Oct. 29, 1946. W. T. POWELL 2,410,304

AUTOMATIC TELEPHONE SYSTEM

Filed March 20, 1944 3 Sheets-Sheet 1

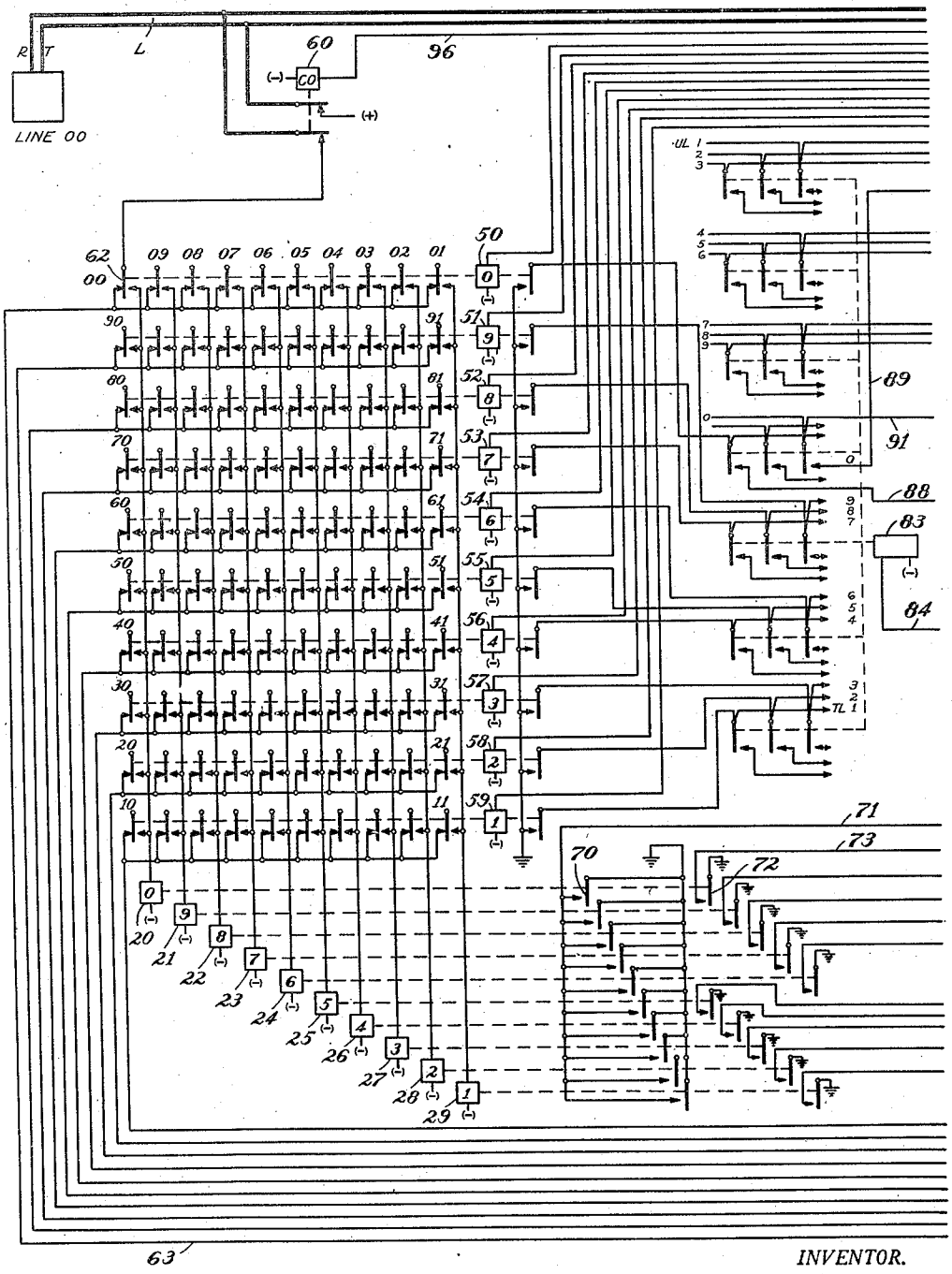


Fig. 1

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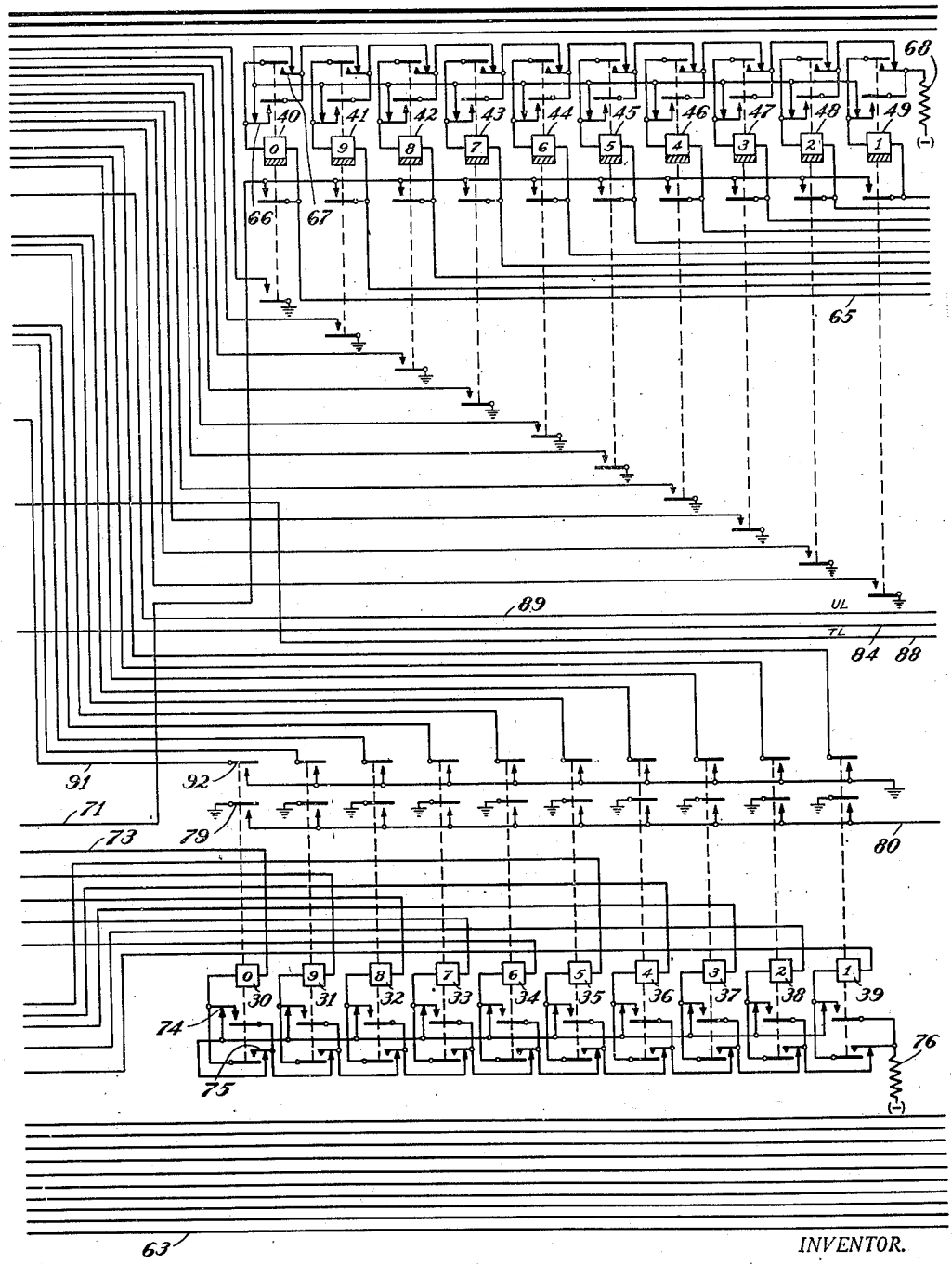


Fig. 2

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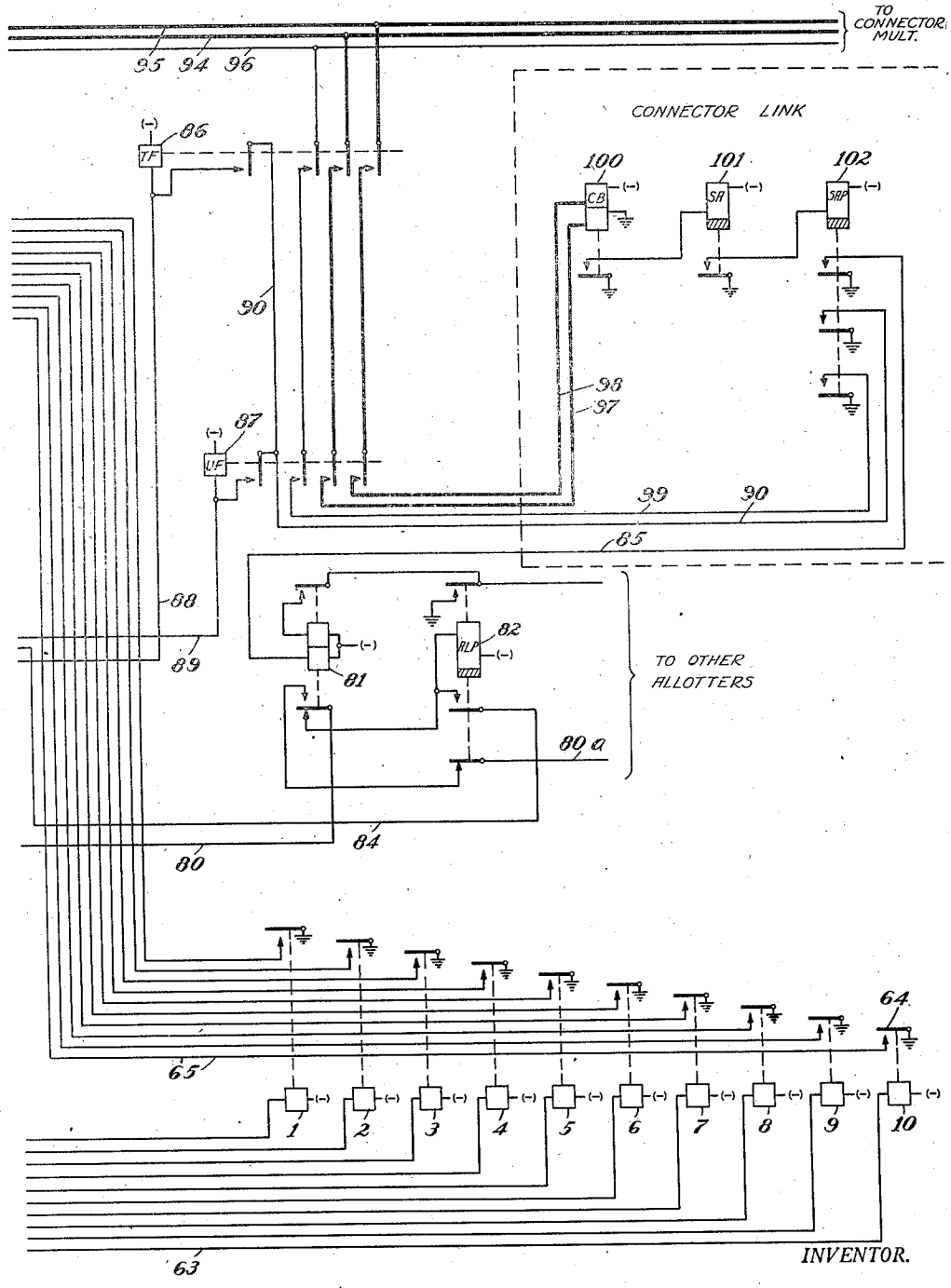


Fig. 3

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AUTOMATIC TELEPHONE SYSTEM

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Application March 20, 1944, Serial No. 527,298

5 Claims. (Cl. 179—18)

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In conventional automatic telephone systems, there is provided an individual line relay for each line so that for each group of one hundred lines, one hundred line relays are required.

In my Patent 1,540,419, granted June 2, 1925, there is disclosed a system employing a lesser number of line relays than the number of related telephone lines, to control the line switches individual to the several lines serving to connect these lines to idle trunks. In the patented arrangement, since a line switch is individual to each line, there is not the necessity of locking out the remaining lines of a group while one of said lines is being extended to an idle trunk, a necessary requirement where an all relay type finder is utilized.

The present arrangement, therefore, has for its purpose the utilization of primary line relays and secondary line relays, less in number than the number of lines in the group which they serve, together with certain cooperating relays whereby all relay line finders can connect idle trunks to calling telephone lines in an accurate, reliable manner with a substantial saving in cost of equipment.

Specifically, the present invention comprises a circuit arrangement in which ten primary line relays and ten secondary line relays common to one hundred lines replace the one hundred line relays usually employed in a line finder system. While other supplemental relays common to this group of lines are required, the total number of relays needed for the mentioned group of lines is substantially less than the one hundred line relays now in current use.

For a clearer understanding of the invention, reference is made to the drawings in which:

Figs. 1, 2 and 3, when arranged side by side in the order named, disclose a portion of a telephone system incorporating the invention.

For convenience in description, the present telephone system is assumed to have one hundred telephone lines although it will be understood that the invention is not so limited but may include systems employing many hundreds of lines. With these one hundred lines of which only the line L is illustrated, there are provided ten primary line relays designated 1 to 10 inclusive and a group of ten secondary line relays designated 20 to 29 inclusive. In addition, there are employed ten units lockout relays 30 to 39 inclusive and ten tens lockout relays 40 to 49 inclusive, together with ten multicontact relays 50 to 59.

With this brief outline of the system, it is believed that the invention will best be understood

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by describing the operation of extending a calling telephone line, such as line L, to an idle link. When the subscriber at the substation on line L lifts his telephone receiver to close the telephone switch contacts (not shown) thereat, a circuit is closed from the positive pole of battery, back contact and armature of the cut-off relay 60, thence over the lower side of the line L, through the mentioned switch contacts now closed, thence over the upper side of the line, armature and back contact of cut-off relay 60, armature 62 and back contact of the multicontact relay 50, conductor 63, winding of the primary line relay 10, to the negative pole of battery. Relay 10 is energized in this circuit and at its armature 64 and front contact, it closes a circuit from the positive pole of battery, conductor 65, winding of the tens lockout relay 40, through a back contact and continuity spring 66 of this relay, and also through the back contact and continuity spring 67 of this relay and thence through the back contacts and continuity springs, similar to 67, of relays 41 to 49 inclusive, resistor 68, to the negative pole of battery. Relay 40 is thus energized to close a substitute circuit for itself through its continuity spring 67 and armature, and thence through the mentioned back contacts and continuity springs, such as 67, of the relays 41 to 49 inclusive, resistor 68 to the negative pole of battery. Relay 40 is maintained operated in this circuit for the time being and at its back contact and continuity spring 67, it interrupts any of the possible operating circuits for the relays 41 to 49 so that none of them can be operated at this time.

As soon as the relay 40 is actuated, it completes an operating circuit for the multicontact relay 50, which circuit extends from the negative pole of battery, winding of relay 50 to the positive pole of battery at the lower armature and front contact of relay 40. The relay 50, when thus operated, switches all ten telephone line circuits, appearing in the level which it controls, from primary line relay 10 to the secondary line relays 20 to 29 inclusive. The closed circuit across the telephone line L is thus disconnected from the primary line relay 10 and is extended to include the winding of the secondary line relay 20. The relay 20 operates and closes a locking circuit for the relay 40 from the positive pole of battery, armature 70 and front contact of the relay 20, conductor 71, inner front contact, armature and winding of relay 40 and thence through the continuity spring 66 and armature of relay 40, through continuity springs and back contacts,

such as 67, of relays 41 to 49 inclusive, as previously described, resistor 68, to the negative pole of battery. Thus, a locking circuit is completed for holding the slow releasing relay 40, before it has time to release when its initial operating circuit is interrupted by the release of primary line relay 10. The release of relay 10 takes place when the relay is disconnected from the line L, as described above. It should be mentioned that the relays 40 to 49 inclusive need not be especially slow in releasing but just slow enough to prevent releasing in the event that a secondary relay, such as 20, is slow in operating, after a switching relay, such as 50, disconnects the line circuit L from the primary line relay 10.

When the secondary line relay 20 is operated, as above described, it closes a circuit for actuating the units lockout relay 30. The circuit for operating the relay 30 extends from the positive pole of battery, armature 72 and front contact of relay 20, conductor 73, winding of the relay 30, its continuity spring and back contact 74, its back contact and continuity spring 75 and thence through the back contacts and continuity springs similar to 75 at each of the relays 31 to 39 inclusive and through the resistor 76, to the negative pole of battery. It will be noted that the relays 30 to 39 inclusive are electrically interlocked to prevent the operation of more than one of them at any one time. The operation of the relay 30 closes its armature 79 and front contact thereby applying ground to the allotter start wire 80, to complete a circuit including start wire 80, armature and back contact of allotter relay 81, winding of slow releasing relay 82, to the negative pole of battery. Allotter relay 82, when energized, completes an energizing circuit for the multicontact allotter relay 83 (Fig. 1), from the negative pole of battery, winding of relay 83, conductor 84, inner armature and front contact of relay 82, back contact and armature of relay 81, conductor 80 to the positive pole of battery at the front contact and armature 79 of relay 30. The mentioned relays 81, 82 and 83 constitute part of an allotting means which serves to assign for use, an idle link or trunk with its relay finder, of which only the tens finder relay 86 (Fig. 3) and the units finder relay 87 thereof, are shown.

With the multicontact allotter relay 83 (Fig. 1) now operated and with the multicontact marker relay 50 energized, as above described, the tens finder relay 86, has its operating circuit completed. This circuit extends from the negative pole of battery, winding of relay 86, conductor 88, front contact and armature of relay 83, front contact and armature of relay 50, to the positive pole of battery. The finder relay, when thus operated, locks itself in this condition, through its inner front contact and armature, holding conductor 90, which is connected to the positive pole of battery, through front contact of relay 102, which will be energized in a manner to be described and will thereafter remain energized as long as the telephone connection under consideration is maintained. Similarly, with the allotter relay 83 operated and with the marker relay 30 (Fig. 2) also operated, the units finder relay 87 (Fig. 3) is energized from the negative pole of battery, winding of relay 87, conductor 89, front contact and armature of relay 83, conductor 91, armature 92 and front contact of relay 30, to the positive pole of battery. Relay 87, when energized, locks itself operated through its front contact and armature, over the holding conductor

90. As soon as the tens finder relay 86 and the units finder relay 87 are operated, the tip, ring and sleeve conductors 94, 95 and 96 respectively are extended to the tip, ring and sleeve conductors 97, 98 and 99 respectively of a link such as the connector link (Fig. 3). When this takes place, the relay 100 is operated over the mentioned tip and ring conductors and the calling line circuit. Relay 100 closes an obvious circuit for the slow releasing relay 101, which in turn effects the operation of the slow releasing relay 102. As soon as the link, indicated in Fig. 3, is seized, the allotter relay 81 is energized over its lower winding and conductor 85. When thus energized, relay 81, locks itself operated through its upper armature and front contact. Relay 81 at this time extends the starter wire 80, to a further extension 80a of this wire having relays similar to 81, 82 and 83 related to another trunk or link.

Relay 102, when operated, completes a circuit from the positive pole of battery through the sleeve conductors 99 and 96, winding of the cut off relay 60 to the negative pole of battery. This circuit operates the cut off relay to open its armatures and back contacts and thereby releases relay 20. Relay 20 at its armature 72 and front contact opens the holding circuit for the units lockout relay 30. The release of the lockout relay 30, makes all of this series of units lockout relays again available for use. Relay 30 at its armature 79 and front contact, opens the starter wire including conductor 80. Also, when relay 20 releases, it opens at its armature 70 and front contact, the circuit including conductor 71, which has been holding operated, the tens lockout relay 40. Relay 40 releases and thereby restores the series of tens lockout relays for subsequent use. The release of the relay 40 in turn effects the release of relay 50.

Calls on any one of the remaining telephone lines of the hundred line group can be extended in a similar manner. It should be pointed out that since the line circuit, such as L, controls the operation of a primary line relay, such as 10, and a secondary line relay, such as 20, and since these relays in turn control the tens and units lockout relays, such as 30 and 40 respectively, there is no possibility of a "tie-up" condition, even when several calls are initiated at exactly the same time. This desired condition prevails since only one tens lockout relay and only one units lockout relay can be operated at any one time, irrespective of the number of simultaneous calls initiated. These operated relays are released after a given line has been connected to a link or trunk in order to effect a separate and distinct marking and lockout condition for the next telephone line to be found.

What I claim is:

1. In a telephone system, a plurality of telephone lines, primary relays and secondary relays common to said telephone lines and less in number than the numbers of said lines, means responsive to the extension of a call over a certain telephone line for operating in combination a given primary relay and a given secondary relay, said combination being individual to said certain telephone line, and finder switching means controlled by the operation of said given primary relay and by the operation of said given secondary relay for seizing said certain telephone line.

2. In a telephone system, a plurality of groups of incoming lines, a primary relay common to each group of lines, a secondary relay common to

a line in each group, means responsive to the extension of a call over a certain line for actuating a primary relay and a secondary relay both common to said certain line, and finder switching means controlled by said last-mentioned primary and secondary relays for seizing said certain line.

3. In a telephone system, a plurality of telephone lines, primary relays and secondary relays less in number than the numbers of said lines, said primary and said secondary relays being controlled over said telephone lines, a chain of tens lockout relays and a chain of units lockout relays, said lockout relays being common to said telephone lines and being selectively operated under the control of said primary and secondary relays, means including certain of said lockout relays for marking said telephone lines in succession when calling, and finder switching means operated responsive to the marking of a calling telephone line for seizing that line.

4. In a telephone system, groups of incoming lines, a primary relay common to each group of lines, a secondary relay common to a line in each group, a first chain of lockout relays corresponding to said groups of lines, a second chain of lockout relays corresponding to the lines of said secondary relays, the operating circuit of each relay of a chain being controlled by each of the remaining relays of a chain whereby the operation of any relay of the chain temporarily disables the remaining relays thereof, means responsive to the extension of a certain incoming line for operating the primary relay related thereto, means controlled by the operation of said last-mentioned relay for operating a corresponding lockout relay of said first chain, a series of multicontact relays corresponding to and operated by said first chain of lockout relays, means including an operated multi-contact relay and said

incoming line for effecting the operation of a certain one of said secondary relays, said secondary relays controlling the operation of a certain lockout relay of the second chain, and finder switching means controlled by the operated multicontact relay and by the operated lockout relay of the second chain for seizing said incoming line.

5. In a telephone system, groups of incoming lines, a primary relay common to each group of lines, a secondary relay common to a line in each group, a first chain of lockout relays corresponding to said group of lines, a second chain of lockout relays corresponding to the lines of said secondary relays, the operating circuit of each relay of a chain being controlled by each of the remaining relays of the chain whereby the operation of any relay of the chain temporarily disables the remaining relays thereof, means responsive to the extension of a certain incoming line for operating the primary relay related thereto, means controlled by the operation of said last-mentioned relay for operating a corresponding lockout relay of said first chain, a series of multicontact relays corresponding to and operated by said first chain of lockout relays, means including an operated multicontact relay and said incoming line for effecting the operation of a certain one of said secondary relays, said secondary relays controlling the operation of a certain lockout relay of the second chain, a plurality of finder switching means, means for allotting finder switching means for use, means including an operated lockout relay of the second chain for operating said allotting means, and means including the operated multicontact relay and the operated lockout relay of the second chain for causing the allotted finder switching means to seize said certain incoming line.

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