

## TELEPHONY

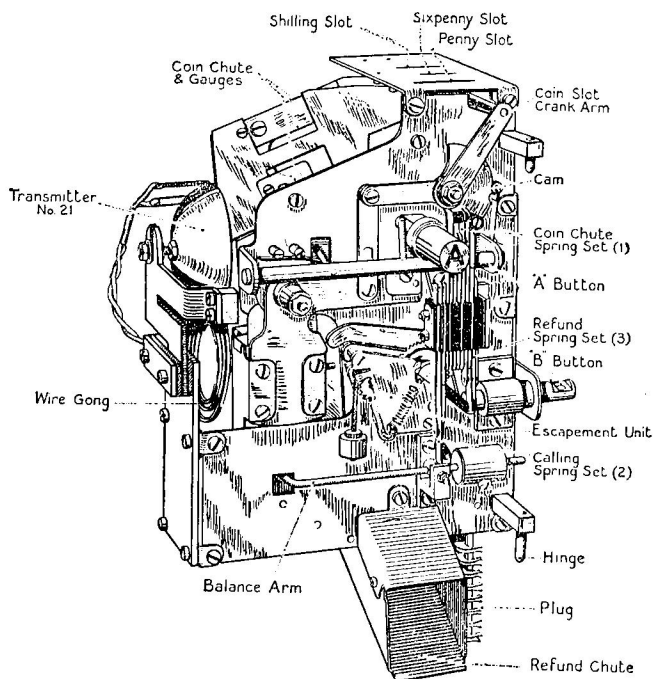
A DETAILED EXPOSITION OF THE  
TELEPHONE SYSTEM OF THE BRITISH  
POST OFFICE

FIG. 39. PREPAYMENT COIN BOX MECHANISM

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## CALL OFFICES

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



prepayment multi-coin collecting box associated with a micro-telephone. 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

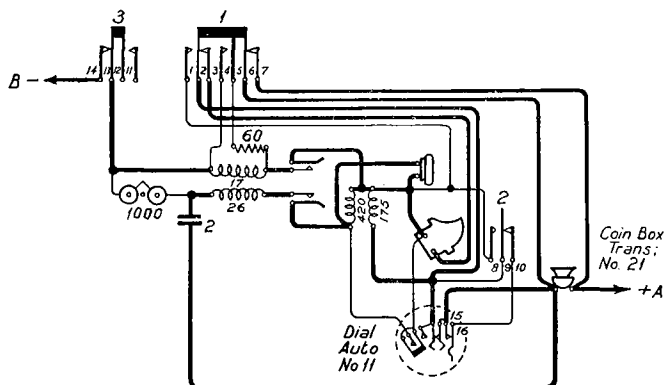


FIG. 41. SCHEMATIC DIAGRAM OF COIN BOX INSTALLATION

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,  $2\mu\text{F}$  condenser, and a  $60\Omega$  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  $17\Omega$  winding of the induction coil by  $60\Omega$  non-inductive resistance through contacts 4 and 5, and short circuits the  $175\Omega$  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  $175\ \Omega$  winding of the transformer and the  $60\ \Omega$  shunt across the  $17\ \Omega$  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. 281AN, which includes a  $2\mu\text{F}$  condenser connected across its  $75\ \Omega$  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



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

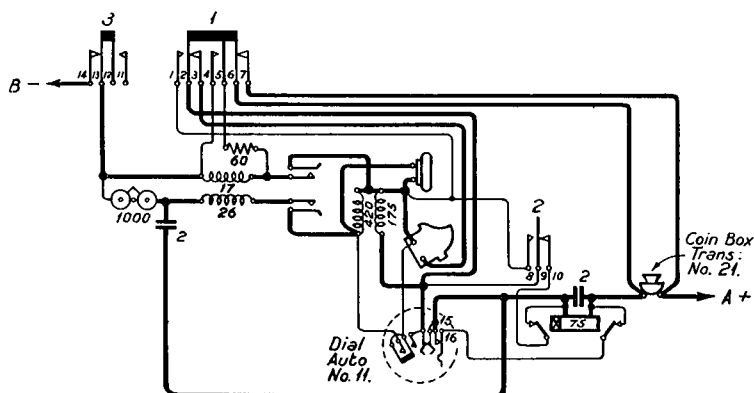


FIG. 43. SCHEMATIC DIAGRAM OF FIG. 42

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.

**Standard Impulse.** The standard impulse consists of a break period of  $66\frac{2}{3}$  per cent, and a make period of  $33\frac{1}{3}$  per cent. The

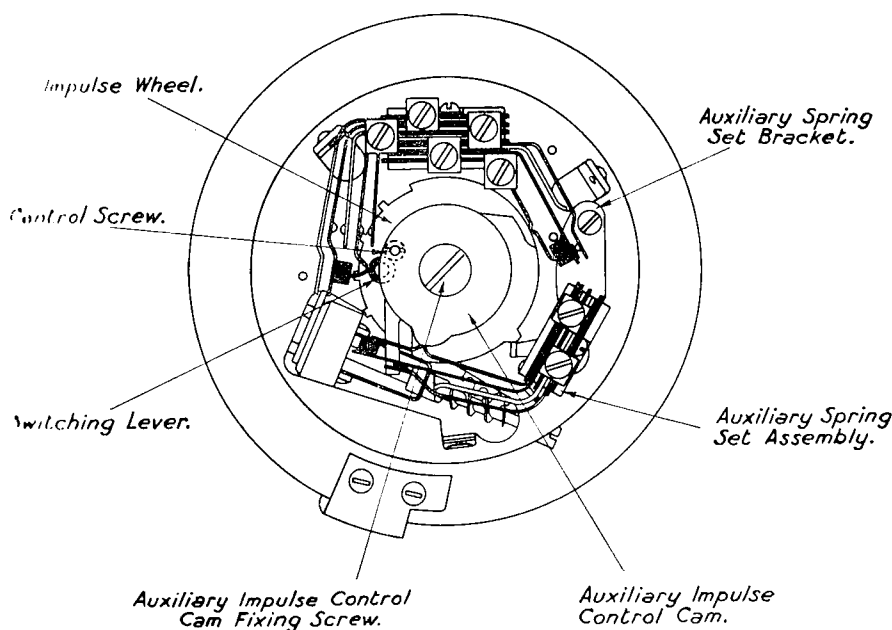


FIG. 26. DIAL, AUTO, NO. 11, SHOWING AUXILIARY SPRING-SET AND CONTROL CAM

standard impulse frequency is 10 impulses per second; thus, the duration of the break period is  $66\frac{2}{3}$  mS, and that of the make period is  $33\frac{1}{3}$  mS. These figures are usually rounded up and down to 67 mS and 33 mS, respectively. The permissible variation in impulse frequency is 9 to 11 impulses per second.

**Dial, Auto, No. 11.** The standard arrangement for call offices connected to automatic exchanges is the provision of pre-payment multi-coin boxes. This device provides for the deposit of the fee before the call can be made, but in cases of emergency it is essential that the call office telephone shall be available to the public without the preliminary insertion of a fee. For a call



to an operator at the auto-manual switchboard associated with the automatic exchange, callers are instructed to dial the single digit 0. The dial used with the telephone is modified so that connexion can be made in such circumstances without the insertion of a prepaid fee. The nature of the circuit arrangements providing this facility is described on page 62, and an essential

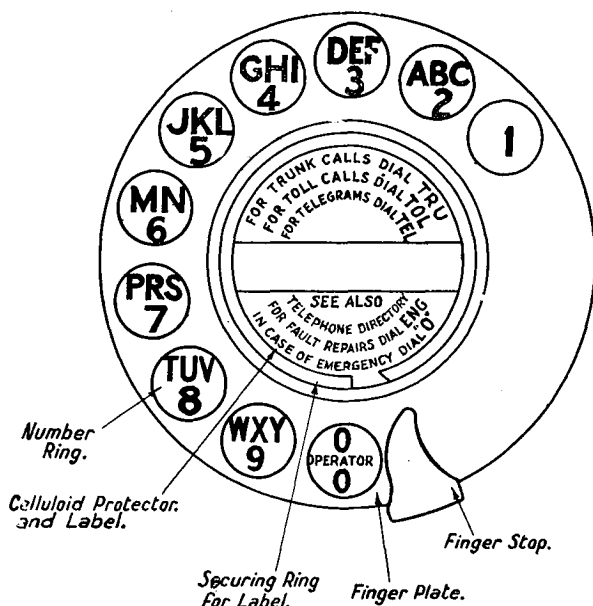


FIG. 27. DIAL USED IN DIRECTOR AREAS

feature is the additional spring-set provided in the dial as shown in Fig. 26. This dial is known as the Dial, Auto, No. 11, and consists of a No. 10 dial provided with an auxiliary impulse control cam fixed loosely to the spindle, and a control screw projecting from the auxiliary cam into the path of the switching lever. When the digit 0 is dialled, the switching lever moves round anti-clockwise as seen in Fig. 26 and on the last portion of the movement engages with the control screw, so forcing the auxiliary cam from engagement with the auxiliary spring-set. The springs change over and remain in this position until the finger-plate returns to its normal position, when the switching lever again engages with the control screw and forces the cam on to the operating lever of the auxiliary spring-set. The springs are thus opened during the whole of the period

during which the impulsing springs are being opened and closed by the teeth on the impulse wheel. The control screw is so placed that the action only occurs when the digit 0 is dialled. In some cases, the action may be required when the digits 8 or 9 are the first to be dialled; in this event, two control screws are used, the second being spaced so that the switching lever engages with it just prior to the completion of the movement when the digit 8 or 9 is dialled.

**Coin Box Discrimination.** When coin box and ordinary subscribers are accommodated in the same group, separate levels are allotted to the coin box lines and normal post springs are fitted to the primary finder and arranged to operate whenever the selector wipers cut in on a coin box level. The operation of these springs extends earth over a fourth wire to the selector, so enabling a flashing calling condition to be applied on 0-level calls from such circuits. Primary finders providing this facility are not used with secondary finders.

**0-level Calls.** For a call to level 0, the discriminating selector is again brought into use for routing purposes. The selector rises to the tenth level and, on entering this level, the earth on the *P1* wiper is connected to relay *DO*, which operates. In the event of a call from an ordinary subscriber, **D01** performs no function, since the "coin box discrimination" (C.B.D.) wire is left unconnected; **D02** extends the earth from **B4** through **JG5** to relay *LD*, which operates to set up the necessary switching conditions to enable the discriminating selector to act as a first selector when searching over level 0. When relay *K* releases, the removal of earth at *K4* releases relay *DO*. The circuit

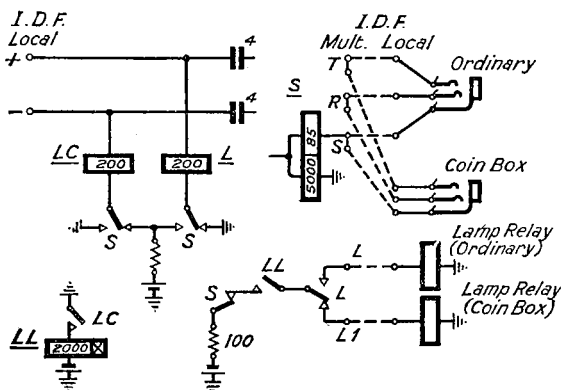


FIG. 196. ELEMENTS OF COIN BOX DISCRIMINATION CALLING CIRCUIT

is now through and ringing tone is provided from the answering equipment at the auto-manual switchboard. The negative and positive wires of the junction are looped through the line coil of relay *D* and relay *I*; this loop causes the calling lamp on the auto-manual switchboard to glow continuously, so indicating to the operator that the call originates from an ordinary subscriber; the portion of the switchboard calling circuit concerned is shown in Fig. 196.

For a call originating from a coin box line, the C.B.D. wire is connected to earth either in the line finder or by being connected to the *P*-wire of the subscriber's hunter. Relay *DO* is therefore locked to this earth through **D01**; **D04** and **D05** disconnect the negative and positive lines from relays *D* and *I*, earthing the negative line and connecting earth through the 500-ohm coil of relay *CO* to the positive line; **D03** returns ringing tone to the calling subscriber, since the junction wires

from the auto-manual switchboard are not now connected to the transmission bridge. This condition on the junction wires causes the coin box calling lamp at the auto-manual switchboard to glow (xii), so indicating to the operator that the call originates from a coin box line. When the operator answers, a battery is connected to the positive line to operate relay *CO*, which locks through **CO1** and disconnects relay *DO* at **CO2**. The release of relay *DO* extends the junction to the transmission bridge and thence to the coin box subscriber's line. (See also page 361.)

**Manual hold** conditions are provided by relay *I*. Should the calling subscriber replace the receiver after the operator has answered, the release of relays *A* and *B* connects relay *I* to the positive line, and the battery connected to this line operates the relay; **I1** polarizes relay *D* and retains relay *MD* through **B3**; **MD3** closes the circuit of relay *C*, which connects a holding earth to the incoming *P*-wire at **C3** (vi).

**Re-ring.** The re-ring facility is provided by relay *RG* in the manner already discussed on page 285; the metal rectifier shunting relay *RG* offers very low resistance to a negative battery, whereas it offers extremely high resistance to a positive battery. The application of a positive battery to the positive wire of the junction accordingly operates relay *RG*; **RG1** and **RG2** connect the subscriber's line to the ringing circuit, whilst **RG3** provides for ringer start facilities should these be required (viii).

**Routing via Main Exchange.** In the event of a call *via* the main exchange, the first digit dialled will be within the range 1-5. When the selector enters the corresponding level, the earth on the *P1* wiper is extended to relay *JD*, which operates and locks through **JD6**. **JD1** disconnects the vertical magnet; **JD2** disconnects relay *JG*; **JD3** disconnects relay *G*; **JD4** changes the supervisory lamp over from P.G. to C.S.H. conditions (ix); **JD5** prepares a circuit for busy tone in the event of all the junctions being engaged; **JD7** prepares a circuit for the overflow meter. The release of relay *JG* is of no material consequence at this stage, its functions being primarily concerned with the provision of a guard period on the junction prior to the release of the junction after local switching. Should all the junctions be engaged, the junction finder steps round to the last contact in the bank; relay *K* operates and **K2** operates the overflow meter through **JD7**; **JD5** extends busy tone to the calling subscriber.