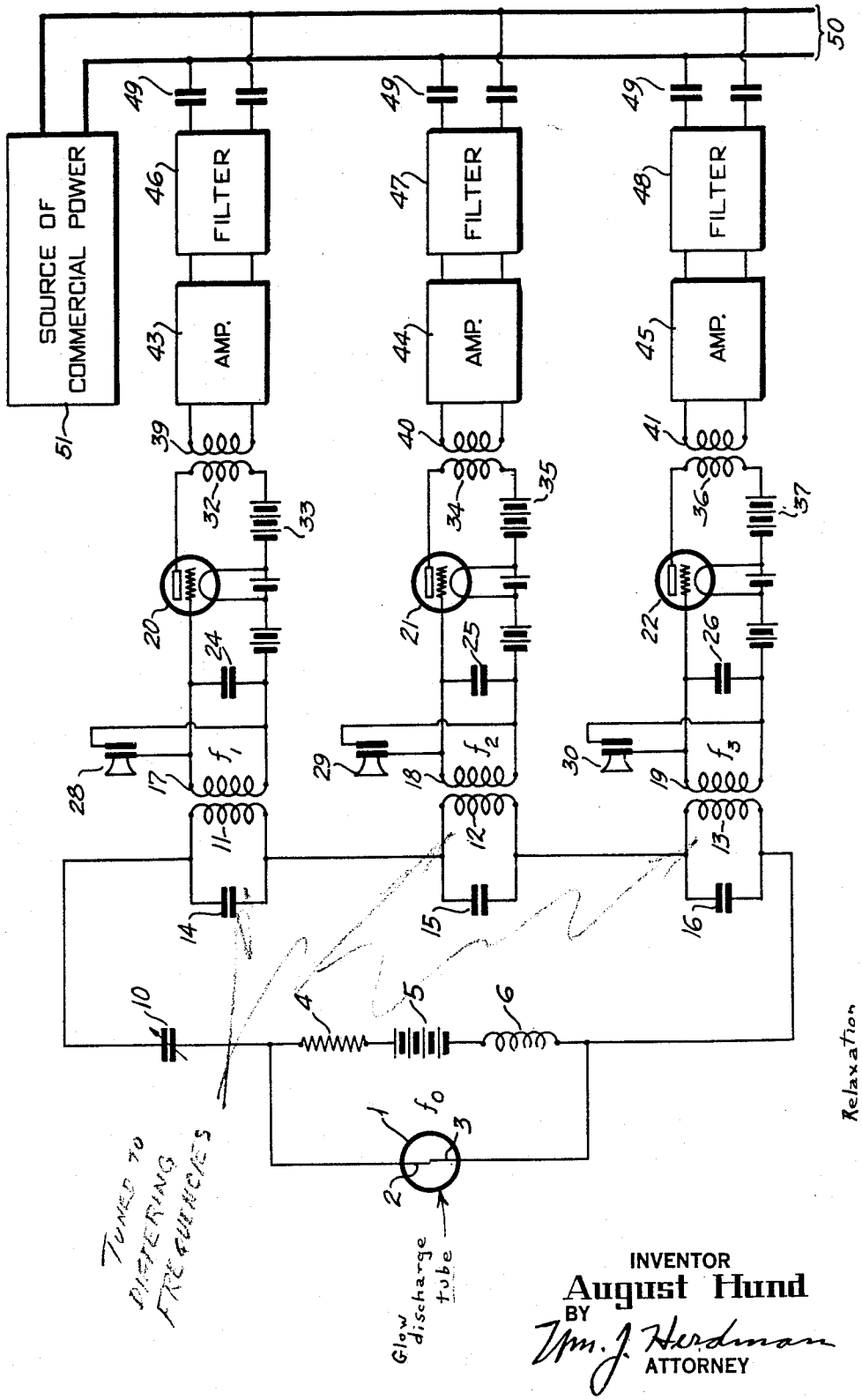
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MULTIFREQUENCY TRANSMISSION

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INVENTOR
August Hund
BY
Wm. J. Herdman
ATTORNEY

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MULTIFREQUENCY TRANSMISSION

August Hund, West Orange, N. J., assignor to Wired Radio, Inc., New York, N. Y., a corporation of Delaware

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2 Claims. (Cl. 179—15)

My invention pertains in general to radio signalling and specifically relates to a system for simultaneously transmitting several programs.

One of the objects of my invention consists in providing a multi-frequency transmission system for simultaneously transmitting a plurality of differently modulated discrete carrier frequencies.

Another object consists in producing a multi-frequency transmission system in which a plurality of discrete carrier frequencies are developed from a common source of oscillations.

A further object comprises providing a system for multi-frequency transmission in which relaxation oscillations are employed to develop a plurality of discrete carrier frequencies for individual modulation and transmission.

I accomplish these and other desirable objects in a novel system for multi-frequency transmission in which a glow discharge tube relaxation circuit serves to energize a plurality of high frequency circuits each having individual modulation.

In the drawing accompanying and forming a part of this specification I have diagrammatically represented one embodiment of my invention as utilized for wired radio broadcasting over power lines.

In my co-pending application, Serial Number 561,837, filed September 9, 1931, entitled "Oscillation generator", there is disclosed, in more detail, a system for producing relaxation oscillations by the agency of a glow discharge tube; while in my co-pending application, Serial Number 563,316, filed September 17, 1931, and entitled "High frequency generator and modulator", I have disclosed a system for producing relaxation oscillations for the development of a plurality of commonly modulated high frequencies.

Referring to the drawing in detail, there is provided a glow discharge tube 1 which comprises an envelope enclosing a pair of electrodes 2 and 3. In the present embodiment of my invention this envelope is preferably provided with an attenuated atmosphere of helium. I have found that satisfactory results can be obtained by maintaining this atmosphere of helium at a pressure of substantially 12 mm. of mercury. It will be understood that other suitable gases can be used in lieu of helium and at other suitable pressures. The electrodes 2 and 3 are of a small area and disposed in a manner such as to reduce inter-electrode capacitance to a minimum. The electrodes 2 and 3 are connected with an external circuit including a resistance 4, a source of direct current 5, and an inductance 6, all connected in series.

Connections from the electrodes 2 and 3 are further extended to include a circuit having a variable condenser 10 connected in series with a plurality of oscillation circuits including the inductances 11, 12, and 13, and the capacitances 14, 15, and 16, connected in parallel circuits as shown. I have found in experiments that the capacitances 14, 15, and 16, may sometimes be omitted when developing high frequencies in accordance with my invention.

Inductances 11, 12, and 13 are electromagnetically coupled to inductances 17, 18, and 19, respectively. The inductance 17 is connected between the control electrode and cathode of an amplifier tube 20. The inductance 18 is connected between the control electrode and cathode of an amplifier tube 21, and the inductance 19 is connected between the control electrode and cathode of an amplifier tube 22. A capacitance 24 is connected in parallel with the inductance 17 to form a resonant circuit tuned to a definite high frequency suitable for carrier purposes in radio signaling. A capacitance 25 is connected in parallel with the inductance 18 to form a resonant circuit tuned to another high frequency which, in the present embodiment of my invention, is an integral multiple of the fundamental frequency of the glow discharge system. A capacitance 26 is connected in parallel with inductance 19 to form another resonant circuit tuned to a still different frequency which has an integral relation with respect to the fundamental frequency of the relaxation oscillations.

A condenser transmitter 28 is connected in shunt with the capacitance 24 for effecting modulation, in accordance with sound waves incident upon the condenser transmitter 28, of high frequency oscillations set up in the circuit 17—24. Other condenser transmitters 29, and 30, are similarly provided with circuits 18—25 and 19—26, respectively.

The output or anode to cathode circuit of the amplifier tube 20 includes an inductance 32 and source of anode voltage 33. The output or anode to cathode circuit of the amplifier tube 21 includes an inductance 34 and source of anode voltage 35, while the output or anode to cathode circuit of amplifier tube 22 includes an inductance 36 and source of anode voltage 37. The inductances 32, 34, and 36 are electromagnetically coupled to inductances 39, 40, and 41, respectively.

These inductances 39, 40, and 41 are included in the input circuits to amplifiers 43, 44, and 45, respectively, which are connected to filters 46, 47, and 48. Filter 46 is designed to pass only those frequencies within a range comprising the carrier and modulation side bands appearing in the input circuit to amplifier tube 20. A similar relation exists between the filters 47 and 48 and their associated amplifier tube input circuits. The filters 46, 47, and 48 have their output cir-

cuits capacitively coupled through condensers 49 to wire lines 50 connected to a source of commercial power 51. The power lines 50 and source of commercial power 51 are indicative of a power distribution network supplying a multiplicity of consumers with commercial power.

In accordance with my invention, the source of current 5 applies a potential difference to the electrodes 2 and 3 which is of a magnitude sufficient to initiate a glow or ionization discharge in the glow tube 1. The voltage necessary to bring about this glow discharge will be called the ignition voltage. If the resistance 4 is of a proper value, the glow discharge which takes place across the electrodes 2 and 3 will produce a potential drop across the resistance 4, whereby the voltage across the electrodes 2 and 3 will become reduced. As soon as the voltage across the electrodes 2 and 3 becomes smaller than the lower critical voltage, the glow discharge will be quenched. The foregoing functions will be repeated to produce continuous relaxation oscillations of a fundamental frequency designated as f_0.

The inductance 6 forms a high frequency choke which presents a high impedance to high frequencies such as those designated as f_1, f_2, and f_3, but presents a low impedance to lower frequencies such as the one designated as f_0. It will be apparent, then, that the inductance 6 subsantially prevents the passage of high frequency currents through the relaxation oscillation circuit without restricting the passage of the relaxation oscillations at the fundamental frequency f_0.

The relaxation oscillations produced by the glow discharge tube 1 and associated circuit just described act through condenser 10 to produce impulse energization of the circuits 11—14, 12—15, and 13—16. These circuits have parameters of values such that this impulse energization will set up oscillatory currents of frequencies which are integral multiples of the fundamental frequency f_0 of the relaxation oscillations. The resonant circuit 17—24 is tuned to a desired high frequency f_1, a particular integral multiple of the fundamental relaxation frequency f_0. This frequency f_1 appears in the circuit 11—14 and is selected by the circuit 17—24 for effecting the transfer of oscillations at the desired frequency f_1 to the amplifier tube 20 and circuit that follows. These oscillations at the frequency f_1 are modulated under control of the condenser transmitter 28.

The resonant circuit 18—25 is tuned to another desired high frequency f_2 which is another integral multiple of the fundamental relaxation frequency f_0. The frequency f_2 appears in the circuit 12—15 and is selected by the circuit 18—25 for effecting the transfer of oscillations at the frequency f_2, as modulated by the condenser transmitter 29, to the amplifier tube 21 and following circuit. The resonant circuit 19—26 is tuned to still another high frequency f_3 which is an integral multiple of the fundamental relaxation frequency f_0. This frequency f_3 appears in the circuit 13—16 and is selected by the circuit 19—26 for effecting the transfer of oscillations at the desired frequency f_3, under control of the condenser transmitter 30, to the amplifier tube 22 and following circuit.

The amplifiers 43, 44, and 45 increase the energy level of the modulated high frequency currents of the carrier frequencies f_1, f_2, and f_3, respectively. The outputs of amplifiers 43, 44, and 45, are directed through the filters 46, 47, and 48 and are impressed upon the power lines 50 for distribution to a multiplicity of consumers having the proper receiving apparatus for selecting any one of the desired carrier frequencies each having separate program modulation. The filters 46, 47, and 48 serve to restrict each program output to its particular frequency range.

It will now be apparent that my system for multi-frequency transmission provides for the production of relaxation oscillations by a glow discharge tube for recurrently energizing a plurality of oscillation circuits for producing sustained high frequency currents. These high frequency currents have frequencies that are integral multiples of the fundamental frequency of the relaxation oscillations and are selected at discrete high frequencies by selection circuits for individual modulation and transmission. Although I have shown a preferred embodiment of my system for multi-frequency tranmission I do not desire to be limited thereto except insofar as may be pointed out in the appended claims.

What I claim is new and original and desire to secure by Letters Patent of the United States is:

1. A system for multi-frequency transmission comprising, a plurality of resonant circuits each comprising a capacitance and an inductance in parallel relation forming a tank circuit and each tuned to a different frequency, all of the frequencies being harmonically interrelated, a relaxation system comprising a resistance, an inductance, a source of current, a variable capacitance, and said plurality of tank circuits conductively connected in series, a glow discharge device the electrodes of which are conductively connected in series with said resistance, said inductance, and said source of current and in parallel with said series of tank circuits for recurrently energizing said relaxation circuit, amplifiers, individually coupled to each of said tank circuits, individual modulation circuits coupled between said amplifiers and said tank circuits and the output circuits of all of said amplifiers being connected to a common transmission line.

2. A system for multi-frequency transmission comprising, a plurality of resonant circuits each consisting of a condenser and an inductance connected in parallel relation to form a tank circuit and each tuned to a definite different frequency, the frequencies being harmonically interrelated, a relaxation oscillation circuit comprising a resistance, an inductance, a source of current, a variable capacitance, and said plurality of tank circuits all conductively connected in series, a glow discharge device the electrodes of which are connected in series relation with said resistance, said inductance and said source of current and in parallel relation with said series of tank circuits for recurrently energizing said relaxation oscillation circuit, a common transmission line and separate circuits, each including a modulation circuit, an amplifier and a filter connecting said tank circuits individually through condensers with said common transmission line.

AUGUST HUND.