

## The Switching Bell Set.

THE origin of the simplest form of extension working is to be found in an ordinary switch or key employed in magneto systems to extend an exchange line from one subscriber's instrument to another. The efficiency of this arrangement was improved later by the addition of an extra bell at the main station. A more elaborate switch connected this bell across the disengaged line when the main station was in communication with either the exchange or extension, thus preventing the loss of calls.

With the introduction of C.B. systems came certain modifications to the subscriber's equipment in order to provide for ringing and speaking between the extension and main telephones. At each point a hand generator was fitted and at the main station two primary cells to supply speaking current. The essential equipment for the main station thus included a standard C.B. telephone, hand generator, extra bell, switching key and the battery. It was very necessary to assemble these parts in the most compact form and the immediate result was the development of a combined type of telephone in which was fitted the whole of the main station apparatus except the extra bell and battery. From an economic aspect, however, an instrument of this class did not possess the same appeal as the use of an ordinary telephone with an auxiliary unit incorporating the bell, switch and generator. The Switching Bell Set was therefore designed and when the installation

of one extension to an existing line was desired, it was necessary to add only at the main station this unit and the speaking battery. The equipment at the extension consisted of a standard C.B. telephone together with a hand generator mounted in a suitable case.

In order to indicate at the main station the condition of the line after switching the exchange through to the extension, a further device was introduced whereby a visual signal was displayed for the duration of such a call. This signal or indicator was included in the Switching Bell Set and was automatically restored to a normal position at the termination of the call.

The present form of Bell Set used extensively by the British Post Office and other Administrations for providing one extension to a subscriber's line is shown in Fig. 1. This unit operates on the principles described and is suitable for use with standard types of subscriber's telephones on C.B., C.B.S. and automatic systems. It is designed for wall mounting, the component parts being assembled in a polished hardwood case.

On the hinged front are fitted the indicator and switching key, two of the main parts on which the reliability and efficiency of the bell set depend. The Indicator is of the self-restoring type showing a white "flag" when operated and is mounted behind a glass screen which renders the movement dust-proof.



Fig. 1

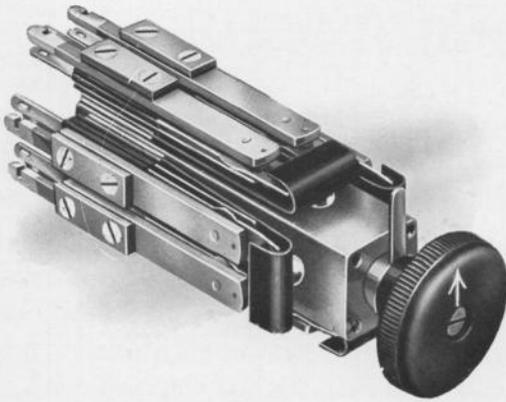


Fig. 2

Whilst providing this visual signal it also performs the function of a relay, contacts being operated by the armature to effect necessary circuit changes.

The switching key is of the G.E.C. patent type illustrated in Fig. 2. Designed specially for use with this bell set, it is positive in action, simple in operation and exceptionally robust in construction. The contact springs which may be built up in any desired combination to meet various requirements are actuated through steel balls operated by a countersunk cam shaft. Powerful master springs ensure unison in movement of both banks of contacts on each of the four faces, smooth action and stability being guaranteed by a generous bearing surface on the chief moving part. The key is definitely fool-proof and no action by the operator can influence the contact pressure or produce false circuit conditions. Absolute accuracy in the machining of the cam shaft and the adjustment of the springs to provide "make before break" contacts on all switching operations affecting the exchange line exclude all possibility of momentary disconnections. When the bell set is used on automatic systems this point is of the greatest importance.

The ringer is also mounted on the front of the set, the condensers and generator being fitted inside the case. These components are of standard British Post Office types of proved efficiency and by reason of their quality and robust character contribute in no small degree to the exceptionally long service life of the complete unit.

Fig. 3 shows in diagrammatic form the circuit conditions corresponding to the four positions of the switching key when the bell set is installed on an automatic system. In this case it should be noted that a condenser is introduced in the generator unit at the extension. In the first or normal position of the key, the main telephone is connected directly to the exchange, the auxiliary ringer being bridged across the extension line. The main station is thus prepared to receive a call from either point. For discriminating between the two ringers special gongs giving a distinctive tone are fitted on the switching bell set.

In the second position the key reverses these conditions by placing the auxiliary ringer across the exchange line and establishing connection between the extension and main telephones, the microphone battery being introduced in series with the line.

When an exchange call received at the main station requires extending, the key is moved from the first to the third position. This effects the same connection between the main and extension telephones as in the case of the second position but leaves a loop across the exchange line to hold the incoming call. For this purpose one coil of the ringer winding in the switching bell set is utilised.

The fourth position of the key gives a "through" condition between exchange and extension and is reached from Position 2

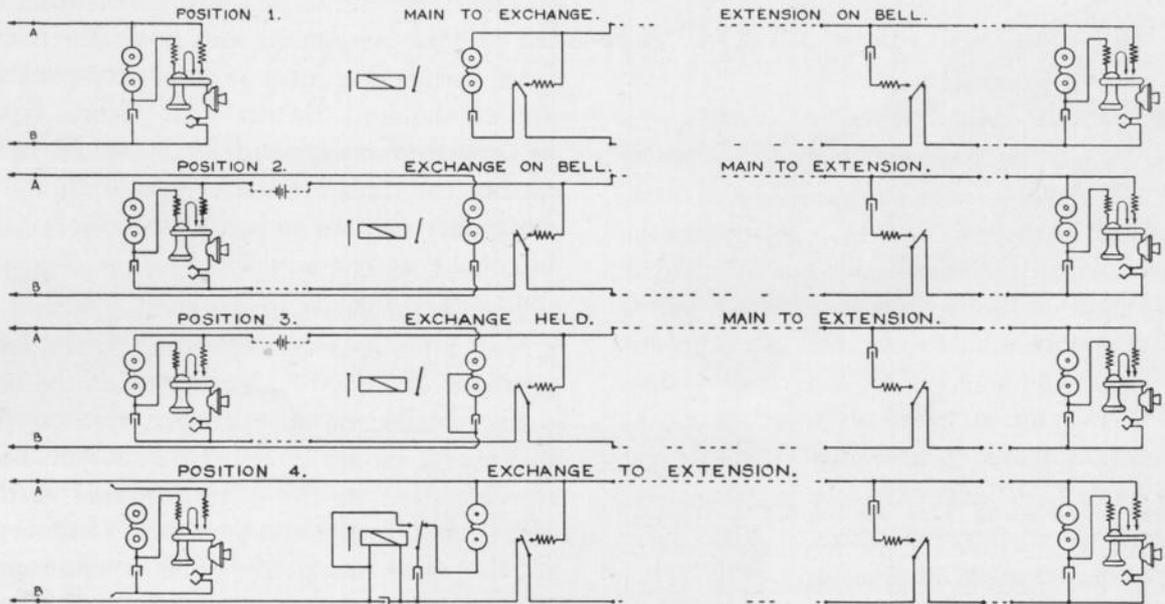


Fig. 3. Switching Conditions

when a call is originated by the extension or from Position 3 in the case of an incoming call. The method of introducing supervision of "through" connections at the main station is ingenious yet simple. Reference to Fig. 3 (Position 4) shows the indicating relay in circuit prior to the removal of the receiver at the extension. When the loop is completed preparatory to dialling or after the extension of an incoming call the indicator is operated and the visual signal displayed. At the same time the normal contact is broken, thus disconnecting the auxiliary ringer at the main station and removing this bridge from the line. The extension dials through the indicator which, being of the slow release type, ensures sufficient delay to prevent the normal contact being made during the short breaks in the circuit. The signal and ringer in the

switching bell set are therefore unaffected by this operation and the "engaged" condition is uninterrupted. When the loop is broken at the end of a call, the indicator returns to normal and again brings the ringer into circuit. Even if the key is not restored immediately to the first position, further calls from exchange or extension are then received at the main station.

Secrecy is usually demanded by the extension and in Position 4 the main telephone is normally disconnected. Provision is made, however, for the addition of this instrument in parallel by the insertion of straps between two pairs of terminals in the switching unit. In the case of non-secrecy the key serves the further purpose of disconnecting the ringer of the main telephone in order to maintain the highest possible efficiency of the line.

