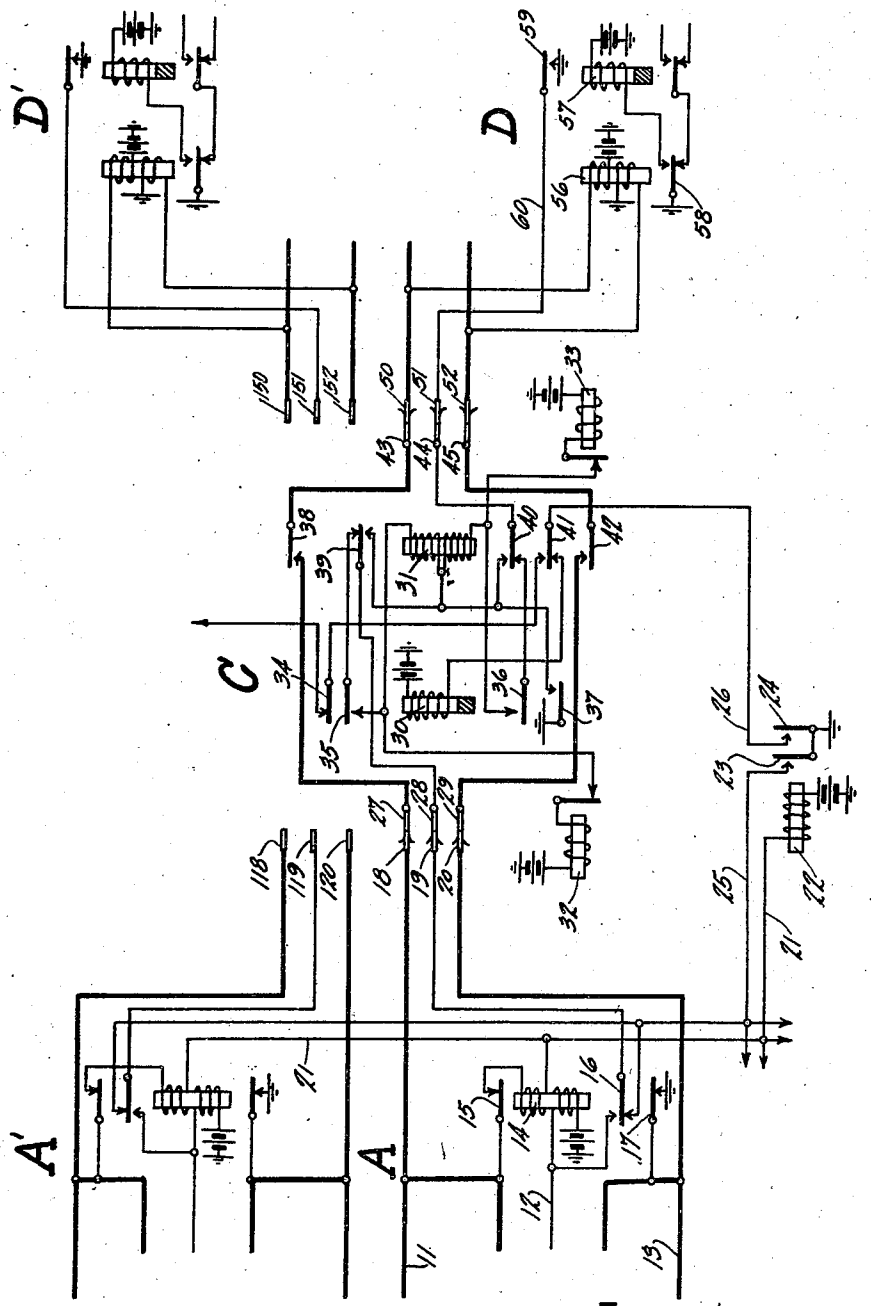
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AUTOMATIC TELEPHONE SYSTEM

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AUTOMATIC TELEPHONE SYSTEM.

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The present invention relates to automatic telephone systems in general, but is concerned more particularly with systems in which the calling lines are automatically connected with first selector switches or connector switches, as the case may be, through the medium of finder-selector links; and the object briefly stated is the provision of new and improved circuit arrangements whereby the circuits of the said finder-selector links may be made more simple and whereby the links themselves are made more practical and are more economical to manufacture.

Heretofore it has been common practice in such systems to provide a complete finder switch which is directly connected to a complete rotary line switch. It has been found, however, that the relays which are duplicated in the two switches may be made common to both by suitable circuit changes.

Referring now to the accompanying drawings, which comprise a single sheet, the finder-selector link C shown therein is mechanically two switches, each of which is of the well known rotary type in which the wipers have no normal position but move in a forward direction only. Each set of wipers has its own stepping magnet but the relays are common to the link.

The reference characters A and A′ denote the line relays of two subscribers' lines, with their contacts 18, 19, and 20; and 118, 119, and 120.

Each of the relay groups D and D′ comprises the well known fast and slow relay combination of an automatic switch, together with their contacts 50, 51, and 52; and 150, 151 and 152. As has been intimated before, these relays may be a part of the controlling relays of either a selector or connector switch, depending of course upon the size of the system.

In order to set forth more clearly the various features of the invention, the equipment will now be described in connection with a detailed description of its operation. For this purpose it will be assumed that the subscriber whose line terminates at A removes his receiver to make a call.

When the receiver is removed at the calling substation a direct current bridge is closed across the line conductors 11 and 13, thereby completing the following circuit: From ground by way of the resting contact of armature 17, of line relay 14, and said armature, line conductor 13, the bridge at the calling substation, line conductor 11, armature 15 and its resting contact, upper winding of line relay 14, common conductor 21, and starting relay 22 to battery. Relays 14 and 22 energize in series over the above traced circuit. Relay 14, upon energizing, operates the weakly adjusted armature 16 so as to cause it to pass from its resting to its working contact, but the said relay, being marginally adjusted, is unable to operate the more stiffly adjusted armatures 15 and 17. Relay 22, upon energizing, places a ground potential on the common conductor 25 at armature 23 and consequently on all the test contacts, such as the test contact 119, in the left-hand bank of the switch C, except the test contact 19 of the calling line, which is disconnected from the common conductor 25 at armature 16 of line relay 14. As a further result of the energization of starting relay 22, armature 24 places a ground potential on the starting conductor 26 thereby closing a circuit for relay 30 of the link C, by way of armature 41 and its resting contact. Upon energizing, relay 30 closes, at armature 37, a circuit for the upper winding of relay 31 and stepping magnet 32 in series, and also a circuit for the lower winding of relay 31 and stepping magnet 33 in series. At armature 35, line relay 30 connects the test wiper 28 to a point between the upper winding of relay 31 and stepping magnet 32; and, at armature 36, connects the test wiper 44 to a point between the lower winding of relay 31 and stepping magnet 33.

From this point the operation depends upon whether or not the wipers 27–29, inclusive, are standing upon the contact 18–20, inclusive, of the calling line; and upon whether the trunk line, upon which the wipers 43–45, inclusive, are standing, is busy or idle. Assuming that the wipers 27–29, inclusive are standing upon the contacts of some line other than the one calling, and that the wipers 43–45, inclusive, are standing upon a set of contacts belonging to a busy trunk, test wipers 28 and 44 both engage grounded contacts with the result that both the upper and the lower windings of relay 31 are short circuited and each of the stepping magnets 32 and 33, interrupt-

ing its own circuit, operates in the manner of a buzzer to advance its respective set of wipers step by step in search of an ungrounded test contact.

We shall assume that the wipers 43–45, inclusive, arrive upon the contacts of an idle trunk line before the other set of wipers have reached the contacts of the calling line. This, it may be stated, is the usual occurrence. When the test wiper 44 arrives upon the ungrounded test contact 51, which is assumed to be the first idle one found, the lower winding of switching relay 31 is no longer short circuited and accordingly stepping magnet 33 does not energize again on account of the high resistance of the said lower winding. Switching relay 31, being marginally adjusted, is not operatively energized by either winding alone and consequently does not operate now.

Assuming now that the wipers 27–29, inclusive, have arrived upon the contacts 18–21, inclusive, of the calling line, the upper winding of relay 31 is no longer short circuited, there being no ground potential on test contact 19, and stepping relay 32 is not energized again on account of the high resistance of the upper winding of relay 31. Relay 31 now operates owing to the combined energization of its two windings and, upon so doing, connects up the heavy line conductors at armatures 38 and 42; places ground on test wipers 28 and 44 at armatures 39 and 40, respectively; and, at armature 41, disconnects the starting conductor 26 from the winding of relay 30, at the same time preparing a starting circuit for the next link. Line relay 30, being slow in releasing, maintains its armatures attracted for an interval. As a result of the placing of ground upon test wiper 28 a circuit is closed for the lower winding of line relay 14. Relay 14 now pulls all the way up, thereby removing the bridge comprising the upper winding of the said relay and starting relay 22 from the line conductors 11 and 13. Starting relay 22, upon deenergizing removes ground from conductors 25 and 26.

In the relay group D, line relay 56 now energizes over the calling subscriber's loop and, at armature 58, completes a circuit for release relay 57 which, upon energizing, places ground on release trunk conductor 60 at armature 59 before line relay 30 has fallen back. By means of this ground potential on test contact 51 and its multiples in the banks of the other finder-selector links, the seized trunk line is maintained busy in the usual manner. This ground potential extends back by way of test wiper 44, and armature 40 and its working contact to the windings of switching relay 31, thereby establishing the usual holding circuit for the said relay. A branch of this holding circuit extends by way of the working contact of armature 39 and said armature, test wiper 28, test contact 19, and armature 16 and its working contact to the lower winding of line relay 14 thereby establishing the usual holding circuit for the said relay. By means of the ground potential on test contact 19 the calling line is made to test busy to the finder wipers of the other links. This ground potential also extends by way of private normal conductor 12 to multiple test contacts in the banks of the connectors having access to the calling line, thereby guarding the same against intrusion in the usual manner.

Returning now to relay 30, the said relay, upon falling back, extends the starting circuit to the next finder-selector link, at armature 34.

From this point the operation is old and well understood and consequently it does not need to be described.

Having described our invention, what we consider to be new and desire to have protected by Letters Patent will be pointed out in the appended claims.

What is claimed is:

1. In a telephone system, means for connecting a calling and called line including directly connected and simultaneously operably forward and backward selecting switches, individual operating magnets for said switches, and a test relay common to both of said switches.

2. In a telephone system, a link terminating at each end in an automatic switch, line wipers in each switch constituting terminals of said link, a test wiper in each switch, a common test relay, and two windings for said relay connected in circuit with said test wipers, respectively.

3. In a telephone system, means for connecting a calling and called line including forward and backward selecting switches, individual operating magnets and test wipers for said switches, a line relay and a test relay common to said switches, two windings on said test relay, means responsive to the initiation of a call for causing the operation of said line relay, and means operated by said line relay to connect the test wiper of each switch to the windings of said test relay.

4. In a telephone system, means for connecting a calling and called line including forward and backward selecting switches, individual operating magnets and test wipers for said switches, a test relay common to said switches, and means responsive to the initiation of a call for electrically connecting said operating magnets and test relay with said test wipers.

5. In a telephone system, means for connecting a calling and called line including forward and backward selecting switches, individual operating magnets and test

wipers for said switches, a double wound test relay common to said switches, and means operable responsive to the initiation of a call for electrically connecting the test wipers with their respective operating magnets and also to the windings of said relay.

6. In a telephone system, means for connecting a calling and called line including forward and backward selecting switches, individual test wipers for said switches, a common test relay for said switches, a motor magnet for each switch, the motor magnet of one switch being connected to one terminal of said test relay and the motor magnet of the other switch being connected to another terminal thereof, and means responsive to the initiation of a call for also connecting the test wipers to the terminals of said relay.

7. In a telephone system, a link terminating at each end in an automatic switch, line wipers in each switch constituting terminals of said line, a test wiper in each switch, a common test relay, two windings for said relay, each winding being individual to a particular one of said test wipers, and operating circuits for said relay controlled by the test wipers of both switches.

8. In a telephone system, means for connecting a calling and called line including forward and backward selecting switches, a stepping magnet in each switch, a switching through relay having a winding in series with each stepping magnet, a test wiper in one switch arranged to shunt one winding of said relay, and a test wiper in the other switch arranged to shunt the other winding of said relay.

9. In a telephone system, means for connecting a calling and called line including forward and backward selecting switches, means for operating said switches to select a calling line and an idle trunk respectively, said means including two test wipers, a double wound switching through relay energized when the selections are completed, contacts on said relay for connecting said wipers together, and holding circuits for said relay extending from the junction of said wipers through the two windings of said relay in parallel.

10. In a telephone system, a link terminating at each end in an automatic switch, line wipers in each switch constituting terminals of said link, a test wiper in each switch, a test relay common to said switches, a winding for said relay connected in circuit with one of said test wipers, and a second winding for said relay connected in circuit with the other of said test wipers at the same time.

11. In a telephone system, a switching device comprising forward and backward selecting switches for connecting calling and called lines, starting and stopping circuits for both said switches, a talking circuit extending through said switches, and two relays having sole control of all of said circuits.

12. In an automatic telephone system, a group of lines, a group of selector switches, a plurality of finder switch links operable to extend a connection from a calling one of the said lines to said selector switches, each of said links comprising a backward and a forward hunting switch, a start conductor chain extending through said links, a starting relay common to said line group and operated in response to the initiation of calls therein to start one of said finder links in search of a calling line and an idle one of said selecting switches, a test relay in said link energized when said line and selector switch are found, and means controlled by said test relay for extending said start conductor to the next link to place that link under the control of said start relay.

Signed by me at Paris, France, this 17th day of September, 1921.

Lu et approuvé.

ALBERT THOMAS.

Signed by me at Paris, France, this 17th day of September, 1921.

Lu et approuvé.

CLAUDIUS STEWART.