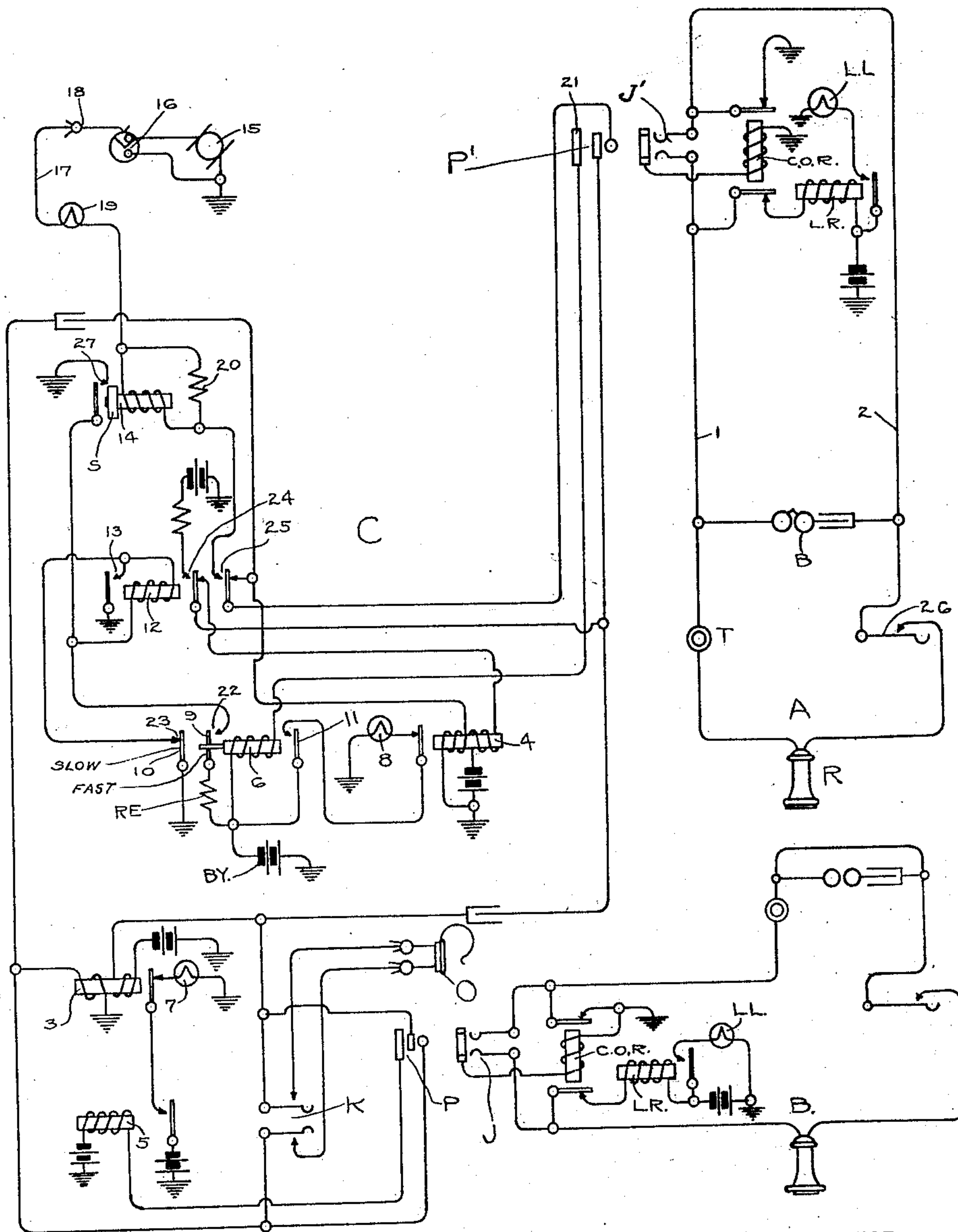


F. M. SLOUGH,
 SIGNALING SYSTEM.
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1,408,540.

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INVENTOR

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SIGNALING SYSTEM.

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Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, FRANK M. SLOUGH, a citizen of the United States, residing in Rochester, in the county of Monroe and State of New York, have invented certain new and useful Improvements in Signaling Systems, of which the following is a full, clear, concise, and exact description.

My invention relates to signaling systems, and more particularly to telephone signaling systems of the type commonly known in the art as "automatic ringing signaling systems."

An object of my invention is to accomplish the signaling function in a central office connective link circuit in an automatic manner responsive to the connection of the link circuit with the terminals of the called line, without the necessity of an operator's depressing a ringing key in order to start the ringing.

It is a further object of my invention to accomplish the aforesaid, which will later be made apparent from the description of the invention which follows, in a most efficient manner requiring a minimum of apparatus operating in the most positive way.

I accomplish the aforesaid objects by the use, in such a system, of a double armature relay, such as that illustrated for instance in an other application of this applicant, Serial No. 135,636, filed Dec. 7th, 1916, and in which application a relay having a plurality of armatures is disclosed, one of the armatures operating immediately following the energization of the relay magnet core, the other armature operating later following the operation of the first armature, there being a time interval between the operations of the two armatures.

Referring to the drawing which forms a part of this specification, at A I show a substation telephone instrument having the usual transmitter T and receiver R, and a signal bell B. Line conductors 1 and 2 extend from the substation instrument to a main station line circuit having a line relay LR, and a cut off relay COR; these two control a line lamp LL in the usual way.

At C I show a central station link circuit which is herein illustrated as a cord circuit, the same terminating in switching terminals at both ends, the switching terminal at the answering end of the cord cir-

cuit being a plug P and at the calling end, a plug P'. Co-operating with the said plugs are illustrated telephone line switch jacks J and J' respectively, the switch jack J being associated with a calling telephone line having a substation B and the usual line relay LR, and cut off relay COR; these two relays controlling the usual signal lamp LL.

In this description the line having the substation B will be described as being a calling telephone line, and the line having the substation A will be described as a called telephone line. Multiple jacks associated with the jacks J and J' might be and usually would be, connected in multiple with the jacks herein shown, but are omitted in this specification for the sake of simplicity in description. Other parts which are inherent and are usual and commonly applied to telephone systems, such as an operator's set for a plurality of link circuits, etc., are not shown in detail, being merely indicated in this drawing.

The link circuit C is provided with six controlling relays, of which, relays 3 and 4 are battery feed relays for the calling and called lines and the relays 5 and 6 for the calling and called ends of the cord circuit control calling and called signal lamps 7 and 8. The relay 6, however, is of special construction, being made with a plurality of armatures, the first namely the armature illustrated at 9 being a fast operating armature and the second illustrated at 10 being a slow operating armature. The armature 10 of the relay 6, may be fast or slow as is convenient or desired. The relay 6 may be constructed in accordance with the disclosure of the above mentioned application of this applicant, or in any other way in order to secure the relative speeds of operation of these two armatures.

At 12 I show a ringing relay which is adapted to be initially operated under the control of the relay 6 and maintained in operation thereafter by locking contacts 13 under the control of the relay 12. A ringing trip relay 14 controlling the release of the relay 12 is provided controlling a circuit, comprising a shunt of the relay 12 to cause its deenergization to release the relay 12. A ringing generator is shown at 15 and a rotary interrupter at 16 in the ringing generator circuit, the two being so included in

the circuit that the interrupter 16 intermittently places ringing current from the source 15 to the ringing bus bar 17, common to an operator's position, and to a brush 18 which may be common to a plurality of operators' positions, and between ringing periods applies a source of ground battery potential to the said conductor 17 and the said brush 18. A resistance lamp 19 is shown in the ringing circuit, as well as a shunt winding of the relay 14, the shunt being preferably a non-inductive resistance 20.

For a better understanding of the invention, a description of the operation of the same will now be had; a call originating from the substation B is answered in the usual way by inserting the plug P into the jack J of the calling line. An operator's set is shown at O bridged by a key K across the talking strands of the cord circuit and by which conversation may be had with the calling subscriber to determine the number of the called line. Assuming that the line having the substation A is desired, the operator after making the usual busy test in a way what is well understood and will not herein be described in detail, except by saying that it is done by touching the tip of the plug P' to the thimble of the jack J', the plug P' is inserted into the jack J'.

Thereupon an energized circuit is completed for the relay 6, the circuit comprising its winding, a contact 21 of the plug P', the thimble of the jack J', the winding of the relay COR of the called line circuit, and the source of current BY. The fast operating armature 9 of the relay 6 now operates, and prior to the operation of the relay armature 10 an energizing circuit for the relay 12 is closed, operating the relay 12. This circuit is traced as follows: from the negative pole of the source BY, the resistance coil RE, normally open contacts 22 of the relay 6, which are now closed, the winding of the relay 12, normal contacts 23 of the relay 6, to the ground pole of the source of current BY. Current from the said source operating the relay 12, will cause the relay 12 to attract its armatures, closing locking contacts 13 which are operated by the relay 12 and maintains its operation. The slow operating armature 10 may now operate, but the relay 12 will be maintained operative by virtue of this locking circuit independent of the contacts 23 of the relay 6, which contacts now break the initial energizing circuit of the relay 12. Ringing and direct current are alternately applied to the called line through normally open contacts 24 and 25 of the relay 12, which contacts are now closed, and the ringing of the called subscriber's bell at B over the called line conductors 1 and 2, will take place until the response of the called-for subscriber, which response closing

a conductive bridge across the line conductors, including contacts 26 of the substation instrument A and the talking transmitter T, causes the operation of the relay 14 in the ringing circuit. This relay has a copper slug s, encircling its core and has a resistance coil 20 bridged about its winding. This relay has such an adjustment of its contacts 27, that these contacts will not be continuously closed at any time during the ringing of the called subscriber's bell, except when the conductive bridge including the contacts 26 of the substation instrument A is closed by the response of the called-for subscriber, these contacts 27 of the relay 14 will be continuously closed by the flow of direct current over the ringing circuit and over its conductive bridge, including the said contacts 26, thereupon the contacts 27 being continuously closed for a sufficient period, will complete a release circuit from grounded battery BY, resistance RE, armature 9, contact 22 of relay 6, armature and contact 27 of relay 14 to ground, which will operatively shunt sufficient of the current from the relay 12 to cause it to release its armatures, causing the opening of the locking circuit for the relay 12 by the breaking of the contacts 13 thereof. This restores the ringing relay to normal, and since the contacts 23 of the double armature relay 6 remain opened until the plug P' is dissociated from the calling line jack J', ringing cannot be again applied to the called line until the relay 6 is again deenergized, for instance, as by withdrawing the plug P' from the jack J', or in some other manner as may be desired.

I am aware that it was old prior to this invention to initiate the ringing on a called subscriber's line by the conjoint operation of a plurality of relays operating together in a given way to cause the energization of a ringing relay, but so far as I know it is new to produce this function, which is often times termed "keyless ringing" in the art, by the conjoint operation of a plurality of relay armatures of the same relay.

I am aware that numerous and extensive departures from the exact structure herein set forth in order to illustrate an embodiment, may be made without departing from the spirit of the invention, but what I claim as my invention and wish to cover by Letters Patent, is—

1. In a keyless ringing telephone system, the combination with a ringing relay, a double armature relay having a plurality of armatures, the one being a fast operating armature and the second a relatively slow operating armature, and a ringing current applied by the operation of the said ringing relay, of a circuit for operating the said ringing relay, the said circuit including serially connected pairs of contacts of the said double armature relay, one of the said contact pairs

being "make" contacts and the other contact pair being "break" contacts.

2. In a telephone system, in combination, a ringing relay and a ringing trip relay, a source of ringing current, a called subscriber's telephone bell, circuit conductors for connecting the said source of ringing current with a called subscriber's bell, the said circuit conductors including contacts of the said ringing relay, a circuit for the said ringing relay, and a double armature relay, the said last-named circuit having serially included normally made and normally open contact sets of the said double armature relay.

3. In a keyless ringing telephone link circuit, a called subscriber's telephone bell, a ringing relay, a source of ringing current, means including the said ringing relay to apply the source of ringing current to the called subscriber's telephone bell, a double armature relay having but one winding, a circuit for the said ringing relay under the joint control of normally open and normally closed contact sets of the said double armature relay, and means operated at will for disabling said ringing relay.

4. In a telephone system, in combination, a plurality of telephone lines, one of the said lines being a called-for line, a link circuit adapted to make connection with the said line, a ringing generator associated with the said link circuit, electromagnetic responsive means adapted to interconnect the said ringing generator and the said called-for line, and switching means comprising co-operating switch contacts associated with the said line and said link circuit, of a relay adapted to be energized responsive to the act of interconnecting the said switch contacts, a pair of armatures for the said relay having different operating time constants, an operating circuit for the said electromagnetic responsive means under the control of both of the said armatures, and a release circuit for the said electromagnetic responsive means under the control of one of the said armatures.

5. In a telephone system, in combination, a plurality of telephone lines, one of the said lines being a called-for line, a link circuit adapted to make connection with the said line, a ringing generator associated with the said link circuit, electromagnetic responsive means adapted to interconnect the said ringing generator and the said called-for line, switching means comprising co-operating switch contacts associated with the said line and said link circuit, a relay adapted to be energized responsive to the act of interconnecting the said switch contacts, a pair of armatures for the said relay having different operating time constants, an operating circuit for the said electromagnetic responsive means under the control of both of the

said armatures, and a holding circuit for the said electromagnetic responsive means under the control of one of the said armatures.

6. In a telephone system, in combination, a plurality of telephone lines, one of the said lines being a called-for line, a link circuit adapted to make connection with the said line, a ringing generator associated with the said link circuit, electromagnetic responsive means adapted to interconnect the said ringing generator and the said called-for line, switching means comprising co-operating switch contacts associated with the said line and said link circuit, a relay adapted to be energized responsive to the act of interconnecting the said switch contacts, a pair of armatures for the said relay having different operating time constants, an operating circuit for the said electromagnetic responsive means under the control of both of the said armatures, and a release circuit for the said electromagnetic responsive means under the control of the said line and link circuit switch contacts.

7. In a telephone system, in combination, a plurality of telephone lines, one of the said lines being a called-for line, a link circuit adapted to make connection with the said line, a ringing generator associated with the said link circuit, electromagnetic responsive means adapted to interconnect the said ringing generator and the said called-for line, switching means comprising co-operating switch contacts associated with the said line and said link circuit, a relay adapted to be energized responsive to the act of interconnecting the said switch contacts, a pair of armatures for the said relay having different operating time constants, an operating circuit for the said electromagnetic responsive means under the control of both of the said armatures, and a holding circuit for the said electromagnetic responsive means under the control of one of the said armatures.

8. In a telephone system, in combination, a plurality of telephone lines, one of the said lines being a called-for line, a link circuit adapted to make connection with the said line, a ringing generator associated with the said link circuit, a ringing relay adapted to interconnect the said ringing generator and the said called-for line, switching means comprising co-operating switch contacts associated with the said line and said link circuit, a relay adapted to be energized responsive to the act of interconnecting the said switch contacts, a pair of armatures for the said relay having different operating time constants, an operating circuit for the said ringing relay under the control of both of the said armatures, and a release circuit for the said ringing relay under the control of one of the said armatures.

9. In a telephone system, in combination,

a plurality of telephone lines, one of the said lines being a called for line, a link circuit adapted to make connection with the said line, a ringing generator associated with the said link circuit, a ringing relay adapted to interconnect the said ringing generator and the said called-for line, switching means comprising co-operating switch contacts associated with the said line and said link circuit, a relay adapted to be energized responsive to the act of interconnecting the said switch contacts, a pair of armatures for the said relay having different operating time constants, an operating circuit for the said ringing relay under the control of both of the said armatures, and a holding circuit for the said ringing relay under the control of one of the said armatures.

10. In a telephone system, in combination, a plurality of telephone lines, one of the said lines being a called-for line, a link circuit adapted to make connection with the said line, a ringing generator associated with the said link circuit, a ringing relay adapted to interconnect the said ringing generator and the said called-for line, switching means comprising co-operating switch contacts associated with the said line and the said link circuit, a relay adapted to be energized responsive to the act of interconnecting the said switch contacts, a pair of armatures for the said relay having different operating time constants, an operating circuit for the said ringing relay under the control of both of the said armatures, and a release circuit for the said ringing relay under the control of the said line and link circuit switch contacts.

11. In a telephone system, in combination, a plurality of telephone lines, one of the said lines being a called-for line, a link circuit adapted to make connection with the said line, a ringing generator associated with said link circuit, a ringing relay adapted to interconnect the said ringing generator and the said called-for line, switching means comprising co-operating switch contacts associated with the said line and said

link circuit, a relay adapted to be energized responsive to the act of interconnecting the said switch contacts, a pair of armatures for the said relay having different operating time constants, an operating circuit for the said ringing relay under the control of both of the said armatures, and a holding circuit for the said ringing relay under the control of one of the said armatures.

12. In a telephone system, in combination, a plurality of telephone lines, one of the said lines being a called-for line, a link circuit adapted to make connection with the said line, a ringing generator associated with the said link circuit, a ringing relay adapted to interconnect the said ringing generator and the said called-for line, switching means comprising co-operating switch contacts associated with the said line and said link circuit, a relay adapted to be energized responsive to the act of interconnecting the said switch contacts, a pair of armatures for the said relay having different operating time constants, an operating circuit for the said ringing relay under the control of both of the said armatures, and a release circuit for the said ringing relay under the control of one of the said armatures.

13. In a telephone system, a plurality of telephone lines, one of said lines being a called line, a link circuit for connecting with said line, a ringing generator associated with said link circuit, a relay for connecting said generator to said link circuit on its energization, a second relay arranged to be energized responsive to the connection of said link circuit to the called line, said second relay having armatures and sets of contacts operating out of synchronism, a circuit for said first relay serially including the sets of contacts of said second relay, a holding circuit for said first relay also completed at contacts of said second relay, and a third relay operative on the response of the wanted party to effect the de-energization of said first relay.

In witness whereof, I hereunto subscribe my name this 1st day of March, A. D. 1919.

FRANK M. SLOUGH.