

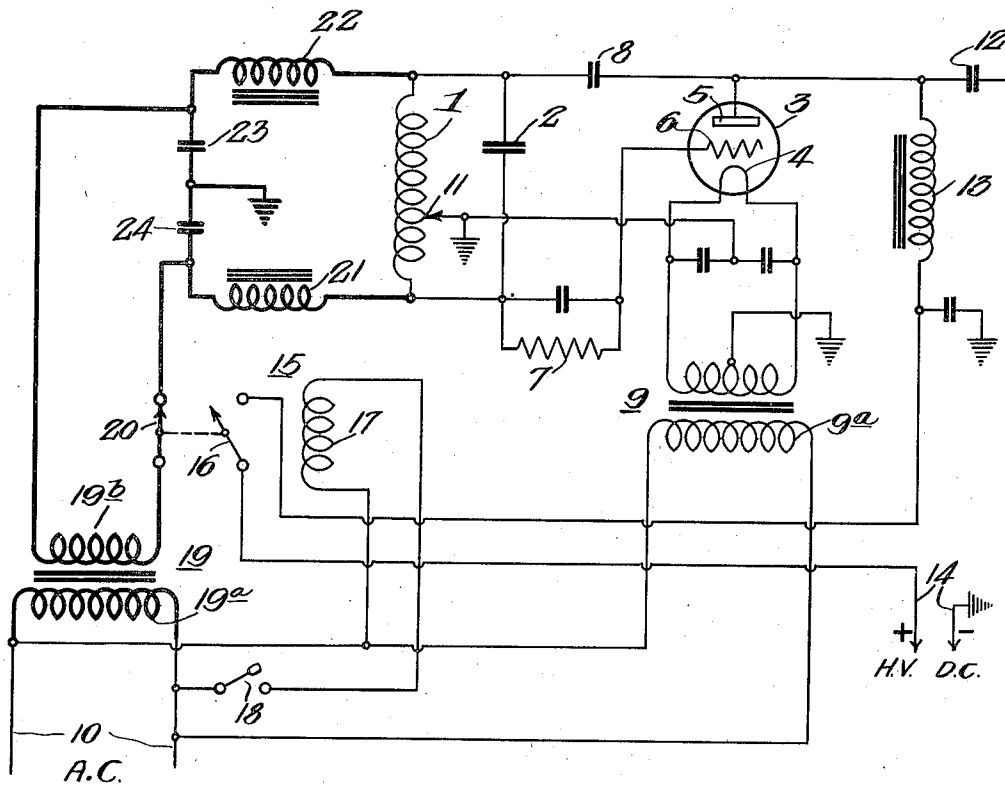
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FREQUENCY DETERMINING CIRCUIT

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FREQUENCY DETERMINING CIRCUIT

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This invention relates to signaling systems, particularly to frequency determining circuits therefor, and has special reference to the provision of auxiliary means for maintaining the electrical characteristics of such circuits substantially constant notwithstanding variations in temperature to which such circuits are normally subjected, for example, during the starting period and during periods of intermittent operation.

While the invention will be described as applied to a frequency determining circuit of a radio frequency oscillation generator of a conventional type, it is to be understood that it is not limited to such application, as the disclosure in this respect is merely illustrative for purposes of explaining the inventive concept.

In a radio frequency oscillator in which the frequency of oscillation is controlled primarily by the inductance and capacitance elements in the frequency-determining or "tank" circuit, a pronounced frequency drift is usually encountered when these elements are subjected to the heating effect incident to the application of the signaling current. A large part of such frequency drift may be traced to changes in the physical and electrical characteristics of the inductance coil when subjected to changes in temperature.

The present invention contemplates, and its practice provides, means for maintaining the temperature, and hence the physical and electrical characteristics of the frequency determining circuit substantially constant during both busy and idle periods, that is to say, irrespective of the presence or absence of signaling currents in the tank circuit.

A circuit arrangement for producing this desired result is shown in the accompanying drawing, in which a series connected inductor 1 and capacitor 2 comprise a circuit electrically tuned to generate oscillations of a desired frequency when subjected to normal operating temperatures. As shown by the light lines of the drawing, the frequency determining circuit 1-2 forms part of a conventional Hartley oscillator which includes a vacuum tube 3 having a cathode 4, an anode 5, and an input or grid electrode 6. As in standard practice, the grid 6 is connected to one terminal of condenser 2 through a resistor 7 or other source of biasing potential, while the anode 5 is connected to the opposite terminal of the capacitor 2 through a blocking capacitor 8. The cathode 4 may be of the indirectly heated type, and is supplied with heating

current by a filament transformer 9, the primary winding 9a of which is connected to an alternating current source 10. This cathode 4 is connected to a point 11 on inductor 1 between the two terminals of the condenser 2. The capacitor 12 in the anode circuit functions as a coupling device for transferring the oscillatory energy to a circuit of transmission or utilization. A choke coil 13 is in the circuit supplying current to anode 5 from the high voltage direct current source 10 symbolically indicated at 14.

The circuit and apparatus thus far described will operate in a manner well understood by those skilled in the art, to generate an undamped electro-motive force which may be employed for radio telegraphic or telephonic transmission, or other purposes. When used for radio telegraphic purposes, a keying relay, generally indicated at 15, may be provided. Relay 15 comprises a switch 16 series connected in the plate circuit, and adapted to be operated by a magnet coil 17 energized from the same A. C. source as the indirectly heated cathode 4 of tube 3. A key 18 is included in the A. C. line to which the magnet coil 17 for relay 15 is connected.

When the oscillation generator of the drawing is used for telephonic purposes, suitable modulating means may be included either in the anode circuit or, if desired, in succeeding stages. In either case parts 15 to 18 may serve as elements of an on-off relay.

When tube 3 is energized, oscillatory currents of a frequency dependent upon the constants of the inductor 1 and capacitor 2 will be set up in the frequency determining circuit which includes these reactance elements. Unless some compensating means are provided, the constants of this circuit, and hence the frequency of the oscillations therein, will not be uniform since, as previously set forth, elements 1 and 2 may be affected by temperature changes such, for example, as may occur during the starting and idle periods and during keying intervals.

The above and other disadvantages incident to the effect of temperature changes upon the frequency determining circuit and circuit elements are obviated in accordance with the invention by the application of heating currents to said circuit during "idle" periods, i. e., in the absence of oscillatory or signaling currents. The signaling and heating currents are preferably alternately applied to the frequency determining circuit by a common actuating device so that there is no substantial lag or interval between

the withdrawal of one type of current and the application of the other.

- The heavy lines in the drawing indicate one manner of applying heating current to the frequency determining circuit 1—2. Here the heating current is supplied through a transformer 19, the primary 19a of which may be included in the A. C. line which actuates the cathode 4 of tube 3 and the coil 17 of relay 15. Serially connected to the secondary 19b of transformer 19 are a switch 20, which forms part of the relay 15, a radio frequency choke coil 21, the reactance 1 of the frequency determining circuit, and a second choke coil 22. The choke coils 21 and 22 and a pair of shunt capacitors 23 and 24 serve to prevent radio frequency energy present in the frequency determining circuit during signaling periods from being dissipated in the heating circuit.
- As above described, the switch 20 in the heating circuit is preferably actuated by the same magnet coil (17) that actuates the switch (16) which controls the keying or (in the case of a telephonic system) the starting operation. Switch 20 is oppositely biased (as by a spring or by gravity) with respect to switch 16, that is to say, switch 20 is adapted to be closed when, as illustrated, the switch 16 in the keying (or starting) circuit is opened, the movement of both switches 16 and 20 being in this case determined by the position of the key or switch 18.

From the foregoing, it will be apparent that when key 18 is closed, switch 16 closes and switch 20 opens, so that only signaling currents are present in the frequency determining inductor 1. On the other hand, when key 18 is open, switch 16 opens and switch 20 closes, so that only heating currents are present in the frequency determining circuit. The heating currents applied to the frequency determining circuit are preferably such as to provide a heating effect of substantially the same order as that incident to the presence of signaling currents, so that the temperature of that circuit, and hence its electrical constants, remain substantially uniform at all times during which operation is contemplated.

Although the invention has been described as applied to a so-called "Hartley oscillator," it will be apparent to those skilled in the art that it may also be applied to oscillators of other types, for examples, to a Colpitts oscillator, and to any of various "electron-coupled oscillators," with but minor changes such, for example, as in the number of choke coils and capacitors required in the heating circuit to prevent the flow of signaling currents therein. Direct instead of

alternating current may obviously be employed as the source of heating current.

Other modifications will suggest themselves to those skilled in the art. It is to be understood, therefore, that the foregoing is to be interpreted as illustrative and not in a limiting sense except as required by the prior art and by the spirit of the appended claims.

What is claimed is:

1. A constant frequency signaling system comprising a frequency determining tank circuit, a source of signaling current and a source of heating current, and means for alternately applying said signaling and heating currents to said tank circuit.

2. A constant frequency signaling system comprising a frequency determining tank circuit including a reactance element, a source of signaling current and a source of heating current, and means for alternately applying said signaling and heating currents to said reactance element.

3. The invention as set forth in claim 2 wherein said reactance element is constituted by an inductor.

4. In combination, an oscillation generator comprising an electron discharge tube having a frequency determining tank circuit coupled thereto, a source of signaling current and a source of heating current, a means for establishing off and on periods in the production of oscillatory currents by said tube and circuit, and means responsive to the operation of said first-mentioned means for selectively connecting said sources of current to said frequency determining circuit.

5. The invention as set forth in claim 4 wherein said means comprises a keying device.

6. In combination, a frequency determining tank circuit, means for applying signaling currents to said circuit, a source of heating current, an auxiliary circuit connected between said source and said frequency determining tank circuit for applying heating currents thereto, and means for preventing the flow of signaling currents in said auxiliary circuit.

7. In combination, a frequency determining tank circuit, a source of signaling current and a source of heating current for said tank circuit, a switch for selectably connecting said signaling and heating current sources to said tank circuit, and means for disconnecting said tank circuit from said heating current source when said switch connects said source of signaling current to said tank circuit.

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