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MICROPHONE TRANSMITTER HAVING A LAVALIER TYPE ANTENNA
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Fig. 1

Fig. 2

Fig. 3

Fig. 4

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2 Sheets—Sheet 2
This invention relates to a microphone transmitter and more particularly to a frequency modulated transmitter wherein the complete transmitter, including lavaliar antenna and power supply, can be worn on the person of the operator. Such transmitters are very useful for radio, television and public address work wherein it is desired that the user be free to move about without trailing wires and without the obvious disadvantages of remote microphones. Such transmitters operate at a low power level, but the frequency modulation produced by changing the battery voltage is sufficiently constant so that a receiver can be located at a convenient point and used to pick up the signal, amplify it to a desired level and feed it into a public address system, telephone line or high powered transmitter.

It is the object of the present invention to provide a microphone transmitter wherein a transmitter, power supply and antenna can be inconspicuously worn on the person of the user. Another object of this invention is to provide a microphone transmitter having a novel antenna arrangement whereby the effects of bodily capacity of the wearer and directivity are minimized.

Another object of this invention is to provide a microphone transmitter having a high fidelity response. Other objects will be apparent from the description of the invention which follows.

In the drawings forming part of this specification:

FIGURE 1 is a schematic diagram of the circuitry used in a preferred embodiment of the microphone transmitter.

FIGURE 2 is a perspective view of a person using the novel microphone transmitter with one form of antenna.

FIGURE 3 is a perspective view of the microphone transmitter showing one form of antenna.

FIGURE 4 is a partial view of an antenna.

FIGURE 5 is a perspective view of a device embodying the present invention showing its position on the body of a user.

FIGURE 6 is an enlarged view, partially in section, of the device of FIGURE 5.

FIGURE 7 is a perspective view of the device of FIGURE 5.

Turning now to a description of the invention by reference characters, there is shown a microphone 3 of the low impedance, dynamic type having a winding 4 therein. One lead from the winding 4 is connected through coupling capacitor 5 to the base 7 of transistor 6 which is of the P-N-P junction type and may suitably be a type 2N555B. The other lead from the microphone winding 4 is connected to ground. Emitter resistor 14 is used for audio gain adjustment and can have values between 0 and 470 ohms. Bias for transistor 6 is derived from emitter 18 of transistor 16 through resistor divider network 15 and 10. This is a D.C. as well as an A.C. negative feedback path and provides good bias stability without the use of a biasing source. A large emitter resistor 14 would require a large costly bypass capacitor if transistor 6 were to have sufficient gain.

The collector 9 of transistor 6 is directly connected to the base 17 of transistor 16 which is also of the P-N-P type and may suitably be a 2N207. The collector 19 of the transistor 16 is connected through switch 1 to the negative terminal of the battery 2, which is suitably of 6.5 volts. Resistor 15, suitably 6,800 ohms, is the load resistor for transistor 6 and is also connected to this point. The emitter 18 of transistor 16 is connected to ground through the load resistor 29, suitably of 2,200 ohms, and also to the bias resistor 15. It will be seen that the re- sistor 15 serves to establish the operating points of both transistors 6 and 16.

It will be seen from the above that a two-stage audio amplifier is provided wherein a first transistor operates as a grounded emitter amplifier while the second transistor operates as an emitter follower so that the amplifier has a low impedance output. The output from this amplifier is taken from the emitter 18 through the capacitor 22, suitably of 6 microfarads.

Turning now to a consideration of the circuitry surrounding transistor 26 which suitably can be a P-N-P type 2N588, an oscillator circuit is provided having the windings of inductance 35 tuned by the capacitors 30 and 33. The inductance 35 and capacitors 30 and 33 will be chosen to resonate at approximately the desired operating frequency. The operating points of the transistor 26 are determined by the resistors 23, 24 and 34, which are suitably 10,000, 2,200 and 470 ohms, respectively. Resistors 23 and 34 are by-passed to RF by capacitors 25 and 36, each of which is suitably 0.01 microfarad. Feedback is from the secondary winding of the inductance 35 to the emitter 28 of transistor 26. It will be seen that the modulating voltage from the capacitor 32 is applied between the base 27 and ground. This results in a change in operating point and a change in collector-base voltage. This results in a change in the collector-base junction capacitance of the transistor and this, of course, alters the oscillating frequency so that the frequency is modulated.

The RF output from the oscillator circuit is taken from the secondary winding of coil 35 through isolating resistor 37 and capacitor 38 to the base 43 of transistor 40. The transistor 40 is also of the P-N-P type and can suitably be a 2N388. The final amplifier operates as a conventional class AB amplifier and its operating points are established by the resistors 39, 46 and 48. These resistors can suitably be of 47,000, 15,000 and 100 ohms, respectively. Resistor 48 has a by-pass capacitor 47, suitably of 0.01 microfarad. A conventional tank coil 53 is provided in the emitter circuit which is tuned by capacitor 50. A wide variety of antennas may be connected to point Y or points X and Y. Typical antennas will be described later. The final amplifier serves primarily as an isolation amplifier to avoid body effects on the oscillating frequency.

The entire unit shown in FIGURE 1 is mounted within a small case 79 as is shown in FIGURES 2 and 3. The antenna 81 is typical of antennas which serve as a means whereby the microphone transmitter can be suspended around the neck of the user. The case 79 contains the microphone unit 80 and has an insulated connection 83 to the final tank coil which in this instance is point Y of FIGURE 1 and which also serves as a means for fastening the antenna 81 to one side of the case 79. The opposite end of the antenna is provided with a hook 88 which is adapted to be snapped into a loop 87 which in turn is fastened to the case 79 by means of an insulator 89. In this instance the metal case 79 is connected to point X, which is at RF ground.

The antenna shown in FIGURE 3 consists of a single wire 81, preferably stranded for flexibility, near the center of which is attached at 85 second wire 86 which is T-shaped section. The wire 86 is preferably about 18 inches long and hangs down the back of the wearer. An alternate form of antenna is shown in FIGURE 4 wherein the portion which hangs down the back consists of two wires 91 and 93 which are fastened together at their ends at 95 so that an antenna of longer electrical length is provided than the one shown in FIGURE 3. The configuration chosen will depend upon the frequency used. It has
been found that by having the T-shaped section hang down the back of the wearer, a minimum of directivity is obtained. In other words, as the user of the microphone turns from side to side, the pickup receiver can still "see" the antenna regardless of position so that the signal strength remains substantially constant.

It has also been found that superior results can be obtained if, in addition to the simple lavaliere cord which serves as an antenna as described above, a second wire is employed in connection with said device which serves as a ground plane or counterpoise. It has been further found that for best results there is a critical relationship between the lengths of the two wires and that the antenna is considerably more efficient if its electrical length is substantially less than a quarter wave length.

Referring now to FIGURES 5, 6 and 7 there is shown a man 96 employing the microphone transmitter employing the two wire antenna. The microphone transmitter 97 has a first wire 99 which is looped around the neck and which serves both to support the microphone transmitter and as an antenna. Wire 99 terminates in an insulated hook 110 which can be fastened to a loop 112 located on the body of the microphone transmitter. The microphone transmitter also has a second wire 111 terminating in a hook 114 with which it can be conveniently looped around the body of the wearer, as it is shown, or which may be allowed to hang down, preferably under the clothing.

FIGURE 6 is an enlarged view with certain parts cut away which shows the manner in which the antenna and counterpoise wires can be electrically connected to the microphone transmitter and also the manner in which either greater or smaller electrical length of the antenna can be achieved for optimum operation. Here the microphone transmitter is provided with a conventional tank coil 53 as has been described. The "hot" side of the tank circuit (Y in FIGURE 1) is connected to the antenna wire 99 at insulated connector 119. The antenna wire 99 may be looped upon itself as at 123 to provide greater length if the frequency selected is one where a greater length than that provided by lavaliere cord is desirable or the depending wire can form a single wire T as in FIGURE 3. The wire 123 may be allowed to hang down the back of a user where it is easily concealed by the clothing. The wire 111, of convenient length, is attached by connector 133 to the "cold" end (X in FIGURE 1) of the tank coil 53.

If working at a higher frequency where the optimum length antenna would not reach around the neck or around the waist, these wires may be electrically shortened by insertion of the appropriate value of capacity as at 135 in series with one or both of the antenna leads.

As has been mentioned above, there are certain optimum lengths for both the antenna and counterpoise wires. Generally speaking, it is preferred that the antenna wire be about ½ wave length long while the counterpoise wire may vary from .18 to .2 wave lengths long. These lengths are considerably shorter than normal antenna theory would dictate since one would normally expect that each of the wires would be about ¼ wave length long. However, it has been found that due to the close proximity of the body, there is capacitive loading effect on the antenna and counterpoise so that the antenna and counterpoise will be considerably shorter than they would be if they were in free space. Further, in many instances it is not necessary to optimize the lengths since, if extreme distances are not to be spanned, one can sacrifice signal strength for more convenient lengths of the two wires. For instance, in one practical unit which was designed to operate at 32 to 37 megacycles, the lavaliere cord was 25" long while the counterpoise cord was 52" long. However, it is generally preferred to operate under conditions wherein the longer cord is not more than about 1.5 times as long as the shorter cord.

Throughout the specification, reference has been made to certain specific transistors and values of components, but it will be understood that these details are given for illustration purposes only and that substantial departures from these values may be chosen in carrying out the invention.

Although not shown in the drawings, it is obvious that the microphone transmitter of the present invention would be used in conjunction with a radio receiver placed at some convenient location for picking up the transmission from the microphone transmitter from whence it can be fed into a public address system or a radio or television transmitter or the like.

This application is a continuation-in-part of my application Serial No. 1,295 filed January 8, 1960, and now abandoned.

I claim:

A microphone transmitter and antenna system comprising in combination a small case holding a microphone, a transmitter and a battery therefor, a first wire extending from said microphone transmitter of a convenient length to suspend the microphone transmitter around the neck of a wearer and act as an antenna therefore said first wire being about ½ wave length long and a second wire attached to said microphone transmitter and adapted to encompass the body of a wearer and serve as a counterpoise for said microphone transmitter, said second wire being from about .18 to .2 wave lengths long.

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