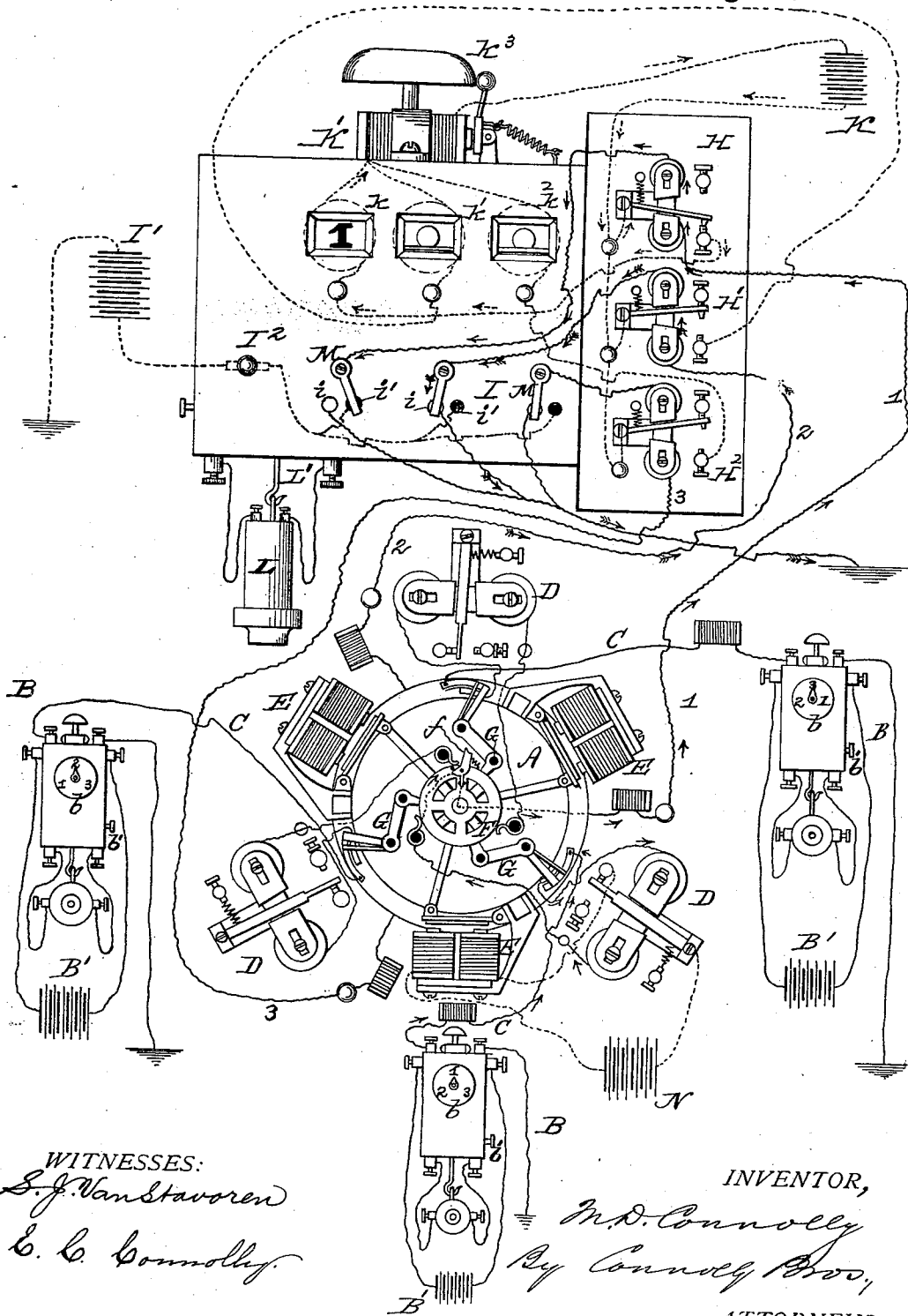


(No Model.)

M. D. CONNOLLY.  
AUTOMATIC TELEPHONE EXCHANGE.

No. 262,647.

Patented Aug. 15, 1882.



WITNESSES:  
*S. J. Van Stavoren*  
*E. C. Connolly*

INVENTOR,  
*M. D. Connolly*  
By *Connolly Bros.*  
ATTORNEYS.

# UNITED STATES PATENT OFFICE.

M. DANIEL CONNOLLY, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO  
SPENCER D. SCHUYLER, OF NEW YORK, N. Y.

## AUTOMATIC TELEPHONE-EXCHANGE.

SPECIFICATION forming part of Letters Patent No. 262,647, dated August 15, 1882.

Application filed November 8, 1881. (No model.)

To all whom it may concern:

Be it known that I, M. DANL. CONNOLLY, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Automatic Telephone-Exchanges; and I do hereby declare the following to be a full, clear, and exact description of the invention, reference being had to the accompanying drawing, which forms part of this specification, and which is a diagram illustrating my invention.

My invention has relation to telephone-exchanges employing automatic switches or appliances which enable subscribers without manual assistance at the central office to effect connection of normally-independent lines.

My improvements have for their object to provide means whereby a subscriber on such exchange may call the central office and receive alarms and communications therefrom without operating the switch, said means providing also for automatic notification to the central office of the failure of a subscriber to get connection with the line of another whom he seeks, so that such failure may be remedied by the central office.

In an application for patent made by myself, Thomas A. Connolly, and Thomas J. Mc Tighe, filed August 29, 1881, No. 40,924, for improvements upon the automatic telephone-exchange for which Letters Patent of the United States dated December 9, 1879, No. 222,458, were granted to us, we have shown and described a switch operated by means of electric impulses sent from subscribers' boxes or stations over lines converging at the central office, said impulses throwing on local batteries through the medium of polarized relays. Said lines normally lead to ground, circuit being shifted therefrom to line as connection with the latter is established.

In an application filed by me October 29, 1881, for improvements upon the invention described in said joint application I have shown and described means for calling up the central office without operating the switching mechanism, said means effecting also a notification to the central office of the failure of any subscriber to get connection with the line of another whom he seeks. Said means comprise essentially a polarized annunciator or

alarm (either or both) in the ground-circuit of the lines at the central office, together with a telephone and devices for placing the same in such circuit and for sending an alarm or call back over line from said central office.

My present application has for its object to effect the same result by the employment of a common electric—*i. e.*, not polarized—annunciator in local circuit at the central office, which circuit is closed whenever a polarized relay in the ground-circuit of subscriber's line is actuated by a reversed current sent over the same, as hereinafter explained.

My present improvements accordingly consist essentially in the combination, with an automatic exchange or switch, of an electric annunciator or alarm (either or both) in local circuit and polarized relays in the ground-circuits of lines leading into said switch and operating to close said local circuits and work such annunciator or alarm when reversed currents are sent over the lines and through the ground-circuits, as hereinafter set forth.

Referring to the accompanying drawing, A indicates an automatic switch constructed substantially as described in said joint application.

B B B represent subscribers' boxes located at the outer terminals of lines C C C, leading out from said switch A. Said boxes have dial mechanisms *b*, which operate to send currents from local batteries B' of one sign over the lines C C, in which latter are polarized relays D, working responsive to currents of such sign and operating to close local circuits on magnets E E, and thereby produce rotation of rings F F, carrying circuit makers or trippers *f f*.

Each line-circuit is normally through its tripper *f*, and thence to ground. When such tripper is in engagement with a contact-bar, G, the circuit is no longer to ground at central, but outward through the line to which such contact-bar belongs.

In the central-office ground-circuits of the lines C C, which are indicated by the numerals 1 2 3, are placed polarized relays H H' H<sup>2</sup>, which are constructed and arranged to work responsively to currents of opposite polarity to that which will actuate the automatic switch-relays D D. From the polarized relays H H', &c., the circuits lead onward to a manual switch, I, having branches *i i* to ground, and other branches, *v v'*, to a local battery, I'. In

the battery-branch is a push-button,  $I^2$ , or equivalent device for breaking and making circuit, so as to send back a call or alarm over line. The polarized relays  $H$   $H'$ , &c., when

energized by currents of the proper direction, close local circuits to a battery,  $K$ , thereby actuating drops or shutters  $k$   $k'$   $k^2$  and ringing a bell,  $k^3$ , of a common electric annunciator,  $K'$ .  
 $L$  represents a telephone on a telephone switch or hook,  $L'$ , constructed and arranged in the usual manner, so that removing the telephone from the hook places the former in line and replacing it on said hook cuts the telephone out.

$M$   $M$  represent switch-levers, whereby circuit may be changed from ground-contact  $i$  to battery-contact  $i'$ , and vice versa. The normal position of these levers is on the ground-contacts.

The operation is as follows: To operate the central-office automatic switch a subscriber starts the dial mechanism at his box, sending electric impulses of one direction over his line. These impulses work his switch-relay  $D$  and throw the main battery  $N$  onto the local circuit of the automatic switch, thus energizing the magnet  $E$ , producing a rotation of the ring  $F$  and movement of the traveling tripper  $f$ . These impulses go to ground through the polarized relay  $H$ , but do not affect the latter, which is constructed and arranged to work responsively to a current of opposite direction or sign. Hence the annunciator remains uninfluenced by the regular working of the automatic switch mechanism. If a subscriber seeking a line gets due connection with it by engagement of his tripper with a contact-bar, he cuts out the ground-circuit in which his polarized relay  $H$  is, so that when he then sends a reversed current to call the party whose line he engages the annunciator at central is still unaffected. If, however, such seeking subscriber fail from any cause to make a connection he seeks to make with another line, he still has his circuit to ground at the central office, so that when from his box he sends a reversed current over his line his polarized switch-relay  $D$  is unaffected thereby; but his other polarized relay,  $H$ , is worked, and closes the local circuit on his annunciator-magnet and bell. This gives notice at the central office of the failure to connect, and designates the party who has failed to make connection. The central-office attendant thereupon moves the lever  $M$ , pertaining to such line, cutting out direct ground and throwing battery  $I'$  onto line. He then sends an alarm back over line to the subscriber at other end thereof and switches in the telephone  $L$ . Having learned who it is the subscriber wishes to connect with, he makes the necessary connection by manual operation of the relay  $D$  or ring  $F$ . The making of such connection diverts the seeking subscriber's circuit to the connecting-line, cutting out central-office ground and with it the relay  $H$ , so that after such connection is made the central-office attendant can at leisure restore the annunciator

appliances, or shutter  $k$  and lever  $M$ , to normal. If the subscriber wishes to call the central office to make a connection without automatically operating the switch mechanism, or for any other purpose, all he has to do is to send a reversed current over the line by pressing his call-button  $b'$ , leaving his dial mechanism, which is arranged to send a current of opposite polarity, undisturbed. Such reversed current does not affect his switch-relay  $D$ . It does, however, work his other polarized relay,  $H$ , and hence operates his drop or shutter and bell at the central office, thus calling the latter, which attends to the matter accordingly.

I should here remark that the poles of the battery  $I'$ , from which the call or alarm is sent back by central office, should be so set that the current therefrom will not work the switch-relay  $D$ . Such a return-current will, under the arrangement already described, work the relay  $H$  and operate the annunciator-shutter and bell; but such operation may be regarded as beneficial, as it advises the central office that the circuit is good.

I have shown and described the annunciator local circuit as normally open, being closed only when the relays  $H$   $H'$  are worked; but it is obvious that the reverse arrangement—*i. e.*, a normally-closed local circuit opened by the working of the relays  $H$   $H'$ , with drops or shutters and bell or bells operated correspondingly—may be substituted for the arrangement shown, and be equally within the spirit and inclusion of my invention.

I have shown and described an automatic exchange of particular construction; but I do not limit my improvements thereto, as I may apply the same to an equivalent device or to any switch in which the connection of normally-independent lines is or may be effected without manual service at the point of convergence or connection—*i. e.*, by subscribers themselves—without aid from the central office.

Reference herein to "ground" circuit is intended to cover as well a return metallic circuit, where the latter is adopted in lieu of return by earth.

If desired, the annunciator drops or shutters may be dispensed with and bells alone used for notifying the central office, my invention accordingly including any kind of an alarm or notifying device capable of operation under the described conditions.

What I claim as my invention is as follows:

1. The combination, with an automatic exchange or switch capable of effecting connection of independent lines without manual assistance, of an annunciator or alarm in a local circuit, and relays in the ground-circuits of lines leading into said exchange or switch, said relays, when worked, operating said annunciator or alarm by opening or closing the local circuit thereto, substantially as set forth.

2. The combination, with an automatic exchange or switch capable of effecting connection of independent lines without manual assistance, said exchange or switch having po-

larized relays in the lines leading thereinto, of an annunciator or alarm in a local circuit and polarized relays in the ground-circuits of said lines, and adapted to operate said annunciator or alarm, said line and ground relays being arranged to be influenced respectively by currents of unlike direction, whereby a current of one direction will actuate the line-relays to work the switch without affecting the annunciator, while a reverse current will operate the annunciator without affecting the switch.

3. The combination of an automatic exchange or central-office switch, a series of subscribers' or local boxes on lines leading into said switch, and having appliances for sending currents of unlike direction over said lines, polarized relays arranged reversely to each other, and located in line and ground circuits of the exchange or switch, an annunciator or alarm in a local circuit which may be opened or closed by working said ground-circuit relays, a local

return-signal battery with a manual switch for shifting from ground to battery, a telephone, and means for placing same in circuit with the boxes, whereby currents of one direction sent from boxes over line will operate the switch to effect connection of lines without influencing the annunciator, while currents of an opposite direction sent over a line not in engagement with another will cause the annunciator to be operated, and the central office may return a signal back over line and place a telephone therein to communicate with the signaling subscriber, substantially as set forth.

In testimony that I claim the foregoing I have hereunto set my hand this 5th day of November, 1881.

M. DANL. CONNOLLY.

Witnesses:

S. J. VAN STAVOREN,  
CHAS. F. VAN HORN.