

Sept. 23, 1924.

J. W. OWEN ET AL

1,509,818

MICROPHONE

Original Filed Aug. 25, 1916

Fig. 1.

Fig. 2.

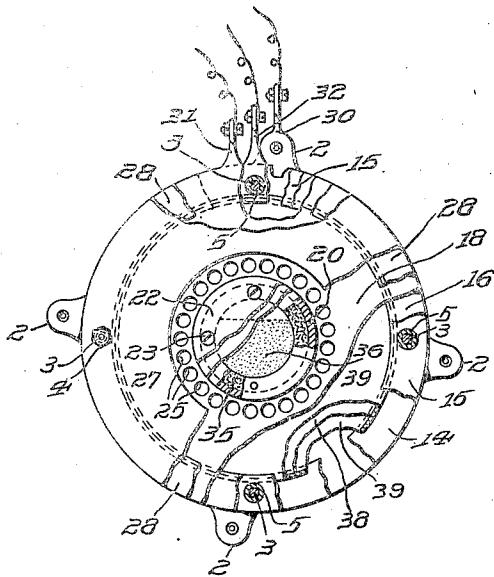
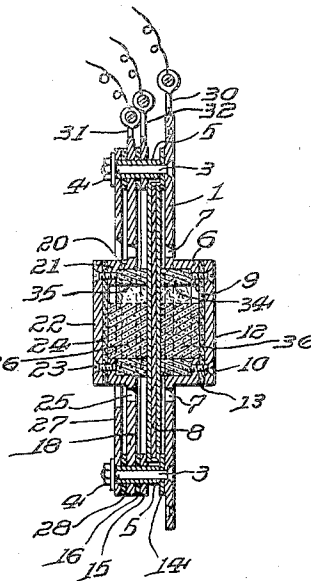
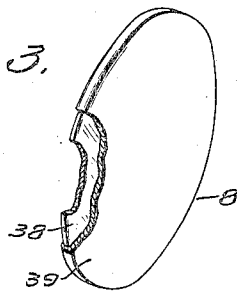


Fig. 3.



WITNESS

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UNITED STATES PATENT OFFICE.

JAMES W. OWEN, OF SECANE, PENNSYLVANIA, AND ALBERTIS HEWITT, OF CAMDEN, NEW JERSEY, ASSIGNORS TO VICTOR TALKING MACHINE COMPANY, A CORPORATION OF NEW JERSEY.

MICROPHONE.

Original application filed August 25, 1916, Serial No. 116,773. Divided and this application filed July 8, 1919, Serial No. 309,382. Renewed February 8, 1924.

To all whom it may concern:

Be it known that we, JAMES W. OWEN, a citizen of the United States, and a resident of Secane, county of Delaware, and State of Pennsylvania, and ALBERTIS HEWITT, a citizen of the United States, and a resident of Camden, county of Camden, and State of New Jersey, have jointly invented certain new and useful Improvements in Microphones, of which the following is a specification, reference being had to the accompanying drawing.

Our invention relates to microphones and more particularly those of the general type disclosed in our pending application for Letters Patent of the United States, Serial No. 116,773, filed August 25, 1916, of which the present application is a division.

A principal object of our invention is to provide a microphone of new and improved construction which is particularly adapted for employment under conditions in which it is desired to utilize a microphone of extremely sensitive character, such as in connection with the recording or reproduction of sound. A further object of the invention is to provide a diaphragm of novel character which in combination with the other elements employed in connection therewith is effective to render the microphone sensitive to the most minute sounds whereby corresponding fluctuations are caused in the electric current in the circuit in which the microphone may be connected.

Our invention includes all of the other various objects and novel features of construction and arrangement hereinafter more definitely specified and described.

While in the practice of our invention, we may employ various instrumentalities suitably arranged for accomplishing the results desired, in the accompanying drawings we have illustrated one form of our invention as embodied in a microphone adapted for connection in a three wire electric circuit, Fig. 1 being a front elevation of the microphone with parts broken away to show the several parts progressively from the front to the rear; Fig. 2 a central section on the vertical diameter of the microphone with certain parts shown in elevation for the sake of clearness, and Fig. 3 a perspective view of the diaphragm removed from the

microphone and with portions broken away to show the construction thereof.

Referring now more particularly to the drawing, the form of the invention therein shown may comprise a disc, plate or member 1 preferably of electrically conductive material, which may conveniently form one of the terminal plates of the microphone and to which one of the wires in the circuit in which the microphone is used may conveniently be connected. This plate or member may be provided with projecting lugs 2 by means of which the microphone may be conveniently attached to some suitable object when in use, it being understood that when so attached the microphone will ordinarily be suitably insulated therefrom. However, in certain constructions, the lugs may be omitted if desired.

The plate or member 1 may be conveniently apertured to receive the heads of a plurality of bolts or screws 3 extending through the plate and towards the opposite side of the microphone, the outer ends of the bolts being conveniently threaded for the reception of the nuts 4 by means of which the various parts hereinafter described may be held in operative relation, the bolts being surrounded by suitable cylinders 5 of insulating material by means of which the screws are held out of electrical contact with the elements through which they pass.

The plate 1 is provided toward the center with an outwardly projecting preferably cylindrical portion or shoulder 6 integral with the plate, and is provided adjacent the junction of the shoulder and the plate with a preferably circumferentially disposed series of apertures 7, each of relatively small dimension, affording communication between the interior of the microphone, in which is positioned the diaphragm 8, hereinafter more particularly described, and the external atmosphere, thereby permitting the passage of sound waves to the interior of the microphone. The shoulder 6 which may be conveniently inwardly directed toward its outer extremity to provide a flange 9 adapted for the reception of screws 10, is adapted to receive a cap 12 arranged to close the opening defined by the internal periphery of the flange, a plate 13 of suit-

able relatively thin preferably electrically conductive material, such as a thin plate of carbon, being positioned between the cap and the flange 9 with the screws 10 passing therethrough, whereby both the cap and the plate are secured to the flange.

The diaphragm 8, hereinafter more particularly described, may be supported in any convenient and suitable manner for performing its function by any suitable means. In the form of the invention illustrated, said means comprise a thin washer 14 of suitable insulating material adjacent the inner side of the plate 1 and an element or ring 15, which may conveniently be in the form of a circular washer of suitable electrically conductive material, the internal diameter thereof being preferably slightly less than the diameter of the diaphragm so that the former will slightly overlap the edge of the latter when the parts are in assembled position, the internal diameter of the washer 14 being preferably of similar size. Another washer 16 of insulating material and preferably similar to washer 14, is located on the opposite side of the ring 15 and is arranged to space the latter from a plate or member 18, preferably formed of electrically conductive material which may in construction and arrangement be preferably substantially like that of the plate 1. The plate or member 18 is provided with a cylindrical portion or shoulder 20 having a flange 21, corresponding to the portion or shoulder 6 and flange 9 of plate or member 1. A cap 22 corresponding to the cap 12 is preferably similarly positioned on the flange 21 by means of screws 23, a carbon or other suitable plate 24 corresponding to plate 13 being positioned between the cap and the flange.

The plate 18 may also preferably be provided with a series of apertures 25 corresponding to the apertures 7 in plate 1 and to afford communication between the inside of the microphone and the external atmosphere similarly to the apertures 7.

If desired, a guard or cover 27 of mica or other suitable material may be provided adjacent the outer side of the plate 18 extending over the same to a point adjacent the cylindrical portion 20 and it may be secured in position by the bolts 3 which may conveniently pass therethrough, a thin washer 28 of suitable, preferably insulating material serving to space the guard or cover 27 from the plate 18. It will be understood that, if desired, a similar guard or cover may be readily positioned adjacent and exterior to plate 1, although in the form of the invention shown and which is adapted for attachment to a suitable object, this guard is conveniently omitted. It will be understood that the various parts when constructed and assembled on the bolts 3, as hereinbefore

described, with the nuts 4 positioned thereon, will be supported in operative relation as clearly shown in Fig. 2, and it will be further understood that the plates or members 1 and 18 which could form the casing of the microphone, and ring 15, may conveniently be provided with suitable connections or extensions 30, 31 and 32 by means of which the microphone may be readily connected in an ordinary three wire circuit.

It will be noted that each of the portions 6 and 20 of the plates 1 and 18 respectively, forms adjacent the center of the microphone, a cell or compartment closed at one end by the caps 12 and 13 respectively holding the carbon plates 13 and 24 in position, and that the diaphragm 8 extends through the cell substantially at the center thereof, dividing the cell into separate chambers. A pair of washers 34 and 35 of suitable material, such as asbestos, are positioned within this cell on each side of the diaphragm to lightly bear against the same, the washers being retained in place by the flanges 9 and 21, and substantially forming a sort of lining to the cell. The chambers on each side of the diaphragm, as best shown in Fig. 2, are adapted to contain suitable electrically conductive material 36, which may preferably consist of carbon particles or granules, a sufficient amount of the material being generally employed to fill each chamber about two thirds full. It will thus be noted that the carbon particles adjacent the plate 1 are in electrical contact therewith; the carbon particles adjacent the plate 18 similarly in contact therewith, and both masses of carbon particles in electrical contact with but separated by the diaphragm, and that as the chambers on each side of the diaphragm are preferably not completely filled with the particles, the latter have relatively free movement therein.

The diaphragm 8, to which reference has hereinbefore been made, is of peculiar construction, and, in the preferred embodiment of our invention may consist of a sheet of some suitable material sensitive to vibration, as for example, a sheet of mica 38 forming a base on which a thin coating 39 which will ordinarily be less sensitive to vibration than the material of which the base is formed is suitably deposited or formed and arranged preferably to entirely cover the mica both at its sides and edges as best shown in Fig. 3 in which, as in Fig. 2, the relative thickness of the coating is necessarily exaggerated, as well as the thickness of the base itself. While the coating may be of any suitable preferably metallic substance formed or deposited on the base in any convenient and suitable manner, nevertheless, it is found in practice that a coating of silver is well adapted for the purpose, and we prefer to employ the same under ordinary conditions, and

while this coating may be placed on the base in various ways, it may be conveniently formed thereon by treating a solution of silver nitrate in water with strong ammonia and then dissolving the yellow deposit with more ammonia until clear, when the solution is poured upon and completely covers the mica. At the same time, a solution of formaldehyde is poured upon and over the mica and finally, in order to clear the deposited silver, ammonia is poured over the diaphragm and the diaphragm then dried. However, any other desired method of forming the metallic deposit or coating on the mica may be employed.

While it is not known positively why a diaphragm of the character of that described exhibits the particular advantages which have been observed to attend its use, it is believed that such advantages are probably due in part to the extremely delicate and true responsive action which is afforded by the mica to vibratory motion, while the bright smooth metallic coating apparently makes a clean contact with the carbon particles. Additionally, as the surface of the metallic coating is of extreme smoothness and but slightly affected by atmospheric conditions so as to remain untarnished for a long time, a diaphragm constructed in the manner described is adapted to transmit the most minute variations in the pressure thereon to the carbon particles and to form an extremely good electrical contact therewith, thus affording the numerous well-known advantages of mica as a medium for diaphragms in general with the necessary electrical conductivity required of the diaphragm in a microphone of this character.

It is thought that the operation of the microphone will be readily comprehended without further description and that it will be understood that the same may be employed in connection with any suitable electrical circuit preferably of the three wire type, although, if desired, the microphone may be readily arranged for use in other forms of circuits as will be well understood by those familiar with the art, and furthermore, that while our invention may be utilized for numerous purposes in the arts, it is especially adapted for use in connection with the recording and reproduction of sound for which purposes it may be readily and conveniently arranged with any suitable instrumentalities adapted for accomplishing the ends desired.

Moreover, while we have with considerable particularity described one embodiment of our invention herein, we do not thereby desire or intend to limit ourselves specifically thereto, as it will be evident that the form and construction of the various elements may be modified as desired to adapt the invention to varying situations encountered

in practice, or to best arrange the invention for a given purpose, or to meet the particular conditions under which it is to be employed, without departing from the spirit and scope of the invention as defined in the appended claims.

Having thus described our invention, we claim and desire to protect by Letters Patent of the United States:

1. A microphone comprising a plurality of electrically conductive plates, a diaphragm having a mica base and a metallic coating entirely enclosing said base supported between said plates, and masses of carbon particles separated by said diaphragm and in electrical contact with their respectively adjacent plates, each of said plates having a plurality of apertures communicating with the interior of said microphone.

2. A microphone comprising a pair of electrically conductive plates, a pair of chambers formed by said plates, masses of carbon particles within and partly filling said chambers and having free uncompressed upper surfaces and in electrical contact therewith, and a diaphragm comprising a mica base and a metallic coating upon said base, the carbon particles in said chambers being in electrical contact with said diaphragm, and the said particles in each chamber being in electrical contact with one of said plates.

3. A microphone comprising a pair of oppositely disposed plates, each of said plates being provided with an annular recesses forming a chamber, a diaphragm, comprising a mica base and a metallic coating upon said base, disposed between said plates, an asbestos washer within each of said chambers and lightly engaging said diaphragm, carbon particles within said chambers, and an electroconductive ring in contact with said diaphragm.

4. In a microphone, the combination of a metallic casing, comprising a pair of metallic members each provided with a recessed portion forming oppositely arranged chambers, a diaphragm secured between said members, insulated therefrom, and out of direct engagement therewith, yielding means within said chambers providing spaces on opposite sides of said diaphragm and loose carbon particles partly filling the spaces formed by said recessed portions of said members, and in electrical engagement with said diaphragm and casing, said yielding means being operative to retain said carbon particles within said chambers, said diaphragm consisting of a thin sheet mica base having its opposite faces provided with a metallic coating adhering thereto, and the said loose carbon particles in said chambers being in engagement with the metallic coating on the face of said diaphragm adjacent thereto.

5. In a microphone having a cell containing loose comminuted carbon particles arranged to be rapidly compressed and released to vary an electrical current there-
5 through, a diaphragm comprising a base of sheet mica and a continuous metallic coating adhering to a face of said sheet mica base and arranged to engage and cooperate with the loose granular carbon contents of said
10 cell.
6. A microphone diaphragm arranged and adapted to form the vibratory wall of a microphone cell comprising a base of sheet mica, and a silver coating firmly adhering to
15 a face of said sheet mica base, said silver coating being arranged and adapted to engage and electrically cooperate with the loose carbon particle contents of a microphone cell.
- 20 7. A microphone diaphragm arranged and adapted to form the vibratory wall of a microphone cell comprising a base of sheet mica, and a metallic coating firmly adhering to and completely covering the opposite faces of said sheet mica base, said
25 metallic coating being arranged to engage and cooperate with the loose carbon particle contents of a microphone cell.
8. As an article of manufacture, a mica diaphragm having a coating of metal ad-
30 hering thereto substantially covering a face thereof.
9. As an article of manufacture, a mica diaphragm having a coating of silver adhering thereto and substantially covering a
35 face thereof.
- In witness whereof, we have hereunto set our hands this 7th day of July, 1919.
- JAMES W. OWEN.
ALBERTIS HEWITT