Oct. 9, 1928

1,686,901

C. A. CULVER

MICROPHONE

Filed July 1, 1927

2 Sheets-Sheet 1

FIG. 1

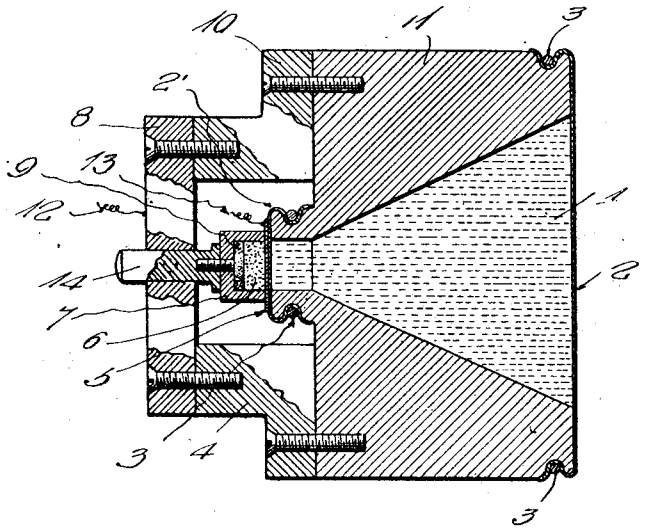


FIG. 2

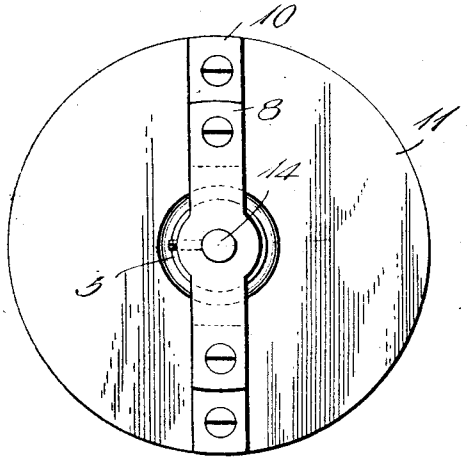
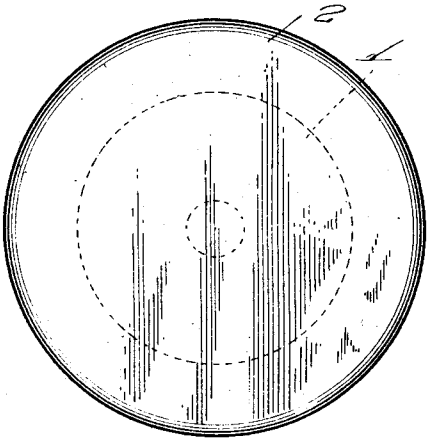


FIG. 3



INVENTOR.

Charles A. Culver,

BY John B. Grady

ATTORNEY

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FIG. 4

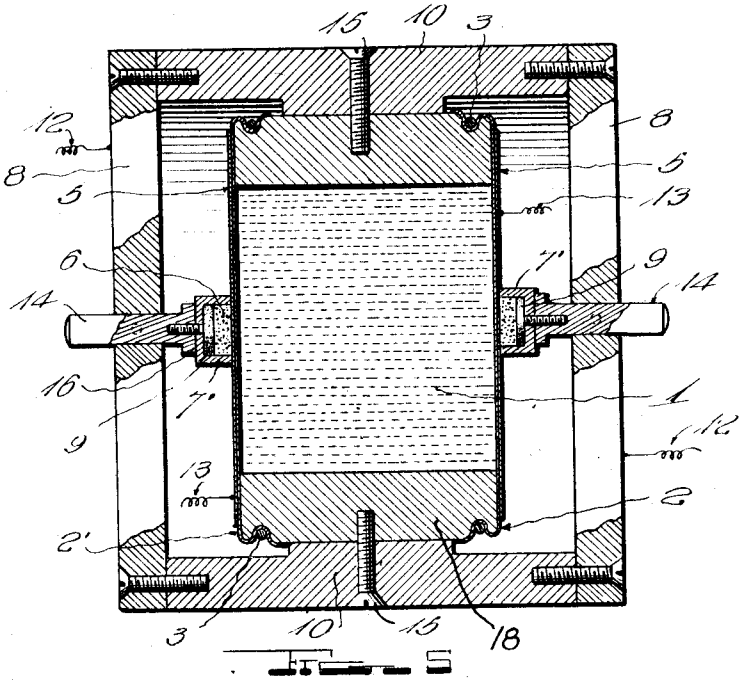
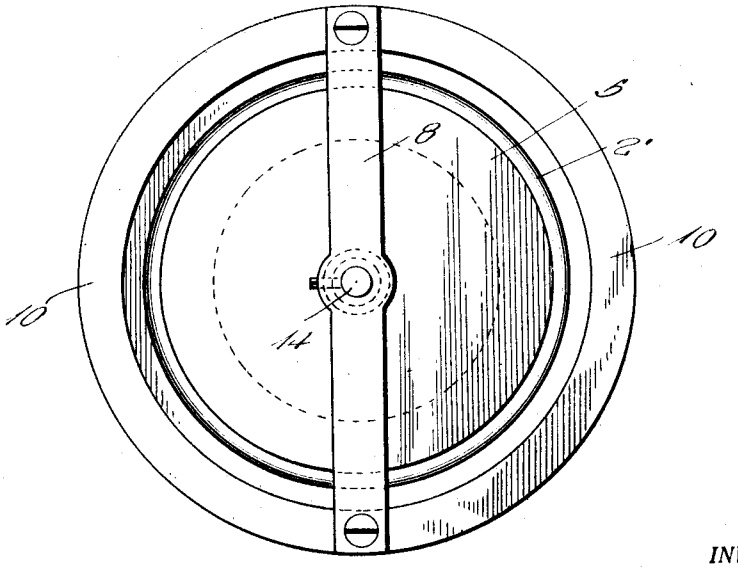


FIG. 5



INVENTOR.
Charles A. Culver,
BY John O. Brady
ATTORNEY

Patented Oct. 9, 1928. 1,686,901

UNITED STATES PATENT OFFICE.

CHARLES A. CULVER, OF NORTHFIELD, MINNESOTA, ASSIGNOR TO WIRED RADIO, INC., OF NEW YORK, N. Y., A CORPORATION OF DELAWARE.

MICROPHONE.

Application filed July 1, 1927. Serial No. 202,962.

My invention relates to an improved type of microphone particularly useful in connection with radio broadcasting and public address systems.

One of the objects of my invention is to provide a microphone or pick-up device in which resonant effects are eliminated.

Another object of my invention is to provide a microphone construction in which a linear energy response may be obtained.

A further object of my invention is to provide a microphone of a portable character having a high degree of sensitivity and permanency of adjustment.

My invention will be more clearly understood from the specification hereinafter following by reference to the accompanying drawings in which:

Figure 1 is a cross-sectional view taken through a microphone showing one form of my invention; Fig. 2 is a rear end view of the microphone construction illustrated in Fig. 1; Fig. 3 is a front elevation of the microphone construction illustrated in Fig. 1; Fig. 4 is a cross-sectional view of a microphone embodying the principles of my invention; and Fig. 5 is a front elevation of the microphone of the construction illustrated in Fig. 4.

Referring to the accompanying drawings, the body of the unit designated as 11 consists of a block of heavy material such as brass which forms a non-vibratile form and support for the several electrical and mechanical elements constituting the device. The conical chamber 1 has both its larger and smaller openings closed by means of thin and highly flexible material such as rubber or gold-beater's skin, these two membranous walls being designated as 2 and 2′ in the diagram. These flexible walls are held in position by suitable cords or bands 3 which rest in appropriate grooves. For additional security the flexible ends may be cemented to the edge of body 11. The space thus formed by the body 11 and the two flexible walls is completely filled with a liquid such as water, alcohol, or glycerine. To the smaller of the two flexible walls is attached, by means of suitable adhesive material, a layer of extremely thin gold foil 5. A small cell or receptacle 7 made of insulating material is held rigidly in position by means of the attached shank 14, this shank being firmly supported by the metal bridge consisting of the parts 4, 10 and 8. The cup or receptacle 7 is supported in contact with the composite flexible wall 5. Within the cell 7 and at its back is placed the usual polished carbon disk 9 or other similar microphonic surface. The space between the flexible gold surface 5 and the carbon mirror 9 is nearly filled with granular carbon 6 or other similar material suitable for microphonic purposes. Suitable flexible electrical terminals 12 and 13 are attached to the bridge bar 8 and to the gold surface 5 whereby the microphone may be connected in series with the usual source of potential and the primary of a transformer.

The operation of the microphone of my invention is as follows: Sound waves impinging on the flexible wall 2 give rise to a varying pressure, which pressure, as a result of the operation of Pascal's principle, is transferred without loss to the rear flexible wall 2′, and thence to the granular material 9. As a result of this variable pressure on the microphonic elements in the cell the energy of the incident sound waves is converted into a variable electrical current in a manner well known to the art.

Owing to the fact that the two end walls of the chamber are highly flexible and, in general, under different peripheral tension, and because of the fact that the liquid between said membranous walls possesses a relatively large mass, damping is complete and the moving system is therefore aperiodic. As a result of this mechanical property resonant effects with the attendant distortion are eliminated, thus overcoming one of the inherent defects in former devices of this character.

In other microphonic pick-up devices (except in the case of the device disclosed in my Patent 1,616,414) an effort is made to minimize undesirable resonance effects by subjecting the diaphragm to high peripheral tension. Such an arrangement results in comparatively low sensitivity and also in a non-linear energy response. In my invention the membranes are highly flexible and are under relatively small peripheral tension. As a result of these conditions the sensitivity of the organization to sound waves is relatively high, and the energy response proves to be approximately uniform over a wide range of frequencies.

Another advantage residing in my invention is that while the device is highly sensitive and also free from resonant effects, it

possesses the same degree of portability as the ordinary microphone.

In the former microphones metal is utilized as the material for the vibratile member. From the nature of the case the tonal quality can therefore not be perfect. In my invention a completely dampened and highly flexible membrane is employed for receiving the sound waves, with the result that a more natural tonal reproduction is secured.

Figs. 4 and 5 show another one of the several possible practical forms which my invention may take. This arrangement provides for two microphonic cells 7′ instead of one, as above described, thus making it possible to utilize a push pull or balanced microphone circuit. The conical chamber 11 is here replaced by a cylindrical enclosure 18, both ends of which are closed by the flexible membranes 2 and 2′. Attached to each membrane is a very thin layer of gold foil, and the two microphonic cells 7′ are supported as shown. The cylindrical member 18 is supported centrally within the frame 10 by means of screw devices 15. The bridge members 8 extend diametrically across opposite ends of the frame 10 carrying the microphonic cells, which are supported by the members 14 projecting through the bridge members 8. The members 14 are each provided with a flange 16 to which the microphonic cell is attached. Sound waves enter opposite ends of the frame 10 and impinge against the flexible sheets of foil 5 and the membranes 2 and 2′ secured by means of cords 3 over opposite ends of the cylindrical frame 18.

The construction of microphone as described herein has proven highly sensitive and yet the apparatus is practical and readily portable. Flexible membranes are placed under moderate peripheral tension. The mass of liquid between the membranes possesses relatively great inertia and the moving system becomes aperiodic, of relatively great sensitivity and gives faithful reproduction of all tonal values.

While I have described certain preferred embodiments of my invention, I desire that it be understood that modifications may be made and that no limitations upon my invention are intended other than are imposed by the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent of the United States is as follows:

1. A microphone comprising a chamber enclosing a liquid content, flexible walls enclosing opposite ends of said chamber, metallic foils carried by the exterior of said flexible walls, a microphonic device positioned in electrical contact with said metallic foils and located with respect to said flexible walls for receiving forces incident thereon from said liquid content corresponding to pressures derived from sound waves impinging against said flexible walls.

2. A microphone comprising a frame structure, a chamber open at opposite ends thereof and disposed within said frame structure, a flexible wall closing each end of said chamber, a metallic coating extending over the exterior of each of said flexible walls, a microphonic contact disposed at substantially the center of each of said flexible walls and resting in contact with the metallic coatings thereon, and a fluid mass disposed within said chamber and between said flexible walls whereby the pressure effects of sound waves incident upon one of said flexible walls are transmitted through said fluid mass and against each of said microphonic contacts for subjecting said microphonic contacts to variable pressure in accordance with variations in sound.

In testimony whereof I affix my signature.

CHARLES A. CULVER.