No. 826,542.

PATENTED JULY 24, 1906.

E. E. CLEMENT.

TELEPHONE TRANSMITTER.

APPLICATION FILED MAY 17, 1904.

Fig. 1.

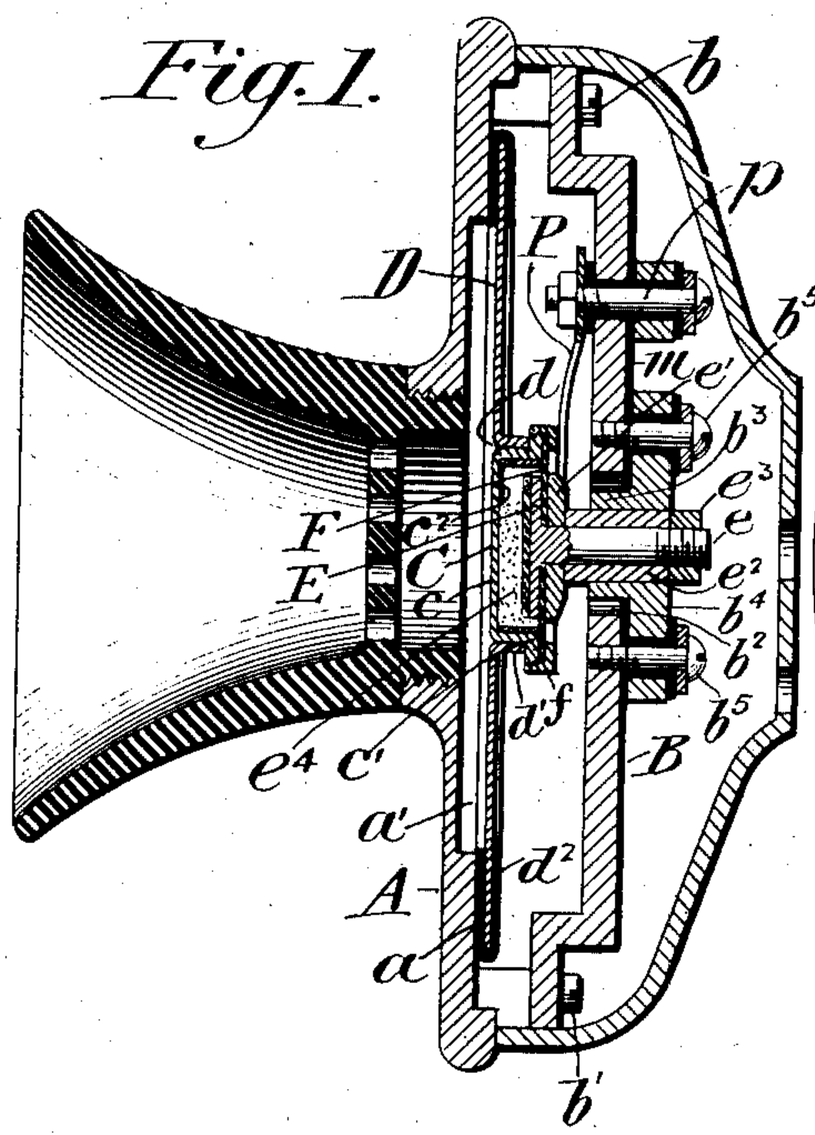


Fig. 2.

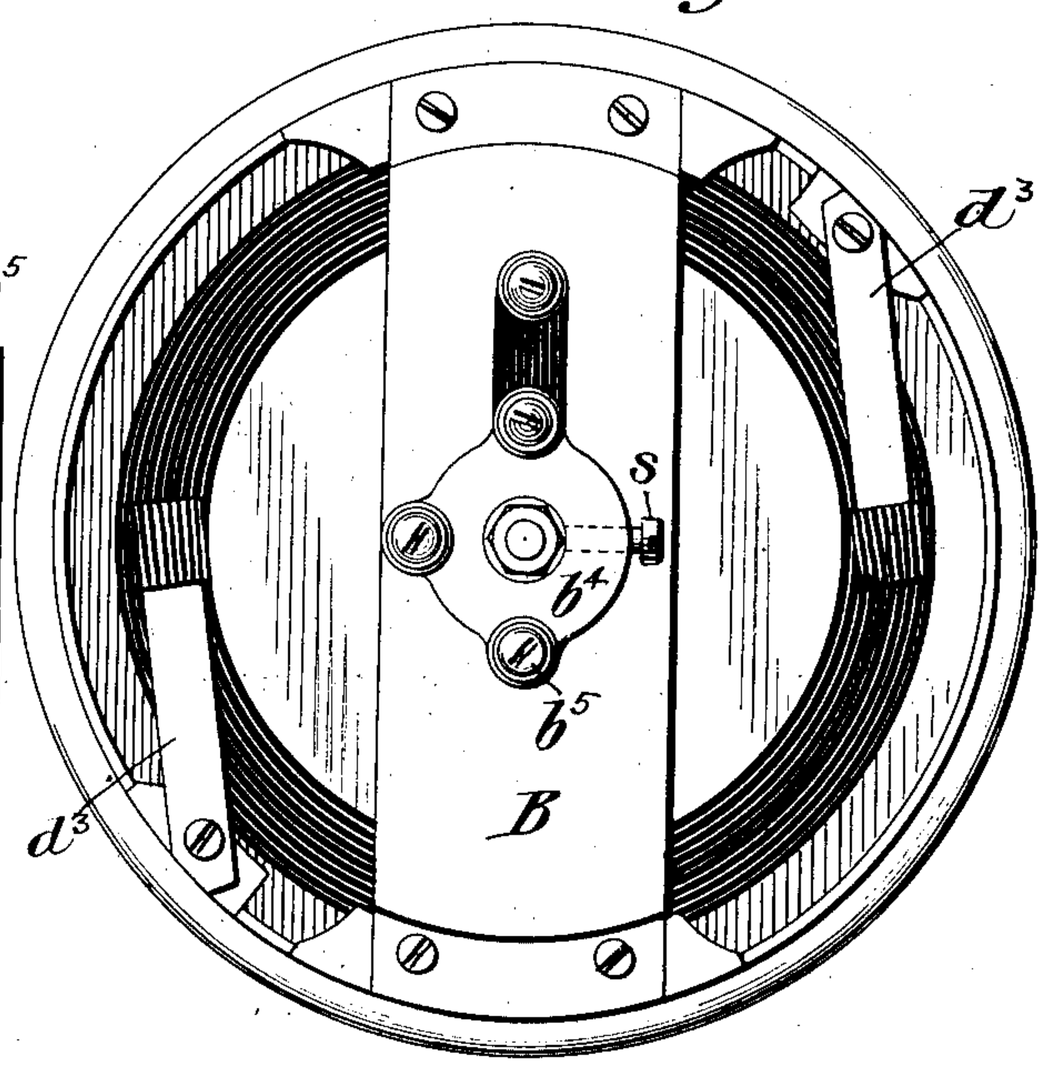
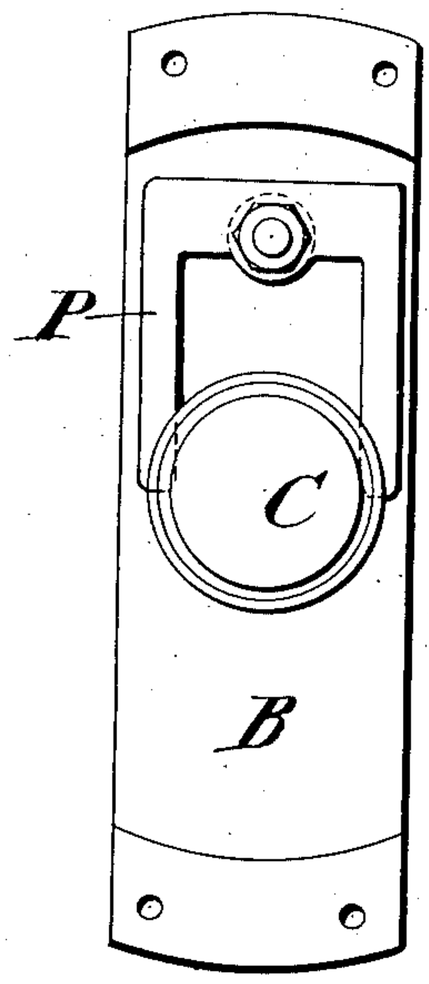


Fig. 3.



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UNITED STATES PATENT OFFICE.

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TELEPHONE-TRANSMITTER.

No. 826,542. Specification of Letters Patent. Patented July 24, 1906.

Application filed May 17, 1904. Serial No. 208,339.

To all whom it may concern:

Be it known that I, EDWARD E. CLEMENT, a citizen of the United States, residing at Washington, in the District of Columbia, have invented a certain new and useful Improvement in Telephone-Transmitters, of which the following is a specification, reference being had therein to the accompanying drawings.

My invention relates to telephone-transmitters, and particularly to that type of granular transmitters commonly known as the "solid back." Instruments of this type have two distinguishing characteristics, one being that the electrodes and the granular material between them are inclosed in a cup or chamber of small diameter as referred to the main diaphragm and the second being that the back electrode is solidly and rigidly supported. A third characteristic feature which was found in the original solid-back instruments was that of having the cup or chamber carried upon and integral with the support for the back electrode. The latest and best designs, however, do not possess this feature, support for the chamber being either the bridge or the diaphragm indifferently, the principal point of identity in all being the rigid mounting of the back electrode.

My present invention joins features of both the early and the late devices, in that while the back electrode is rigidly secured to the bridge the containing cup or chamber vibrates with the diaphragm, although not supported thereon.

It is the object of my invention to eliminate points of weakness and defects which have been shown to inhere in the transmitters heretofore used and to produce an instrument that will be economical to manufacture, convenient to assemble, and of a high and uniform efficiency.

A further object of my invention is to produce an instrument that shall be particularly suitable for use on common battery-circuits.

Apart from the consideration of resistance, the size of the chamber, and the amount of filling, there are several points to be taken into account in common battery-work that are immaterial where local-circuit transmitters only are in question. For instance, it is desirable that exposed circuit-terminals should be avoided and that the main circuit should not be connected in any way with the frame or shell. If possible, connection to the movable electrode should be effected without going through the diaphragm, and all connections should be solid and substantial, having ample current-carrying capacity to prevent possible burn-outs.

In order to obtain my objects, as will be noticed upon reading my detailed description, I have departed from convention in at least two standard parts—viz., the diaphragm and the electrode-chamber. I find that the changes I have made produce very marked results in the way of increased volume of transmission and much greater sensitiveness. A large part of this improvement I ascribe to my peculiar form of diaphragm. In almost all transmitters in use prior to my invention the diaphragm has been a flat circular piece of metal, formerly of iron and now usually of aluminium, with each surface an unbroken plane. A rubber band is usually stretched about its periphery for a double purpose—first, to insulate the diaphragm from the frame, and, second, to slightly compress its edge, and thereby produce a buckle in the center to put it under tension. It should be stated that a diaphragm free to vibrate, held but not clamped at the edges between the limits of its amplitude of vibration, has a certain swing between what may be called the "dead-points," there being neither compression nor tension strains upon either skin. As the diaphragm swings one way driven by the vibration of the voice it absorbs energy for its return swing, and although in a sense the speech vibrations directly assist it in this return motion, yet it is principally the stored energy that swings it back from the dead-points and to its forward limits. The main losses in the diaphragm motion are those due to inertia and air resistance, and these produce their maximum retarding effect during the swing between the dead-points.

Without having stated the problem in the terms I have used others have proposed to put diaphragms under tension. This they have done, however, by providing springs sticking up in front or forcing out the diaphragm from the rear or the like, with the

result that the damping effect usually lowers the efficiency of the instrument more than the tensional arrangement has raised it. I have found that the same or a better result in the way of putting the diaphragm under tension or "stiffening" it may be attained without any excessive damping, and this by means inhering in the diaphragm itself, so that subsequent to its manufacture no further adjustment is required than that ordinarily given in assembling. I take my diaphragm, which is preferably of aluminium, and in the center thereof produce an aperture not quite large enough to admit the body of the cup or resistance-chamber I propose using. I then subject the diaphragm to a process of forming, during which the metal is preferably worked toward the center to slightly and uniformly thicken the edges around the central aperture. These edges are then formed up into a circular flange or collar upstanding from and substantially perpendicular to the plane of the diaphragm. In so forming up the edges they are expanded, and thereby again reduced in thickness, the diameter of the central aperture being at the same time increased until it is large enough to admit the resistance-chamber. This cup or chamber is afterward introduced upon the flanged side of the diaphragm, so that the edges of the flange rest against a shoulder or flange upon the cup, and the bottom of the cup lies flush with the outer face of the diaphragm. In assembling the cup is maintained in this position by a supporting-stem passing through the bridge of the transmitter and is pressed against the diaphragm by suitable springs, which serve to some extent as dampers and also to complete the electrode-circuit.

My electrode chamber or cup differs from those usually employed, in that it contains but one electrode, the bottom of the cup itself serving as the other. Saving thus the thickness of an electrode-plate and its carbon face in the depth of my chamber, I also gain in another way—viz., by rendering the body of the cup or chamber more sensitive as an auxiliary to the main diaphragm, and that in the central position, where the amplitude of vibration is always the greatest.

In order to keep the main circuit entirely separate from the frame or shell of the transmitter, I insulate one side of the electrode-circuit, as usual, by springing a rubber band around the edge of the diaphragm, and the other side I protect by completing the connections through the springs already referred to, mounting these springs on an insulated post, and by insulating with rubber or mica the metal collar or boss which receives the stud of the back electrode.

My invention is fully illustrated in the accompanying drawings, wherein—

Figure 1 is a sectional view of a transmitter embodying my design. Fig. 2 is a rear view thereof with the shell removed. Fig. 3 is a detail view of the front side of the bridge, the latter being removed from the transmitter to show the insulated contact-spring and the resistance-button.

Referring to the drawings, A is a circular frame or front plate flanged upon its rear side, provided with a bearing-face a for the diaphragm D and recessed as usual over the diaphragm at a'. Seated upon this face is the diaphragm D, which I will presently describe, and reaching across this diaphragm, somewhat to the rear thereof, lies the bridge B, secured at its extremities to opposite sides of the front plate by the screws b b'. I have shown this bridge as a finished casting; but it may conveniently be punched and formed out of sheet metal of considerable thickness. At its middle point the bridge is perforated with an opening b^2, through which extends with ample clearance the boss or collar b^3 on the plate b^4. This plate is solidly secured to the bridge by means of the bushed screws b^5, tapped thereinto. A sheet of hard rubber, mica, or other suitable material m insulates the plate b^4 from the bridge.

The diaphragm D, as I have already stated, is centrally perforated at d, and the edges around the aperture are formed up into a flange or collar d'. Around the periphery of the diaphragm a rubber band or gasket d^2 is sprung, and the usual side springs d^3 extend out from the flanges of the front plate, with their sleeved extremities resting on the rubber gasket to hold the diaphragm in place.

Within the aperture of the diaphragm, with its bottom flush with the front face thereof, lies the cup C, containing the resistance-varying elements of the transmitter. This comprises the thin light metal body c, provided with an annular flange or shoulder c', upon which rests the mica auxiliary diaphragm F, clamped to the cup around its edge by the threaded ring f. This mica diaphragm or disk F is centrally perforated to receive the stem e of the electrode-plate E, which passes through the twin clamping-plate e' and the hollow stud e^2, receiving the nut e^3 outside the end thereof, by which the parts are drawn together to clamp the mica disk firmly between them. The stud e^2 lies in the aperture in the collar b^3 b^4 and when adjusted therein is securely held by the set-screw s. (Shown in Fig. 2.)

The electrode E is carbon-faced and of course in the operation of the instrument remains fixed, inasmuch as it is supported upon the bridge B. The opposing electrode is the bottom of the cup itself, (indicated at c^2,) and this I plate with gold in order to insure a high and uniform conductivity without danger of deterioration. Granular carbon e^4 is introduced within the chamber, and as the electrode E is of a smaller diameter than the

chamber it constitutes a piston, leaving space for expansion all around it.

It will be observed that the body of the cup *c* is in metallic connection with the diaphragm, but is insulated from other parts of the instrument. In order to complete the circuit thereto, I provide the contact-springs P, supported on the bridge and secured thereto by the screw-bolt *p*, which is insulated by suitable bushings and by an extension of the same plate which underlies the collar b^4. The springs P are formed from one integral piece of spring metal in substantial U shape, the bolt *p* passing through the horizontal connecting member. The extremities of the springs straddle and rest upon the opposite edges of the threaded ring *f*, which being metallically connected with the top of the cup *c* completes the circuit from the springs thereto. This arrangement is clearly shown in Fig. 3.

The electrode-circuit completed extends from the screw-post *p* through the springs P to screw-ring *f*, flange *c'*, cup *c*, inner face c^2, through the granular carbon to electrode E, through stems *e* and stud e^2 to the collar and boss b^3 b^4. Thus the current-carrying circuit is absolutely distinct from the shell or frame of the instrument.

The operation of my transmitter is sufficiently apparent from the description; but I may note that vibrations due to sound-waves are not by any means limited to the diaphragm. It is quite true that this vibrates and by the pressure of its flange against the flange *c''* of the cup vibrates the latter and thereby communicates more or less pressure to the granular carbon; but it is also true that the cup *c* vibrates of itself, and this not only as a whole, but also probably in the sense of bending and distorting its bottom. All the effects thus produced reinforce each other, and the inner flange around the opening in the diaphragm insures a condition of constant tension in the latter which eliminates the dead point or points from consideration.

It should be noted that I have shown the cup *c* lined as to its side walls with paper c^3. This is not absolutely essential; but I find it advisable, insuring that the current-path between the electrodes shall be constant in length.

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

1. In a telephone-transmitter a supporting frame or plate, a diaphragm carried thereon, a central aperture being produced in said diaphragm, a resistance cup or chamber independently supported within said aperture with its outer face substantially flush with the outer face of the diaphragm, and direct connection between said diaphragm and cup, an electrode extending into said cup and rigidly held with respect thereto, substantially as described.

2. In a telephone-transmitter a supporting frame or plate, a diaphragm resting thereon, said diaphragm being centrally apertured and having its edges around the aperture formed up into an annular flange, a cup or chamber fitting within the aperture and supported against said flange, an electrode within and vibrating with the cup and the diaphragm, a piston-electrode extending into the cup or chamber and rigidly supported with respect thereto, together with granular carbon in said chamber, and means to complete a circuit therethrough, substantially as described.

3. In a telephone-transmitter a supporting frame or plate, a diaphragm resting thereon, said diaphragm being centrally apertured and having its edges around the apertures formed up into an annular flange, a flanged cup having its body within the aperture and its flange against the diaphragm-flange, an electrode within and vibrating with the cup, a second electrode rigidly supported with respect to the first and extending into the cup, an auxiliary diaphragm extending about said second electrode and clasping the mouth of the cup, and granular material between the electrodes, substantially as described.

4. In a telephone-transmitter, a diaphragm, an annular flange formed in said diaphragm, an electrode independently supported so as to be vibrated by said flange, and a second electrode rigidly fixed with respect to the first, substantially as described.

5. In a telephone-transmitter, a diaphragm, a flanged aperture therein, a flanged cup lying in the aperture with its bottom flush with the face of the diaphragm, an electrode fixed in the cup, a second electrode entering the same but separately supported, a supplemental diaphragm connected to said second electrode and clamped around its edges to the periphery of the cup, and granular material in the cup, substantially as described.

6. In a telephone-transmitter, a diaphragm formed with an annular flange, an electrode separate from but lying within said flange, unsupported thereby, and vibrating with the diaphragm, a second electrode fixed with respect to the first, granular carbon between the electrodes, and means to confine the same, substantially as described.

7. A diaphragm for acoustic instruments provided with a stiffening rib or flange having its outer edge open and disconnected.

8. A diaphragm for acoustic instruments provided with an open annular stiffening flange or rib.

9. A diaphragm for acoustic instruments provided with an aperture and a stiffening-flange having its outer edge open and disconnected.

10. A diaphragm for acoustic instruments provided with an aperture surrounded by a stiffening-flange, said flange having its outer edge open and disconnected.

11. A sounding-diaphragm for acoustic instruments provided with a central aperture having its edges formed up into a stiffening-flange, substantially as described.

12. A diaphragm for acoustic instruments provided with an annular stiffening-flange defining the walls of a hole, said stiffening-flange adapted to move an electrode.

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

EDWARD E. CLEMENT.

Witnesses:

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