

S. RUSSELL.
Electric Telephone.

Patented March 1, 1881.

Fig. 2.

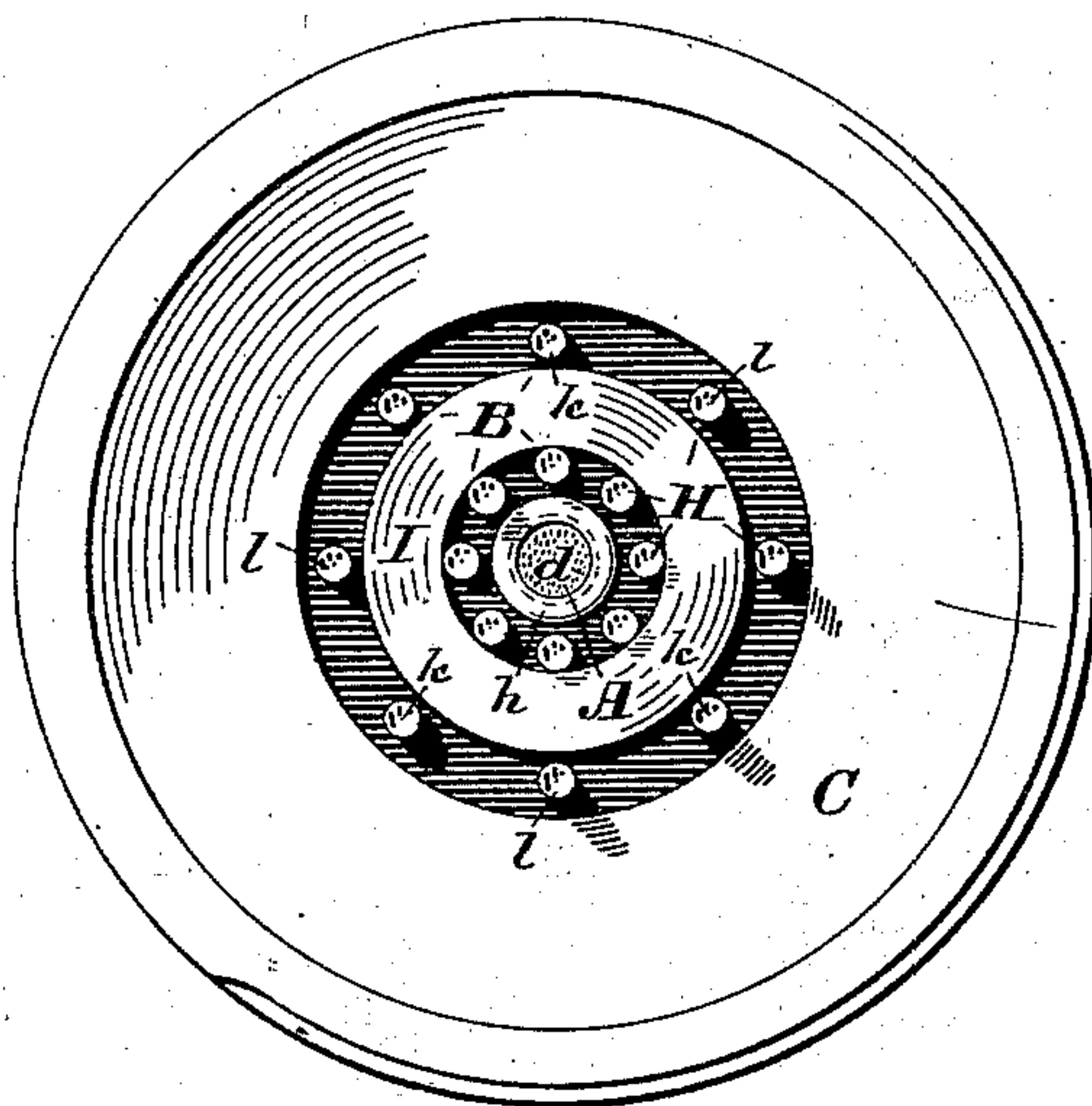
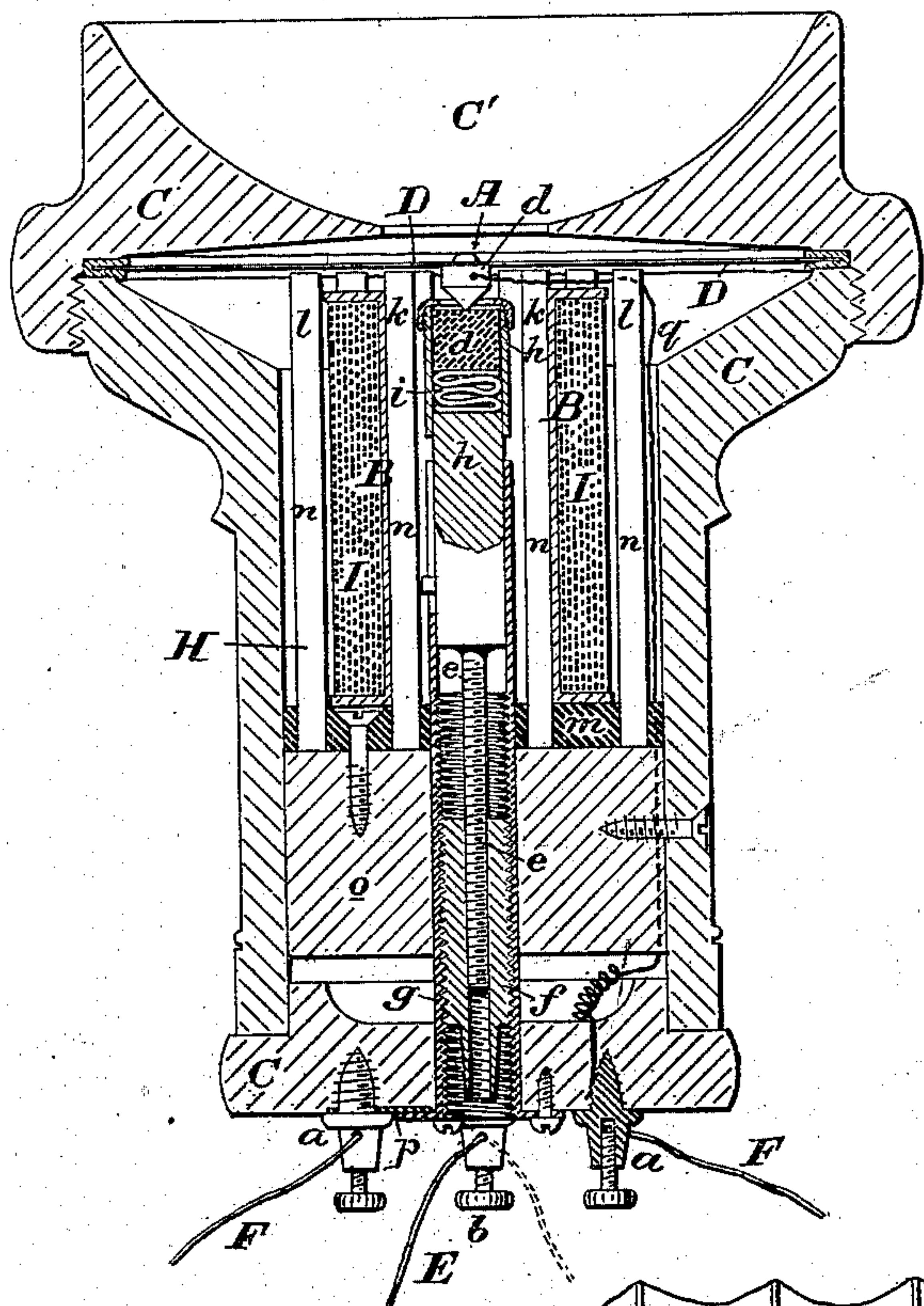
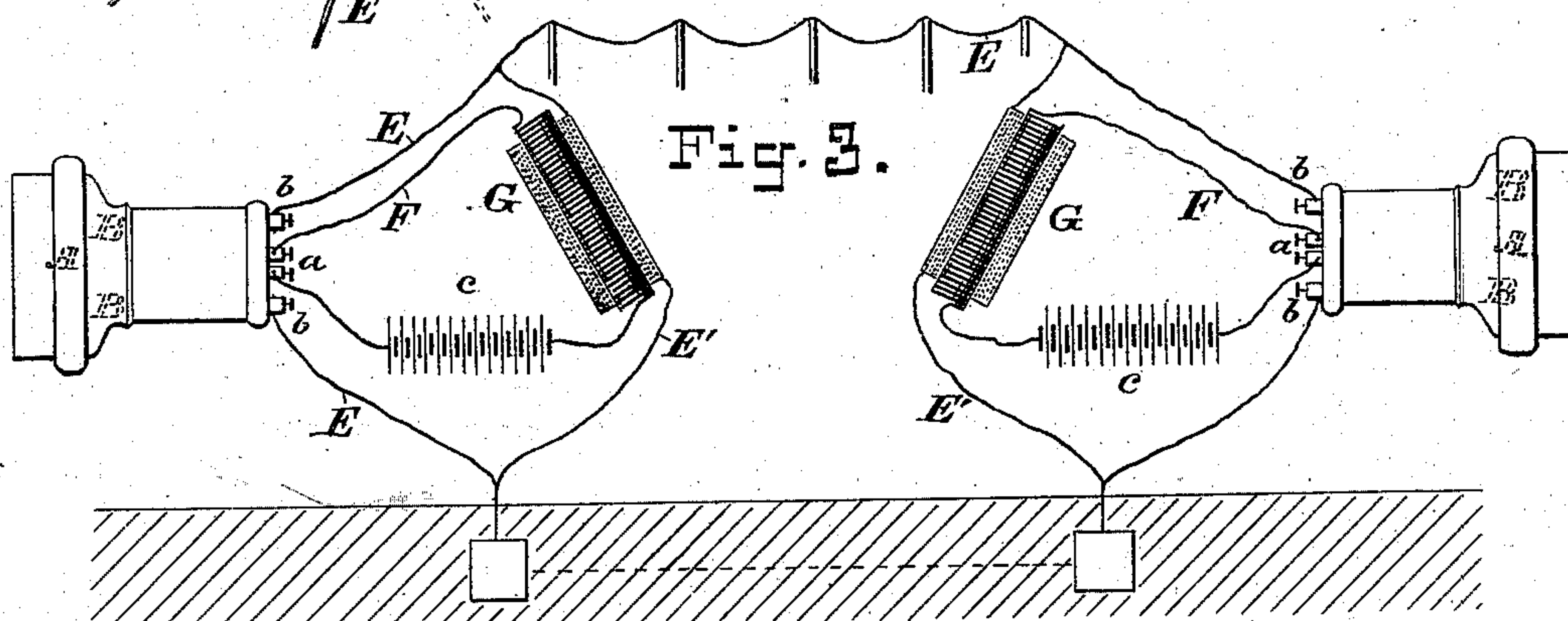


Fig. 3.



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UNITED STATES PATENT OFFICE.

SAMUEL RUSSELL, OF BROOKLYN, NEW YORK.

ELECTRIC TELEPHONE.

SPECIFICATION forming part of Letters Patent No. 238,253, dated March 1, 1881.

Application filed April 2, 1880. (No model.)

To all whom it may concern:

Be it known that I, SAMUEL RUSSELL, a citizen of the United States, residing at Brooklyn, in the county of Kings and State of New York, have invented certain Improvements in Electric Telephones, of which the following is a specification.

My invention relates to what are known as "reaction-telephones," or those in which an electrically-influenced magnet is combined with a resistance-varying battery-transmitter to react upon the diaphragm and amplify its vibrations. It is more especially an improvement upon the reaction-telephone of Thomson and Houston, wherein the diaphragm is acted upon by a single-bar magnet placed centrally behind it and surrounded by an induction-coil, which is in the same circuit as the resistance-varying device. This device consists of a pointed fragment of carbon fixed on the back of the diaphragm and dipping into a drop of mercury placed in a hollow made for it in the adjacent end of the magnet. As the diaphragm vibrates the carbon dips more or less into the mercury, and the differences of contact resulting therefrom produce undulations in the battery-current passing through the carbon and mercury, and these undulations affect the electro-magnet, causing it to attract the diaphragm with the most force when the latter is deflected downward, and to attract it with the least force when it is deflected upward, and thus augmenting its vibrations and increasing the power of the instrument. In receiving, the electro-magnet acts upon the diaphragm in the same way as the magnet of any ordinary magnetic telephone.

The object of my invention is to combine together the most effective form of transmitter with the form of magnetic telephone which will secure the loudest and most marked effects in receiving.

My improved telephone is shown in the accompanying drawings, wherein—

Figure 1 is a longitudinal mid-section of my telephone. Fig. 2 is a plan of the same, the mouth-piece and diaphragm being removed; and Fig. 3 is a diagram illustrating the preferred arrangement of circuits in connection with my telephone.

Let A designate a battery-transmitting telephone as a whole, and B a magnetic telephone as a whole. The case C incloses both tele-

phones, and the mouth-piece C' and diaphragm D are common to both, and are or may be of the usual construction or formation.

The telephone A comprises the diaphragm D, solid resistance-varying contacts *d d*, and an adjusting device for regulating the mutual pressure upon the two contacts or the intimacy of their connection. The contacts are of solid substance, which conduct the electric current but indifferently, being preferably of platina-tipped metal and of carbon. The metal contact is connected to the center of the diaphragm, and the carbon contact, which is in the form of a block or button, is pressed against the metal contact by a spring or cushion, the tension of which is regulated by the adjusting device.

The magnetic telephone B consists of a series of magnetic poles arranged on opposite sides of the contacts *d d*, in close proximity to the diaphragm D, acting upon the latter consequently at two or more points, and surrounded by a common electric coil or helix, or each by a separate coil, the former arrangement being the preferable one.

Fig. 3 shows the circuit-connections of the telephone. The instrument A is in connection with the binding-posts *a a*, and the instrument B with the posts *b b*. E is the line-circuit extending from one station to the next, and F is a local circuit containing a battery, *c*, and in connection with the primary wire of an induction-coil, G, whose secondary wire is in a branch, E', of the circuit E, as shown in Fig. 3, or which may be in the main circuit E, the arrangement shown being, as I believe, the preferable one. The circuit E is in connection with the binding-posts *b b*, thus including the telephone B, and the circuit F is in connection with the posts *a a*, thus including the telephone A. In transmitting, the variations of the current in the circuit F, caused by the variations of resistance in the telephone A, affect the line-circuit through the medium of the induction-coil G, causing a varying current therein, which re-enforces and strengthens the similar current simultaneously developed therein by the action of the magnetic telephone B, and the augmented current thus formed acts upon the telephone B at the receiving-station.

By arranging a series of poles to act upon the diaphragm at opposite points around its center, I cause the diaphragm to vibrate over

a much larger proportional area of its surface in receiving, and in re-enforcing the action of the resistance-varying device in transmitting. A series of poles acting co-operatively and at
 5 different points have a more thorough control of the vibrations of a diaphragm than has a single pole centrally arranged.

In Figs. 1 and 2 is shown the preferred arrangement of the poles around the contacts
 10 *d d*. *k k* are a series of poles of like polarity (north, for instance) arranged in a circle close around the contacts *d d*; and *l l* are poles of opposite polarity (as south) arranged in a larger circle around the first-mentioned poles, and in
 15 the annular space between the two series is arranged the electric coil *I*, whose ends extend to the binding-posts *b b*. The coil, by passing outside of one series of poles and inside of the other, acts oppositely upon each, in accord-
 20 with their opposite polarity.

In Fig. 1 is shown my improved method of connecting the carbon contact *d* to its adjusting device. The block or button of carbon is held loosely in a cup, *h*, in the bottom of which
 25 is placed a spring or elastic cushion, *i*. The cup *h* is provided with a threaded stem, *e*, which projects back and is engaged by an externally and internally threaded tube, *f*, which works in a fixed threaded tube, *g*. The out-
 30 side and inside threads of the tube *f* are of unlike pitch, thus making it a differential screw, by which an exceedingly accurate adjustment may be secured. The outer end of the screw *f*
 35 is squared for engagement by a key, or it may project beyond the case and be provided with a milled head. The tube *g* extends forward to and forms a guide for the cup *h*, and the latter is provided with a laterally-projecting lug,
 40 whereby the stem *e* is kept from rotating with the screw *f*. The tube *g* is fastened to the cap of the case, and is supported by passing through a block, *o*, which also supports the magnets. The several magnetic poles *k k* and
 45 *l l* are in the form of slender straight pins, and their lower or back ends are all inserted in or fixed to a base-plate, *m*, of magnetizable metal, which is screwed to the block *o*. The compound magnet or magnetic battery thus formed
 50 I have designated by the letter *H*. The plate *m* serves as a means of magnetic communication between the several poles, merging together and equalizing their magnetism, and insuring their co-operative action. I make no
 55 claim in this application to this form of magnet, it being the subject of a separate application.

I am aware that a series of poles of like polarity has been arranged in a small circle, with
 60 or without a second series of poles of the opposite polarity arranged around the first, this being shown in my Patent No. 228,395, dated June 1, 1880; but I am not aware that poles so arranged have ever been employed
 65 in a reaction-telephone, or ever used in any way in connection with resistance-varying contacts.

I am also aware that a carbon contact has been backed by an elastic cushion in an inclosing-cup, and the cup and its contents have
 70 been adjusted by a screw behind; but the carbon has been in the form of powder into which the metal contact enters, and it has been sandwiched between two cushions, the result of
 75 screwing forward the cup being not to press the carbon contact with greater force against the point of the metal one; but to compact the grains of carbon closer together and make the carbon itself a better conductor, as well
 80 as to force the particles against the sides of the metal contact.

I claim as my invention—

1. The combination of the diaphragm *D*, with a solid resistance-varying contact, *d*, placed at its center, another solid contact, *d*,
 85 pressed lightly against the first, and two or more magnetic poles, *k k*, of like polarity, arranged on opposite sides of or surrounding the contacts facing the diaphragm and inclosed
 90 by an electric coil or coils, whereby, in transmitting, the resistance-varying contacts act as a battery-transmitter, and the diaphragm and magnetic poles and coil act co-operatively as
 95 a magnetic transmitter, and in receiving the magnetic elements alone act, substantially as set forth.

2. The combination of the diaphragm *D*, resistance-varying contacts *d d*, arranged at its center, a series of magnetic poles, *k k*, of one
 100 polarity (as north) arranged in a circle surrounding the contacts and facing the diaphragm, an electric coil, *I*, inclosing said poles, and a second series of poles, *l l*, of the opposite
 105 polarity (as south) arranged in a circle closely surrounding said coil, and also facing the diaphragm, substantially as set forth.

3. In a battery transmitting-telephone, the combination of a solid resistance-varying contact, fixed to the diaphragm, with another
 110 similar contact held loosely in a cup, capable of sliding back and forth therein, seated upon a spring or elastic cushion in the bottom of
 115 said cup and adjusted to press bodily against the first contact by adjusting the cup toward or from the latter, substantially as set forth.

4. The combination of the diaphragm *D*, solid contacts *d d*, cushion *i*, cup *h* fixed to a
 120 screw *e*, differential screw *f*, and fixed threaded guide-tube *g*, all arranged and operating substantially as set forth.

5. The combination, to form a telephone, of the case *C*, diaphragm *D*, contacts *d d*, adjusting device *e f*, guide-tube *g*, block *o*, magnet *H*, composed of poles *k l* and plate *m*, and
 125 coil *I*, all arranged substantially as shown and described.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

SAML. RUSSELL.

Witnesses:

ARTHUR C. FRASER,
 HENRY CONNETT.