

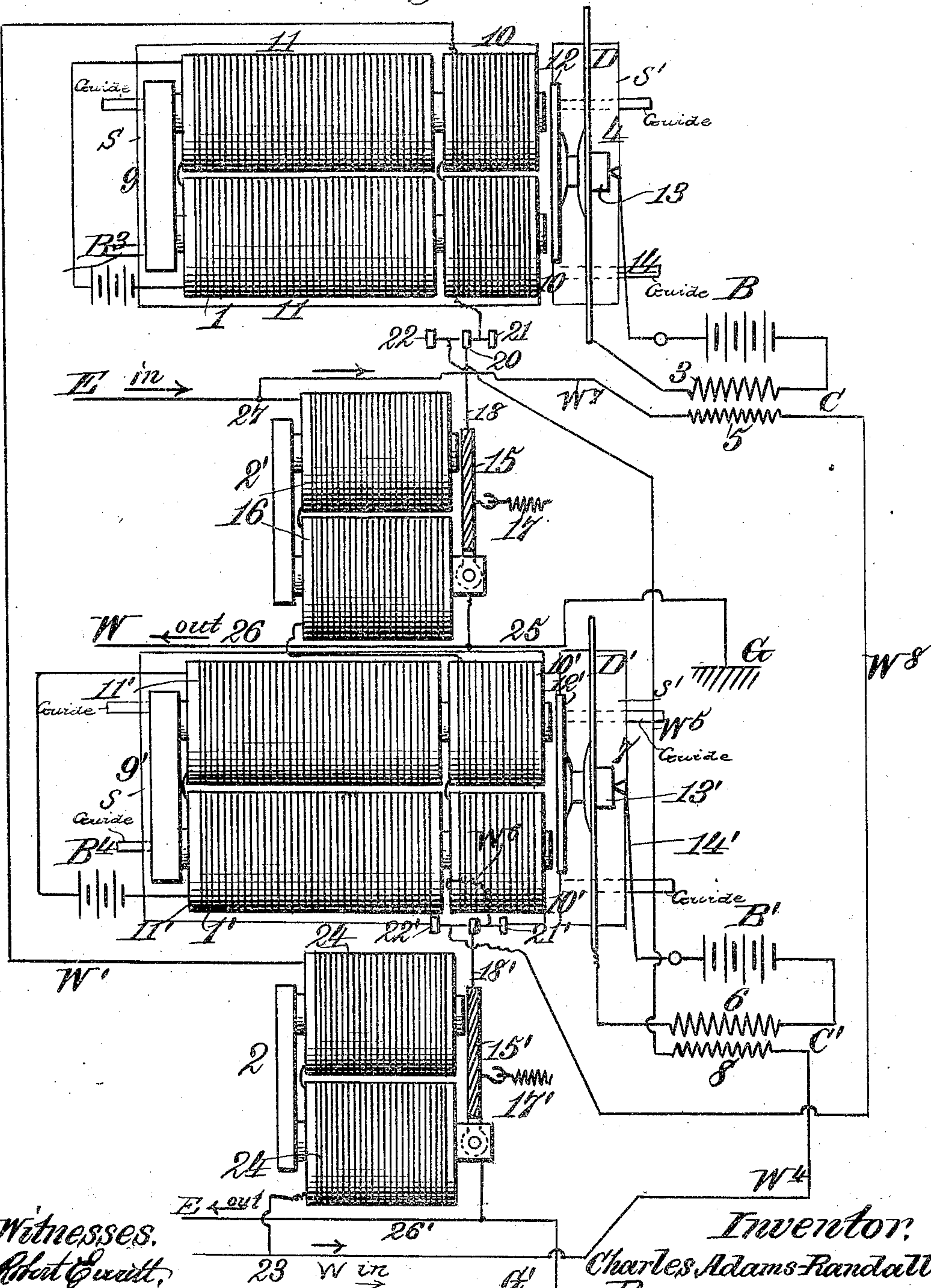
C. ADAMS-RANDALL.
TELEPHONE REPEATER.
APPLICATION FILED APR. 15, 1905.

970,288.

Patented Sept. 13, 1910.

2 SHEETS—SHEET 1.

Fig. 1.



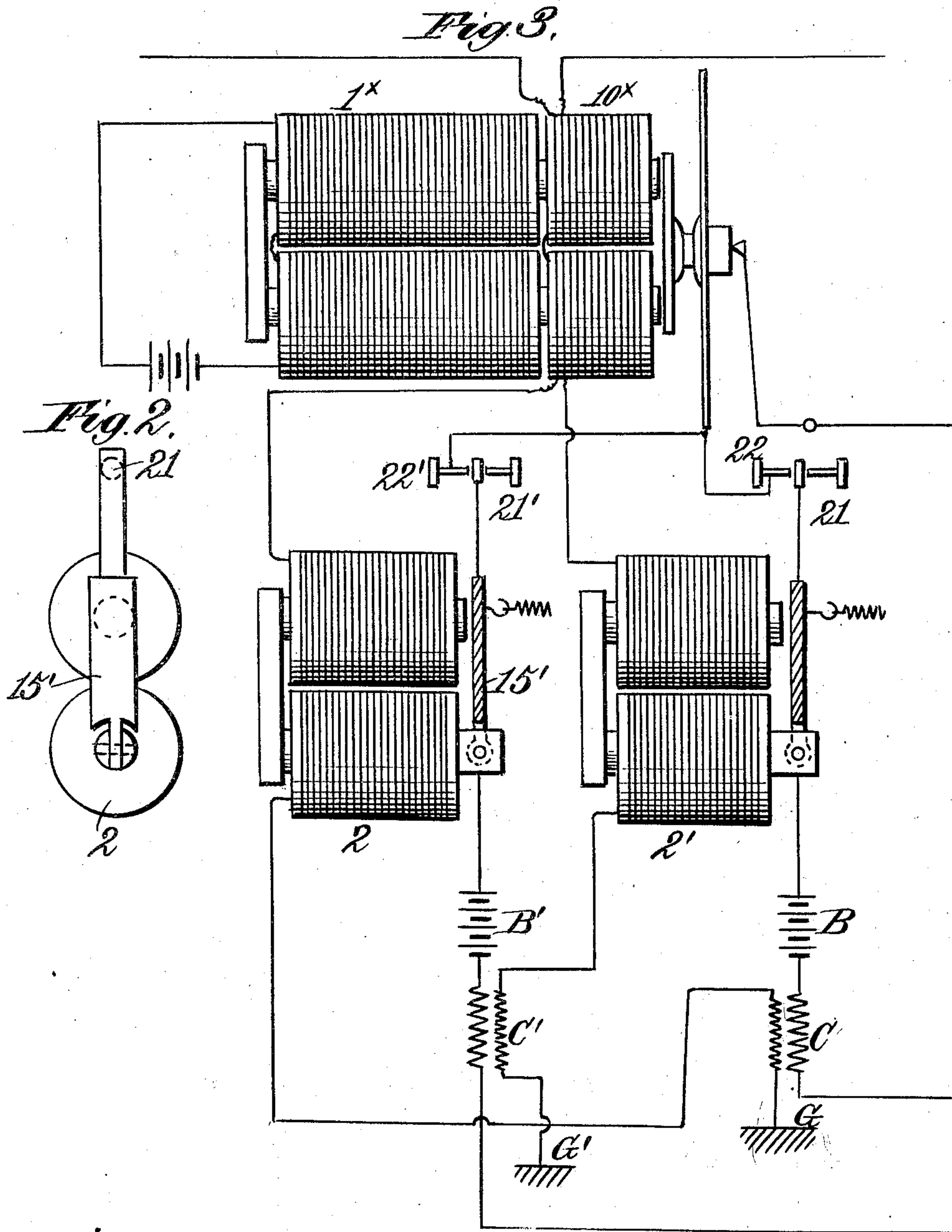
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970,288.

Patented Sept. 13, 1910.

2 SHEETS—SHEET 2.



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UNITED STATES PATENT OFFICE.

CHARLES ADAMS-RANDALL, OF NEW YORK, N. Y.

TELEPHONE-REPEATER.

970,288.

Specification of Letters Patent. Patented Sept. 13, 1910.

Application filed April 15, 1905. Serial No. 255,754.

To all whom it may concern:

Be it known that I, CHARLES ADAMS-RANDALL, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented new and useful Improvements in Telephone-Repeaters, of which the following is a specification.

This invention relates to what is technically known as telephone "repeaters" and telephone "relays".

The invention has for its object the automatic repetition of telephonic messages from one main line circuit into, or over or upon, another main line circuit.

In the application for use of the invention as a telephone "relay", that is, for reproducing the messages transmitted from a main line circuit, in a local circuit, increased loudness of the messages results by the use of a local battery in the local circuits similar to the usual telegraph relay and sounder organization. To change the apparatus from a "repeater" to a "relay", it is only necessary to convert the second main line circuit connections to a local circuit.

The invention consists, generally, in the use of an electro-magnetic telephone transmitter in combination with an electro-magnetic line controlling device which is termed the "controller". The controller is so constructed that when the rapid, alternating telephone currents or impulses are passing thereover, the electro-magnetic element of the controller is energized and the armature thereof is attracted and held in one position.

One of the most essential features of the invention is an electro-magnetic telephone transmitter consisting principally of a suitable microphone having a magnetic diaphragm, or a magnetic metal piece attached to the diaphragm and arranged to be operated by the electro-magnet forming a part of the transmitter, the coils of the latter being included in the line circuit and the electro-magnet or the microphone or both being preferably adjustable to and from each other. The microphone, or that part of the transmitter which constitutes the variable contact, may be of any of the well known forms, but preferably I employ the form of transmitter disclosed in my Patent No. 554,141, dated February 4, 1896. A simple, single contact form of transmitter, however, is shown herewith to demonstrate the practicability of the apparatus.

A further important feature of the invention is the plan or organization of circuit connections, provided with means for automatically connecting the same. The several features of the invention will, however, be more fully hereinafter set forth in detail in the subsequent description.

In the drawings, Figure 1 is a diagrammatic view of one form of the apparatus and circuits. Fig. 2 is a plan view of the armature of the controller. Fig. 3 is a view similar to Fig. 1, showing a modified form of the apparatus and the circuit connections therefor.

Similar characters of reference are employed to indicate corresponding parts in the several views.

The numerals 1, 1', Fig. 1, designate the electro-magnetic transmitters, 2, 2' the controllers, and C an induction coil having its primary 3 included in the local circuit with a battery B and a microphone 4. The secondary coil 5 of the induction coil C is included in the main line circuit E, when required. The induction coil C', located adjacent to the electro-magnetic transmitter 1' and controller 2', at a distance from the like mechanisms, which may be at another station, has its primary coil 6 included in a local circuit with a battery B' and microphone 7. The secondary coil 8 of the induction coil C' is included in the main line circuit W, when required.

The electro-magnetic transmitters 1, 1' are alike in construction, each having an electro-magnet 9, 9' with extended pole ends, upon which are placed the main line coils 10, 10' included in their respective main line circuits. As shown, the said extended pole ends are magnetized by the use of a current from a battery B³, B⁴ passing over the coils 11, 11'. It will be readily understood that in lieu of the battery and coils just set forth, a permanent magnet may be used, care being taken to obtain a normally strong magnetic field at the pole ends. The magnetic transmitters, as shown, have centrally secured to the diaphragms D and D' thereof, and on one side, magnetic extension pieces 12, 12' which act as armatures, and cause the diaphragms to vibrate in unison with the variations caused in the magnetic field by the currents passing over the main line coils 10 and 10'. To the opposite sides of the diaphragms, contact pieces 13 and 13' are secured and composed preferably of carbon,

upon which contact spring arms or analogous devices 14 and 14' have bearing, such parts representing one form of a variable contact transmitter and acting to produce variations in the batteries in circuit therewith and in the primary coils of the induction coils, as the diaphragms are caused to vibrate, and in a manner which will be readily understood. Vibrations of each of the diaphragms thus produced electro-magnetically, instead of by the voice, are of amplitude and energy dependent entirely upon the variable energy of the magnets.

The line controllers 2 and 2' are also duplicate in construction, as shown, and each is in the form of an electro-magnet having one of the cores extended by means of a swiveled or otherwise suitably fulcrumed magnetic metal piece which serves as a vibrating armature, as at 15, the two poles of the magnet thus being opposite each other. When rapid alternating telephonic currents pass over the coils 16 of this controller, the armature 15 is attracted and held in one position, and connected thereto is a retractile spring 17, serving to return the said armature to normal position in the absence of these telephonic currents. The armature 15 has terminally secured thereto a metal strip or extension 18 carrying platina points 20 on opposite sides which are movable between two contact screws 21 and 22, contact being normally made with the screw 21. The description of the controller construction just enumerated has been more particularly directed to the controller 2', but the controller 2 is of similar construction and embodies coils 24, and an armature 15' movably attached to one of the extended cores, the armature 15' having a retractile spring 17' secured thereto for an operation similar to the spring 17 heretofore described. The controller magnets are preferably made slow to discharge, by having a large mass of iron or long cores, the object of this preferred construction being to prevent a discharge of the magnet between the alternations of the telephone impulse passing over the magnet. The electro-magnets 9 and 9' and the microphone parts or attachments 4 and 7 will be preferably mounted upon sliding plates or supports S and S', or in some instances either one of the electro-magnet organizations and microphone attachments may be stationary and the other movable, the adjustable construction in either event being for the purpose of moving one organization or attachment to the other for obvious reasons. Any one of the well known forms of adjustment can be used for this purpose and similar to telegraphic or analogous instruments or simple electro-magnetic organizations embodying adjustable features.

The line and local connections are as follows: The lines W and E coming in, and

indicated by the word "in", are divided into two parts, the line W dividing at 23 and passing in one direction through the controller magnet coils 24, and thence by wire W' to the coils 10 of the electro-magnetic transmitter 1, thence to contact screw 21 by a wire W² through the armature 15, and from the latter by wire 25 to ground G or to wire 26 "out", when a metallic circuit is used. In the other direction, the circuit divides at 23 and passes to the secondary 8 of the coil C' by a wire W⁴ and from said secondary by a wire W⁵ to the contact screw 22 only. These are the normal positions. The line E coming in divides at 27 and passes in one direction through the controller magnet coils 16, thence to coils 10, 10' of the electro-magnetic transmitter 1' and to the contact screw 21' by a wire W⁶, and from said contact screw to the armature 15' to ground G' or to wire 26' "out". In the other direction, the circuit dividing at 27 passes to the secondary coil 5 of the induction coil C by a wire W⁷, thence to the contact screw 22' by wire W⁸. This concludes the description of the normal positions.

When telephoning from west to east, the currents or impulses pass over the coils 24 and the electro-magnetic transmitter coils 10 to ground G or to return wire 26 "out". The armature 15' of the controller 2 is attracted to the magnet and contact made with the contact screw 22', thus automatically closing the line E as follows: From the armature 15' to ground G', or to line "out" 26', which remains thus closed so long as the telephoning operation continues over the line W, the conversation being repeated over line E by the action of the electro-magnetic transmitter 1 in varying the currents over or in its local circuit, which includes the primary coil 3 of the induction coil C, such variations being reproduced in the secondary in a manner well known, and transmitted over the line E of which the said coil C is a part. Telephoning messages over line E and repeating them into line W is accomplished in the same way, but in the latter operation the controller 2' and electro-magnetic transmitter 1', included in line E, are actuated.

In the modification shown by Fig. 3, but one electro-magnetic transmitter 1^x is employed, the line coils 10^x, 10^x being double-wound, one set of coils being included in the line W with the controller 2 as before, and the other set of coils included in the line E with the controller 2'. The lines are shown grounded at G, G', but it is well understood that a return wire may be used in lieu of the grounds. Two independent induction coils C and C' and batteries B, B' are included in the modified organization similarly to the apparatus shown by Fig. 1. In this case, however, both contact screws 22 and 22' are connected to the one diaphragm or some

part of the variable contact of the electro-magnetic transmitter, whereby either of the local batteries and induction coils may be used, the use of the batteries or coils being determined by the line currents traversing the lines E, W and their respective controllers, the operation then being substantially as before described.

In the modified form of the apparatus shown by Fig. 3, all the parts included and similar in construction to the apparatus shown by Fig. 1, have like reference numerals applied thereto, except as otherwise hereinbefore noted.

It is to be understood that the invention is not limited to the exact apparatus shown, which is simply representative, and various forms of electro-magnetic transmitters may be devised, having in view strong magnetic effects. The controllers may also be modified in many ways without departing from the spirit of the invention, the main feature being to have an electro-magnetic device readily responsive to the action of the telephone currents or impulses, and so constructed, by using long coils or otherwise, that the same will be slow to discharge in contradistinction to a telegraph relay, in which rapid charge and discharge of the magnet is sought and essential, due consideration being given to the power or energy of such apparatus.

The apparatus heretofore disclosed is actuated and controlled by the act of speaking into the transmitter at either sending station, and without pursuing such act the apparatus would have no practical operation, and hence the invention is thereby materially distinguished from mechanically controlled signal or sign apparatuses.

Having thus fully described the invention, what is claimed as new is:

1. A telephone repeating apparatus of the class specified, embodying two independent normally closed main line circuits, each circuit being characterized by an electro-magnetic line controlling device for rendering the circuits operative, one by the other, and an electric transmitter.

2. A telephone repeating apparatus embodying two independent normally closed main line circuits individually having an electro-magnetic line controlling device for rendering the circuits operative, one by the other, an electric transmitter, and circuit connectors.

3. A telephone repeating apparatus embodying normally closed independent main line circuits each having means for opening and closing the other, and electric transmitting means.

4. In a telephone system of the class specified, the combination with a telephone circuit, of means for generating and transmitting voice-caused currents thereover, a second telephone circuit independent of the

first circuit, the said circuits being normally closed, and independent means in each circuit actuated by said voice-caused currents for controlling the circuits.

5. A telephone apparatus of the class described having two independent main line circuits, intermediate means for reproducing telephonic speech, sounds or the like, alternately from one main line circuit into the other main line circuit, consisting of electro-magnetic telephonic transmitting means, induction coils, batteries and circuit connections, and an electro-magnetic device in each main line circuit actuated and controlled by the act of speaking into the transmitter at either sending station whereby from the distant terminal of either of the two independent main line circuits the other circuit can be automatically selected and connected in or electrically completed at the said intermediate means.

6. In a telephone apparatus of the class described, two independent main line circuits, means for generating and transmitting voice-caused currents over said circuits, and means in each circuit actuated by said voice-caused currents to automatically select and connect in the other or second circuit to enable the operator of either of the main line circuits to control the two independent main line circuits by the act of speaking into the transmitter of either of the said circuits.

7. A telephone repeater characterized by two independent normally closed main line circuits each having an electro-magnetic controlling device, an electro-magnetic transmitting apparatus, induction coils, local batteries and circuit connectors, each electro-magnetic line controlling device being automatically actuated by the act of speaking into the transmitting apparatus at either sending station, and the operator at either sending station being enabled to gain control of the complete apparatus by speaking into the transmitting apparatus at the terminal of either station.

8. A telephone repeating apparatus characterized by independent normally closed main line circuits each having an electro-magnetic controlling device, electro-magnetic telephone transmitters having their coils connected to the independent main line circuits and provided with a variable contact, batteries, and induction coils, the variable contacts being connected up in one set of circuits with the batteries and primary coils of the induction coils, the secondary coils of the induction coils being also connected up to the main line circuits and the coils of the electro-magnetic controlling devices being included in the main line circuits and serving to automatically connect the secondary coils of the induction coils to the respective circuits for the purpose of repeating and reproducing in one main line

circuit with relation to the other electric currents, vibrations or impulses corresponding to the electric currents, vibrations or impulses produced in either of the main line circuits by words, sentences, and sounds uttered into the transmitters of either of the main line circuits.

9. In a telephone apparatus of the class described, two independent main line circuits each provided with means for generating and transmitting voice-caused currents thereover, and independent means in each circuit actuated by said voice-caused currents for connecting the circuits and including movable elements which are attracted and held in one position when said independent means are energized by rapid alternating telephone currents or impulses passing over the circuit of which each independent means is a part for selecting and completing the other main line circuit.

10. In a telephone apparatus of the class described, independent normally closed main line circuits, means for generating and transmitting voice-caused currents over said circuits, and independent means in each circuit automatically operated by said voice-caused currents for connecting the two circuits and including movable elements which are held in closed position when said means are energized.

11. In a telephone apparatus of the class described, independent main line circuits, means for generating and transmitting voice-caused currents over said circuits, and means in each circuit actuated by the voice-caused currents over the circuit of which each of said means is a part for interchangeably selecting and completing automatically either of the two main line circuits for the reception of the repeated or retransmitted messages at the will of an operator speaking from either of the main line circuits.

12. In a telephone apparatus of the class described, two independent normally closed main line circuits over either of which telephonic messages may be sent, and electromagnetic means for individually controlling said circuits, and electro-magnetic means for producing upon one of said circuits electrical impulses corresponding to the voice-caused currents passing over or upon the other circuit.

13. In a telephone system, the combination with a telephone circuit, of means for generating and transmitting voice-caused currents over said circuit, a second telephone circuit, said circuits being normally closed and means individually cooperating with each circuit and actuated by said voice-caused currents for connecting either of the circuits.

14. A telephone apparatus of the class described having means for reproducing telephonic speech, sounds or the like alternately from one main line circuit into another main line circuit, the two main line circuits being independent and normally closed, said means consisting of an electromagnetic telephone transmitter, induction coils, batteries and circuit connections, and electro-magnetic apparatus individually included in each main line circuit for automatically selecting and connecting in or electrically completing either of the two independent main line circuits, said electro-magnetic apparatus being complete for each circuit and operated by voice-caused currents passing thereover and over the circuit of which it is a part.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

CHARLES ADAMS-RANDALL.

Witnesses:

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M. B. LOVELACE.