(No Model.)

2 Sheets—Sheet 1.

E. M. HARRISON.

TELEPHONE.

No. 476,200. Patented May 31, 1892.

Fig. 8.

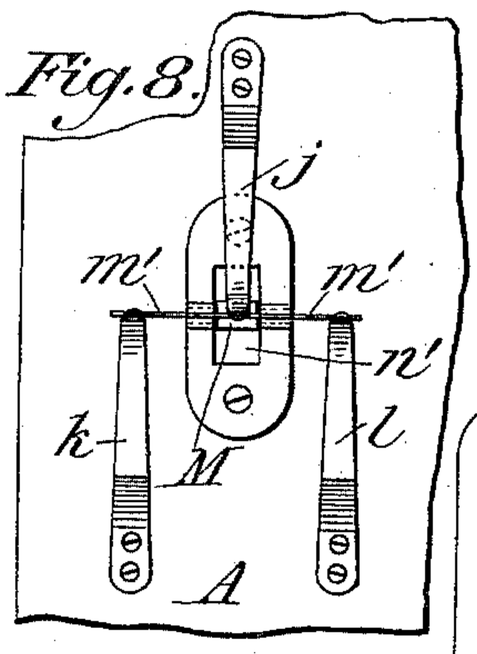

Fig. 1.

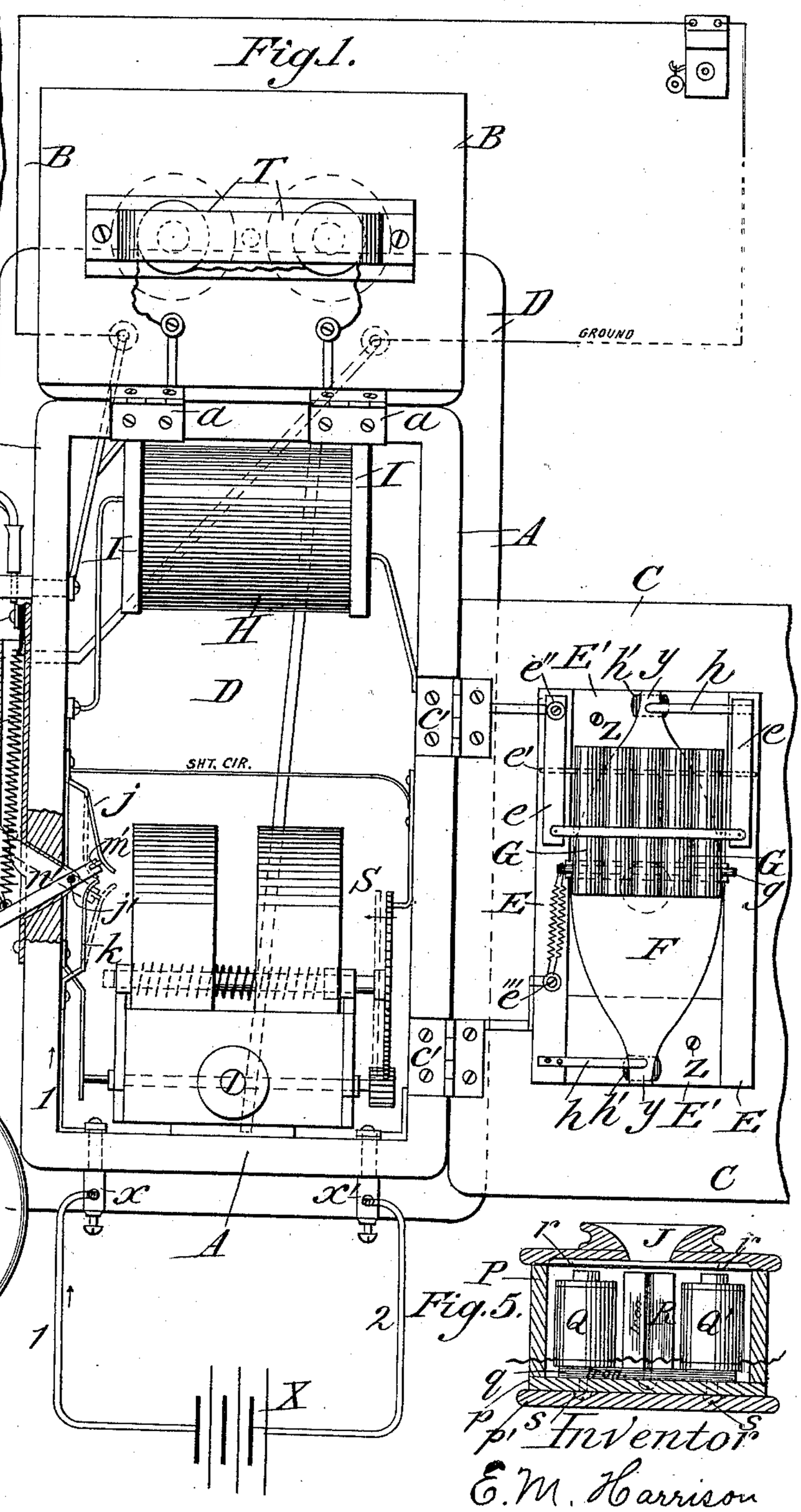

Fig. 5.

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(No Model.) 2 Sheets—Sheet 2.

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Fig. 2.

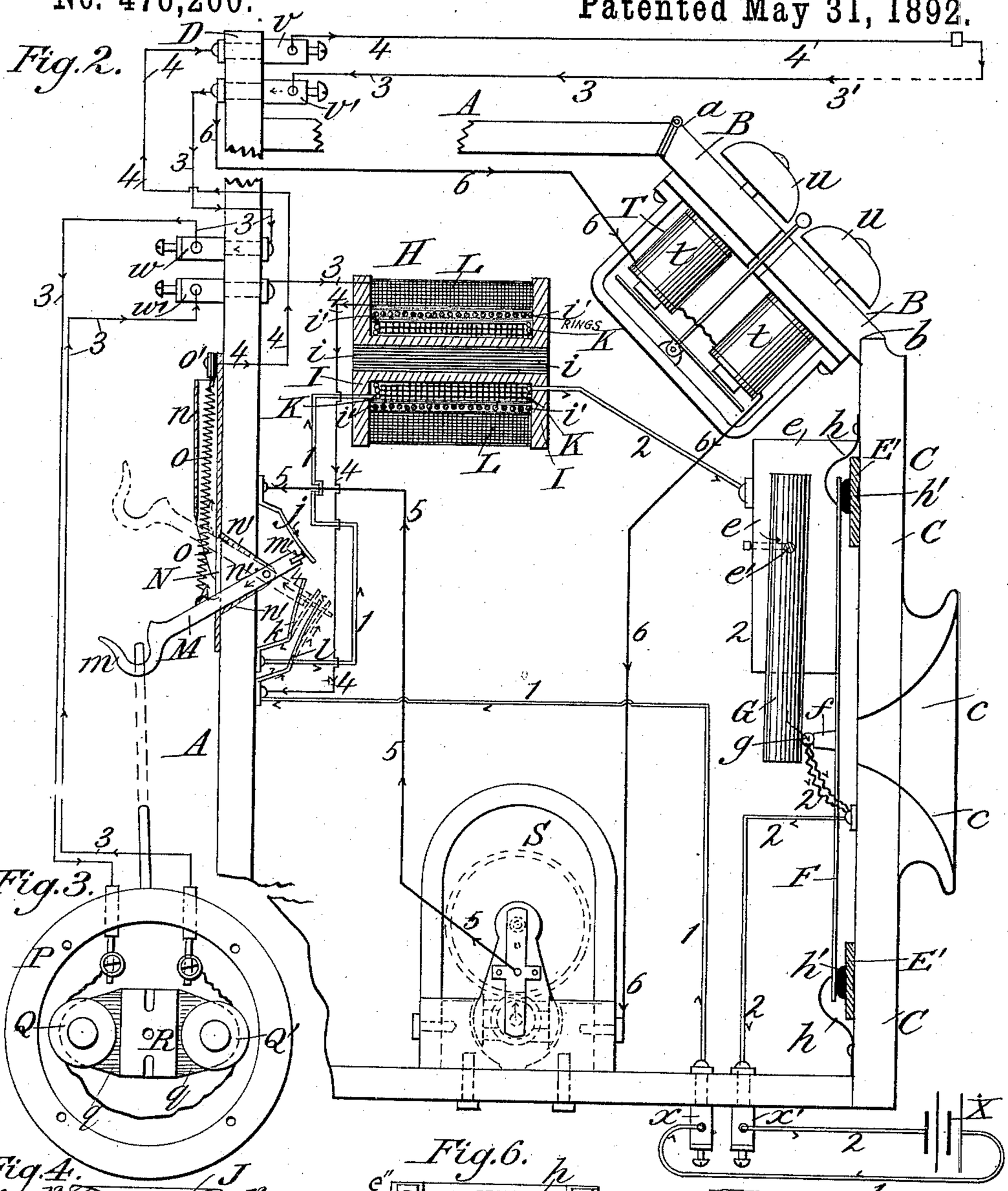


Fig. 3.

Fig. 4.

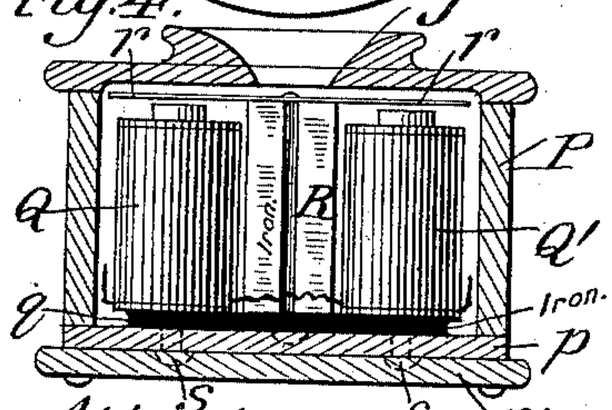


Fig. 6.

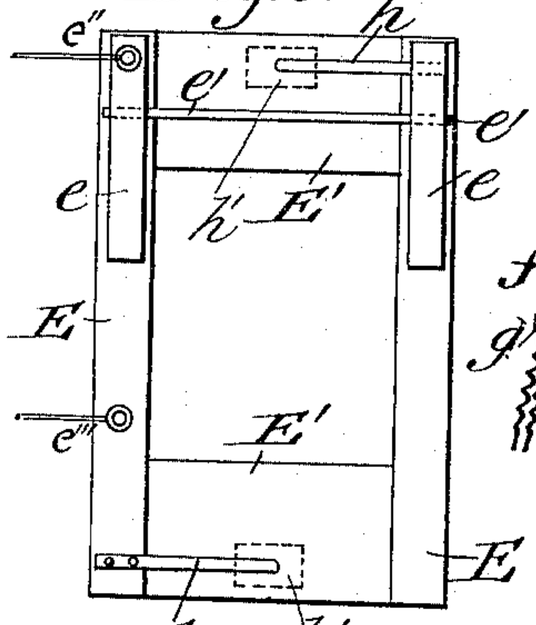
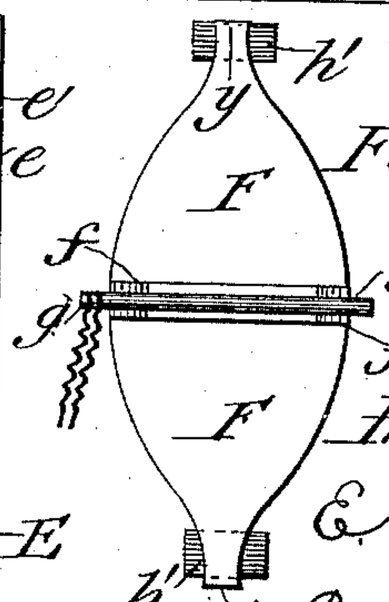


Fig. 7.



Attest:

H. C. Schott

M. A. M. Trapper

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Atty.

UNITED STATES PATENT OFFICE.

EDWARD M. HARRISON, OF FORT SMITH, ARKANSAS.

TELEPHONE.

SPECIFICATION forming part of Letters Patent No. 476,200, dated May 31, 1892.

Application filed August 9, 1890. Serial No. 361,599. (No model.)

To all whom it may concern:

Be it known that I, EDWARD M. HARRISON, a citizen of the United States, residing at Fort Smith, in the county of Sebastian and State of Arkansas, have invented certain new and useful Improvements in Electric Telephony, of which the following is a specification.

This invention relates to an electric telephone in which are utilized the well-known galvanic current of 1786 and Faraday's induced current of 1837 by means of my improved phonetic transmitter, my phonetic motor or receiver, my improved switch device or battery cut-out, and certain details of construction, as will be hereinafter fully described.

The object of my invention is to make the telephone-case as strong, compact, durable, and easy of access to its interior as possible; to improve the Reis and Hugh's phonetic transmitter by providing a diaphragm of a new and improved shape and a separate frame supporting the pendent electrodes and said diaphragm independent of each other, so as to facilitate the instantaneous vibrations of the diaphragm, thereby leaving the extreme ends and edges of said diaphragm free to vibrate; also to reduce the resistance of the flow of the galvanic current through the phonetic transmitter to the minimum; to provide an improved Faradic electric generator or induction-coil; to provide a new and improved electro-phonetic motor or receiver; to provide an improved cut-out or switch, and certain details of construction for connecting my electrical devices one with the other to form an operative combination, as hereinafter described.

The matter constituting my invention will be defined in the claims.

I will now particularly describe my improvements in the telephone by reference to the accompanying drawings, in which—

Figure 1 represents a front elevation of the telephone box or case with the doors thrown open and showing the back of the phonetic transmitter secured to the front door, the magneto-bell coils secured to the upper door, the induction-coil in the upper part of the case, the magneto-generator in the lower part of the case, the switch secured to the left-hand side of the case and the phonetic motor or receiver hung on the switch-bar. Fig. 2 represents a diagrammatic view of the parts of my telephone arranged for conveniently exhibiting their construction and electrical connections. Fig. 3 represents a front view of the electro-phonetic motor or receiver with the earpiece removed, showing the permanent magnet arranged in proper relation to the electro-magnetic coils. Fig. 4 represents a longitudinal section of the phonetic motor or receiver having the thin metal diaphragm in contact with the permanent magnet. Fig. 5 represents a longitudinal section of the upper part of the phonetic motor or receiver having the diaphragm resting at its edges or corners on the top of the case. Fig. 6 represents a front view of the frame for holding the phonetic transmitter diaphragm. Fig. 7 represents a front view of the wooden phonetic diaphragm having the transverse wooden bridge and carbon rail or hammer in proper position thereon.

Similar letters of reference designate corresponding parts in the different figures of the accompanying drawings.

The inclosing telephone box or case A is composed of a back board D, which projects up above the top of the box a short distance for the purpose of receiving the binding-posts of the line-wires and any suitable form of lightning-arrester and of suitable sides, top, and bottom wooden walls. The upper front corners of the side walls are cut off diagonally to provide for arranging the upper door B in an inclined position, as shown in Fig. 2, and said door is united to the top of the case by hinges *a*. The front of the case below the inclined door B is closed by the vertical door C, which is joined to one side of the case by hinges *c'*, as shown in Fig. 1.

The front edge of the door B is rabbeted to form an angular recess *b*, adapted to receive the upper angular edge of the lower door C and make a tight joint therewith for excluding the dust, as shown in Fig. 2. In closing the case, door B is first shut down and then door C is closed and locked, with its upper edge fitting in the recess *b*, thereby holding the upper door tightly in place. When the doors B and C are thrown open, free access is given to all the mechanism in the

interior of the case, so that any part may be readily repaired or adjusted when required.

The ringer T, provided with bell-coils *t t*, is secured to the under side of door B, as shown in Figs. 1 and 2.

My phonetic transmitter, arranged in a suitable frame, is secured to the inside of door C, and such door is provided with the conical mouth-piece *c*, just in front of the transmitting diaphragm, as shown in Fig. 2.

For the purpose of supporting my phonetic transmitter I provide a frame E, composed of the parallel side bars E and the cross-bars E′ E′ at top and bottom. To the upper ends of the side bars E of the frame are secured the two brackets *e e*, which are perforated transversely for receiving and holding the metal pivotal rod *e′*, which pivotally supports the pendent electrodes G. These electrodes are provided with transverse holes near their upper ends and the pivotal rod *e′* is passed through such holes and through the holes in the brackets *e*. Two rubber cushions *h′ h′* are glued either to the cross-bars at the top and bottom of the frame or to the under side of the diaphragm F for permitting the free and ready vibration of the diaphragm. On the bracket *e* next to the hinge I secure a washer *e″* for making electrical connection with the metallic hinge and thence to the induction-coil. On the side bar E of the frame adjacent to the hinge I secure a second washer *e‴* for making electrical connection to the hinge and thence through the binding-post *x′* to the battery X. The frame is secured to the door C by means of screws *z*, passed through the end pieces E′.

The diaphragm F of the phonetic transmitter is composed of a single piece of thin wood or its equivalent, about the twenty-fourth of an inch thick and of a peculiar elliptical shape, having elongated portions *y y* at the ends of the long axis of the ellipse or at the arches of the ellipse, as shown in Figs. 1 and 7. A transverse wooden bridge *f* is secured to about the middle portion of the diaphragm, and has secured to its upper surface the carbon-rod or hammer-electrode *g*, upon which rests the pendent anvil-electrodes G, as shown in Figs. 1 and 2. At one end of the carbon electrode *g* there is attached one of the primary wires from the binding-washer *e″*, which is in electrical connection with the battery. The diaphragm F is lightly supported in its frame with its elongated ends *y y* resting on the rubber cushions *h′*, and is held in position by two thin springs *h* at top and bottom, which springs are secured at their ends to the frame, as shown in Figs. 1 and 6. These springs being thin and light, exert only sufficient pressure to lightly hold the diaphragm in place and do not interfere with its free vibration or motion.

By making the diaphragm of my phonetic transmitter independent of the anvil-electrodes G, the brackets *e*, and the frame E E′, I thereby on producing instantaneous vibrations of the diaphragm, from whatever cause, give the maximum motion to the lower ends of the anvil-electrodes and the minimum motion to the upper ends thereof. I claim this to be a great advantage over any of the Hugh's transmitters, in which the anvil and hammer electrodes are both mounted on the diaphragm and in which the motion given to both ends of the anvil-electrodes is consequently alike and at the same time.

It is evident that by means of my construction and arrangement of the diaphragm, so as to be independent of the anvil-electrodes and the brackets which support them, such diaphragm is much more sensitive and freer to vibrate by slight phonetic impulses, and therefore acts most effectively through the medium of its transverse rod or hammer-electrode upon the anvil-electrodes G. The carbon electrodes G hang from their pivotal rod *e′* nearly perpendicular, with their lower ends lightly resting on the carbon-rod electrode *g*, making a very loose connection between the hammer and anvil electrodes, which can therefore be easily put in motion by the least vibration of the diaphragm. The air put in motion on entering the case through the conical mouth-piece escapes above and below the lateral arches of the elliptical diaphragm, and therefore there does not occur rebounds of the air, which produce overtones and prevent the free and instantaneous vibration of the diaphragm. These two separate and distinct currents are used on two separate and distinct circuits. The short circuit 1 2 is a local circuit, which the galvanic current flows over, passing from the battery X to the switch-springs *k l*, and thence to the induction-coil H, thence to the transmitter-electrodes G *g*, and thence back to the battery X. The long circuit begins at the ground-wire 3′ and passes thence to the binding-post *v′*, thence on line 3 to binding-post *w*, thence to the receiver P, Fig. 3, thence back to binding-post *w′*, thence to the secondary coil of the induction-coil H, thence out on line 4 to switch-spring *l*, up switch-bar M to spiral spring *o* or the escutcheon *n*, thence to binding-screw *o′*, up line 4 to binding-post *v′*, and out on line 4 to a kindred instrument.

The induction-coil is not of the ordinary experimental coils. Its general make-up is materially changed.

The primary coil K is wound on a wooden spool I, having a three-eighths-inch hole lengthwise through its center, which is filled with soft-iron wires or rods *i* the full length of the spool. The primary coil K is composed of three layers of No. 20 silk insulated copper-wire, and next to this copper-wire coil is one or two layers of paper wrapped to the thickness of about the one-twenty-fourth of an inch. On top of this paper is placed a single layer of either circular or longitudinal No. 20 soft-iron wires *i′*, side by side, until the circum-

ference of the card-board is completely covered therewith. Then outside of these wires is placed another layer or two of thin wood or paper about one twenty-fourth of an inch thick, thus forming a complete primary coil of my induction-coil. The secondary coil L is the ordinary No. 32 insulated copper wire of several hundred windings.

My electro-phonetic motor or receiver is shown in the sectional views, Figs. 3, 4, and 8. The receiver-case is composed simply of a wooden or hard-rubber circular box P, like a short cylinder, with two wooden bottoms *p p'* secured thereto, and an ear-piece J secured to the top. Internally it is provided with two electro-magnets Q Q', fastened to an iron heel-piece *q* by screws or rivets, and with the permanent magnet R, fastened between the two electro-magnets by screws or rivets to the same heel-piece *q*. The permanent magnets and the electro-magnets are exactly of the same length, and the electro-magnets are wound with very fine insulated copper wire their full length, but not on their upper or outer ends. A thin ferrotype-plate *r*, a fraction smaller in diameter than the inside diameter of the case, is fastened at its center with a screw to the permanent magnet, as shown in Fig. 4, whereby the plate is magnetized by direct contact.

Fig. 8 represents an electro-phonetic motor similar to the one shown in Fig. 4 and differing therefrom only in having the ferrotype-plate *r* raised just a fraction above the magnets and resting at its edges or corners on the top of the case, making a very valuable receiver or electro-phonetic motor. The adjusting-screws *s s* for the electro-magnets are covered by the cap or outside bottom *p'* of the receiver to keep moisture or perspiration of the hands from rusting them. When the instantaneous alternating flashes or currents of electricity from the induction-coil H reach the receiver, they pass through the coils Q Q', and therefore exert a magnetic force upon the ferrotype-plate *r*. When these instantaneous flashes or currents in the coils are in such a direction as to assist the power of the steel-magnet R, the ferrotype-plate *r* is drawn nearer, and when it is in the opposite direction, and so opposes this attraction, the plate *r* moves farther away. The succession of alternating currents or flashes of electricity therefore produce instantaneous vibrations in the ferrotype-plate *r* similar to the instantaneous starts and stops of the wooden transmitter diaphragm F, so that the sounds emitted by the receiving ferrotype-plate *r* are similar to those sounds actuating the transmitter. From this it will be seen that the transmitter by its instantaneous vibrations acts as a generator, converting the instantaneous starts and stops or mechanical energy of the diaphragm F into induced or Faradic electrical energy, while the receiver acts as an electro-phonetic motor, converting electrical energy of the main line into mechanical vibrations or instantaneous starts and stops of the ferrotype-plate *r*, producing the tones and sounds of the transmitter. The tones and sounds themselves, it will be noticed, are not transmitted from one point to the other.

In order to save the battery when not in use, I provide at some convenient part of the primary circuit a cut-out or switch M *j k l*, the form which I prefer on account of its simplicity and trustworthiness in these connections. It consists of a long metal bar M, having a hook *m* at its outer end and at its inner end a thin horizontal piece of metal *m'* tempered very hard. The bar M is pivoted near its inner end to the socket *n'* of the escutcheon N. The upper part of the escutcheon is elongated in the form of a tube or cylinder *n*, which contains a stiff spiral spring *o*, secured at the top by the binding-screw *o'* to the wall of the case and engaging at its lower end with switch-bar M, and serving to pull the hook end of said bar up when the weight is removed therefrom. The ground connection 3' of the line-wire is made fast to the upper end of the escutcheon by binding-screw *o'*, giving three easy courses for the induced flashes of electricity to pass over, first, from the binding-screw *o'* down the spring to the switch-bar M; second, from the binding-screw *o'* down the escutcheon to the switch-bar M at its junction near the spring; third, down the back of the escutcheon to the pivot *j'*, and thence through bar M to either of the switch-springs *j*, *k*, or *l*.

The switch-springs *k l* represent the terminals of the primary and line circuits. If the receiver is removed from hook *m*, the spiral spring *o* will raise bar M, thereby shifting the metal contact-piece *m'* from spring *j* to springs *k l*, thus cutting out the magneto bell-ringer T and connecting into circuit the battery X to the phonetic transmitter and the phonetic motor or receiver P to the line-wire 4.

In order to call a person to a kindred telephone at a distance, and the switch-bar being down, as shown in the drawings, the crank of the generator S is given a few turns, producing a current of electricity, which flows out over circuit 5 through the switch, thence on main line 4, thereby ringing the bell of a kindred telephone, then through the return or ground circuit 3 to binding-post *v'*, thence through circuit 6 to the bell-coils *t t*, thus ringing bells *u u*, and finally down circuit 6 to the generator S.

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

1. A telephone-case provided with a fixed top piece, an upper inclined door hinged at at its inner edge to said top piece and having a rabbeted or recessed outer edge, and with a front lower door hinged to one of the side walls of the case and fitting at its top inner edge into the rabbet of said inclined door,

making a tight joint therewith, whereby the case may be fully opened for inspection and the inclined door may be held closed by the lower door and dust excluded, substantially as described.

2. A telephone-case provided with a fixed top-piece, the upper inclined door B, hinged to said top piece and having a rabbeted outer or front edge, and also having the ringer secured to its under side, said case being also provided with a lower door C, fitting at its upper edge into the rabbet of door B and having secured to its inner side the phonetic transmitter, substantially as described.

3. In a phonetic transmitter, the diaphragm having an elliptical shape, in combination with means for supporting it and leaving its edges free, substantially as described.

4. In a phonetic transmitter, the diaphragm of an elliptical shape, with narrow extensions at the ends of the long axis, in combination with supporting devices, the edges of the diaphragm being left free, substantially as described.

5. In combination with a frame, an elliptical diaphragm having extensions at the ends of its long axis resting on the frame and supporting-springs bearing on said extensions, substantially as described.

6. In combination with a frame, an elliptical diaphragm, cushions interposed between its ends and said frame, and supporting-springs bearing on the ends of the diaphragm above said cushions, substantially as described.

7. In combination with a frame, an elliptical diaphragm resting at its ends on the frame and having a transverse bridge and carbon-rod electrode, and springs adapted to hold the diaphragm in the frame, substantially as described.

8. A frame provided with side brackets at its upper ends having pivotally supported therein the pendent carbon electrodes, in combination with the elliptical diaphragm supported at its ends in said frame and provided with a transverse bridge and carbon-rod electrode in contact with said pendent electrodes, substantially as described.

9. The phonetic motor or receiver having two electro-magnets wound their full length and a permanent magnet between, all being of the same length and secured to a soft-iron heel-piece, adjusting-screws bearing on said heel-piece, a ferrotype diaphragm supported normally out of contact with the ends of the electro-magnets, and an inclosing case, all combined substantially as described.

10. The combination, in a telephone-switch, of a swinging metallic bar or lever having secured to its inner end a thin horizontal metallic bar, an escutcheon having an upper cylindrical end, and a socket n', having a pivotal eye, a strong spiral spring in said cylindrical end for the purpose of pulling the switch-lever up, said bar being pivotally connected to said socket, three flat springs to make the different connections with the horizontal bar as the switch-lever is moved up and down, substantially as described.

In testimony whereof I have hereunto subscribed my name.

EDWARD M. HARRISON.

Witnesses:
A. H. BOLES,
FRED TITGEN.