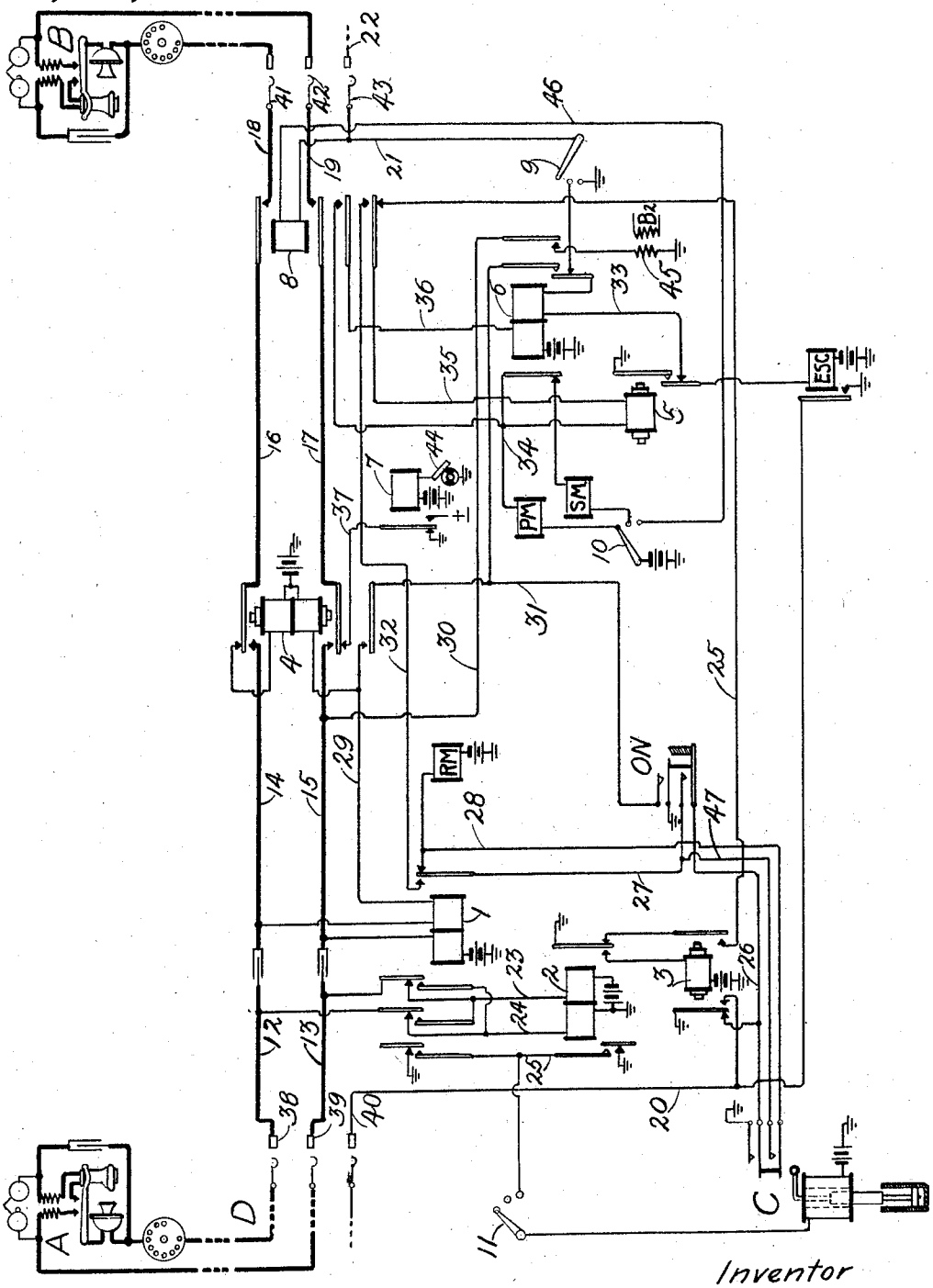
H. P. CLAUSEN.

MACHINE SWITCHING TELEPHONE SYSTEM.

APPLICATION FILED NOV. 26, 1917.

1,387,353. Patented Aug. 9, 1921.



Inventor
Henry P. Clausen.
by J. H. Roberts Att'y.

UNITED STATES PATENT OFFICE.

HENRY P. CLAUSEN, OF MOUNT VERNON, NEW YORK, ASSIGNOR TO WESTERN ELECTRIC COMPANY, INCORPORATED, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

MACHINE-SWITCHING TELEPHONE SYSTEM.

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To all whom it may concern:

Be it known that I, HENRY P. CLAUSEN, a citizen of the United States, residing at Mount Vernon, in the county of Westchester and State of New York, have invented certain new and useful Improvements in Machine - Switching Telephone Systems, of which the following is a full, clear, concise, and exact description.

This invention relates to machine switching telephone systems, and particularly to means for controlling the release of the switches in such systems.

In well known automatic telephone systems, various arrangements are employed to disestablish a connection at the end of conversation. In some systems the control of the release of all switches used in establishing a connection, lies in the hands of the calling party, in other systems either party may disconnect, and in still others both parties to a connection must replace their receivers to the switchhooks in order to sever a connection. It is to systems of the latter class that this invention relates.

It is obvious in arrangements of this character that at times the switching apparatus and telephone lines used in establishing a connection may be uselessly tied up due to one of the parties abandoning a call or for some other reason neglecting to replace his receiver to its switchhook.

It is the object of this invention to provide a simple and effective means for breaking down such connections where a line is unduly tied up out of control of its subscriber.

The invention is illustrated in the accompanying drawing, which shows diagrammatically a connection between two subscribers. The circuits of a connector switch used in the connection embody the principles of the invention and are shown in full.

In accordance with this invention, an electromagnetic device of special design is associated with each connector switch. This device comprises a solenoid and a dashpot and is so constructed as to operate a plunger by means of impulses, until this plunger engages a set of contacts which close a release circuit for the connector switch. The circuit for the operation of this device is closed only when the connector switch is in the talking position, and the impulses are transmitted by the manipulation of the sender at either subscriber's station. The device is so adjusted that a predetermined number of successive impulses, say, ten, will actuate its contacts. If less than, say, ten successive impulses are sent, the contacts will not be actuated and the plunger will return to normal. In the event that one of the parties to a connection abandons a call without replacing his receiver to the switchhook and the other party desires to be freed from this connection in order to make another call, he has but to operate his dial to, say, the digit 5, and then initiate the new call. The manipulation of the dial to digit 5 will cause one of the bridge relays to retract and again attract its armature five times. An impulse is sent to the device upon the pass-by of the relay contacts on each movement of the bridge relay, that is, once during attraction and again on retraction so that digit 5 will send ten impulses.

The calling subscriber's substation is shown at A and the called subscriber's substation at B. C represents the dashpot relay above referred to, and D represents other switching devices used in connecting the calling subscriber's line to the terminals 38, 39 of the connector switch.

The invention will be more readily understood from the following description of the operation of the system. When the subscriber at A removes his receiver from the hook, a line finder switch at D automatically connects, either directly or through the agency of a selector switch operated by his dial, his line to the terminals 38 and 39 of the connector. Thereupon a circuit is closed from battery, right-hand winding of relay 2, conductor 23, inner left-hand normal contact of relay 1, conductor 13, terminal 39, over line A, terminal 38, conductor 12, middle left-hand normal contact of relay 1 and conductor 24 to the left-hand winding of relay 2 and ground to operate relay 2. The operation of relay 2 in turn closes a circuit at its right-hand armature and front contact to the winding of relay 3 to battery and ground. The operation of relay 3 in turn opens at its left-hand normal contact a connection to prevent the closure of the release magnet circuit during the operation of the

connector switch, and closes at its right-hand contact a circuit receptive to impulses to operate the switch. The switch is now in position receptive to dial impulses. The subscriber at A operates his dial to position the brushes 41, 42, 43 in relation to the group containing the wanted line B. The manipulation of the dial at A causes an opening and closure of the circuit of relay 2 above traced, a number of times corresponding to the number dialed. Upon each retraction of the armatures of relay 2 a circuit is closed from ground, right-hand armature and normal contact of relay 2, right-hand contact of relay 3, conductor 25, lower normal contact of relay 8, conductor 35, winding of low wound relay 5, conductor 34, the winding of the primary magnet PM, side-switch brush 10 and first position contact to battery and ground. The closure of this circuit causes the operation of the primary magnet PM and relay 5. Relays 3 and 5 are slow to release and will not retract their armatures between impulses in a series. The operation of the primary magnet PM causes the rotation of the brushes 41, 42, 43 to their predetermined position. The operation of relay 5 closes at its armature and front contact, a circuit from ground to the winding of the escapement magnet ESC to grounded battery. This circuit is opened at the cessation of the series of impulses, thereby deënerigizing the magnet ESC and allowing the side switch to move to position 2.

The subscriber at A now operates his dial to position the brushes 41, 42, 43 upon the terminals of the wanted line. The manipulation of the dial again opens the circuit of relay 2 as before and closes the circuit previously traced through relay 5 and conductor 34 through the left-hand contact of relay 6 and the winding of the secondary magnet SM to the side-switch brush 10 and second position contact to grounded battery. The intermittent closure of this circuit operates relay 5 and the secondary magnet, thereby stepping the brushes to their predetermined line contact and energizing the magnet ESC.

Upon the cessation of the series of impulses relay 5 releases, and closes a connection from grounded battery, the winding of magnet ESC, the normal contact of relay 5, conductor 33, the right-hand winding of relay 6 and its inner normal contact, side-switch brush 9 and second position contact, conductor 21, brush 43 to test the line terminal 22. If the line to subscriber B is busy, contact 22 will be grounded and a circuit will be closed through relay 6 and magnet ESC above traced, thereby holding magnet ESC operated and operating relay 6 to lock up through its inner armature and front contact, conductor 31 and off-normal contact ON to ground. The operation of relay 6 opens at its left-hand contact, a circuit to prevent further operation of the secondary magnet SM, and closes at its right-hand armature and front contact, a circuit from ground, transformer coil 45, conductor 30, conductor 15 and the left-hand winding of relay 1 to grounded battery. The closure of this circuit transmits, by induction, a tone indicating the busy condition of the line to the calling party A, who thereupon replaces his receiver to the hook and releases his connection as will be shown later. If, however, the line is not busy, the circuit through relay 6, since no ground is found on contact 22, will remain open and the release of the magnet ESC will allow the side switch to pass to position 3.

In side-switch position 3 a circuit is closed from ground through side-switch brush 9 and third position contact, conductor 21 to brush 43 holding the called line busy, and through the winding of relay 8, conductor 46, the side-switch brush 10 and third position contact to grounded battery. The operation of relay 8 closes a circuit to signal the called party as follows. Relay 7 is operated intermittently by means of interrupter 44. When operated, relay 7 closes a circuit from an alternating current supply at its front contact, through its armature, conductor 37, inner armature and normal contact of relay 4, conductor 17, armature and contact third from the bottom of relay 8, conductor 19, brush 42 over the subscriber's line B, brush 41, conductor 18, upper armature and contact of relay 8, conductor 16, upper armature and normal contact of relay 4, through the upper winding of relay 4 to battery. The bells at substation B ring intermittently until the receiver is removed from the switchhook, whereupon the ringing circuit is shunted out and relay 4 is operated over the path previously traced in the ringing circuit and this shunt circuit.

The operation of relay 4 closes a locking circuit for itself from ground, the upper off-normal contact ON, conductor 31, lower armature and contact of relay 4 to the lower winding of relay 4 to grounded battery. The operation of relay 4 also breaks the ringing and its operating circuits at its upper and inner normal contacts, and closes a battery feed circuit to the called line as follows: from grounded battery, left-hand winding of relay 1, conductor 15, inner armature and front contact of relay 4, conductor 17, armature and contact third from the bottom of relay 8, conductor 19, brush 42 over the line of subscriber B, brush 41, conductor 18, upper armature and contact of relay 8, conductor 16, upper armature and front contact of relay 4, conductor 14, the right-hand winding of relay 1, conductor 29, bottom contact of relay 4,

conductor 31, through the off-normal contact ON to ground. The closure of this circuit operates relay 1 and completes the talking connections between the two parties.

Previous to the operation of relay 1 the control of the release of all switches used in the connection was in the hands of the subscriber at A. By replacing his receiver to the switchhook, he deënergized relay 2 and in turn relay 3, closing a path from ground, the left-hand armature and normal contact of relay 3, conductor 26, off-normal contact ON, conductor 27, right-hand armature and normal contact of relay 1, through the winding of release magnet RM to battery, thereby restoring the connector switch to normal. The control of the release of the line finder at D is local previous to the operation of relay 3. When relay 3 is operated it closes at its left-hand front contact a circuit from ground over conductor 20 and contact 40 to assume the release control of the switch or switches at D.

Subsequent to the operation of relay 1 the release control is under the joint control of both parties at A and B, except for the arrangement hereinafter disclosed as the essential part of this invention. From the above description it is apparent that in order to free the switches used in the connection established, or to use either line A or B to originate or receive other calls, it is necessary to have the receivers of both subscribers' sets on their switchhooks at the same time. As stated above this does not always occur when desired by either party, but by the additional arrangement, when one party desires to free his line, he dials say five, thereby causing the intermittent opening of his line and the retraction and attraction of the armature of relay 1 in the case of the called party, or relay 2 in the case of the calling party, to send impulses from the left-hand armature and both contacts (at the time in their movement when all are together), of relays 1 and 2 respectively over conductor 25, side-switch brush 11 and third position contact through the winding of device C to grounded battery.

The operation of the plunger of device C over ten steps actuates its contacts to cause the release of the connector switch, by closing a circuit from ground over the top contact or device C, conductor 26, lower contacts of off-normal contact ON, conductor 47, the lower contacts of device C, conductor 28, through the winding of release magnet RM to grounded battery.

The operation of release magnet RM by releasing the connector, frees both parties so that they may originate and receive calls independent of each other.

What is claimed is:

1. In a machine switching telephone system, calling and called subscribers' lines, automatic switches including a connector for interconnecting said lines, a magnetic device associated with said connector to control the release of said connector, normal means to release said connector and auxiliary means controlled by a predetermined series of line interruptions for actuating said device.

2. In a machine switching telephone system, calling and called telephone lines, automatic switches including a connector for connecting said lines, a calling and a called line relay for said connector, a release magnet for said connector, a switching device for said connector, and means responsive to a series of closures of the contacts of either of said line relays for rendering said switching device effective to operate said release magnet.

3. In a machine switching telephone system, a calling and a called subscriber's line, means including a connector switch for connecting said lines, a release magnet for said connector, an impulse counting device, and means responsive to a predetermined number of impulses for rendering said counting device effective to operate said release magnet.

4. In a machine switching telephone system, a calling and a called telephone line, a connection including a connector switch between said lines, means under the joint control of said calling and called lines for disestablishing said connection, and other means including a timing device under control of either said calling or said called line for disestablishing said connection.

5. In a machine switching telephone system, a calling and a called line, a connection including automatic switches between said lines, means including a release magnet associated with one of said switches for severing said connection when the circuits of both of said lines are open, other means associated with said one of said switches under the control of either line for severing said connection when neither of said line circuits is open.

6. In a machine switching telephone system, calling and called subscribers' lines, means including a connector switch for interconnecting said lines, a magnet, means to restore said connector switch to its normal position as a result of a single energization of said magnet, controlling mechanism for said magnet and means for actuating said mechanism responsive to a predetermined number of interruptions in the talking circuit of said connector.

7. In a machine switching telephone system, the combination with telephone lines, automatic switches including a connector for interconnecting said lines, of a switching device, means under control of either line, when said connector is set, for sending impulses to said switching device, and means

under the control of said switching device when operated to a predetermined position for effecting the release of said connector.

8. In a machine switching telephone system, calling and called subscribers' lines, automatic switches including a connector for interconnecting said lines, release means normally under the joint control of a calling and a called subscriber to cause the release of said automatic switches, and auxiliary release means under the control of either subscriber for causing the release of said switches.

9. In a machine switching telephone system calling and called subscribers' lines, automatic switches including a connector for interconnecting said lines, release means for said automatic switches under the control of either subscriber, and operative in response to a predetermined series of line interruptions.

10. In a machine switching telephone system calling and called subscribers' lines, automatic switches for interconnecting said lines, a controlling device under the control of either subscriber, said controlling device being operative after connection has been established, and means to actuate said controlling device in response to a predetermined series of line interruptions.

In witness whereof I hereunto subscribe my name this 22nd day of November, A. D. 1917.

HENRY P. CLAUSEN.