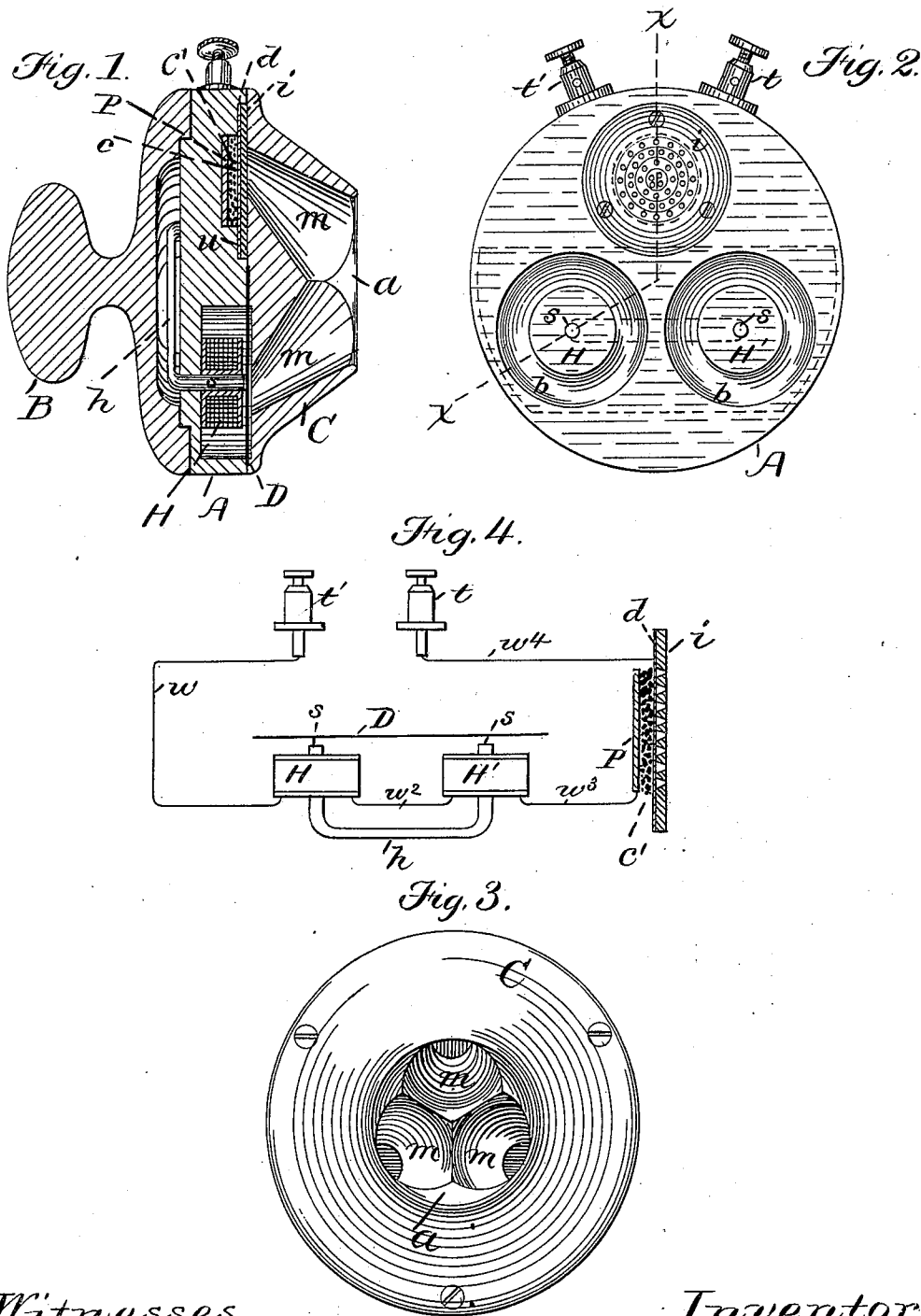


(No Model.)

G. LEE ANDERS.
COMPOUND TELEPHONE.

No. 252,641.

Patented Jan. 24, 1882.



Witnesses.
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COMPOUND TELEPHONE.

SPECIFICATION forming part of Letters Patent No. 252,641, dated January 24, 1882.

Application filed August 8, 1881. (No model.)

To all whom it may concern:

Be it known that I, GEO. LEE ANDERS, of London, in the county of Middlesex, England, have invented certain Improvements in Compound Telephones, of which the following is a specification.

My invention relates to electric telephones, and more especially to that class of telephones which combine in one instrument appliances and means for generating and varying a magneto-electric current, as in the ordinary Bell telephone, and means for varying the strength of a steady and continuous battery-current flowing through a variable resistance or tension regulator placed in the circuit of said current, thus providing an instrument which may be used indifferently as a transmitting or receiving telephone, or both.

Heretofore the general practice in the use of telephones has been to use separate instruments for transmitting and receiving, the well-known Blake transmitter, wherein the variable resistance or contact point is placed in the circuit of a local battery, which also includes the primary circuit of an induction-coil, being employed ordinarily in the former capacity and the Bell magneto-telephone in the latter. In the Blake transmitter the variations of current produced in the primary circuit by the action of the sound-waves of the human voice upon the variable resistance of the contact-point through the influence of the vibrating diaphragm are inductively transferred to a secondary coil which is in circuit with the line-wire, the receiving-telephone being also included in the same circuit.

The object of my invention is generally to produce a more economical construction by combining in one instrument apparatus capable of efficient utilization either as a telephonic speech reproducer or transmitter; also, to combine the requisite instrumentalities to such an end in such a manner as to operate independently of the usual induction-coil and local battery for the transmitting feature of the instrument, and generally to increase the efficiency and portability of such telephonic instruments by causing them to be easily and economically operated. These aims I attain by providing

a case or support and mounting therein a magneto-telephone constructed as hereinafter described, and a transmitting device consisting of a metallic bed-plate and a thin metallic vibrating diaphragm, an annulus, washer, or shoulder of some non-conducting material being placed between the two, and the intervening space filled with carbon or other conductor in a granulated or finely-divided condition. The resistance thus formed I join up in serial circuit with the helices of the magneto-telephone, and the circuit so constructed from the vibrating diaphragm through the granulated conductor, the metallic plate, and the helices is terminated at each end in a binding-screw placed on the outside of the case. I also provide a cap or mouth-piece of peculiar form and function, which is screwed to the case and serves both to clamp the diaphragm of the magneto-telephone and to direct the sound-waves to the requisite points. The screw-connections shown form the terminals of a continuous circuit through the instrument.

In the drawings, Figure 1 is a sectional view on the line *xx* of Fig. 2, and is arranged to illustrate both battery and magneto features. Fig. 2 is a plan or front view of my apparatus with the mouth-piece or cap removed. Fig. 3 is a front view with the cap or mouth-piece attached, and illustrates the trifurcations of the main aperture; and Fig. 4 is a theoretical diagram of the electrical connections.

The greater portion of the operating parts are attached to the main body of the case A.

B is a back-cover, which is screwed on, to afford a finished surface, over the magnet *h*, and which serves also for a handle. Holes or cavities *b* are cut or otherwise made in the front of the case A, for the reception of the spools or helices *H H'*. These helices are mounted upon the cores or pole-pieces *s* of a soft-iron bar, *h*, which is secured on the back of the case A, as shown in Fig. 1, while its cores *s s* extend through to the front, terminating just below the level of the front surface of the case A.

D is a metallic vibrating diaphragm of segmental form, which is supported upon the said front surface of the case A, immediately over but not touching the cores *s* and helices *H H'*,

as indicated by dotted lines in Fig. 2, and which is clamped and held in position by the attachment of the cap C. The helices H H' are connected together by a wire, w^2 , and occupy two-thirds of the case A, the remaining third being taken up by the transmitting device. This consists of a fixed metallic disk or plate, P, set in a third cavity, c , in the frame A, and connected by a wire, w^3 , to the helices H H'. Over this plate, and separated from it by a shoulder, u , cut in the material of which the frame or case is constructed, or by a washer or annulus of some hard non-conducting substance, is a vibrating diaphragm, d , which I make extremely thin and preferably of platinum-foil, though very thin iron or other material may be used. This is kept in place by being soldered or otherwise fastened to a perforated brass plate, i , which is connected by a wire, w^4 , to one of the terminals, t , the other terminal or screw-connection, t' , being provided with a wire, w , leading to the helix H.

This perforated plate i is set so that its outer surface is flush with the face of the case A, and it serves to maintain the fragile vibrating diaphragm d firmly in place, while allowing the sound-waves free access thereto by its perforations. The intervening space between the fixed plate P and the diaphragm d is loosely filled to a depth of about one-sixteenth of an inch with carbon or other suitable conducting material in a finely divided or granulated state.

Fitted to the front of the case A, and permanently attached in any desirable manner, is a cap, C, provided with a mouth-piece or aperture, a , extending through from the front of the instrument to the front surface of the case A, and which, though terminating externally in one flaring orifice, a , trifurcates as it trends inward, terminating at its inner extremity in a trifurcated tube, $m m m$, the main tube a of the mouth-piece thus diverging at its interior into three branches, one of which is brought over each core s , and the third terminating immediately over the center of the perforated plate and vibrating diaphragm which controls the variable resistance. Thus when the instrument is used as a transmitter sound-waves directed into the mouth-piece are caused to concentrate with effect upon the electric and magnetic sound-centers, producing a combined effect on the circuit.

The wires w , w^2 , w^3 , and w^4 connect the different portions of the apparatus together and to the terminal screws $t t'$.

In the practical operation of my instrument the terminal screws are connected directly in the line-circuit without the intervention of any induction-coil, and a battery is also included in the same line-circuit.

I have ascertained by practical experiment that an instrument constructed in accordance with the subject-matter of this application is a most effective transmitter, while it is equally efficient as a receiver, and since it is not essential that the battery employed shall be located

at the same station as the instrument, but may be at any point on the circuit, it is obvious that by the use of my compound telephone I effect a great saving in battery. For example, if my telephone is used in a telephone-exchange system, the battery could readily be kept at the central station and be made common to a number of sub-stations, being only connected in circuit with any given sub-station when that particular sub-station is engaged in electrical conversation. The necessary apparatus at each station is therefore greatly simplified.

In the form of telephone I have described, the receiving-diaphragm is operated by an electro-magnet whose soft-iron cores are magnetized by the passage of the battery-current through the helices. Such an instrument is inoperative except when placed in a battery-circuit. I may, however, if I so desire, substitute for the soft-iron cores connected by a yoke piece of the same metal a permanent steel magnet of any suitable form approximating to the horseshoe, in which case the instrument is no longer dependent upon the main battery for the proper performance of its functions as a magneto-telephone, but is at all times adapted to operate in that capacity.

I am aware that a telephonic instrument wherein the transmitting and receiving features are combined is not new, as such an instrument is shown and described in Letters Patent granted to Alexander Graham Bell, No. 213,090, and bearing date of March 11, 1879, and is, moreover, described in Du Moncel's Treatise on the Telephone, the Microphone, and the Phonograph, pages 100 to 103, edition published in London, 1879. In the aforesaid patent to Bell the diaphragm is placed before the poles of a permanent magnet of horseshoe form, provided with coils on the poles, and the electrodes, which produce variations in resistance by means of the friction of one on the other, are combined with said diaphragm, and are connected in direct circuit with the said coils. This apparatus differs from that shown herein in having a common diaphragm for the magnet and the electrodes, and in having the coils surrounding the poles of a permanent instead of a neutral magnet, as well as in the character of the means employed to vary the resistance of the circuit and the general arrangement of the apparatus. Nothing is claimed herein which is set forth in the aforesaid patent.

I claim as my invention—

1. The combination, in a telephonic instrument, of a transmitter provided with a variable resistance consisting of a layer of finely divided or granulated carbon or similar conducting material confined in a loose state between two metallic surfaces, one of which is a vibrating diaphragm, and a receiving-telephone consisting of a magnet of horseshoe or equivalent form, having a coil or helix on each pole and a vibrating diaphragm common to both poles and separate from the vibratory diaphragm of the transmitter.

2. In a telephonic instrument, the combina-

tion, substantially as hereinbefore described, of a transmitter provided with a variable resistance consisting of a layer of granulated conducting material confined in a disintegrated state between two metallic plates, one of which is a vibrating diaphragm, and a receiving-telephone consisting of soft-iron cores carrying helices, the said cores mounted upon and connected together by a soft-iron yoke or heel piece, the whole forming a neutral or electro magnet operating only when connected in a battery-circuit, and a vibrating diaphragm or resonant plate common to and actuated by both poles.

3. In a telephonic instrument, the combination of a transmitter provided with a variable resistance and a vibrating diaphragm to operate the same, a receiving-telephone consisting of a bipolar magnet carrying a helix on each pole, said helices being arranged successively in electrical series with the variable resistance, a vibrating plate or diaphragm common to both poles, and a triune mouth-piece, whereby the impact of the sound-waves is evenly distributed to the transmitter and receiving diaphragms simultaneously, and directed immediately upon said diaphragms at the respective centers of electric and magnetic force.

4. In a direct-acting telephonic transmitter, the combination, substantially as hereinbefore set forth, of a variable resistance consisting of granulated carbon or similar conductor, a case for the same consisting of a fixed metallic plate and an extremely thin vibrating diaphragm of any suitable metal, separated from one another by means of an annular shoulder of non-con-

ducting material, and a metallic perforated plate placed over and in contact with the thin-metal vibrating diaphragm, and acting to protect the same and maintain it in position.

5. The combination, in a telephonic instrument, of a battery transmitting-telephone constructed substantially as hereinbefore described and a magneto receiving-telephone having a neutral electro-magnet the helices or coils of which are in direct electrical circuit with the variable resistance of the transmitter and connected in series therewith, as and for the purpose set forth.

6. The combination of a magneto-telephone, a segmental diaphragm therefor, a variable resistance in circuit with the helices of said telephone, means, as indicated, for varying the same, and a case for the whole provided with a cap perforated with a trifurcate speaking or listening tube, all substantially as described.

7. A compound telephone comprising a battery or variable-resistance transmitter, a magneto-electric receiver, and an inclosing-case, said transmitter and receiver being provided with separate diaphragms, and the mouth-piece of the inclosing-case communicating with the space in front of both diaphragms, substantially as described.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 29th day of July, 1881.

GEORGE LEE ANDERS.

Witnesses:

A. M. ALLEN,
GEO. W. PIERCE.