Feb. 16, 1971 E. G. PRICE 3,564,416

CORDLESS, SELF-CONTAINED MICROPHONE TRANSMITTER

Filed March 29, 1968

Fig. 1

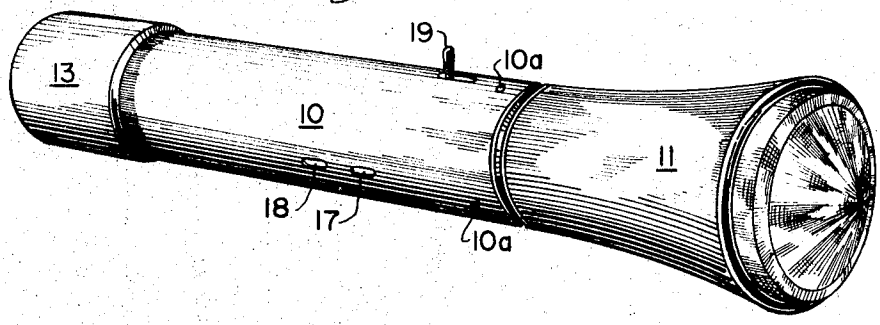
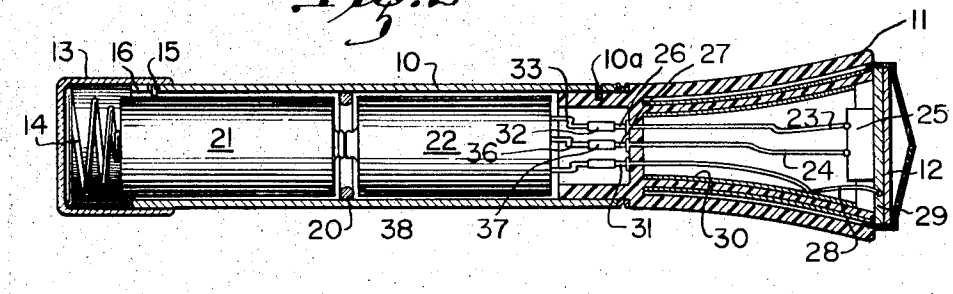


Fig. 2



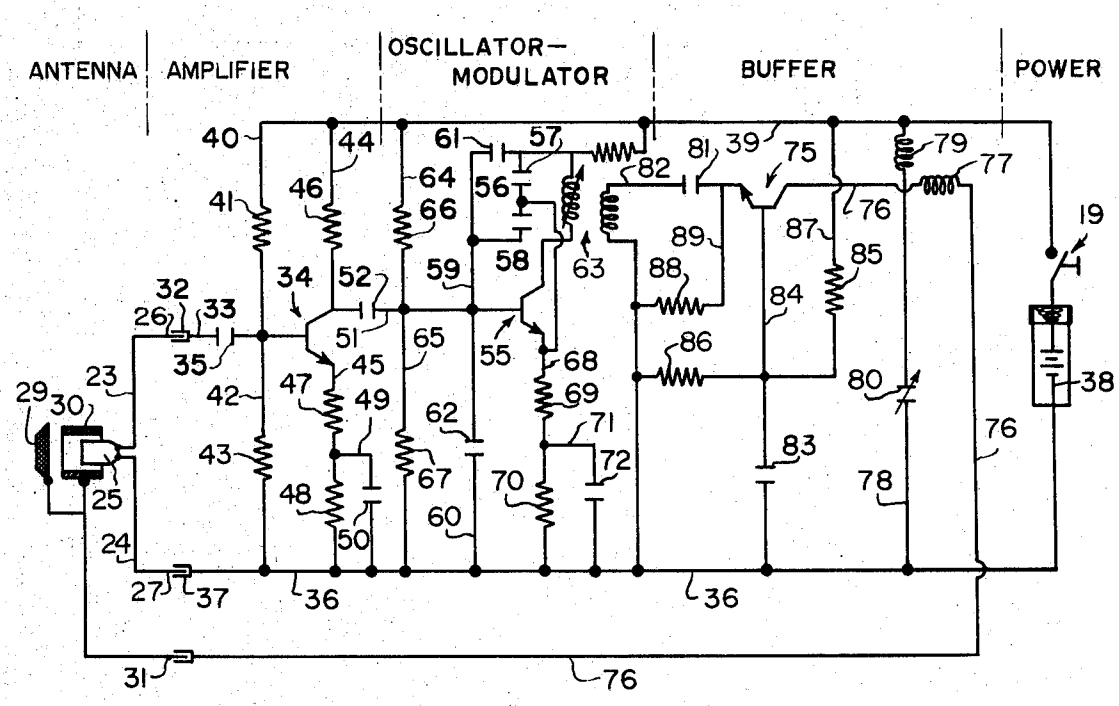


Fig. 3

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CORDLESS, SELF-CONTAINED MICROPHONE TRANSMITTER

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ABSTRACT OF THE DISCLOSURE

A cordless, self-contained, frequency modulated microphone transmitter including a housing adapted to be hand-held; a microphone pickup element; and a circuit comprising a battery, an input impedance matching and equalization network, a triplex Colpitts radio frequency oscillator-modulator, an antenna that includes components of the microphone pickup element; and an isolating buffer amplifier to couple frequency modulated energy to the antenna.

BRIEF DESCRIPTION

There has long been a need for a cordless microphone transmitter that can be effectively used by radio and television announcers, performers, public speakers and others, as they move about, or that can be moved from place to place for use by a number of different persons, without the audio cable that is usually associated with microphones, being dragged behind. Cordless microphone transmitters have been used in the past, but the ones with which I am familiar have not been entirely satisfactory. Most have been unsatisfactory because of their antenna construction and the manner in which the antennas perform their functions. These known cordless microphone transmitters have incorporated antennas that are wrapped around the user's body, inserted into the user's garments or otherwise conspicuously and obtrusively placed where they distract the user and/or persons viewing him, or that form long, difficult to handle, extensions of the microphone transmitter. Generally, the user's body is required to serve as a ground plane for the antenna, and all too often the body acts as a shield, blocking effective transmission from these elaborate and bulky antennas.

Some of the cordless, microphone transmitters with which I am familiar have also been large and difficult to handle and some have not been capable of transmitting the radio frequency carrier without fade-out for sufficient distances. For such a microphone transmitter to be satisfactory, it should have a transmission range, even under adverse conditions, of several hundred feet.

Principal objects of the present invention are to provide an unusually compact and efficient, cordless, microphone transmitter that can have the appearance and size of a conventional cord-type microphone, but that does not utilize an audio interconnecting cable or an exterior antenna.

Other objects are to provide such a microphone transmitter that can be hand held, that can be easily suspended from an inexpensive cord, placed around the user's neck, or that can be rested on a support or suspended in many other ways, without the suspension apparatus or support apparatus becoming an integral part of the transmitting circuit.

Still another object is to provide a microphone transmitter having an antenna with elliptical polarization so that the resulting radio frequency field is not as subject to disruption as that developed by the linear polarization of the wire antennas heretofore used.

Principal features of the invention include a self-contained microphone case, which has a power supply stage; a circuit including an amplifying, input impedance matching, and equalization stage, an oscillator-modulator stage having a radio frequency oscillator, and an isolating buffer amplifier stage to couple frequency modulated energy to an antenna; a microphone cartridge; and an antenna that is integrally connected to the shield structure of the microphone cartridge, such that the cartridge forms a part thereof and the overall antenna structure launches an elliptically polarized wave.

Additional objects and features will become apparent from the following detailed description and drawing, disclosing what is presently contemplated as being the best mode of the invention.

THE DRAWING

FIG. 1 is a perspective view of the invention;

FIG. 2, a side elevation view, with the housing cut away to show the interior thereof; and

FIG. 3, a circuit diagram, schematically showing the circuit of the invention, including the antenna construction.

DETAILED DESCRIPTION

Referring now to the drawing:

In the illustrated preferred embodiment, the invention includes a tubular metal case **10** that has a conventional microphone head **11**, at one end. The microphone head contains a pickup cartridge **12**, FIG. 2. Although other microphone heads can be used, the R4M and other models manufactured by Shure Brothers, Inc., have proven suitable. Screws **10***a* inserted through holes provided therefor in case **10** and threaded into the microphone head **11** secure the head in place.

The other end of case **10** is closed by a cap **13** having a spring **14** therein that projects into the case to engage a battery **21**. Cap **13** telescopes over case **10** and is secured in place, in conventional fashion, by a stub post **15** that projects inwardly from the wall of the cap and a matching angled slot **16** in the case. The stub post slides into the slot and when the cap is twisted, it is securely held.

Small openings **17** and **18** through the side wall of case **10** allow a screwdriver blade (not shown) to be inserted to tune and adjust the power of the circuit for maximum performance. A switch **19** protrudes through another opening through the sidewall of case **10** to connect or disconnect a circuit, shown generally at **22**, from the battery **21**.

A split ring **20** fits in a groove provided therefore, inside case **10** and divides a power supply compartment containing the battery **21** from a circuit compartment containing the encapsulated circuit **22**.

The encapsulated circuit **22** and the antenna connected thereto are best shown, schematically in FIG. 3.

As illustrated, the pickup cartridge **12** of the microphone head has lead wires **23** and **24**, leading from an induction coil **25** to plugs **26** and **27** respectively, and another lead wire **28**, leading from the metal portions **29** of the microphone cartridge, and a metallic plate **30** normally used as an electrostatic shield rolled inside the microphone head, is connected to another plug **31**.

Plug **26**, and therefore wire **23**, are connected through a plug receptacle **32** and a line **33** to the base of an NPN amplifier transistor **34**. A capacitor **35** in line **33** acts to block DC current into the microphone coil winding. Another line **36** serving as a circuit ground, is connected to plug **27** and, therefore, wire **24**, through a

plug receptacle **37**, and to a post **38** adapted to be contacted to one terminal of battery **21**.

The other terminal of the battery is adapted to be connected through spring **14**, cap **13** and the metal case **10**, line **39** and a line **40** having a resistor **41** therein, to the line **33**. Another line **42**, having a resistor **43** therein interconnects lines **40** and **36** and lines **44** and **45**, respectively interconnecting the emitter and collector of the transistor **34** with lines **39** and **36**. Line **44** has a resistor **46** therein and line **45** has a pair of resistors **47** and **48** connected in series and with a line **49** connected to line **45** between resistors **47** and **48** and to line **36**, such that the capacitor **50** therein is in parallel with resistor **48**.

The lines **40**, **42**, **44**, **45**, and **49**, resistors **41**, **43**, **46**, **47**, and **48** and capacitor **50** form with the transistor **34**, a pre-amplifier stage of the circuit that receives an audio signal from the pickup cartridge, through line **33**, and that transmits the signal through a line **51** having a blocking capacitor **52** thereon to the oscillator-modulator stage of the overall circuit.

The amplifier stage, through proper component selection, is designed to match a particular microphone head and also equalizes audio amplification with frequency to provide a suitable preemphasis to the subsequent oscillator-modulator stage. The preemphasis is obtained by choosing the resistor **48** and the capacitor **50** to have a time constant such that the audio gain of transistor **34** is increased with frequency. It will be apparent that some amount of preemphasis will also occur in the oscillator-modulator stage.

The oscillator-modulator unit of the circuit is of triplex type. It includes a common base, Colpitts type oscillator, with a silicon NPN transistor **55**, the base of which is connected to line **51** to receive the audio signal from the amplifier circuit. Transistor **55** is selected so that there is just sufficient magnitude and degree of phase shift in a feedback circuit that includes line **56** and capacitors **57** and **58** to maintain stable oscillation at the desired frequency, i.e. 100 megahertz.

At radio frequency the capacitors **61** and **62** offer very low impedance and the circuit functions as a Colpitts oscillator whose frequency of oscillation is governed by the particular values of the capacitor **58** and variable inductor **63**. At audio frequencies the tank circuit, comprising capacitor **58** and a primary winding of a variable inductor **63** is not significant and the transistor **55** functions as an audio common emitter amplifier.

The audio input voltage at the base of transistor **55** causes a coincident voltage change in the collector current. This, in turn, causes a change in the collector voltage, which linearly changes the output capacitance of the transistor. The change in output capacitance appears across the capacitor **58** in the Colpitts connection, and frequency, therefore, deviates the oscillator, under the direct control of the input audio voltage.

As is common in circuitry of this type, lines **64** and **65**, respectively containing resistors **66** and **67**, are provided to maintain the base voltage of transistor **55** constant and thus set a stabilized bias. Line **68** and resistors **69** and **70** therein and line **71** and capacitor **72** maintain the emitter voltage constant while providing some further preemphasis.

The secondary winding of coil **63** couples the oscillator-modulator stage to an output buffer amplifier stage between the oscillator and the antenna. This "buffer" stage serves to provide power gain at radio frequencies and load isolation between the antenna and the oscillating tank circuit including capacitor **58** and coil **63**. The load isolation is obtained since there is only an extremely low feedback capacitance and leakage of the NPN silicon transistor **75** in the common base amplifier configuration. The transistor **75** operates as a constant current source to the antenna load.

The output tank circuit, connected between the collector of the transistor **75** and the antenna member **30** by plug **31**, consists of the inductor **77** connected in the line **76**, the choke **79** in the line **78** that interconnects the lines **39** and **36** and a variable capacitor **80** that serves to match the highly reactive and changeable load impedance of the antenna, which includes member **30** and other components of the microphone head **11**, to the output impedance of the transistor **75**.

The transistor **75** in turn is impedance matched to the oscillator secondary tank coil by capacitor **81** in line **82**. A capacitor **83** in line **84** sets the base of transistor **75** at radio frequency ground potential in order for it to operate as class A common base amplifier while providing a DC block that will allow resistors **85** and **86** in line **87** and resistor **88** in line **89** to establish a proper DC bias voltage.

The circuit is tuned by adjusting tuning coil, i.e. inductor **63** with a screwdriver blade or other suitable tool inserted through opening **17** in the case **10** and the circuit is adjusted for optimum power transfer to the antenna by inserting a tool through opening **18** to adjust variable capacitor **80**.

The on-off switch **19** is provided in line **39**, between case **10** and the other circuit elements, and it extends through the case such that it can be easily manipulated by a user.

With the circuit and antenna construction herein described, it has been found that a strong signal is continuously transmitted and that the signal does not fade out with the repositioning of the body of the user or even when the user's hand comes in contact with the microphone head. The antenna is slightly elliptically polarized and is biased along the longitudinal axis of the microphone-transmitter.

By encapsulating the elements of the circuit, except of course for the tuning coil, variable capacitor and, switch and lead wires, in an epoxy, it is possible to protect the circuit components against damage due to rough treatment of the microphone-transmitter.

Although the microphone-transmitter of the invention can be suspended by a lavalier hung around the neck of a user or can be otherwise supported, the lavalier and/or support structure do not comprise any part of the microphone-transmitter circuit or antenna.

Although a preferred form of my invention has been herein disclosed, it is to be understood that the present disclosure is made by way of example and that variations are possible without departing from the hereinafter claimed subject matter I regard as my invention.

I claim:

1. A cordless, self-contained microphone-transmitter comprising

a case;

a power supply positioned within said case;

a microphone head including a non-metallic housing, a metallic mesh extending across one end of the housing, a metallic shield rolled inside said housing and positioned between the shield and the mesh, and an induction coil within the housing and adjacent to said microphone cartridge, the other end of said housing being attached to one end of said case;

a solid-state circuit including an amplifying input impedance matching and equalization stage electrically connected to the power supply and to the microphone head, an oscillator-modulator stage including a tuning coil electrically connected to the amplifying input impedance matching and equalization stage, and an oscillating buffer amplifier stage including a tank circuit with a transistor, a coil and a variable capacitor; and

means electrically connecting the oscillating buffer stage to the microphone cartridge and the shield as an antenna, whereby the oscillating buffer stage matches the load impedance of the antenna to a common base network including a transistor that

thereby acts as a constant current source to the antenna.

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