Nov. 12, 1929. G. EICHHORN 1,735,267

APPARATUS FOR AMPLIFYING LOW FREQUENCY SPEECH CURRENTS OF RADIO RECEIVERS

Filed Jan. 6, 1927

Fig. 1.

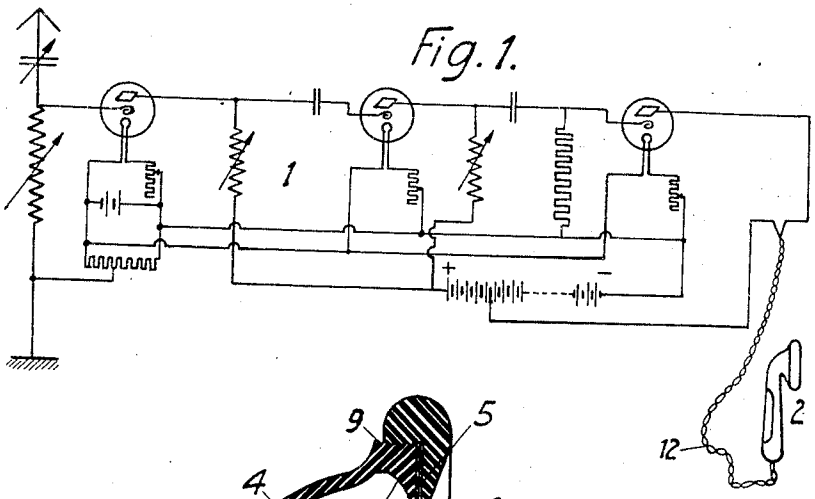


Fig. 2.

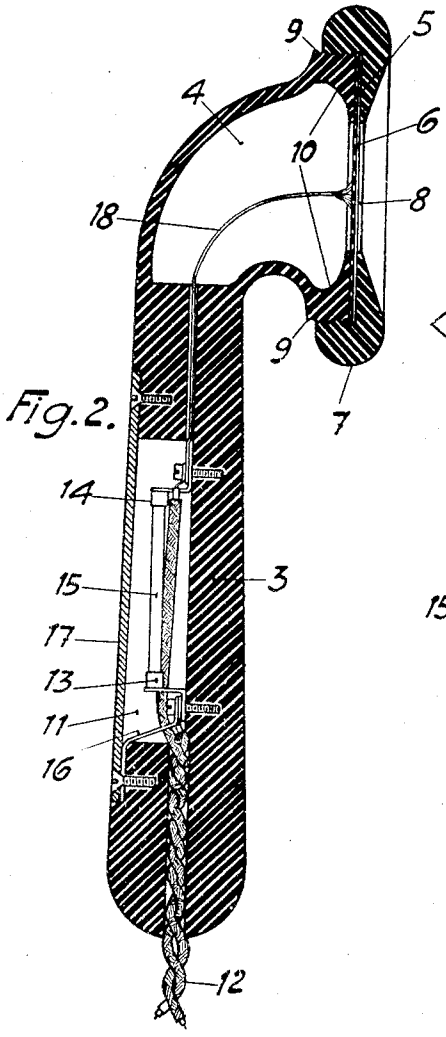
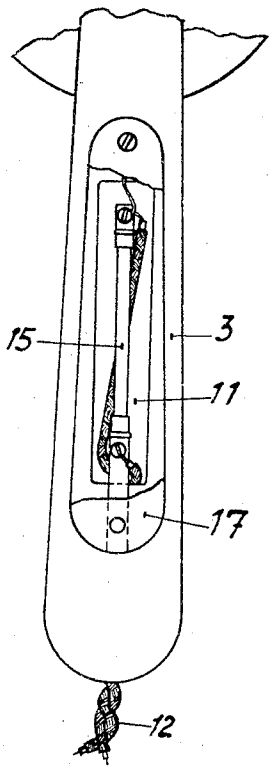


Fig. 3.



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UNITED STATES PATENT OFFICE

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APPARATUS FOR AMPLIFYING LOW-FREQUENCY SPEECH CURRENTS OF RADIO RECEIVERS

Application filed January 6, 1927, Serial No. 159,387, and in Switzerland September 11, 1926.

This invention relates to wireless telephony employing valve-receivers and in particular to a receiving device which has the distinguishing feature that a portion of the phone-circuit is adapted to be applied to the ear of the user, or to a part of the head near the ear and another portion is to be brought into contact with some other part, say the hand of the user, so that the body of the user is included in the anode circuit with one pole of a tube- or valve-radio-receiver connected by a connecting lead to the human body, and the other pole connected by a connecting lead to an exciting element which is held against the head or near the ear, so that a polarity is prevented and the skin or supple part of the face in the immediate neighborhood of the ear are forced by an electrostatic effect to set up oscillations which are not transferred to the ear drum but direct to the inner organs of hearing.

As a diaphragm or metallic surface (which may also be composed of a metal powder) tinfoil (staniol) or aluminium foil has proved very satisfactory, in that the metallic portion of the lead is clamped between two thin sheets or foils and the whole pressed together. A metal plate, for example sheet copper, is, however, also satisfactory. For the insulating (dielectric) coating the perfect dielectrics such as hard rubber, mica, glass, etc. with which even in very thin layers a great receiving intensity is not to be obtained, are not very suitable for this purpose, but the so called semi-conductors or imperfect dielectrics such as paper, parchment paper, linen paper, presspan, thin leather and the like which also have great mechanical strength or clear calf hide, such as used for drums, which latter produces very good results and is very resistant to damage, are much more suitable for the purpose. Calf hide when used is drawn while damp over the copper disc onto the casing so that after drying it bears tightly and firmly thereon.

The accompanying drawing illustrates an example of a form of construction of the device according to the invention.

Fig. 1 shows a circuit diagram of three valve receiving set with the "radiophone."

Fig. 2 illustrates the radiophone in Fig. 1 to a larger scale in section.

Fig. 3 shows a portion of Fig. 1 seen from the left hand side.

The circuit diagram of Fig. 1, 1 indicates a simple high frequency three valve receiving circuit, the connection to the "radiophone" being illustrated.

The shown receiver is of known construction and the wiring diagram shows that the connection of the radio phone takes place in the same manner as when an ordinary head phone or loud speaker is connected. The radio phone may be connected to all other hook-ups adapted for head phones or loud speakers and operates without any changes in the wiring.

The device in Fig. 2 consists of a hand piece 3 which is provided with a chamber 4. This chamber is closed by an exciting element which is here shown as a metal disc or diaphragm 5 and an insulation layer 6, a ring 7 of insulating material having a central opening 8 being threaded to the hand piece as at 9, and pressing 5 and 6 against the annular bearing surface 10 of the hand piece.

In a recess 11 in the hand piece terminate the members of the double connecting lead 12. Of the ends one is electrically connected to cap 13, the other to the connecting cap 14 of a high ohmic resistance 15. A metal strip 16 connects the cap 13 to the metal shield 17, which covers the recess of the handpiece 3. A lead 18 connects the metal disc or exciting element 5 to the cap 14.

Hence the ends of the two wires of the connecting lead 12 terminate the one at the metal shield 17 the other at the metal disc 5 while the high ohmic resistance is arranged parallel thereto.

This high ohmic resistance of the order of magnitude of about 100000 ohms completely eliminates the "fluttering" (inconstancy), which is otherwise occasionally observed, of the sounds and speech transmitted, the cause of which fluttering is due to the fact that the uptimum valve potentials do not remain constant. The optimum anode potentials of the valves used depend solely upon the types used, but as end valve especially good results

have been obtained from one which operates with at least 70–100 volts.

As to the explanation of the phenomenon the following interesting observation was made, which probably points to the fact that the effect is a double one, namely physiological and acoustic. The listener therefore holds the "radiophone" with the dielectric layer or member in contact with the ear. The perception obtained is strongest directly on the ear or in the immediate vicinity thereof; it however still continues in contact with other parts of the head such as the cheek bones, temples, parts of the forehead and even on the top of the head there are parts of weak perception. This therefore points to a physiological action directly upon the sensitive organs of hearing that is to say, the skin or supple part of the face in the immediate neighborhood of the ear are forced by an electrostatic effect to set up oscillations which are not transferred to the ear drum (the absence of acoustic vibrations being therefore essential) but direct to the inner organs of hearing. This is confirmed by the result of a research that it is in this manner practicable to impart good perception to a person having difficulty in hearing, whose ear drum no longer functions properly.

It is not necessary to have elastic oscillations of the metal surface (similar to the oscillations of the metal diaphragm in headphones) for producing the sounds, as such oscillations can be rendered impossible by firmly pressing between two insulating objects without the perception ceasing or being appreciably weakened. On the contrary the audibility appears to become clearer. It is however probable that occasionally such elastic oscillations by reason of electrostatic attraction also assist in the effect.

What I claim is:—

1. A receiving phone for use in connection with radio apparatus, employing thermionic valves, said phone comprising a hand piece having a chamber the wall of which has a ring of dielectric material for application to the ear of the user, a diaphragm forming an exciting element and also forming a closure for said chamber and insulated from the wall of said closure, a terminal for application to the person of the user, a conductor having two leads, one connected to the diaphragm and the other to said terminal, and a high ohmic resistance in parallel with the leads of said conductor.

2. A receiving phone as claimed in claim 1, in which the hand piece has a recess in which the high ohmic resistance is located, and the terminal is a metal plate which closes said recess.

3. A receiving apparatus for use in connection with radio apparatus, employing thermionic valves, and comprising a sound box having a dielectric member for application to the ear of the user, an exciting element, a terminal for application to the person of the user, a conductor having two leads, one connected to the exciting element and the other to the terminal, and a high ohmic resistance connected in parallel with the leads of said conductor.

In witness whereof I affix my signature.

GUSTAV EICHHORN.