Dec. 29, 1936. A. R. HOPKINS 2,066,149

SELF EXCITED MICROPHONE CIRCUIT

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Fig. 1

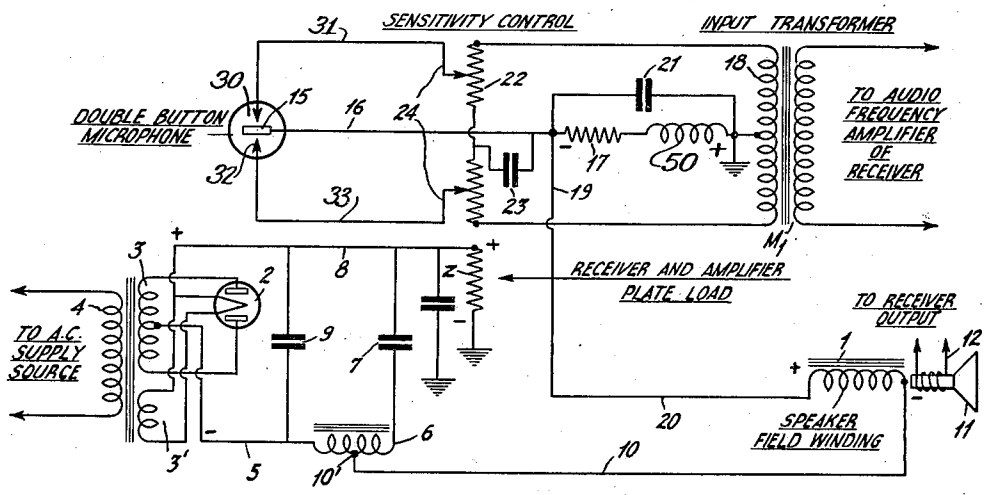
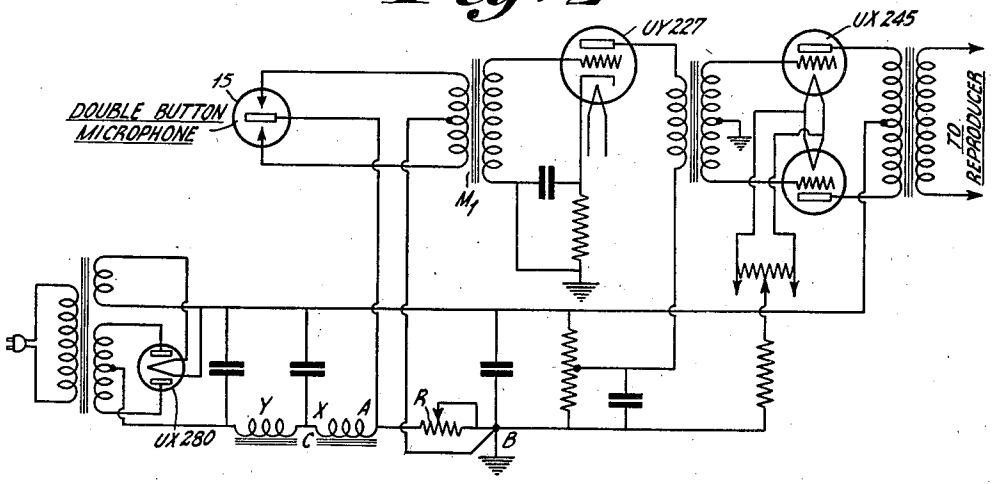


Fig. 2



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SELF-EXCITED MICROPHONE CIRCUIT

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5 Claims. (Cl. 179—1)

My present invention relates to microphone biasing circuits, and more particularly to a self-excited microphone circuit especially adapted for use with a centralized radio system.

One of the main objects of my present invention is to provide a microphone circuit wherein the bias for the microphone is obtained by utilizing the potential drop occurring across a resistor connected in series with a filter reactor associated with the conventional rectifier and filter circuit of a receiver or amplifier, it being possible to use the speaker field winding as a filter reactor as a matter of economy.

Another important object of the present invention is to provide a microphone circuit adapted for use in connection with the channel rack equipment of a centralized radio system, the biasing voltage for the microphone being obtained by utilizing the potential drop occurring across a resistor connected in series with a reactance, the monitoring speaker field winding, constituting the reactance, and which field winding is disposed in the negative side of the power supply circuit for the channel rack receiver equipment.

Another object of the present invention is to provide in combination with a rectified alternating current power supply circuit containing a reactance in its negative side, a microphone and resistor connected to the negative side of the power supply circuit so as to produce the potential drop across said resistor for biasing the microphone, and additional means for varying the sensitivity of the microphone.

Still other objects of the present invention are to improve generally the simplicity and efficiency of microphone circuits for use with centralized radio equipment, and to particularly provide a microphone circuit of this type which is not only self-excited from the amplifier circuit of the equipment, but is durable and reliable in operation, and economically manufactured and installed.

The novel features which I believe to be characteristic of my invention are set forth in particularity in the appended claims, the invention itself, however, as to both its organization and method of operation will best be understood by reference to the following description taken in connection with the drawing in which I have indicated diagrammatically two arrangements whereby my invention may be carried into effect.

In the drawing,

Fig. 1 shows one embodiment of the invention,

Fig. 2 shows a modification.

Referring now to the accompanying drawing wherein there is shown a schematic diagram of an arrangement embodying the present invention, only those portions of the circuit arrangement of a receiving system adapted for use in a centralized radio, or public address, arrangement will be shown which are essential to a clear understanding of the present invention. Thus, the impedance Z will be understood to represent the receiver and amplifier plate load; the latter is to be considered connected in series between the positive side of the speaker field winding 1 and the cathode of the double wave rectifier 2.

The rectifier 2, a UX280 type tube, has its anodes connected to the power supply transformer secondary portion 3, while the cathode of the rectifier is connected across the transformer secondary portion 3', the primary 4 of the transformer being connected to any alternating current supply source. The mid-point of the anode circuit of rectifier 2 is connected by a lead 5 to one side of the filter circuit choke 6, the other side of the choke being connected through a shunt condenser 7 to the lead 8 which connects the positive side of the receiver and amplifier plate load Z to the cathode of the rectifier 2. The power filter circuit, additionally, includes the shunt condenser 9. The negative side of the speaker field winding is connected through lead 10 to a predetermined point 10' on the choke 6, those skilled in the art being well acquainted with the advantages, both economical and electrical, attending the use of a tapped power filter choke 6, and, hence, the latter need not be described at this point.

The speaker field winding 1, of course, supplies the required magnetic field for the electrodynamic reproducer which includes the diaphragm 11 and movable coil 12 adapted to be connected to the receiver output circuit. The reproducer comprising the coils 1, 12 and diaphragm 11 comprises the monitoring speaker of the usual rack equipment of a centralized radio system.

The receiver and amplifier plate load Z may comprise the anode to cathode circuits of a plurality of tubes arranged as a tuned radio frequency amplifier, detector and push-pull audio amplifier receiver, or they may be arranged as the various circuits of a superheterodyne receiver up to and including a push-pull audio frequency amplifier. In any event, the rectified, filtered output of the power supply circuit flows through the impedance Z and through the speaker coil 1 back to the negative side of the power supply.

There will be a potential drop of substantially

100 volts across the field winding 1, and a current flow of substantially 85 milliamperes through the field winding. The speaker field is used as a filter reactor because of cost, but it should be understood that a regular filter reactor can be employed instead. A double button microphone, whose construction is well known to those skilled in the art, is arranged so that it may be used for local announcements through the audio frequency amplifier of the receiver. The input transformer to the audio frequency is designated by the letter M_1, the terminals of the secondary being adapted for connection to the audio frequency amplifier referred to above. An audio frequency amplifier for use in this case preferably comprises a UY—227 tube followed by a pair of RCA—247 tubes in push-pull. The voice coil 12 is connected to the output of this last mentioned final push-pull stage including the 247 tubes, while the microphone is situated for connection to the input of the 227 stage. The UY—227 is used as a detector when the receiver is used for radio reception, but with a change in grid bias is used as an audio amplifier when phonograph or microphone is used.

The central diaphragm 15 is connected by a lead 16 to one side of a biasing resistor 17, the other side of the biasing resistor being connected through the coil 50, as shown to the mid-point of the primary 18 of the transformer M_1. This last mentioned side of the resistor 17 is additionally effectively grounded, while the opposite side of the resistor 17 is connected by leads 19 and 20 to the reactor or speaker field. A by-pass condenser 21 is shunted across the resistor 17 and coil 50.

The opposite terminals of the input transformer primary 18 are connected to opposite sides of a microphone sensitivity control resistor 22, a by-pass condenser 23 being connected between substantially the mid-point of resistor 22 and the end of resistor 17 adjacent the resistor 22. The microphone is placed in circuit by connecting a pair of sliders 24 to the resistor 22, sliders 24 being arranged for adjustment on the resistor 22 to control the sensitivity of the microphone. That is to say, the elements 24, 22 function as a microphone volume control instrumentality. As diagrammatically shown, the central diaphragm 15 is connected to the low potential end of resistor 17 by lead 16, the upper button 30 of the microphone by lead 31 to slider 24 and the lower button 32 by the lead 33 to the lower slider 24. By raising the upper slider 24 from the position shown, the bias voltage between button 30 and diaphragm 15 may be increased and also the current flow between these elements increased. The separate sliders 24 thus provide a means for equalizing the bias on the two sides of the microphone at the same time that they provide means for changing or controlling the input signal voltage to the primary 18. In actual construction three terminals are mounted on the rear of the centralized radio channel rack to which connections through the microphone may be made by the operator. One of these terminals has the resistor 17 connected to it, the resistor supplying about 4.5 volts bias to the microphone.

It will be noted that the resistor 17 is in series with the reactance in the negative side of the power supply circuit, and, hence, the plate current flowing through the receiver and amplifier tubes flows into the reactance and resistor 17, thus providing the bias for the microphone. A plug and jack arrangement may be employed for connecting the microphone and sensitivity control instrumentality to the biasing resistor 17 and the input transformer M_1, removal of the plug in that case resulting in shorting out the microphone bias resistor.

By this arrangement microphone bias is provided by the addition of the bias resistor to any conventional power filter circuit. It is extremely economical, and easily adaptable to existing equipment.

This is shown in Fig. 2, where a conventional circuit is shown. A ordinarily would be connected to B. R is added to supply the microphone voltage. The resistor R may be made variable to provide means for adjusting the microphone bias. The symbols Y and X represent filter reactors. The total plate current is generally of the order of 100 milliamperes and R is generally approximately 60 ohms. If the reactor X has an inductance of 30 henries the reactance at 120 cycles would be 22,000 ohms. Therefore, any hum voltage existing between points B and C would be divided in the ratio of 60 to 22,000. Or

$$\frac{60}{22{,}000}$$

of the total $e=e_2$ at 120 cycles; at 60 cycles,

$$\frac{60}{11{,}000}\, e=e_2$$

where e=ripple voltage across X and R; e_1=voltage across X; e_2=voltage across R.

While I have indicated and described several arrangements for carrying my invention into effect, it will be apparent to one skilled in the art that my invention is by no means limited to the particular arrangements shown and described, but that many modifications may be made without departing from the scope of my invention as set forth in the appended claims.

What I claim is:

1. In combination, a source of alternating current energy, a rectifier therefor, a filter circuit connected to the rectifier and providing positive and negative power supply leads, a reactor connected in the negative power supply lead, a microphone having a diaphragm and at least one button, an audio frequency amplifier, and connections between the microphone and the input of said audio frequency amplifier including an adjustable resistor in series with said button for varying the sensitivity of said microphone output, said connections also including means for biasing the microphone comprising a resistor having one end thereof grounded and the other end connected to the positive side of said reactor.

2. In combination with a rectifier, a filter circuit connected to the output terminals of said rectifier and providing positive and negative power supply leads, a resistor connected in series in the negative lead, a microphone having a diaphragm and two electrodes, a connection between said diaphragm and a point on said resistor and a circuit connected between the other two electrodes and a second point on said resistor whereby a potential difference is established between said diaphragm and said electrodes, said circuit including a second resistor which is adjustable to control the current between said diaphragm and one of said electrodes independently of the current passing to the other electrode.

3. In combination, an audio frequency transformer, a microphone having two buttons and a central diaphragm, a resistor connected in series

with said transformer primary winding, two contacts adjustable along said resistor to vary the sensitivity of said microphone, a connection between each of said contacts and one of said buttons, a second resistor having one end connected to the midpoint of said primary winding, a connection between the other end of said second resistor and the microphone diaphragm and means for causing a direct current to flow through said second named resistor whereby a potential difference is maintained between the diaphragm and buttons of said microphone.

4. In a device of the class described, the combination of an audio frequency transformer, a microphone having two terminals, a resistor connected in series with said transformer primary winding, a contact adjustable along said resistor to vary the sensitivity of said microphone, a connection between said contact and one of said microphone terminals, a coil and a resistor connected in series, a condenser shunted across said coil and second resistor, means for causing a direct current to pass through said coil and second resistor, a connection between one end of said second resistor and the other of said microphone terminals and a connection between one terminal of said coil and a point on said primary winding.

5. In a device of the class described, the combination of an audio frequency transformer, a resistor connected across the primary winding of said transformer, a microphone having a diaphragm and two buttons, connections between said buttons and spaced apart points on said resistor, a condenser having its first side connected to said diaphragm and its second side to the midpoint of said resistor, a second resistor having one end connected to said diaphragm and its other end to the midpoint of said primary winding and means for causing a direct current to flow through said second resistor whereby a bias voltage is established between said diaphragm and buttons.

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