

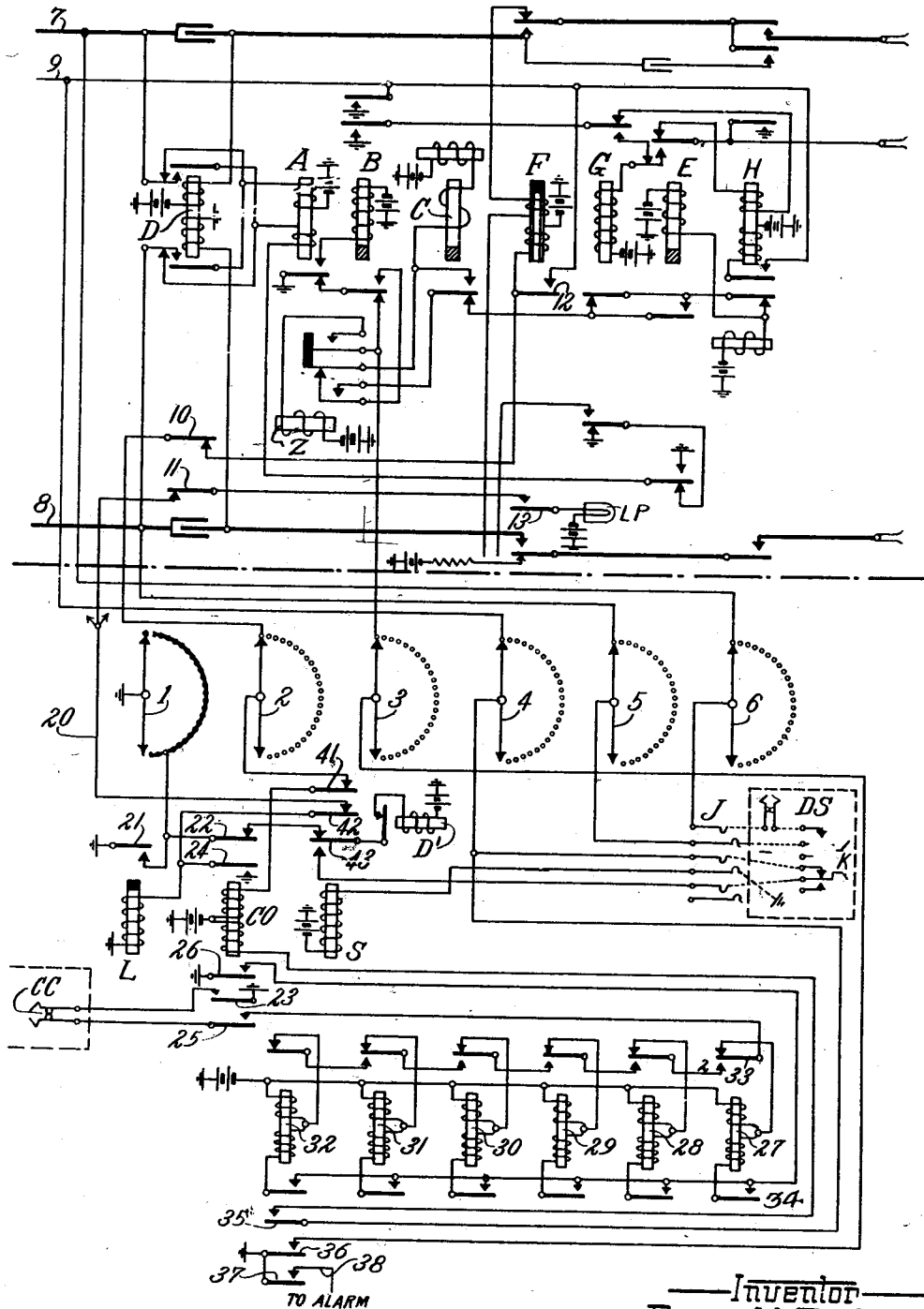
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RETARDED ALARM FOR CONNECTERS

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RETARDED ALARM FOR CONNECTERS.

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The present invention relates to automatic or semi-automatic telephone systems and is more particularly concerned with test and supervisory arrangements for use in connection with final selectors as employed in such systems.

In cases where the release of the connection is under the control of the calling party, it will generally happen that if the calling party delays to hang up at the end of a connection, since the connection will remain established to the called party, the latter will be unable to initiate a call himself in case he wishes to do so. Accordingly it is highly desirable, particularly in unattended exchanges, to make some provision for overcoming this difficulty so that in case the calling party, whether maliciously or otherwise, omits to replace his receiver in the usual manner at the end of a conversation, the called party will not be inconvenienced.

According to one feature of the invention therefore, in a system employing automatic switches in which the release of a connection is normally controlled by the calling party, means are provided for automatically effecting release independently of the calling party after the called party has hung up.

According to another feature of the invention in a system employing automatic switches the release of which is normally controlled by the calling party, timing apparatus common to a number of battery-fed switches is adapted to effect the release of an operated switch a predetermined time after the called party hangs up. It is usually desirable that the apparatus provided for producing these effects shall be common to a number of switches and it is then important to arrange that the effect of successive overlapping calls from different switches shall not be cumulative so as to effect a premature release before the predetermined time period has expired. This also is taken care of according to the invention by the provision of a hunting switch for associating the common apparatus with only one switch at a time and by arranging that the common apparatus must be restored to normal between successive associations with different switches.

The above features will be better appreciated from the following description of one method of carrying the invention into

effect, which is illustrated in the accompanying drawing. It will be understood however, that this arrangement is given by way of example only and that various modifications of it could be devised without exceeding the scope of the invention.

Referring now to the drawing, this shows in the usual manner the circuits of a connector or final selector of well known type together with the alarm and supervisory equipment which is common to a number of connectors depending on the capacity of the rotary switch.

In order that the complete operation of the apparatus shown may be properly understood, a brief description will first be given of the changes which take place when the connector is used for extending a connection to a wanted line, though since the normal operating circuits of this switch are well known and form no part of the invention, they will not be described in full detail. When the switch is taken into use from a preceding selector, line relay A operates and completes a circuit for release relay B, which prepares the switch for operation and supplies earth to the release trunk conductor to hold up the preceding switches. The calling party then dials the next digit in the wanted number whereupon relay A energizes correspondingly and impulses are sent to the vertical magnet to step the switch up to the required level. Relay C, which is slow, is operated throughout the train of impulses and when they terminate it releases and connects the operating circuit through to the rotary magnet. This magnet is accordingly operated in response to the next and last train of impulses and thereupon rotates the wipers into engagement with the contacts of the desired line. Relay E is operated throughout this train of impulses and serves to delay the testing operation until the wipers have come to rest. In case the wanted line is busy, relay G then operates to prevent the connection being switched through, and to give busy tone to the calling party, while if the line is free, relay H operates in series with the cut-off relay of the wanted party's line switch and connects up the line wipers and starts the ringing. When the wanted party replies, the ring-cut-off relay F operates to disconnect ringing current and complete the speaking connection and remains locked up to

the release trunk conductor. The back-bridge relay D is then operated over the wanted party's loop and in the arrangement shown reverses current flow back over the connection for supervisory or metering purposes.

The circuits remain in this condition while the conversation is in progress, and when the calling party hangs up, relay A de-energizes and opens the circuit of relay B and when this relay releases earth is removed from the release trunk conductor 9 whereupon all the preceding switches are released in known manner. Moreover a circuit is also completed over the off-normal contacts for the release magnet Z of the connector which operates to restore the switch to normal. In case however the calling party should delay to hang up, the connector would remain in its operated position and the effect of replacing the receiver at the called substation would be merely to de-energize relay D; then in case the called party wished to initiate a connection himself while the connector was still in operated position, he would be unable to do so as the only effect produced when he removed his receiver again would be the re-energization of relay D. Owing to the delayed release feature about to be described however, this state of affairs will not persist indefinitely and after a short interval the switch will be released and preferably an alarm will be given to notify an attendant; this operation will now be described in more detail.

It will be seen that under the conditions which it is desired to guard against, relay F will be operated but relay D will be de-energized. In these circumstances a circuit is completed as follows: battery, lamp LP, (which is individual to the connector shown), armature 13 and its front contact, armature 11 and its back contact, common lead 20, back contact and armature 42, winding of relay L to earth. Relay L thereupon operates and at armature 21 completes a circuit which extends over armature 22 and its back contact, back contact and armature 43, interrupter contact and winding of magnet D' to battery. The wipers 1—6 of the rotary switch are therefore set in operation and as soon as wiper 1 leaves its normal contact, earth is connected over the bank of this wiper to maintain a circuit for the magnet so that the switch continues to operate, even in case relay L should be de-energized at this time. The advance of the wipers continues until they engage the contacts associated with the connector which is being held, whereupon wiper 2 encounters earth, and a circuit is completed from the release trunk conductor 9, front contact and armature 12, back contact and armature 10, contact in the bank of wiper 2 and said wiper, back contact and armature 41, upper

winding of relay CO to battery. Relay CO is thereupon operated and at armature 22 opens the circuit of the magnet D' so as to bring the switch to rest; at armature 24 completes a direct circuit to earth for the lamp LP, at the same time shorting out relay L; at armatures 23 and 25 connects up the clock contacts CC so that impulses are sent to the chain of relays 27—32 and at armature 26 prepares locking circuits for these relays.

It should be mentioned at this point that the arrangement of the circuits permits a connector to be reached over the normal contacts of the rotary switch, as shown, and in this case the relay L does not actually operate since a circuit is at once completed for relay CO and the magnet circuit is opened before the wipers have been moved. The more general case has been described above however in order to give a fuller understanding of the circuits.

The clock contacts CC are conveniently closed every half minute and upon the first closure after the operation of relay CO, a circuit is completed for two-step relay 27 which thereupon operates its light armature 34 so as to connect up its lower winding. When contacts CC open, the short-circuit round this winding is removed and the relay operates fully and at armature 33 transfers the circuit from the contacts CC to the next chain relay 28. Since six chain relays are provided, it will be appreciated that after the lapse of a three-minute interval, if the conditions still persist, the last relay 32 will be operated and this in addition to locking up to armature 26 as usual, at armature 37 completes a circuit over lead 38 for an alarm, at armature 35 completes an additional circuit over the lower winding of relay CO which circuit extends over wiper 4 to the release trunk conductor 9, and at armature 36 completes a circuit which extends over wiper 3 and the off-normal contacts of the connector to release magnet Z, whereupon the release magnet operates and the switch is restored to normal. In consequence of the release of the switch, the called party is no longer prevented from extending a call but in the arrangement shown the original train of switches still remains set up until the attendant, who has been notified by the alarm, takes steps to release them. In order to locate the switch which has initiated the alarm, he has only to look for the lamp LP which is lighted. When the switch train is finally cleared down and earth is removed from the release trunk conductor 9, relay CO de-energizes and a homing circuit is then completed from earth, wiper 1 and the homing bank, armature 22 and its back contact, back contact and armature 43, and interrupter contact and winding of magnet D' to battery, so that the switch is

restored to normal in readiness for reoperation in the case of another blocked call. It will be appreciated that in case the calling party hangs up before the three-minute interval has expired, the circuit through the upper winding of the relay CO will be opened and such of the chain relays as have operated will be released so that there is no danger of the effect being cumulative in case another call requiring attention should occur on some other connector immediately.

It will be apparent to those skilled in the art that though the arrangement shown is only adapted to effect the release of the connector while keeping the remainder of the switch train set up, there would be no particular difficulty in arranging for the whole connection to be released by the removal of earth from the release trunk conductor. For instance, the earth extended over wiper 3 might be arranged to operate a slow release relay which opened the circuit of relay A and thus effected the release of relay B also, and hence the completion of the release magnet circuit. It will be appreciated also that in case the battery feeding was from the first switch in the train rather than the last, the common equipment would for the sake of convenience preferably be associated with this first switch, though clearly also the called party's line would be freed if only the connector switch were released.

A brief description will now be given of the sequence of operations in case the equipment shown is to be used for effecting routing tests. In this case a test plug is inserted in the jack J and a circuit is then completed for the operation of relay S. This relay thereupon at armature 41 disconnects the relay CO, at armature 42 disconnects the relay L, and at armature 43 changes over the circuit for the rotary magnet D' so that it may be controlled by way of the test plug. It will be seen that a circuit is completed for the magnet D' over wiper 4 as long as this wiper engages contacts associated with connectors which are in use, as indicated by the presence of earth on the release trunk conductor. The wipers of the switch therefore continue to rotate until they are moved into engagement with a free connector and the key K in the testing equipment is then thrown, whereupon a circuit is completed through the dial springs DS, over wipers 5 and 6 and by way of line conductors 7 and 8 for the line relay A. This accordingly operates in the usual manner and completes a circuit for relay B, upon the operation of which earth is connected to the release trunk conductor to busy this connector to selectors having access to it. The operation of the key K also opens the original circuit for the magnet D' so that when this earth is extended back to wiper 4, the magnet shall not

again operate. The attendant now manipulates the dial as desired, for instance in accordance with the test number, whereupon the impulses produced at the springs DS are effective for setting the connector switch in the same way as under the control of a calling subscriber. When the attendant has ascertained that the switch has operated satisfactorily, he will restore the key K thereby opening the circuit for the line relay A which will release and open the circuit of relay B. When both these relays have fallen away a circuit will be completed for the release magnet and the switch will be restored to normal as usual. In the meantime, the completion of the circuit for the magnet D' at the lower springs of the key K will cause the rotary switch to hunt for the next free connector upon which the same test may then be made. In case the switch has not returned to normal when the attendant withdraws the plug from the jack J, this will be taken care of when relay S de-energizes since the usual homing circuit is then completed over wiper 1.

What is claimed is:

1. In an automatic telephone system wherein connections between called and calling lines are made by means including a connector, and wherein the connector is arranged so that it may be maintained in an operated position when the called party terminates the call, a device operated responsive to the termination of a call by the called party to hunt for the connector, a signal individual to the connector operated when the connector is found, and a signal in the device operated within a predetermined period of time.
2. In an automatic telephone system wherein connections between called and calling lines are made by means including a connector, and wherein the connector is arranged so that it may be maintained in its operated position when the called party terminates the call, a device operated responsive to the termination of a call by the called party to hunt for the connector, a signal individual to the connector operated when the connector is found, and means operated a predetermined period of time thereafter to release the connector.
3. In a telephone system wherein a connector is directly controlled by the calling party to establish connections to a desired line and wherein the connector is released responsive to the termination of the call by the calling party, a connector releasing device, and means in said device operated a predetermined period of time after the called party has terminated the call to cause the release of the connector.
4. In an automatic telephone system wherein connections between called and calling lines are made by means of switches

including a final connector, and wherein the connector is arranged so that it may be maintained in its operated position when the called party terminates the call, a time measuring device initiated in its operation responsive to the termination of a call by the called party, means for releasing both said device and the switches including the connector when the calling party terminates the call, and means operated by the time measuring device if it is not released within a predetermined period of time to cause the release of the connector while maintaining the other switches operated.

5. In a telephone system wherein a connector is used to establish connection to a desired line and wherein the connector is released responsive to the termination of the call by the calling party, a device for insuring the release of the connector within a predetermined period of time after the called party terminates the call, a signal individual to the device to indicate that the device has operated to cause the release of a connector, and a signal individual to the connector to indicate that it has been released by said device.

6. In a telephone system wherein a connector is used to establish connections to a desired line and wherein the connector is released responsive to the termination of the call by the calling party, a device for insuring the release of the connector within a predetermined period of time after the called party terminates the call, means for rendering the device ineffective for release purposes and for causing said device to automatically hunt for an idle connector, means for testing the connector over said device, and means responsive to the termination of the test to cause the device to hunt for a different connector.

7. In combination, a hunting device, a plurality of connectors accessible thereto, means for automatically starting said device hunting for a connector over which a called party has terminated a call while the calling party is attempting to continue the call, a signal operated when the connector

is found, manually operated means for preventing that hunting movement of the device and for causing the device to automatically hunt for and select an idle connector, means for testing the selected connector, and means responsive to the termination of the test to cause the device to hunt for a different idle connector.

8. In combination, a hunting device, a plurality of connectors accessible thereto, means for automatically starting said device hunting for a connector over which a called party has terminated a call while the calling party is attempting to continue the call, a signal operated when the connector is found, manually operated means for preventing that hunting movement of the device and for causing the device to automatically hunt for and select an idle connector, means for testing the selected connector, means responsive to the termination of the test to cause the device to hunt for a different idle connector, and connections effective when the manually operated means is released to cause the return of the device to its normal position.

9. In a telephone system the combination with a connector, of a device for insuring the release of the connector within a predetermined period of time after the called party terminates a call, and means in the device for converting it into a connector testing apparatus.

10. In a telephone system, a testing device, a plurality of connectors accessible thereto, means for causing the device to automatically hunt for and select an idle connector, a key in said device for seizing or releasing the selected connector, means in the device for testing the seized connector in a desired manner, and means responsive to the release operation of the key to cause the connector to hunt for and select a different idle connector.

In witness whereof, I hereunto subscribe my name this 29th day of November, A. D. 1926.

REGINALD TAYLOR.