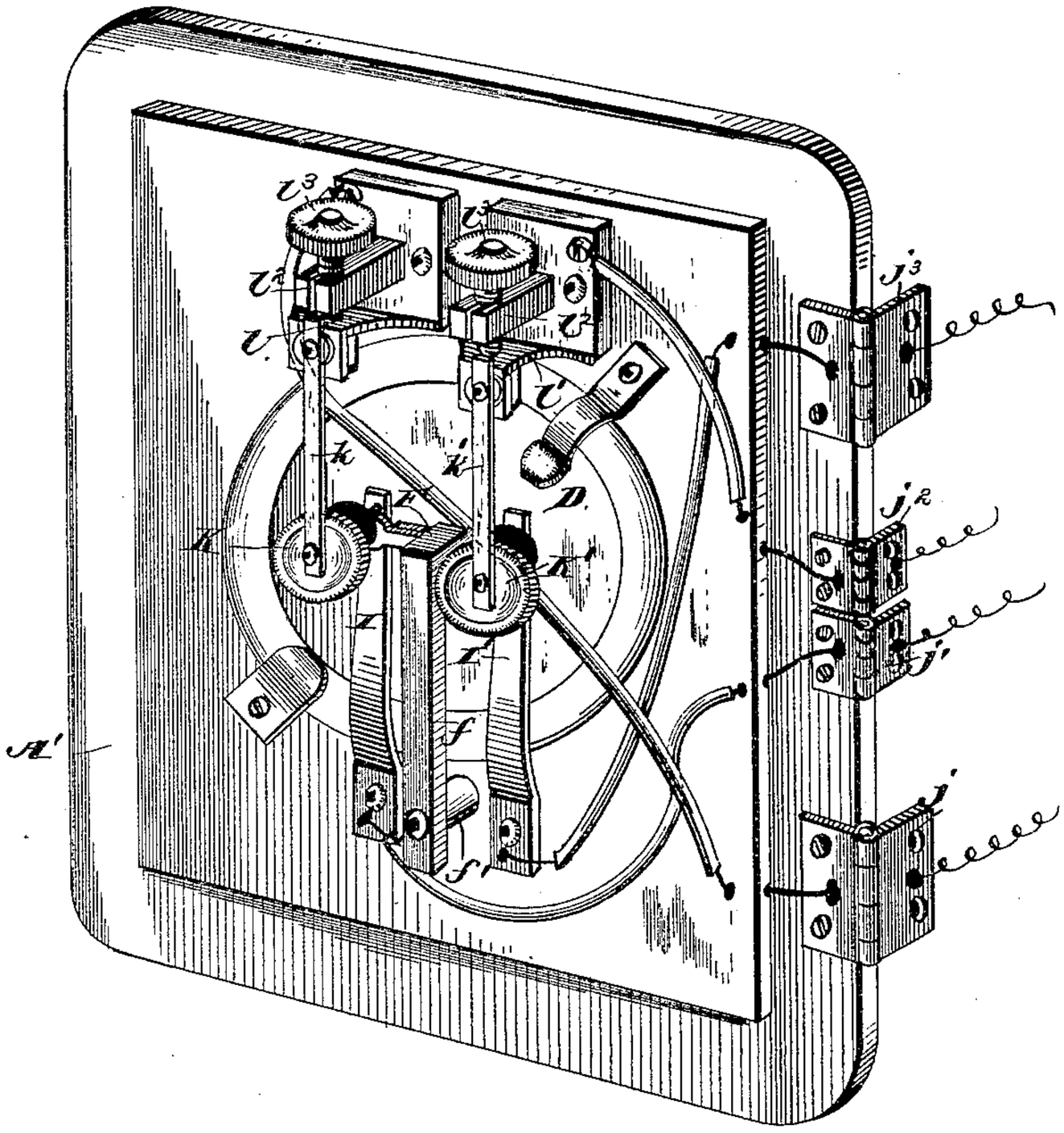
(No Model.) 3 Sheets—Sheet 1.

J. P. FREEMAN.

TELEPHONE TRANSMITTER.

No. 318,423. Patented May 19, 1885.

Fig. 1.



Witnesses:
Charles S. Hyer.
Russell H. Scott.

Inventor:
James P. Freeman
By Munn & Co
Attys.

(No Model.) 3 Sheets—Sheet 2.

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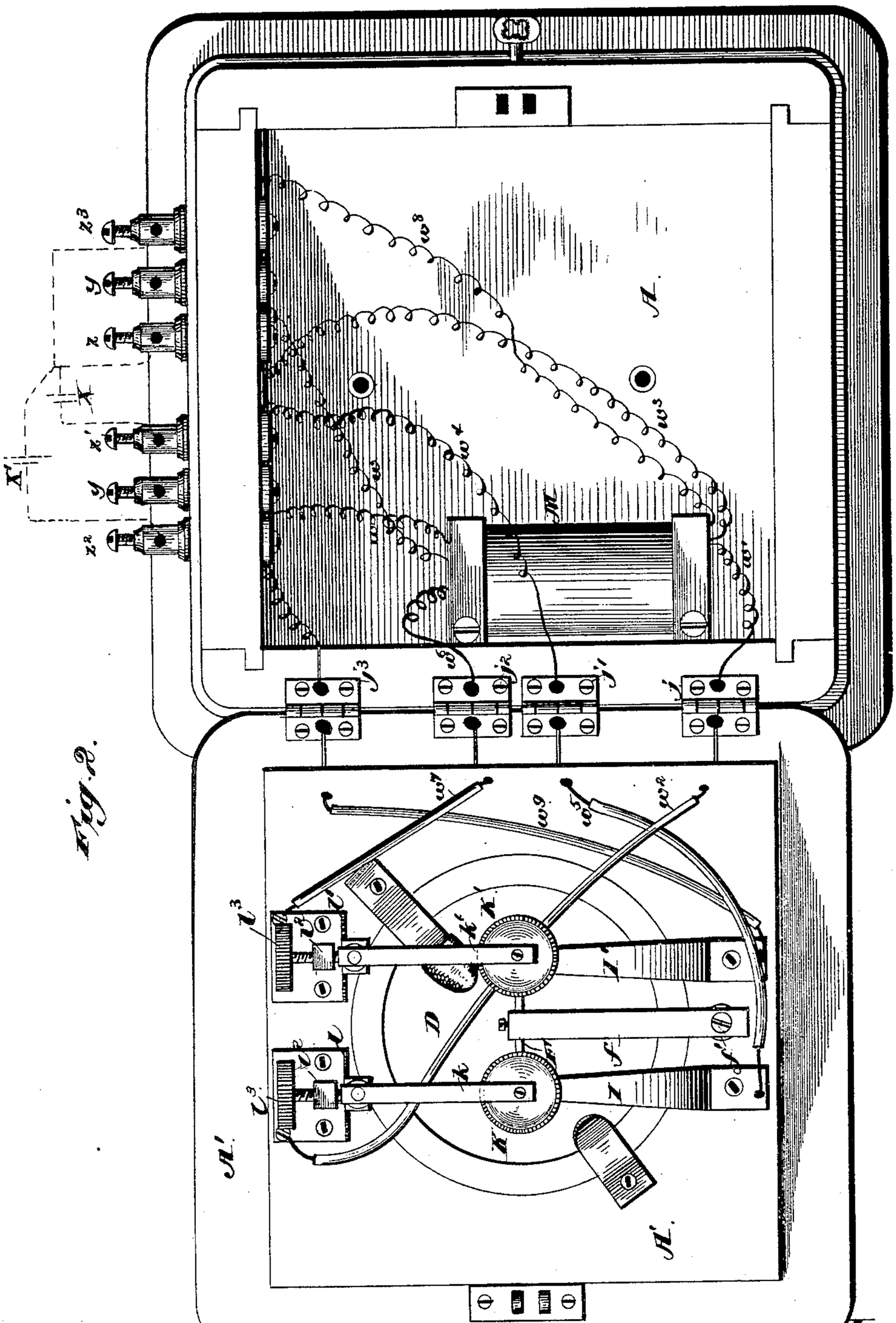

Witnesses.
Charles S. Hoyer.
Russell H. Scott.

Inventor
James P. Freeman
By Munn & Co.
Attys.

(No Model.) 3 Sheets—Sheet 3.

J. P. FREEMAN.

TELEPHONE TRANSMITTER.

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Fig. 3.

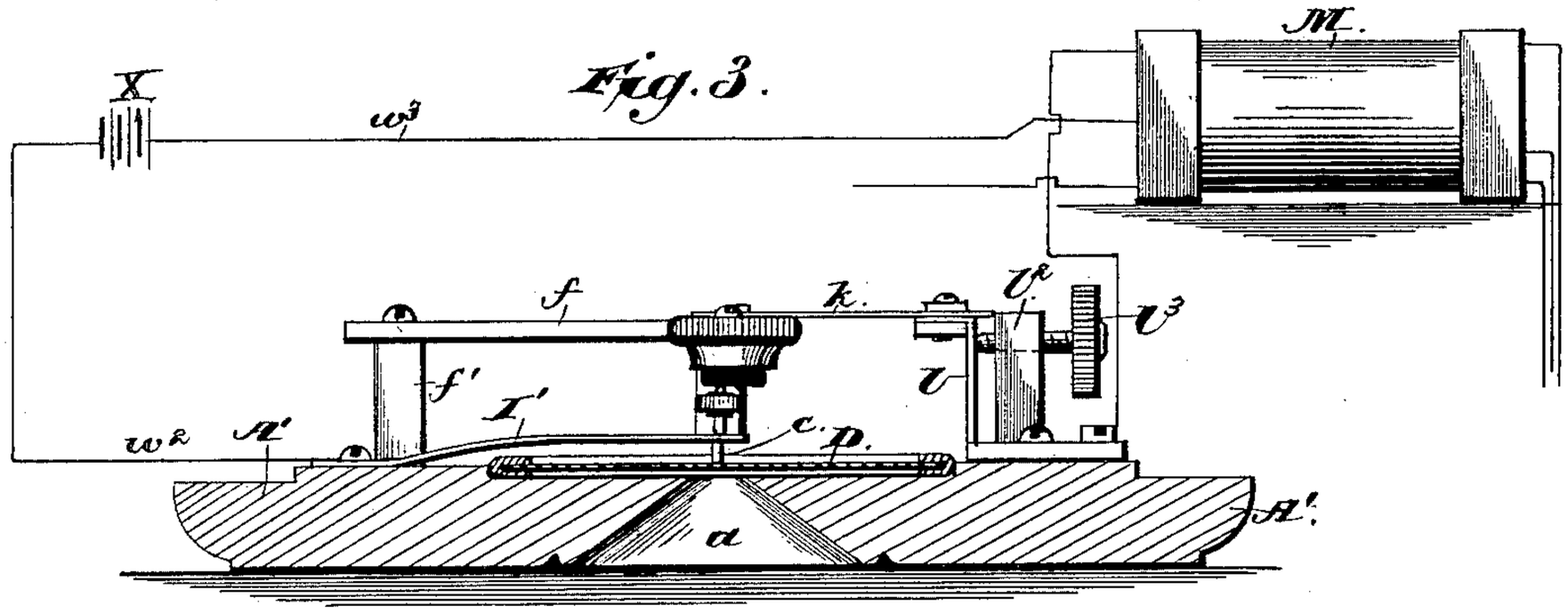

Fig. 4.

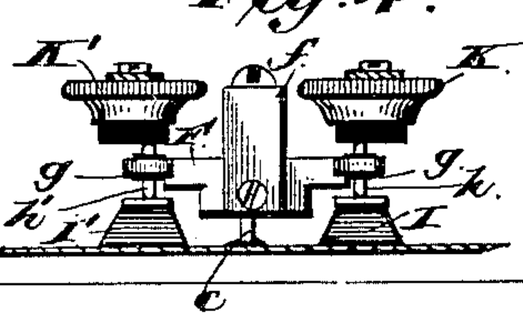

Fig. 5.

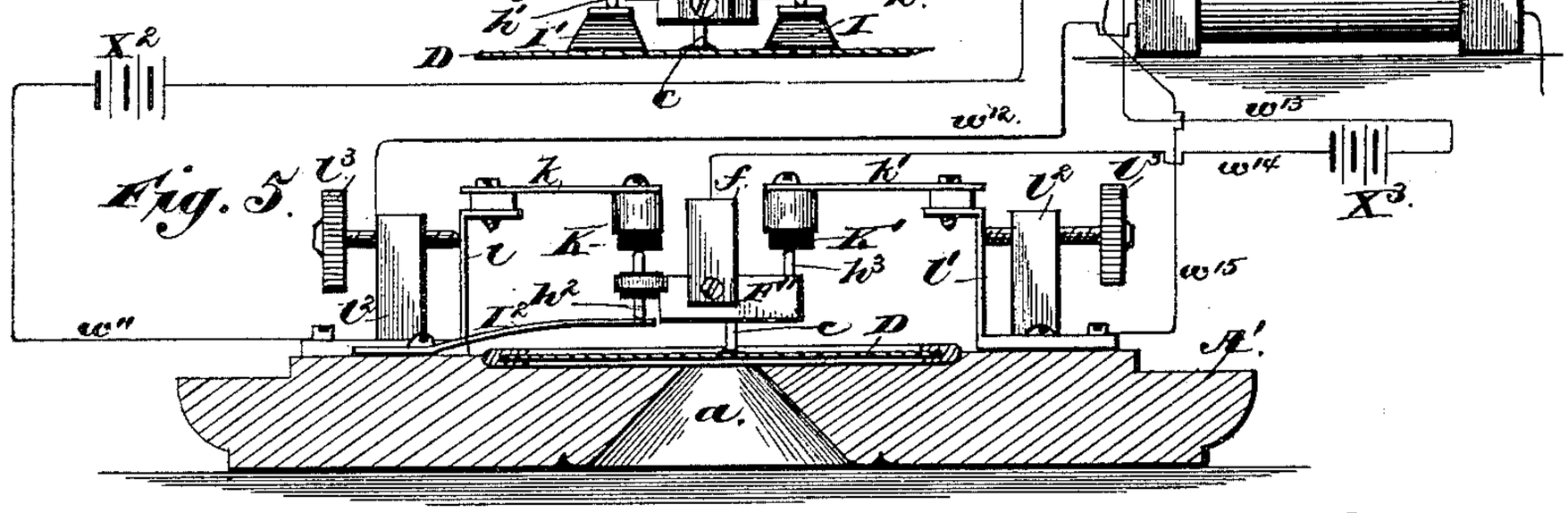

Fig. 6.

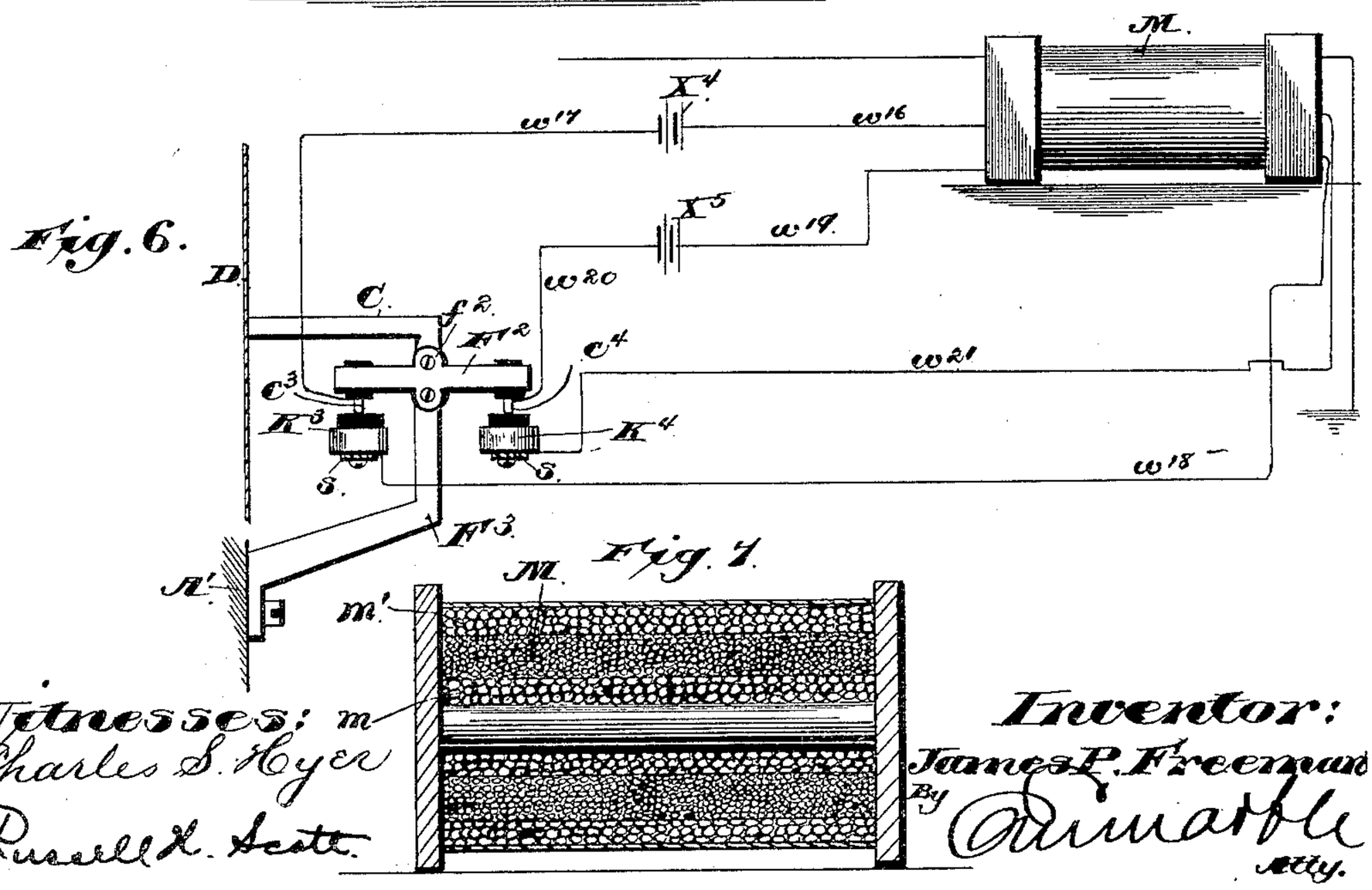

Fig. 7.

Witnesses:
Charles S. Hyer
Russell L. Scott.

Inventor:
James P. Freeman
By Dumaresq
Atty.

UNITED STATES PATENT OFFICE.

JAMES P. FREEMAN, OF CHICAGO, ILLINOIS, ASSIGNOR OF NINE-TWENTIETHS TO E. M. MARBLE, OF WASHINGTON, DISTRICT OF COLUMBIA.

TELEPHONE-TRANSMITTER.

SPECIFICATION forming part of Letters Patent No. 318,423, dated May 19, 1885.

Application filed January 14, 1885. (No model.)

To all whom it may concern:

Be it known that I, JAMES P. FREEMAN, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Telephone-Transmitters, of which the following is a specification, reference being had to the accompanying drawings.

My invention relates to telephonic transmitters of the class known as "battery-transmitters;" and its object is to utilize for telephonic transmission an intermittent electrical current instead of the so-called "continuous undulatory current" employed in variable-contact closed-circuit transmitting-instruments as heretofore constructed.

My invention in part consists in breaking and closing the primary circuits of an induction-coil rapidly in response to the vibrations of a diaphragm actuated by sound-vibrations of the air, and thereby causing said circuits to be traversed intermittingly by strong electric impulses, which have the effect to induce in the secondary circuit and the line-wire connected thereto impulses of alternating direction, having quantity and tension so great that they will travel over very long stretches of line-wire, and actuate receiving-instruments connected therein with greater force than has heretofore been known in the art of telephony, reproducing articulate speech clearly, loudly, and distinctly; and in part in a novel combination, in a transmitting-instrument, of circuit closing and breaking devices with a diaphragm, battery-circuits, and an induction-coil having two primaries and one secondary coil, which will be hereinafter more fully described, and pointed out in the claims.

In the accompanying drawings, forming a part of this specification, and in which similar letters refer to like parts, Figure 1 is a perspective view of the door of a transmitter box or casing having mounted thereon the diaphragm and circuit closing and breaking devices. Fig. 2 is a view in elevation of the transmitter-box with its door open to show the interior parts. Fig. 3 is a section of the door and diaphragm in the plane of the vertical diameter of the latter, the circuit closing and breaking devices and induction-coil being shown in full lines. Fig. 4 is a detached end elevation of the working-lever and electrodes. Fig. 5 is a section of the door and diaphragm and view in elevation of an induction-coil and circuit closing and breaking devices of modified construction. Fig. 6 is a diagram illustrating another modification of the circuit closing and breaking devices in connection with an induction-coil. Fig. 7 is a longitudinal diametric section of a preferred form of induction-coil.

Referring to Figs. 1, 2, 3, and 4, the letter A indicates the box or casing of the apparatus, and A′ is its door, having the diaphragm D mounted behind an orifice, *a*, therein in the usual manner. From the center of the rear surface of the diaphragm projects a pin, *c*, and behind this pin is an approximately-equal-armed rocking lever, F, pivoted to an arm, *f*, which stands behind the diaphragm and is supported by a post, *f′*, projecting rearwardly from the door A′. This rocking lever F has inserted through openings in its ends insulating or non-conducting plugs *g g*, and through these plugs are secured metallic pins *h h′*, the forward ends of which are arranged to make contact with the tips of metallic spring-fingers I I′, which project from the door A′ and stand at a little distance from the rear face of the diaphragm. The rear ends of the pins *h h′* are arranged to make contact with the respective carbon electrodes K K′, carried by metallic strip-springs *k k′*, projecting from metallic spring-arms *l l′*, which project rearwardly from the door A′. Each of these spring-arms has behind it a post, l^2, through which passes an adjusting-screw, l^3, the tip of which bears against said arm. By means of these screws the arms may be adjusted to cause the springs to hold the carbon electrodes in proper relation to the contact-pins. These spring-fingers, spring-arms, electrodes, rocking lever, and contact-pins constitute, in connection with the diaphragm, the circuit closing and breaking devices, and with them I use an induction-coil of peculiar construction, in that it has two primary coils, one of which is preferably arranged within the secondary coil in the usual manner, while the other is wound outside of

the secondary coil. I have illustrated such an induction-coil in Fig. 7, though I wish it to be understood that I do not confine myself to this form, the essential requirement being only that there shall be two primary coils which act alternately for inducing currents in the secondary. In the figure, M is the secondary coil, *m* the inner primary, and *m'* the outer primary, coil. Now, in connecting this coil for use I connect the outer terminal of the outer primary coil with the spring-arm *l*, and the inner terminal with one pole of a battery, X, which has its other pole connected with the spring-finger I. The outer terminal of the inner primary coil is connected with the spring-arm *l'*, and the inner terminal of this inner primary coil is connected with one pole of a battery, X', the other pole of which is connected with the spring-finger I'. It will now be seen that if the spring-finger I is in contact with the forward end of contact-pin *h*, and the rear end of said pin is in contact with the carbon electrode K, the circuit of battery X will be closed through the spring-finger I, contact-pin *h*, carbon electrode K, strip-spring *k*, arm *l*, and the conductors, including the outer primary circuit, which connect said arm and spring-finger I with the opposite poles of the battery. If, instead of the pin *h* being in contact with its adjacent spring-finger and carbon electrode, the pin *h'* should be in contact with the spring-finger I' and carbon electrode K', then the circuit of battery X' would be closed through the inner primary circuit, as will be readily understood.

The actual mechanical arrangement of the conductors and other parts is illustrated in Fig. 2, in which the induction-coil is indicated by M, and *w w* are the terminals of its secondary coil leading to binding-posts *y y*. The outer terminal of the outer primary is connected by a wire, *w'*, with one side of the lower door-hinge, *j*, from the other side of which a wire, w^2, leads to an arm, *l*. The inner terminal of the outer primary is connected by a wire, w^3, with binding-post *z*, which is to be connected with one pole of the battery X, the other pole of which is to be connected with binding-post *z'*, which is connected by a wire, w^4, with one side of hinge j', the other side of which is connected by a wire, w^5, with spring-finger I. The outer terminal of the inner primary is connected by a wire, w^6, with one side of hinge j^2, the other side of which is connected by wire w^7 with arm *l'*, while the inner terminal of this inner primary is connected by a wire, w^8, to binding-post z^3. This post is to be connected with one pole of battery X', the other pole of which is to be connected to binding-post z^2, which is connected with one side of hinge j^3, the other side of which is connected by a wire, w^9, with spring-finger I'.

The pin *c*, at the center of the diaphragm, touches the inner side of the rocking lever F at one side of its pivot and at a point nearer to pin *h'* than to pin *h*. The carbon electrode K is adjusted to bear normally but lightly on the inner end of pin *h*, and said pin is always in contact with the spring-finger I. The circuit of the battery X is thus normally closed through the outer primary coil of the induction-coil. At this time pin *h'* is in contact with spring-finger I' and just out of contact with carbon electrode K'. Now, if the diaphragm makes an inward half-vibration it moves the rocking lever F to force the pin *h'* into contact with carbon electrode K' and break the contact of pin *h* with carbon electrode K, thus breaking the circuit of the outer primary coil. As the spring-finger I' follows pin *h'* and never breaks contact therewith, the circuit is closed through the inner primary coil as soon as said pin touches the carbon electrode K', which is immediately after the breaking of the contact between pin *h* and carbon K. Both the closing of one and the breaking of the other produce inductive effect upon the secondary, and the winding or direction of current in the two primaries is such that the breaking of one induces a current in the same direction as does the closing of the other, and their combined effect is to induce in the secondary very powerful impulses, which flow on the connected line and actuate with great force the receiving-instruments included therein. The outer half-vibration of the diaphragm of course restores the parts to their normal position, breaking one circuit and closing the other.

While it is true that there is an instant of time between the breaking of one primary circuit and making of the other, and vice versa, the making and breaking of said circuits are so rapid that every word and every part of every word spoken in front of the instrument is taken up and transmitted clearly and distinctly. This result is due to the peculiar construction of the instruments embodying the invention in each of the forms shown.

In the modified construction of the circuit closing and breaking devices illustrated in Fig. 5 the carbon electrodes K K' are supported in the same manner as shown in Fig. 1, the only difference being that they project inwardly from the door on opposite sides of the diaphragm. In this modification the rocking lever F' has one insulated contact-pin, h^2, at only one end, while at the other end a pin, h^3, in metallic connection with the lever, is arranged to make contact with the carbon electrode K'. There is but one lower spring-finger, as at I^2, and it is arranged to make contact with the forward end of pin h^2, while the rear end of said pin makes contact with the carbon electrode K. The pin *c*, at the center of the diaphragm, touches the rocking lever F' on one side of its pivot nearest the pin h^3. The spring-finger I^2 is constructed to press the pin h^2 into normal contact with the carbon electrode K, and at such time the pin h^3, at the other end of the lever, is just out of contact with the carbon electrode K'.

The outer terminal of the outer primary coil of the induction-coil M is connected by a wire, w^{10}, with one pole of the battery X^2, the other pole of which is connected by a wire, w^{11}, with the spring-finger I^2, and the inner terminal of this outer primary is connected by a wire, w^{12}, with the arm l, supporting the strip-spring k, which carries the carbon electrode K. The outer teminal of the inner primary coil is connected by a wire, w^{13}, with one pole of a battery, X^3, which has its other pole connected by a wire, w^{14}, with the arm f, which supports and is in electric connection with the rocking lever F′, and the inner terminal of said inner primary is by a wire, w^{15}, connected with the spring-arm l', supporting the strip-spring k', which carries the carbon electrode K′.

The secondary circuit of the induction-coil is to be connected to line the same as in the first-described instrument.

The pin h^2, in the normal condition of the instrument, is always in contact with spring-finger I^2, and the carbon electrode K is also in light contact with the inner end of pin h^2, and the pin h^3 is just out of contact with carbon electrode K′. Now, when the diaphragm D moves inwardly the pin c forces the lever F in such direction as to put the pin h^3 in contact with the carbon electrode K′, thus closing the circuit of battery X^3, and at the same time the pin h^2 is carried down out of contact with carbon electrode K, thus breaking the circuit of battery X^2. The circuit being thus closed through one primary coil and broken through the other, the same inductive effect is produced upon the secondary as in the first-described form of the apparatus.

In the modified form of the apparatus illustrated in the diagram Fig. 6, an arm, C, projects inwardly from the center of the diaphragm D. An equal-armed lever, F^2, is pivoted at one side to the inner end of this arm by means of a projection, f^2, and at its other side it is pivoted by a similar projection to the end of a bent arm, F^3, projecting from the door of the box. From the opposite ends of this equal-armed lever pins c^3 and c^4 project downward, and are arranged to make contact alternately with carbon electrodes K^3 and K^4, which are supported by springs s s. (Shown in section.) The inner terminal of the outer primary coil of the induction-coil M is connected by a wire, w^{16}, to one pole of a battery, X^4, the other pole of which is connected by a wire, w^{17}, to pin h^3 on arm of lever F^2, which is next to the diaphragm, and the outer terminal of said primary is connected by a wire, w^{18}, with the carbon electrode K^3. The inner terminal of the inner primary is connected by a wire, w^{19}, with one pole of a battery, X^5, which has its other pole connected by a wire, w^{20}, with the pin h^4 on arm of lever F^2, which is turned away from the diaphragm, and the outer terminal of this inner primary is connected by a wire, w^{21}, with the carbon electrode K^4. This apparatus will be normally constructed so that the pin at the end of lever F^2 next to the diaphragm will be lightly in contact with carbon electrode K^3, and the pin at the other end will be just out of contact with carbon electrode K^4. Now, when the diaphragm moves inwardly the arm C will rock the lever F^2, so as to raise the pin at the end next to the diaphragm out of contact with carbon electrode K^3, while throwing the pin at the other end in contact with electrode K^4. Thus the circuit will be alternately closed and broken through the respective primaries of the induction-coil with the same effect of double induction produced by the two forms of the apparatus previously described.

I make no claim to the mechanical construction of the instrument herein described, as that is claimed in my application filed April 21, 1885, which is a division of this application.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The method of transmitting articulate speech telephonically which consists, first, in causing primary intermittent electrical impulses in the transmitting-circuits through the agency of sound-waves due to articulate speech; secondly, causing said primary impulses to generate secondary electrical impulses of an alternating nature; thirdly, causing said secondary electrical impulses to actuate a receiving-telephone at a distant station and reproduce said articulate speech accurately and clearly, substantially as described.

2. The method of transmitting articulate speech telephonically by causing intermittent electrical impulses to traverse an electrical circuit, and thereby generate secondary electrical impulses, which secondary electrical impulses in turn actuate a telephone-receiver and cause it to accurately reproduce the aforesaid articulate speech, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

JAMES P. FREEMAN.

Witnesses:
CHARLES S. HYER,
RUSSELL H. SCOTT.