H. J. CARMODY.

TRANSMITTER.

APPLICATION FILED JUNE 30, 1917. RENEWED AUG. 6, 1920.

1,372,862. Patented Mar. 29, 1921.

Figure 1.

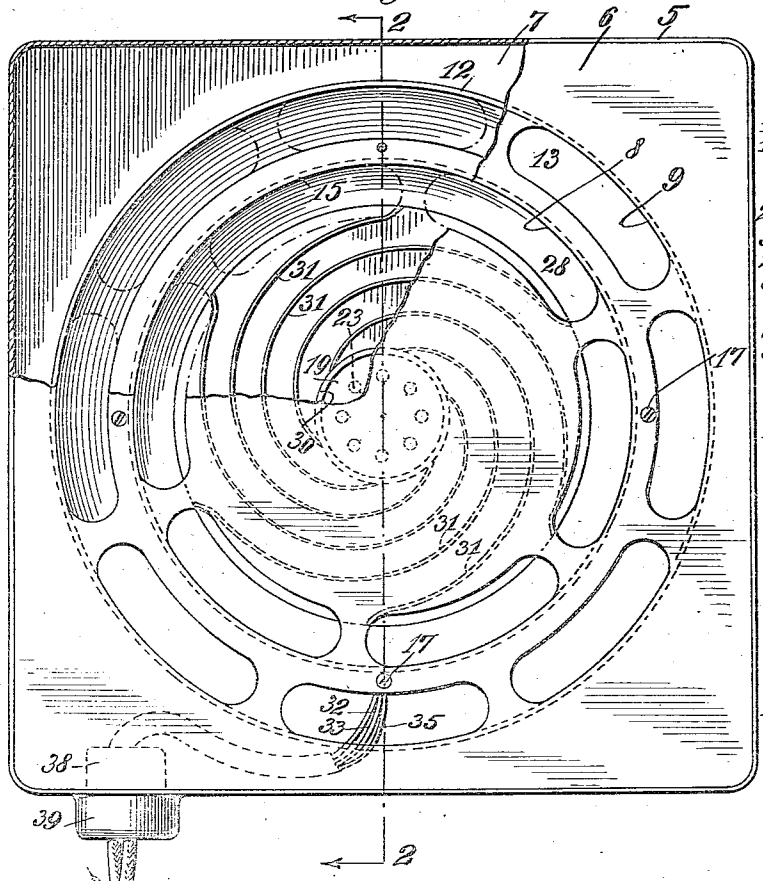


Figure 2.

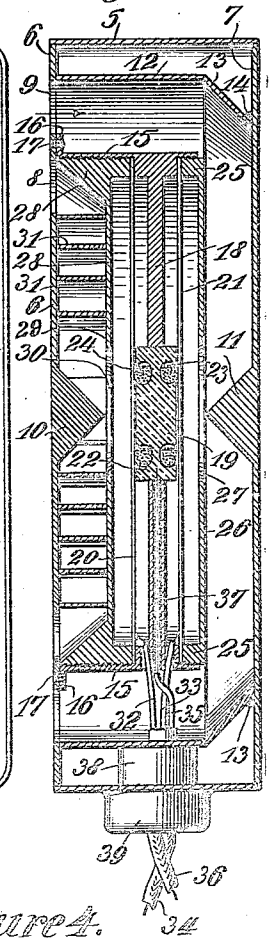


Figure 3.

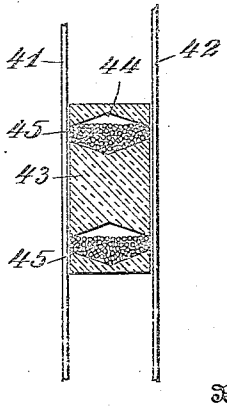
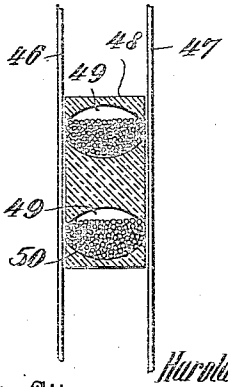


Figure 4.



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UNITED STATES PATENT OFFICE.

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TRANSMITTER.

1,372,862. Specification of Letters Patent. Patented Mar. 29, 1921.

Application filed June 30, 1917, Serial No. 178,030. Renewed August 6, 1920. Serial No. 401,821.

To all whom it may concern:

Be it known that I, HAROLD J. CARMODY, a citizen of the United States, residing in Woodhaven, in the county of Queens and State of New York, have invented certain new and useful Improvements in Transmitters, of which the following is a full, clear, and exact description.

My invention relates to transmitters of a type suitable for use in telephony and dictaphone work, as well as in all relations requiring a transmitter of great sensitiveness coupled with adaptability for use under different conditions.

More particularly stated, my invention is a sensitive microphone, in which I seek to attain a number of advantages, among which are the following:

I. To employ a plurality of separate diaphragms, one located back of another and each adapted to control a current, the aggregate control of the diaphragms being cumulative.

II. To virtually equalize the lengths of the respective paths whereby sound waves reach the several diaphragms in order to enable the diaphragms to vibrate in exact unison.

III. To so arrange the loose carbon particles as to prevent undue freedom of movement thereof, and by so doing to prevent the production of certain undesirable noises during the transmission of sounds.

IV. To render the transmitter compact and to give it such form as to enable it to work in any position in which it may be placed.

While it is impracticable to describe all of the different varieties of telephone transmitters in which my invention can be used, I will describe one concrete embodiment as representative of others, it being understood that I do not limit myself thereby, the scope of my invention being commensurate with my claims.

Reference is to be made to the accompanying drawing forming a part of this specification, and in which like letters indicate like parts throughout the views.

Figure 1 is a view partly in elevation and partly in section, showing one representative form of my improved transmitter.

Fig. 2 is a section on the line 2—2 of Fig. 1, looking in the direction indicated by the arrows.

Fig. 3 is a section corresponding to the proximate middle portion of Fig. 2, but showing a different arrangement of the carbon particles and parts immediately associated therewith.

Fig. 4 is a section showing another arrangement of the carbon particles and parts immediately associated therewith, this figure being otherwise similar to Fig. 3.

A casing is shown at 5 and in this instance is made of metal though if desired it can be composed of rubber, wood or any preferred material. The casing is fitted with a front plate 6 and a rear plate 7.

The front plate 6 is provided with a number of acoustical openings 8, 9, conveniently designated as sound holes. They are each of arcuate form, and they are collectively arranged in two concentric circles, as may be understood from Fig. 1, the circle made up of the holes 9 being of greater diameter than the one composed of the holes 8. The front plate 6 is provided with a cone 10 and the rear plate 7 has a somewhat similar cone 11. These cones are for the purpose of deflecting and guiding the sound waves, as hereinafter described.

Located within the casing 5 and abutting the front plate 6 thereof is an annulus 12, which is provided with a frusto-conical portion 13, preferably integral with it, and secured to the rear plate 7 in any appropriate manner, for instance by solder 14.

Another annulus 15 is located within the casing, and held in position by any suitable means. In this particular instance the annulus 15 is provided with a flange 16, integral with it and of annular form, and this flange is by screws 17 secured directly to the adjacent portion of the front plate 6.

The annulus 15 supports a plate 18, mounted rigidly in position. The plate 18 is preferably but not necessarily made of

conducting material. It has a comparatively thick or massive portion 19 made of carbon.

Located upon opposite sides of the plate 18 are two diaphragms 20, 21, each made of carbon and adapted to vibrate when subjected to the action of sound waves.

The thick portion 19 of the plate 18 is provided with pockets 22, 23, each having in this instance the proximate form of an oblate spheroid. There are two groups of the pockets 22, 23, each arranged substantially into the form of a circle. The pockets 22 are nearly but not quite closed by the presence of the diaphragm 20, the pockets 23 being likewise nearly but not quite closed by the presence of the diaphragm 21. The opening of each pocket 22, 23 is restricted; that is to say, each pocket is of undercut form, so that its opening, in close proximity to the adjacent diaphragm, has a cross diameter short as compared with the maximum cross diameter of the pocket.

Each pocket is filled with a number of loose particles 24 of carbon or other semi-conducting material, preferably spherical in form and polished. These carbon particles, which, if spherical, are known as carbon balls, are of sufficient number and volume to nearly but not quite fill each pocket. With the device in normal position, as indicated in Figs. 1 and 2, the upper mean level of the mass of carbon particles in any one of the pockets is a little higher than the uppermost part of the opening of the pocket in question. Such being the case, every carbon grain in direct engagement with a diaphragm is in engagement with other carbon particles resting upon it. In other words, no carbon particle in direct engagement with a diaphragm can be altogether free, as other carbon particles above it have more or less tendency to confine it and restrict its vibratory movements.

I have made the discovery that certain undesirable noises, often heard in the telephonic receiver, are traceable to undesirable vibratory movements of carbon particles in the transmitter. For instance some noises suggestive of squealing or wailing are due to the undue freedom of loose carbon particles, resting upon the top of the general mass of carbon particles in the transmitter, and usually in actual contact with the diaphragm or very close to it. The vibration of the diaphragm causes such relatively free carbon particles to dance, roll and quiver, and by so doing to disturb the proper electrical action of the transmitter.

I have made the further discovery that the undue freedom of the carbon particles can be effectively prevented by a suitable arrangement of the carbon particles relatively to the diaphragm. Following this idea, I employ such a volume of the carbon particles as to fill the pockets to a level slightly higher than the uppermost portion of the opening of the pocket, the apparatus being in its normal position. That is to say, I prevent all such particles as have undue freedom from resting against the diaphragm.

A ring 25, threaded externally, is fitted into the annulus 15, which is threaded internally to receive this ring. A sound plate 26 is carried by the ring 25, and is provided centrally with an opening 27. This opening is so located that sound waves, converging upon the cone 11, are deflected and caused to impinge upon the center of the diaphragm 21. These sound waves, before reaching the cone 11, pass in through the openings 9, and thence between the annulus 12 and the annulus 15, and are deflected by the frusto-conical member 13.

A ring 28, threaded externally, is fitted into the annulus 15. The ring 28 is beveled internally, and carries a sound plate 29, which is provided centrally with an opening 30. This opening coacts with the cone 10 for the purpose of directing sound waves against the center of the diaphragm 20.

A number of partitions 31, each having the general form of a spiral, are spaced equidistant and located between the front plate 6 and the sound plate 28. The spaces between the partitions are essentially sound passages, each of which communicates with one of the sound holes 8. The inner ends of these sound passages communicate with the sound hole 30. The spiral passages, because of their form, have a tendency to increase the distance over which sound waves, entering the sound holes 8, must travel in order to impinge upon the center of the diaphragm 20.

Thus the sound waves which enter through the sound holes 8 have, by virtue of the circuitous paths through which they are guided, substantially the same distance to travel, in order to impinge upon the center of the diaphragm 20, that the sound waves, entering through the holes 9, have to travel in order to impinge upon the center of the diaphragm 21.

Connected to the two diaphragms 20, 21 are two conductors 32, 33, preferably insulated wires, which are connected to a single conductor 34. Another conductor 35, provided with a portion 36 of enlarged diameter, extends through a tube 37 of insulating material. This tube extends radially inward through the plate 18, the conductor 35 being connected to the massive carbon portion 14. The two conductors lead outwardly through eyes 38, 39 to a plug 40. By aid of this plug the connections from the transmitter to a circuit can be quickly made or

broken. If desired, however, the connections can be made in any other suitable manner.

In Figs. 3 and 4, I show other forms of carbon contacts made in accordance with my invention.

In Fig. 3 the two diaphragms appear at 41, 42, and the massive carbon member at 43. The latter is provided with pockets 44, each extending entirely through it. Each pocket 44 has the form of a double-ended cone frustum, and is nearly but not quite filled with loose carbon particles 45. These particles are used in such number and quantity that the mean upper level of the mass (the parts being in normal position as shown) is a trifle higher than the uppermost portions of the pocket in immediate proximity to the diaphragms. In other words these pockets are each of such form that all particles of carbon within it, if resting against either diaphragm or in immediate proximity thereto, are not unduly free, for the reason that they have other carbon particles resting upon them.

In the form shown in Fig. 4 the diaphragms appear at 46, 47, and the massive carbon member at 48. This member 48 is provided with pockets 49 extending entirely through it and containing carbon particles 50. The structure and action for the mechanism here shown is practically the same as that appearing in Fig. 3 and above explained. The only difference is in the shape of the pockets 49, which are rounded and have each the proximate form of a prolate spheroid.

While I have shown only two diaphragms, used together, I do not wish to be limited thereby, as any greater number may be employed, if desired.

My invention is well adapted for dictaphone work, in which it has been tried with considerable success. One advantage it has for such work is that it will operate in any position. If it be placed in such position that one diaphragm is rendered wholly or partially useless for the time being, the other diaphragm can still be depended upon.

The movements of the diaphragm 20 are always in unison with those of the diaphragm 21. That is, first the two diaphragms swing toward each other and then they swing further apart. There is no interference of sound waves, and the effect of the diaphragms upon the control of the electric current is cumulative.

The transmitter is exceedingly sensitive, and may be used under great difficulties. It is very compact, and may be carried in the pocket, or suspended from the neck of the operator without any difficulty. For detective work it is unobtrusive in appearance, and because of its outward form is not likely to excite suspicion.

I do not limit myself to the precise form shown, as variations may be made therein without departing from the spirit of my invention, the scope of which is commensurate with my claims.

I claim:

1. In a transmitter the combination of a plurality of diaphragms located one behind the other relatively to the proximate direction of propagation of sound waves, and guiding means for enabling a portion of said sound waves to reach one of said diaphragms by a comparatively direct path, yet causing another portion of said sound waves to reach another of said diaphragms by a comparatively circuitous path of substantially the same length as said first mentioned path.

2. In a transmitter, the combination of a plurality of microphonic contacts, a plurality of sound-controlled diaphragms for said contacts, one of said diaphragms being located back of another in the general direction of propagation of the sound waves, and a casing inclosing said diaphragms and provided with sound passages leading to said diaphragms respectively, said sound passages being of different lengths in order to equalize the virtual distances of the diaphragms from the source of the sound waves.

3. In a transmitter the combination of a casing provided with a front plate and a rear plate, said front plate being provided with sound holes, a pair of diaphragms located within said casing and spaced apart, one of said diaphragms being disposed adjacent said front plate and the other of said diaphragms being disposed adjacent said rear plate, microphonic contacts connected with said diaphragms and controllable thereby for the purpose of transmitting sounds, means for guiding sound waves by a path leading from one of the sound holes in said front plate to said diaphragm disposed adjacent said rear plate, and mechanism connected with said front plate and associated with the sound holes thereof for guiding sound waves from said sound holes by spiral paths to the diaphragm disposed adjacent said front plate.

HAROLD J. CARMODY.