(No Model.)

E. P. WARNER.

THREE WIRE MULTIPLE SWITCH BOARD SYSTEM.

No. 428,189. Patented May 20, 1890.

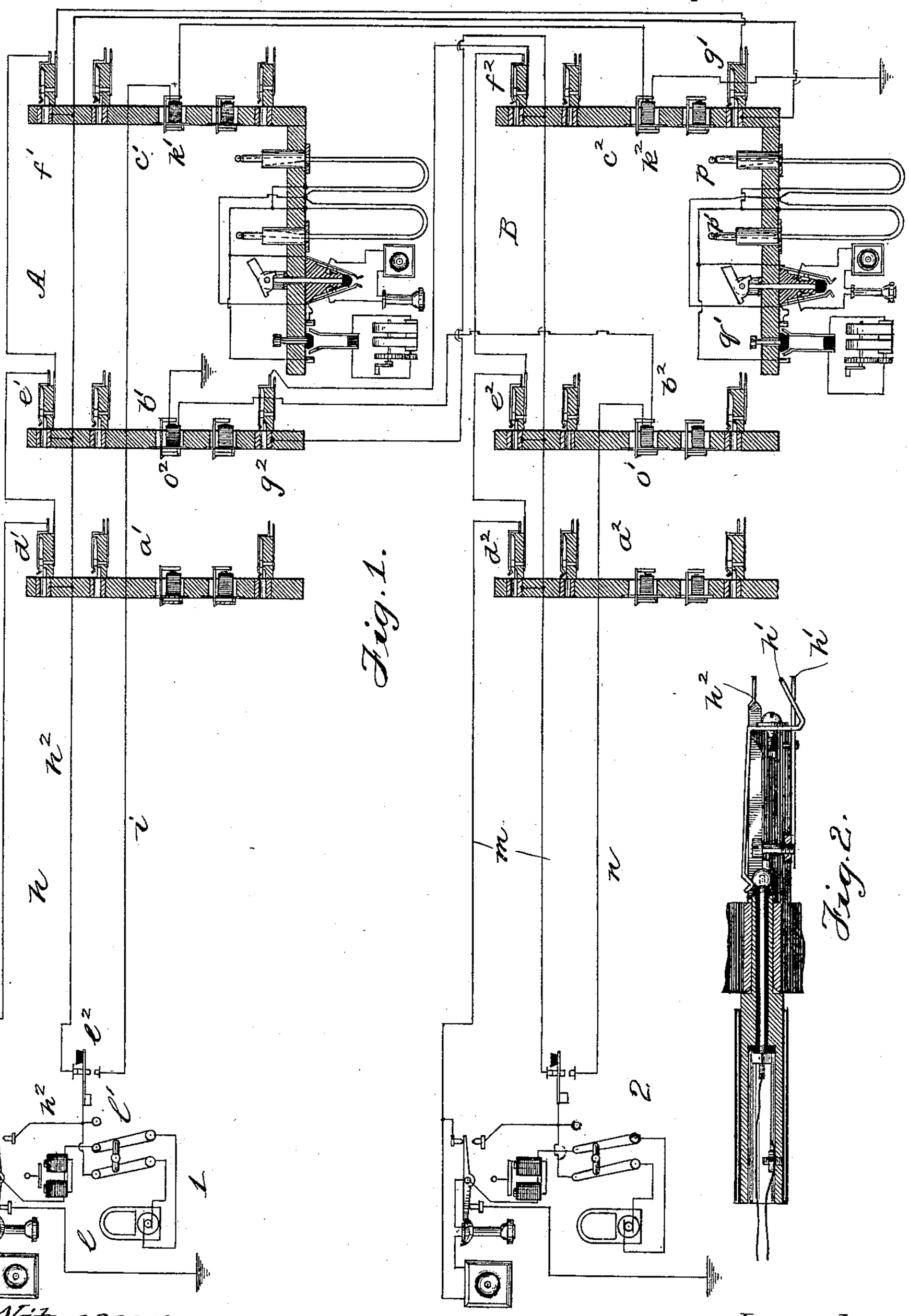

Fig. 1.

Fig. 2.

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UNITED STATES PATENT OFFICE.

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THREE-WIRE MULTIPLE SWITCH-BOARD SYSTEM.

SPECIFICATION forming part of Letters Patent No. 428,189, dated May 20, 1890.

Application filed December 10, 1888. Serial No. 293,140. (No model.)

To all whom it may concern:

Be it known that I, ERNEST P. WARNER, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Three-Wire Multiple Switch-Board System, (Case 19,) 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.

My invention relates to telephone-exchange apparatus of the multiple type, in which the boards are divided into two groups, a connecting device being provided for each of—say, half of—the lines on each board of one of the groups, and a connecting device for each of the other half of the lines upon each of the boards of the other group. In a divided multiple switch-board system of this class we have half the lines connected with one group of boards according to the multiple plan, and the other half of lines connected with another group of boards. Each line of division 1 is provided with a terminal upon one of the boards of group 2, and each of the lines of division 2 is provided with a terminal on one of the boards of group 1. Signaling apparatus has also been provided, so that each subscriber may signal at will to either one or the other of the two groups of switch-boards. The lines, say, from 1 to 3,000, will form the first division and be connected with the first group of switch-boards, while the lines from 3,000 to 6,000 would form the second division and be connected with the second group of boards. A subscriber knowing the number of the line with which he wants connection sends in one of two signals, accordingly as the line wanted is above or below 3,000—that is, he sends the signal to the group of boards upon each of which the line wanted has a terminal. Heretofore in such divided systems it has been proposed to use metallic circuits for the different subscribers. In such systems the expense and difficulties at the exchange-office are multiplied as the number of lines are increased. It is therefore desirable to provide a special signal-circuit in addition to the talking-circuit of each subscriber. I have sometimes termed my system the "three-wire system" on this account, though it will be apparent that my invention is not in all respects limited necessarily to those systems in which each subscriber is provided with two wires—that is, a metallic circuit for talking. It will also appear that my invention is not limited to any particular test system—that is, it is not limited to any particular apparatus for finding out when a line is called for whether said line is connected or in use. I shall therefore describe my invention as embodied in a divided multiple system employing metallic talking-circuits, and for clearness of description and illustration shall refer only incidentally to the test system.

Speaking generally, my invention consists in connecting the different telephone-lines with switches on each of the boards of one group and with a switch on one of the boards of the other group, and, in connection with each telephone-circuit, running a special signal-circuit from each subscriber's station through signal devices, as annunciators, one at least on one of the boards of each of the groups, the signal device of each group or division in each signal-line being adapted to respond to current of different polarities or character.

In the accompanying drawings, Figure 1 is a diagram illustrative of two subscribers' stations connected with a telephone-exchange by circuits embodying my invention. Fig. 2 is a detailed sectional view of an ordinary spring-jack switch, a loop-plug inserted therein, such as are used preferably at the exchange-office.

The multiple switch-boards at the exchange-office are in two divisions or groups, group A consisting of three boards a' b' c', and group B consisting likewise of three duplicate boards a^2 b^2 c^2. Subscriber's station 1 is connected with spring-jack switches d' e' f', one being on each of the boards of group A, and also with a spring-jack switch g' upon one of the boards of group B—in this instance board c^2. This station 1 is provided with a connecting device on each of the boards of group A and with another connecting device upon one of the boards of group B.

The talking-circuit or telephone-line of station 1 is a metallic circuit h, the limb h', when the telephone is removed from the switch, extending from the switch through the telephone and through the spring and contact of each of the switches d' e' f' g' of the line, while the other branch h^2 extends to the ring or test piece of each of said spring-jack switches. As shown in Fig. 2, the two branches h' and h^2 may be connected with the different strands of the cord of the loop-plug when the plug is inserted.

It will be observed that I have included no annunciator or other device for signaling the central office in the metallic circuit h, or rather in each of the limbs h' h^2, which when united form the metallic circuit. I provide a special wire i for signaling. This wire i extends from the subscriber's station through an annunciator k' on one of the groups and through another annunciator k^2 on one of the boards of the other group. These annunciators k' k^2 in the signaling-circuit i should be polarized to respond to current in different directions.

At the subscriber's station I provide a generator l, in connection with a switching device or pole-changer l', adapted to loop the generator into the circuit i to send current in the proper direction to operate the annunciator k' or the annunciator k^2. The key l^2 is included in the circuit of branch or limb h^2 at station 1, and is so placed with respect to the contact or terminal of signal-circuit i that when depressed circuit i will be closed to ground through the switching apparatus l' and the generator l, the direction of the current through annunciator depending upon the position of switch l', which may be moved at the will of the user to the position required. We have, then, station 1 connected by a telephone-line with a different switch of each of the switch-boards of group A and with a switch on one of the boards of group B.

In addition to the telephone-line we have a signal-circuit wire which extends to an annunciator upon one board of each of the groups of boards, and these annunciators are polarized to respond each to current in one direction only, and are so placed in circuit that only one will be operated by current of a given direction.

The circuits of station 1 and their connections with the different switch-boards of the exchange as thus described, may be considered the same as those of other stations. Station 1 would be considered as belonging to the first division or group A of the exchange. This first division might embrace the stations numbered from 1 to 3,000, the remaining stations of the subscribers being numbered from 3,000 to 6,000.

As shown in Fig. 1, station 2 may be considered as one of the subscribers' stations of the second division. The telephone-line m of this station is run in the same manner heretofore described with respect to telephone-line h of station 1—that is to say, telephone-line m includes a spring-jack switch on each of the boards of group B, and a spring-jack switch on one of the boards of the first group A. These spring-jack switches d^2 e^2 f^2, distributed on the boards of group B, and the spring-jack switch g^2 upon board b' of group A, may be of the construction shown in Fig. 2. The circuit m will be found open normally at switch g^2. A loop-plug inserted in any one of the switches d^2 e^2 f^2 g^2 may be used to connect the telephone-line m in metallic circuit with any other line with which connection is desired. The switching apparatus or pole changer, the generator, and connections may be the same at station 2 as heretofore described with respect to station 1. The signaling-circuit n includes polarized annunciators o' and o^2, one annunicator being on one board of each of the divisions or groups B A.

I have thus described the manner of connecting the telephone-lines and the signal-lines with the different groups or divisions of switch-boards of the divisional multiple switch-board system.

I will now describe the manner of signaling the central office and making the connections between the different telephone-lines. Suppose subscriber 1 wishes connection with subscriber 2. He depresses key l^2 and places the pole-changing switch l' in position to send current from the generator l over signal-wire i in proper direction to operate annunciator k^2. The operator at board c^2, seeing annunciator k^2 fall, will at once insert a loop-plug, as loop-plug p, into answering spring-jack g' of line h, which is numbered to correspond with the annunciator k^2. The operator's telephone at board c^2 is then brought into the circuit by bringing the operator's telephone-switch into the position shown, to bridge the telephone in a circuit-crossing from one cord to the other, which is a well-known method of making the connection with the operator's telephone and is generally termed "bridging across." It will be observed that the signal is sent in over the signal-wire i, and that the operator on seeing the signal loops the telephone into the telephone-line h, thus completing the circuit between the subscriber's station and the operator, it being understood that the subscriber on sending the signal will immediately take down his telephone, so as to bring his telephone into the circuit of line h. The operator at board c^2, upon receiving the order for subscriber 2, inserts the other plug p' of the pair into the spring-jack switch f^2 of line m. Having inserted plug p' in spring-jack f^2 the operator, by depressing key q, brings the generator into circuit, so as to send current over line m and ring the bell at subscriber's station 2. The operator then disconnects her telephone and is ready for the next call. When the subscribers are through talking, the one who sent in the call—that is to say,

in this instance subscriber 1—will send current over signal-wire *i* in direction to throw down again shutter k^2. This will be the disconnecting-signal and the operator pulls out the plugs *p p'*.

In case subscriber 1 wished a connection with any one of the subscribers of the first division, current would be sent over line *i* in the other direction so as to operate the shutter *k'*. The operator thereupon at board *c'* will proceed to make the connection ordered. It should be observed that whenever two telephone-lines are connected together no clearing-out annunciators are included in their united circuit.

In telephone-exchange systems the greatest part of the troubles from induction arise from the signaling-current. By providing independent signal-circuits for the subscribers I am enabled to separate the telephone-circuit so far from the signal-circuits in running the wires that no injurious induction can take place.

I have not described any test system for determining whether a line wanted or called for at one board is connected or in use at any other of the boards, since such test systems are well known and a number of them might be readily adapted to my three-wire system of its circuits.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. The combination, with a subscriber's station, of a telephone-line extending through spring-jack switches, one on each of a group or division of multiple switch-boards, and one on one board of the other group or division of switch-boards, and a signal-wire extending from the subscriber's station through annunciators or signal devices, one on one board of each of the groups or divisions of boards, said annunciators or signal devices being polarized and connected to respond to currents of opposite polarities and switching apparatus and a source of electricity at the subscriber's station, whereby current may be sent in either direction over the signal-wire, and the telephone of the subscriber brought into the telephone-circuit, substantially as and for the purpose specified.

2. A telephone-exchange consisting of multiple switch-boards in two divisions or groups, subscribers' stations divided in corresponding groups, each subscriber's station being connected by telephone-lines with a switch or terminal on each of the boards of its division and with a switch or terminal on one of the boards of the other division, and a special signal-wire for each station connected with an annunciator on one board of each of the divisions or groups, said annunciators being polarized to respond to current of different polarities, substantially as and for the purpose specified.

3. The combination, with a telephone-line extending from a subscriber's station to a group of multiple switch-boards and to a single board of another group at a central station, of a special signal-wire extending from the same subscriber's station to two oppositely-polarized annunciators located at boards of the said groups, switching apparatus, a source of electricity, and a telephone and bell at the subscriber's station, and switching apparatus, a source of electricity, and a telephone at one board in each group of the multiple switch-boards, whereby the subscriber may signal the central office over the special signal-wire, and the operators at the central office may signal the subscriber over the telephone-line, and whereby the telephones may be connected together for conversation without including in their circuits either the bell of the snbscriber or the annunciator at the central office.

4. The combination, with the subscriber's outfit, consisting of a telephone, bell, generator, and switching apparatus, of a telephone-line consisting of two branches or limbs, one branch or limb being connected through the spring and contact of each of several switches distributed on different multiple switch-boards of one group and one switch or spring-jack upon one board of another group of switch-boards, the other branch or limb being connected with the frame or test piece of each of said spring-jack switches, a special signal-wire extending from said subscriber's station through two polarized annunciators placed on different boards of the two groups of switch-boards and connected in circuit to respond to current of different polarities, respectively, and an operator's outfit consisting of a telephone and switching apparatus at each of the boards at which the polarized annunciators are placed, whereby the subscriber may signal at will at either of said switch-boards, and whereby connection may be made between the operator's telephone at either of the boards and the subscriber's telephone, substantially as and for the purpose specified.

In witness whereof I hereunto subscribe my name this 29th day of September, A. D. 1888.

ERNEST P. WARNER.

Witnesses:
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