

July 31, 1945.

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2,380,438

MICROPHONE CIRCUIT

Filed Feb. 11, 1944

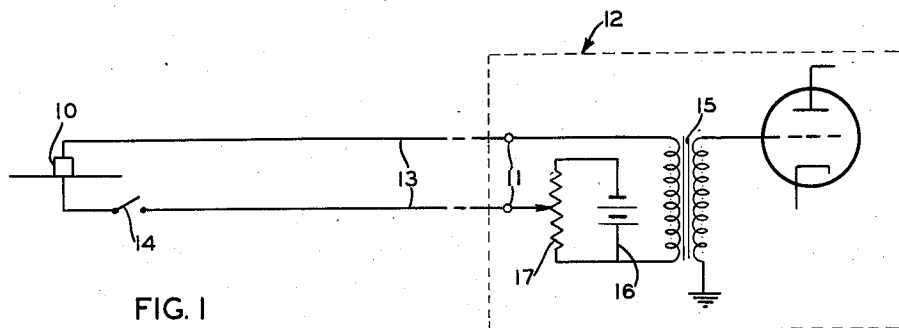


FIG. 1

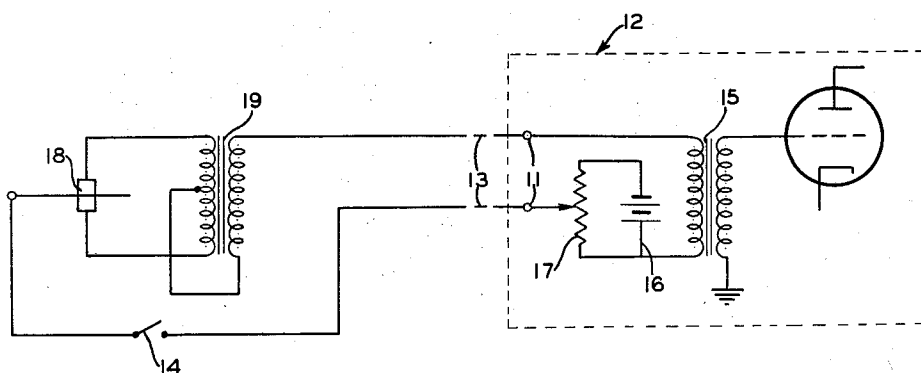


FIG. 2

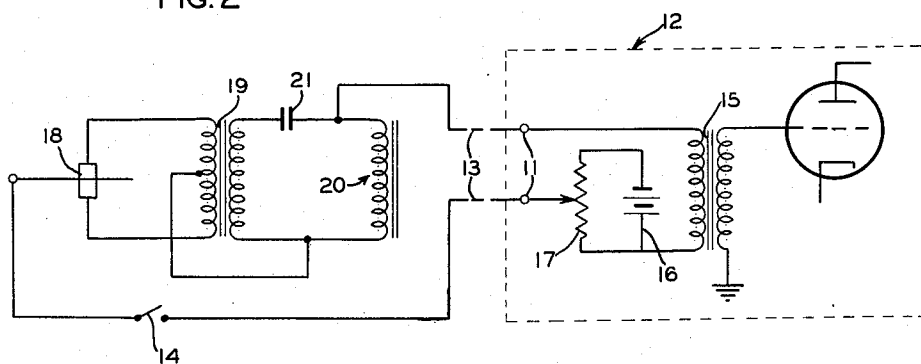


FIG. 3

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2,380,438

MICROPHONE CIRCUIT

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Application February 11, 1944, Serial No. 521,963

2 Claims. (Cl. 178-1)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

The invention described herein may be manufactured and used by or for the Government for governmental purposes, without the payment to me of any royalty thereon.

This invention relates to electro-acoustic transducer circuits and more especially to input circuits for carbon microphones.

Due to its high sensitivity the carbon microphone is almost universally employed in radiotelephone communication circuits, wherein the primary requisite is sensitivity rather than uniform frequency response over a broad frequency range. Voice frequencies falling within a range of about 100-4000 cycles are adequately reproduced by carbon microphones, but in fidelity systems, such as radio broadcasting or motion picture recording, an increased frequency response is desirable and other types of microphones, as for example, the condenser or velocity microphones, are preferably used.

Carbon microphones fall into two classes; that of the single-button type and that of the double-button type. In the single-button microphone the voice waves impinge upon a metal diaphragm having mounted in the central area thereon a button comprising a hemispherical metallic cup filled with carbon granules, usually manufactured of anthracite coal, and some form of closure to prevent carbon leakage at the point where they make contact with the diaphragm. As the diaphragm is displaced, the pressure is varied between the granules in the cup which results in a change of resistance from granule to granule, which, in turn, results in a corresponding change in resistance between the cup and diaphragm. By connecting the microphone in series with a source of electrical energy these resistance changes are converted into corresponding electrical fluctuations. In the two-button microphone an additional cup is mounted on the diaphragm on the opposite face thereof, and the microphone operates similarly, but in an electrical push-pull manner.

As regards fidelity, the double-button carbon microphone is known to have numerous advantages over the single-button type. Improved frequency response is obtained in the double-button microphone due to balanced diaphragm loading. Because of the push-pull operation of the double-button microphone the even order harmonics generated in the buttons are cancelled, thus effecting a further reduction in distortion. The variations in frequency response and harmonic content as a result of a change in the diaphragm position

which occur in a single-button microphone are minimized in the double-button type.

Another desirable feature of the double-button microphone of primary importance in military applications is that it may be successfully adapted to the provision of noise cancellation. Noise cancellation is accomplished by introducing ambient noise to both sides of a microphone diaphragm whereas the voice impinges only on one side. It has been found that the use of a double-button microphone will allow improved noise cancellation due to the fact that both sides of the diaphragm will be loaded equally and the acoustic chambers on both sides will be identical.

Because of the simplicity and relative inexpensiveness of the single-button microphone, as well as its excellent sensitivity, a large majority of radiophone and intercommunication apparatus employed for military and other purposes entailing voice transmission have been designed for single-button carbon microphones. These microphones may be carried in the form of handsets, chestsets, face mountings and throat mountings, and are ordinarily linked to the communication apparatus by a two-wire cord. Inasmuch as the double-button microphone requires a three-wire line and a center-tapped primary microphone transformer, the double-button microphone is not interchangeable with the single-button type without alterations in the wiring and the components of the input circuit.

Communications equipment in recent years has been improved to a degree where the limiting factor in the transmission of intelligence is the single-button carbon microphone. Although the communications apparatus may be capable of uniform frequency response of a wide audio range, the full effectiveness of the apparatus is not employed since the over-all fidelity of the apparatus never exceeds the characteristics of the weakest element in the system, which in this instance, is the single-button microphone. As the percentage of articulation is contingent upon the amount of noise and distortion present in a communications system, it is manifest that the service area covered by a radiotelephone transmitter may be augmented by improved microphone response. However, inasmuch as vast quantities of communications apparatus which are presently in field use employ two-wire microphone input circuits intended for single-button carbon microphones, the revision of circuit design in order to accommodate a double-button microphone having a three-wire line would involve considerable time and expense if performed on a large scale.

Consequently, the principal object of my invention is to provide an external circuit and apparatus, whereby a double-button carbon microphone may be adapted as a direct replacement for a standard single-button microphone without any alterations in microphone cordage, microphone plugs, or of the input circuits with which the single-button microphone is associated.

Another object of my invention is to provide a circuit of the above type whereby the full fidelity response of a double-button microphone is obtained in a single-button channel.

A further object of my invention is to provide a circuit of the above type in which all the requisite apparatus may be contained in the microphone housing.

The various objects and features of my invention will be better understood from the following detailed description when read in conjunction with the accompanying drawing in which:

Figure 1 illustrates the schematic circuit diagram of a conventional form of single-button carbon microphone input circuit;

Figure 2 is a schematic circuit diagram of an embodiment of my invention in which a double-button microphone is adapted to a two-wire line; and

Figure 3 is a schematic circuit diagram of another embodiment of my invention in which a double-button microphone is adapted to a two-wire line.

In the figures, identical numbers designate identical parts. Referring now to the drawing, and more particularly to Figure 1, a single-button carbon microphone 10 is shown connected to the input terminals 11 of a conventional microphone amplifier 12, a portion of which is shown. The connection to the amplifier 12 is made by means of a two-wire cord 13 and the microphone may be contained in any form, that is, in a handset, throat mounting, etc., with a switch 14 mounted on the handset or mounting structure. An input transformer 15 is provided, having a primary winding whose impedance matches that of microphone 10. A battery 16 is connected in series with microphone 10 and primary winding of transformer 15 to furnish energy for the microphone circuit. The voltage from battery 16 is controlled by a potentiometer 17. The circuit illustrated in Figure 1 is a commonly used form of microphone input circuit and my invention is applicable to this form or any other conventional form of single-button microphone input circuit, whether the input be resistive or inductive.

Referring now to Figure 2, a circuit is shown for adapting the two-wire line for use with a double-button microphone. The components of the circuit are a center-tapped primary, microphone transformer 18 and a double-button carbon microphone 19, both components being preferably contained in a single housing or mounting. The output of this circuit is fed to the identical two-wire cord 13 and amplifier 12 illustrated in Figure 1. The end leads of the primary winding of transformer 18 are connected to the buttons of microphone 19 and the center-tap of the primary winding is connected to one end of a secondary of transformer 19. The other end of a secondary winding of transformer 19 is connected to one of the input terminals 11 of amplifier 12. The remaining amplifier terminal 11 is connected through the cord 13 to the diaphragm of microphone 19.

In conventional double-button microphone transformer circuits the supply voltage is applied

between the diaphragm and the center-tap of the primary winding. This would ordinarily require the use of a third wire from the amplifier 12, but I have obviated the need for this wire by my circuit arrangement wherein it may be seen that one terminal of the battery 16 is connected through potentiometer 17 to the diaphragm of microphone 19, whereas the other terminal is connected to the center-tap of primary winding of transformer 18 through the primary winding of transformer 18, and secondary winding of transformer 19. The series resistance offered by the primary of transformer 18 and the secondary of transformer 19 requires a higher voltage to secure the proper microphone current. This voltage can be readily obtained by the proper positioning of potentiometer 17.

The audio output of microphone 19 appears across the secondary winding of transformer 19, and one end of the secondary winding is wired directly to one of the amplifier input terminals 11. The opposite end of the secondary connected to the center-tap of primary winding of transformer 18, where it is connected to one of the terminals 11 through the microphone 19. Since the primary microphone circuit of transformer 19 is of the balanced type, it does not introduce a variable resistance into the secondary output circuit, so that, in effect, the secondary of transformer 19 is connected to the input terminals 11 through a small fixed series resistance.

For the purpose of eliminating the direct current of battery 16 from the secondary of transformer 19, I have shown another embodiment of my invention in Figure 3, wherein a choke 20 is provided having a high impedance to audio frequency currents. Energy for the microphone 19 is obtained from the battery 16 through the primary of transformer 15 in series with choke 20. Inasmuch as the condenser 21 serves as an open circuit to direct current, the primary current does not flow through the secondary of transformer 19, thereby eliminating distortion due to saturation effects in the core. The output of transformer 19, being of an alternating current nature, is conducted by condenser 21 to one of the terminals 11 and is not affected by choke 20 since it functions as a high impedance to audio frequency currents.

The components shown in Figures 2 and 3 may be assembled in a unitary structure in the form of a handset or chest mounting, or whatever structure is desired. The transformer 19 and choke 20 are preferably of a miniature lightweight construction.

It is to be noted that no changes have been made in the amplifier 12 or in the microphone extension cord 13 so that it is merely necessary to connect the two-wire cord of any single-button microphone channel to the present invention in order to convert it for double-button microphone use and obtain its attendant advantages.

Various modifications of the circuits, which have been illustrated and described, which are within the spirit and scope of the invention, will occur to persons skilled in the art.

What is claimed is:

1. The combination in a circuit for adapting a double-button microphone to a two-wire input circuit arranged for a single-button microphone and including a source of electrical energy, comprising, a transformer having a center-tapped primary winding, a secondary winding, one end of said secondary winding being connected to the center-tap of said primary winding and the other

end of said secondary winding being connected to one end of said input circuit, a double-button carbon microphone having its diaphragm connected to the end of said input circuit and its buttons connected to the primary winding of said transformer whereby said double-button microphone is electrically energized and in electrical association with said single-button input circuit.

2. The combination, in a circuit for adapting a double-button microphone to a two-wire input circuit arranged for a single-button microphone and including a source of electrical energy, comprising, a transformer having a center-tapped primary winding, a secondary winding, one end of said secondary winding being connected to the

center-tap of said primary winding, a double-button carbon microphone having its diaphragm connected to one end of said single-button input circuit and its buttons connected to the primary winding of said transformer, a network having a capacitive reactance in series connection with an inductive reactance, said network being shunted across the secondary of said transformer and having its juncture in connection with the other end of said single-button input circuit, whereby said double-button microphone is electrically energized and in electrical association with said single-button input circuit.

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