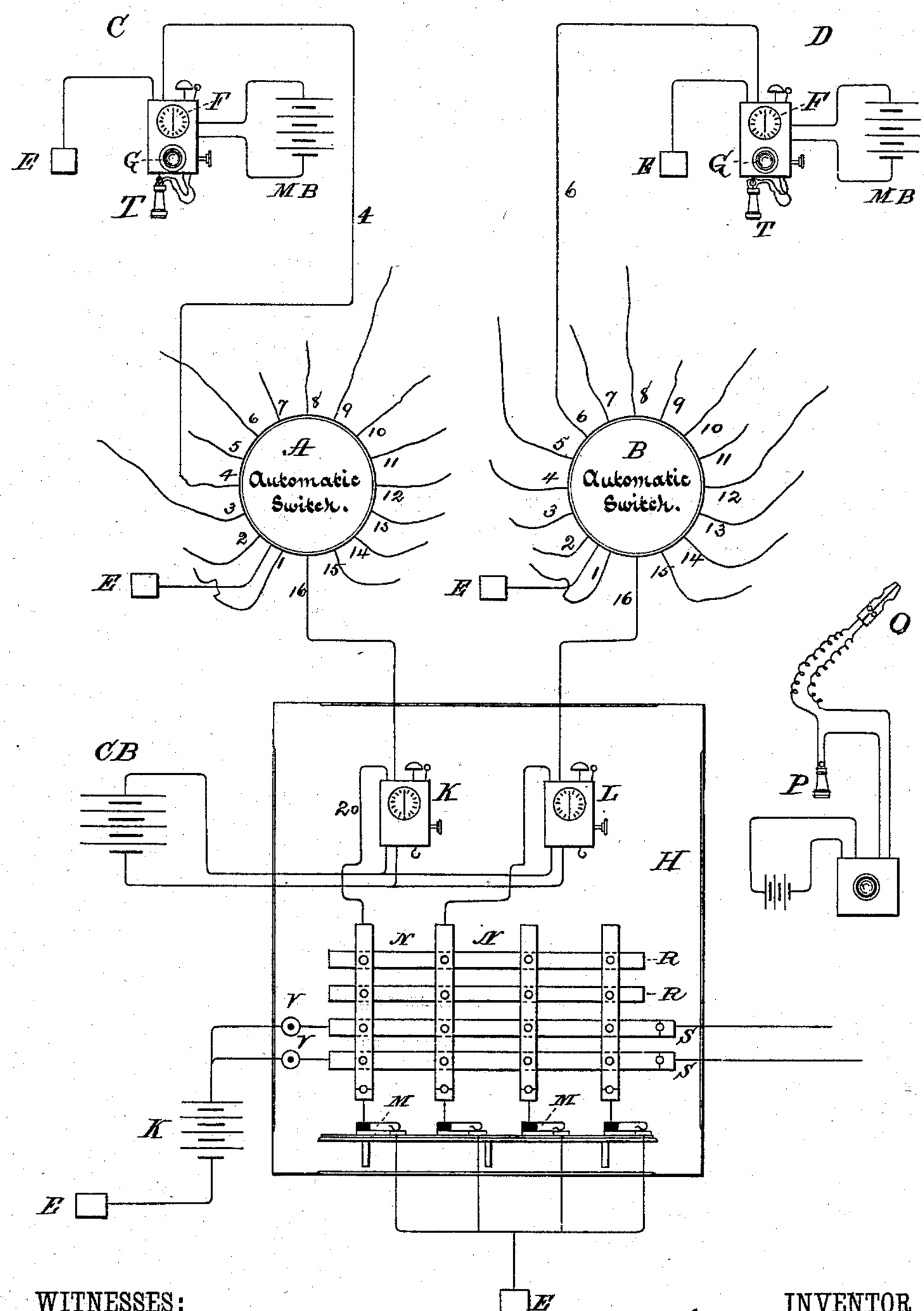
(No Model.)

C. E. BUELL.

TELEPHONE EXCHANGE APPARATUS.

No. 255,766. Patented Apr. 4, 1882.



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TELEPHONE-EXCHANGE APPARATUS.

SPECIFICATION forming part of Letters Patent No. 255,766, dated April 4, 1882.

Application filed December 12, 1881. (No model.)

To all whom it may concern:

Be it known that I, CHARLES E. BUELL, of the city and county of New Haven, State of Connecticut, have invented certain new and useful Improvements in Automatic Telephone Exchanges, of which the following is a specification.

My invention constitutes an improvement upon that class of telephone-exchange apparatus in which the operations of connecting and disconnecting subscribers' lines for oral communication, sending and receiving calls, &c., are performed entirely by the subscribers themselves through the intervention of automatic mechanism located at a central office, and without the aid of central-office attendants.

In United States patent granted to M. D. and T. A. Connolly and T. J. McTighe December 9, 1879, No. 222,458, there is disclosed an invention having the general objects stated in view, and I have hereinafter described the connection and disconnection of subscribers' lines, sending and receiving calls, &c., as performed with apparatus like that shown in the patent referred to, that apparatus being, so far as I am aware, the first adapted to perform the operations mentioned entirely by automatically-acting mechanism at the central office. I do not, however, wish to be understood as limiting my invention to the special devices described in that patent, as the general principles therein set forth may be embodied in other forms of devices; and my improvement is applicable to automatic exchanges of any kind having the general characteristic before referred to—that is, to any exchange apparatus in which any subscriber connected to a central-office apparatus may, through the automatically-acting mechanism there placed, connect and disconnect his line with any other for giving signals, or for oral communication. As apparatus of this kind has been before constructed and used, a limitation exists to the number of lines which may be automatically worked through the same automatic switch, it being obviously impracticable to connect any very large number of subscribers to the same automatic mechanism, since the number of circuit-connections required increases in geometrical ratio with the number of subscribers. It is, moreover, apparent that certain operations required in the switch—as, for instance, that of locking or cutting out all other subscribers from the two in communication—cannot be performed with ease and certainty by the particular means described in the patent if many hundreds of lines are connected to the same automatic switch. The design of my invention is not to improve the mechanism of the automatic switch, but to make the use of such a switch entirely practicable in large cities by a special combination and method of working a number of automatic switches in conjunction with a manual or hand switch of any desired construction.

My invention contemplates the subdivision of subscribers into classes, each of which embraces those subscribers engaged in special avocations, or among whom intercommunication is more frequently desired. To each class I propose to assign a special automatic exchange-switch, the subdivisions into classes being carried to any extent that may be found convenient in practice. In conjunction with the automatic switches I use a manual switch, to which run one or more circuit-connections from each automatic switch, each circuit-connection being provided at the manual switch with the same, or practically the same, special apparatus employed at the stations of subscribers whose lines are connected to the automatic switches. As will be readily understood, then, my plan contemplates making the manual switch one of the stations of every automatic switch, and puts it into the power of any subscriber to connect his line with the manual connecting-switch in the same manner that he would connect it to any other subscriber's line in the same automatic section, while at the same time it enables the central-office attendant for such manual switch to connect the manual switch-board by means of the mechanism of the automatic switches with any subscriber connected to an automatic switch in precisely the same manner that any subscriber would connect his line to another line, or to the line-connection which runs to the manual switch-board.

It will therefore be seen that my invention has in view the following special mode of operation for a telephone-exchange apparatus:

Ordinarily each subscriber would connect his line with any other line connected to the same automatic switch in the manner already contemplated in the patent before referred to. If it should happen that such subscriber desires communication with a subscriber upon some other automatic section of the system, he would first place himself in communication with the attendant at the manual switch-board through the circuit-connection running from the automatic switch to the manual switch in precisely the same way that he connects himself with any other subscriber upon his section. The central-office attendant, having learned the name or number of the subscriber called for, would by means of the apparatus located at the manual switch connect such switch with the line of the subscriber wanted through the automatic mechanism of that subscriber's section and the circuit-connection for such section to the automatic section, the operation being performed in the same way as that which resulted in the connection of the subscriber calling with the manual switch. Both subscribers, being then connected to the manual switch, are placed in oral communication by means of the manual-switch apparatus in the ordinary way.

The system above described, as will be readily seen, is based upon the idea that the bulk of the business should be done by the automatic switches, occasional connections only being made through the manual switch, for which latter the services of but comparatively few attendants would be necessary, even in very large cities or with very large exchanges. When, moreover, it is considered that an automatic switch of large size would require at least the services of one attendant to keep the same in order, the economy, so far as the number of attendants required is concerned, is still more manifest.

Having now described the general principles of my invention, I will proceed to describe in connection with the accompanying drawing one arrangement of the automatic switch and the manual-switch apparatus and its associated devices that may be employed.

The drawing shows diagrammatically two automatic switches, each having subscribers' lines connected thereto and radiating therefrom, and one manual switch with its subscriber's apparatus, connected in the present instance by but one wire with each automatic switch.

A and B represent two automatic central switches, to each of which are connected fifteen radiating subscribers' lines, the lines of each switch being those of a class of subscribers to which intercommunication is generally confined. E represents the common earth-connection for the lines centering in each automatic switch.

At C is indicated the subscriber's apparatus at a station upon line numbered 4 of switch A, and at D similar apparatus upon line 6 of automatic switch B.

The apparatus at C and D consists of devices substantially like those of the patent referred to, and embodies a dial apparatus, the face of which is indicated at F, for producing the necessary pulsations, interruptions, or variations of the current for operating or controlling the movement of the mechanism in the automatic switch A or B, so that line 4 or line 6 may be placed in connection with any other line in its own section; a telephone-transmitter, the mouth-piece of which is indicated at G; a telephone-receiver, T; a battery, M B, the current from which, through line 4 or 6 to the switch A or B and to earth, is controlled by the dial apparatus; and suitable mechanism within the box for reversing the main-line battery for the purposes set forth in the patent, and for switching the bell, the telephone, and the battery into and out of the proper circuits. As these devices may be of the special construction and arrangement described in the patent, or of any other construction adapted to perform the precise operation therein described, or of any construction adapted to work a central-office connecting-switch automatically so as to connect the line with any other and disconnect it from the same, it is not necessary to describe them in detail.

H represents a manual central-office switch-board, and K L apparatus substantially like that at C D, K being placed in a connection, 16, from automatic switch A, which connection is joined to the apparatus of said switch in precisely the same manner as line 4 and all the other lines, numbered from 1 to 15, while L is placed in a similar connection, 16, from automatic switch B. The connections to earth from the dial-boxes K L are, as indicated, through line-strips N N of the manual switch and spring-jacks M M, into which latter may be inserted the plug O of a transmitting and receiving telephone apparatus, P, of any ordinary construction. This arrangement, as will be readily understood, makes the use of a telephone apparatus for each dial-box K L unnecessary, and only involves the removal of such devices from the dial-box and the bridging of the two points between which are included the telephone-receiver and the secondary of the induction-coil, a suitable switch being employed in K and L in place of the gravity or similar switch used at C and D, and the circuit-connections and switch-points by which the main battery or a portion thereof is connected in local circuit with the transmitter being omitted.

C B is the battery corresponding to the battery M B at subscribers' stations. It is controlled in the same manner, and preferably by the same apparatus, as that at C and D.

The boxes K and L are connected in multi-

ple arc to the battery C B, which is thus made to do the work of two batteries. It is obvious, however, that a separate battery might be used for each box.

R R represent line-connecting strips, by means of which and the ordinary switch-plugs the line-bars N N, or any other two line-bars crossing said strips, may be connected together.

S S represent line-strips with line-connections leading to distant points, and V V calling-keys adapted to connect a battery, K B, to the line-strips S S, for the purpose of transmitting a signal to the distant stations.

The line-strips N N have a plug-switch at their lower ends. When two line-strips are connected the plugs are withdrawn, thus breaking the connection to ground. Either line-strip N may obviously be connected with either line-strip S S in the ordinary manner.

The general operation of an exchange thus organized would be as follows: Under ordinary circumstances each subscriber desiring communication with another would connect his line with that subscriber's line by the automatic switch common to them both. If the subscriber desired to be connected to some other automatic switch, as would be the case from time to time, the subscriber desiring communication would connect his line with the line running to the manual switch. If, for instance, subscriber at C, line 4, of automatic section A, desired to converse with subscriber at D, line 6, automatic section B, the steps in detail would be as follows: Subscriber at C, line 4, section A, first sets automatic switch A so as to connect lines 4 and 16, and gives the signal upon bell or annunciator of box K, the circuit then being through line 4, automatic switch A, line 16, bell or annunciator of K, line-strip N, spring-jack M, and to ground. The central-office attendant thereupon, by means of the plug O and spring-jack, inserts his telephone apparatus into the line, having first cut out the bell so as to connect line 16 to the earth-wire 20, leading from box K, without passing through the bell, by means of the switch ordinarily employed for that purpose. The subscriber at C having connected his telephone to line, the central-office attendant and the subscriber are now in oral communication. Subscriber at C having informed the attendant that he desires to be placed in communication with a subscriber—say D in automatic section B—the attendant manipulates the dial apparatus L so as to connect lines 16 and 6 through automatic switch B, and, after the usual signal and return signal, may immediately connect the two lines 16 of K and L through line-strips N N and a connecting-strip, R, at the same time disconnecting both line-strips from ground by withdrawing the plugs at the bottom of the line-strips. The telephonic circuit is then from earth at D, line 6, switch B, line 16, box L, strips N N, and connecting-strip line 16 of A, line 4 of A, and to ground. In making the connection upon the manual switch the attendant may leave the call-bell or annunciator of L in circuit, or may put that of K into the circuit, so that when subscriber at D switches in his battery for the purpose of restoring the switch-apparatus in A to zero he will give a signal upon the bell or annunciator of K or of L, and thus indicate to the attendant that the lines 16 and 16 are to be disconnected upon the manual switch. This having been done, and earth connection of 16, section B, having been restored, the attendant thereupon switches in battery C B, and by means of the apparatus in L restores the switch apparatus in section B to zero. Subscriber at D merely restores his station apparatus to its normal condition.

The apparatus is obviously capable of use in other ways, and the details of the various acts of signaling, switching, and oral communication may be varied. If a subscriber of an automatic section desire to be placed in communication with a station or subscriber upon a line connected to S, (which, being only occasionally called into use, is not connected to an automatic switch, but is equipped in the ordinary manner,) the connection can be made through a line-strip, N, and a strip, S, in a manner that will be readily understood. So, also, if a subscriber, or an office connected to a strip, S, desire to communicate with a subscriber connected to A or B, the connection can be made through S and N, the manual switch having been first connected to the subscriber's line wanted by manipulating the proper dial apparatus at the manual switch.

The apparatus and connections for receiving calls from stations connected to S S are not here shown, but may be of any ordinary construction and arrangement. These connections are also intended as connections to a similar manual switch with connected automatic switches, said switch being located at a considerable distance from that shown.

It is obvious that the manual switch may be connected to each automatic section by several wires, so that if a subscriber on setting the automatic switch to one of said wires fails to get a response, thus indicating that the wire is in use, he may turn his automatic switch apparatus to the next connecting-wire. The automatic switches and the manual switch need not all be located at the same place. For instance, the automatic switches may be placed at the center of isolated districts to which certain classes of subscribers or lines of business are mostly confined.

I do not limit myself to any particular construction of manual switch apparatus, that shown being intended only as a representation of any ordinary form. Other forms and constructions may obviously be used in place of it.

Having thus described my invention, I claim broadly—

1. The combination of two or more auto-

matic switches, substantially such as described, located at a central office, circuit-connections from each automatic switch to a manual switch, and apparatus in such circuit-connections for operating the automatic switches, substantially as and for the purposes set forth.

2. The combination of two or more automatic switches, each constructed to allow any subscriber connected thereto to automatically connect his line with any other line upon the same automatic switch and a line or lines from each automatic switch to a common manual switch, and apparatus at the manual switch for operating the automatic switches, as set forth, whereby any subscriber may connect his line either to any other subscriber's line of his automatic section or to a line leading to the manual switch for connecting the subscriber's line with any other line-connection upon the manual switch.

CHARLES E. BUELL.

Witnesses:
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W. E. CHAFFEE.