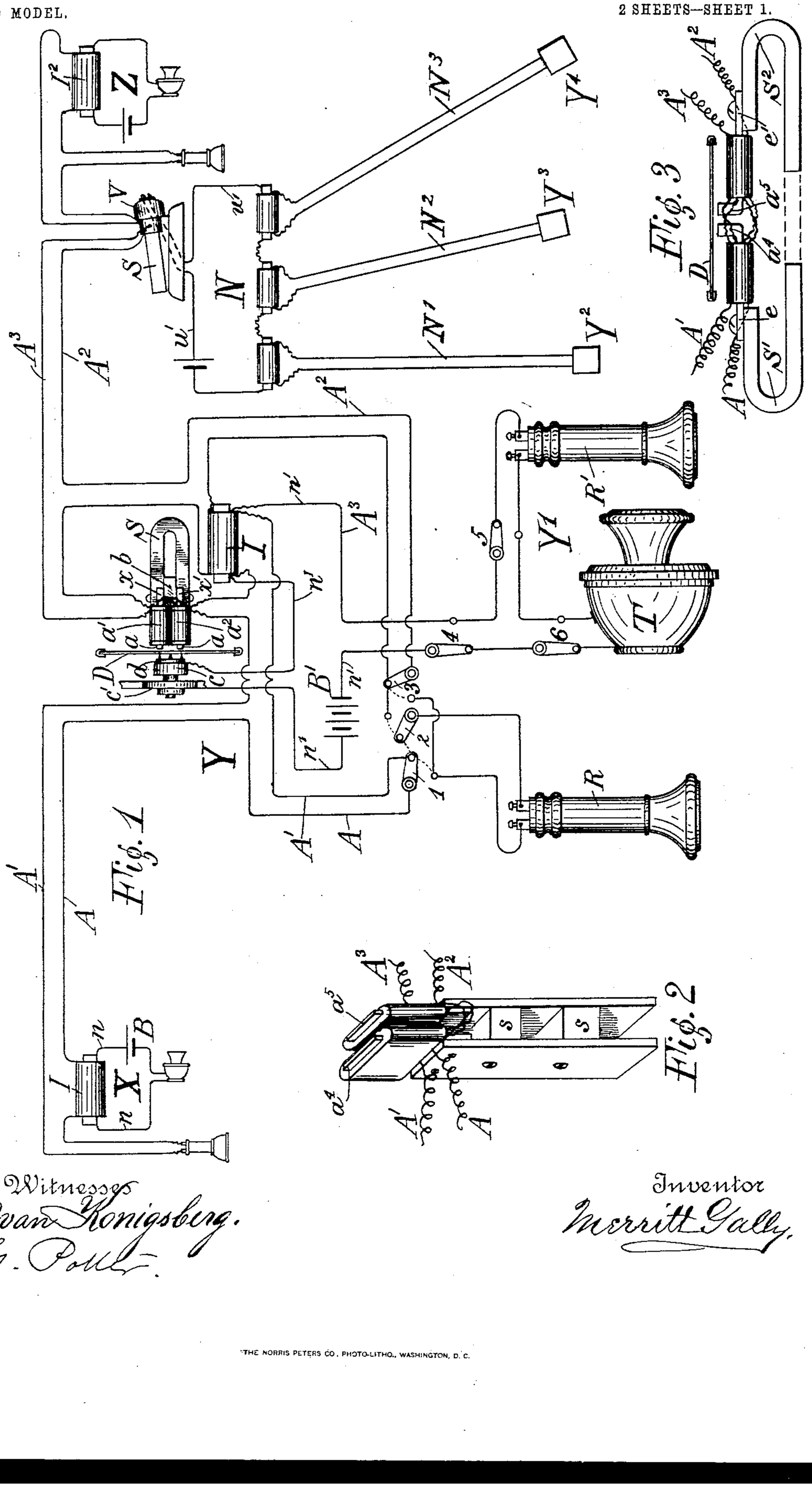
No. 751,845. PATENTED FEB. 9, 1904.

M. GALLY.

TELEPHONIC REPEATER.

APPLICATION FILED APR. 23, 1903.

NO MODEL. 2 SHEETS—SHEET 1.



Witnesses
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Inventor
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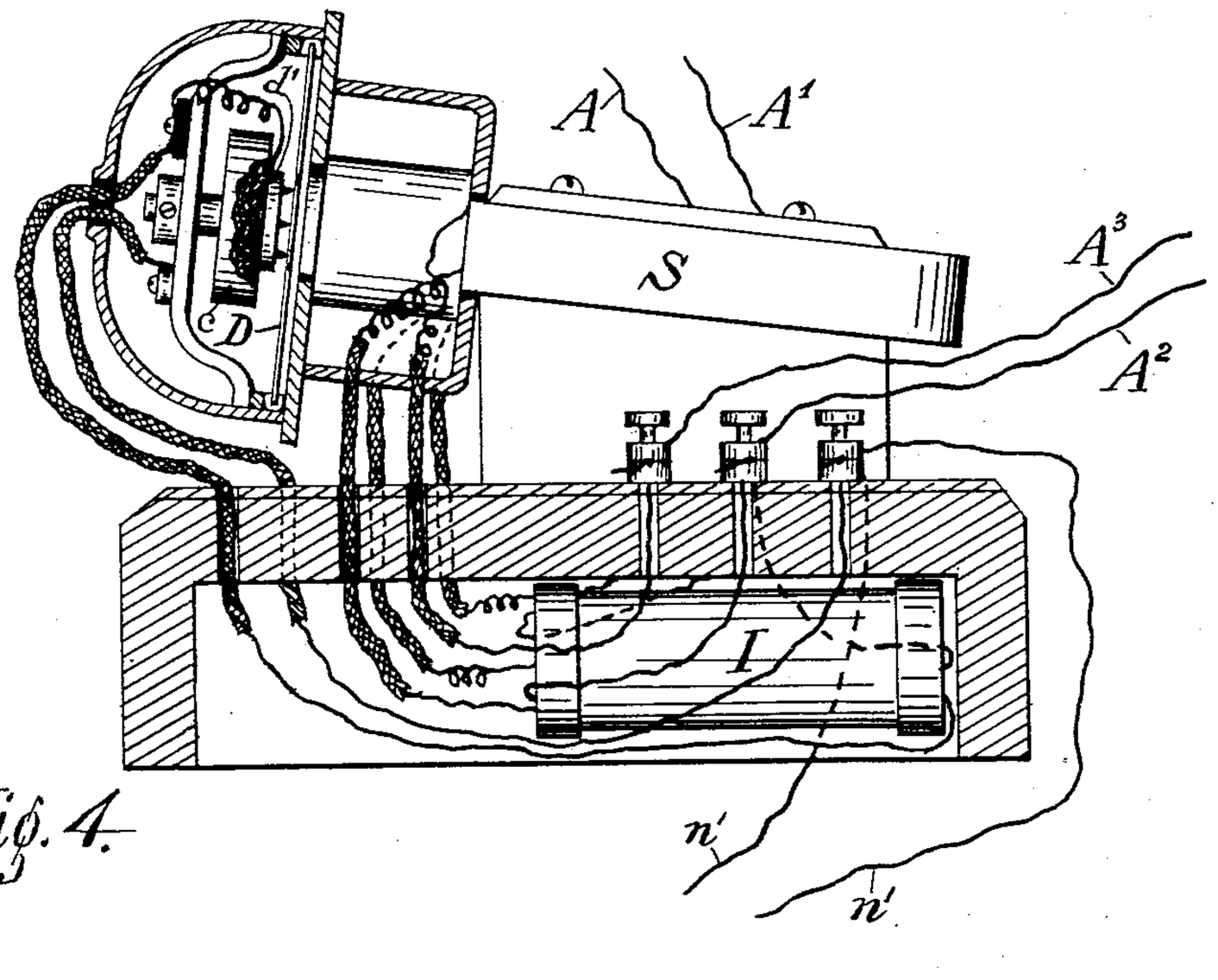

Fig. 4.

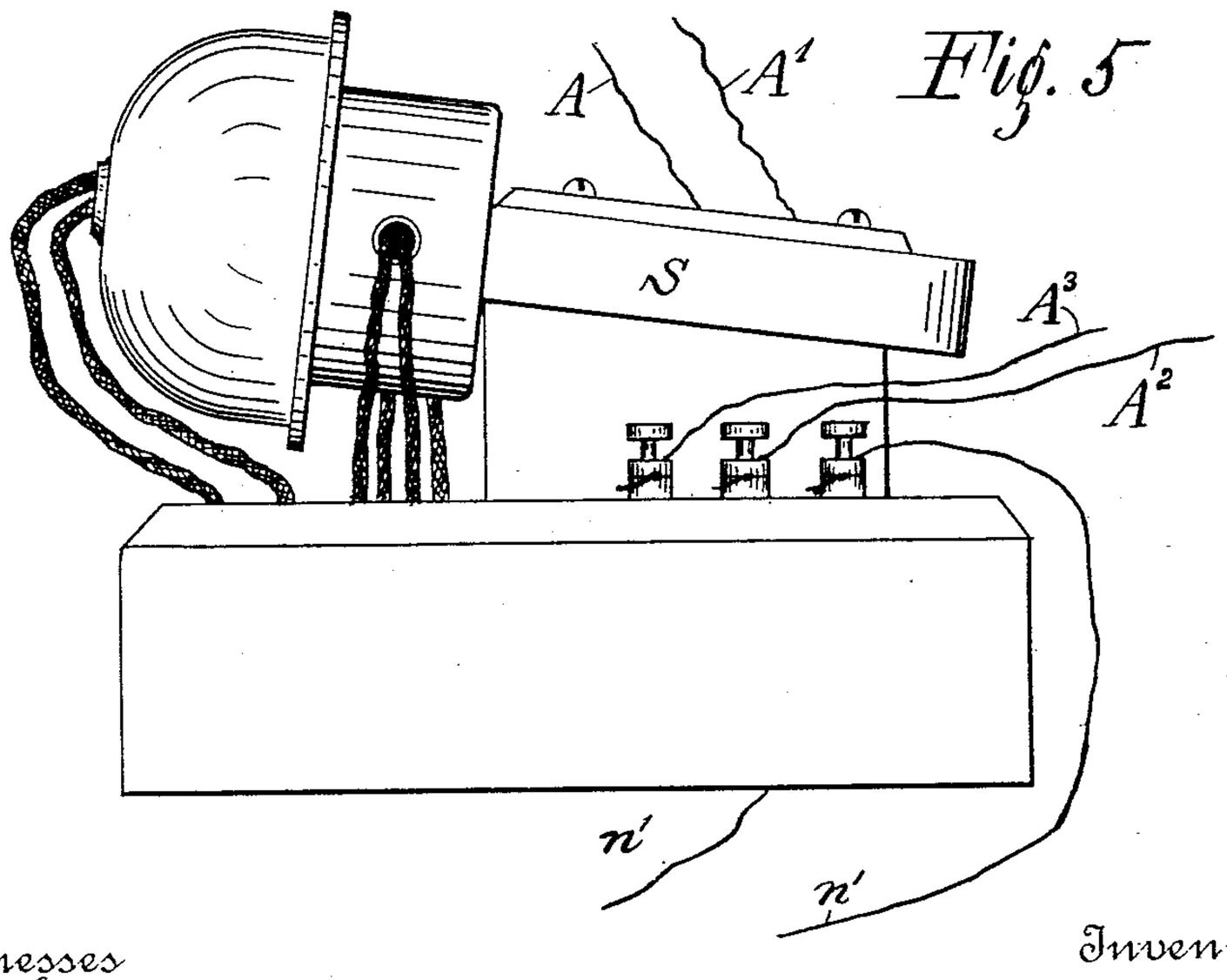

Fig. 5

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UNITED STATES PATENT OFFICE.

MERRITT GALLY, OF BROOKLYN, NEW YORK.

TELEPHONIC REPEATER.

SPECIFICATION forming part of Letters Patent No. 751,845, dated February 9, 1904.

Application filed April 23, 1903. Serial No. 153,965. (No model.)

To all whom it may concern:

Be it known that I, MERRITT GALLY, a citizen of the United States, residing at Brooklyn, in the county of Kings and State of New York, have invented a new and useful Improved Telephonic Repeating System, of which the following is a specification.

In the accompanying drawings, Figure 1 represents a divided telephone main line with two terminal stations distant from each other and two intermediate repeating-stations. Fig. 2 shows in perspective the repeater-magnet in modified form. Fig. 3 shows the repeater-magnet with the magnet-spools parallel with the face of the diaphragm; and Figs. 4 and 5 show the repeater complete in its case, three-fourths full working size, the case in Fig. 4 being in section to show the internal working parts.

In a general way the apparatus here shown is similar to that of my application for telephonic repeater, filed March 18, 1903, Serial No. 148,368, but in this case is shown especially with lines and stations as a complete made-up system.

Five telephone-stations are shown, X, Y, Y′, N, and Z. Intermediate between the terminal stations X and Z is the station Y, where a repeater is placed between the two main lines A A′ and A^2 A^3. At station Y′ is a microphone-transmitter T in a primary circuit n', with battery B′. This primary circuit passes through the primary wire of the induction-coil I. The transmitter T can be thrown into the primary circuit n' at will for use on either of the main lines from station Y by means of the switches 4 and 6 or can be cut out, if desired. The induction-coil I has two secondary wires wound together. One of the secondary wires leads to the main line A A′, and the other secondary wire leads to the main line A^2 A^3. The two spools a' a^2 of the repeater-magnet, Fig. 1, are wound doubly, the two wires leading separately each one to its main line, one winding of each spool passing into the other spool in the double winding. When the two wires are thus wound together, the coils act in exact harmony upon the repeating-transmitter D c c', while it is reinforcing the main line by means of battery B′ through the induction-coil I, which also has two windings in the secondary leading to the two lines. The diaphragm is perfectly insulated from the button-electrode d, and there is no conflicting magneto-current. The impulses of the receiving-magnet, diaphragm, and the induction-coils are instant and practically simultaneous. Mechanical connection between a receiver and a repeating-transmitter has been frequently tried in the endeavor to make an operative repeater, but only with indifferent results and without practical success.

One of the principal features of my invention is the harmony of the various electrical conditions secured by a peculiar arrangement of electrically-acting elements and a construction of parts favorable thereto. This secures complete control of the combined action of receiver and repeating-transmitter and holds the operative elements of the system in perfect accord, and this has secured a successful repeater. The two secondary wires of the coil I acting inductively together secure harmony by an associated action and reaction between the two lines in using the energy derived from the primary circuit n', with its battery B. As this repeater is a battery-relay, the message passing from one line to the other can be reinforced with any amount of electrical energy that will safely pass through the transmitting part of the repeater.

One of the secondary wires of the coil I and one of the wires of magnet a' a^2 may be connected to line A A′ in multiple, and the other secondary wire of the coil I′ and the other wire of the magnet a' a^2 may be connected to line A^2 A^3 in multiple. This may be desirable in case of a very long main line, when by making the secondaries of the coil I′ of very high resistance a very large portion of the current of either line is applied directly to energize the receiving-magnet. The connections, as shown, are in series.

Besides the receiver R, which is arranged to be thrown by switches 1 2 3 into or cut out of either main line at will, a second receiver R′ is shown. This receiver may be thrown into or cut out of the primary circuit n' by

means of switch 5. When this receiver is in the primary circuit and the repeater is in operation, both of the alternately-passing messages from stations X and Z can be heard. With the use of receivers so placed "through messages" may be dropped at different points along the line without clogging the main line with the resistance of intermediate receivers. This position for receiver in such local circuit is also useful at terminal stations when the receiver in the main line gives a weak message, as with the addition of battery-power the message may be strengthened as much as desired. This is of the same importance as a local relay in telegraphy.

Figs. 2 and 3 show modified constructions of the repeater-magnet. Either one of these can be used in place of the magnet a a' a^2. That shown in Fig. 2 has two permanent bar-magnets and two spools with soft-iron cores. Two wires are used, each wound on both spools. The two ends of one of the wires are represented by A A', and the two ends of the other wire are represented by A^2 A^3. Each of the cores a^4 a^5 is attached to one of the bar-magnets, the two bar-magnets S' S^2 being held together by non-magnetic blocks s s, to which the bars are attached. In some arrangements of the system it is advantageous to use this double bar-magnet rather than the bipolar U-magnet, as the electric current can be passed through both spools in the same direction and like magnet-poles act on the diaphragm. The parallel magnet, Fig. 3, is simply a modification in form of either that of Fig. 1 or Fig. 2, its use depending on the general construction of other parts. In Fig. 3 the spools are placed parallel to the face of the diaphragm and one end of each core is bent at right angles to its body to project toward and in near proximity to each other toward the diaphragm. Two permanent U-magnets are shown drawn in full line, the dotted lines indicating that they may be joined together and made in one.

Care must be taken in arranging the circuits that their relative polarity be in proper order, so that one current may not in any way operate against or neutralize another.

In Fig. 1 station N is the repeater, connected to a local repeating battery-circuit u', having therein a plurality of induction-coils connected to a number of branch lines for delivering a message to several stations simultaneously. With this arrangement a telephone press-despatch coming from a distance may be received at a number of publishing-offices Y^2 Y^3 Y^4 simultaneously, or a general order or alarm may be telephoned and distributed to a number of stations, all the stations receiving the same order or alarm simultaneously. In the drawings three induction-coils are shown connected in the battery-circuit u', operated by the repeater V. From these induction-coils extend the lines N', N^2, and N^3 to their respective stations Y^2 Y^3 Y^4, at all of which the same message is received.

Fig. 4 represents the repeater in section, about three-quarters full working size, showing its several elements in working order. S is the receiving-magnet, D is the receiving and transmitting diaphragm, and I' is the duplex induction-coil.

Fig. 5 shows the repeater in its external appearance about three-quarters full size.

In Fig. 4 the transmitting part of the repeater has its cup cut away to show the carbon granules interposed between the transmitting-electrodes c and d'.

In Fig. 1 either receiver R or R' can be used, whichever is required for the occasion. Receiver R is the ordinary receiver to connect directly to either line. Receiver R' takes the relay-message.

In Fig. 1, X is a terminal station, Y is a repeating-station, Y' is the local relay-station, N is a distributing-station, and Z is a terminal station. This completes a fully-equipped system, which, however, may be extended or multiplied as desired.

The two wires of the coils a' and a^2 are wound together side by side in a single strand in order to preserve throughout their winding an equal distance of the two from the magnet-core. It will be readily understood, however, that they may be wound in different manner without departing from the gist of my invention. For example, they may be wound in alternate layers or in alternate multiple layers or with one coil complete outside the other on one core. In the latter case when two cores are used with double winding the inside wire on one core should be the outside wire on the other core in order that the two may balance each other in effect.

There may be more than two wires in the coils a' a^2, provided a proper number of the wires connect with one of the main lines and a proper number with the other main line. So, also, the two secondary wires of the induction-coil may be wound in alternate layers or otherwise, provided they are arranged to properly connect with their respective main lines. So, also, the induction-coil may have more than two secondary wires, provided a proper number of the wires are arranged to connect to each of the two telephone-lines.

I claim—

1. In a telephone system; the primary circuit of a telephonic repeating device; an induction-coil having its secondary coil wound doubly two wires being wound together, one of its wires connected to one main line, and the other wire connected to another main line.

2. In a telephone system; a telephonic repeating device, placed between two telephone-lines; said device comprising a permanent magnet, combined with one or more electro-magnet-cores; each core being doubly wound,

one of its two wires connected to one of the telephone-lines and the other wire connected to the other telephone-line.

3. In a telephone system; a telephonic repeating device; comprising a bipolar magnet, with two doubly-wound coils, one for each magnet-pole; one of the wires of each of said coils connected with one telephone-line, and the other wire for connection with another telephone-line.

4. In a telephone system; a telephonic repeating device; comprising a magnet having two permanently-magnetized bars with pole-pieces, each pole-piece with coils of two wires wound together thereon; one of the wires connected with one telephone-line and the other wire for connection with another telephone-line.

5. In a telephone system; a repeater between two telephone-lines; a local circuit in connection with the repeater; switching means for converting the repeater into a local relay, and a local transmitter therefor.

6. In a telephone system; a repeater between two telephone-lines; a local circuit in connection with the repeater; switching means for converting the repeater into a local relay; and a local receiver therefor.

7. In a telephone system; a telephonic repeating device, for connection with two telephone-lines; said device comprising a magnet having one or more cores; each core wound with a plurality of wires, a part of the wires connected with one telephone-line and a part for connecting with another telephone-line.

8. In a telephone system; a telephonic repeating device, for connection with two telephone-lines; said device comprising connections for a primary circuit; a primary induction-coil, comprising a plurality of secondary wires wound together, a part of them for connection with one telephone-line and a part of them for connection with another telephone-line.

9. In a telephonic repeating device; combined receiving and retransmitting means, comprising a plurality of doubly-wound magnet-cores; one of the wires of each, connected with one telephone-line, and the other wire connected with another telephone-line.

10. In a telephonic repeater; a diaphragm for receiving pulsations from one main line, and transmitting the same to another main line; and a bipolar magnet; the two pole-pieces doubly wound, both pieces with wire connected with both of the main lines.

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