

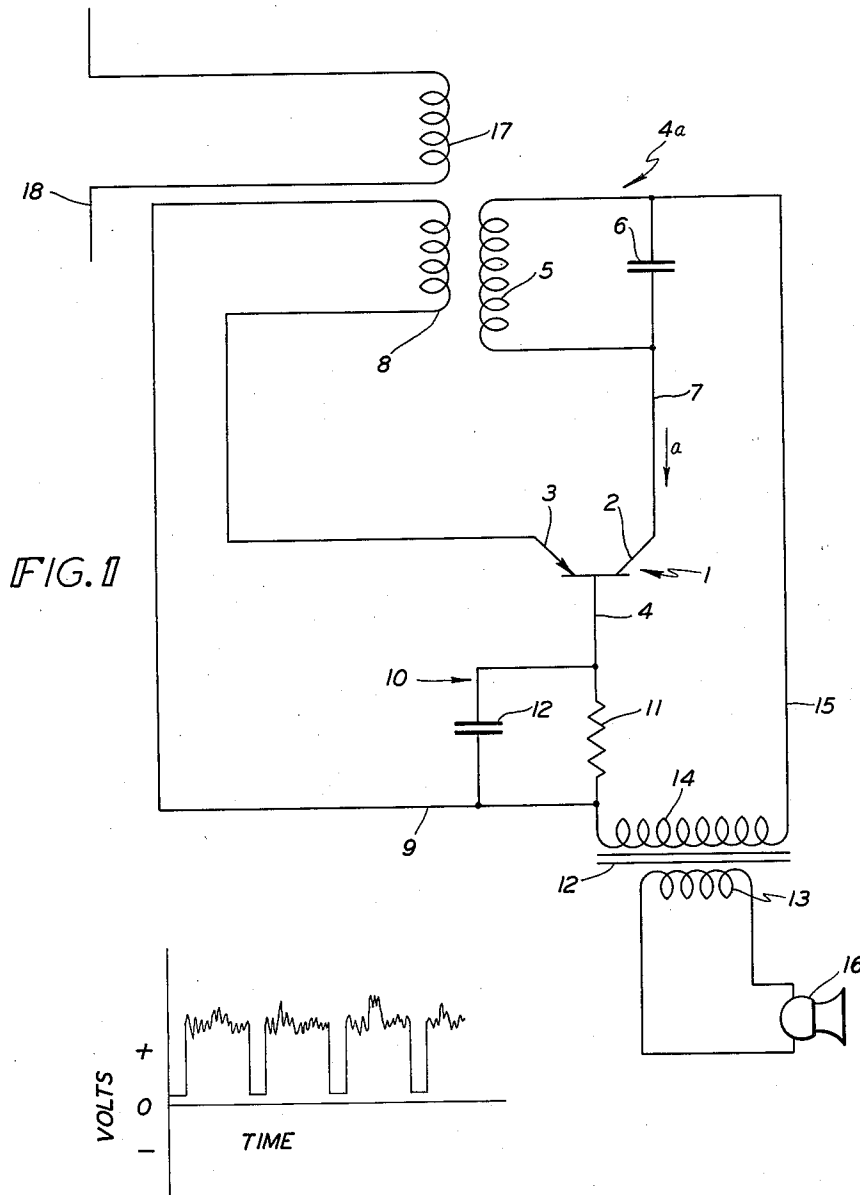
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SELF-POWERED RADIO TRANSMITTER

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SELF-POWERED RADIO TRANSMITTER

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The present invention relates to a self-powered radio transmitter and more particularly to a radio transmitter having no external source of supply potential.

Following the discovery of the transistor, numerous circuits employing the transistor as a substitute component for the conventional electron discharge device have been proposed. In every one of such transistor circuits of which knowledge is had, a separate source of potential, such as a battery, is used for supplying operating power to the circuit.

In view of the foregoing, it is an object of this invention to provide a radio frequency oscillator which may be operated without a separate supply of operating potential.

It is another object of this invention to provide a radio transmitter capable of emitting intelligible signals, such transmitter receiving its operating power from mechanical vibrations which may occur at an audible rate.

In accordance with the present invention, there is provided a self-powered radio transmitter comprising a transistor device having collector, emitter and base electrodes, circuit means coupled to the electrodes for producing radio frequency oscillations, and a source of alternating or varying current potential operatively coupled to said circuit means for supplying operating potential to said transistor, the frequency of said source being less than the frequency of said oscillations.

For a better understanding of the invention, together with other and further objects thereof, reference is made to the following description, taken in connection with the accompanying drawing, the scope of the invention being pointed out in the appended claims.

In the accompanying drawing:

FIG. 1 is a circuit diagram of a representative embodiment of the present invention; and

FIG. 2 is a graph used in explaining the operation of an alternative embodiment.

With reference to the drawing, a transistor, indicated generally by the reference numeral 1, is provided with the usual collector, emitter and base electrodes 2, 3 and 4, respectively. A resonant tank circuit, indicated generally by the reference numeral 4a, comprised of an inductance 5 and a condenser 6 connected in parallel, is connected by means of a wire 7 to the collector electrode 2. A feed-back inductance or coil 8 inductively coupled to the tank circuit 4a has a conductive connection with the emitter electrode 3 and another conductive connection 9 with the lower end of a time constant circuit generally indicated by the reference numeral 10. This time constant circuit 10 is comprised of a resistor 11 and a secondary windings 13 and 14, respectively, is connected into condenser 12 connected in parallel, the upper end of the circuit being conductively connected to the base electrode 4. A transformer 12 having primary and secondary windings 13 and 14, respectively, is connected into the foregoing described circuit, one end of the winding 14 being connected to the lower end of the resistor 11 and the other end of the winding being conductively con-

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nected by means of a line 15 to the upper side of the tank circuit 4a. A conventional microphone 16 is operatively coupled across the ends of the primary winding 13. This microphone may be of any available type or design so long as voice or the like vibrations communicated thereto will be transformed into electrical impulses which may be delivered to the transformer winding 13.

A suitable antenna pick-up coil 17 is inductively coupled to the feed-back coil 8 for the purpose of coupling radio frequency energy to a dipole antenna 18.

In operation, voice vibrations or the like directed onto the microphone 16 are transformed into electrical impulses which are conducted to the transformer winding 13. By means of a suitable step-up ratio between the two transformer windings 13 and 14, respectively, the same impulses are applied between the lower end of the time constant circuit 10 and the upper end of the tank circuit 4a. Since the transistor 1 is a uni-directionally conducting device, a current flowing in the direction of the arrow "a" will be produced, this current also passing through the time constant resistor 11 which serves to develop a potential charge on the condenser 12. This potential produced in the time constant circuit may be considered as operating bias for the transistor 1 and may be of such value as to produce the desired end result in circuit operation.

This current "a" also passes through the tank circuit inductance 5 and serves to induce a potential in the coil 8 which is so polarized as to provide a voltage on the emitter electrode 3 of such polarity as will augment conductance of the current "a" between the collector and base electrodes. This current will increase in amplitude until the circuit limit of conductance is reached and current change in coil 5 ceases, at which time the voltage induced into the coil 8 drops to zero. The transistor 1 becomes less conductive whereupon the current "a" progressively reduces in amplitude until a lower limit is reached, at which time feed-back voltage across the coil 8 again drops to zero and the previously-described cycle is initiated to produce current build-up.

The time constant circuit 10 provides a positive bias on the emitter electrode with respect to the base electrode, and is of such value as to sustain oscillations for a given alternating voltage produced by the transformer winding 14.

The transistor 1 and its associated circuit may be regarded as a radio frequency oscillator which produces vibrations of a frequency substantially greater than the frequency of the vibrations imparted to the microphone 16. Therefore, in considering the foregoing explanation of circuit operation, an instantaneous value of voltage supplied by the transformer winding 14 will serve to produce a number of cycles of oscillation in the transistor circuit.

In actual practice, however, the voltage appearing across the secondary winding 14 will vary in polarity, frequency and amplitude, corresponding to the character of the vibrations directed toward the microphone 16. Therefore, the amplitude, frequency and phase of oscillations produced by the transistor circuit will vary in accordance therewith, such variations producing distortion in the signal emitted by the antenna 18 when such signal is compared with the high fidelity signals being transmitted currently by standard broadcasting and the like transmitters.

While a particular oscillator circuit has been illustrated

and described in exemplification of this invention, it will be understood by persons skilled in the art that various radio frequency oscillator arrangements are possible, with each circuit being powered by means of a simple microphone or similar potential-generating device. Similarly, loads other than the antenna system 17 and 18 may be employed to utilize the signal appearing either in the tank circuit 4a or the feed-back coil 8.

While a transistor has been described in connection with a particular embodiment of this invention, a conventional vacuum tube having heater voltage supplied thereto may be incorporated in a similar oscillator circuit to accomplish substantially the same mode of operation. Therefore, the claims are intended to cover both transistor and equivalent vacuum tube devices, and claim definitions of transistor electrode structure are intended to include corresponding equivalent vacuum tube electrodes.

The operation of an alternative embodiment of this invention is exemplified by FIGURE 2 of the drawing. The graph of this drawing illustrates a uni-directional voltage of varying amplitude which may be operatively coupled into the circuit of FIGURE 1 in place of the alternating voltage source 12, 16. Specifically, this graph represents a conventional video or television signal which is coupled into the transistor circuit by any means well known to the art. A modulated R.F. carrier is thereby produced. This arrangement has particular utility in industrial television equipment.

While there has been described what is at present considered the preferred embodiment of the invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention, and it is, therefore, intended by the appended claims to cover all such changes and modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. A self-powered radio transmitter comprising a transistor device having collector, emitter and base electrodes, circuit means coupled to said electrodes for producing radio frequency oscillations, said means including a resonant tank circuit operatively coupled to said collector electrode, a feedback circuit inductively coupled to said tank circuit and operatively coupled to said emitter electrode for feeding energy in predetermined phase relation from the tank circuit to the emitter electrode, a time constant biasing circuit comprised of a condenser and a resistor connected in parallel and connected in series between said feedback circuit and said base electrode in such a manner that the current conducted by said base electrode will pass through said resistor; a transformer having primary and secondary windings, the secondary winding being connected in series between said resistor and said tank circuit respectively whereby a potential provided by said secondary winding will cause a current to flow between said collector and base electrodes, and a microphone operatively coupled to said primary winding for producing an A.C. potential in said secondary winding in response to mechanical vibrations imparted to said microphone.

2. A transmitter which is powered solely by microphone energy comprising a transistor device having collector, emitter and base electrodes, circuit means coupled to said electrodes for producing radio frequency oscillations, said means including a resonant tank circuit operatively coupled to said collector electrode, a feedback circuit inductively coupled to said tank circuit and operatively coupled to said emitter electrode for feeding energy in predetermined phase relation from the tank circuit to the emitter electrode, a time constant biasing circuit comprised of a condenser and a resistor connected in parallel operatively coupled to said base electrode in such a manner that the current conducted by said base electrode will pass through said resistor; a transformer having primary and secondary windings, the secondary winding being operatively coupled to said resistor and said tank circuit

respectively whereby a potential provided by said secondary winding will cause a current to flow between said collector and base electrodes, said feedback circuit comprising an inductor having one end coupled to the connection between said resistor and said secondary winding and the other end coupled to said emitter electrode, and a microphone operatively coupled to said primary winding for producing an A.C. potential in said secondary winding in response to mechanical vibrations imparted to said microphone.

3. A transmitter which is powered solely by microphone energy and needing no other source of either direct current or alternating current power for generating an intelligible radio frequency signal comprising an oscillator circuit, a transistor in said circuit, self-biasing means in said circuit for supplying an operating biasing potential to said transistor, a signal output circuit operatively coupled to said oscillator circuit for coupling power from the latter, and a microphone capable of transforming audio vibrations into electrical power waves operatively coupled into said oscillator circuit for supplying operating and modulating power to the latter, said transistor serving to rectify said power waves into a unidirectional current which serves in establishing said biasing potential, the alternations in said power waves serving to determine the frequency, amplitude and phase of oscillations of said oscillator circuit whereby such oscillations constitute an intelligible signal corresponding to the character of said electrical power waves.

4. A circuit of the character described comprising a transistor having collector, emitter and base electrodes, a source of varying potential, first circuit means including said source connected in series with said collector and base electrodes for developing a unidirectional bias, second circuit means regeneratively coupled to said first circuit and said emitter electrode for supplying a potential to the latter of such polarity as will augment conduction between said collector and base electrodes.

5. A circuit of the character described comprising a transistor having collector, emitter and base electrodes, a source of varying potential, a time constant network, first circuit means including said source and network connected in series with said collector and base for developing a unidirectional bias, second circuit means regeneratively coupled to said first circuit and said emitter electrode for supplying a potential to the latter of such polarity as will augment conduction between said collector and base electrodes.

6. A self-powered circuit composed of only a single transistor having collector, emitter and base electrodes; a source of varying potential, a time constant network, and a first inductance connected in series with said collector and base electrodes for developing a unidirectional bias, a second inductance regeneratively coupled to said first inductance and said emitter electrode to apply a potential on said emitter electrode of such polarity as to augment conduction between said base and collector electrodes.

7. In a signal transmitter, an oscillator circuit comprising a semi-conductor device having base, emitter, and collector electrodes, a transformer having a secondary winding, means for inducing a voltage in said winding including means for converting acoustical energy into electrical energy, one end of said winding conductively connected to said emitter and base electrodes, an inductor having one end directly and non-capacitively connected to said collector electrode and the other end directly and non-capacitively connected to the other end of said winding, regenerative feedback means including an inductive element coupled to said inductor, said inductive element being connected between said base and emitter electrodes for coupling signals therebetween from said collector electrode and providing sustained oscillation over a range of frequencies, a biasing network including a resistor and capacitor connected in parallel, said biasing network being

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connected in series with said inductive element, the electrical energy converted from said acoustical energy being the sole source of biasing potential for said device, and means coupling a load to said oscillator circuit.

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