

No. 628,046.

Patented July 4, 1899.

G. K. THOMPSON.

REPEATING AND TRANSMITTING TELEPHONE.

(Application filed Nov. 29, 1898.)

(No Model.)

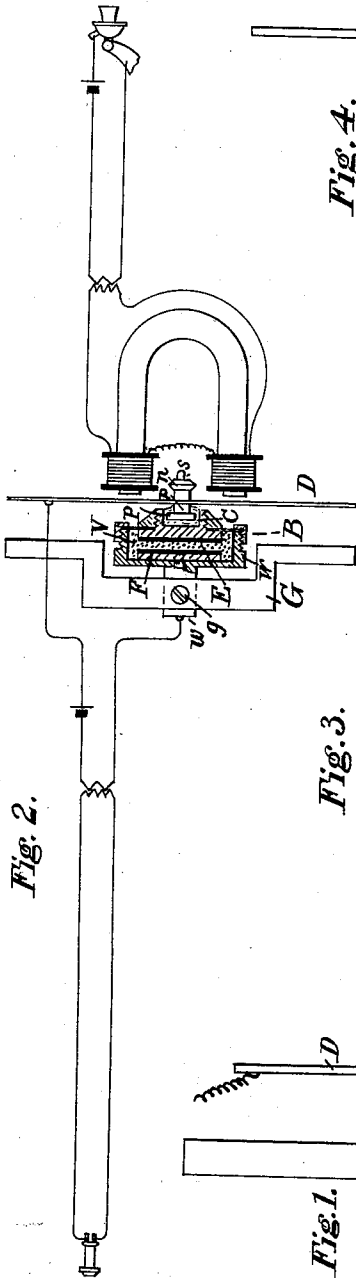


Fig. 2.

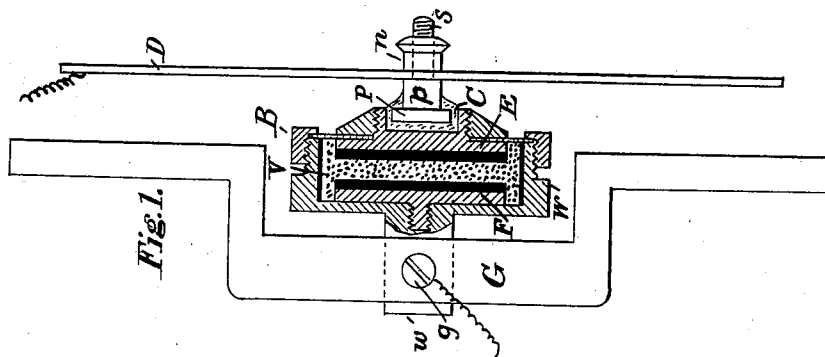


Fig. 1.

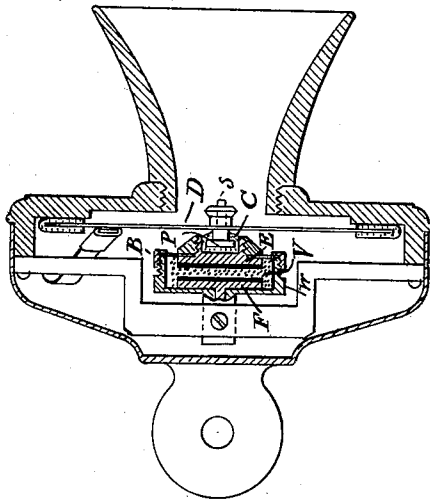


Fig. 3.

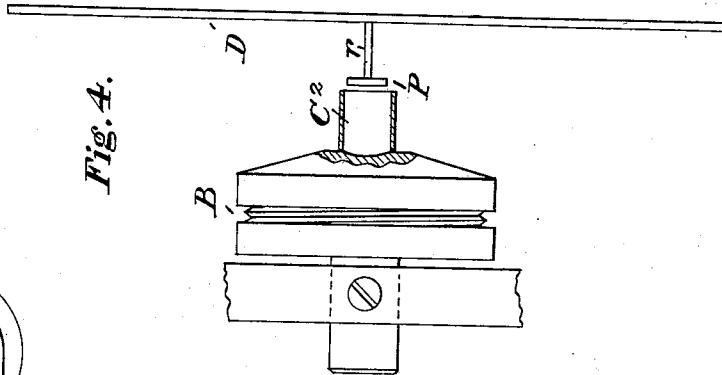


Fig. 4.

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REPEATING AND TRANSMITTING TELEPHONE.

SPECIFICATION forming part of Letters Patent No. 628,046, dated July 4, 1899.

Application filed November 29, 1898. Serial No. 697,758. (No model.)

To all whom it may concern:

Be it known that I, GEORGE K. THOMPSON, residing at Malden, in the county of Middlesex and State of Massachusetts, have invented certain Improvements in Repeating and Transmitting Telephones, of which the following is a specification.

This invention relates to electric speaking-telephones, and more particularly concerns transmitting and relaying or repeating telephones employing a variable resistance consisting of granular carbon inclosed between two electrodes in a button or case of which the said electrodes are the front and rear walls, the required resistance variations being produced by the speech-vibrations of a diaphragm which is in mechanical connection with and controls the front electrode. In telephone instruments of this type it has been difficult to maintain under all circumstances a correct relative adjustment of the button-electrodes or such an exact space of separation between them and also of the diaphragm with respect to the other working parts as is conducive to the highest efficiency of the instrument. Prior to my invention the diaphragm has been attached by a rigid or inflexible connection (usually a screw or bolt) to the front electrode.

In the operation of the instrument the passage of the normal working current through the variable-resistance button develops therein a considerable degree of heat, and thus even though a proper adjustment be initially obtained its permanence cannot be relied upon, for as the temperature rises expansion of the various parts occurs, resisted, of course, by the firmly-fixed portions of the instrument. As a result the front electrode and diaphragm suffer displacement, the diaphragm being put under strain or stress. In fact, if the diaphragm were not so designed and mounted as to allow and (partly at least) compensate for this motion the efficiency of the transmitter or repeater would be seriously impaired, and for this reason thick unyielding rigidly-secured diaphragms, which in many respects are to be desired, have not been available.

The object of my invention is to overcome this difficulty and to provide for an adjustment of the operative parts of a variable-re-

sistance telephone which remains permanent and unimpaired during and notwithstanding the expansions and contractions due to temperature variations and which enables the electrodes to execute such changes without any action upon the diaphragm and without any tendency to place the same under stress.

In my invention the bolt, screw, or similar solid or inflexible connection between the front electrode and the diaphragm is discarded, and in place thereof I interpose between the said diaphragm and front electrode a mechanical connection, yielding and elastic to such changes in the parts of the instrument as are attributable to the expansions and contractions arising from temperature variation, but rigid and unyielding under the rapid vibrations of the diaphragm in operation, the said diaphragm being by this means enabled to retain a complete control over the variable-resistance or transmitting electrodes, while, on the other hand, it is fully emancipated from any necessity of participating in such changes of position or adjustment as may be experienced by the said electrodes, and hence can no longer be subject to stress or strain accruing from such change. I attach to the external face of the front electrode or the plate on which it is supported a small cup, chamber, or cylinder and to the diaphragm-center a small piston or plunger, which projects into the said chamber, to which it is loosely fitted. A mass of mercury fills the chamber and surrounds the plunger placed therein. There must be a sufficient distance between the plunger and the bottom of the mercury-containing cup to permit the variable-resistance button to expand without causing pressure upon the diaphragm, and the clearance between the plunger and the sides of the cup must be sufficiently wide to permit the mercury to flow round the edge of the said plunger readily as the button gradually changes its temperature and expands or contracts.

An important condition of my invention is that the several surfaces in which the mercury comes in contact shall be well amalgamated. Otherwise the efficiency of the device is materially reduced by slight cushions of air which introduce themselves. More-

over, by the amalgamation of the said surfaces any tendency which the mercury otherwise might have to leave them is greatly minimized.

5 In the accompanying drawings, Figure 1 is an enlarged vertical section of the transmitting-electrodes and diaphragm of a telephone instrument, showing my improvement. Fig. 2 shows the said improvement as applied to
10 a telephone relay or repeater, and Fig. 3 the improvement comprised in a telephone-transmitter. Fig. 4 indicates a slight structural modification.

D is the vibratory diaphragm.

15 B is the variable-resistance button, having a front electrode E and a back electrode F, shown as being both faced internally with carbon.

V is the granular carbon or other variable-
20 resistance material placed within the button between the electrodes E and F.

The outer casing of the button is a heavy-chambered metallic block W, provided rearwardly with a stout shank *w*, which passes
25 through a hole in the bridge-piece G, being secured therein by a set-screw *g*. The whole button may thus be supported by the said bridge-piece.

Attached to that side of the front electrode
30 E which faces the diaphragm is a cup or chamber C, of metal or other suitable conducting material, which in general form may be cylindrical, and a mass of mercury is contained therein. To the proximate face of the dia-
35 phragm is attached, by means of a short rod, bolt, or shank, a small metal piston or plunger P, and the diaphragm being in position the said plunger projects into the cup C, which it fits loosely, being surrounded by and em-
40 bedded in the mercury, which is present in sufficient amount to cover the said plunger.

In Figs. 1 to 3 a cavity formed in the forwardly-extending boss or shank of the front electrode constitutes the cup or chamber C;
45 but, if desired, the external face of the said electrode may be made with a broad plane surface, and to this the cup or chamber C², separately formed, may be secured, as in Fig. 4. So, also, in Figs. 1 to 3 the plunger P is
50 secured to the diaphragm by a screw-shank *s*, secured in appropriate position by the sleeve-washer *p* on one side of the diaphragm and the nut *n* on the other. It is evident, how-
55 ever, that any preferred mode of attachment may be adopted—as, for example, a light rod *r*, soldered or riveted at one end to the diaphragm D and at the other to the piston P, as shown in Fig. 4. It will of course be under-
60 stood that in Fig. 4 the parts are shown as being much enlarged and that the separation of the piston P from the mercury-holding cup C² is purely for clearness of illustration.

As already indicated, the clearance between the edge of the piston and the side of
65 the chamber must be wide enough for the free circulation of the mercury and the plunger must normally be so placed that there shall

under any circumstances always be a layer of mercury between it and the bottom of the cup. I have experimentally determined that
70 when the instrument is constructed with a space of one thirty-second of an inch between the bottom of the mercury-containing chamber and the plunger and with a clearance of one sixty-fourth of an inch between the sides
75 of the plunger and the said chamber it works satisfactorily.

The internal surface of the cup C and the surface of the piston P—that is to say, all surfaces with which the mercury comes into
80 contact—must be amalgamated, and as in operation the mercury tends to bank itself up around the shank of the said piston the amalgamation should be continued for a little distance along the said shank.

In the normal operation of a transmitting or repeating telephone with which my invention is incorporated the mercury acts substantially as a solid and unyielding mechanical medium between the diaphragm and the
90 carbon-holding button and conveys the rapid vibrations of the said diaphragm to the front electrode of the said button with unimpeded strength and unimpaired fidelity.

There being less margin for losses or distortions in the operation of the transmitting elements of telephone relays or repeaters than in telephone instruments organized to act initially and solely as transmitters, my improve-
95 ment is especially applicable to instruments 100 of the first-mentioned type.

I claim—

1. The combination in a telephone instrument having transmitting-electrodes, with the diaphragm; the said electrodes and the gran-
105 ular variable-resistance material between said electrodes; of a mechanical connection interposed between the said diaphragm and the front electrode, the said connection being yielding to expansions and contractions of
110 the adjacent parts such as may be produced by temperature variation, but rigid and unyielding under the rapid vibrations of the diaphragm in operation; substantially as and for the purposes set forth.

2. In a variable-resistance telephone instrument, the combination with the transmitting-electrodes, and diaphragm; of a cup or chamber of mercury mounted on the front plate of the said electrodes, and a plunger attached to
120 the diaphragm, working loosely in the said cup, and embedded in the mercury contained therein; the said mercury acting as a solid and unyielding medium between the electrodes and diaphragm as respects the rapid speech
125 vibration of the latter, and as a yielding connection for slow or gradual changes such as those arising from expansions or contractions of the electrodes and their supporting parts; substantially as described.

3. In a telephone repeater or transmitter, the combination of a vibratory diaphragm; transmitting-electrodes adapted for operation thereby; a cup or cylinder in or upon the sur-
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face of the front electrode, having its internal surface amalgamated; a piston or plunger also having an amalgamated surface carried by the diaphragm and projecting into the said cup; and a mass of mercury held within the cup, surrounding the plunger; substantially as specified and for the purposes set forth.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 22d day of November, 1898.

GEORGE K. THOMPSON.

Witnesses:

GEO. WILLIS PIERCE,
JOSEPH A. GATELY.