In Position 3, springs 1, 2 and 3 are operated. One coil of the magneto bell is connected across the exchange line to provide for the retention of the loop while the main telephone is connected to the extension line. The necessity for this condition arises when the main telephone receives an inquiry which necessitates consultation with the extension before replying.

In Position 4, springs 4 only are operated. The extension instrument is connected directly to the exchange line, but the Relay 257*A* is inserted in series with the *B*-wire. At the conclusion of the conversation, when the extension telephone receiver is replaced, the circuit is disconnected and the indicator, which has been operated while the call was in progress, falls back to normal. This is known as a negative clearing signal to distinguish it from a positive clear, which may be defined as a signal which is operated to give the clearing indication. Failure to restore the switch to normal involves the receipt of any subsequent ring from the exchange on the bell-set and also on the bell at the extension.

The Bell Set No. 20 provides for both secrecy and non-secret conditions. With Plan No. 7, the conditions are non-secret and terminals *A* and *A*1, and *B* and *B*1 are connected by straps; this connects the main station telephone across the line when the extension is connected through to the exchange (*vide* Fig. 37). Plan No. 7A provides for secrecy, and the two straps are omitted to provide this condition.

Extension Bells and Buzzers. In all the telephones illustrated, an extension bell can be connected in series or in parallel with the magneto bell of the telephone by removing a strap between two terminal connexion plates in the circuit of the magneto bell and connecting the extension bell thereto; these connexion plates are usually marked EB1 and EB2. Loud sounding bells are often required in yards and workshops; in such circumstances, an indicator (No. 3701 AN) is connected in place of the extension bell, and the local contact of this indicator is included in the circuit of a Bell No. 19A, which has a 12-in. gong and requires a 5-cell primary battery. When the calling signal is required in situations where the sound of the bell is masked by the noise of running machinery, as in factories and power-houses, a motor-car type hooter is employed; when an electric power supply is available, the electric horn, Buzzer No. 19B, is worked from a battery of five small secondary cells which are kept charged by a current of from 20 to 30 mA

supplied from the power mains through suitable resistance lamps. In other circumstances, Buzzer No. 19A is used, and is driven from a battery of two small secondary cells which are kept charged by a battery of five WK1 Leclanché cells connected to them through a resistance of 100 Ω.

When the extension bell is not required to ring continuously

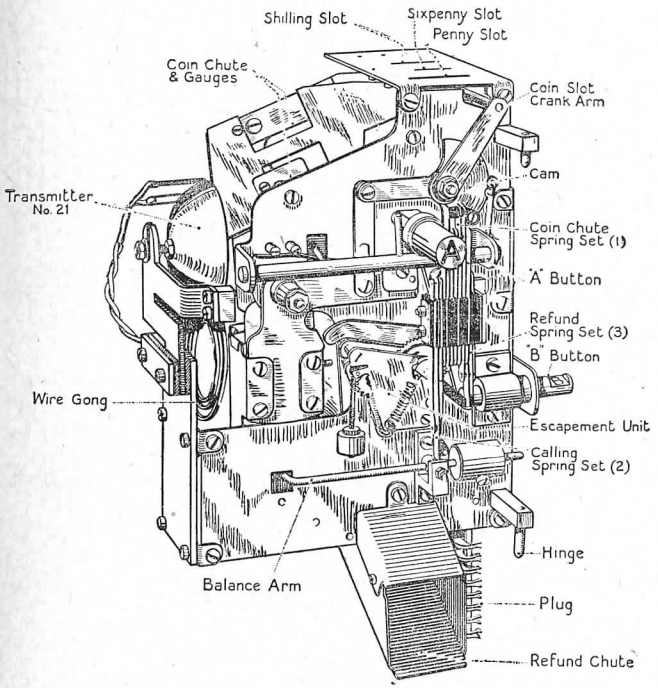

FIG. 39. PREPAYMENT COIN BOX MECHANISM

from the receipt of a call until attention is given at the telephone, a relay 56*A* (1,900 Ω) is connected in place of the indicator. The extension bell is operated by the relay contacts and, as the relay responds to the ringing currents and then restores to normal, the extension bell rings in synchronism with the rings received on the magneto bell at the main telephone. Such extension bells are termed non-continuous ringing bells.

CALL OFFICES

Prepayment Call Offices. The standard arrangement for a call office in an automatic exchange area is the provision of a

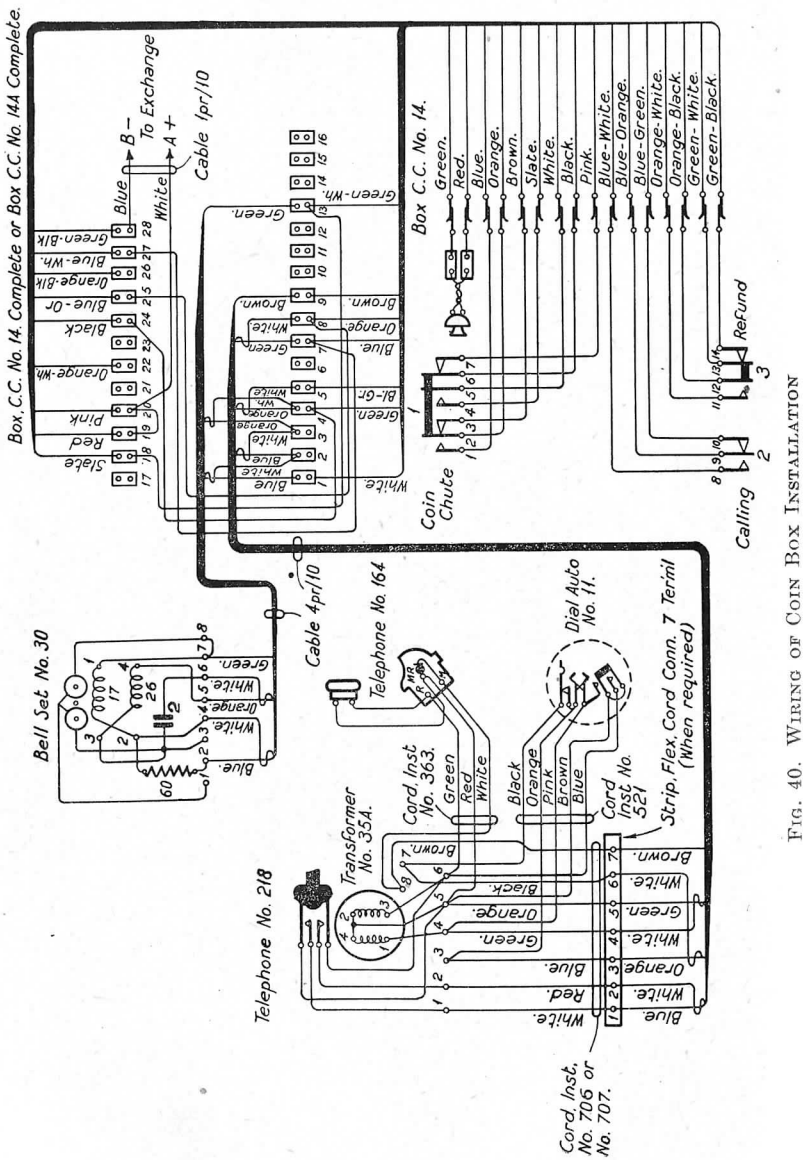

FIG. 40. WIRING OF COIN BOX INSTALLATION

prepayment multi-coin collecting box associated with a microtelephone. The telephone is known as Telephone No. 218 and the coin box as Box, Coin Collecting, No. 14 complete.

The mechanism of the coin box (Fig. 39) embodies coin gauges and slots which ensure that coins of the correct dimensions and weights shall be effective, any coins not coming within

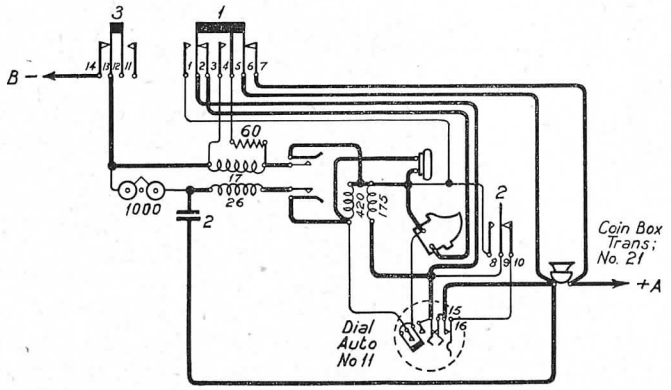

FIG. 41. SCHEMATIC DIAGRAM OF COIN BOX INSTALLATION

this category being returned to the user through the refund chute. A wiring diagram of the complete installation is shown in Fig. 40 and the corresponding schematic diagram in Fig. 41. The Bell Set No. 30 accommodates the induction coil, magneto bell, 2μF condenser, and a 60 Ω non-inductive resistance.

For a local call, the insertion of the first penny causes the coin slot crank arm to be moved over, so operating spring set 1. The coin rolls down the coin track and strikes the wire gong at the end of the track before rolling into the coin container. The operation of spring set 1 disconnects the transmitter of the microtelephone at contacts 2 and 3, disconnects the short circuit across the coin box transmitter (Transmitter No. 21) at contacts 6 and 7, shunts the 17 Ω winding of the induction coil by 60 Ω non-inductive resistance through contacts 4 and 5, and short circuits the 175 Ω winding of the Transformer No. 35A through contacts 1 and 2. The insertion of the second penny causes the balance arm to be depressed by the combined weight of the two coins, and spring set 2 is changed over, so removing the short circuit across the impulsing springs of the dial at contacts 9 and 10. The caller is now free to dial the required number and to hear the response of the called subscriber, but

the short circuit across the transmitter of the microtelephone, together with the short circuit across the 175 Ω winding of the transformer and the 60 Ω shunt across the 17 Ω winding of the induction coil which prevent the use of the receiver as a transmitter, precludes the possibility of the caller being able to speak to the called subscriber. To release the speaking circuit, it is necessary to depress the *A* button, so depositing the coins in the cash box and restoring springs sets 1 and 2. The circuit is thereby restored to normal and conversation can proceed.

If the called subscriber is engaged or unobtainable, the caller recovers the prepaid fee by depressing the *B* button. This operates spring set 3, which restores to normal under the control of an escapement mechanism taking approximately 7 seconds to restore. The line is thus disconnected for this period, so releasing the selectors in the exchange and clearing down the connexion. Depression of the *B*-button also restores spring sets 1 and 2.

Emergency Calling. To gain the attention of an operator, callers are instructed to dial the single digit 0. To provide for emergency, it is necessary that this should result in connexion to an operator at the auto-manual switchboard without the necessity for inserting any coins. This facility is provided by the No. 11 dial (see page 47), the short circuit normally across the impulsing springs being taken through the auxiliary springs provided in this dial. When the digit 0 is dialled, the auxiliary impulse control cam opens the springs, marked 15 and 16 in Fig. 41, so removing the short circuit from the impulsing contacts and permitting the impulses to be sent to the selector at the automatic exchange. On completion of the train of impulses, the auxiliary springs are restored to normal by the control cam when the finger-plate reaches its normal position.

Trunk Calls. Whenever a caller requires a trunk call or any call other than one within the local fee area, the attention of an operator is necessary in order that the requisite fee may be collected. The appropriate code is dialled and when the operator answers, particulars of the call are given. When the call matures, the operator requests the caller to insert the appropriate fee. This is done by means of the shilling, sixpenny, and penny coin slots. A shilling rolls down the shilling coin track and strikes the top of the bell gong forming part of the transmitter No. 21. It then continues rolling, and strikes the bottom edge of the gong before coming to rest in the coin container.

The operator thus hears the two strokes on the bell gong when a shilling has been inserted. A sixpence rolls down the sixpence coin track and strikes the bottom edge of the gong. Thus, one stroke of the bell gong is heard when a sixpence has been inserted. The sound of the wire gong, due to the insertion of pennies, is also transmitted to the operator, who is thereby enabled to check the insertion of the correct amount by these distinctive signals.

On calls of this nature, the control of the call is vested in the operator and should the caller depress the *B* button after the insertion of the fee, the disconnexion of the line for 7 seconds causes the answering cord supervisory lamp at the switchboard to glow for this period. The operator is thereby informed that the caller has recovered the fee in place of depositing it by depressing the *A* button.

Box, Coin Collecting, No. 14A. The cash box of the No. 14A coin collecting box has a glass window, running the whole length of the lower part of the box, through which the refund chute is visible. This modification is designed to prevent dishonest people from collecting refunded coins by stuffing the refund chute of the box with paper, subsequently removing it and collecting any coins trapped in the chute in this manner.

Call Offices connected to Unit Automatic Exchanges. In unit automatic exchanges, the subscribers obtain the attention of an operator at the parent exchange by dialling the digits 01. To enable the second digit to be dialled in these conditions a relay No. 281*AN*, which includes a 2μF condenser connected across its 75 Ω coil, is added to the equipment. The wiring diagram for an installation of this type is shown in Fig. 42, the corresponding schematic diagram being given in Fig. 43.

When the digit 0 is dialled, the removal of the short circuit across the impulsing springs of the dial is effected by the relay; the auxiliary springs in the dial remove the short circuit from the relay coils, and the relay operates in series with the *A* and *B* wires. The relay is made slow-releasing by a copper sleeve fitted over the core, in order to prevent its release during the break period at the dial impulsing contacts. The condenser serves the dual purpose of assisting the slow release feature by discharging through the relay on the break at the impulsing contacts, and of reducing the transmission loss by offering a low impedance path to speech currents. The relay remains operated from the current flowing in the line and a second digit may be dialled after the digit 0. In other respects, the

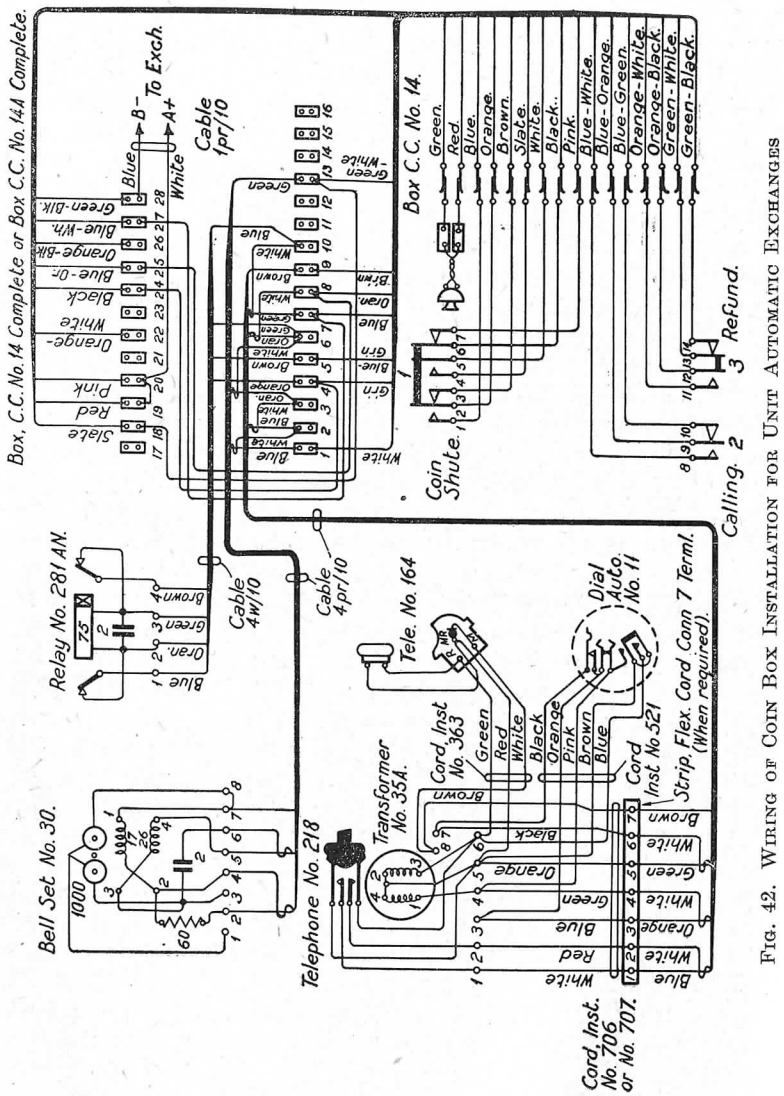

FIG. 42. WIRING OF COIN BOX INSTALLATION FOR UNIT AUTOMATIC EXCHANGES

call office apparatus operates in the same way as that already described.

Prevention of Electric Shocks. To prevent the possibility of a caller receiving a shock while dialling, the dial mounting and the metal case of the coin box are connected to earth. The instrument cords used are of the waterproof type to prevent loss

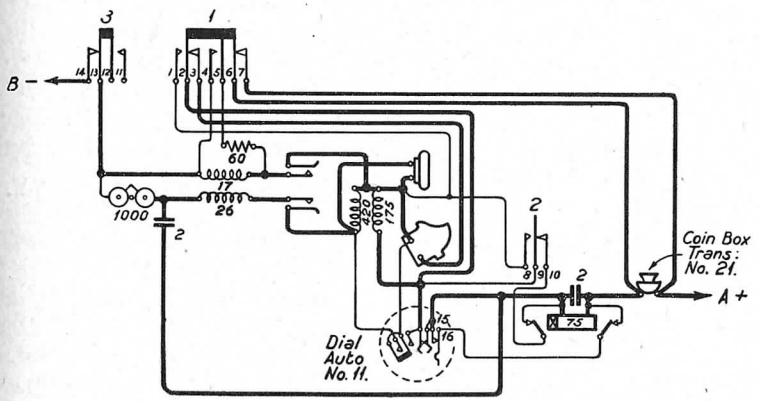

FIG. 43. SCHEMATIC DIAGRAM OF FIG. 42

of insulation resistance by continued contact with moisture, as occurs when the cord rests against the wet coats and mackintoshes of callers in inclement weather.

PRIVATE MANUAL BRANCH EXCHANGES
(P.M.B.X.'s.)

Through Clearing. Generally, the design of private manual branch exchange switchboards for use in association with automatic exchanges follows similar lines to the P.M.B.X's in C.B. manual exchange areas. Through clearing facilities are provided, normally, on all types of switchboard as the facilities so given result in a reduced occupancy of the selectors in the automatic exchange as well as providing for through supervision from an extension telephone on trunk calls; as the chargeable time indicator is controlled from the calling subscriber's gravity switch, this results in the chargeable time shown approximating more closely to the actual duration of the conversation than is possible when the clearing of the exchange connexion is vested in the P.M.B.X. operator.

Through clearing facilities also enable several calls to be made