(No Model.) 2 Sheets—Sheet 1.

T. A. EDISON.

DUPLEX TELEGRAPHY.

No. 333,290. Patented Dec. 29, 1885.

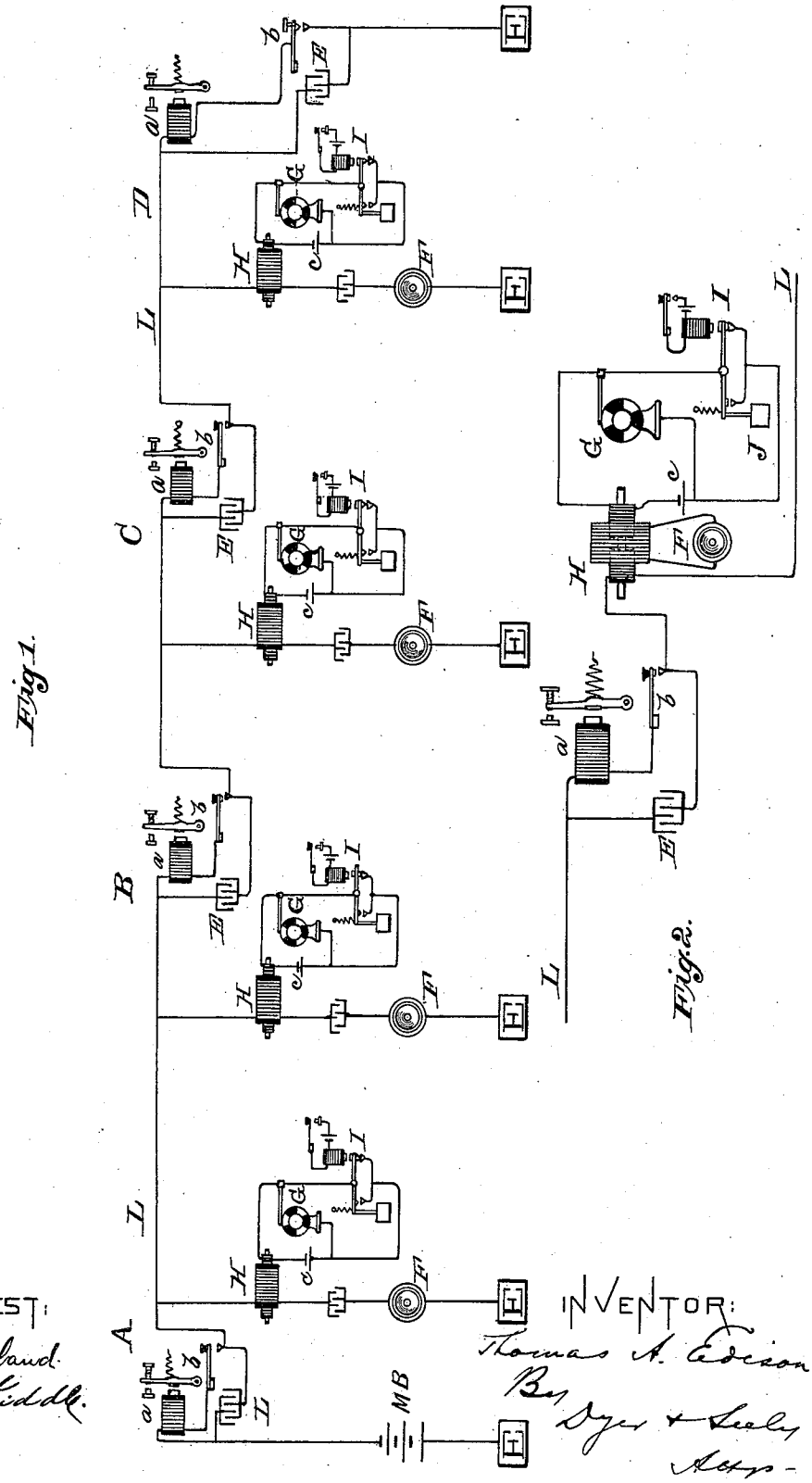

Fig. 1.

Fig. 2.

ATTEST:
E. C. Rowland.
F. W. Kiddle.

INVENTOR:
Thomas A. Edison
By Dyer & Seely
Attys.

(No Model.) 2 Sheets—Sheet 2.

T. A. EDISON.

DUPLEX TELEGRAPHY.

No. 333,290. Patented Dec. 29, 1885.

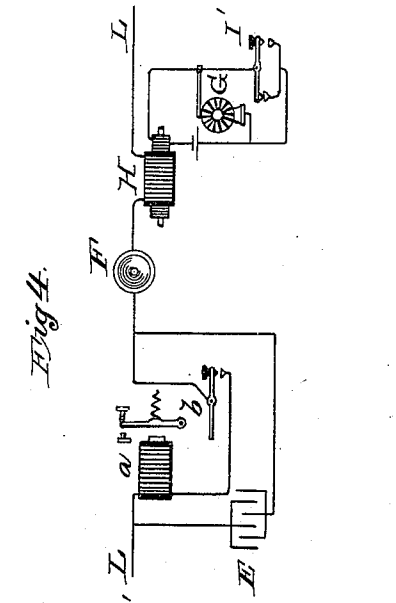

Fig. 4.

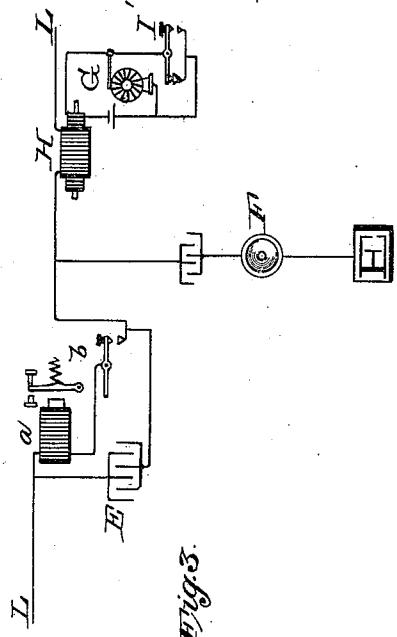

Fig. 3.

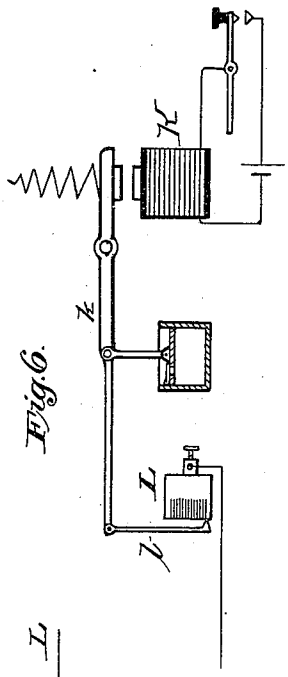

Fig. 6.

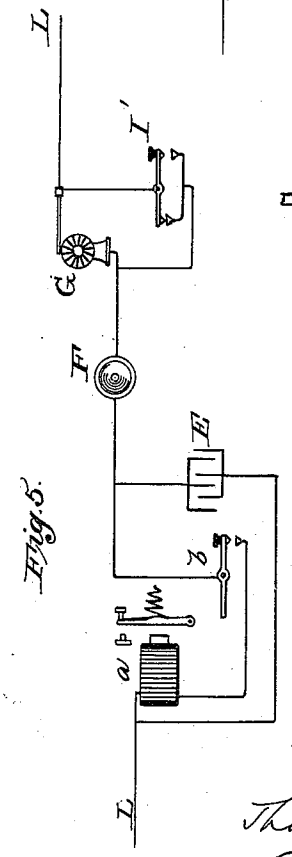

Fig. 5.

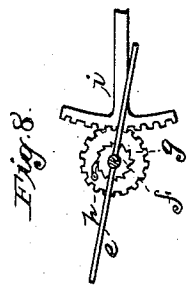

Fig. 8.

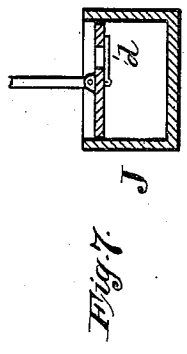

Fig. 7.

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

INVENTOR:
Thomas A. Edison,
By Dyer & Seely
Attys.

UNITED STATES PATENT OFFICE.

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

DUPLEX TELEGRAPHY.

SPECIFICATION forming part of Letters Patent No. 333,290, dated December 29, 1885.

Application filed May 8, 1885. Serial No. 164,857. (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 Telegraphy, (Case No. 649,) of which the following is a specification.

The object I have in view is to increase the capacity of telegraph-lines in a simple and practical manner by the production of instruments and connections permitting the transmission of two sets of Morse signals back and forth over the line at the same time without interfering one with the other, and not only between terminal offices, but between a terminal office and any intermediate office, or between intermediate offices alone.

The invention is especially applicable to local lines, or to lines having several offices upon them, to which it can be applied at small expense, each office upon the line being provided with instruments for transmitting and receiving a second set of signals, and with devices for making the two sets of signals independent and for insuring against their interference. Not only is the capacity of the telegraph-lines doubled, but the delays occasioned on lines with several offices by the interfering of two or more operators in their attempts to gain possession of the line are diminished.

The general objects before stated are fully accomplished by apparatus described and claimed in my application No. 648.

The present invention is an improvement upon that apparatus, and relates more particularly to a peculiar transmitter for producing the momentary and sharply-defined waves to which the diaphragm-sounder responds, and also to the manner of connecting the diaphragm-sounder to the line.

In the accompanying drawings, forming a part hereof, Figure 1 is a view in diagram of a line with four offices; Fig. 2, a separate view in diagram of the arrangement for one office; Figs. 3, 4, and 5, views similar to Fig. 2 of modified arrangements; Fig. 6, a view of a further modification of the transmitter; Fig. 7, a sectional view of a dash-pot for varying alternate signals, and Fig. 8 a view of another device for the same purpose.

Like letters denote corresponding parts in all the figures.

The line L L is grounded at its ends, and has the usual main battery, M B. The four offices A B C D have each the ordinary set of Morse instruments, composed of a relay, *a*, and key *b* in line, the former working a sounder (not shown) in the circuit of a local battery. With these ordinary Morse instruments telegraphing is carried on by Morse signals in the usual way. At each office the set of Morse instruments (the relay and key) or the key alone is shunted by a condenser, E, which keeps the line closed constantly to signals produced by momentary and sharply-defined waves, which are received on diaphragm-sounders F, located one at each office, at which there is also located a transmitter for producing such waves. This transmitter is an instrument constructed to make and break circuit with great rapidity, so as to send for each signal a large number of such momentary and sharply-defined waves. It may be constructed in a variety of ways. The form I prefer is a rapidly-revolving circuit-controller, G, kept in motion by a suitable electrical or mechanical motor. This circuit-controller may be placed directly in line, as shown in Fig. 5; but I prefer to place it in the primary circuit of an induction-coil, H, the secondary circuit of which is directly in the line, as shown in Figs. 2, 3, and 4 or is in a condenser-circuit connected with the line, as shown in Fig. 1. This condenser-circuit may be a ground-connection from line or a shunt around a resistance or magnet in line.

In the primary circuit of H is a battery, *c*, and in a shunt around the revolving circuit-controller G is a sounder, I, with both its front and back points connected in circuit and operated by a key and local battery, as shown in Figs. 1 and 2.

In place of a sounder, a key, I′, Figs. 3, 4, and 5, may be employed, connected to close circuit at front and back points. Normally, the sounder or key closes this shunt at its back contact, and the revolution of the circuit-controller does not affect the induction-coil. The movement of the sounder-lever (or the key) first breaks this shunt at its back point and then closes it at its front point. During this interval, while the shunt-circuit is open the circuit-controller produces a series of waves in the primary of the induction-coil,

and the secondary of such coil throws upon the line a large number of momentary and sharply-defined waves. The return movement of the sounder-lever or the key first opens and then closes the shunt-circuit, producing the same result as in the forward movement. The momentary and sharply-defined waves do not work the relays, but are responded to by the diaphragm-sounders, and are translated by them into sound, the intervals between the signals representing dots and dashes. The number of waves transmitted for each signal is sufficiently great to make a corresponding number of air-waves audible, and hence the sound is transmitted electrically instead of being produced by a mechanical blow, which is the result of a single electrical impulse, as at an ordinary Morse sounder.

To make the signal different for the down and up stroke of key, I connect the lever of sounder I with a dash-pot, J, the plunger of which has a valve, *d*, opening in one direction, Fig. 7, so that the sounder-lever will have a quicker movement in one direction than the other. This movement is preferably made quicker on the upstroke of key, causing the second signal marking the interval denoting a dot or dash to be weaker or shorter or of different tone from the first signal. This prevents confusion in receiving.

Instead of a dash-pot with valved flanges for varying alternate signals, the device shown in Fig. 8 can be used. This consists of a retarding-fan, *e*, secured to a spindle with ratchet-wheel, *f*. The cog-wheel *g*, loose on the same spindle, has a pawl, *h*, which engages with ratchet-wheel *f*. The sounder-lever has on its end a toothed sector, *i*, engaging with wheel *g*. The movement of the sounder-lever in one direction will turn the fan. In the other direction, the wheel *g* turns free of the ratchet-wheel *f*.

My transmitter may be constructed as shown in Fig. 6. A magnet, K, worked by a key and local battery, operates a lever, *k*, which is extended the required distance to get the necessary movement. At its end it carries a finger, *l*, playing over the surface of a contact-block, L. This contact-block has its face composed of a large number (preferably fifty or more) of thin plates separated by insulation. This block L and the lever *k* are connected in circuit, preferably in the primary of induction-coil H, and the movement of *k* causes the circuit to be made and broken rapidly, throwing upon the line momentary and sharply-defined waves. A dash-pot or the fan-regulator is attached to lever *k* to vary alternate signals.

The diaphragm-sounders F may be any form of telephone-receiver.

I prefer to use my electro-motograph receiver, although a magneto-electric or other telephone receiver can be employed.

The diaphragm-sounders may be located directly in line, Figs. 4 and 5, or in condenser-circuits connected with line, Figs. 1 and 3; but I prefer the arrangement shown in Fig. 2, wherein the diaphragm-sounder is located in the tertiary circuit of induction-coil H, and is operated by induction from the line.

What I claim is—

1. In a system of Morse telegraphy, the combination, with ordinary Morse telegraph-instruments shunted to keep the line constantly closed to momentary and sharply-defined waves, of diaphragm-sounders and transmitters transmitting Morse signals electrically by throwing upon the line for each signal a large number of momentary and sharply-defined waves, which do not work the Morse relays, but are responded to by the diaphragm-sounders, substantially as set forth.

2. In a system of Morse telegraphy, the combination, with a diaphragm-sounder, of a transmitter consisting of a circuit-breaker and a controlling-key, the former being constructed to make and break circuit rapidly a large number of times for each movement of the controlling-key, substantially as set forth.

3. In a system of Morse telegraphy, the combination, with a diaphragm sounder, of a transmitter consisting of a circuit-breaker and a controlling-key, the former being constructed to make and break circuit rapidly a large number of times for each movement of the controlling-key, and means for retarding the movement of the transmitter in one direction, so as to vary alternate signals, substantially as set forth.

4. In a system of Morse telegraphy, the combination, with a diaphragm-sounder, of a transmitter composed of a revolving circuit-controller, and a shunt around the same controlled by a key, substantially as set forth.

5. In a system of Morse telegraphy, the combination, with a diaphragm-sounder, of an induction-coil with secondary in line, and a transmitter in the primary of such coil, consisting of a circuit-breaker and a controlling-key, the former being constructed to make and break such primary circuit rapidly a large number of times for each movement of the controlling-key, substantially as set forth.

6. In a system of Morse telegraphy, the combination, with ordinary Morse telegraph-instruments shunted to keep the line constantly closed to momentary and shaply-defined waves, of a transmitter of such waves, and a diaphragm-sounder responding to such waves and connected inductively with the line, substantially as set forth.

This specification signed and witnessed this 30th day of April, 1885.

THOMAS A. EDISON.

Witnesses:
RICHD. N. DYER,
A. W. KIDDLE.

Correction in Letters Patent No. 333,290.

It is hereby certified that in Letters Patent No. 333,290, granted December 29, 1885, upon the application of Thomas A. Edison, of Menlo Park, New Jersey, the title of the invention was erroneously written and printed "Duplex Telegraphy," whereas the said title should have been written and printed *Telegraphy;* and that the said Letters Patent should be read with this correction therein to make the same conform to the record of the case in the Patent Office.

Signed, countersigned, and sealed this 26th day of January, A. D. 1886.

[SEAL.]

H. L. MULDROW,
Acting Secretary of the Interior.

Countersigned:

M. V. MONTGOMERY,
Commissioner of Patents.