May 11, 1943. B. S. SWEZEY 2,318,723

COMMUNICATION SWITCHING SYSTEM

Filed July 16, 1940

FIG. 1

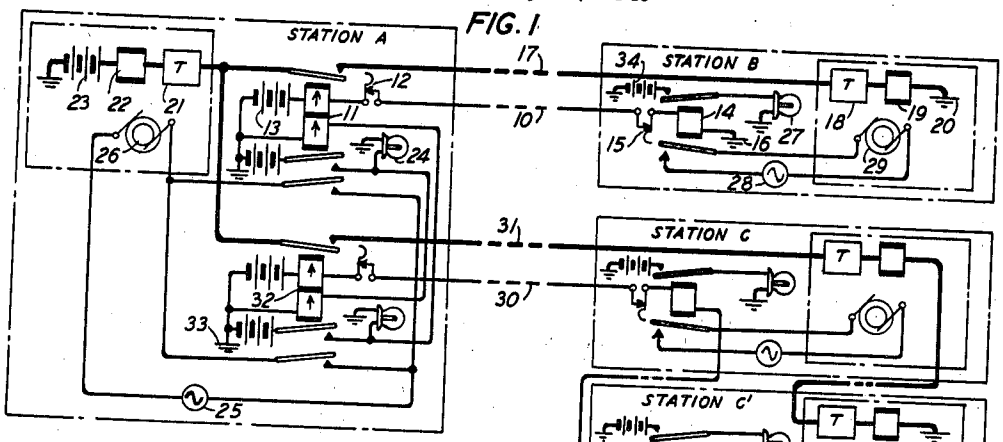
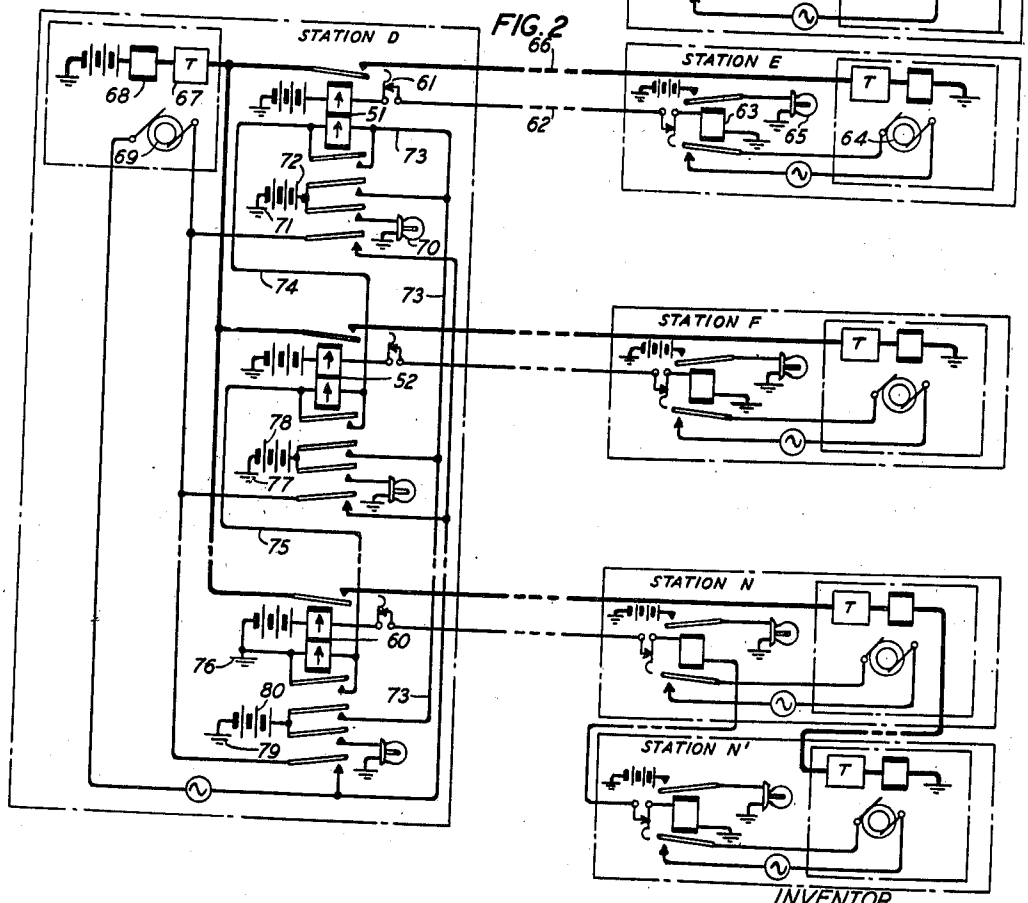


FIG. 2



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COMMUNICATION SWITCHING SYSTEM

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13 Claims. (Cl. 178—2)

This invention relates to a communication system and more particularly to a switching arrangement adapted for interconnecting any one of a plurality of outlying stations and a master station for communication purposes.

An object of the invention is to simplify the switching arrangement between a common transmitting and receiving device at the master office and any one of two or more communication circuits respectively extending to outlying stations.

Another object is to remotely control from a master station teletypewriter motors at any one or more of a plurality of outlying stations and vice versa.

Another object is to prevent interference with established connection between one or more of the outlying stations and the main station by any one of the remaining outlying stations.

According to the present invention, any one of a plurality of outlying teletypewriter stations connected radially to a master station may be maintained in an established connection with the master station exclusively of the remaining outlying stations in the system. The master station is connected by a line consisting of two single-conductor circuits to one or a number of outlying stations connected in series, one circuit being of the normally open type and utilized for transmitting and receiving teletypewriter messages and the other of the normally closed type and utilized for control purposes. The control circuit of each line includes at each station a manually operable switch and a relay winding. The purpose of the switches is to furnish means for initiating a call at an outlying station or the master station whereby a switch when operated, opens the normally closed control circuit to release the relays at each of the stations connected in the circuit. The relay at the master station, upon releasing effects at one of its armatures, the closing of the normally open message circuit and at another of its armatures, closes the operating circuit for the teletypewriter motor at the master station. At still another armature of the relay at the master station, a circuit is closed extending through an additional winding on each of the corresponding relays at the master station, which are respectively associated with the one or more of the remaining lines. Because of their energized additional windings these other relays are maintained operated against any interference from any one of the remaining outlying stations, such as would otherwise occur in response to subsequent attempts to initiate calls from these remaining stations being made during the time that the master station is engaged in an established connection. The relay at the outlying station engaged in the established connection upon releasing closes the operating circuit for the teletypewriter motor at such outlying station.

A feature of the invention is the simplified arrangement for effecting switching functions at a master station.

Another feature is the remote control of the teletypewriter motor at a station whereat a call is to terminate.

Another feature is the lock-out arrangement whereby only one outlying station at a time can be operatively connected to the master station.

Another feature is the provision of furnishing at the master station, an indication as to which of the lines extending to one or a number of outlying stations, connected in series, is engaged in an established connection with the master station.

Referring to the drawing:

Fig. 1 shows a schematic of a system wherein a master, or common, station is connected to outlying stations over two line circuits;

Fig. 2 shows a schematic of a system wherein a master, or common, station may be connected to outlying stations over three or more line circuits.

Referring to Fig. 1, station A represents the master station and stations B, C and C', represent outlying stations. Station C' may be one or more outlying stations connected in series with station C to the master station on a party line basis. Each of stations B and C is connected to the master, or main, station by two single conductor circuits, namely, one for control purposes and the other for transmitting message signals. It is obvious, however, that full metallic message and full metallic control circuits may be employed, instead of ground return circuits, if desired. The control circuit conductor 10 includes at the master station A, the upper winding of control relay 11, call switch 12 and grounded battery 13 and at station B, the winding of control relay 14, call switch 15 and ground connection 16. The message signal circuit conductor 17 normally includes at station B, a teletypewriter comprising transmitting device 18 and receiving printer magnet 19 connected to ground connection 20. At the master station A, conductor 17 includes by means of the upper armature and contact of relay 11, when released, a teletypewriter comprising a transmitting device

21 and receiving printer magnet 22 connected to grounded battery 23.

The starting of the apparatus at the master station A and at station B is accomplished by opening the control conductor 10 by either start switch 12 or 15 depending on at which of these two stations the call is initiated. Relays 11 and 14 are normally operated, as shown, and upon the operation of either switch 12 or 15 both relays release. Relay 11, upon releasing, completes at its upper armature and contact the message signal circuit, at its inner lower armature and contact, a circuit for lighting busy lamp 24, thereby indicating to the operator at station A that the line to station B is busy, and at its outer lower armature and contact, closes a circuit traceable from one side of power source 25, teletypewriter motor 26, outer lower armature and contact of relay 11 to the other side of the source 25 to start the teletypewriter motor 26 at station A. Relay 14, upon releasing, closes at its upper armature and contact a circuit including power source 34 for operating busy lamp 27 and at its lower armature and contact interconnects power source 28 and teletypewriter motor 29 to start the teletypewriter motor at station B.

Stations C and C' represent a multiparty line wherein the control circuit conductor 30 and message circuit conductor 31 extending from the master station A, connects stations C and C' in series. The arrangement of station A for conductors 30 and 31 is identical with that described hereinbefore for conductors 10 and 17, except that the source of power 25 and the teletypewriter comprising transmitting device 21, printer magnet 22, grounded battery 23 and teletypewriter motor 26, are common to the lines extending to stations B and C. When relay 11 released and caused its inner lower armature and contact to engage each other, as hereinbefore stated, a circuit in addition to that for busy lamp 24 extends through the lower winding of relay 32 to ground connection 33. The lower winding of relay 32 is thereby energized to aid the normal current normally flowing through the upper winding of relay 32 to hold the relay operated. In the event that a subscriber at station C or C' attempts to initiate a call at the time when a connection is established between stations A and B, relay 32, by means of its energized lower winding, is held operated to prevent communication from the second station, even though the current in the upper winding is interrupted, the message signaling conductor 31 remains open, and the teletypewriter motor at the station attempting to initiate the second call, operates. The fact that the line does not close and that the teletypewriter "runs open" indicates that a connection is established between master station A and station B. At master station A each primary control relay is provided with two windings arranged so that when the circuit of one outlying station is busy, the circuit extending to the other station may not be put into operation.

Referring to Fig. 2, which shows a system wherein three or more outlying stations may be connected to the master station and wherein one of the lines may be arranged on a multiparty basis, station D is the master station, stations E and F are outlying stations each connected to the master station D by a line circuit arranged on a private line basis and stations N and N' are outlying stations both connected to the master station by a line arranged on a party line basis. The line connecting station N with master station D, represents the highest numbered line of three or more and therefore the line is given the "N" designation. However, for the purpose of illustration it is assumed hereinafter that there are three lines only and station N is connected to the third line. The equipment at each of stations E, F, N, and N' is identical to that used at each of stations B, C, and C' in Fig. 1 and the functions of each of the respective control circuits and respective message signal circuits are the same as those of conductors 10 and 17, respectively. The primary control relays 51, 52 and 60 at master station D are, like the corresponding relays of Fig. 1, of the two-winding type, but each has four instead of two lower armatures. Also in systems of three or more lines, it is preferable to use at each of the primary control relays a separate armature for operating the busy lamp. In the system shown in Fig. 2, therefore, one upper and four lower armatures are shown for each primary control relay at the master station in order to provide for a three or more line circuit arrangement.

Having described the equipment and function of the arrangement shown in Fig. 1, the method of operation of Fig. 2 will now be described. Assume that the operator at master station D wishes to establish a connection to outlying station E. The operator opens call switch 61 in the control circuit conductor 62. Relays 51 and 63 which are normally operated, release. Relay 63, upon releasing, closes at its lower armature and contact an obvious operating circuit for teletypewriter motor 64 at station D and at its upper armature and contact a circuit for lighting busy lamp 65. Relay 51, upon releasing, connects at its upper armature and contact, the message signal circuit conductor 66 to the teletypewriter at master station D which comprises transmitting device 67 and receiving printer magnet 68. Relay 51, upon releasing, also closes at its outermost lower armature and contact an obvious operating circuit for teletypewriter motor 69, at its next to the outermost lower armature and contact a circuit for lighting busy lamp 70, at its next to the innermost lower armature and contact, a circuit traceable from ground connection 71, battery 72, next to the innermost lower armature and contact of relay 51, conductor 73, innermost lower armature and contact of relay 51, conductor 74, through the lower winding of relay 52, conductor 75, through the lower winding of relay 60 to grounded connection 76. Relays 52 and 60 are maintained operated in the event that should a call be initiated by the subscribers at any one of the stations F, N and N' during the time when a connection between outlying station E and master station D is established, the station attempting such call could not interfere with the established connection.

Assume that a connection is established between station F and master station D, then relay 52 will be released and the locking circuit for the remaining stations will be traceable from ground connection 77, battery 78, next to the innermost lower armature and contact of relay 52, conductor 73, through the lower winding of relay 51, conductor 74, innermost lower armature and contact of relay 52, conductor 75, through the lower winding of relay 60 to ground connection 76. Relays 51 and 60 will be maintained in an operated position against any attempt by any of the subscribers at stations E, N and N' to interrupt the established connection.

Assume that a connection is established be-

tween the master station D and either station N or N', then relay **60** will be released and the locking circuit for stations E and F will be traceable from ground connection **79**, battery **80**, next to the innermost armature and contact of relay **60**, conductor **73**, through the lower winding of relay **51**, conductor **74**, through the lower winding of relay **52**, conductor **75**, innermost lower contact and armature of relay **60** to ground connection **76**. Relays **51** and **52** will be maintained in operated positions against any attempt by any one of the subscribers at stations E and F to interrupt the established connection. When an established connection between master station D and any one of the stations such as N and N' connected to the party line **81** is completed, the equipment at all the stations connected to the party line are operated and the transmitted messages are recorded at all the stations so connected. The busy lamp at each of the party line stations is lighted during an established connection of the party lines so that all subscribers at the party line station other than the one who initiated a call, is informed that the party line is busy.

The invention is not limited to the arrangements shown in Figs. 1 and 2. For systems of two or more lines the number of armatures for the primary control relays **51**, **52**, etc., may be reduced to three, as shown for relays **11** and **32** in Fig. 1, by employing one more locking winding on each of the primary control relays for each line over two. For example, in systems of three lines, three windings will be required on each of the primary control relays and in systems of four lines four windings will be required on each of these relays. When three armatures only are provided, one will effect the closing of the message line, one will close the motor control circuit, and one will serve two purposes, one of which is to close its own busy lamp circuit and the other will energize a locking winding on each of the other primary control relays, in series connection, the lamp and the locking circuits being connected in parallel with each other.

It is also understood that the several batteries shown at the master stations may be a common source of power.

What is claimed is:

1. A signaling system comprising a main station, a plurality of other stations, a normally deenergized circuit and a normally energized circuit connecting each of said other stations with said main station, switching means near opposite ends of each of said normally energized circuits and forming parts thereof, and other means comprising contacts responsive to the operation of either or both of the switching means forming part of one of said normally energized circuits for rendering the normally deenergized circuit associated with said one circuit, energized for signaling purposes.

2. A signaling system according to claim 1 wherein each of said other means comprise other contacts operable to prevent a plurality of other of said normally deenergized circuits from being energized and to furnish at said main station an indication when the normally deenergized circuit associated with said one circuit is energized, said indication being individual to the particular normally deenergized circuit which becomes energized.

3. A signaling system according to claim 1, wherein said main station comprises a message sending and receiving device common to all said normally deenergized circuits and each of said other means comprises other contacts operable to condition for sending and receiving said message sending and receiving device.

4. A communication system comprising a main station, a plurality of substations, a system of conductors for interconnecting said main station and each of said plurality of stations, there being one such system mutually exclusive of all the others for each substation, operable means at each of said stations for seizing one of said systems for establishing communication between said main station and one of said substations, and means for preventing any of the other of said systems of conductors from being seized for communication purposes while said one system is engaged.

5. A communication system comprising a main station, a plurality of other stations, a normally energized and a normally deenergized circuit for interconnecting said main station and each of said plurality of other stations, operable means at said main station and each of said other stations for opening one of said normally energized circuits to initiate a connection between said main station and one or more of said other stations, individual other means at said main station responsive to the opening of said one normally energized circuit for energizing the associated one of said normally deenergized circuits for communication purposes, and holding means included in each of said other means for preventing interference with an established connection between said main station and one or more of said other stations, by any of the remaining said other stations.

6. A communication system comprising one chief station and a plurality of substations, a system of conductors for interconnecting said chief station and each of said plurality of stations, there being one such system of conductors mutually exclusive of all the others for each substation, each system comprising a pair of paths closed and conductive when closed at each station through which conductors pass, operable means at each of said stations for seizing one of said systems for establishing communication between said chief station and one of said substations, and means for preventing any of the other of said systems of conductors from being seized for communication purposes while said one system is engaged.

7. A communication system comprising a main station, a plurality of other stations, a normally energized and a normally deenergized circuit for interconnecting said main station at each of said plurality of other stations, operable means at said main station and each of said other stations for opening one of said normally energized circuits to initiate a connection between said main station and one or more of said other stations, individual other means at said main station responsive to the opening of said one normally energized circuit for energizing the associated one of said normally deenergized circuit, holding means included in each of said other means for preventing interference with an established connection between said main station and one or more of said other stations by any of the remaining said other stations, and indicating means controlled by each of said other means for informing when each of said normally deenergized circuits is energized.

8. A communication system comprising a main station, a plurality of other stations, a pair of circuits for interconnecting said main station and each of a plurality of said other stations, one of said pairs of circuits interconnecting said main

station and one of said other stations including at each end a normally energized relay and the other of said pair including at each end message sending and receiving devices, and means for operatively interconnecting the sending and receiving devices at opposite ends of said other circuit of said pair for communication purposes when one of said normally energized relays is released.

9. A communication system comprising a main station, a plurality of other stations, a message sending and receiving device at each of said stations, a normally energized and a normally deenergized circuit for interconnecting said main station and each of said plurality of other stations, each of said normally energized circuits including at each end a normally energized relay and each of said normally deenergized circuits including at one end, an individual one of said message sending and receiving devices and at the other end a message sending and receiving device common to all normally deenergized circuits and means for operatively interconnecting the sending and receiving devices at opposite ends of one of said normally deenergized circuits for communication purposes when one of said normally energized relays is released.

10. A communication system comprising a main station, a plurality of three or more other stations, a circuit pair comprising a normally energized and a normally deenergized circuit for interconnecting said main station and one of said plurality of other stations, certain pairs of said circuits being arranged to interconnect said main station and certain of said other stations respectively, and other pairs of said circuits being arranged to interconnect said main station and a group of two or more the remaining of said other stations connected in series, and means included in the termination of each of said pairs of circuits at said main station for preventing interruption of a connection established over any one of the other of said pairs of circuits.

11. A communication system comprising a main station, a plurality of other stations, a pair of circuits for interconnecting said main station and each of certain of said other stations, a pair of circuits for interconnecting said main station and each group of the remaining of said other stations connected in series, one circuit for each pair being normally energized and the other circuit of each pair being normally deenergized, motor control means at said main station and each of said other stations, and means under the control of said normally energized circuit of each pair for starting and stopping said motor means at each of two or more interconnected stations.

12. A communication system comprising a main station, three or more other stations, a normally deenergized circuit and a normally energized circuit connecting each of said other stations with said main station, switching means included in each of said normally energized circuits at each of said stations, other means individual to each pair consisting of a normally energized circuit and a normally energized circuit and comprising contacts responsive to the operation of either one or both of said switching means in one of said normally energized circuits for rendering the normally deenergized circuit associated with said one normally energized circuit over which the call was initiated, energized for signaling purposes, and means at each of said other stations for indicating when a connection is established between said main station and one of said other stations.

13. A communication system comprising a main station, three or more other stations, a normally deenergized circuit and a normally energized circuit connecting each of said other stations with said main station, switching means included in each of said normally energized circuits at each of said stations, other means individual to each pair which consists of a normally deenergized circuit and a normally energized circuit comprising contacts responsive to the operation of either one or both of said switching means in one of said normally energized circuits for rendering the normally deenergized circuit associated with the normally energized circuit over which the call is initiated, energized for signaling purposes, and means at said main station for indicating which of said other stations is established in an operative connection with said main station.

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