R. H. MANSON.

TELEPHONE EXCHANGE SYSTEM.

APPLICATION FILED FEB. 19, 1910.

998,705.

Patented July 25, 1911

2 SHEETS—SHEET 1.

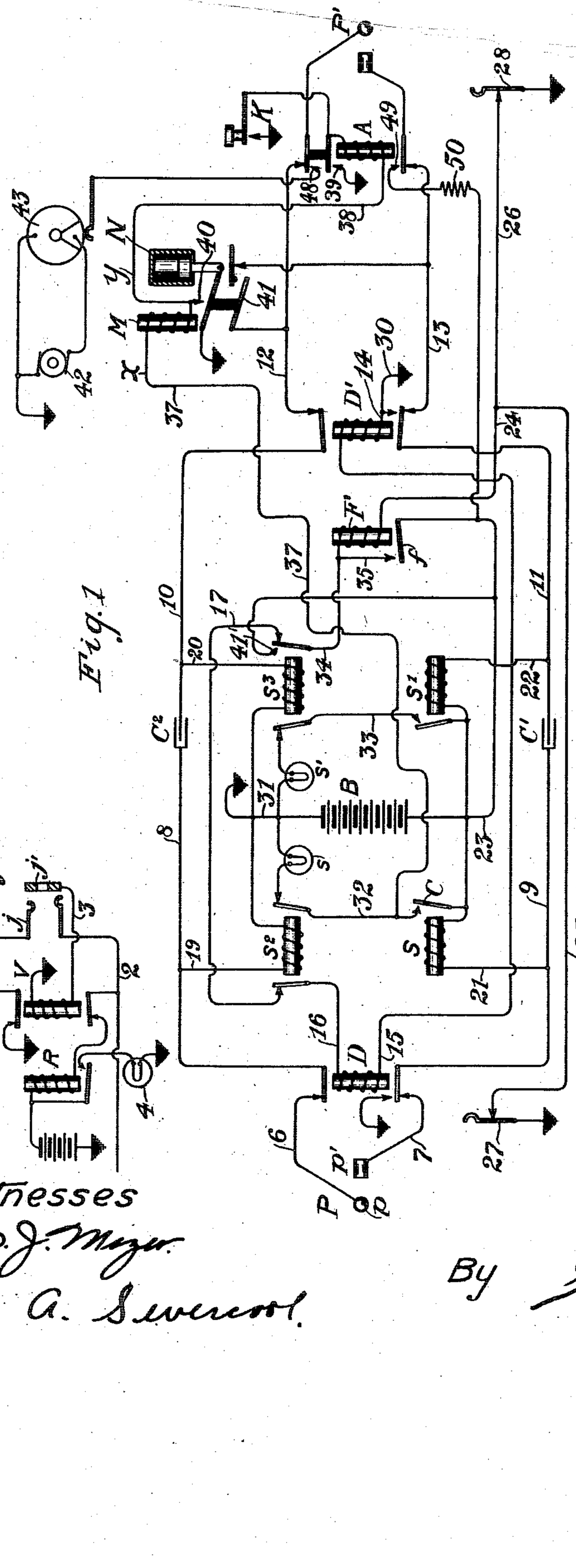

Fig. 1

Fig. 2

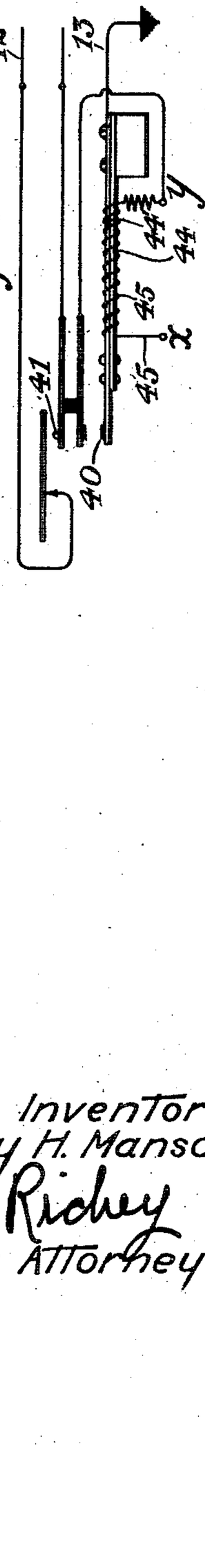

Fig. 3

Witnesses

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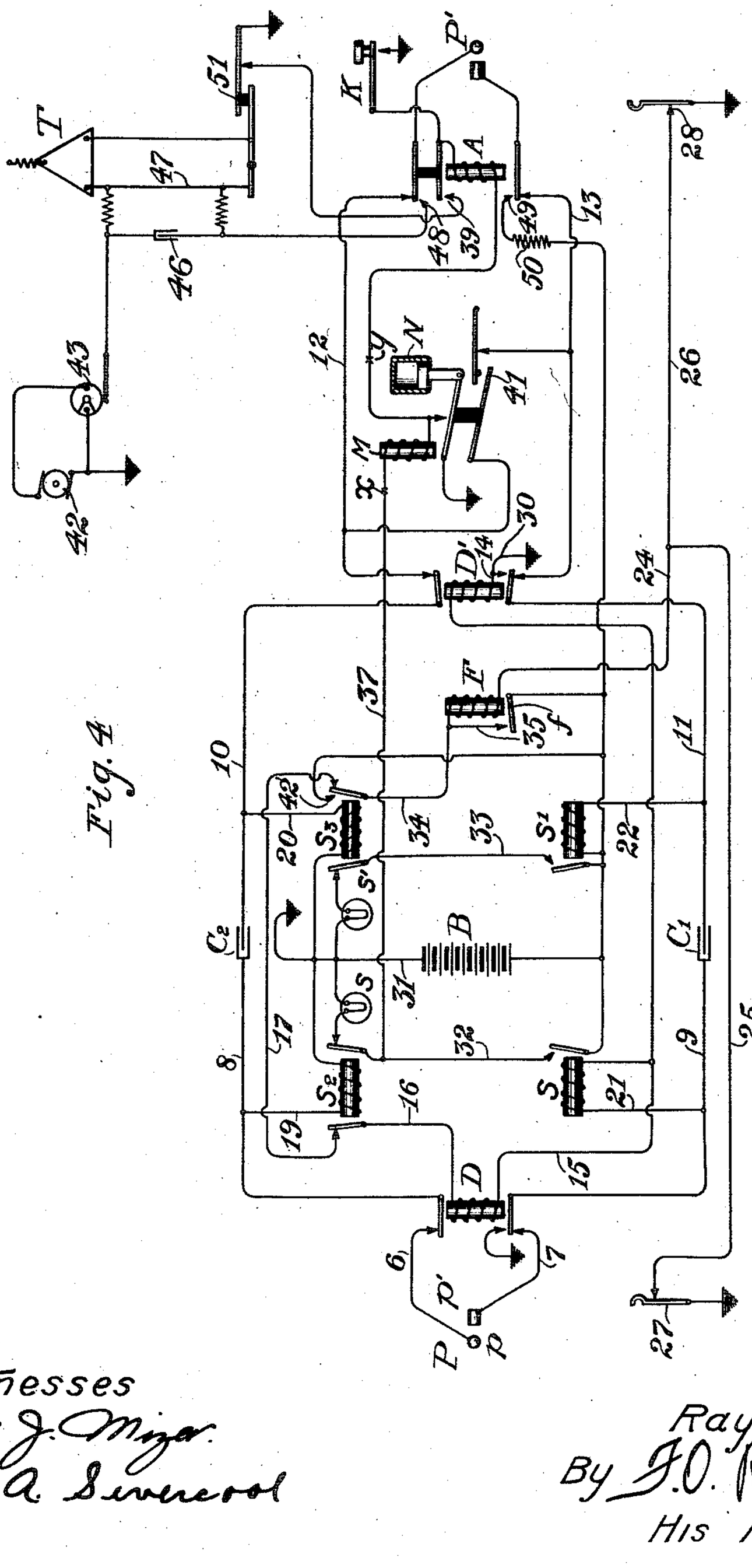

Fig. 4

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UNITED STATES PATENT OFFICE.

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TELEPHONE-EXCHANGE SYSTEM.

998,705. Specification of Letters Patent. Patented July 25, 1911.

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To all whom it may concern:

Be it known that I, RAY H. MANSON, a citizen of the United States, residing at Elyria, in the county of Lorain and State of Ohio, have invented certain new and useful Improvements in Telephone-Exchange Systems; and I do hereby declare the following to be a full, clear, and exact description of my invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to telephone exchange systems, and it consists in the arrangements and combinations herein described.

The main object of my invention is to arrange a telephone system having a central office connection means so that after a subscriber has once been called, the calling subscriber will be able to clear out by merely hanging up his receiver. Both subscribers will then be able to make calls and be answered without waiting for the customary disconnect at the central office.

A further object of my invention is to arrange in an exchange system having double supervisory lamps, an automatic disconnect circuit provided with automatic ringing so that after a predetermined time the ringing of the subscriber's bell will cease and the circuit will be put in such a condition that the calling subscriber will be able to get a disconnect without having to depend on the operator's observing the flashing of the supervisory signal.

Briefly stated, the invention comprises supplementary cut-off relays inserted in the cord circuits and controlling the continuity thereof, one of said relays being a time relay. These relays are brought into service at a predetermined interval after the operator has called a subscriber who fails to answer, and operate to prevent the further ringing up of said subscriber, at the same time putting both subscribers back on their line signals so that they can make calls and be answered in the ordinary way.

My invention is illustrated in the accompanying drawings wherein—

Figure 1 is a diagram showing a cord circuit in a central office and one embodiment of my invention as applied thereto. Fig. 2 shows the line jack end of a subscriber's line circuit. Fig. 3 is an enlarged detail view showing the operation of a thermostatic relay. Fig. 4 is a view similar to that shown in Fig. 1 illustrating a modification of the disconnect mechanism.

Referring to Fig. 1, P and P′ represent the answering and calling plugs respectively of a cord circuit. These plugs are normally connected by way of the conductors 6—8—10—12 and 7—9—11—13, broken of course by the condensers C′ and C². Between 6 and 8, 10 and 12, 7 and 9, and 11 and 13, are inserted contacts controlled in pairs by the relay magnets D and D′. The main battery B is bridged in the cord as usual, each end of the cord being typical, the battery connected to the sleeve side 9 through supervisory control relay S and to the tip side 8 through the supervisory relay S², wires 19 and 21, thus forming a bridge on one side of the condensers, and wires 20 and 22, with the corresponding relays S′, S³ forming a similar bridge on the other side. When a subscriber takes down his receiver either in calling or answering and the respective plug is inserted in the proper jack, the relay S or S′ pulls up at once, taking current from ground to battery and ground over the sleeve side, 9—7—2, in series with the cut-off relay V. This puts battery on the wire 32 or 33, as the case may be, and the lamp *s* or *s′* is thereafter controlled by the relay S² or S³, itself controlled over the tip side of line from the subscriber's station.

From extra back contacts in series, of the relays S² and S³ I derive the circuit of my control relays D and D′, which may be traced as follows: battery B, 23, *f*, 35, 34, 17, 16, D, 15, D′, 14, 30 and ground. Beside the two armatures of relays S² and S³, this circuit is controlled by the locking relay F. Of course the relays D, D′ must be normally deënergized, and in order that they may cut off the plugs I have provided an automatic device to throw said relays into circuit, and which forms the subject of the present invention. The relay F is energized through the wire 34 by the relay S³, battery then coming on the relay F, which pulls up and puts battery on itself to lock. In order that it shall unlock again, both plugs

P, P′ must be in their seats, each seat being provided with the plug seat switch closed to ground, the wire 24 and relay F through the branches 26—28, and 25—27 when the plugs are out.

Relay A takes the place of the regular ringing key of a cord circuit. This relay is operated by means of a single contact key K which closes the circuit from the battery B through a contact C on the sleeve supervisory relay S and thence by the wires 37 through the windings of the special relay M, thence by 38 through the winding of relay A to the special key K and to ground side of battery. The relay A is operated and locked in position by the contact 39, while the relay M is energized and slowly moves its armature, this movement being controlled by the dash pot N. When the armature of the relay M is completely drawn up, the contact 40 is closed which connects the circuit to earth, locking the armature of this relay M in its operated position and placing a low resistance shunt across the winding of the relay A, thereby allowing the latter to release its armature. The relay M also operates a passing contact 41, which momentarily connects the tip and sleeve sides of the cord circuit together, thereby taking the place of the answering of the called subscriber. This operates the tip calling relay S^3, and through a contact 41′ on the latter energizes the relay F so as to put the same in a position to complete the release circuit when the calling subscriber hangs up or moves the hook switch.

The ringing current is furnished by a generator 42 and passes through an interrupter 43 arranged to give any desired interruption in the ringing of the bell, such as one second on and four seconds off. It will be seen that with the relay M arranged to operate in fifteen seconds that three complete interruptions of the ringing current will be had. In other words, the subscriber will be rung from two to three times and the circuit put in condition so that the calling party can get a disconnect if he so desires, after waiting a reasonable length of time for the other party to answer.

The electromagnet and the dash pot of the relay M can be replaced by any similarly operating mechanism, such as the thermostat shown in Fig. 3. Two strips of metal 44 and 44′, having dissimilar coefficients of expansion, are riveted together and wound with a resistance wire 45 and the latter inserted in the circuit between the points *x* and *y* in place of the relay winding. The laminated metal bar will be gradually heated and the unequal expansion will cause it to bend slightly until a contact is made at the points 40 and 41.

In the automatic ringing circuit just described it will be noted that a predetermined number of rings will be given even if the subscriber wanted should answer in the meantime. I have shown in Fig. 4 a circuit designed to obviate this objection. The circuit is provided with a ringing release relay so that when the subscriber responds the ringing will be immediately stopped without regard to the slow acting relay M. The general arrangement is the same as that shown in Fig. 1, with the addition of the above mentioned relay and the necessary connections.

Referring to Fig. 4, the ringing circuit from the generator 42 is interrupted by the interrupter 43, after which it finds a path through the condenser 46 in shunt with one wire 47 of a thermal relay T, thence to the tip side of the calling cord and to line through the closed contact 48 of the relay A. The ringing current after passing through the subscriber's signal bell returns through the sleeve side of cord, contact 49, noninductive resistance 50, battery and ground. The resistance of the signaling circuit in the subscriber's instrument is sufficiently high to prevent the ringing current from heating up the wire 47 of the thermal relay T so as to open up its contact 51. As soon as the subscriber removes his receiver from the hook switch, the resistance of this external circuit is greatly reduced and sufficient ringing current is allowed to flow through the circuit to heat the wire 47 of the thermal relay and open the contact 51. This breaks the locking circuit of the relay A and allows it to resume its normal position.

The operation of the circuits shown in Figs. 1 and 2 is as follows: When a subscriber calls, closing circuit through 1 and 2, the relay R takes current and the lamp 4 lights. The plug P is inserted and the number obtained. When the plug P is inserted, the cut-off circuit is completed through the sleeve side of the cord as follows: ground side of battery, B, S, 21, 9, 7, *p*′, 3, V, ground. V pulls up and the line lamp 4 is extinguished. The relay S pulls up and puts battery on wire 32, lighting the lamp *s*. Circuit 1—2 being closed at the substation, current flows over the path already traced and as the relay V has pulled up, the current continues through 2—1, *j*, *p*, 6, 8, 19, S^2, 31, ground. Relay S^2 pulls up, extinguishing lamp *s* and breaks the circuit of the relays D, F and D′. The line wanted is now tested, the plug P′ inserted and the operator presses the ringing key K. As before stated, the circuit is now closed from battery B through C, 37, M, 38, A, K, and ground. The relay A is operated and locked through 39, the ringing current now passing at intervals through the closed contacts 48 out on the line, and through the signal bell of the called subscriber. The relay M, in the

meantime, has been slowly pulling up, and if the called subscriber has not answered, the passing contact 41 momentarily connects the tip and sleeve sides of the cord circuit together, thereby taking the place of the answering subscriber. This momentarily operates the relay S^3 and the latter closes a circuit and energizes relay F, which pulls up and locks. When the armature of the relay M is completely drawn up, it is locked and the relay A lets go, its winding being shunted to earth through the contact 40 of the relay M. Having been unable to get the party wanted, the calling subscriber now hangs up his receiver or moves his hook switch. The line circuit is broken and the armature of the relay S^2 falls back thereby establishing the following circuit: 31, B, 23, *f*, 35, 34, 17, 16, D, 15, D′, 14, 30. Both relays D and D′ then pull up, cutting off the plugs from the rest of the circuit. These bare plug ends, which are harmless, may be left in the jacks without effecting the line in any way. The cut-off relays V put both subscribers back on their line relays R and they can make calls as before. When the operator gets ready to disconnect, she takes down the plugs P and P′ and their restoration to their seats opens the switches 27 and 28, thereby breaking the circuit through the locking relay F which lets go, and battery is at once taken off the wire 34, and hence off the relays D and D′. These relays retract and the cord circuit is again complete and ready for another operation.

In Fig. 4 the operation is the same as in Fig. 2, except that in this case if the called subscriber should answer before the relay M had fully pulled up, the closing of the circuit at the hook switch so reduces the external resistance of the circuit that enough of the ringing current from the generator 42 will go through the thermal relay T to actuate the latter, thereby breaking the locking circuit of the relay A and hence disconnecting the generator 42 from the line. After the relay A has released, the cord circuit may be broken by either subscriber hanging up his receiver or moving his hook switch, the cut-off relays D and D′ effecting this operation in the same manner as previously described.

My invention provides a simple and positive means for disconnecting the cord circuit after the automatic ringing has ceased, and for putting the subscribers back on their line signals, without waiting for the operator to disconnect the cord plugs which she would ordinarily have to do before a new connection could be obtained.

While I have shown this particular form of my invention and have shown it applied to this particular form of circuit, it will be obvious to those skilled in the art to which this invention appertains, that numerous and extensive departures from the form and the details of the apparatus here shown may be made or that it may be employed in connection with other forms of circuits without departing from the spirit of my invention, the same being herein shown in this manner solely for the purpose of clearly illustrating one specific embodiment thereof.

Having thus described my invention, what I claim and desire to secure by Letters Patent is—

1. In a telephone exchange system, subscribers' lines, and an operator's cord for connecting them, with an automatic ringing circuit therefor, means operated by the calling subscriber for disconnecting the cord plugs from the main cord circuits, and means operating on the completion of the ringing, to place the cord circuit in condition to be thus disconnected.

2. In a telephone exchange system, subscribers' lines, and an operator's circuit for interconnecting them, with an automatic ringing circuit therefor, line signals connected with said subscribers' lines, means operated by both subscribers for disconnecting the cord plugs from the main cord circuits, and means operating on completion of the ringing to place the cord circuit in condition to be thus disconnected.

3. In a telephone exchange system, subscribers' lines, and an operator's cord circuit for interconnecting them, with an automatic ringing circuit therefor, line signals connected with said subscribers' lines, cut-off relays adapted to be operated by the calling subscriber for disconnecting the cord plugs from the main cord circuits, means operating on completion of the ringing to place the cord circuit in condition to be thus disconnected, and means controlled by the operator upon withdrawal of the cord plugs to break the cut-off relay circuit thereby restoring the cord to operative condition.

4. In a telephone exchange system, subscribers' lines and an operator's cord circuit having terminal plugs for interconnecting the lines, a supervisory signal magnet associated with each plug and controlled during connection by the corresponding subscriber, a cut-off relay associated with each plug and adapted when operated to disconnect the respective plug from the cord circuit, automatic ringing mechanism for said cord circuit, and means operating on completion of the ringing to place the cord circuit in condition to be disconnected.

5. In a telephone exchange system, subscribers' lines provided with line signals, a cord circuit comprising automatic ringing means, a time relay, cut-off relays for disconnecting the cord plugs from the cord circuit, said relays being controlled by the connected subscribers, and means actuated by said time relay for disconnecting the ring-

ing means from the line after a predetermined interval and for placing the cord circuit in condition to be disconnected.

6. In a telephone exchange system, subscribers' lines, and a cord circuit having an automatic ringing means connected therewith, comprising a generator and an interrupter, cut-off relays for disconnecting the plugs from the cord circuit adapted to be operated by the connected subscribers, a slow acting time relay adapted to limit the number of calls of said ringing means and arranged to place said cut-off relays in operative connection, said time relay comprising a magnet, armatures therefor, and a dash pot controlling the movement of the latter, and means controlled by the operator, upon withdrawal of the plugs, to break the cut-off relay circuit and to restore the cord to operative condition.

7. In a telephone exchange system, subscribers' lines, and a cord circuit interconnecting the lines, automatic ringing means connected with the cord circuit, means operated by the called subscriber for disconnecting the said ringing means from the line, cut-off relays for disconnecting the plugs from the cord circuit adapted to be operated by the connected subscribers, a slow acting time relay arranged to place said cut-off relays in operative connection, and means controlled by the operator upon the withdrawal of the plugs to break the cut-off relay circuit and to restore the cord to operative condition.

8. In a telephone exchange system, subscribers' lines, and a cord circuit interconnecting the lines, automatic ringing means connected with the cord circuit, a thermal relay adapted to be energized by the called subscriber for disconnecting said ringing means from the line, cut-off relays for disconnecting the plugs from the cord circuit adapted to be operated by the connected subscribers, a slow acting time relay arranged to place said cut-off relays in operative connection, and means controlled by the operator upon withdrawal of the plugs, to break the cut-off relay circuit and to restore the cord to operative condition.

9. In a telephone exchange system, subscribers' lines, an operator's cord circuit for interconnecting said lines, said cord circuit including automatic ringing means, disconnect mechanism operating to disconnect the ringing mechanism from the line on the answering of the called subscriber, cut-off relays included in said cord circuit and arranged to be operated when the connected subscribers hang up their receivers to disconnect the cord plugs from the cord circuit, and means controlled by the operator upon the withdrawal of the plugs to break the cut-off relay circuit and to restore the cord to operative condition.

10. In a telephone system, subscribers' lines, manually operated means at the central office for interconnecting said lines, and means actuated during the operation of ringing to place the interconnecting means in condition to be broken by the calling subscriber.

11. In a telephone system, subscribers' lines, manually operated means at the central office for interconnecting said lines, automatic ringing devices, and means actuated through the operation of said automatic ringing devices to place said interconnecting means in condition to be broken by the calling subscriber.

12. In a telephone system, subscribers' lines, central office means for interconnecting said lines, automatic ringing devices, and means actuated either by the operation of said ringing devices or by the called subscriber for placing said interconnecting means in condition to be broken by the calling subscriber.

13. In a telephone system, subscribers' lines, manually operated means at the central office for interconnecting said lines, automatic ringing devices, and means actuated in the operation of said ringing devices to place the circuits in condition to be broken by the connected subscribers after the ringing ceases.

14. In a telephone exchange system, subscribers' lines, means under the control of operators for interconnecting the lines, and means controlled first by both subscribers and then after a certain interval by only one subscriber for severing the operator's connecting means.

15. In a telephone system, subscribers' lines, manually operated means at the central office for interconnecting said lines at one point, automatic ringing devices, and means acting to enable the calling subscriber to break said interconnecting means at another point, either on completion of the ringing or after the called subscriber has hung up his receiver.

16. In a telephone system, subscribers' lines, manually operated means at the central office for interconnecting said lines at certain points, automatic ringing devices, and means acting to place the circuits in condition for the connected subscribers to break said interconnecting means at other points after the ringing ceases.

17. In a telephone exchange system, subscribers' lines, means for interconnecting the lines at an exchange, means for applying ringing current to the interconnecting means, a normally disabled means for severing such interconnecting means, and means only under the control of the called subscriber during the ringing condition for removing the disability of the severing means.

18. In a telephone exchange system, sub-

scribers' lines, means for interconnecting the lines at an exchange, means for applying ringing current to the interconnecting means, a normally disabled means for severing such interconnecting means, and means only under the control of the called subscriber during the ringing condition for removing the disability of the severing means, the termination of the sending of ringing current also adapted to remove such disability.

19. In a telephone exchange system, subscribers' lines, means for interconnecting the lines at an exchange, means for applying ringing current to the interconnecting means, a normally disabled means for severing such interconnecting means, and means only under the control of the called subscriber during the ringing condition for removing the disability of the severing means, such severing means adapted to be controlled jointly by both subscribers after the response of the called subscriber.

20. In a telephone exchange system, subscribers' lines, means for interconnecting the lines at an exchange, means for applying ringing current to the interconnecting means, a normally disabled means for severing such interconnecting means, and means only under the control of the called subscriber during the ringing condition for removing the disability of the severing means, the termination of the sending of ringing current also adapted to remove such disability, such severing means adapted to be controlled by the calling subscriber after the termination of the sending of ringing current in the absence of response of the called subscriber.

21. In a telephone exchange system, subscribers' lines, means for interconnecting the lines at an exchange, means for applying ringing current to the interconnecting means, and a normally disabled means for severing such interconnecting means, the termination of the sending of ringing current adapted to remove such disability, and such severing means adapted to be controlled by the calling subscriber after the termination of the sending of ringing current in the absence of response of the called subscriber.

In testimony whereof I affix my signature in presence of two witnesses.

RAY H. MANSON.

Witnesses:

MARY MALLEY,

F. O. RICHEY.