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CONTENTS

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Multiphone Working

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The authors describe equipment which enables a central station to speak simultaneously to a number of others. The system permits the out-stations to speak to the central office but not to one another.

Introduction.

IN the last few years there has been a growing demand for facilities for more than two people to take part simultaneously in a telephone conversation. In the attempt to meet this demand three main types of service have been developed, known as: multiphone, conference and broadcast.

It is the object of this article to distinguish between these three and then to give a brief description of multiphone facilities offered by the G.P.O. and of the apparatus and circuits employed.

Definitions.

Multiphone provides for two-way conversations between a central station and a number of outstations. The central station can call and speak to one outstation or to any number of outstations simultaneously, but the latter cannot speak to one another. This can be illustrated very simply by reference to Fig. **1**:

A can talk to b, c and d individually or simultaneously: b, c and d can talk to A but cannot talk to one another.

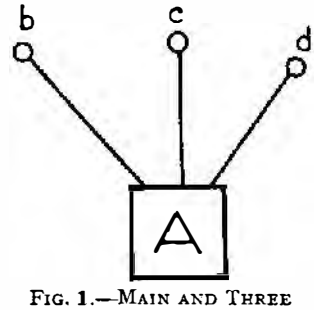

FIG. 1.—MAIN AND THREE OUTSTATIONS.

Conference facilities provide for connecting a number of lines together to allow both-way conversation between all the stations concerned. Again referring to Fig. **1**:

A can talk to b, c and d.
b can talk to A, c and d.
c can talk to A, b and d.
d can talk to A, b and c.

Broadcast facilities provide for a central station to speak to a number of outstations, which are, however, unable to reply, i.e., speech is one way only. In Fig. **1**: A can talk to b, c and d, but b, c and d are unable to talk to A or to one another.

Scope and Applications of Multiphone.

Multiphone facilities can be provided over all types of circuits, private wires, exchange lines or extensions from P.B.X.'s, but private wires must not be mixed with exchange lines on the same multiphone board, owing to the ban on the extension of exchange calls over private wires. Although multiphone facilities can be provided over exchange lines, there has been a relatively small demand for this service, and the principal applications have been to private wires.

As an example, a subscriber may have a private wire network devoted entirely to one purpose such as the distribution or collection of news. In such a case the lines would be terminated at the head office on a multiphone board from which the distribution of news can be handled.

On the other hand, a number of private wires, linking together various branches of an organisation, may be terminated on a P.B.X. and be available to any extension. As a supplementary service the lines could be intercepted on a multiphone board to allow general instructions or information to be sent out from the head office to all branches simultaneously.

So far the greatest demand for multiphone facilities has arisen in conjunction with:

(1) Organisations interested in the rapid transmission of racing and press news to subscribers and agencies throughout the country.

(2) County police telephone networks, where a multiphone switchboard is installed at the divisional headquarters, and is used for quickly disseminating police news over the system.

The ability to issue information or instructions from a central point to a number of outstations simultaneously has obvious applications in other directions under present conditions as well as in peace-time.

Facilities.

The lines from outstations are terminated at the head office on a multiphone switchboard which comprises calling indicators and keys to connect selected lines to the operator's telephone. On some boards provision is made for two or three operators. One point that should be emphasised is that a multiphone switchboard does not provide intercommunication between one outstation and another, and if this facility is wanted the multiphone board must be associated with a P.B.X. switchboard.

When a large number of lines is bunched or the transmission loss over the worst circuit exceeds 20 db., an amplifier is used, details of which are given later. This equipment enables an operator to broadcast to a maximum of 80 lines without loss in sending efficiency. Any outstation may reply to the operator, but conversations between outstations are prevented by joining the lines in parallel across a low resistance.

A ringing key is provided for each line, and on some boards a single "group" key is fitted for simultaneously ringing the whole of a previously selected group of lines. Ringing power may be taken from A.C. mains via a step down transformer, since it is rarely practicable to obtain a large enough current from a ringing lead from the public exchange. Hand generators are not favoured where speed of signalling is of paramount importance as in the

distribution of news. A disadvantage resulting from the use of A.C. mains is that it is necessary to adjust outstation bells specially to respond to both 17 and 50 c/s ringing.

A line may be terminated at an outstation on a single instrument or on a P.B.X. switchboard. At the central station the lines may be taken to a P.B.X., in which event they are wired via the keys on the multiphone board so that they may be intercepted when a message is to be broadcast. It is occasionally desired to broadcast messages or information from a point remote from the actual switchboard. If an amplifier is used, this necessitates a special 4-wire extension wired from the normal operator's circuit.

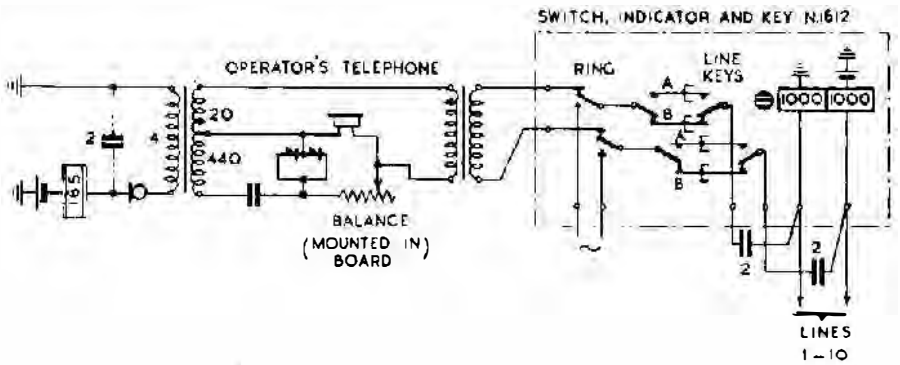

FIG. 3.—MULTIPHONE WORKING WITHOUT AMPLIFIER.

The operator's instrument consists of a breastplate transmitter and a single or double headgear receiver, connected to a standard anti-side-tone induction coil, fed from a power lead when possible. A copper oxide limiter is joined across the receiver to reduce switching clicks. At the outstations, standard types of telephone instrument are fitted, but where room noise is troublesome, e.g., in press rooms, grand stands, etc., a hand or foot-operated switch is provided to cut out the transmitter when listening.

Apparatus.

Three types of switchboard have been designed. The first, illustrated in Fig. **2**, is a 10-line C.B.S. private wire switchboard (Switch, Indicator and Key N 1612 10/10) specially designed for press work to allow rapid manipulation of a previously selected group of lines. The incoming circuits terminate on disk signal indicators which operate when the distant end of the circuit is looped, and remain operated while the circuit is in use, giving negative clearing. Calling, clearing and supervisory signals are all received on one indicator.

A schematic diagram of the circuit conditions is given in Fig. **3**. The speech and ringing path is via the 2 μF blocking condensers inserted to give individual D.C. supervision on each line. Ten line keys offer the choice of either of two speaking commons, A and B, and a third position marked " Line out of use " disconnects the circuit from both speech commons but leaves the indicator across the line. The indicator coil resistance is 2,000 ohms, and it is sufficiently sensitive to work over a 2,000 ohm line with a 20 V supply at the central station.

When an amplifier is used with this board, the top positions of the line keys are arranged to substitute a 600 ohms resistance for the line to maintain the balance of the hybrid transformer in the amplifier.

The two speaking commons are connected via ringing keys and a changeover key to the operator's circuit. It is thus possible to set up a broadcast on one common while still dealing with individual circuits on the other. When the time for a broadcast comes (e.g., when the result of a race is received) the operator has merely to throw over the speaking keys and ring all the lines simultaneously. As each station answers, the corresponding indicator operates, any lines not participating in the broadcast being switched to the " Out of use " position. Alternatively, terminals are provided so that the two commons may be brought out to two separate operators if desired.

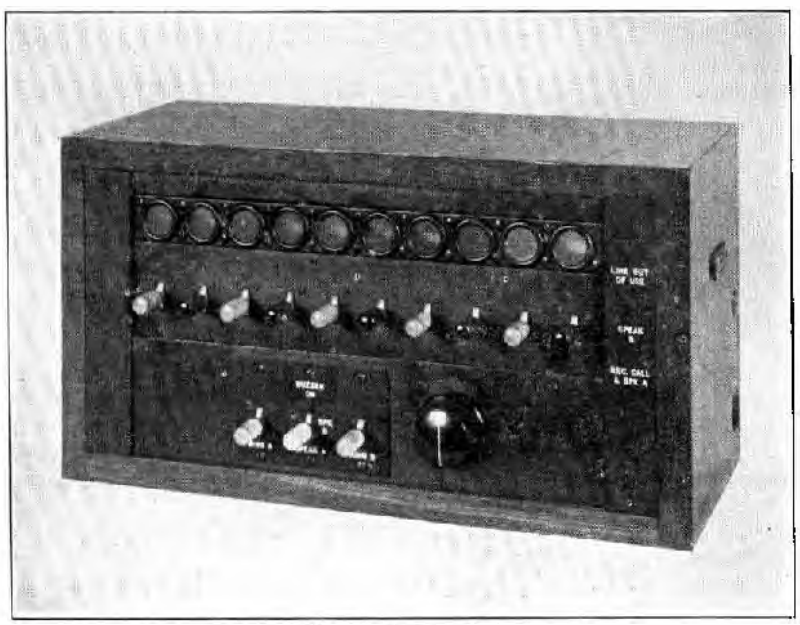

FIG. 2.—10-LINE C.B.S. SWITCHBOARD.

The second type of switchboard (Switch, Indicator and Key N1617 10/10) is a 10-line universal switchboard suitable for any type of line — private wire, P.B.X. extension, manual or automatic exchange line. Disk signal indicators are used which may be arranged to operate to either generator ringing current or a D.C. loop according

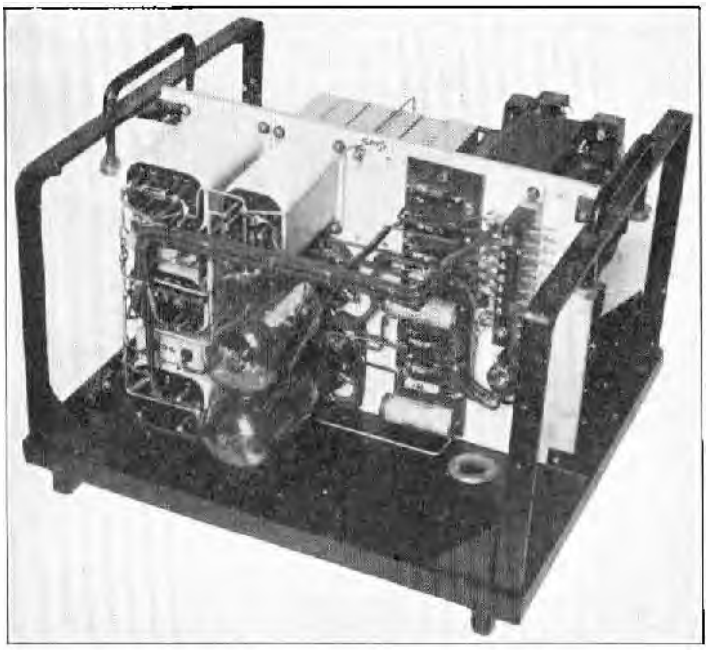

FIG. 4.—UNIT AMPLIFYING NO. 23A.

to the type of line connected. One, two or three operators may work at the board at the same time, each having access to a small group of lines. This is useful where each group is reserved for a special purpose, and coupling keys are provided so that one operator can control all three groups during slack periods.

The third type (Switchboard T.L.1806 10/10) is a 10-line magneto signalling board with drop indicators and keys to allow any line to be connected to either of two operators' circuits. This board has been used for private wires where, owing to the length of a circuit it has been necessary to use generator signalling in both directions.

Each of the above switchboards is contained in a wooden case $13\frac{6}{8}$ in. by $7\frac{3}{8}$ in. by $6\frac{7}{8}$ in. deep, adapted so that if more than 10 lines are to be accommodated the boards may be stacked together or mounted side by side.

Multiphone Working Without Amplifier.

Fig. **3** shows the principles adopted and is almost self-explanatory. The operator's instrument is coupled to the multiphone board via a matching transformer so that the maximum possible output is obtained from the transmitter. A consistently high sending efficiency is ensured by feeding the transmitter from a power lead or secondary battery. The line balance on the operator's induction coil is made variable by a potentiometer mounted on the switchboard so that optimum conditions may be secured when the number of lines at the bunching point is varied.

Amplifier.

The amplifying unit (No. 23a) (Fig. **4**), consists of a pair of single-stage amplifiers employing pentode valves, with an output sufficient to cater for a maximum of 8● lines. The unit is designed for operation from A.C. mains (100-250 V, 50 c/s), and a rotary transformer is used if D.C. mains only are available. Separate go and return paths are provided from the operator's instrument as far as the line hybrid transformer. When several lines are connected a separate balance is dispensed with by dividing the lines into two complementary groups and connecting one group to each side of the hybrid. When only a few lines are connected it has been the practice to connect all lines to one side of the hybrid and provide an adjustable resistance balance across the other side (Fig. **5**). Consideration is being given, however, to the design of an amplifier fitted with a simple side-tone suppressor circuit. With this it should be possible to tolerate a less exact balance and thus avoid the need for an adjustment under the control of the operator.

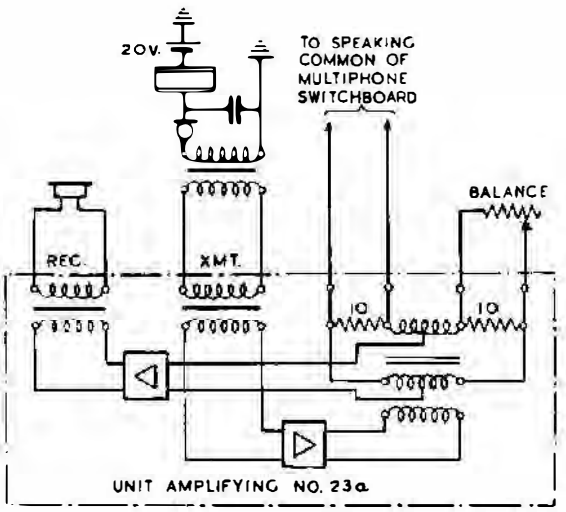

FIG. 5.—MULTIPHONE WORKING WITH AMPLIFIER.

Conclusion and Acknowledgments.

The subject of simultaneous transmission to a number of stations on a telephone network is one which is still largely in the development stage. Certain items of equipment have been standardised, but so many different problems arise that each new request has to be considered on its merits. There is not doubt however that the facility has a wide field of application, much of which has still to be explored.

Finally the authors wish to thank Messrs. W. Bryan Savage, Ltd., for the photograph of the Unit Amplifying No. 23a.