(No Model.) 2 Sheets—Sheet 1.

C. A. RANDALL.

TELEPHONE TRANSMITTER.

No. 312,160. Patented Feb. 10, 1885.

Fig. 1.

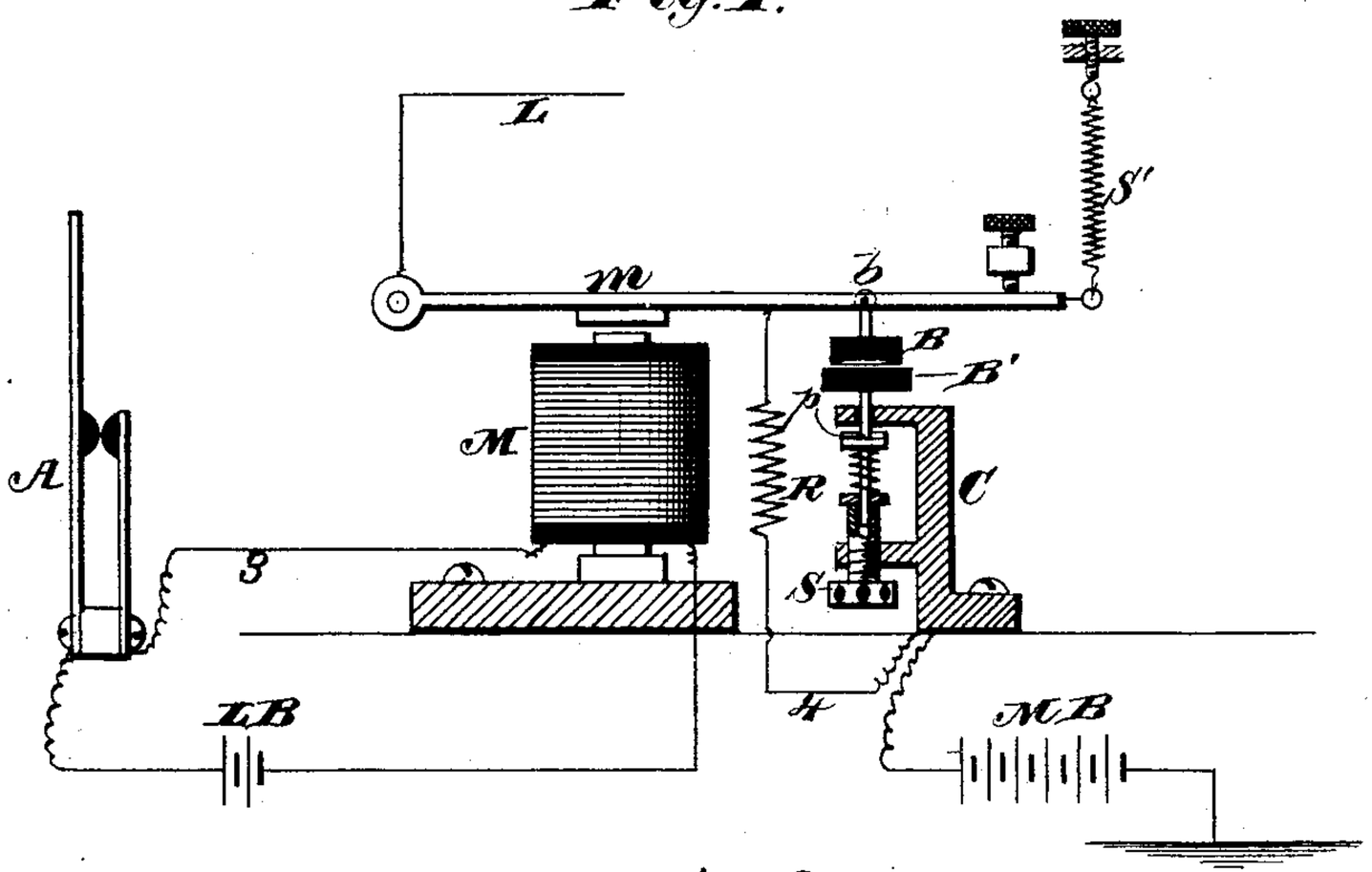
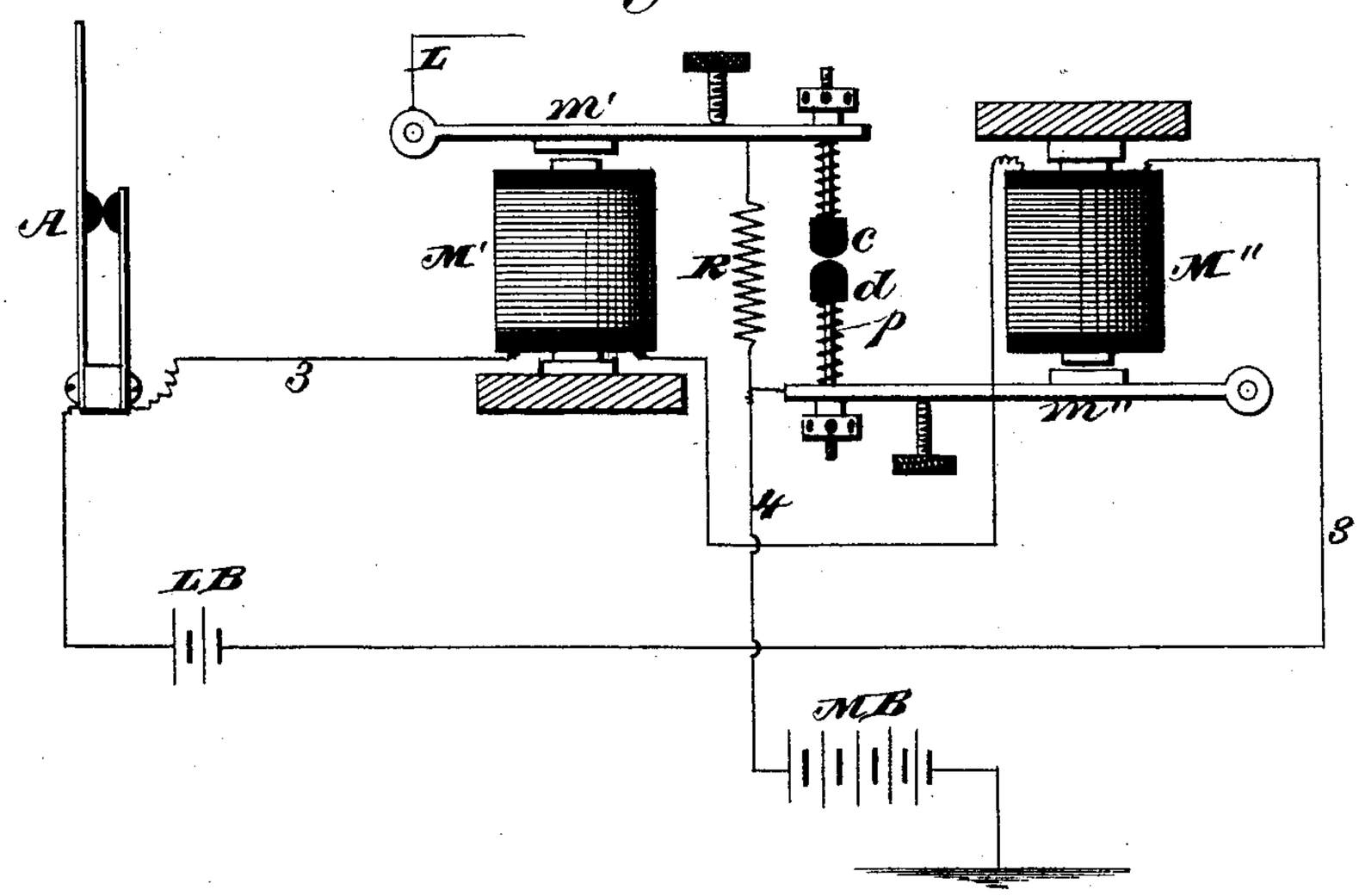


Fig. 2.



Witnesses.
Robt Ewett.
Chas. F. Dyer.

Inventor:
Charles A. Randall.
By James L. Norris.
Atty.

(No Model.) 2 Sheets—Sheet 2.

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Fig. 3.

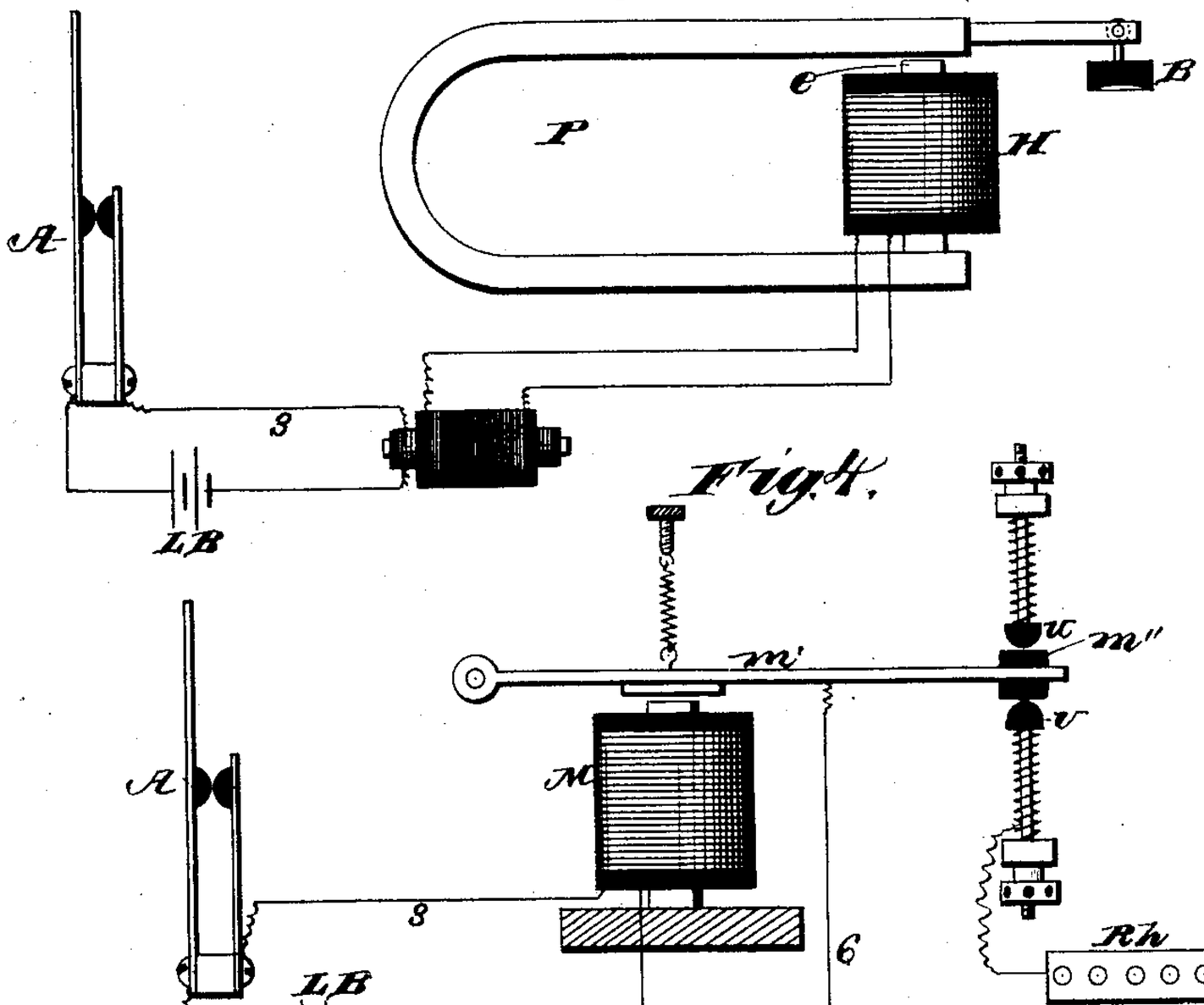

Fig. 4.

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UNITED STATES PATENT OFFICE.

CHARLES A. RANDALL, OF NEW YORK, N. Y.

TELEPHONE-TRANSMITTER.

SPECIFICATION forming part of Letters Patent No. 312,160, dated February 10, 1885.

Application filed January 7, 1884. (No model.)

To all whom it may concern:

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

The object of my invention is to furnish a telephonic transmitter and system designed to utilize to a maximum degree the force of a line-battery controlling the receiving apparatus at a distant station or stations, to cause an extended or amplified range of vibration of the current therein, thereby effecting an increased force and amplitude of vibration in the receiver-diaphragms, and to afford means for operating telephonically long lines and even ocean-cables, and also designed to obviate any "spark" at the line-controlling electrodes, thereby avoiding the interference with the transmission of vocal or other sound vibrations and the destruction of such electrodes, due to the presence or creation of such spark.

In accomplishing this I preferably use an extended range of contact-surface by making one of the electrodes slightly concave, and so pivoting or supporting it that it may press firmly and squarely around its whole edge upon the other electrode, both being made of an enlarged area, so as to increase the contact-surface, which of course may be varied as may be required. I also provide two branch circuits from the main battery to the line, one branch containing an adjustable resistance equal or about equal to the resistance of the main line or circuit, the other containing the variable contacts controlled by the diaphragm, so that as the contacts in the latter branch are varied the relative amounts of current passing to line through the two branches are varied, and hence the current in the line varied. In such construction, as there is always an unbroken circuit from the main battery, all danger of spark at the electrodes is avoided, while at the same time currents of great electro-motive force may be utilized and varied. These features, their operation and results, may be better understood by reference to the following detailed description, and to the drawings, in which—

Figures 1, 2, 3, and 4 represent, mainly diagrammatically, typical arrangements embodying the invention.

In Figs. 1, 2, 3, and 4, A represents any ordinary transmitter-diaphragm operating electrodes controlling the local circuit 3 of a local battery, L B. In Fig. 1 this circuit passes around the electro-magnet M, provided with an armature-lever, *m*, of the usual construction and operation, the line L being connected thereto.

B B′ are the main-line-circuit-controlling electrodes, made of enlarged area, as shown. Of these B′ is supported upon a rod or pin, *p*, spring-acted on to normally keep it up to the desired position, while an adjusting screw or nut, S, at the base of the pin regulates and controls this desired position, while the position of the armature-lever *m* is determined by the adjusting screw and spring S′ at the end of the lever. S and *p* are supported in any suitable device, as the double bracket C, through which connection is made from the main battery M B to B′. The other electrode, B, is slightly concave, and is pivotally suspended from armature-lever *m* at *b*, so that it may take squarely upon B′, in any position of *m*, with a firm and extended connection upon the whole periphery, the surface of B′ being made flat to aid in this.

Independent of the electrodes and the branch circuit containing them is a branch circuit, 4, from the battery to *m* and line, in which is the resistance R, which may be of any desired kind, and may be adjustable. It should be adjusted so as to have normally a resistance about equal to the resistance of the line-circuit through B B′ when in minimum contact, a resistance largely in excess, consequently, of the resistance through B B′ when in maximum or firmest contact. It is evident, then, that when B B′ are in minimum contact but a small strength of current will be upon the line, owing to the resistances in the line-circuit or branches of the line-circuit. As, however, B and B′ are pressed more firmly together in correspondence with the vibrations of A, the resistance in such circuit will be proportionately lessened and an increased amount of current pass therethrough, the battery-current then flowing with maximum force. Upon the reverse movement of B and B′ the reverse action of flow of current through B and B′ and branch 4 R will take place until, if contact between B and B′ be en-

tirely broken, all the current will flow over 4 R, but enfeebled greatly by resistance R, this maintenance of the circuit at 4 R, however, preventing any spark at B B'.

In Fig. 2, instead of one magnet, M, being used, two, M' M'', are used, both in the local circuit 3. Each is provided with the customary armature-levers *m' m''*, *m'* controlling one electrode, *c*, while *m''* controls the other, *d*, each of the electrodes being carried or supported by a spring-acted-on pin or rod, *p*, having adjusting-screw S, as in case of B', before described. The circuit from the main battery M B is to line L, through the two electrodes *c d*, whose relation to each other is of course controlled by the variations in the local circuit 3, caused by the movements of A. Independent of these electrodes and the branch circuit containing them is a branch circuit, 4, from battery to line containing resistance R, the effect and function of which are the same as in case of Fig. 1.

While the circuit of M B in both cases has been referred to as leading directly to line L, it is of course evident that it may lead to the primary of an induction-coil whose secondary wire is connected to the line. It is also evident that the branch 4 might be directly to the electrodes, or to their supports or seats.

In Fig. 3 is shown a form of magnet which may be substituted for the magnets shown in Figs. 1 and 2. In it P is a permanent horseshoe-magnet, one leg carrying a polar extension, *e*, projecting therefrom at a right angle toward the other leg and ending in close proximity thereto. Upon *c* is a helix, H, preferably of low resistance, if included in the circuit direct with the battery and transmitter A, but of higher resistance if in circuit with the secondary of an induction-coil. The free arm of P has an extension carrying one of the electrodes—say B. This form, as may be readily seen, is of exceedingly rapid and decided action when alternating currents are used.

In Fig. 4 the branch circuit 6 6, containing the rheostat R*h*, instead of being connected directly from + to — poles of the battery, so as to be invariable, (except as R*h* is definitely changed,) is formed through *m'*, contact *m''* thereon, and an electrode, *v*, while the line-circuit is made through *m' m''* and electrode *u*. If, now, the branch circuits 6, *m'*, *m''*, *v*, R*h* and 6, *m'*, *m''*, *u*, line to distant station or ground be adjusted relatively to each other, current in proportion will flow over each; but if either be varied by action of A L B and M on *m'* the resistance of one will be increased as the other is diminished, and vice versa, the current on the line being varied accordingly.

By the use of the adjustable resistances R and R', placed in the branch circuits, the resistance of these branches may be readily determined and controlled relatively to the main circuit. I prefer that the resistance of the two branch circuits should be about equal. It will also be understood that in all these forms the line L, instead of leading directly to the distant or receiving station, may lead to and be included in the primary circuit of an induction-coil at any desired point, in a manner well understood in the art.

Having thus described my invention, what I claim is—

1. In a telephone-transmitter, the combination, with a main battery, of a pair of circuit-controlling electrodes therefor, one of which is made concave upon its active or bearing surface, substantially as described.

2. In a telephone-transmitter, the combination, with a main battery, of a pair of circuit-controlling electrodes therefor of extended area or surface, one of said electrodes being concave and the other flat upon their active or bearing surfaces, substantially as described.

3. In a telephonic transmitter, the combination, with a main-line battery, of circuit-controlling electrodes, one of which is pivotally hung or swung from the armature-lever, controlling the relative positions of the electrodes to each other, so that it may be free to take evenly and firmly upon the other, a magnet controlling the armature-lever, a diaphragm, and circuit-connections for variably energizing the magnet, substantially as described.

4. In a telephone-transmitter, the combination of a main battery, a pair of circuit controlling electrodes therefor, and two independent electro-magnets in one local circuit controlled by a diaphragm, each magnet controlling through its armature an electrode, so that both are simultaneously moved to or from each other, substantially as described.

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

CHAS. A. RANDALL.

Witnesses:
ALBERT H. NORRIS,
J. A. RUTHERFORD.