(No Model.)

H. H. ELDRED.

TELEPHONE EXCHANGE SYSTEM AND APPARATUS.

No. 303,714. Patented Aug. 19, 1884.

Fig: 1.

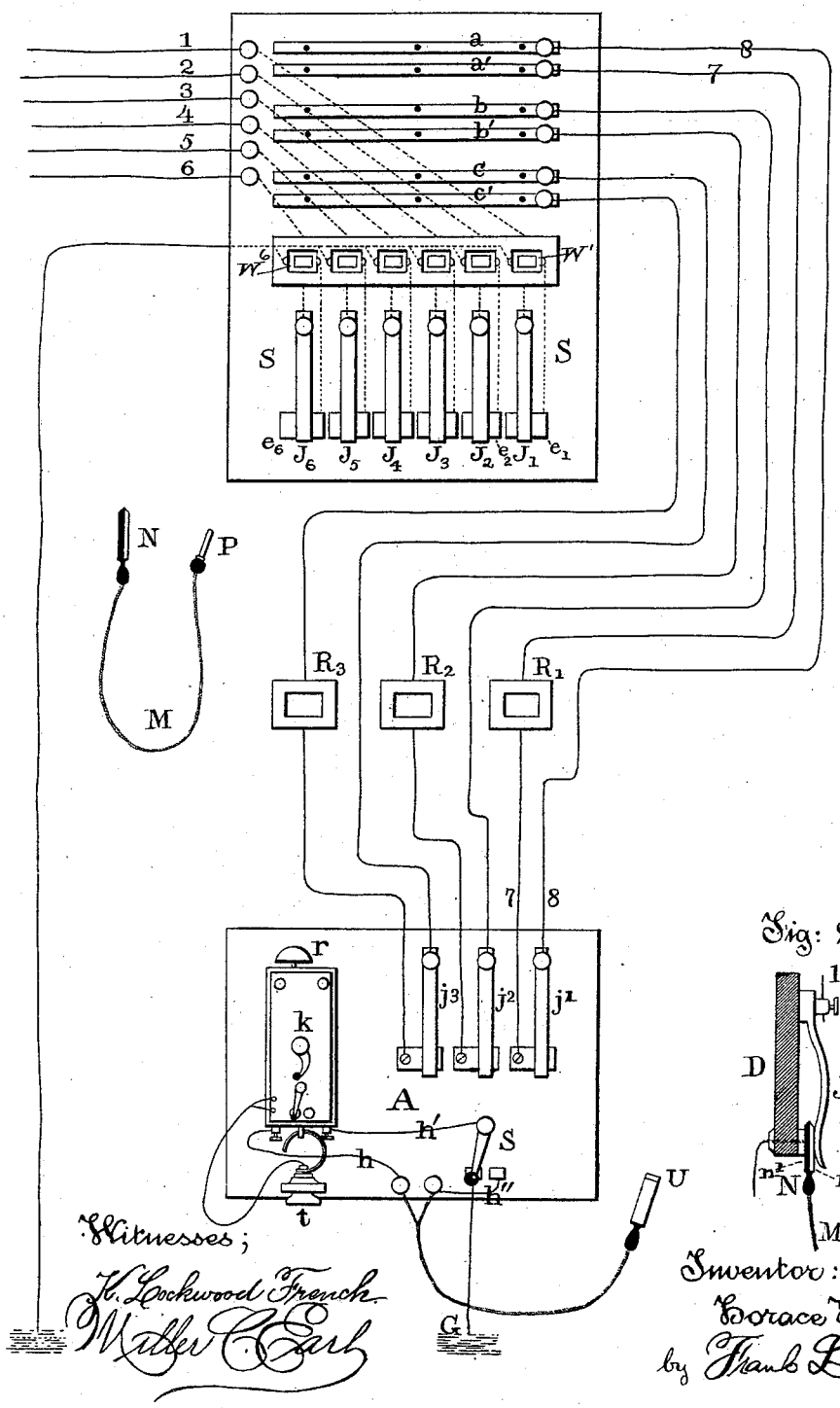

Fig: 2.

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TELEPHONE-EXCHANGE SYSTEM AND APPARATUS.

SPECIFICATION forming part of Letters Patent No. 303,714, dated August 19, 1884.

Application filed June 9, 1880. (No model.)

To all whom it may concern:

Be it known that I, HORACE H. ELDRED, a citizen of the United States, and a resident of the city, county, and State of New York, have invented certain new and useful Improvements in Telephone-Exchange Systems and Apparatus, of which the following is a specification.

My invention relates to a method of intercommunication known as the "district exchange telephone system;" and it consists, in general, of a central or exchange station, which is connected with a number of sub-stations by means of telegraphic or telephonic lines radiating therefrom, these latter being so organized and arranged that any two of the sub-stations may be placed at a moment's notice in direct telegraphic or telephonic communication with each other by the act of an attendant at the central or exchange station, who, upon being notified to do so, connects together the two lines leading to the respective sub-stations, so that they are enabled thereafter to communicate with each other directly.

My invention consists in the combination, with a series of telephone-lines converging to a central station from a corresponding number of sub-stations, hereinafter termed "sub-station lines," of a switch-board consisting of a series of spring-jacks—one for each line—for the insertion of wedges or other equivalent devices for effecting changes in the connections of the several lines, and a series of visual signals or annunciators—one for each line—for indicating the particular line or spring-jack with which a connection is required to be made, one of these visual signals placed on each line at a point between the said spring-jack and the earth, to which all the lines are normally connected, whereby, when any two independent lines are temporarily disconnected from the earth and coupled together to form a combined circuit, their corresponding annunciators are excluded therefrom.

The invention further consists in the combination, with the hereinbefore-described system of lines converging to a central station, of movable switches and conducting bars or strips united in pairs, with branch or loop conductors at said station, whereby direct communication can be established between any two sub-stations by connecting their respective lines together at the central station, and a signaling apparatus included in each of said branches, loops, or connecting-conductors, whereby, after having been thus connected together, the two sub-stations or either of them may notify the attendant at the central station to disconnect the said lines.

The invention further consists in the combination, with the apparatus last mentioned, of a signal sending and receiving apparatus and a telephone mounted upon an auxiliary or operator's table included in a loop-wire, which wire is provided with a wedge for insertion into a spring-jack placed in any one of the branch, loop, or connecting conductors, together with a switch, whereby said loop may be divided and the leg thereof containing the signaling apparatus and telephone connected with the earth.

The invention further consists in various details of construction and organization of the apparatus, whereby its efficiency and convenience of manipulation are enhanced, which will be hereinafter more particularly described and claimed.

In the accompanying drawings, Figure 1 is a theoretical plan showing the general arrangement of the switch-board and other apparatus at a central station, and embodying my improvements; and Fig. 2 is a sectional view of the spring-jack and wedge which is employed for effecting the connections at the main switch.

In Fig. 1 I have shown, for the purpose of illustrating my invention, a central exchange or station having six independent lines, which connect with different sub-stations.

The apparatus at each of the several sub-stations is arranged in a well-known manner, and consists of an instrument for transmitting and receiving calls, alarms, or signals, together with a transmitting and receiving telephone, which may be separate or may be combined in one instrument, as most convenient. It may be remarked that any convenient num-

ber of lines connecting with as many different sub-stations may be grouped together in this manner, according to the requirements of the service. The signaling and telephonic apparatus at each sub-station is assumed to be connected in the usual manner with the earth, and also by means of its appropriate line-wire with the central station shown in the figures. These several sub-station line-wires are numbered in Fig. 1 of the drawings as 1, 2, 3, 4, 5, and 6. Upon entering the central station each line is extended directly to the switch-board S, which consists of a row of spring-jacks, J' J^2 J^3, &c., which are constructed so as to press firmly against corresponding metallic plates, e' e^2, &c., and thus form an electrical connection therewith. Each spring-jack is connected with or attached to one of the separate lines leading to the several sub-stations, and the several spring-jacks may be conveniently designated by a number corresponding to the one which serves to distinguish that line, as illustrated in the drawings.

I will now proceed to describe the instrumentalities which I prefer to employ for coupling the different wires together at the central station in pairs for direct communication between independent sub-stations. A flexible insulated conductor, M, usually termed a "switch-cord," is provided with a terminal or wedge, N, at one of its extremities. The details of the construction of this wedge and the manner in which it is applied to the switch may be best seen in Fig. 2, which represents a sectional view of one of the spring-jacks of the switch with the wedge inserted therein, in order to make a connection between one of the lines and the central conductor.

In Fig. 2, D is a slab of wood or other non-conducting material, to which the parts of the apparatus are secured. The spring-jack J is formed at its upper extremity into a metallic block, which is mounted upon the slab D and secured thereto, and by means of a suitable binding screw is electrically connected with the wire 1, which is united to one of the lines extending to a sub-station. The contact-plate upon which each spring-jack rests is connected with its own independent annunciator, indicator, or visual signal W' W^2 W^3 W^4 W^5 W^6 by a wire, which, after passing through said annunciator, is joined to the earth-wire w, which is common to all the lines when normally connected. By this arrangement it will be observed that the annunciators, indicators, or visual signals are placed between the switch-board or spring-jack and the earth, instead of being between the switch and the line, as has heretofore been the practice. An important advantage gained by this arrangement consists in the fact that when two lines are coupled together at the central station for direct communication the annunciators belonging to these lines are thrown out of the combined circuit, and thus the resistance to be encountered in passing through the central station is greatly diminished. The spring-jacks may be normally kept firmly in contact with the plates on which they rest either by their own resiliency or by means of springs. The terminal or wedge N has one of its faces, n, formed of metal, and the other face, n', of non-conducting material, the former face being electrically connected with the flexible insulated conductor M. When, therefore, the wedge is inserted beneath the spring-jack, as shown in Fig. 2, the previously-existing connection between the line-wire 1 and the earth-wire w' is interrupted, and the former is placed in connection through the metallic face n of the wedge with the conductor M; but if the wedge be withdrawn the line is automatically and instantly restored to its normal connection with the earth. The opposite extremity of the flexible cord M terminates in a tapering metallic peg, P, which may be inserted with a twisting motion into one of a number of suitable holes provided for that purpose in the horizontal metallic bars or strips a a', b b', c c', which are insulated from each other by the non-conducting base-board, and placed preferably above the spring-jacks upon the switch-board S, as shown in the drawings. These bars are coupled together in pairs, each pair, as a a', being connected by wires 7 8, forming a branch or loop, and having inserted therein one of a series of auxiliary spring-jacks, j' j^2 j^3, and which are mounted upon the operator's table A in any convenient part of the room. For example, the bar a' is connected with one terminal of the spring-jack j' by a wire, 7, which also passes through a visual signal or annunciator, R', which is operated by an electro-magnet in a well-known manner, so as to display an indicating device whenever the magnet is traversed by the current. The other terminal of the spring-jack is connected directly with the bar a by another wire.

Upon or beside the operator's table A is placed an apparatus for transmitting and receiving calls, signals, or alarms. I prefer to employ for this purpose a magneto-generator operated by a crank, k, and which transmits a series of successive electrical pulsations alternately of opposite polarity. The bell r, for receiving calls, alarms, or signals, is operated by an electro-magnet. A telephonic transmitter, T, and a telephonic receiver, t, with the usual switch, which may be automatic or non-automatic, for throwing either the signaling or the speaking apparatus into the circuit at pleasure, is also provided. This apparatus is placed in a looped wire or circuit, one leg of which, h, terminates in one side of a double-faced wedge, U, while the other leg, h', goes to the lever of a circuit-changer, S, on the operator's table A. When this circuit-changer is moved to the right, it completes the loop through the wire h'' to the opposite face of the wedge U, but when turned to the left, as in the figure, it connnects the leg h of the loop directly to the earth at G'.

The operation of my improved system is as follows: When a call signal is transmitted from one of the sub-stations (say upon the line numbered 1) to the central office, the corresponding annunciator-drop or other visual signal, $W' W^2 W^3 W^4 W^5 W^6$, connected with the wire is actuated, notifying the attendant at the switch, who immediately takes one of the flexible conductors M and inserts its wedge N into the spring-jack belonging to that line which is directly beneath the indicator, and the peg P at its other end into the lower bar, a', of the unoccupied pair of bars, $a\,a'$. The operator at the table A at the same time inserts the wedge U into the corresponding spring-jack, j', the circuit-changer S being normally turned to the left, as shown in the drawings. The effect of this is to connect line-wire No. 1 with the earth at the central station by the way of flexible conductor M, bar a', branch-wire 8, wires h and h', and circuit-changer S, including the telephonic and signaling apparatus upon the operator's table. The operator then immediately ascertains, by speaking through his telephone, what line the sub-station calling desires to be placed in connection with, and calls out to the switchman (for example) that No. 6 is wanted, whereupon the switchman instantly connects No. 6 with the upper bar or strip, a, by means of another cord, M, with its wedge N and peg P, as in the former case, while the table-operator at the same moment turns the circuit-changer S to the right. The two lines, No. 1 and No. 6, are now entirely disconnected from the earth at the central station, and are united directly with each other through the telephonic and signaling instruments in the loop-wire $h\,h'$. The table-operator now signals the sub-station on No. 6 by means of alternate positive and negative currents transmitted over the line from his magneto-generator, and upon receiving a response to his signals informs him who is connected with him, and this, being heard also on No. 1, informs that sub-station that the desired connection with his correspondent has been made. The table-operator now withdraws the wedge U, leaving the two sub-stations in connection with each other without any instrument in the circuit at the central office except the auxiliary annunciator or visual signal R′ in the branch or loop circuit which connects the two lines. As soon as the two sub-stations thus connected have finished their conversation, one or the other of them, by operating the signaling apparatus, produces an indication upon the annunciator R′ at the central station in the usual manner, whereupon the table-operator notifies the switchman to disconnect Nos. 1 and 6 and restore them to their normal position, and this having been done, the entire operation of connection and disconnection is completed.

By the use of my improved system connections and disconnections may be effected in a telephone exchange system with great facility and convenience, even when the number of lines is very great, inasmuch as I am enabled to divide the work between one or more table-operators and a switchman without introducing any elements of complication or confusion.

I claim as my invention—

1. The combination, substantially as hereinbefore set forth, of a series of telephone-lines converging to a central or exchange station from different sub-stations, a series of spring-jacks—one for each line—for the insertion of connecting-wedges, and a series of visual signals or calling-annunciators, $W' W^2 W^3 W^4 W^5 W^6$, one of which is placed in each line at a point between its spring-jack and the earth, whereby the annunciators are cut out while talking.

2. The combination, substantially as hereinbefore set forth, of a series of telephone-lines converging to a central or exchange station from different sub-stations, movable switches and conductors 7 8, &c., at said central station, whereby direct communication can be established between any two sub-stations by connecting both their respective lines together, and an auxiliary or supplemental signaling apparatus, R′, &c., included in each of said connecting-conductors, whereby the sub-stations so connected, or either of them, may notify the attendant at the central station to disconnect the said lines.

3. The combination, substantially as hereinbefore set forth, of a series of telephone-lines converging to a central or exchange station from different sub-stations, movable switches and conductors at said central station, whereby direct communication can be established between any two sub-stations by connecting their respective lines together, a spring-jack in each of said connecting-conductors, an apparatus for transmitting and receiving calls or signals, and telephonic apparatus included in a loop which is provided with a wedge for insertion into said spring-jack, and a circuit-changer whereby said loop may be divided and the leg containing the signaling apparatus and telephone connected directly with the earth.

4. The combination, substantially as hereinbefore set forth, of a switch-board, an auxiliary table, telephonic or electric apparatus located upon said table, and devices for establishing temporary electrical connection between one or more lines centering in said table, communication between sub-stations and the central station or between different sub-stations being established through the table apparatus.

5. The combination, substantially as hereinbefore set forth, of a series of visual indicators at a central station, a series of independent sub-station lines converging to said central station, each passing through its respective indicator, and thence to a normal connection with an earth common to all of said lines, an operator's table, and devices for tempo-

rarily disconnecting one or more of said lines from the earth and simultaneously connecting them with said table.

6. The combination, substantially as hereinbefore set forth, of a series of sub-station lines converging to a central station, a series of conducting bars or strips permanently connected with an operator's table, and devices for temporarily connecting one or more of said lines with said bars or strips.

7. The combination, substantially as hereinbefore set forth, of a series of sub-station lines converging to a central station, a series of spring-jacks—one for each line—a series of conducting bars or strips, and flexible conductors armed with suitable plugs or terminals for temporarily establishing electric connection between one or more of said lines and said bars or strips.

8. The combination, substantially as hereinbefore set forth, of a series of sub-station lines converging to a central station, a series of annunciators or indicators—one for each line—a series of spring-jacks—one for each line—a series of conducting bars or strips, and flexible conductors armed with suitable plugs or terminals for temporarily establishing electric connection between one or more of said lines and said bars or strips.

9. The combination, substantially as hereinbefore set forth, of a series of sub-station lines converging to a central station, a series of conducting bars or strips, a series of branch or loop circuits, each uniting a single pair of said bars or strips, and means for forming a temporary electrical connection between any two lines and a pair of bars or strips.

10. The combination, substantially as hereinbefore set forth, of a series of conducting bars or strips, a series of branch or loop circuits, each uniting a single pair of said bars or strips, a series of spring-jacks—one in each branch or loop circuit—a telephonic apparatus, and a flexible conductor armed with a suitable terminal plug for connecting said apparatus with any of said branch or loop circuits.

11. The combination, substantially as hereinbefore set forth, of a number of spring-jacks, a plug for insertion into said spring-jacks, a switch, central-office instruments, and connections from said instruments to the points of said switch.

12. The combination, substantially as hereinbefore set forth, of a series of sub-station lines converging to a central station, an operator's table, devices for temporarily connecting one or more of said lines with said table, an electric generator, and key and switch mechanism upon said table for connecting said generator and key with any of the lines connected with said table.

13. The combination, substantially as hereinbefore set forth, of a series of indicators with a series of corresponding spring-jacks, each indicator being placed in proximity to its respective spring-jack.

14. The combination, substantially as hereinbefore set forth, of one or more operator's tables, one or more indicators, and controlling mechanism therefor located upon said tables.

15. The combination, substantially as hereinbefore set forth, of a series of independent lines or conductors, one or more branch or loop circuits, one or more central-office instruments, means for uniting any two of said lines or conductors with each other through one of said branch or loop circuits, and means for switching one or more central-office instruments into or out of such branch or loop circuit.

16. The combination, substantially as hereinbefore set forth, of a series of main lines converging to a switch at a central station, devices for uniting any two of said lines for oral communication, apparatus included in each line at the central station to indicate a call or signal, and independent devices for connecting either line to a pole-changing apparatus for transmitting outgoing signals.

Signed by me this 28th day of April, A. D. 1880.

HORACE H. ELDRED.

Witnesses:

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