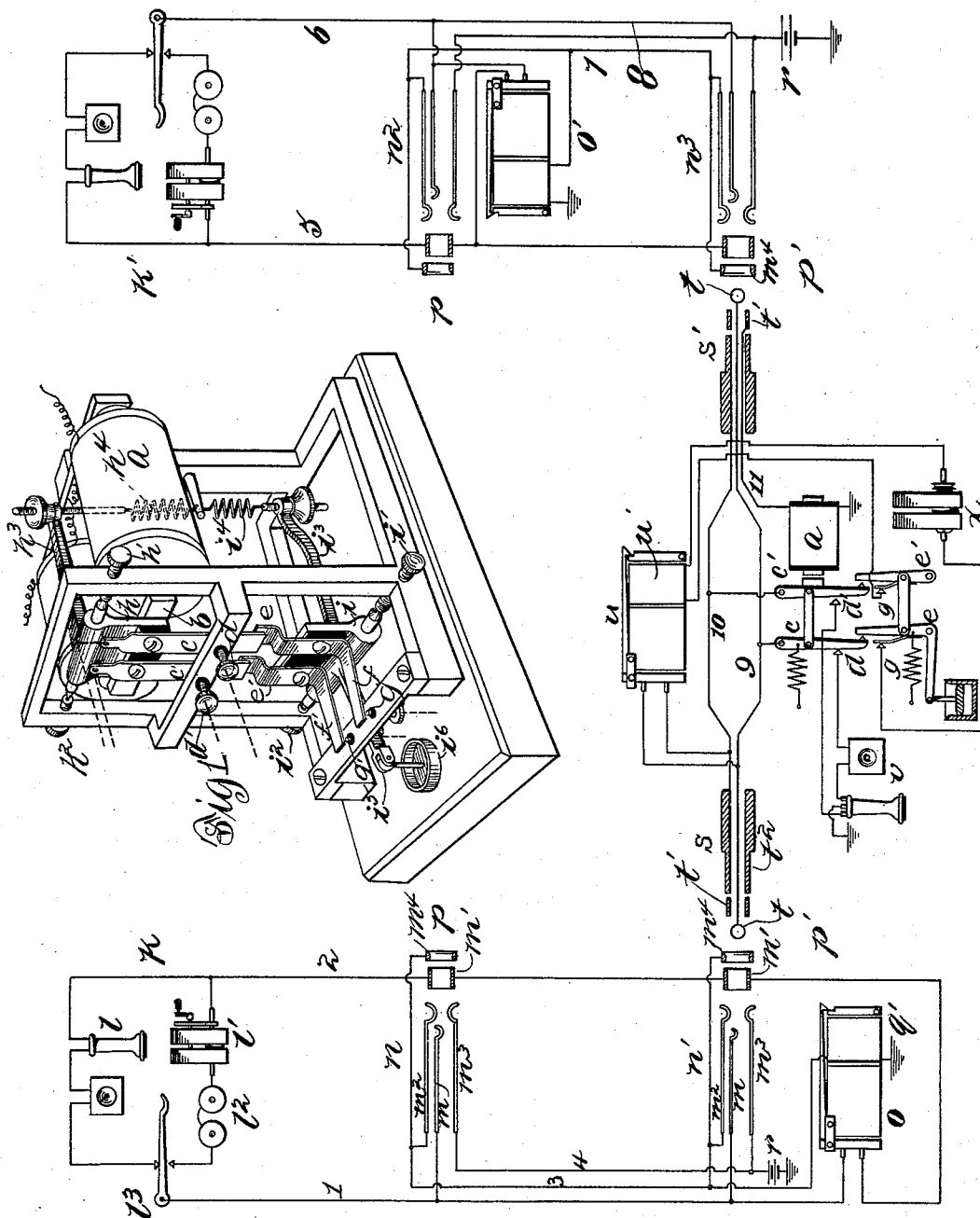


(No Model.)

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APPARATUS FOR TELEPHONE SWITCHBOARDS.

No. 572,223.

Patented Dec. 1, 1896.



WITNESSES:
George L. Bragg.
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Fig. 2

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UNITED STATES PATENT OFFICE.

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APPARATUS FOR TELEPHONE-SWITCHBOARDS.

SPECIFICATION forming part of Letters Patent No. 572,223, dated December 1, 1896.

Application filed June 6, 1894. Serial No. 513,719. (No model.)

To all whom it may concern:

Be it known that we, CHARLES E. SCRIBNER, residing at Chicago, in the county of Cook, and FRANK R. MCBERTY, residing at Downer's Grove, in the county of Du Page, State of Illinois, citizens of the United States, have invented a certain new and useful Improvement in Apparatus for Telephone-Switchboards, (Case No. 356,) of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

Our invention relates to the keyboard apparatus of telephone-switchboards, more particularly to the switching apparatus for connecting the operator's telephone and the generator of signaling-current with the plug-circuit in the operation of establishing communication between two telephone-lines comprised within the exchange.

In switchboards commonly in use each telephone-line terminates in a socket upon the switchboard, and the attendant operator at the switchboard is provided with a number of pairs of connecting-plugs adapted to fit the sockets, the members of each pair being electrically united. In combination with the conductors uniting the two plugs of a pair several switch-keys are arranged, usually one for switching the operator's telephonic appliances into and out of connection with the plugs and others for looping either plug into circuit with the generator of signaling-current for operating the signaling-bells at the substations. In establishing connection between two telephone-lines the operator is required to insert one plug of a pair into a socket of each of the lines to be connected and to manipulate first her "listening-key" both for connecting and disconnecting her telephone from the plug-circuit and afterward the calling-key for signaling to the substation of the line with which the connection has been completed—the "answering-line."

It is the object of our invention to perform these operations of connecting and disconnecting the telephone and the generator of signaling-current automatically at suitable times in the process of making the desired connection, thus relieving the attendant of

the manipulation of all mechanism excepting the connecting-plugs themselves, and at the same time dispensing with switch-keys on the face of the switchboard. To this end we have provided a local circuit in the exchange, normally open and terminating in a contact-piece upon the spring-jack switch or socket of the telephone-line and in a cooperating contact-piece upon the connecting-plug, and a relay of peculiar construction included in this local circuit having switch-contacts controlling the circuits between the connecting-plugs and the telephone and signaling-generator. The operation of inserting the connecting-plug into a spring-jack to make or complete a desired connection closes the local circuit, whereby all the necessary switching of other appliances into and out of circuit is performed.

The instruments which it is especially desirable to thus automatically switch into connection with the plug are, as before mentioned, the telephone and generator of signaling-current, and when our relay is required to control the circuits of these appliances only it may consist of a lever connected with one conductor of the plug-circuit normally resting against an anvil constituting a terminal of the telephone, but brought, when attracted, against a lever which is connected through a suitable yielding connection with a pole of the calling-generator, the yielding connection being adapted to follow its lever only a short distance, separating therefrom and thus breaking the circuit of the calling-generator before the relay-lever shall have reached its extreme forward position. The lever carrying the yielding connection, or this connection itself, may be considerably retarded, if desired, to prolong the moment of connection between the lever and the generator. In combination with metallic circuits it is desirable to duplicate the switch parts, in order to make the necessary connections simultaneously with both conductors of the metallic plug-circuit.

It will be understood that our relay is equally well adapted to perform any other desired or usual operation of switching whose accomplishment is required during the time

the operator is handling the connecting-plugs, and, of course, the details of construction herein described are unessential to its operation.

5 Our invention is especially adapted to use in connection with that type of telephone-switchboard in which the annunciators are of the self-restoring or self-resetting form, a local circuit being provided in combination
10 with the spring-jacks adapted to be closed through the resetting-magnet of the annunciator when a connecting-plug is inserted into a spring-jack of the corresponding line. In this type of switchboard the local circuit
15 mentioned commonly terminates in two normally-separated springs in each spring-jack, which springs are adapted to register with and be crossed together by an insulated ring upon the connecting-plug. One of these
20 springs is grounded through a battery or other source of electric current and the other spring through the resetting or restoring magnet of the individual annunciator. In adapting our invention to this switchboard
25 we provide a conductor or cord strand extending to this insulated ring upon the plug and grounded through the magnet of our relay, this connection being preferably made with the "test-plug" or that member of a pair
30 which is employed in completing the connection—that is, the one which is designed to be inserted into the spring-jack of the answering subscriber.

Our invention is illustrated in the accompanying drawings.

35 Figure 1 of the drawings represents in perspective view the relay which performs the operation of switching the different appliances. Fig. 2 is a diagram of two telephone-
40 lines extending from substations to a telephone-exchange and terminating at the exchange in annunciators and spring-jacks upon a switchboard, the telephone-lines being supplied with local annunciator-restoring circuits, and plugs and plug-circuits for uniting
45 the lines equipped with our improved relay and arranged with certain connections appropriate thereto.

Referring to Fig. 1, it will be observed that
50 our relay comprises, as before described in a general way, an electromagnet *a*, controlling an armature *b*, carrying two levers *c* and *c'*, which normally rest against adjustable anvils *d* and *d'*, but which may be brought against
55 the extremities of pivoted levers *e* and *e'*. These levers *e* *e'* are continued in flexible extensions *f* *f'*, which normally rest upon contact-anvils *g* *g'*. The armature *b* is carried upon a lever *h*, pivoted in trunnion-screws
60 *h'* *h''*. The lever *h* carries a horizontal arm *h'*, provided at its extremity with an adjustable hook attached to a retractile spring *h'*, whose other extremity is fixed to a projection of the frame of the instrument. The levers or arms *c* *c'* are rigidly connected with
65 this armature-lever *h*, but are insulated therefrom by an interposed plate of hard rubber.

The adjustable contact-anvils or stops *d* *d'* are insulated from the frame by bushings of hard rubber.

The levers *e* *e'* are likewise in mechanical connection with but electrically insulated from a block *i*, pivoted on trunnion-screws *i'* *i''*, and also provided with an extension *i'*, fixed to the free extremity of a retractile
75 spring *i'*. The block or lever *i* carries a rigid arm *i'*, to which the plunger of a dash-pot *i'* is pivoted, retarding the movement of the lever.

In the normal position of this apparatus the
80 armature *b* is drawn back from its magnet by spring *h'*, and the contact-levers *c* and *c'* rest against their stops *d* and *d'*. The lever *i* is also retracted by its spring *i'* into a position in which the yielding extensions *f* and *f'* rest
85 upon their anvils *g* and *g'*, these being adjusted, however, so that the levers *e* and *e'* do not touch the extremities of levers *c* and *c'*.

When the magnet *a* is excited, armature *b* is attracted, withdrawing levers *c* and *c'* from
90 their resting-stops and closing them against the extremities of levers *e* and *e'*. In the further motion of armature *b* the levers *e* and *e'* are carried with it in opposition to spring *i'*, the motion being retarded by the dash-pot
95 *i'*. After the levers *e* *e'* have passed through a certain predetermined range of motion the yielding extremities *f* and *f'* are lifted from their contact-stops *g* and *g'*. When the magnet *a* is again demagnetized, the levers *c* and
100 *c'* instantly separate from the levers *e* and *e'*, which latter slowly follow to their normal position, impeded by the dash-pot *i'*.

Referring now to the diagram, Fig. 2, we will trace the organization and operation of
105 our invention in connection with a telephone-switchboard.

The substations *k* and *k'* are equipped with the usual apparatus, comprising a telephone
110 *l*, a generator *l'*, a signal-bell *l''*, and an automatic switch *l'''*, adapted to be controlled by the telephone to switch the telephone and the signaling apparatus alternately into circuit, according as the telephone is removed from or replaced upon the switch-hook. Each
115 substation is connected by line-wires with the usual apparatus at the exchange. Thus from station *k* extend line-wires 1 and 2, which are connected at the exchange with a spring *m* and a thimble *m'*, respectively, of
120 each of two spring-jacks *n* and *n'* and with the extremities of the main or operating coil of an individual annunciator *o*. The spring-jacks *n* and *n'* may be assumed to be located upon different sections *p* and *p'* of a multi-
125 ple switchboard, the annunciator *o* being upon the section *p'*.

In addition to the line-contacts *m* and *m'* each spring-jack is provided with two local contacts or springs *m'* *m''*, the former being
130 connected also with a small ring *m'* at the front of the jack for testing purposes. Springs *m'* of the different spring-jacks are connected together by a conductor 3 and are

grounded through the restoring or resetting magnet q' of the annunciator o . The springs m^3 are connected together by a conductor 4 and are grounded through a battery r .

5 The apparatus of substation k' is connected with like mechanism at the exchange by line-wires 5 and 6, the spring-jacks being lettered in the drawings n^2 and n^3 and the annunciator o' . The annunciator o' is supposed to be
10 located upon the section p of the multiple switchboard, so as to be under the attendance of a different operator. The conductors 7 and 8 of the corresponding local circuit are also arranged in a manner exactly similar to
15 those of station k , the batteries r being identical, if desired.

The switching mechanism provided for the attending operator is shown at switchboard p' only, a single pair of plugs and accessory
20 devices being represented for the sake of clearness. The plugs s and s' each comprise a central tip t , adapted to register with the line-spring m , an insulated ring or sleeve t' to cross together the springs m^2 and m^3 , and
25 a sleeve t^2 , adapted to make connection with the ring m' . The tips t of the two plugs are connected together by a conductor 9 and the sleeves t^2 by a conductor 10. The ring t' of plug s is insulated, but that of plug s' is connected by a separate flexible conductor 11 to
30 earth through the magnet a of the relay. A clearing-out annunciator u is provided in a permanent bridge connection between conductors 9 and 10. The levers c and c' of the
35 relay are connected with conductors 9 and 10, respectively, while their resting-stops d and d' constitute the terminals of the operator's telephone set v . The resting-contacts g and g' of levers e and e' constitute the terminals of a continuously-operating generator x of signaling-current. The circuit of
40 this generator is carried through the restoring or retaining magnet u' of clearing-out annunciator u , in order that when the generator x is connected in a bridge between conductors 9 and 10 the clearing-out annunciator shall not be operated by the current
45 shunted through its main magnet, it being rendered unresponsive at that moment by the current of generator x through its restoring-magnet.

To follow the operation of this system, assume that subscriber at station k desires to communicate with subscriber at station k' .
55 The generator l' at station k being rotated, current is transmitted over the line and through the main magnet of annunciator o , causing the latter to display its indicator. The operator at switchboard d' , observing this
60 signal, inserts the plug s into the spring-jack n' of the corresponding line at her switchboard. By this means the conductors 1 and 2 are extended through the tip t and the sleeve t^2 of the plug s to the conductors 9 and 10, thence to the levers c and c' , and thence to the operator's telephone r . The operator is
65 thus in position to receive the oral order of

subscriber at station k for the desired connection. The operation of inserting plug s into spring-jack n' has crossed together the
70 springs m^2 and m^3 , completing the local circuit of battery r through restoring-magnet q' of annunciator o and thus resetting this annunciator to its normal position.

Having received the order, the operator
75 tests the line called for in the usual way, to determine whether or not it is already in use—that is, by applying the tip of plug s' to the test-ring m^4 of spring-jack n^3 —and having found the line free she inserts the plug
80 fully into spring-jack n^3 . Local springs m^2 m^3 of this spring-jack are thus closed together, completing the local circuit through the restoring-magnet of annunciator o' , and at the same time conductor 11, through the me-
85 dium of ring t' , is connected with battery r and current finds circuit therefrom through magnet a . The latter being excited attracts its armature. In the first movement of the latter the telephone v is disconnected from
90 conductors 9 and 10, the levers c and c' being drawn from their contact-anvils d and d' . An instant later levers c and c' make contact with levers d and d' , and since the yielding extensions of these levers still rest against their
95 stops g and g' the generator x is closed in a bridge connection between conductors 9 and 10. A signaling-current is thus transmitted to the substations, operating the bell t^2 at station k' , where the telephone is still upon
100 the switch-hook. The levers c and c' now carry with them the retarded levers e and e' , by which the connection of the latter with anvils g and g' is soon interrupted, after which the levers c and c' are disconnected from all
105 other circuits.

The operations of disconnecting the telephone and of signaling to the substation of the answering subscriber to call his attention to the telephone are thus performed auto-
110 matically, without the manipulation of any switching apparatus by the operator.

When the subscribers have completed their conversation, either or both may give the
115 usual signal for disconnecting by rotating his calling-generator l' , the signal being received and indicated by the clearing-out annunciator u . The operator then withdraws the plugs s and s' from the spring-jacks. Circuit
120 through magnet a is thus interrupted and the relay is permitted to return to its normal position, in which the telephone v is connected with conductors 9 and 10, in condition for communication as soon as plug s is inserted
125 into another spring-jack to answer a call.

As we have before stated, our invention herein described is of a broad and general character, and we do not desire to limit ourselves to any specific form of relay or to any particular appliances which the latter may
130 switch into or out of circuit; and

We therefore claim, broadly, as new and desire to secure by Letters Patent—

1. The combination with a telephone-line,

of an operator's telephone connected therewith, a plug connected with the line for uniting it with another line by means of a spring-jack thereof, a relay controlling switch-contacts included in the circuit of the telephone, and a local circuit containing the magnet of the said relay terminating in registering contact-points of the said plug and spring-jack; whereby the operator's telephone is connected with the line until the plug is inserted in the said spring-jack, and is reconnected with the line when the plug is removed from the spring-jack, as described.

2. The combination with a pair of plugs adapted for insertion into spring-jacks of telephone-lines, the plug-circuit uniting the plugs, and an operator's telephone in a bridge of the plug-circuit, of switch-contacts included in the bridge containing the telephone, an electromagnet controlling the switch-contacts, and a local circuit terminating in registering contacts upon one of the plugs and the spring-jacks, completed when the plug is inserted into a spring-jack substantially as described.

3. The combination with telephone-lines terminating in spring-jacks, of a connecting-plug adapted for insertion into one of the spring-jacks, and the plug-circuit thereof, a generator of signaling-current, and an electromagnetic switch adapted when excited to connect the generator of signaling-current with the plug-circuit, a local circuit inde-

pendent of the line including the electromagnet of said switch terminating in contact-pieces adapted to be closed together in the act of inserting the plug into the spring-jack, substantially as described.

4. The combination with a connecting-plug and an operator's telephone, of an electromagnet connected with a circuit of the plug adapted to be closed during the insertion of the plug in a spring-jack, and switching mechanism actuated by said magnet to interrupt the circuit of the telephone, substantially as described.

5. In combination, a conductor forming a part or extension of a line to a telephone-substation, a relay having a lever *c* connected with said conductor, normally resting upon a stop *d* connected with a telephone, adapted to make connection with and to carry with it a lever *e* when it is attracted to its magnet, a contact *f* electrically connected with said lever *e* and adapted to be separated thereby from its resting-stop *g*, means for retarding the movement of lever *e*, and a generator of signaling-current connected with stop *g*, substantially as described.

In witness whereof we hereunto subscribe our names this 17th day of May, A. D. 1894.

CHARLES E. SCRIBNER.

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Witnesses:

GEORGE L. CRAGG,

W. CLYDE JONES.