April 19, 1932. W. R. LANE 1,854,474

MICROPHONE

Filed May 31, 1930

Fig. 1.

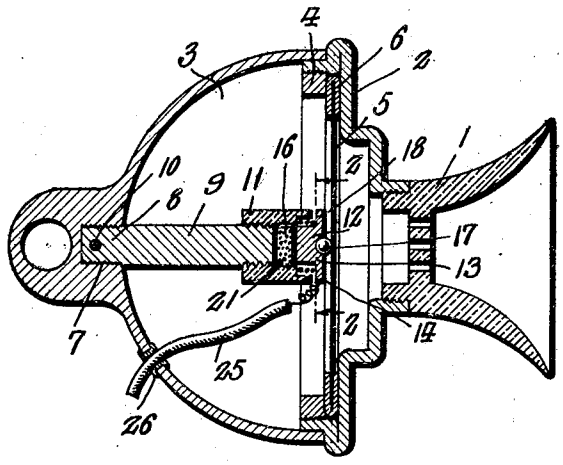


Fig. 2.

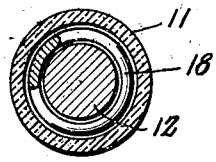


Fig. 4.

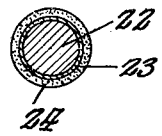
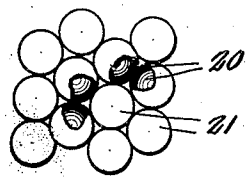


Fig. 3.



William R. Lane,
INVENTOR

BY Victor J. Evans
ATTORNEY

Patented Apr. 19, 1932

1,854,474

UNITED STATES PATENT OFFICE

WILLIAM ROE LANE, OF NIAGARA FALLS, NEW YORK

MICROPHONE

Application filed May 31, 1930. Serial No. 458,147.

This invention relates to improvements in microphones and more particularly to that class which are employed as telephonic transmitters although the invention is not by any means restricted to this use, and one of the primary objects of the present invention is to provide a microphone possessing a high degree of stability and freedom from caking so that the instrument will operate with the same degree of efficiency and dependability in all positions.

Another object of the invention is to provide a microphone which may possess a high sensitivity and which may be controlled by suitable adjustment to a high degree of efficiency with a relatively low current consumption.

Another object of the invention is to provide a microphone which will be more simple in its construction than the ordinary microphone of high quality and which may be manufactured at a low cost and its component parts readily assembled and adjusted.

Generally speaking, the invention resides in an improvement in the construction of the electrodes of a microphone and in the employment of a novel material or medium between the fixed and movable electrodes possessing none of the disadvantages of carbon granules ordinarily employed in this connection and which, as is well known have a tendency to pack.

In developing my invention I have taken into consideration that if microphonic action between contact points or surfaces is due to their elasticity, or change in contact area, then such action would necessarily be accompanied by some shortening or contraction of the particles along the axis of the stress imposed. In other words, the normal cross-sectional dimension of two contracting bodies, under mechanical pressure, would be increased, but, at the same time, the dimension of diameter along the axis of the applied pressure would also be decreased, and both of these conditions would result in a decrease of electrical resistance. It is belived that the given mechanical pressure applied to a given material, would produce a given measure of elastic response and therefore if its dimension in the line of pressure were very small, then the decrement percentage of this dimension under given mechanical pressure, would be proportionately great.

I have discovered that if two iron balls were provided with an externally thin coating film of carbon and were brought into contact, that their microphonic response to mechanical pressure would be unusually pronounced. The iron core of each ball having a resistance wholly negligible in comparison to the carbon coating, would serve merely as a low resistance conductor. In other words, virtually the entire resistance of such an arrangement would reside in the points of contact at all times, a desideratum in the design of an ideal microphone. However, in order that such a medium might be employed in accordance with the purpose of the present invention, I have found that a more desirable resistance would be obtained by the use, as such a medium, of small magnetic particles, suitably graded, which particles are coated with carbon by sifting them through the hot flame of a gasoline blow-furnace, thereby heating them to incandescence and automatically quenching them as they fall into the hydro-carbon liquid in the priming cup below the blow flame. But first, and after extended experiment, it was found necessary to electro-plate the small magnetic particles with silver as a sort of priming coat, for it was discovered that in no other way, apparently, was it possible to avoid the formation of an oxide coating or film underneath the carbon coating, and this in turn interposed such as inordinately high electrical resistance as to defeat the purpose of the scheme. The reason for resorting to silver as a plating medium was due to the fact that silver oxide, if formed, has substantially the same conductivity as the base silver, which is of notably low resistance. While this coating was successfully accomplished by me, it is conceivable that it might be obtainable by other methods.

I further found that if such silver and carbon coated magnetic particles were substituted for the said carbon-granules originally employed in the common type of microphone

and that if a rear or stationary electrode could be mounted on one pole of a magnet, I could obtain a microphonic increase by the present invention.

This invention also consists in certain other features of construction and in the combination and arrangement of the several parts, to be hereinafter fully described, illustrated in the accompanying drawings and specifically pointed out in the appended claims, it being understood of course that minor changes may be made so long as they fall within the scope of the claims.

In describing my invention in detail, reference will be had to the accompanying drawings, wherein like characters denote like or corresponding parts throughout the several views, and in which:—

Figure 1 is a vertical front to rear sectional view through a telephonic microphone embodying the invention.

Figure 2 is a vertical transverse sectional view taken substantially on the line 2—2 of Figure 1, looking in the direction indicated by the arrows.

Figure 3 is a detail view on an enlarged scale, illustrating schematically the character of the carbon coated electro-magnetic particles as they will be assembled between the fixed and movable electrodes of the microphone.

Figure 4 is a sectional view on an enlarged scale illustrating one of the carbon coated electro-magnetic particles prepared by a process somewhat different from that by which the particles shown in Figure 3 are formed.

In the drawings the numeral 1 indicates in general the ordinary hard rubber mouth piece of a telephone transmitter embodying the invention and the numeral 2 indicates the front of the shell of the microphone casing, the rear part of the shell or the body thereof being indicated by the numeral 3. The numeral 4 indicates a lock ring for clamping in place the diaphragm of the microphone which is indicated by the numeral 5, and which may be the ordinary type of diaphragm.

A soft rubber band 6 is disposed to embrace the periphery of the diaphragm 5 and is confined between the front piece 2 of the shell and the locking ring 4, and serves effectively to insulate and at the same time cushion the diaphragm 5. The body 3 of the shell is formed in its inner side at its rear with a threaded socket 7, and the threaded end 8 of a permanent magnet 9 is fitted into the socket and held against rotative displacement by a set screw 10. The numeral 11 indicates an insulating sleeve of bakelite, which is interiorly threaded at its rear end and fitted onto the forward end of the permanent magnet 9. This permanent magnet constitutes the fixed electrode of the microphone and the movable electrode is indicated by the numeral 12 and comprises a circular body portion 13 having an outstanding circumscribing flange 14 at its forward end. The body 13 of the movable electrode is of a movable diameter to fit within the forward end of the bore of the sleeve 11. The numeral 15 indicates carbon disks, one of which is in engagement with the forward end of the magnet 9 and the other in engagement with the inner end of the body 13 of the movable electrode, and the filling 16, of metallic magnetic particles coated with carbon is arranged between the disks 15.

A ball 17 of magnetic material is seated in a socket formed centrally in the outer end of the movable electrode 12 and presses against the diaphragm 5 at the center thereof. A helical spring 18 which may consist of a few turns of small wire, of suitable material and dimensions, is preferably arranged between the inner side of the flange 14 of the movable electrode within the recess 19, thus providing a resilient spacing means between the movable electrode and the fixed electrode, and also functioning as a centering and aligning device for the body 13 of the movable electrode 12.

As stated, Figure 3 of the drawings illustrates, on a much enlarged scale and schematically, the magnetic metal particles which are coated with carbon, and in this figure the numeral 20 indicates the individual particles of magnetic metal and the numeral 21, the coating of carbon which is formed thereon by the method above described or any other practical method.

In the embodiment of the invention shown in Figure 4 of the drawings, the medium between the electrodes of the microphone differ somewhat from the material previously described and shown in Figure 3 in that, in addition to selecting suitably graded particles of magnetic material and shifting them through the hot flame of a gasoline blow-furnace, thereby heating them to incandescence and automatically quenching them as they fall into the hydro-carbon liquid in the priming cup below the blow-flame, I have found that if silver and carbon coated magnetic particles are substituted for the carbon granules ordinarily employed, and if the rear or stationary electrode could be mounted upon one pole of a magnet I could obtain a microphonic increase more effectually than by the mere carbon coating of the particles and, as shown in Figure 4, one of the individual particles is indicated by the numeral 22 and the deposit of silver, which deposit is indicated by the numeral 23 is effected by electro-plating the small magnetic particles with silver. The carbon coating is indicated by the numeral 24 and it will be understood that the silver coating 23 constitutes in effect a priming coating which avoids the forma-

tion of an oxide coating or film beneath the carbon coating 24, and I have found it desirable to employ silver as a plating medium in view of the fact that if oxide of silver is formed it has substantially the same conductivity as the silver itself, the silver having a notably low resistance.

While all of the metal parts in the embodiment of the invention, except, possibly, the resilient spacer 18, shown in the present drawings are of magnetic material, this is true for the reason that I thought it desirable to provide a substantially closed magnetic circuit. It is conceivable, however, that an open magnetic circuit might be employed, in which case, an aluminum diaphragm and other parts might be substituted for the other parts, which are of another metal, in the illustrated embodiment of the invention, with the exception of the magnet. The aluminum diaphragm may be employed in any event if it were deemed of importance to do so without introducing a very large air gap into the magnetic circuit. Also the magnet might be an electro-magnet instead of a permanent magnet, if this construction would be considered advantageous, and in this case, the magnet would be energized by the line circuit as are the so-called D. C. telephone receivers used in a common battery system.

A conductor wire 25 from a source of current is led through a sleeve 26 mounted in the wall of the body 3 and connected to the movable electrode 12.

What I claim is: —

1. In a microphone, a magnet constituting the fixed electrode, and an armature constituting the movable electrode, a diaphragm, a magnetic element upon the movable electrode contacting the diaphragm, carbon disks disposed against the end of the magnet and against the opposing face of the movable electrode, the said mass of carbon coated magnetic particles filling the space between the said disks, a helical spring interposed between a flange upon the movable electrode and the adjacent end of said sleeve and constituting a resilient means for yieldably holding the said element upon the movable electrode in contact with the diaphragm.

2. In a microphone, a magnet constituting the fixed electrode, and an armature constituting the movable electrode, a diaphragm, a magnetic element upon the movable electrode contacting the diaphragm, and a mass of carbon and silver coated magnetic particles interposed between the fixed and movable electrodes.

In testimony whereof I affix my signature.

WILLIAM ROE LANE.