use with the set as an additional safeguard. This telephone set has been tested and listed by the Underwriters' Laboratories for certain specified atmospheres.