

(No Model.)

G. L. ANDERS & T. D. LOCKWOOD.

Telephone Exchange System.

No. 239,133.

Patented March 22, 1881.

Fig: 1.

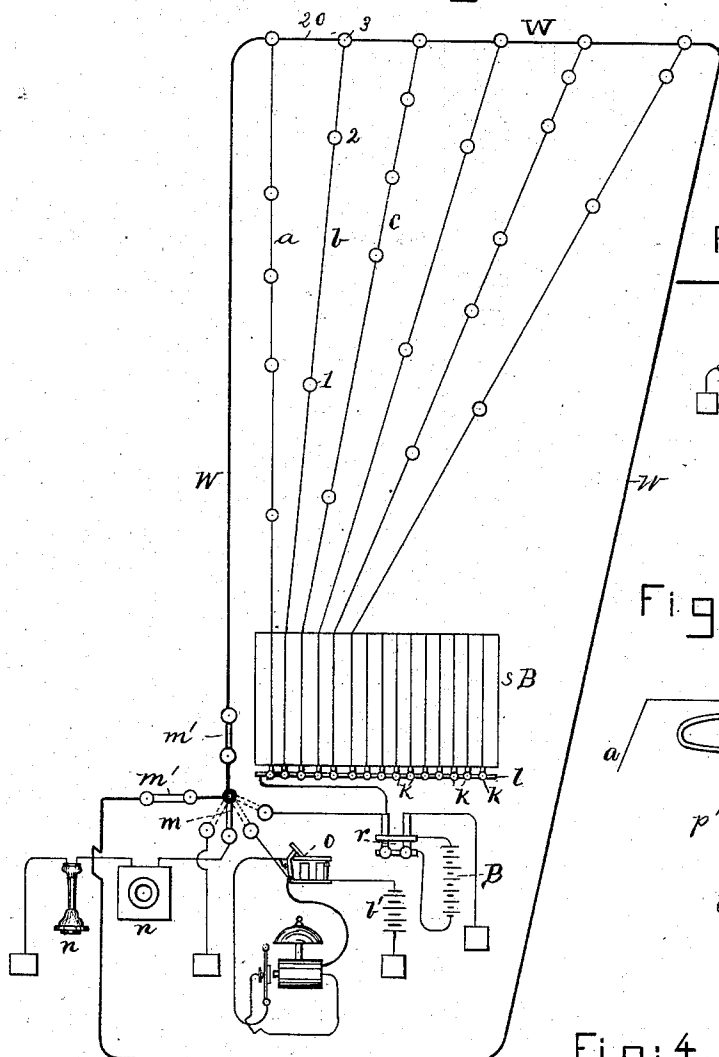


Fig: 2.

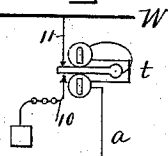


Fig: 3.

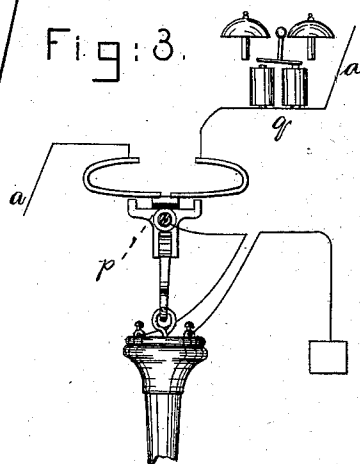
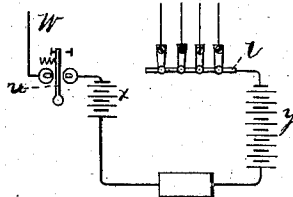


Fig: 4.



WITNESSES -

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GEORGE L. ANDERS, OF BOSTON, AND THOMAS D. LOCKWOOD, OF MALDEN,
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TELEPHONE-EXCHANGE SYSTEM.

SPECIFICATION forming part of Letters Patent No. 239,133, dated March 22, 1881.

Application filed November 19, 1880. (No model.)

To all whom it may concern:

Be it known that we, GEORGE L. ANDERS, of Boston, county of Suffolk, and THOMAS D. LOCKWOOD, of Malden, county of Middlesex, State of Massachusetts, have invented an Improvement in Telephone-Exchange Systems, of which the following description, in connection with the accompanying drawings, is a specification.

Our invention relates to telephone-circuits and exchange systems, and has for its object partly to render the working of the exchange more expeditious by facilitating the various operations of signaling, making connections, testing wires, and so on, the system having also various other advantages, which will be hereinafter more fully set forth.

In the exchanges as now commonly arranged the series of subscribers' circuits radiate out from the central office and are normally grounded at both extremities to form closed circuits over which an electric current may be passed to give a signal, or the circuit may have a current normally passing over it and the signals be given by breaking the circuit, and in either case each circuit has to be independent of the others, and each requires a separate signaling device—as, for example, an annunciator-drop at the central office.

In our improved arrangement the subscribers' circuits radiating from the central office, instead of being grounded at their outer ends, in the usual manner, are all connected with a single return-wire, preferably of a very low resistance, and having one or both of its ends brought into the central office, where it may be grounded either directly or through any suitable instrument, as may be desired, the proper connections being made by the operator. The ends of the independent subscribers' circuits that radiate from the central office are then connected with the usual switch-board, by which they may be connected with one another, and are preferably normally all left open. By this arrangement a subscriber, by grounding the portion of the line on the side of his station away from the central office, so as to include his telephonic instruments therein, will close the circuit thence through the common return-wire and instruments therein at

the central office; when, if the said central instrument is a telephone, he can at once communicate what connection is wanted, or if it be an indicator or bell, and a battery is in circuit therewith, the indicator will at once drop or the bell ring, and if the battery is not used a magneto-current may be generated in any usual way to operate the indicator or other signal to call the central operator, who will then switch in the telephone and find out what is wanted.

When it is desired to signal a subscriber from the central office the normally open end of that individual circuit on which the subscriber is stationed is connected through a suitable battery or magneto-generator with the common return-wire, or both may be grounded directly, so that there is now a complete closed circuit passing through the subscriber's station in question, which may be signaled in any usual way by any ordinary instruments, after which the individual ends of the two subscribers' circuits upon which a communication is wanted may be connected at the central-office end in the usual manner, the subscribers properly arranging their switches. When two circuits are thus connected all the subscribers thereon at stations farther away from the central-office than those that are communicating are still able to call the central office in the usual way, and it is possible, though not usually desirable, for two subscribers on different circuits to communicate by their connection through the common return-wire without any connection of their individual ends at the central office.

If desired, the outer ends of the circuits, where they join the common return-wire, may be provided with a switch, herein shown as a polarized relay, by which the said circuit may be disconnected from the common return-wire and put directly to ground, like the usual subscribers' circuits.

Figure 1 is a general diagram illustrating an exchange arranged and operated in accordance with our invention; Fig. 2, a detail showing a polarized relay arranged to connect or disconnect the subscriber's circuit from the common return-wire; Fig. 3, an arrangement of switch and instruments that may be con-

veniently used in the subscribers' stations, and Fig. 4 a modification showing a different apparatus for signaling the central office.

The subscribers' circuits *a b c*, &c., each containing one or more subscribers' stations, are connected at the central-office end with the usual switch-boards *S B*, where they terminate in a series of keys, *k*, normally open, but each adapted to be depressed into contact with or closed upon a common anvil-piece, *l*. The outer ends of the circuits are connected, either directly or through a suitable relay or switch, with the common return-wire *W*, terminating in the central office, where it may be put by the operator in connection with any desired electrical apparatus. As shown, both ends of the return-wire are brought to the central office, where either or both ends may be connected with a hand-switch, *m*, by which they may be grounded either directly or through telephonic instruments *n*, or through an indicating-instrument or annunciator-drop, *o*, according to the button with which the arm of the switch *m* is placed in contact.

The subscribers' stations may be provided, as shown in Fig. 3, with secrecy-switches *p*, which normally close the circuits through the said stations and signaling-instruments *q* therein, and by the proper movement will close the line on either side of the station through the telephonic instrument, there to ground.

The operation of the exchange will then be as follows: If a subscriber, for example, on the circuit *b* wishes to communicate with one on the circuit *d*, he merely throws his switch away from the central office, and by this operation grounds the outer end of his wire through his telephone, which will thus be placed in circuit through the common return-wire with the telephonic instruments *n* at the central office, the switch *m* being usually kept on the proper button, and an operator listening at the instrument *n* during the busier portion of time for the exchange. The subscriber will then immediately, through his telephone, tell the central operator which other subscriber in the circuit *d* he wishes to communicate with, after which the key *k* of the circuit *d* will be brought in connection with the anvil *l*, connected with proper instruments for operating a signal, herein shown as a battery, *B*, and reversing-key *r*, and will thus complete a closed circuit through the circuit *d* and the grounded return-wire *W*, which may at this time, if desired, be grounded directly, instead of through the instrument *n*, by the proper movement of the switch *m*. The desired subscriber on the circuit *d* will then be signaled by any usual signaling apparatus, either individual or not in its operation, and the two circuits *d* and *b* will be connected at the switch-board *S B* in any usual manner, these subscribers throwing their secrecy-switches toward the central office. If we suppose the subscriber in the circuit *b* to be at station 1, then the subscriber at station 2 or 3 on the said circuit could call the central

office just as before described, although the subscriber at station 1 was still conversing.

During the less busy portion of time of the exchange, when there is not sufficient business to warrant keeping an operator constantly listening at the telephone *n*, the switch *m* may be placed to connect the wire *W* with the indicating-instrument *o*, (shown as one of the usual annunciator-drops,) and, if desired, sufficient battery may be placed, as shown at *b'*, in circuit with the said indicating-instrument to operate it when the circuit is closed, or it may be operated by magneto-currents in any usual manner. In either case the circuit will be closed, as before, by a subscriber throwing his switch away from the central office, and thereby grounding that portion of his circuit lying between his station and the common return-wire *W*. If the battery *b'* is used, the instrument *o* will be operated as soon as the subscriber moves his switch; but if not it will be operated only when, after moving his switch, he generates the proper magneto-currents in the usual manner.

As but one instrument *o* is used for all the circuits, a signal-bell may be employed instead of the annunciator-drop, or one may be employed in addition to such visual signal, either a vibrating bell placed in the same circuit with the annunciator *o* and battery *b'* or a magneto-bell if such battery is not used; or the annunciator *o* may be employed, as shown, as a relay to close a local circuit through a vibrating bell, *S*, and its battery.

At the ends of the subscribers' circuits *a b c*, &c., polarized relays *t* may be used, as shown in Fig. 2, the subscriber's circuit passing through the coils thereof and to the polarized tongue, whence the circuit is completed either directly to the ground, as by wire 10, or to the common return-wire *W*, as by wire 11. The tongue will normally rest closing the circuit through wire 11 to the common return-wire *W*; but by sending a current in the proper direction over the subscriber's circuit the said tongue may be thrown over to ground the said circuit directly through the wire 10, thus leaving it entirely separated from the common return-wire *W*.

In the modification, Fig. 4, a polarized indicator, *u*, is employed instead of the ordinary indicator *o* at the central office, it being so arranged that when the battery *x* is thrown in circuit, as by grounding one of the subscribers' circuits, its tongue will be moved to give an indication; but when the main battery *y* for signaling the subscriber is thrown on by closing one of the keys *k* the said battery has no effect on the said indicator *u*, it being arranged to oppose the battery *x*, and of greater strength, so that it neutralizes the battery *x* and acts upon the polarized indicator so as to retain it in its normal position instead of removing it therefrom, and it is enough stronger than a battery, *x*, to operate the signaling-instrument while acting in opposition to the said battery.

By connecting the radiating subscriber's circuit with the common return-wire W the operations of the exchange are simplified, as herein described, and for testing the different circuits it is only necessary to complete the circuit for the common wire W to the common anvil *l* of the switch-board through a suitable battery and indicating-instrument, when by depressing the keys *k* in succession the circuits *a b c*, &c., may all be quickly and thoroughly tested, and if any be found open it will either be because the line has been actually broken or one of the switches *p'* misplaced, and if the latter be the case one end of the circuit will be grounded at the station containing the said misplaced switch, which may be accordingly signaled and the occupant notified. By bringing both ends of the wire W into the central office the exchange will still operate equally well if the said wire be broken at any point—as, for example, at 20—between the circuits *a* and *b*, as the circuit *a* in this case can be connected with the central office by one end of the wire W and the remaining circuits by the other end of the said wire. Both ends of the wire W may be connected before reaching the switch *m*; but in testing one end may be connected at a time, and thus the soundness of the wire W itself tested, as well as the subscriber's circuit connected therewith. Switches *m'* are shown for connecting either end of the wire W with the switch *m* or disconnecting it therefrom.

I claim—

1. In a telephone-exchange system, a series of independent subscribers' circuits radiating from a central office and a common return-wire connected with the outer ends of the said subscriber's circuit and grounded through appropriate apparatus at the central office, substantially as described.

2. In a telephone-exchange system, a series of subscribers' circuits normally open at the central office, and each provided with a key to connect it with apparatus common to all the said circuits for operating signaling-instruments therein, and a common return-wire con-

nected with the outer extremities of all the said circuits and having its terminal in the central office, whereby a complete closed circuit can be formed at the central office, including any of the subscribers' circuits, substantially as and for the purpose described.

3. In a telephone-exchange system, a series of subscribers' circuits normally open at the central office and a common return-wire therefor connected with the outer extremities of all the said circuits, and having both its terminals in the central office, said return-wire being additional to the subscribers' circuits, through which the communication of one subscriber with another is established, and serving as a call-circuit, over which the several subscribers can signal the central office, substantially as described.

4. In a telephone-exchange system, a series of subscribers' circuits and a common return-wire therefor, combined with an electric switch placed at the junction of the said circuits and the return-wire, and adapted to be operated by an electric current passing over the said circuits to connect them with the said return-wire or the ground, substantially as described.

5. In a telephone-exchange system, a series of circuits normally open at one end and connected at the other end to ground through a polarized indicator and battery to operate it common to all the said circuits, the said indicator being operated by the said battery upon the grounding of any of the said series of circuits, combined with a signaling-battery adapted to be connected with any of the said circuits in opposition to the said indicator-operating battery, and stronger than the said battery, to overcome it and operate the signals in the said circuits, substantially as described.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

GEORGE LEE ANDERS.
THOS. D. LOCKWOOD.

Witnesses:

JOS. P. LIVERMORE,
L. F. CONNOR.