

(No Model.)

2 Sheets—Sheet 1.

C. J. SCHWARZE.
TELEPHONIC APPARATUS.

No. 566,416

Patented Aug. 25, 1896.

Fig. 1.

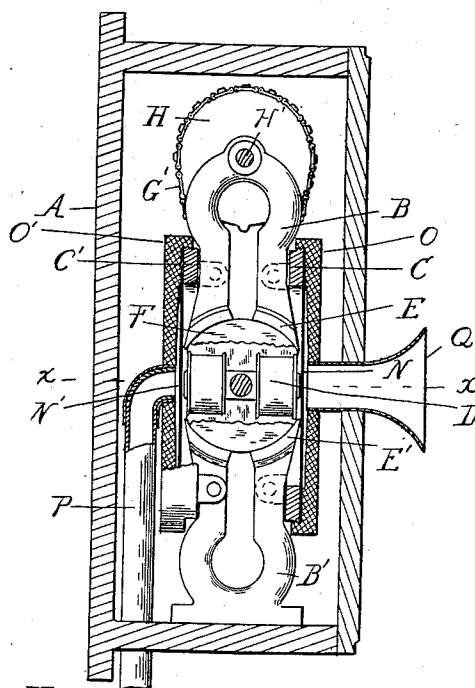
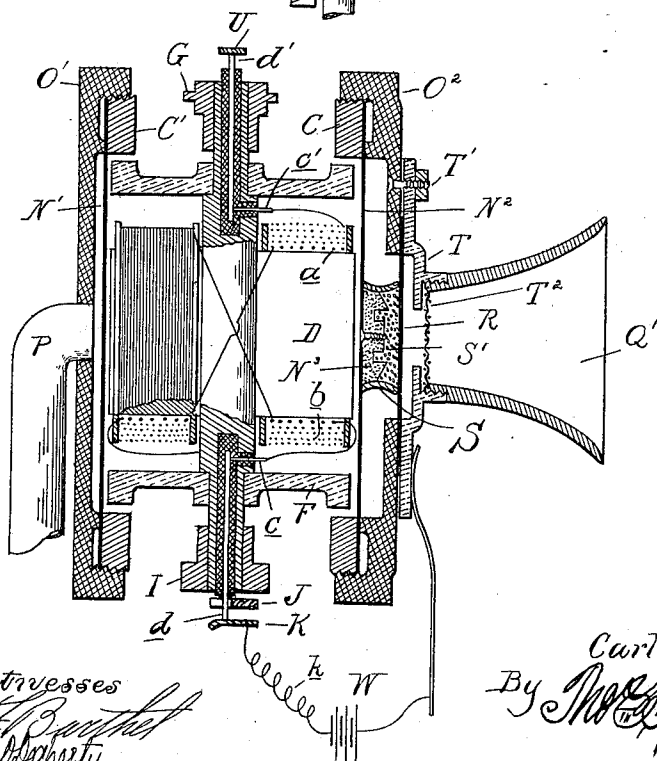


Fig. 2.



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TELEPHONIC APPARATUS.

SPECIFICATION forming part of Letters Patent No. 566,416, dated August 25, 1896.

Application filed February 11, 1896. Serial No. 578,849. (No model.)

To all whom it may concern:

Be it known that I, CARL J. 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.

It is the object of my invention to obtain an instrument adapted to be used in connection with different telephone exchanges or systems, and which to this end is made capable of being quickly changed from a magneto to a microphonic telephone, as the exigencies of the case may require.

The invention consists in the peculiar construction of a magneto-electric generator for signaling and the combination therewith of transmitting and receiving devices all organically united in a single instrument; further, in the peculiar construction of the switching devices, and, further, in the peculiar construction, arrangement, and combination of parts, as more fully hereinafter described.

In the drawings, Figure 1 is a vertical longitudinal section, partly in elevation, through my instrument as arranged for a magneto-telephone. Fig. 2 is a horizontal section therethrough on line *x x*, showing it changed to a microphonic telephone. Fig. 3 is an elevation of the combined switch operating and resetting lever. Fig. 4 is a section on line *y y*, Fig. 3, looking toward the right. Fig. 5 is a diagram showing the arrangement of the circuits.

A is a suitable box or casing. Within this casing is arranged the field-magnet of the magneto-electric generator, preferably comprising the oppositely-arranged horseshoe-magnets B and B', having their like poles united by the rings or annular pole-pieces C and C'.

D is a pole-armature arranged to revolve between the segmental pole-pieces E and E' on the magnets B B' and journaled in suitable non-magnetic heads F. This armature has a double winding consisting of the primary coil *a* and the secondary coil *b*, one terminal of each coil being connected to the metallic core of the armature, the other terminal being connected, respectively, to the in-

insulated posts *c c'*, which are connected to the insulated pins *d d'*, passing out from the opposite ends of the armature-shaft.

G is a sprocket-wheel on one end of the armature-shaft connected by a chain G' to the sprocket-wheel H on the crank-shaft H'. This shaft is preferably journaled in bearings formed in the magnet B and extends out through an aperture in the casing, being provided with a suitable crank-handle (not shown) for actuating it.

I is a head or disk at the opposite end of the armature-shaft. I' are pins projecting from the outer face of the disk at diametrically opposite points.

J is a lever, which is shown in the form of a bell-crank, fulcrumed upon the post J', secured to the magnet B'. The free end of this lever is adapted to move into the path of the pins I' and is provided with the oppositely-inclined cam-faces *e* and *e'*, adapted to bear against said pins and turn the armature into the position shown in Figs. 1 to 4 of the drawings, *i. e.*, with its poles extending at right angles to the longitudinal axis of the magnets.

J² is a spring tending to move the lever J against the pins I'.

J³ is the actuating-arm of the lever, projecting out through an aperture in the casing and provided with the hook J⁴, on which the ear-phone is hung, and the knob or finger-key J⁵.

J⁶ is a spring beneath the arm J³, upon which said arm normally rests, the weight of the ear-phone being sufficient to overcome the tension of the spring J².

K is a spring-plate secured to the lever J, but insulated therefrom and adapted to contact with the pin *d* in the end of the armature-shaft when the lever J is in its upper position.

L and M are contact-springs adapted to contact with the lever J in different position of that lever.

N and N' are iron diaphragms seated upon the annular pole-pieces C and C' and forming portions of the opposite poles of the magnet, said diaphragms constituting, respectively, the transmitting and receiving diaphragms of the telephone.

O and O' are caps for securing the diaphragms to the annular pole-pieces.

P is a flexible tube through which the sound

is conveyed from the receiving-diaphragm N' to the ear-telephone P'.

Q is a funnel-shaped mouthpiece arranged in front of the transmitting-diaphragm.

- 5 When only a magneto-telephone is required, the parts so far described constitute the complete instrument and operate in the manner more fully hereinafter described, but where the instrument is to be used as a microphonic telephone it is arranged as shown in Fig. 2 of the drawings, in which R is a diaphragm, preferably of carbon, arranged in front of the diaphragm N and insulated therefrom.

- 10 S is a ring of felt or other soft material placed between the two diaphragms N and R and filled with granular carbon or like material. These parts may be held in position by securing them to the cap O; but for convenience in manufacture and to facilitate the ready conversion of the telephone from a magneto to microphonic transmitter I preferably provide each instrument with an additional cap O², having a diaphragm N² corresponding to the cap O and diaphragm N.
- 25 N³ is a roughened carbon plate attached to this diaphragm, against which the granular carbon is placed.

- T is a metallic ring secured to the cap O² by screws T' and firmly clamping the carbon disk R in position. To this ring the mouthpiece Q' is secured, and a screen T² is preferably placed across the inner end of this mouthpiece to protect the carbon disk from injury.

- The caps O, O', and O² may be secured in any suitable manner to the annular pole-pieces, preferably, as shown in the drawings, by a screw-threaded engagement.

- The arrangement of the electric connections is shown in Fig. 5 of the drawings, in which *f* and *f'* are two binding-posts, to which the main-line wire and return or ground wire are respectively attached.

- g* is a connection between the post *f'* and a contact-spring U, bearing against the pin *d'* in the end of the armature-shaft.

- h* is a connection between the post *f* and the metallic frame of the instrument, in which connection the bell V is included.

- i* is a connection between the post *f'* and the spring-contact L, and *j* is a connection between the post *f* and the contact-spring M. Where the microphone-transmitter is used, the contact-spring K is connected by the connection *k* and the contact-spring *k'* to the metallic ring T, which connection also includes the local battery W.

- In the normal position of parts, where the telephone is not in use, the lever J is held in its mid-position, as indicated by full lines in Fig. 3, by the weight of the ear-telephone P', which overcomes the tension of the spring J² and holds the lever against the spring J⁰. In this position the spring K has broken contact with the pin *d*, the spring M has broken contact, and the spring L has made contact with the lever J, which completes the circuit from the post *f* through the connection *h* and

bell V to the metallic frame of the generator, and through said frame to the lever J, as indicated by the connection *l* in the diagram, 70 and thence through the spring L and connection *i* to the post *f'*. The bell may now be rung when desired by the operator at the other end of the line, the signal-current passing over the line and through the connections just described to the ground or return. 75 In responding to the call the user lifts the ear-telephone from its hook, which allows the lever J to be drawn by the spring J² into the position where the spring K contacts with the pin *d*, the spring L has broken contact 80 with the lever J, and the spring M has made contact therewith, as indicated by dotted lines at *m*, Fig. 3. This breaks the bell-circuit before described and closes a circuit 85 from the post *f'* through the connection *g* and spring U to the pin *d'*, thence through the coil *b* to the armature-core and through the metallic frame to the lever J, thence through the contact-spring M and connection 90 *j* to the post *f*. Conversation may now be carried on over the line, as the transmitting and receiving diaphragms constitute the opposite poles of the permanent magnet, and the armature being arranged with its opposite 95 poles in proximity thereto and its coil *b* connected into the line-circuit, a complete magneto transmitting and receiving telephone is formed. Where the microphone attachment is used, in this position of parts the local battery-circuit is also completed from 100 the battery W through the connection *k* to the spring K, and through the pin *d* and primary armature-coil *a* to the core of the armature, thence through the metallic frame 105 to the diaphragm N² and through the granular carbon to the carbon diaphragm R, whence it passes through the ring T and spring *k'* to the other pole of the battery. In speaking into this transmitter the undulatory current 110 produced in this circuit whenever the diaphragm R vibrates in passing through the primary coil *a* alters the magnetism of the armature-core and correspondingly varies its pull upon the diaphragm N², causing said 115 diaphragm to react upon the granular carbon between it and the diaphragm R. The effect of this action, as I have found in practice, is to greatly improve the speaking qualities of the instrument. At the same time 120 the current induced in the secondary coil *b* is free to pass over the line through the armature described to the other instrument, which it operates in the manner above described. 125

To operate the signal-generator, the operator presses upon the knob J⁵, depresses the lever J by compressing the spring J⁶ to a position lower than its normal position, or as indicated in dotted lines at *n*, Fig. 3. This 130 breaks the contacts of all three springs K, L, and M, opening the local battery-circuit and the two shunts *i* and *j*, the only remaining circuit being from the post *f'* through the con-

nection *g*, spring *U*, pin *d'*, coil *b*, the metallic frame, connection *h*, and bell *V* to the post *f*. The armature may now be revolved, which generates a current in the coil *b*, ringing the bell *V* and passing over the other end of the line, ringing the bell of that instrument. At the same time the revolution of the armature will cause a violent vibration of the diaphragm *N*² as each of the poles passes it, which agitates the granular carbon and prevents it from packing. Upon releasing the pressure on the knob *J*⁵ the lever *J* is moved by the springs *J*⁶ and *J*², and the cams *e* and *e'*, striking against the pins *I'*, turn the armature into its normal position and lock it there while the telephone is being used.

What I claim as my invention is—

1. In a telephone, the combination with a magneto-electric generator for signaling, of a microphone-transmitter, in magnetic inductive relation to said generator and adapted to have its microphonic material agitated by the magnetic influence in the operation of the generator.

2. The combination with a magneto-generator for signaling, and a vibratory diaphragm constituting, in connection with said generator, a magneto-telephone, of an extra winding upon the armature of said generator and a variable resistance in mechanical contact with said vibratory diaphragm, included in an electric circuit with said extra armature-winding, the whole constituting a microphone-transmitter.

3. In a telephone, the combination with a magneto-generator for signaling, of a vibratory diaphragm forming one of the poles of the permanent magnet held in proximity to the revolving armature of said generator, and a granular variable-resistance medium, forming an element of a microphone-transmitter, in mechanical contact with said vibratory diaphragm, and adapted to be agitated thereby during the operation of said magneto-generator.

4. In a telephone, the cap *O*² provided with the separated diaphragms *N*² and *R*, with a granular variable-resistance medium between, and the mouthpiece *Q'*; in combination with a magneto-generator for signaling having an annular pole-piece to which said cap is adapted to be detachably secured, a battery, and electric connections together constituting a microphone-transmitter.

5. In a telephone apparatus, a magneto-generator for signaling, a vibratory diaphragm forming one of the poles of the permanent magnet, a second diaphragm separated therefrom with a granular variable-resistance medium between, and a primary and secondary winding on the armature, the former con-

nected in a local battery-circuit including said variable resistance, and the latter connected into the line-circuit.

6. In a telephone apparatus comprising transmitting, receiving and signaling instrumentalities all included in the main circuit, with shunts around said devices, a switch-lever held normally in its mid-position by the ear-phone hung thereon, in which position the transmitter receiver and signal-generator are shunted out, said lever being adapted to be depressed to open said shunt and to automatically rise when the ear-phone is removed to shunt out the bell.

7. In a telephone, the combination with a magneto-electric generator for signaling, provided with a vibratory diaphragm forming a part of one of the magnetic poles thereof and adapted to be agitated by the operation of said generator, of a microphone-transmitter in mechanical contact with said diaphragm.

8. In a telephone, the combination with a magneto-electric generator for signaling, of a microphone comprising two diaphragms, a variable-resistance medium between, one diaphragm being formed of magnetic material arranged in magnetic inductive relation to said generator, and adapted to be agitated by the magnetic influence of the generator in the sending of the signal.

9. In a telephone, the combination with a magneto-electric generator for signaling provided with a vibratory diaphragm forming a part of one of the poles of the field-magnet, and a revolving armature having two windings, one of which is connected into the line-circuit; of a microphone-transmitter in mechanical contact with said diaphragm and included in an electric circuit with the other armature-winding.

10. In a telephone, a magneto-electric generator for signaling having an armature provided with two windings, one of which is connected in the line-circuit, in combination with a microphone-transmitter included in an electric circuit with the other armature-winding.

11. In a telephone, a magneto-electric generator for signaling, having its permanent magnet formed with an opening in one of its pole-pieces, a microphone-transmitter mounted in said opening provided with a diaphragm forming an element of the permanent magnet, and an electric circuit including said microphone and a second winding on the armature of the generator.

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

CARL J. SCHWARZE.

Witnesses:

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O. F. BARTHEL.