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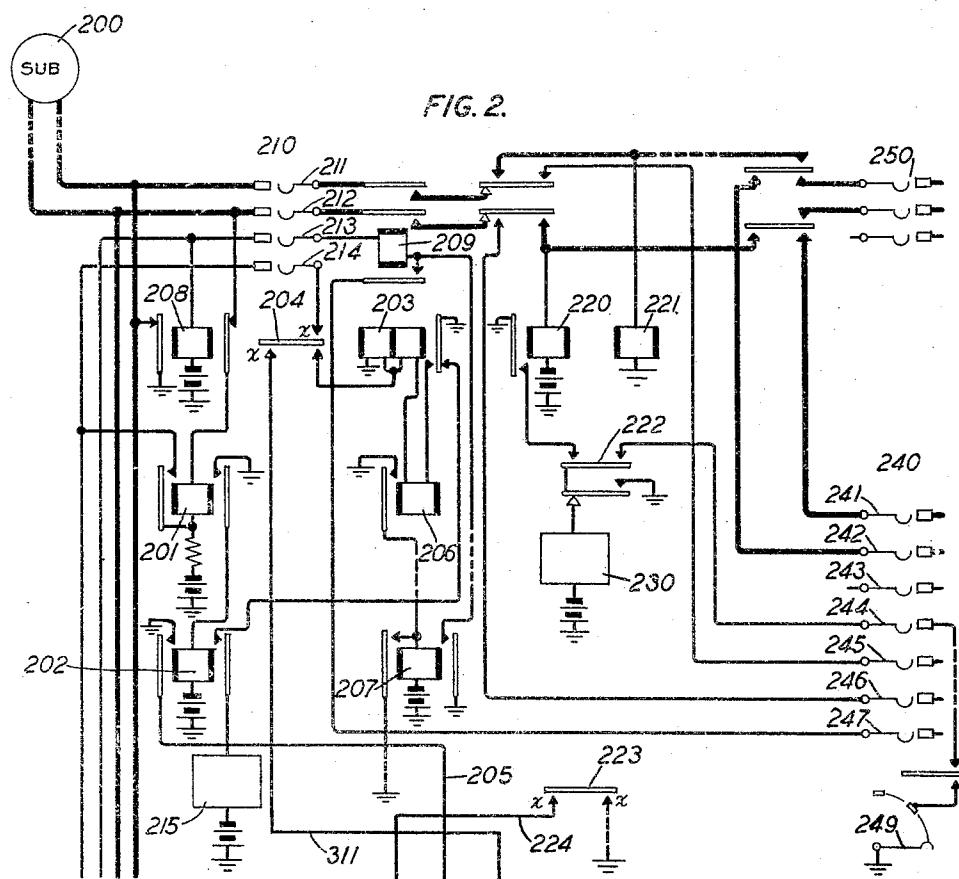
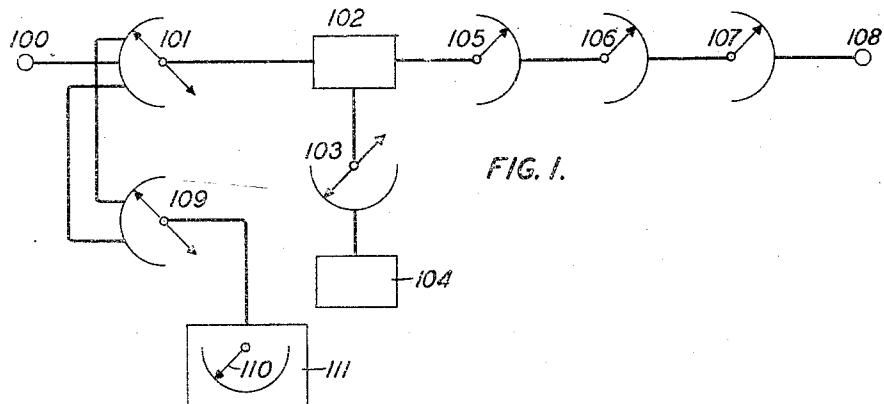
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1,897,048

TELEPHONE SYSTEM

Filed Sept. 1, 1931

2 Sheets-Sheet 1



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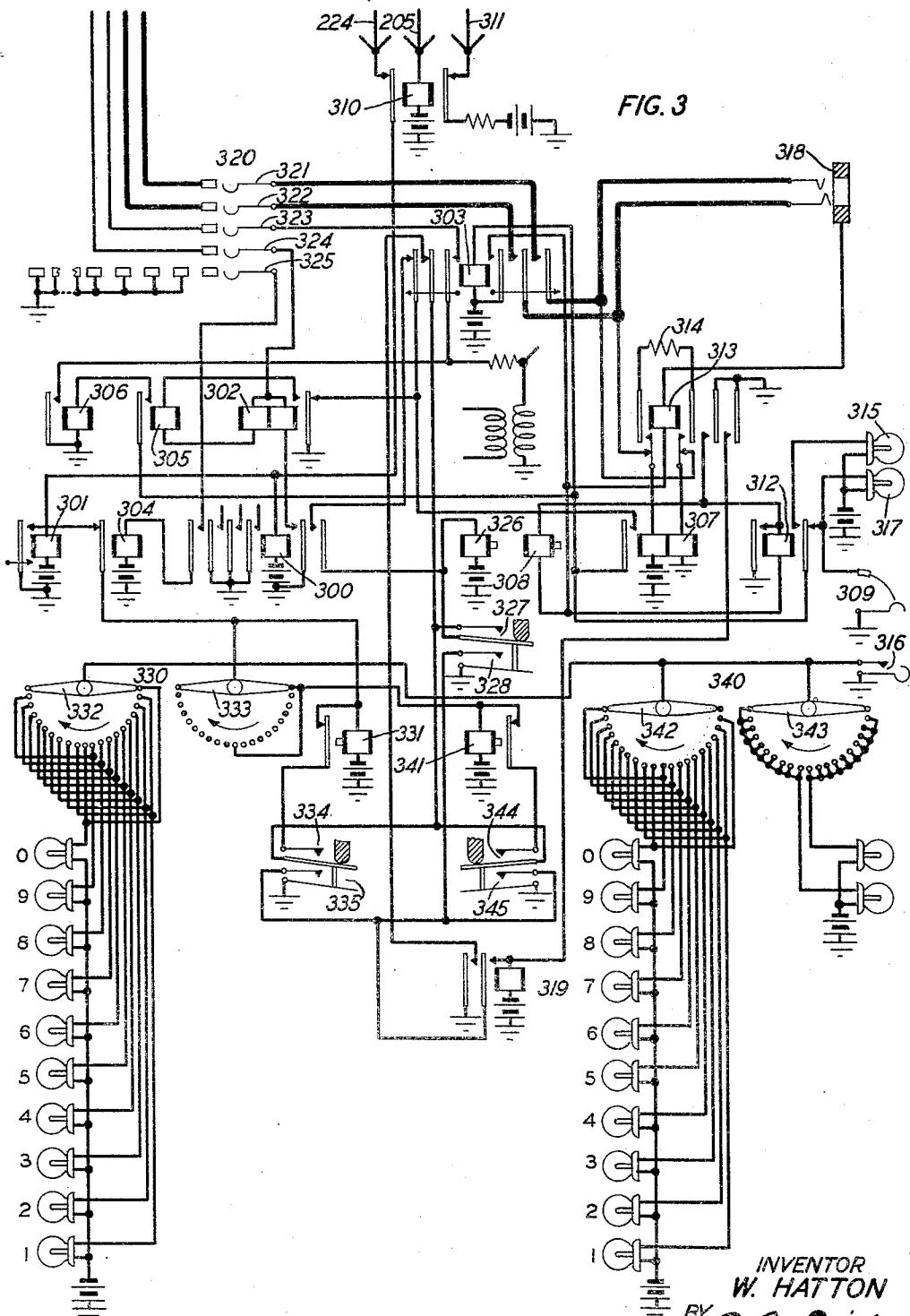
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2 Sheets-Sheet 2



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## UNITED STATES PATENT OFFICE

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## TELEPHONE SYSTEM

Application filed September 1, 1931, Serial No. 560,554, and in France December 1, 1930.

This invention relates to telephone systems and more particularly to a system in which connections may be set up either wholly or in part by means of automatic switching mechanisms. The invention is particularly applicable to a telephone system employing means for giving an indication as to the presence of certain kinds of faults, particularly the occurrence of false calls and an object of 10 the invention is to provide an improved system of this type.

According to one feature of the invention, a circuit arrangement is provided in which the presence of a false call on a calling line is 15 adapted to cause the partly set up connection to seize a false call circuit which is then adapted to set itself to a definite position depending on the designation of the calling line and to control the mechanism associated 20 therewith which is adapted to indicate the line on which a false call is present. Preferably the arrangement is such that the presence of a false call causes the registering mechanism or sender to transmit a signal to 25 the link circuit or district selector whereupon the auxiliary controlling switch mechanism of the latter moves into a position in which a circuit is completed for moving the false call circuit into connection with the calling 30 line.

As soon as the false call signal has been transmitted, the presence of such false call is registered in the link circuit or district selector and the registering mechanism is automatically released for another call.

Furthermore, as soon as the false call signal is transmitted to the district selector, the false call circuit is brought into operation and as soon as the latter establishes connection with the line on which a false call is present, an indicating signal is operated and the district selector is automatically released for another call, and the line on which the false call is present is automatically connected to a device by means of which such line may be tested from an operator's position, or if desirable, connected to the wanted line.

The switching mechanism which is normally employed for hunting for and connecting with a calling line is so arranged that a

brush of such switching mechanism is adapted to test for the calling line and is also adapted to complete a circuit for setting another switching device which is adapted to hunt for a calling line in the event of a false 55 call having been extended thereover.

The calling line is preferably extended to the registering mechanism or sender over one of a plurality of finder switches which may be associated with a special finder switch 60 for dealing with false calls, means being provided whereby after a calling line has been extended to a sender over one finder switch, the simultaneous hunting of the associated false call finder and of another finder switch 65 having access to the same group of calling lines is prevented and whereby the finder switch is given priority over the false call finder switch associated therewith. These and other features of the invention will be 70 more clearly understood from the following detailed description which is given in conjunction with the accompanying drawings, in which:

Fig. 1 shows a lay-out diagram of the circuit embodying the invention;

Fig. 2 shows a subscriber's line circuit, a portion of a line finder district selector circuit with the brushes of the selector and of the sender selector; and,

Fig. 3 shows a false call circuit having a finder switch for establishing a connection with the calling line shown in Fig. 2.

It is thought that the invention will be understood best by first considering the lay-out diagram shown in Fig. 1. When a call is initiated by subscriber 100, a line finder 101 is set in motion and extends the calling line to a district selector circuit 102, whose sender selector 103 hunts for a free sender 104. The 85 district selector switch itself is indicated by switch 105. The sender 104 causes the calling line to be extended from the district selector over the selectors 105, 106 and the final selector 107 to the wanted subscriber 108 in the usual well-known manner. If a false call causes the seizure of the sender 104, the latter 90 after a certain time will cause the sequence switch of the district selector circuit 102 to move into a position in which a circuit is com- 95 100

pleted for operating a false call finder 109 which is multipled to the bank of the line finder 101. The false call finder 109 hunts for the calling line and in doing so transmits 5 impulses to a switching mechanism 110 in the false call circuit 111. The false call finder 109 will stop on the terminals of the calling line and when it reaches the latter, the switch 110 of the false call circuit will have moved 10 into a position in which the particular line on which the false call is present will be indicated in the false call circuit.

The circuit is so arranged that on the occurrence of a false call, as soon as the sequence switch of the district selector circuit 102 has moved into the false call position in response to the signal from the sender 104, the latter is at once freed for another call. Furthermore, as soon as the false call finder 20 109 has established connection with the calling line the whole line finder district selector circuit is made free for another call, the connection from the line on which a false call is present being maintained to the false call circuit 111 over the false call finder.

Referring now to Figs. 2 and 3, the operation of the circuit will be described. In Fig. 2 the usual subscriber's line circuit is shown connected to the bank of a 200-point line finder, the terminals of which are strapped to the bank of the false call finder. A skeleton district selector circuit is shown connected with the brushes of the 200-point line finder on the left and the brushes of a district selector switch on the right. The brushes of the sender selector are shown in the lower right hand corner of Fig. 2, it being understood that these brushes establish connection with a controlling register sender in 30 the usual well-known manner. It is to be understood that in Fig. 2 only those parts of the district selector circuit are shown which are necessary for a complete understanding of the invention, the position of the remaining 40 parts of the circuit which have been omitted and which will be necessary when the circuit is used in practice being indicated by dotted lines.

When a calling subscriber 200 lifts his receiver, a circuit is closed for line relay 201 which at its right contact completes a circuit for the start relay 202 of the line finder 210. Relay 202 completes an obvious circuit for magnet 215 of the line finder which drives the 50 line finder brushes around until they meet the terminals of the calling line, whereupon the test relay 203 is operated over cam 204, brush 214 and the left front contact of relay 201 to battery, breaking the circuit of magnet 215, and stopping the brushes on the calling line. Relay 202 also closes a circuit over conductor 205 for relay 310 in Fig. 3 which energizes 60 and prevents the false call finder from energizing while a line finder is hunting for a calling line. Relay 203 locks up in series

with relay 206 which in turn energizes relay 207. The subscriber's cut-off relay 208 now operates in series with relay 209 over wiper 213 to ground at the front contact of relay 207. Relays 201, 202 and 310 are in turn released, as well as relays 203 and 206.

The relay 209 extends the connection to relays 220 and 221 which energize over the loop of the calling line. Relay 220 closes a circuit which causes the sequence switch 230 to move to a position where the connection is extended over the brushes of sender selector 240 to the sender and relays 220 and 221 are disconnected. The sender causes the line to be extended over the selector switch 250 in the manner well-known in the art.

If, after the connection has been extended to the sender, no dialing impulses are transmitted, that is, if a false call or permanent signal condition should develop on the calling line, after a predetermined time interval has elapsed, the sender connects ground over brush 244 and cam 222 to operate sequence switch 230 and to drive the latter into a special false call position which may be indicated on the sequence switch cams by an "X", the exact position being unimportant, in which ground is connected over cam 223 and conductor 224 to the windings of relays 300 and 301 in the false call circuit of Fig. 3. If no other call finder is hunting, test potential is connected from the right back contact of relay 310 over conductor 311, lower left and upper right contacts of cam 204, to brush 214 and thence to the terminal of the false call 90 finder 320 to which brush 324 has access.

The connection of ground to drive the sequence switch 230 into the special false call position, is brought about by a relay in the sender which operates under the control of a timing mechanism 249 and this relay on operating also brings about the release of the sender and renders the latter free for another call. The operation of the sender in response to the timing mechanism 249 is set forth in British Patent 256,544 to the Western Electric Company, Ltd., accepted August 31, 1926.

The start relay 300 closes the circuit for the magnet 326 of the false call finder from ground over the right back contact of relay 302, outer left back contact of relay 303, outer right front contact of relay 300 to the winding of magnet 326 and battery. Relay 300 also connects ground to the winding of test relay 302 and at its outer left contact prepares the circuit of relay 304. Relay 301 operates the magnets 331 and 341 of the step-by-step switches 330 and 340 from ground at the contact of relay 301, back contact of relay 304, through the winding of magnet 331, and over the normal contact of brush 333 to the winding of magnet 341 and battery.

The false call finder 320 starts from the normal position under the control of magnet

326 and at each step operates relay 304 over brush 325, breaking the circuit of magnet 331 which causes switch 330 to advance one step. Relay 304 upon its first energization also 5 opens the circuit of magnet 341 thereby advancing switch 340 one step. At each tenth step of call finder 320, magnet 341 is connected in parallel with magnet 331 and makes one step.

10 When the line is found, battery is connected over brush 324 to relay 302 which operates to ground at the front contact of relay 300, opens the circuit of magnet 326 and locks in series with the slow operating relay 305 over 15 an obvious circuit. At the left front contact of relay 305, a circuit is closed from ground through the winding of relay 306 and the winding of relay 303 to battery. Both relays 303 and 306 operate in this circuit.

20 Relay 303 at its outer left back contact further opens the circuit of magnet 326 and at its left front contact connects ground from the front contact of relay 306 over brush 323 to the winding of the subscriber's cut-off relay 208 thereby short-circuiting relay 209 in the district selector (Fig. 2) which falls back and releases the district selector. After the short circuit of relay 209, the release of 25 the district selector takes place in a manner well-known in the art and it is not considered necessary therefore to show the circuits controlled by relay 209. Over the outer right contacts of relay 303, relay 307 and jack 318 are connected by way of brushes 321 and 322 to the subscriber's loop and relay 307 operates. Relay 303 is held operated over the left front contact of relay 307 to ground at back contact of relay 302 which releases as 30 soon as the district selector releases. Relay 303 also connects battery over its inner right contact, to the winding of the time alarm magnet 308, which controls brush 309.

40 Relay 307 also connects ground from the back contact of relay 302 over the right back contact of relay 312 to lamp 317. When the operator observes this lamp, she inserts the plug of her cord circuit in jack 318, completing a circuit from battery at the inner right front contact of relay 303, winding of relay 313, sleeve of jack 318 to ground in her cord circuit. Relay 313 disconnects relay 307 from the subscriber's line, but holds relay 307 operated over its inner left and right contacts and resistance 314. At its middle right contact relay 313 completes a circuit for relay 312 to battery at the contact of relay 303. Relay 313 also connects ground to the time alarm magnet 308 causing that time alarm to 45 start to operate. The circuit of the time alarm magnet is also maintained at the front contact of relay 312 should the plug be withdrawn from jack 308 before the trouble is cleared. The ground at the right contact of 50 relay 312 also holds that relay operated. The

operation of relay 312 extinguishes lamp 317 and closes a circuit for lamp 315. The operator is now connected to the subscriber's line and may talk or make any desired test 55 on that line.

As has been explained above, the brushes of switches 330 and 340 will have been set in a position depending on that of the false call finder. Therefore, by pressing key 316, ground will be connected over brushes 332 and 342 to the indicator lamps. The position of switch 330 corresponds to the units digit and the position of switch 340 to the tens digit of the group of lines in which the calling line is located. The position of brush 342 of switch 340 indicates whether the subscriber is in the odd or even hundred of the group, while the jack itself identifies the group of two hundred lines.

60 If the subscriber does not release or the trouble is not cleared when a certain time has elapsed after the energization of the time alarm 308, ground is connected over brush 309 to lamp 317 and both lamps 315 and 317 are lighted.

When relay 313 operates in response to the insertion of the operator's cord circuit in jack 318, relay 319 is operated over the outer right contact of relay 313 and locks over the off normal contacts 328, 335 and 345 of switches 320, 330 and 340, respectively. When the subscriber releases or the trouble is cleared, relay 307 releases in turn releasing relay 303. Circuits are thereupon closed from ground at the outer front contact of relay 319, over the inner back contact of relay 303 and the off normal contacts 327, 334 and 344 to magnets 326, 331 and 341 respectively, restoring switches 320, 330 and 340 to normal. When all three switches have reached 65 normal position the holding circuit of relay 319 is opened and that relay releases.

What is claimed is:

1. In a telephone system, a subscriber's line, a selector switch for extending calls from said line, a register sender for controlling said selector switch, means responsive to the initiation of a call on said line to associate said selector switch and said sender with said line, and auxiliary means responsive to a false call on said line to connect said line with an operator's position independent of said selector switch.

2. In a telephone system, a subscriber's line, a selector switch for extending calls from said line, a register sender for controlling said selector switch, means responsive to the initiation of a call on said line to associate said selector switch and said sender with said line, and auxiliary means responsive to a false call to connect said line with an operator's position independent of said sender and said selector switch.

3. In a telephone system, a subscriber's line, a selector switch for extending calls

from said line, a register sender for controlling said selector switch, means responsive to the initiation of a call on said line to associate said selector switch and said sender with said line, and means responsive to a false call on said line to disconnect said sender and said selector switch from said line.

4. In a telephone system, a subscriber's line, a selector switch for extending calls from said line, a register sender for controlling said selector switch, means responsive to the initiation of a call on said line to associate said selector switch and said sender with said line, and means responsive to a false call on said line to disconnect said sender and said selector switch from said line, and to connect said line with an operator's position.

5. In a telephone system, a subscriber's line, a selector switch for extending calls from said line, a register sender for controlling said selector switch, means responsive to the initiation of a call on said line to associate said selector switch and said sender with said line, and means responsive to a false call on said line to disconnect said sender and said selector switch from said line, to connect said line with an operator's position, and to identify said line.

6. In a telephone system, a subscriber's line, a selector switch for extending calls from said line, a register sender for controlling said selector switch, means responsive to the initiation of a call on said line to associate said selector switch and said sender with said line, and means responsive to a false call on said line to disconnect said sender and said selector switch from said line, to connect said line with an operator's position, and to prepare a visual indication of the identity of said line.

7. In a telephone system, a subscriber's line, a selector switch for extending calls from said line, a register sender for controlling said selector switch, means responsive to the initiation of a call on said line to associate said selector switch and said sender with said line, and means responsive to a false call effective after a measured time interval to disconnect said sender and said selector switch from said line.

8. In a telephone system, a subscriber's line, a selector switch for extending calls from said line, a register sender for controlling said selector switch, means responsive to the initiation of a call on said line to associate said selector switch and said sender with said line, and means responsive to a false call effective after a measured time interval to disconnect said sender and said selector from said line, to connect said line with an operator's position and to prepare a visual indication of the identity of said line.

9. In a telephone system, a subscriber's line, a selector switch for extending calls

from said line, a register sender for controlling said selector switch, means responsive to the initiation of a call on said line to associate said selector switch and said sender with said line, means responsive to a false call on said line to cause said sender to transmit a signal to said selector switch, an auxiliary finder switch, and means under the control of said selector switch independent of said sender to cause said auxiliary finder switch to connect said line with an operator's position.

10. In a telephone system, a subscriber's line, a selector switch for extending calls from said line, a register sender for controlling said selector switch, means responsive to the initiation of a call on said line to associate said selector switch and said sender with said line, an auxiliary finder switch, and means responsive to a false call on said line, effective after said line has been associated with said selector switch and said sender to cause said finder switch to hunt for and find said line.

11. In a telephone system, a subscriber's line, a selector switch for extending calls from said line, a register sender for controlling said selector switch, means responsive to the initiation of a call on said line to associate said selector switch and said sender with said line, an auxiliary finder switch, means responsive to a false call on said line, effective after said line has been associated with said selector switch and said sender to cause said finder switch to hunt for and find said line, and means responsive to the association of said finder switch with said line to disconnect said selector switch from said line.

12. In a telephone system, a subscriber's line, a selector switch for extending calls from said line, a register sender for controlling said selector switch, means responsive to the initiation of a call on said line to associate said selector switch and said sender with said line, an auxiliary finder switch, an operator's position, and means responsive to a false call on said line, effective after said line has been associated with said selector switch and said sender to cause said finder switch to hunt for and find said line and to extend said line to said operator's position.

13. In a telephone system, a subscriber's line, a selector switch for extending calls from said line, a register sender for controlling said selector switch, means responsive to the initiation of a call on said line to associate said selector switch and said sender with said line, a finder switch, means responsive to a false call on said line to cause said finder switch to hunt for and find said line, and means operated from said finder switch in hunting for said line to indicate the identity of said line.

14. In a telephone system, a subscriber's

line, a selector switch for extending calls from said line, a register sender for controlling said selector switch, means responsive to the initiation of a call on said line to associate said selector switch and said sender with said line, a finder switch, means responsive to a false call on said line to cause said finder switch to hunt for and find said line, an indicating mechanism, and means controlled by said finder switch in its hunting operation for setting said indicating mechanism.

15. In a telephone system, a subscriber's line, a selector switch for extending calls from said line, a register sender for controlling said selector switch, means responsive to the initiation of a call on said line to associate said selector switch and said sender with said line, a finder switch, means responsive to a false call on said line to cause said finder switch to hunt for and find said line, means responsive to the association of said finder switch with said line to disconnect said selector from said line, an indicating mechanism, and means under the control of said finder switch for transmitting impulses to said indicating mechanism to position it to indicate the identity of said line.

16. In a telephone system, a subscriber's line, a selector switch for extending calls from said line, a register sender for controlling said selector switch, means responsive to the initiation of a call on said line to associate said selector switch and said sender with said line, auxiliary means responsive to a false call on said line to connect said line with an operator's position independent of said selector switch, a pair of switches, means for transmitting impulses from said finder switch during its hunting operation to operate said pair of switches, and means including said switches for indicating the identity of said line.

17. In a telephone system, subscribers' lines, line finders having terminal blanks in which said lines appear, another finder switch having access to said lines in multiple with said line finders, a register sender, means responsive to the initiation of a call on one of said lines to cause one of said line finders to connect said line with said register sender, means in said register sender effective if said call is a false call to cause said other finder switch to hunt for the terminals of said line, and means responsive to the finding of said line by said other finder switch to release said line finder.

18. In a telephone system, a subscriber's line, a selector switch for extending calls from said line, a register sender for controlling said selector switch, means responsive to the initiation of a call on said line to associate said selector switch and said sender with said line, an auxiliary switch associated with said selector switch, means in said send-

er effective after a predetermined interval to advance said auxiliary switch into a predetermined position, and to release said sender from said selector switch, a finder switch, means operated in said predetermined position of said auxiliary switch for initiating the operation of said finder switch to find said line, and means responsive to the finding of said line by said finder switch for releasing said selector switch.

19. In a telephone system, a subscriber's line, a selector switch for extending calls from said line, a register sender for controlling said selector switch, means responsive to the initiation of a call on said line to associate said selector switch and said sender with said line, an auxiliary switch associated with said selector switch, means in said sender effective after a predetermined interval to advance said auxiliary switch into a predetermined position, and to release said sender from said selector switch, a finder switch, means operated in said predetermined position of said auxiliary switch for initiating the operation of said finder switch to find said line, means responsive to the finding of said line by said finder switch for releasing said selector switch, and means for extending said line over said finder switch to an operator's position.

20. In a telephone system, a subscriber's line, a selector switch for extending calls from said line, a register sender for controlling said selector switch, means responsive to the initiation of a call on said line to associate said selector switch and said sender with said line, an auxiliary switch associated with said selector switch, means in said sender effective after a predetermined interval to advance said auxiliary switch into a predetermined position, and to release said sender from said selector switch, a finder switch, means operated in said predetermined position of said auxiliary switch for initiating the operation of said finder switch to find said line, means responsive to the finding of said line by said finder switch for releasing said selector switch, and means for extending said line over said finder switch to an operator's position, an indicating mechanism, and means operated by said finder switch in hunting for said line for positioning said indicating mechanism to identify said line.

21. In a telephone system, a subscriber's line, a selector switch for extending calls from said line, a register sender for controlling said selector switch, means responsive to the initiation of a call on said line to associate said selector switch and said sender with said line, an auxiliary switch associated with said selector switch, means in said sender effective after a predetermined interval to advance said auxiliary switch into a predetermined position, and to release said sender from said selector switch, a finder switch, means oper-

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ated in said predetermined position of said auxiliary switch for initiating the operation of said finder switch to find said line, means responsive to the finding of said line by said 5 finder switch for releasing said selector switch, means for extending said line over said finder switch to an operator's position, an indicating mechanism comprising a pair of switches, and means operated by said finder 10 switch in hunting for said line for positioning said indicating mechanism to identify said line.

22. In a telephone system, a subscriber's line, a false call finder, means responsive to 15 the presence of a false call on said line to cause said false call finder to find said line, a pair of auxiliary switches, means operated by said false call finder in hunting for said line to transmit impulses to said auxiliary 20 switches, banks of lamps and means controlled by said auxiliary switches for selectively lighting said lamps to identify said line.

22 23. In a telephone system, subscribers' 25 lines, line finders having terminal banks in which said lines appear, another finder switch having access to said lines in multiple with 30 said line finders, a register sender, means responsive to the initiation of a call on one of said lines to cause one of said line finders to connect said line with said register sender, means in said register sender effective if said 35 call is a false call to cause said other finder switch to hunt for the terminals of said line, means responsive to the finding of said line by said other finder switch to release said line 40 finder, and means to prevent the operation of said finder switch while any one of said line finders is hunting for one of said subscribers' lines.

22 24. In a telephone system, a plurality of 45 subscribers' lines, a plurality of line finders each having a plurality of brushes, means responsive to the apparent initiation of a call on one of said lines to mark said line to said line finders and to operate one of said line finders, means including one of the brushes of said line finders for testing for said marked line, an auxiliary finder switch, means effective if said call is a false call to initiate the operation of said auxiliary finder switch, and means including said brush for marking said line to said auxiliary finder switch.

50 In witness whereof, I hereunto subscribe my name this 18th day of August, 1931.

55 WILLIAM HATTON.