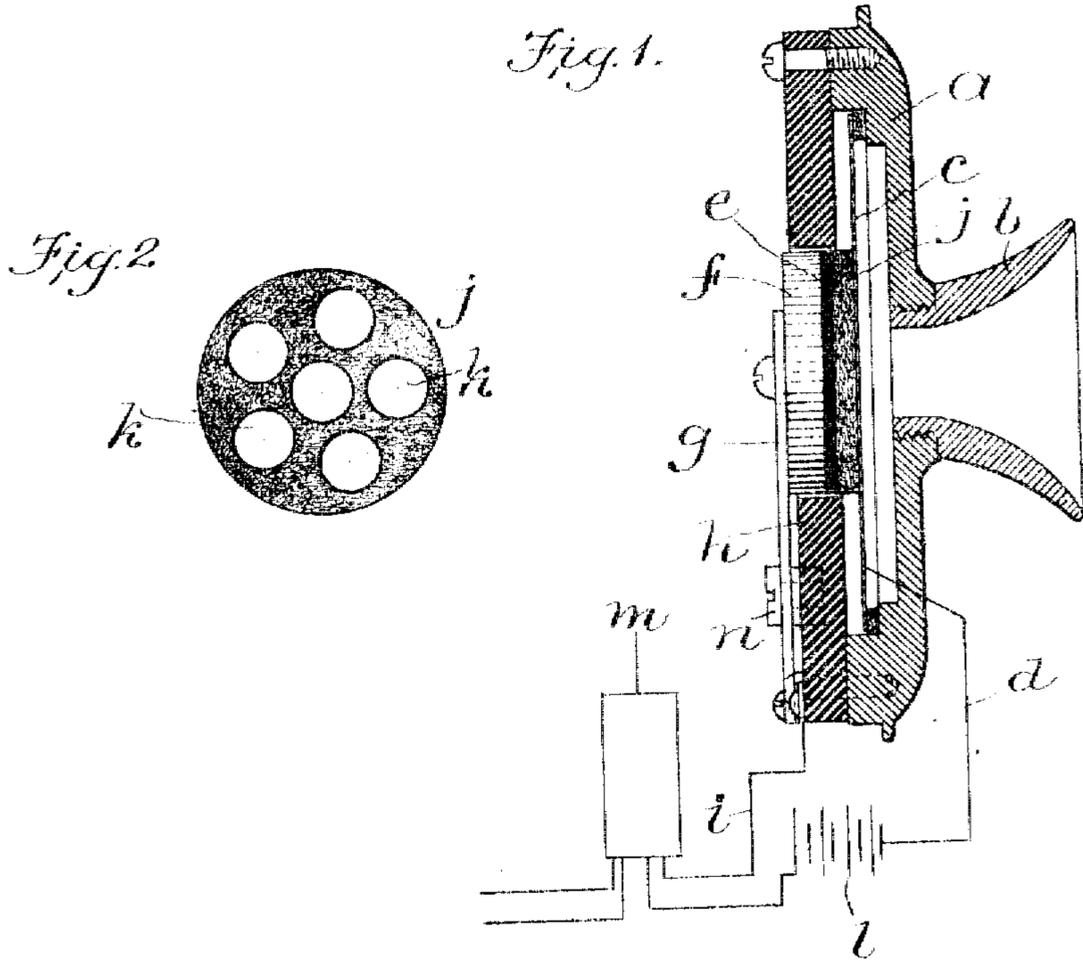


P. G. RANDALL.
TELEPHONE TRANSMITTER.
APPLICATION FILED DEC. 19, 1907.

Patented Mar. 29, 1910.

953,102.



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UNITED STATES PATENT OFFICE.

PHILIP G. RANDALL, OF MALDEN, MASSACHUSETTS.

TELEPHONE-TRANSMITTER.

953,102.

Specification of Letters Patent. Patented Mar. 29, 1910.

Application filed December 19, 1907. Serial No. 407,154.

To all whom it may concern:

Be it known that I, PHILIP G. RANDALL, of Malden, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Telephone-Transmitters, of which the following is a specification.

This invention relates to telephony and has for its object to enable increased battery power to be used so that articulate speech may be transmitted clearly over longer distance and with a louder quality than is possible at the present time, and also to abolish the noises which are heard so frequently under present conditions when a telephone receiver is applied to the ear, and are so objectionable.

In carrying my invention into effect I employ a vibrating diaphragm, as one electrode, a complementary adjustable cooperating electrode or contact-maker, and a granular variable resistance conductor held suitably and positively in place on the diaphragm and intermediate the diaphragm and the cooperating electrode, said granular variable resistance conductor being subdivided into fractional parts forming a plurality of contacting points or surfaces with the diaphragm electrode on one side and the supplemental electrode on the other side, the said parts being so constituted and arranged as to cause a certain positive contact, in contradistinction from a microphonic contact such as is obtained when the granules are held in a loose and free state, between the diaphragm, the cooperating electrode, and the variable resistance conductor, and to cause in operation a variation of the resistance of the variable resistance conductor to the passage of the current therethrough or thereover, and also a variation of said current corresponding to the variations of sound vibrations of articulate speech and other sounds.

Of the accompanying drawings,—Figure 1 represents a sectional view of a telephone transmitter having an embodiment of my invention applied thereto, and showing diagrammatically the electric circuit associated therewith. Fig. 2 represents an elevation of a plurality of variable resistance contacts employed in connection with a rigid electrode.

The same reference characters indicate the same parts in both figures.

In the drawings, *a* represents the front plate of the casing of a telephone transmit-

ter in which is mounted the usual conical mouth-piece *b*. Contained in the casing is the usual diaphragm *c* which is located with its center adjacent the mouth-piece and mounted so as to be free to vibrate when impinged upon by sound waves. The diaphragm is insulated from the transmitter casing but is connected electrically with the lead *d* of an electric circuit. Located opposite the diaphragm is a button *f* of a readily conducting material, preferably metal such as brass, which has a face *e* of carbon on the side adjacent the diaphragm, and is secured to the end of a stiff spring bar *g*. This bar is insulated from the diaphragm, being attached to a hard rubber disk *h* which is mounted in the transmitter frame, and is connected electrically with the other terminal *i* of the circuit of which the lead or terminal *d* forms a part. The button *f* projects through a central perforation in the hard rubber disk.

Between the electrode *e* and the diaphragm is a soft pad *j* which is secured to the diaphragm and is held by the latter against the carbon face of the electrode button *f*. This pad is of material capable of yielding easily, preferably felt, and has a number of perforations *k* which pass entirely through it and form cells, cups or pockets to contain the variable resistance conductor, forming a plurality of contacts. This variable resistance conductor consists of separate portions of granular carbon which fill the cells and are retained therein on the one side by the diaphragm, and on the other by the pressure thereon of the electrode *e*. The carbon granules are in positive contact with the diaphragm; consequently they serve to conduct the current carried to the latter by the lead *d*, allowing it to flow from the generator battery *l* and the lead *d* through the button *e*, bar *h* and the primary winding of an induction coil *m*. As the diaphragm is vibrated by the sound waves toward and from the button *f*, the carbon granules are pressed alternately tighter together and released so that the resistance to the passage of the current through them is continually varying according to the character of the sound waves. The granules in all of the several cells are in positive multiple contact in contradistinction from a microphonic contact such as is obtained when the granules are held in a loose and free state, with the diaphragm and the electrode *f* and, they are all in the same circuit and connected

electrically with the same lead *d*. I have found that this arrangement, that is, a plurality of distinct granular contacts in the same circuit, or the subdivision of the variable resistance conductor, and a certain positive contact therewith, produces greatly improved results in the transmission of articulate speech, enabling greater battery power to be used, and obtaining better results with the same battery power as that now ordinarily employed, and also equally good results with less power.

By my invention it is possible to materially increase the voltage used with the transmitter and to transmit speech over a greater distance than has been possible hitherto with granular transmitters as commonly constructed with a loose gravity contact, and to obtain greater volume and clearness in the transmission over distances practicable at the present time. This invention permits an increased electrical current to pass without causing the snapping and crackling or "frying" sounds heard in the receiver, and without danger of burning the instrument. At the same time it entirely eliminates such sounds of the character referred to as are found under the present usual conditions.

The instrument is adjusted by means of a screw *n* which passes through the spring bar *g* into the disk *h*, whereby the proper normal pressure contact between the rigid and the granular variable resistance conductor is obtained.

I claim:—

1. A telephone transmitter having means for permitting the use of increased battery power and obtaining clearer and louder effects in the transmission of sounds, said means comprising a variable resistance conductor under pressure subdivided to make a plurality of separated positive contacts with the transmitter diaphragm and connected in parallel in an electrical circuit with one and the same source of electrical energy.

2. In a telephone transmitter, a variable resistance conductor subdivided into a plurality of parts, an elastic holder in which the subdivided parts of said conductor are held, a diaphragm, means for pressing said conductor in firm, non-microphonic contact with said diaphragm, and means for connecting said conductor parts in circuit with a single source of electrical energy in multiple.

3. In a telephone transmitter, a diaphragm or other vibrator, a granular variable resistance conductor subdivided into detached parts, a single pliable holder in which such parts of said conductor are held and separated from each other, a single adjustable spring-supported electrode cooperating with said diaphragm, between which and the latter said pliable holder is held, and with which all the sub-divisions of said granular conductor are in electrical connection, and

means for forcing said electrode toward the diaphragm to press the parts of the granular conductor into firm non-microphonic contact with the diaphragm.

4. In a telephone transmitter, a diaphragm and its cooperative electrode, moved to and from each other variably by the movements of the diaphragm, a variable resistance conductor subdivided into a plurality of separated groups of granules, all of which are in positive electrical connection with the diaphragm and its cooperative electrode, and a single battery, the current from which is divided among the several groups of granules.

5. In a telephone transmitter, a diaphragm, an adjustable electrode of rigid material, and a plurality of variable resistances, all connected in multiple through the diaphragm or vibrator supporting the same to a battery with one lead, and constituting a variable resistance conductor which is pressed against the electrode of rigid material with pressures varying from the normal, by the movements of the diaphragm.

6. In a telephone transmitter, a plurality of granular contacts united in multiple with one electrical lead, a complemental adjustable electrode and a diaphragm in the same circuit, the diaphragm arranged so as to cause a varying pressure contact between said granular contacts, electrode, and diaphragm, to vary the resistance thereof proportionately to the movements of the diaphragm.

7. In a telephone transmitter, the combination with a diaphragm, a yielding holder carried by said diaphragm and having a plurality of distinct cups or cells, separate granulated conducting material in said cells connected up in multiple with the diaphragm, a complemental adjustable electrode in electrical contact with said conducting material, and a battery or other source of electric energy in circuit with said electrode.

8. In a telephone transmitter, the combination with a diaphragm, of a soft pad carried by the diaphragm and provided with a number of separate pockets containing granular material, and a single complemental adjustable electrode against which the material in the pockets is variably pressed by the action of the diaphragm.

9. In a telephone transmitter, the combination with a diaphragm, of a soft pad carried by the diaphragm and provided with a number of separate pockets containing granular material in positive multiple electrical contact with the diaphragm, a single lead or wire passing from the diaphragm, a single complemental adjustable electrode against which the granular material is variably pressed by the diaphragm, and a wire connected with said electrode and in the

same battery circuit with the lead to the diaphragm and the granular material.

10. A telephone transmitter having in combination a diaphragm or other vibrator, 5 a pad of soft or pliable material having a plurality of perforations therethrough, carried or supported upon the vibrator, a variable resistance conductor disposed within the perforations in the pad, and in multiple 10 contact with the diaphragm or vibrator, a cooperative adjustable contact piece or electrode covering said variable resistance or conductor and in multiple electrical contact therewith, the diaphragm or vibrator and 15 the electrode being connected in series with the terminals of a battery or other source of electric energy or supply.

11. In a telephone transmitter adapted to use therewith high or low voltage currents 20 at will as desired, the combination with a diaphragm or other vibrator and a cooperating or corresponding electrode, and a suitable single source of electrical energy, of an intermediate variable resistance conductor 25 subdivided into fractional parts and retained under pressure in suitable receptacles therefor, said variable resistance being in positive electrical contact with the diaphragm or vibrator and the electrode at a 30 number of separate independent points, and with said source of electrical energy and arranged to be agitated or vibrated by the movements of the diaphragm when actuated by the sound waves of articulate speech or 35 other sounds.

12. In a telephone transmitter constructed and adapted to carry and vary high or low voltage currents, as desired, having a variable resistance granular conductor subdivided into fractional parts, with such fractional parts held under pressure in a suitable receptacle having a corresponding number of subdivisions, the combination of suitable contact pieces or electrodes in positive 45 engagement with the variable resistance conductor and in connection with a single battery, one on each side of said granular conductor and in multiple electrical contact therewith, and means for adjusting disturbing and vibrating the variable resistance conductor to cause electrical vibrations or variations thereof corresponding to the vibrations of the sound waves of articulate speech and other sounds.

55 13. In a telephone transmitter, the combination with a casing and a mouth-piece, of

a diaphragm immediately in rear of the mouth-piece and supported so as to be free to vibrate, a soft pad carried by said diaphragm having a number of separated cells 60 or sub-divisions filled with a variable resistance granular conductor, a rigid electrode in rear of said pad, a bar by which the same is supported and held in firm non-microphonic contact with said granular conductor, adjusting means engaged with said 65 bar, by the operation of which the proper normal pressure contact between said rigid electrode and the granular conductor may be obtained, and an electric circuit having 70 its terminals in electrical connection with the diaphragm and rigid electrode, respectively.

14. In a telephone transmitter, the combination with a casing and a mouth-piece, 75 of a diaphragm immediately in rear of the mouth-piece and supported so as to be free to vibrate, a soft pad carried by said diaphragm having a number of separated cells or sub-divisions filled with a variable resistance granular conductor, a rigid electrode 80 in rear of said pad having a facing of the same material as said granular variable resistance conductor in direct contact with the latter, a bar by which the same is supported 85 and held with its facing in firm non-microphonic contact with said granular conductor, adjusting means engaged with said bar, by the operation of which the proper normal pressure contact between said rigid electrode 90 and the granular conductor may be obtained, and an electric circuit having its terminals in electrical connection with the diaphragm and rigid electrode, respectively.

15. In a telephone transmitter, provisions 95 for permitting use of increased battery power and increasing the intensity of the sound transmitted thereby, consisting of an electrode and a sub-divided variable resistance conductor making a plurality of separated contacts with the diaphragm of the transmitter and with said electrode and held 100 in positive, firm, non-microphonic contact therewith, and all the divisions of said subdivided conductor being in circuit with the same source of electrical energy. 105

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

PHILIP G. RANDALL.

Witnesses:

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