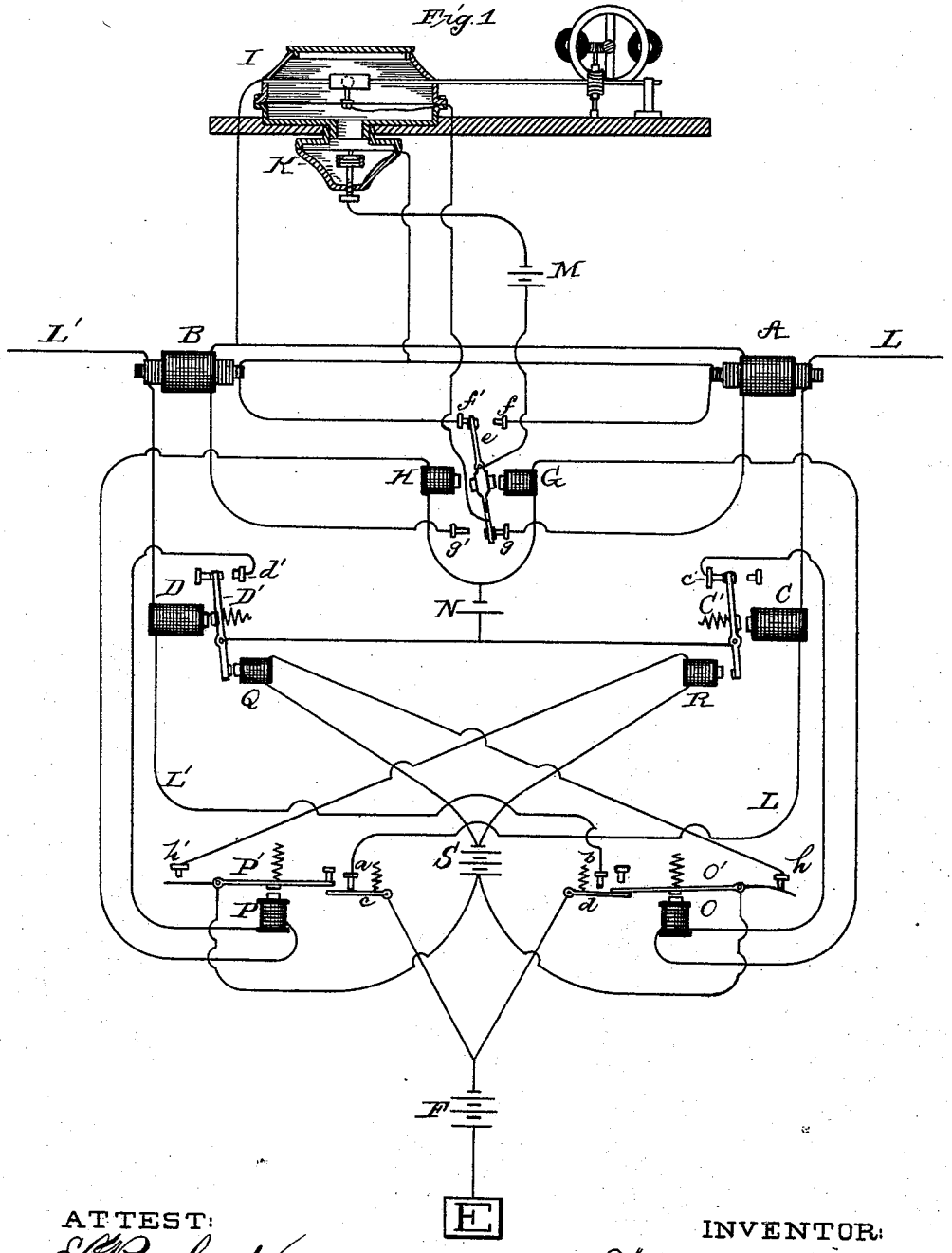
(No Model.) 2 Sheets—Sheet 1.

T. A. EDISON.

TELEPHONE REPEATER.

No. 478,743. Patented July 12, 1892.

Fig. 1



ATTEST:

E. C. Rowland

M. Riddle.

INVENTOR:

Thomas A. Edison

By Dyer & Seely

Atty's

(No Model.) 2 Sheets—Sheet 2.

T. A. EDISON.

TELEPHONE REPEATER.

No. 478,743. Patented July 12, 1892.

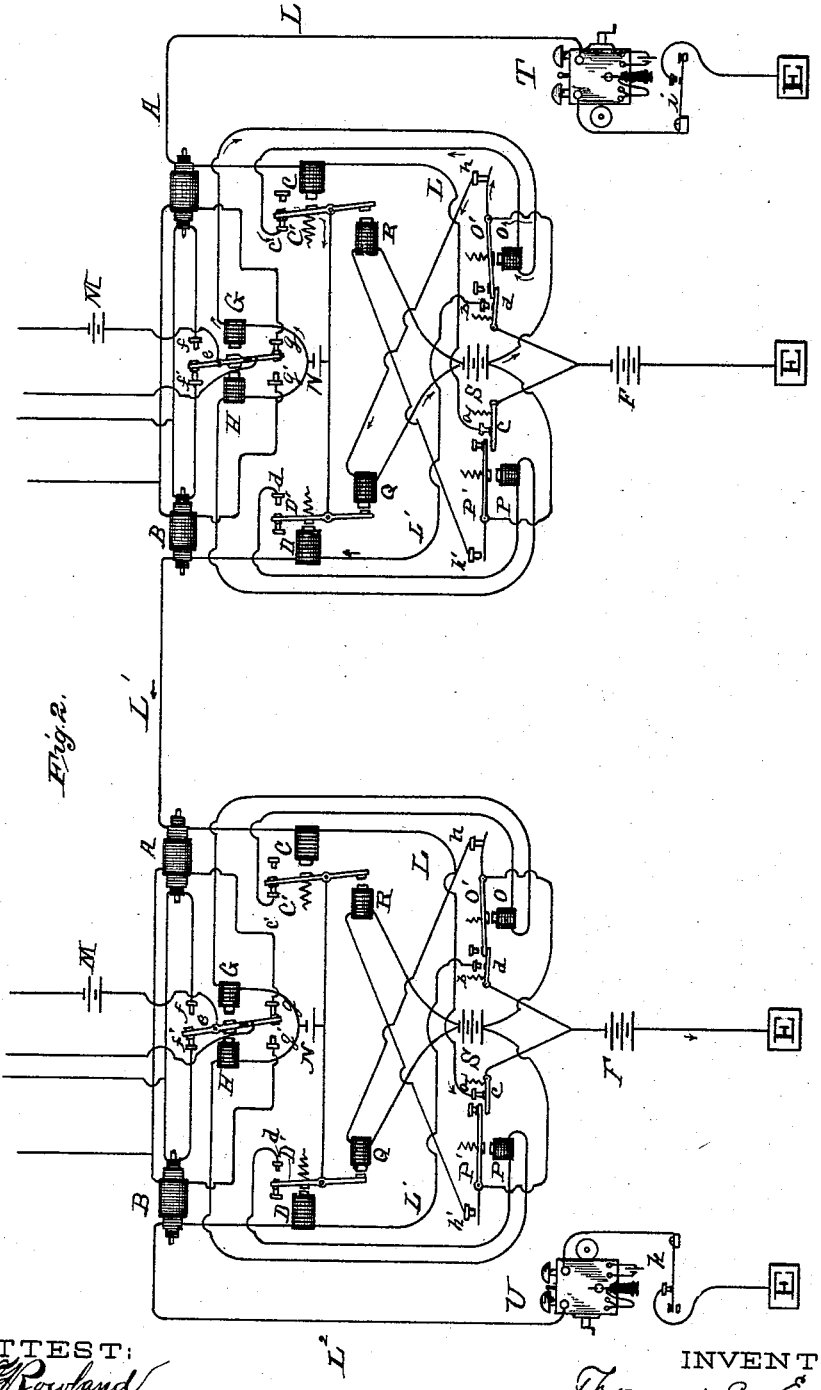


Fig. 2.

ATTEST:
E. C. Rowland.
H. W. Tiddle.

INVENTOR:
Thomas A. Edison
By Dyer & Seely
Atty

UNITED STATES PATENT OFFICE.

THOMAS A. EDISON, OF MENLO PARK, NEW JERSEY.

TELEPHONE-REPEATER.

SPECIFICATION forming part of Letters Patent No. 478,743, dated July 12, 1892.

Application filed October 14, 1885. Renewed March 1, 1892. Serial No. 423,411. (No model.)

To all whom it may concern:

Be it known that I, THOMAS A. EDISON, of Menlo Park, in the county of Middlesex and State of New Jersey, have invented a new and useful Improvement in Telephone-Repeaters, (Case No. 643,) of which the following is a specification.

The object I have in view is to provide for the use of two or more telephone-repeaters upon a line, so that talking can be carried on over lines of any length, and also to permit signaling to be carried on through one or more telephone-repeaters.

In my most successful form of reciprocal telephone-repeater, described in my patent, No. 422,579, of March 4, 1890, a switch is used for changing the connections of the repeating receiver and transmitter with the joining lines. This switch is operated by each subscriber before commencing to talk by means of a key or push-button, the position of the repeater-switch being reversed each time the direction of talking is changed. Heretofore I have been able to use only one repeater upon a line, having no devices to continue to a second repeater the action produced by the subscriber's key at the first repeater. Such devices are supplied by this invention, by which the action may be carried through two or more repeaters, setting all the repeater-switches in one or the other position, as desired. The devices acting to continue the impulse to the second line, it will be seen that they enable a signal-bell or other signaling device to be operated through one or more repeaters.

The invention will be understood by reference to the accompanying drawings, in which—

Figure 1 is a view, principally in diagram, of a telephone-repeater and switching devices; and Fig. 2, a similar view of two repeaters in line with two subscribing-telephones, the repeating transmitter and receiver being omitted.

With reference more particularly to Fig. 1, L L′ are telephone-lines, which at the repeater extend through the secondary circuits of induction-coils A B, through magnets C D, to contacts *a b* and spring-arms *c d*, closing normally on such contacts, to the same pole of the centrally located switching-battery F, the other pole of which is grounded by earth-plate E.

G H are magnets controlling the switch-lever *e*, which has its ends insulated one from the other. This lever has four contacts. Contacts *f f′*, on opposite sides of its upper end, are connected to ends of the two primary coils of A B, the other ends of such primary coils being connected together, as shown. Contacts *g g′*, opposite the lower end of lever *e*, are connected to ends of the tertiary coils of A B, the other ends of such tertiary coils being connected together. I K are the repeating telephone receiver and transmitter, I being located in circuit between the connected ends of the tertiary coils and the lower end of switch-lever *e*, and K, with the repeating telephone-battery, being located in circuit between the connected ends of the primary coils and upper end of *e*.

In the position of lever *e* shown the repeating-receiver I is connected with the tertiary of A, while the repeating-transmitter K is connected with primary of B. The switch in its reverse position connects I with tertiary of B and K with primary of A. The circuits of magnets G H are controlled by the armature-levers C′ D′ of magnets C D at the back contacts *c′ d′* of such levers. The circuit of magnets G H includes a local switching-battery N, and is divided into two branches, one branch including G, back contact *c′*, and armature-lever C′, while the other includes magnet H, back contact *d′*, and lever D′.

So far as described, with the exception of contacts *a b* and spring-arms *c d*, the parts are the same as described in my application for patent before referred to. The lines L L′ being normally closed through central switching-battery F, both C′ and D′ would be on their front contacts, and by opening either line at subscriber's key or push-button the circuit of G or H would be closed and lever *e* moved to a position it would retain until other line was opened. It will be seen that this simple arrangement permits of the use of but one repeater upon a line and does not provide for signaling from one subscriber to the other.

The devices for enabling the use of more than one repeater and for permitting signaling through one or more repeaters will now

be explained. In circuit with G is another magnet O, while a similar magnet P is in circuit with magnet H. These magnets O and P have armature-levers O′ P′, which in their forward movement are adapted to force arms *c d* from contacts *a b*, opening lines L L′, and to close other circuits at contacts *h h′*. The circuits are closed at *h h′* before the lines are opened, and they include two magnets Q R and a local battery S. The magnets Q R act upon levers D′ C′ in the same direction as do the magnets D C, the attractive force of Q R serving to keep the circuit of switching-magnets H G open.

In talking from L through the repeater the line is first opened, demagnetizing C and permitting C′ to make circuit at its back contact. This energizes G, which moves lever *e*, and also energizes O, which moves O′, opening line L′ and closing circuit of Q. Q retains D′ forward, although D is demagnetized, and the impulse caused by the opening of the circuit of line L′ through battery F is transmitted to next repeater and from thence to other repeaters, if there be any in line. The parts are shown in Fig. 1 in the position they momentarily assume when L is opened. Before the subscriber on L begins to talk he releases his key or push-button, closing the line, and C′ and O′ resume their normal positions, while *e* remains in the position shown, to which it has been moved by the action described. In talking from a distant telephone through one or more repeaters over L′ to L the reverse operation would take place.

In general the action at each repeater of the switching mechanism described is to operate by the impulse upon a line the switching-magnet for that line and also a circuit-controller for continuing the impulse upon the other line and a locking-magnet for locking at the particular repeater the switching-magnet for the second line.

By the mechanism described the same impulses may also be used to operate signal-bells or other signaling device at subscribers' stations, whereby one subscriber may signal to another through one or more repeaters. This, aside from the switching arrangement, I consider a feature of importance.

In Fig. 2 two telephone-repeaters are shown connecting lines L, L′, and L^2. The telephone-sets T U are shown, one on line L and the other on L^2. At the telephone-sets are circuit-opening keys *i k*, by which impulses are given to set the repeater-switches and to produce signals. Line L is shown as open at key *i*, and the parts of the repeaters are shown in positions they take while line L remains open.

It will be seen that I add to my telephone-repeater a switching-repeater which is also used as a signaling-repeater.

It will be understood that in its broad features my invention is not limited to the particular form of wave-repeater shown for switching and signaling, since any one of various forms of repeaters well known in their application to telegraphy may be employed.

What I claim is—

1. The combination, with a telephone-line, of two or more reciprocal telephone-repeaters connected therewith, each repeater comprising a receiving and a transmitting telephone, substantially as set forth.

2. The combination, with a telephone-line, of two or more reciprocal telephone-repeaters connected therewith and switches at the telephone-repeater controlling the direction of transmission and operated successively from either end of the line, and each repeater containing a switching-circuit controller in each line-section, substantially as set forth.

3. The combination, with a reciprocal telephone-repeater, of a switch controlling the direction of transmission and circuits for carrying the switching impulses around the telephone-repeating instruments, substantially as set forth.

4. The combination, with a telephone-line, of two or more reciprocal telephone-repeaters connected therewith and provided with switches controlling the direction of transmission and reciprocal repeaters for the switches, substantially as set forth.

5. The combination, with a telephone-repeater, of signaling devices and circuits carrying the signaling impulses around the telephone repeating-instruments, substantially as set forth.

6. The combination, with a telephone-repeater, of signaling devices in the telephone-line and a repeater for the signaling-impulses, substantially as set forth.

7. The combination, with a reciprocal telephone-repeater, of signaling devices in the telephone-line and a reciprocal repeater for the signaling impulses, substantially as set forth.

8. The combination, with a telephone-line, of two or more reciprocal telephone-repeaters, signaling devices, and reciprocal signaling-repeaters, substantially as set forth.

9. In a telephone-repeater, the combination, with line connections and repeating telephone-instruments, of a switch controlling the direction of transmission and operated from the line on either side of the telephone-repeater by an electrical impulse and an electrically-operated circuit-controller for continuing the impulse to the other side of the repeater, substantially as set forth.

10. In a telephone-repeater, the combination, with line connections and repeating telephone-instruments, of a switch controlling the direction of transmission and operated from the line on either side of the repeater by an electrical impulse, electrically-operated circuit-controllers continuing the impulse to the line on the other side of the repeater, and locking-magnets preventing the reversal of the switch, substantially as set forth.

11. The combination, with telephone repeating-instruments and connected lines

grounded thereat, of a centrally-located switching or signaling battery connected with both of said lines and a switching or signaling repeater transferring the impulse of said battery from one grounded line to the other, substantially as set forth.

12. The combination, with telephone repeating-instruments and connected lines grounded thereat, of a switch controlling the direction of transmission, a centrally-located switching-battery connected with both of said lines, and a switching-repeater, substantially as set forth.

13. The combination, with a reciprocal telephone-repeater and grounded lines grounded thereat, of a switch controlling the direction of transmission, switching-magnets in the lines controlling the switch for operation in opposite directions, repeating-line circuit-controlling magnets also worked by said line switching-magnets, and locking-magnets controlled by the repeating-line magnets, whereby the telephone-repeater switch can be worked from either line and the switching impulse continued to the other line for switching or signaling or both, substantially as set forth.

This specification signed and witnessed this 31st day of December, 1884.

THOMAS A. EDISON.

Witnesses:
A. W. KIDDLE,
E. C. ROWLAND.