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METHOD OF AND APPARATUS FOR TELEPHONY

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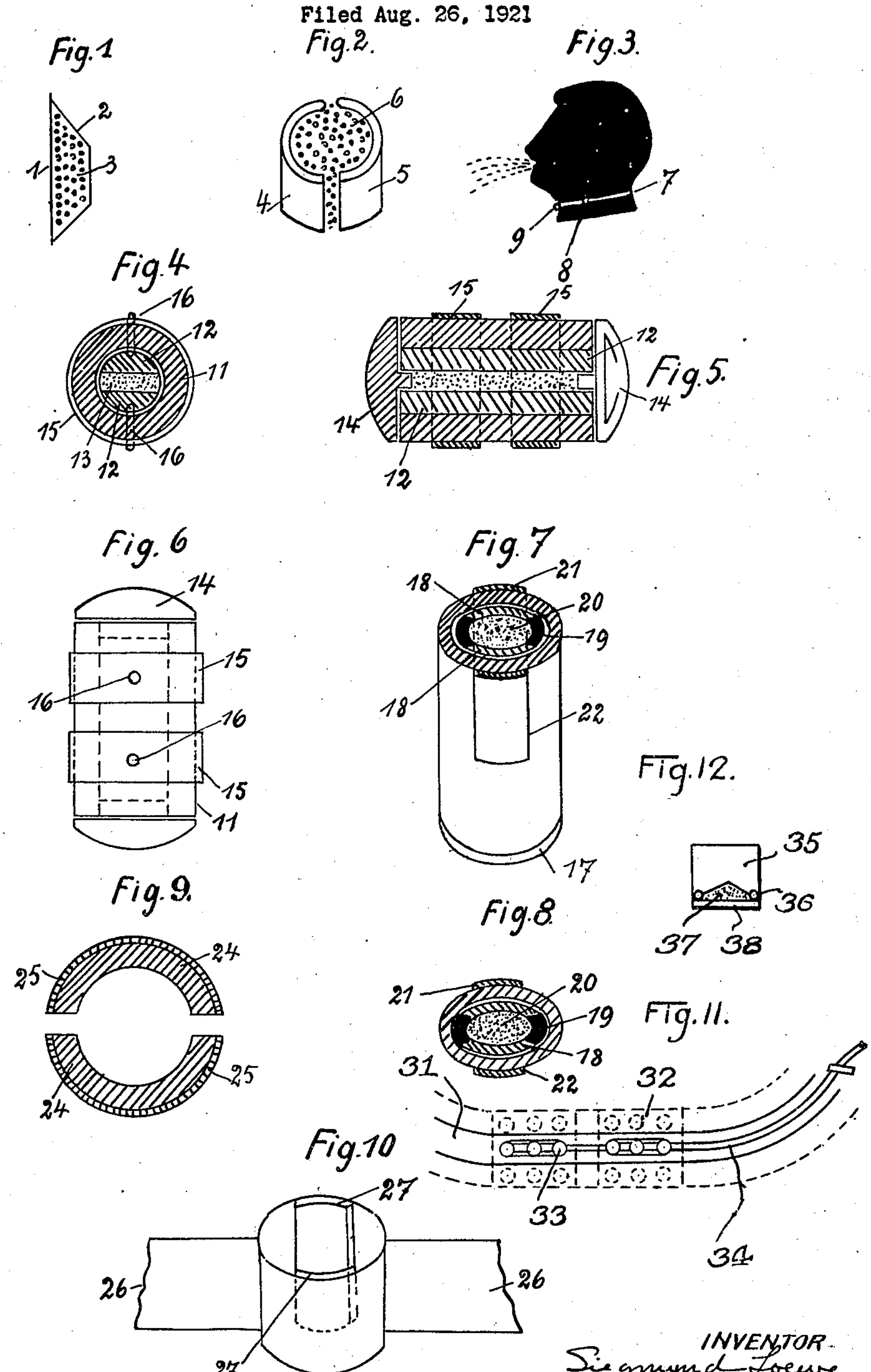

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METHOD OF AND APPARATUS FOR TELEPHONY.

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Microphones for use in transmission of intelligence have been of the type actuated by sound waves transmitted through air to the microphone. Microphone transmitters of this type usually employ an elastic diaphragm which vibrates in accordance with the sound waves reaching it through the air and modulates an electric current by associated mechanical means. A disadvantage of this method, that undesirable sound waves are also taken up and transmitted by the microphone, is especially noticeable in cases where one (or both) of the call stations is situated in a position where much noise is prevalent, for example, on board air-craft, in the engine rooms of ships, on railway trains, and the like. In such situations ordinary microphones cannot be used because the microphone, in consequence of its diaphragm, picks up and transmits the loud noise prevailing nearby. This effect is so pronounced that nothing is heard of the actual speech, which is drowned in the loud outside noises.

This disadvantage is overcome by the present invention which provides means for transmitting only the sounds which are desired and excluding any disturbances due to extraneous noises or the like. For this purpose the microphone is made non-sensitive to sound waves propagated through the air, but sensitive to direct vibration such as is secured by direct mechanical contact with the sound producing body. A microphone which is non-sensitive to sound waves differs from other microphones in that the variations in electrical resistance are effected by mechanical vibration of the whole microphone or a part thereof. It is possible to have the sound waves reinforce the action of the microphone, but this is not essential. The microphone itself, which is non-sensitive to sound, can be constructed as a strong current microphone or as a weak current microphone for controlling relays of the most general kind, for example, for varying the magnetization of choke coils energized by direct current or transformers, or for controlling oscillation-generators of the vacuum tube relay type and the like. These two possibilities are described in the drawings.

Further, the apparatus according to this invention can also be so arranged that either the microphone itself or the microphone together with an amplifying device, as may be desired, can be used in order to converse with other persons.

A microphone constructed in accordance with this invention may be used to transmit speech by holding it in contact with a portion of the speaker's body which vibrates in accordance with articulations of the voice, the speaker speaking into the free air. It has been found that the most advantageous position for the microphone is on the throat in the region of the larynx, although success has been obtained with it on the speaker's chest. The mechanical vibration of the microphone by means of the sound producing body (in this case the larynx) is so strong and follows the speed pulsations so exactly, that a clear understanding can be obtained with the exclusion of all outside noises. Results are improved in some cases by using a plurality of microphones connected in series or in parallel.

A better understanding of the invention may be gained from the following description of the apparatus and its use as illustrated in the accompanying drawings.

In the drawings

Fig. 1 shows elementally a microphone of the type actuated by sound waves in air;

Fig. 2 shows elementally a microphone non-sensitive to sound waves as provided by the present invention;

Fig. 3 illustrates a preferred arrangement of the microphone on the speaker's person;

Fig. 4 is a cross section of a preferred form of microphone shown in Fig. 6;

Fig. 5 is a longitudinal section of the microphone shown in Fig. 6;

Fig. 6 shows a preferred form of microphone;

Fig. 7 illustrates a modified form of microphone of elliptical cross section;

Fig. 8 is a cross section of the microphone shown in Fig. 7;

Fig. 9 illustrates diagrammatically a hemispherical form of the microphone;

Fig. 10 shows a preferred form of carrying band in which the microphone may be mounted;

Fig. 11 illustrates a carrying band of a different type carrying microphones of a modified form;

Fig. 12 shows elementally a modified form of microphone which is non-sensitive to sound waves;

Figs. 1 and 2 show elementally the difference between a microphone which is sensitive to sound waves and one which is non-sensitive to sound waves, as provided by the present invention. The microphone shown in Fig. 1 comprises a casing 2, which is usually of carbon, a diaphragm 1 which is free to vibrate in accordance with sound waves which strike it, and carbon granules 3 which serve as a current path of variable resistance between the diaphragm 1 and the carbon member 2. As is well known, sound waves striking the diaphragm 1 cause it to vibrate and vary the compression of the carbon grains which in turn varies the resistance of the current path, thus modulating the current between the diaphragm 1 and the carbon member 2 in accordance with the sound waves striking the diaphragm. It will be seen that all sound waves, regardless of the source, are effective in vibrating the diaphragm with the result that much undesirable noise is transmitted.

The microphone as provided by the present invention (shown schematically in Fig. 2) comprises two conductive members 4 and 5 which may be of carbon, and neither of which responds to free vibrations in air. Between these members 4 and 5, which are otherwise insulated, is a quantity of carbon granules as in the usual form of microphone shown in Fig. 1.

In Fig. 12, which illustrates a modification of the microphone of Fig. 2, a carbon member 38 is separated from carbon member 35 by an insulating ring 36. Carbon granules 37 are loosely packed in the conical recess provided in the member 35. The member 38 is not a diaphragm and is not sensitive to sound waves in air.

For convenience this new form of microphone will be called a "shaking" microphone, as variations in current are produced when the microphone is actually shaken by being in contact with the vibrating body, the sound of which it is desired to transmit. Any movement of the microphone as a whole will alter the relative positions of the carbon granules with respect to each other and to the carbon members 4 and 5, thus producing a variation in resistance. As it is non-sensitive to sound waves in the air, sounds emanating from a source other than that with which the microphone is in contact will not be transmitted.

The mode of using a microphone of this character is illustrated in Fig. 3, in which 9 is a shaking microphone attached to a band 7 which is fastened around the speaker's throat preferably near the larynx. The speaker speaks into the free air and the vibrations of the throat, which are in exact accord with the articulated sound, shake the microphone and produce corresponding variations in the current flowing through it. Exceptionally loud noises in the vicinity of the speaker may affect the microphone to a small extent, but the movement produced by the vibration of the throat is so large in comparison that the spoken sounds predominate to the exclusion of all outside noises.

A preferred form of the shaking microphone is illustrated in Figs. 4, 5 and 6. Within a cylindrical casing 11 of insulating material, preferably hard rubber, are mounted the carbon members 12, between which carbon granules 13 are loosely packed. End members 14 are attached to the casing 11 to retain the carbon granules and carbon members in place. On the exterior of the casing contacts 15 are mounted, and each is electrically connected to one of the carbon members 12 by means of a screw or pin 16. These contacts are provided for connecting the microphone in an electric circuit as will be more fully described later. No portion of this microphone is free to respond to sound waves in air, but the contacts 12 and the carbon granules 13 are freely movable with respect to each other and will move when the microphone is shaken, even though very slightly.

A modified form of the microphone which may be more desirable under certain circumstances is shown in Figs. 7 and 8. In this embodiment the casing is elliptical in cross section, as is clearly shown in Fig. 8. The carbon members 18 are also elliptically formed and are separated by insulating members 19. The space 20 between the carbon members is loosely packed with carbon granules and the covers 17 serve to retain them in place. Contacts 21 and 22 are provided on the outside of the casing and are connected to the carbon members by means not shown. Pins such as those shown at 16 of Fig. 4 could be employed for this purpose.

In the embodiment illustrated elementally in Fig. 9, the carbon members 24 are hemispherical in form and the contacts 25 may be either hemispherical or annular. A complete microphone of this form would appear as a sphere.

In order that the microphones of the improved type may be conveniently held against one's throat, a carrying band as shown in Fig. 10 has been devised. This consists of a band 26 of webbing or other insulating material having a pocket on the inside of which contacts 27 are attached. These are adapted to register with the contacts on the microphone, for example, contacts 21 and 22 of Fig. 8, when the microphone is slipped in place. The connecting wires may be attached to the contacts 27 and led from there to the instruments. Several pockets may be provided in order that one or more microphones can be employed. The band 26, which may be elastic, is fastened preferably about the neck as shown in Fig. 3.

A modified form of band is shown in Fig. 11. In this, frames 32, each carrying a plurality of shaking microphones 33, are attached to a band 31. The microphones 33 are connected as desired by means of leads 34. As indicated by dotted lines, more microphones than shown can be mounted on one band.

In order to protect the operator from electrical shocks due to high potentials, it is desirable to line the neckband with electrically conductive material, for example copper foil, which is unipolarly connected with the microphone system, thus maintaining the body at the same potential as the microphone. By connecting the microphone to that point of the electrical system where there is zero potential with respect to the conducting bodies near the operator, the danger of shock is further reduced.

It is at once apparent that the shaking microphone provided by the present invention may be used in any of the circuits in which microphones have heretofore been used.

It is to be understood that the foregoing description of preferred embodiments and applications of this invention are intended to be merely illustrative and not to in any way limit the spirit or scope of the invention.

I claim:

1. In a microphone, a cylindrical container formed of insulating material, a pair of carbon electrodes loosely mounted within said container and carbon granules loosely held between said electrodes.

2. In a microphone, a hollow cylinder of insulating material, two terminals mounted on the exterior of said cylinder, two carbon plates extending lengthwise of said cylinder and connected respectively to said terminals, granular carbon in the space between said plates and insulating end pieces loosely retaining said granular carbon and said plates in place.

3. In a microphone, a hollow cylinder of insulating material, two terminals mounted on the exterior of said cylinder, two carbon plates extending lengthwise of said cylinder and connected respectively to said terminals, granular carbon in the space between said plates and insulating end pieces loosely retaining said granular carbon and said plates in place and strips of insulation extending lengthwise of the cylinder and separating said carbon plates.

4. In a microphone, a cylindrical container, a pair of carbon electrodes within said container and free to move toward and from each other and carbon granules loosely held between said electrodes.

5. In combination, a microphone comprising a casing provided with external contacts, a carrying band therefor provided with a pocket, and contacts so arranged in said pocket as to register with the contacts carried by the microphone.

6. In combination, a plurality of microphones each comprising a casing provided with external contacts, a carrying band therefor provided with a plurality of pockets, and contacts so arranged in said pockets as to register with the contacts on the microphone when such microphone is inserted in the pocket.

7. In combination, a microphone comprising a casing provided with symmetrically disposed contacts, and a carrying-band therefor provided with similarly disposed contacts, whereby the microphone may be connected into a circuit including the carrying-band contacts, irrespective of which end of the microphone casing is first inserted into the pocket.

In testimony whereof I affix my signature.

DR. SIEGMUND LOEWE.