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P.W.—F.7.

**POST OFFICE  
ENGINEERING DEPARTMENT**

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**TECHNICAL PAMPHLETS  
FOR  
WORKMEN**

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*Subject :*

**House Telephone Systems.**

ENGINEER-IN-CHIEF'S OFFICE

1919

# HOUSE TELEPHONE SYSTEMS

(F.7).

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*The following pamphlets in this series are of kindred interest :*

- D.1. Elementary Principles of Telephony.
- F.8. Wiring of Subscribers' Premises.

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## INTERCOMMUNICATION OR HOUSE TELEPHONE SYSTEMS.

These systems are designed to provide a self-contained telephone service in offices, works, and large buildings generally, without incurring the expense of an operating staff, switch-board, etc. Satisfactory results are obtained up to 20 stations, but for larger systems it is generally better to instal a switch-board.

The principal requirements which house telephone systems have to satisfy are :—

- (a) Cost of installation reasonable.
- (b) Simplicity of working. Direct call and automatic clearing.
- (c) Secrecy of conversations and freedom from interruption.
- (d) Maximum number of independent conversations at same time, without overhearing or loss of efficiency.
- (e) One station to be able to call up and converse with several other stations simultaneously.

The various systems on the market cater for some or all of these requirements to a greater or less degree. The method of wiring, and the instruments used, are briefly described in the following paragraphs. A more detailed description, with circuit drawings, is given of the apparatus stocked by the Department.

### WIRING.

The usual method is to study the lay-out of the system and determine a route along which a main cable may be laid, with junction boxes inserted at suitable points to pick up the tees from the various stations. For instance, in a building of several floors, the main cable might run up the staircase or the lift-well, with junction boxes at each floor.

In the majority of systems the number of wires in the cable is one per station, to which is added one for common return, two for ringing battery, and two for central speaking battery, as required by the particular system.

In order to eliminate overhearing, due to induction, between the single wires in the cable, some systems adopt full metallic wiring, a twisted pair of wires being used for each station on the system. The common return is not then required.

As full metallic wiring involves extra expense for instruments and cable it is not much in demand.

**Instruments.**—The instruments usually consist of a hand micro-telephone resting on a cradle, and a device for selecting the line required. This device is generally :—(a) Selector Switch, (b) Press button, and (c) Keys.

(a) The **selector** is a switch through which one side of the instrument circuit may be connected to any one of the incoming lines, the common return to complete the circuit being already permanently connected to the instruments. The line required is first connected through the selector switch and then rung up by means of the call button. Only one station can be called at a time, and an all-station call must be passed on from station to station. The selector is never used with full metallic wiring, but it would be possible to do so.

(b) **Press-Button Sets.**—These are usually arranged so that when a button is depressed it is locked in position until either another button is depressed or the switch-hook is operated. Replacing the receiver on the cradle restores the buttons. A little extra pressure on the button enables it to reach and operate the contact springs of the ringing circuit. By depressing a number of buttons at the same time it is possible to call up and converse with a similar number of stations simultaneously.

(c) **Key Type.**—The keys are of the familiar type, with ringing contacts on one side and speaking contacts on the other. All stations can be called simultaneously if desired. Automatic restoration of keys is arranged for on similar lines to those described for press buttons.

**Central and Local Battery Working.**—The circuit length and resistance of the connections which may be obtained on a fairly large system of house telephones may vary considerably, and in practice it is difficult to secure uniform speaking and ringing throughout an extensive system with central battery working. This is especially the case where the system includes several busy stations. Local battery speaking sets are mostly in demand. Central battery ringing is the standard arrangement, and the bells used are designed to work with very small current.

The apparatus stocked by the Department consists of:—

- (a) **House telephone without full intercommunication.**
- (b) **Non-secret, central battery, full intercommunication.**
- (c) **Secret, local battery, full intercommunication.**

(a) **House Telephone without full Intercommunication.**—Diagram No. 1 shows a system of five stations fully wired. The main station has full intercommunication, but all others are limited to communication with or through the main station. The apparatus at all stations consists of:—

- 1 Hand Microtelephone.
- 1 Trembler Bell,
- 1 Press Button.

In addition, the main station has a selector switch.

The speaking circuit consists of a common pair throughout the system, to which all five micro-telephones are connected in parallel. A 4-cell Leclanché battery No. 1, with circular zincs, is connected across this circuit at the main station, an inductor

## **P.W.—F.7.**

Page 2, line 2. *Delete incoming and insert outgoing.*

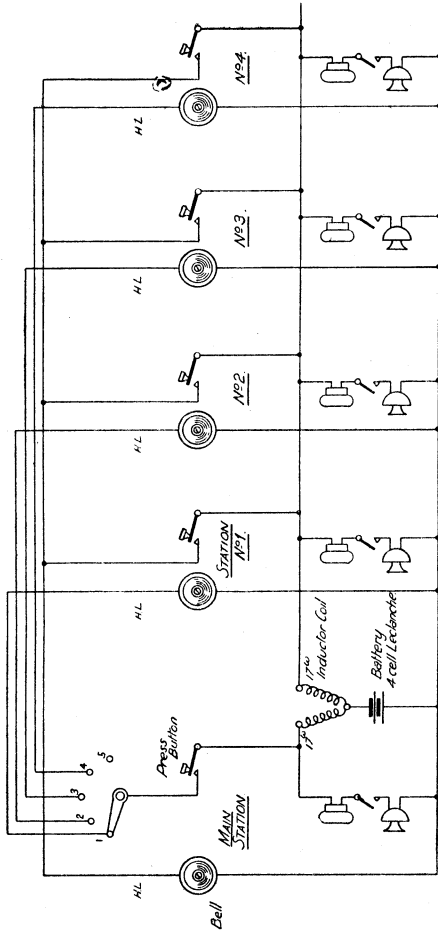


Diagram 1.

coil being placed in one of the battery leads to prevent accidental short circuiting. To enable each station to call the main, a third wire is run from one side of the main station bell, and tees taken off to the press buttons of the other stations. When a press button is operated the ringing circuit is completed through one wire of the speaking circuit, one winding of the inductor coil, and thence, through the battery, to the other side of the main station bell.

Direct ringing to the sub-stations required (otherwise known as selective ringing) is provided at the main instrument through the selector switch. For this, four other wires are necessary, one to each bell, and the circuit is completed through the bell to one wire of the speaking circuit, thence through the battery, through one side of inductor coil and main station press button, to selector arm.

It will be seen that the main station can speak to all stations at once, or can, by calling up the required station, put stations in communication with each other.

**(b) Non-Secret House Telephone with full Intercommunication.—Central Battery Type.**—Diagram No. 2 shows a system of five stations fully wired. The apparatus at each station is identical, and consists of hand micro-telephone, trembler bell, press button and selector switch. A battery of four cells (Leclanché No. 1 C.Z.) is placed at a central point in the system, with an inductor coil in one lead to prevent accidental short circuits. The speaking circuit consists of a common pair of wires throughout the system. The battery is connected across this pair and the five hand micro-telephones are connected to it in parallel. Therefore one conversation only is possible at any time, and any number of stations may take part.

Selective ringing is obtained by the provision of five additional wires throughout the system, numbered 1 to 5 on the diagram.

No. 1 wire is connected to the bell at No. 1 station, and is teed-in to the No. 1 contact stud on the selector switches of the other stations. The bell circuit is completed through the selector switch and press button of any station, through one wire of the speaking circuit to one side of the inductor coil, and thence through the battery and back to the other side of the bell at No. 1 station. The other wires (Nos. 2, 3, 4 and 5) are connected to the bells of their respective stations, and to corresponding contact studs at all other stations in exactly similar fashion. The usual method of operating is as follows:—

First listen-in to ascertain if the circuit is disengaged. If clear, turn the selector switch to the number of the station required, press the ringing button and await reply. It is not necessary to have the selector switch in any particular position to take an incoming call.

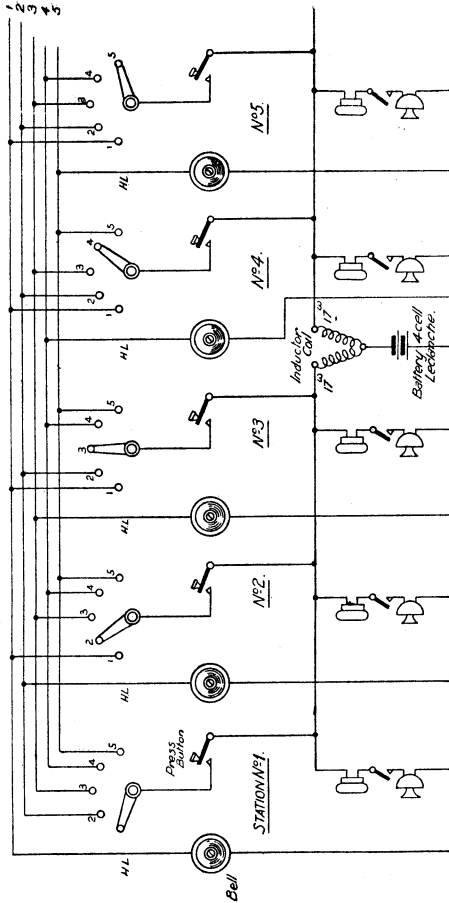


Diagram 2.



(c) **Secret House Telephone with full Intercommunication.**—**Local Battery Type.**—Diagram No. 3, Fig. 1, shows four stations fully wired. The apparatus at all stations is identical, and consists of:—

Hand micro-telephone.  
Switch hook,  
Selector switch,  
Press button,  
Ringing vibrator,  
Cut-in relay,  
Induction coil,  
Local battery,  
Trembler bell.

The main cable to all stations consists of one wire per station, plus two wires to distribute power for ringing from a battery of three Leclanché cells, No. 1, C.Z., fitted in a central position on the system.

In describing this system it is best to follow out the procedure for establishing a connection. Fig. 2 shows No. 1 calling up No. 2. No. 1 has moved his selector switch to No. 2 stud and pressed his calling button. Following the connections from No. 1 selector to No. 2 switchhook, which is depressed and making contact on the bottom spring if No. 2 is not already using his telephone, the circuit is joined up through No. 2 bell to the positive side of the battery and thence through battery and out on negative line to No. 1 ringing vibrator coil and press button. An intermittent current flows through this circuit as the trembler bell at No. 2 alternatively breaks and makes connection and this current actuates the armature of the No. 1 vibrator coil in unison with the movements of the trembler bell hammer, giving out an audible clapping sound which signifies to No. 1 that the No. 2 station is not engaged and is being rung.

No. 2 now lifts his receiver, breaking the bell circuit at the switchhook and connecting No. 2 line direct to his selector switch through the winding of his cut-in relay, battery and press button contacts, see Fig. 3. Whilst listening on the line No. 2 turns his selector switch over the contact studs, stopping on the stud on which he hears a click in his receiver. This click is produced by the operation of the cut-in relay when a full circuit is established. The complete connection in this case will be through No. 2 selector to No. 1 stud and via No. 1 line to No. 1 switchhook, cut-in relay, battery, press button and selector.

The local speaking circuit of each instrument is completed through a contact on the cut-in relay which connects up the side circuit containing primary of induction coil and transmitter, the receiver being in a closed circuit through the secondary winding of the induction coil.

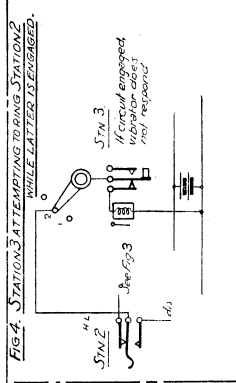
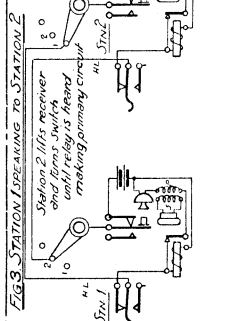
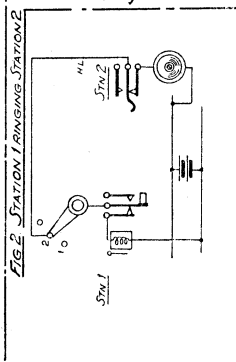
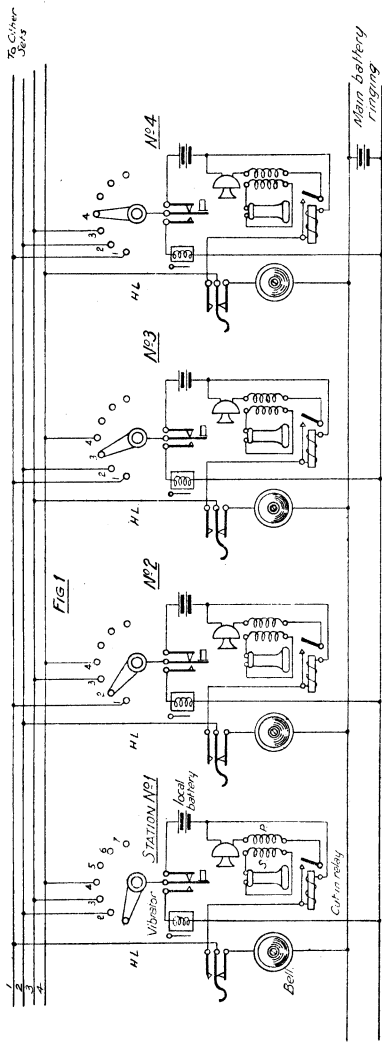


Diagram 3.

It will be seen that a conversation in progress between two stations cannot be interrupted by a third station as communication with another station can only be obtained by that station co-operating in building up the circuit by placing its selector switch in connection with the Home Line of the station desiring to speak with it. The term "home line" is given to the line which is joined up to the switchhook of a particular station and to corresponding studs on the selector switches of other stations.

Fig. 4 shows an unsuccessful attempt on the part of station No. 3 to ring up No. 2 when the latter is engaged. No. 2 bell is disconnected at the switchhook and the ringing circuit is therefore incomplete.

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