[redacted]ov. 30, 1948. M. A. LALANDE 2,454,812

ELECTROMECHANICAL AMPLIFIER

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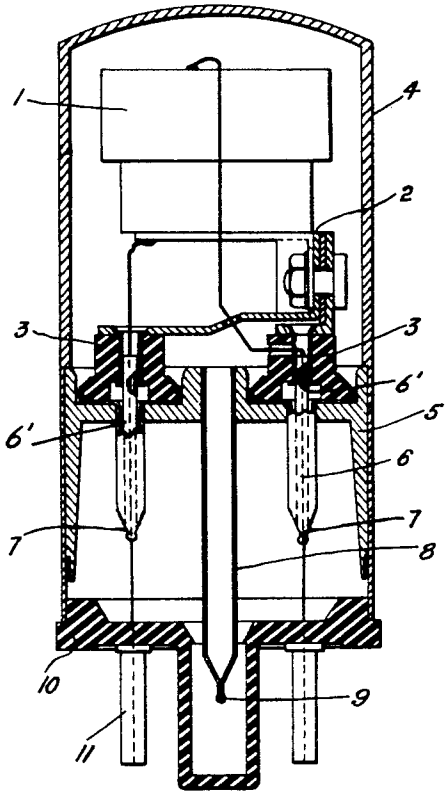
*Fig. 1.*

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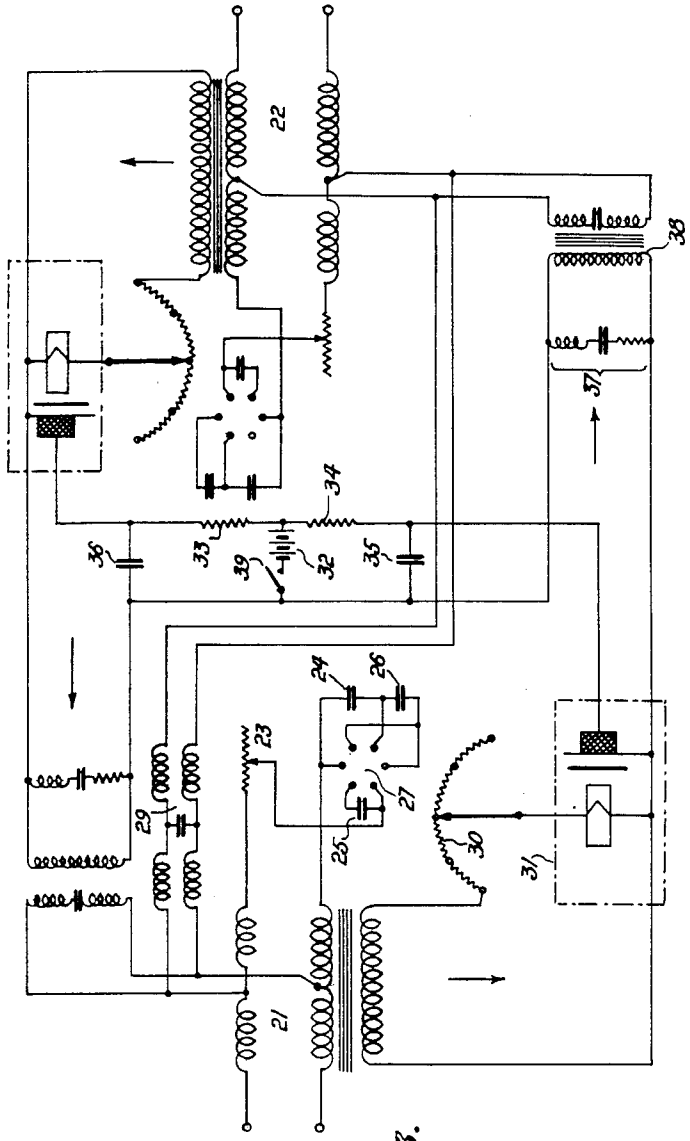


Fig. 2.

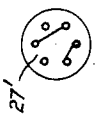


Fig. 3.

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## ELECTROMECHANICAL AMPLIFIER

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3 Claims. (Cl. 179—171)

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The present invention relates to electro-mechanical amplifier devices, particularly as used for the amplification of telephone communication currents and the like.

According to one embodiment of this invention, use is made of an electro-mechanical amplifier element, comprising a receiver which is acoustically coupled to a carbon granule microphone, while both are kept in an atmosphere of a gas, which latter is preferably one which is a good conductor of heat. The amplifier element is mounted on a support or base similar to a tube base, and can be used in telephone repeater circuits of the two-wire amplifier type, either series-connected on a line or as a receiving amplifier in connection with a telephone station or a telephone receiver. The amplifier assembly, including the source of energy, can be constructed as a compact piece of apparatus that is easily transportable and that can be conveniently connected with an ordinary telephone station.

The invention is hereinafter explained with reference to the appended drawings, in which:

Fig. 1 shows, in section, an amplifier element according to this invention;

Fig. 2 illustrates one example of this invention as applied to a two-way repeater; and

Fig. 3 illustrates a capacity shifting plug for use in the circuit of Fig. 2.

Referring to Fig. 1, the amplifier element properly so-called, shown at 1, is screwed and soldered on a support 2 which is sustained by insulating members 3. A metallic housing 4 fits snugly on a support 5, e. g. of brass, to which it is soldered as well, in order to insure tightness. The member 5 maintains in position the insulating members 3 which are perforated and are traversed by tubular members 6 having tapered lower ends. Glass tubes 6' are positioned within the tubular members 6 and protrude slightly from the ends of the members 6 where they are fused to the ends of the members forming glass beads 7. The conductors for affording external connection pass through some of these little tubular members toward the amplifier element 1, traversing the glass beads 7 in such a way as to form a gas-tight connection. Reference character 8 denotes a copper pipe which passes all the way through member 5, to which it is soldered, and which serves to allow evacuation and afterwards serves for introducing a selected gas. This tube is sealed off and soldered together at 9, after the gas has been introduced therethrough. The use of gas is necessary on account of acoustic coupling that exists thereby, between the receiver and the microphone units

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of the amplifier, which units may all be types described in French Patent 731,715, filed February 22, 1932. Furthermore, the gas pressure may be different from the atmospheric pressure, depending on the characteristics of the amplifier elements. Finally, member 4 is closed at the lower end by a base plate 10, on which the pins 11 are fastened, which permits insertion of the amplifier into a conventional tube socket, e. g. one of the so-called Octal type.

The reason for using a gas different from air is, on the one hand to protect the amplifier against the hygroscopic effects due to the humidity of the air, and on the other hand to prevent oxidation of the carbon by the oxygen of the air and to facilitate the acoustic coupling between the receiver and the microphone of the amplifier element. As mentioned above, it is usually preferable to make use of a gas that is a good conductor of heat, in order to permit the carbon granules which are slightly heated by the passage of the current to dissipate the heat, e. g. to use hydrogen.

Amplifier elements constructed in this way are easily interchangeable and may be used in a certain number of circuits of which there is here given one example.

Fig. 2 illustrates one example of a circuit in which the electromechanical amplifier of this invention is used for the amplification of a two-wire telephone circuit at an intermediary point.

The circuit is that of a characteristic repeater; 21 and 22 designate the differential transformers and the balancers consist of an adjustable resistance, 23 in series with a capacity. The resistance is variable, and the capacity may consist of an assembly comprising three condensers, 24 and 25, of 1 microfarad and 26, of 0.25 microfarad, which can be united in various ways by means of the switching system 27. This switching device consists of six receptor contacts disposed in hexagonal form and a four-pin plug, 27' this latter being connected as shown in Fig. 3. By successively shifting this plug by rotation of 60 degrees, it is possible to obtain the following various connections: open circuit, short circuit, 2 mf. (condensers 24 and 25 in parallel), 1 mf., 0.5 mf. (condensers 24 and 25 in series), and 0.25 mf.

The midpoints of the differential transformers 21 and 22 are connected over a low-pass filter device 29 which allows the passage of ringing currents of low periodicity, such as 20 cycles.

The secondary of the differential transformer 21 is connected to the electro-mechanical amplifier element 31 over a gain adjustment po-

tentiometer **30**. The feeding of the electro-mechanical amplification buttons is effected by a battery **32** over de-coupling resistances **33** and **34** provided with condensers **35** and **36**, and a switch or key **39** serves for starting in operation. A gain correcting circuit is provided at **37** and an output transformer at **38**. Amplification in the other direction of transmission is effected by similar elements, which is thought unnecessary to describe in detail.

This amplifier device can be constructed so as to be portable and it can render great service in every case, e. g. in the country, where there are no electrical energy supply sources available or when it is impossible to use bulky equipment. It can be made up to fit in a box 15 by 10 by 15 cm., for example.

Although this invention has been described in one embodiment and with the above described examples of utilization circuit, it is evident that the invention is by no means limited to such examples but that it is capable of numerous variations and modifications such as will be apparent to those skilled in the art without departing from the scope of the hereunto appended claims.

What is claimed is:

1. An electro-mechanical telephone amplifier unit comprising, a cup-like metal shell having a cylindrical side wall terminating at one end in a circular opening, a base plate covering and sealing said opening, a plurality of insulated connector pins rigidly mounted on said base plate and projecting away from said shell, a metal partition dividing the space within said shell into a base compartment adjacent said base plate and a working compartment remote from said base plate, insulating means mounted on said partition within said working compartment, an electro-mechanical telephone amplifier unit of the acoustically coupled type positioned within said work compartment and supported on said insulating means out of direct contact with said shell, a plurality of lead wires extending through said partition and said base compartment and electrically insulated from each other and connected to said connector pins to provide electrical connections to said amplifier unit, and a body of gas filling said working chamber and surrounding said amplifier unit to provide the acoustical coupling for said amplifier unit, said gas having a high thermal conductivity as compared with air whereby the heat produced by the operation of said amplifier unit is transmitted efficiently to the surrounding metal walls of said shell with the result that the heat is dissipated rapidly and at a steady rate.



2. Apparatus as described in claim 1 wherein said gas is hydrogen and wherein an evacuation and gas filling tube extends from said working compartment through said partition to said base plate whereby the working compartment may be evacuated and filled with hydrogen.

3. An electro-mechanical telephone amplifier comprising, a thin metal cup having a substantially cylindrical side wall closed at one end and open at the other end, a base plate of insulating material snugly fitting and sealing the open end of said cup, a plurality of insulated connector pins rigidly mounted in predetermined spaced relationship on said base plate and projecting away from said cup, a gas-tight metal partition extending across said cup transversely of the axis thereof and forming a sealed chamber which is bounded by the side and end walls of said cup and said partition, an electro-mechanical telephone amplifier unit of the acoustically coupled type positioned within said chamber and mounted by an insulated bracket means on said partition and out of direct contact with said cup, and means providing a plurality of insulated electrical connections through said partition and respectively to said connector pins and providing electrical connections to said amplifier unit, said sealed chamber being adapted to be filled with a gas having high thermal conductivity with respect to air, whereby said amplifier unit is immersed in the gas which provides the acoustical coupling for the amplifier unit with the result that heat produced by the operation of said amplifier unit is transmitted to the surrounding cup walls and dissipated to atmosphere in an efficient and dependable manner.

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