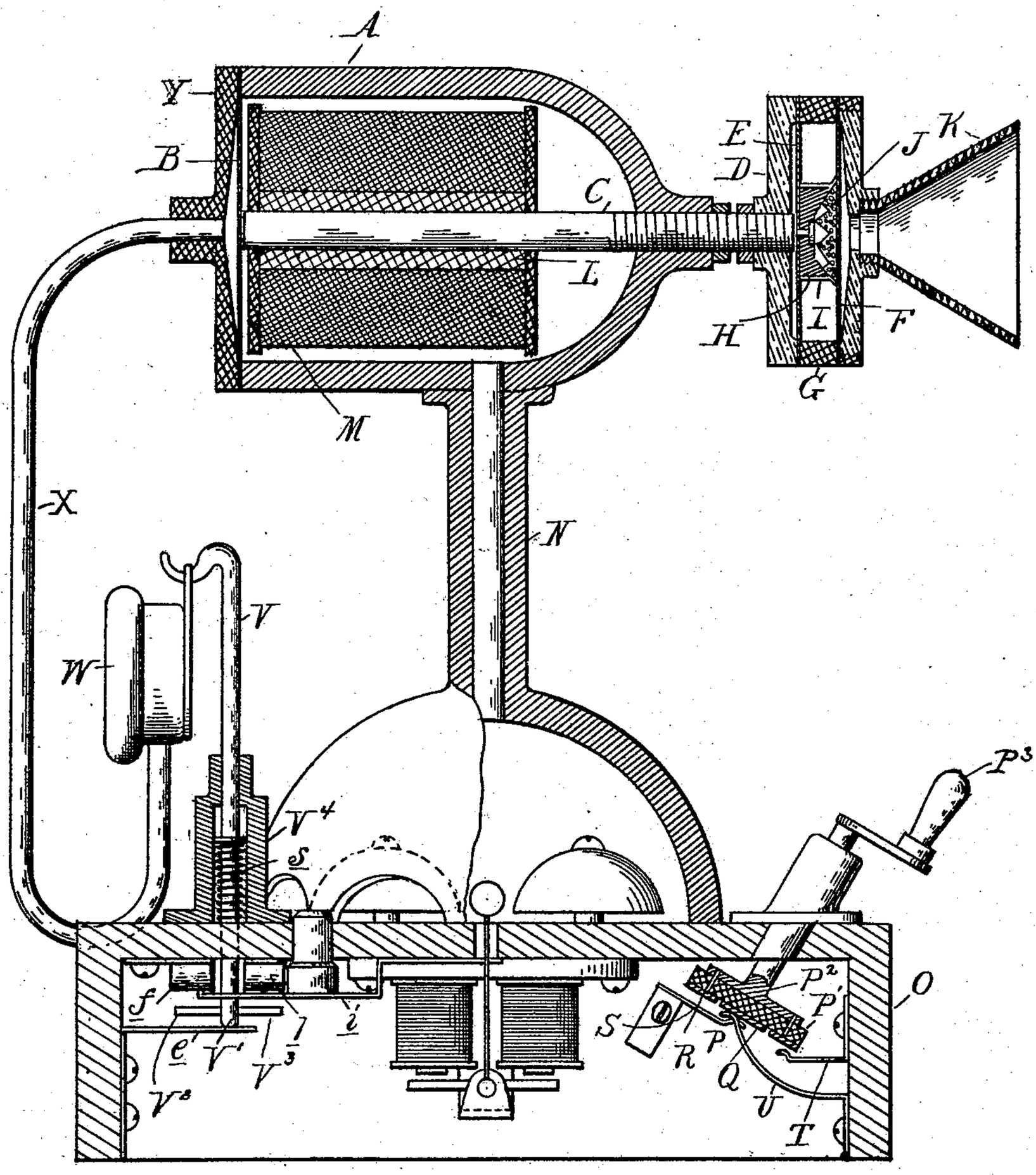
(No Model.) 2 Sheets—Sheet 1.

C. J. SCHWARZE.

TELEPHONIC APPARATUS.

No. 572,775. Patented Dec. 8, 1896.

Fig. 1.



Witnesses
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(No Model.) 2 Sheets—Sheet 2.

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Fig. 1.

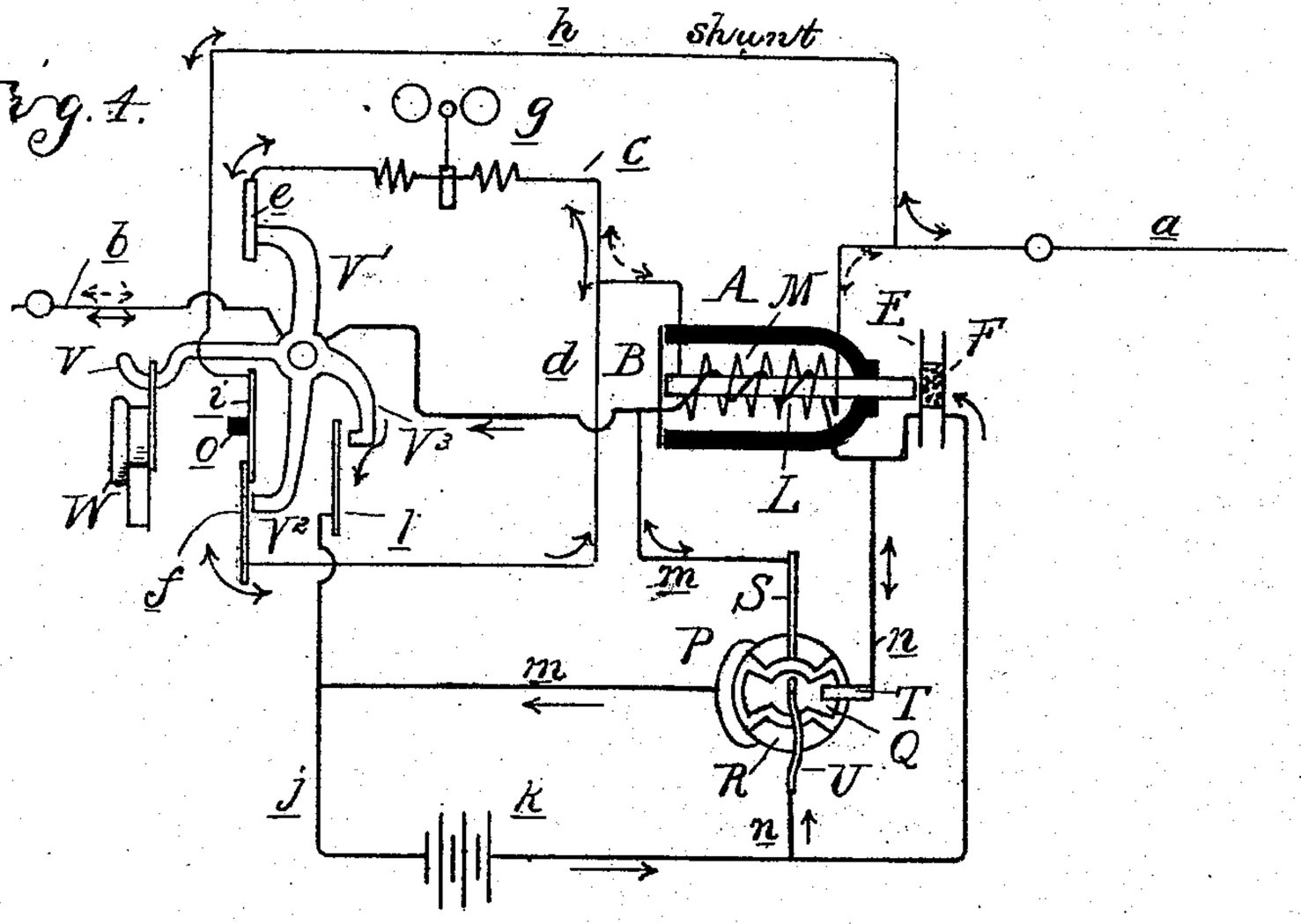


Fig. 3.

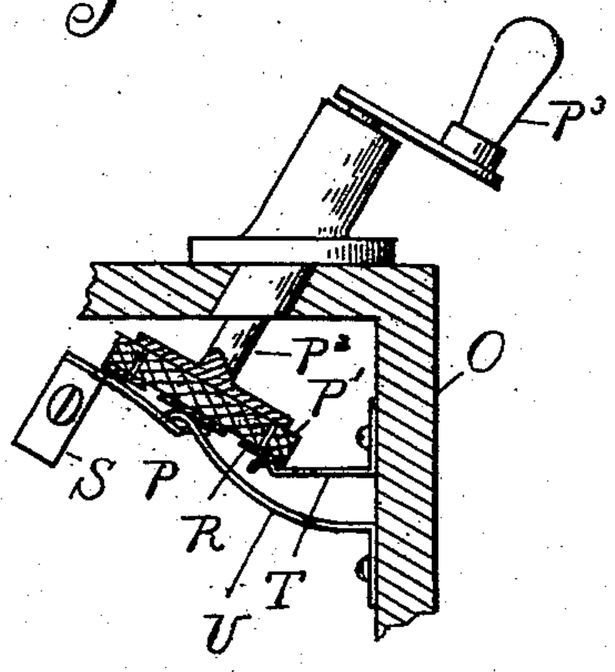
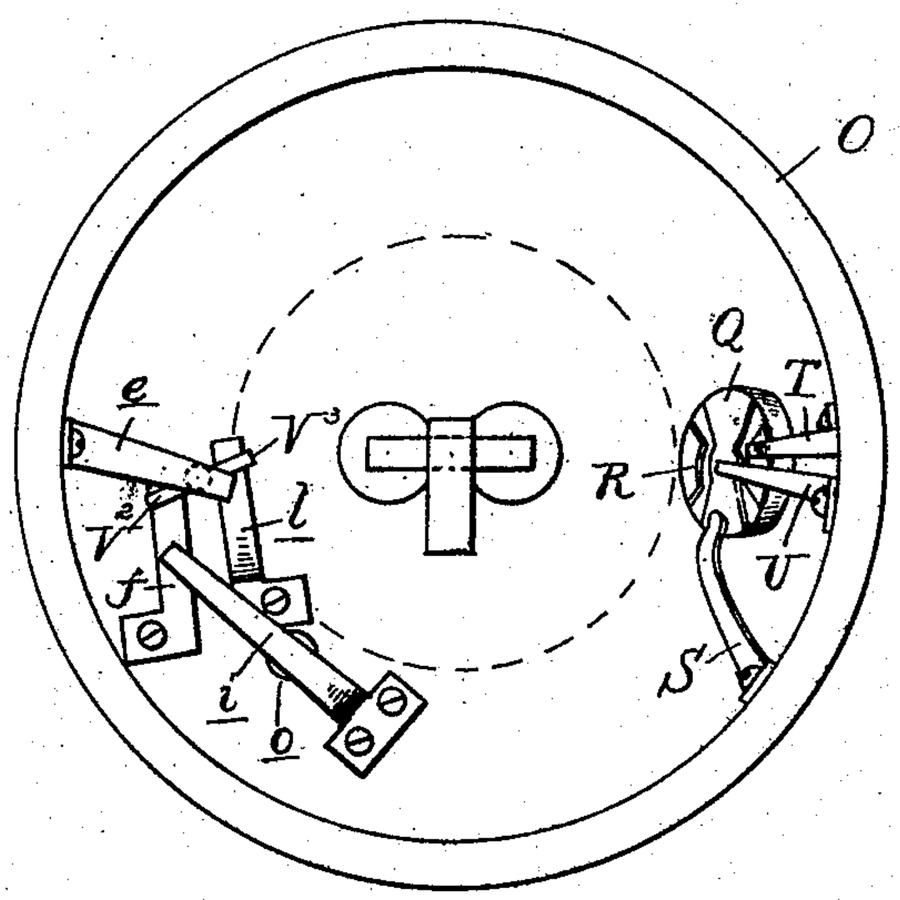


Fig. 2.



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UNITED STATES PATENT OFFICE.

CARL JOSEPH SCHWARZE, OF ADRIAN, MICHIGAN.

TELEPHONIC APPARATUS.

SPECIFICATION forming part of Letters Patent No. 572,775, dated December 8, 1896.

Application filed June 30, 1896. Serial No. 597,545. (No model.)

To all whom it may concern:

Be it known that I, CARL JOSEPH SCHWARZE, a citizen of the United States, residing at Adrian, in the county of Lenawee and State of Michigan, have invented certain new and useful Improvements in Telephonic Apparatus, of which the following is a specification, reference being had therein to the accompanying drawings.

My invention relates to a telephonic apparatus comprising transmitting, receiving, and signaling instrumentalities organically combined in a single instrument.

The invention consists in the peculiar construction of a transformer for the transmitter adapted to also form the receiver and, in conjunction with a battery connected with its primary coil and means for pulsating or alternating the primary current, constituting the signal-generator.

The invention further consists in the peculiar construction, arrangement, and combination of parts, as more fully hereinafter described and claimed.

In the drawings, Figure 1 is a vertical central longitudinal section of my instrument. Fig. 2 is a bottom plan view of the base. Fig. 3 is a detail view of the commutator. Fig. 4 is a diagram showing the arrangement of electrical circuits.

A is a permanent magnet in the form of a bell-shaped casing having a diaphragm B extending across its mouth, forming one of the poles of the magnet.

C is a soft-iron core extending longitudinally through the center of the casing, with one end in proximity to the diaphragm B and the other passing out through the end of the casing.

D is a head, of non-magnetic material, secured to the projecting end of the core C. E is a diaphragm, preferably of iron, extending across this head in proximity to the end of the core C.

F is a diaphragm, preferably formed of carbon, arranged in front of the diaphragm E and separated therefrom by the ring G, of insulating material.

H is a carbon plate secured to the diaphragm E, having its outer face notched or roughened. I is a ring, of soft material, surrounding this plate and bearing against the diaphragm F.

J is the microphone material, preferably consisting of granular carbon, inclosed within the ring I and between the plate H and diaphragm F.

K is a funnel-shaped mouthpiece in front of the diaphragm F.

Within the casing A and surrounding the core C is a transformer or induction-coil comprising the primary winding L and secondary winding M.

The casing A is preferably mounted upon a suitable standard, such as the tube N, secured to the base O.

P is a commutator, preferably arranged within the base O, and comprising a head P′, of insulating material, on a shaft P^2, having the crank P^3 for revolving it.

Q and R are commutator-plates arranged on the face of the head P′.

S and T are brushes arranged opposite the plates Q and R, but normally out of contact therewith, being brought into contact by an endwise movement of the head.

U is a spring bearing against the plate Q, which serves to hold the commutator in its normal position, out of contact with the brushes S and T, and also to form an electrical connection with said plate.

V is a movable switch-hook secured in any convenient place and provided with the contact-arms V′, V^2, and V^3.

W is the ear-phone, adapted to be hung on the switch-hook V and connected by the flexible tube X to the cap Y in front of the diaphragm B.

The electrical connections and circuits are arranged as follows:

a is the main line, and *b* is the ground or return line. The former includes the secondary coil M of the transformer and is divided at its end into two branches *c* and *d*, terminating, respectively, in the contact *e* and spring-contact *f*. The return-line *b* is connected with the switch-hook V, the arms V′ and V^2 of which are adapted to contact, respectively but alternately, (according to the position of the switch,) with the contacts *e* and *f*.

g is the magnet of the signal-bell included in the branch *c*.

h is a shunt around the coil M, having the spring-contact *i*, with which the spring *f* contacts whenever the arm V^2 is withdrawn from contact with said spring *f*.

j is a local circuit including the primary coil L of the transformer, the battery *k*, the microphone, (comprising the diaphragms E and F, plate H, and granular carbon J,) and a break formed by the arm V^3 of the switch-hook, which is adapted to contact with the contact *l*. *m* and *n* are shunts around said break and microphone, respectively, and including the commutator P, three of the terminals being connected with the brushes S T and spring U, respectively, and the fourth being connected through the bearings and shaft to the commutator-plates R.

When the telephone is not in use, the ear-phone is hung on the switch-hook V, holding said hook in the position where the arm V′ is against the contact *e* and the arms V^2 and V^3 are withdrawn from their respective contacts. In this position of parts the shunt *h* is also closed by the spring *f* pressing against the contacts *i*, so that the signal-current from the other end of the line *a* may pass through the shunt *h*, spring *f*, branches *d* and *c*, bell-magnets *g*, and the arm V′ of the switch-hook to the ground or return line *b*, as indicated by arrows in Fig. 4, thereby sounding the bell.

To use the instrument as a signal-generator, the operator presses in on the crank of the commutator to force the contacts Q and R against the brushes S and T, and then revolves the commutator, which sends the battery-current alternately in opposite directions through the primary coil L of the transformer, inducing an alternating current in the secondary coil M. At the same time he presses upon a button O, connected to the spring *i*, which opens the shunt *h* and compels the induced current to pass through the branch *c* and over the line *a*, as indicated by dotted arrows.

With each reversal of the current in the coils a corresponding magnetic disturbance is created in the core C, which has the effect of altering the pull on the diaphragm E and agitating the microphonic material between said diaphragm and the diaphragm F.

To use the device as a speaking instrument, the operator removes the ear-phone from the switch-hook, which latter when released from the weight of said ear-phone will be turned by a suitable tension device into the position where the arm V′ is withdrawn from the contact *e* and the arms V^2 and V^3 press against their contacts, the arm V^2 also pressing the spring *f* out of contact with the contact *i* and opening the shunt *h*. The local circuit *j* is thus closed and the battery-current is made to undulate in the coil L of the transformer by the action of the microphone, as in the common microphone-transmitter. The bell-magnets are cut out of the main circuit by the opening of the branch *c* and closing of the branch *d*, thus reducing the resistance of the circuit.

The receiving instrument is formed by the diaphragm B, which is operated by the magnetic change in the permanent magnet caused by the variation of the current passing through the coil M of the transformer, the sound vibrations being conveyed through the flexible tube X to the ear-phone W.

Although I have shown and described a commutator for reversing the primary current in order to generate the signal-current in the transformer, I do not wish to be limited to this construction, as it is obvious that any means of either reversing or interrupting the primary current will produce an alternating current in the secondary coil. Reversing the primary current is, however, preferable to pulsating it, and a revolving commutator which when at rest opens the circuit is a desirable construction.

The switch-hook V, I preferably form, as shown in Fig. 1 of the drawings, in the shape of a rod vertically slidingly secured in a bearing V^4 and supported on the spring *s*. The end of the rod projects into the hollow base and forms the contact V′, while a cross-pin forms the contacts V^2 and V^3. In the diagram Fig. 4 for sake of simplicity I have shown the switch as pivoted and provided with radiating arms forming the different contacts.

What I claim as my invention is—

1. In a telephone, the combination with a microphone-transmitter, a transformer therefor, having primary and secondary windings with a magnetic core, and a battery in local circuit with said microphone and primary winding, of vibrating diaphragms arranged in proximity to the opposite ends of said core, the one being in mechanical contact with said microphone and the other forming the receiver, and means for pulsating or alternating the current in said primary winding to induce an alternating signal-current and at the same time agitate the microphonic material in the transmitter.

2. In a telephone, the combination with a transmitter of a transformer therefor, comprising a bell-shaped permanent magnet having a diaphragm across its mouth forming one of the poles thereof, a soft-iron core extending into proximity to said diaphragm forming the opposite pole and primary and secondary windings inclosed within the magnet, said transformer constituting the receiver.

3. The combination with the microphone-transmitter, the transformer and the bell, of a line-circuit including the secondary winding of the transformer, and the branches *c* and *d* each containing a break and the former including the bell-magnet; a local circuit including the microphone, the primary coil of the transformer, the battery and a break, and a single switch controlling said breaks adapted in one position to open the branch *d* and

the local circuit and in its other position to close said branch and local circuit and open the bell branch *c*.

4. The combination with the microphone-transmitter, the transformer and the bell, of a line-circuit including the secondary winding of the transformer and the branches *c* and *d* each containing a break and the former including the bell-magnet; a shunt around the transformer connected to the branch *d*, a local circuit including the microphone, the primary coil of the transformer, the battery and a break, and a single switch controlling said breaks adapted in one position to open the branch *d* and local circuit and in its other position to close said branch and local circuit and open the branch *c* and the shunt.

5. The combination with the microphone-transmitter and the transformer having its secondary coil included in the line-circuit, of a local circuit including the microphone, the primary coil of the transformer and the battery, a normally open branch circuit including the battery and primary coil, and means such as a commutator for closing said branch and alternating the current in the primary coil.

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

CARL JOSEPH SCHWARZE.

Witnesses:
ANNIE WAHLIG,
ALEXANDER WAHLIG.