

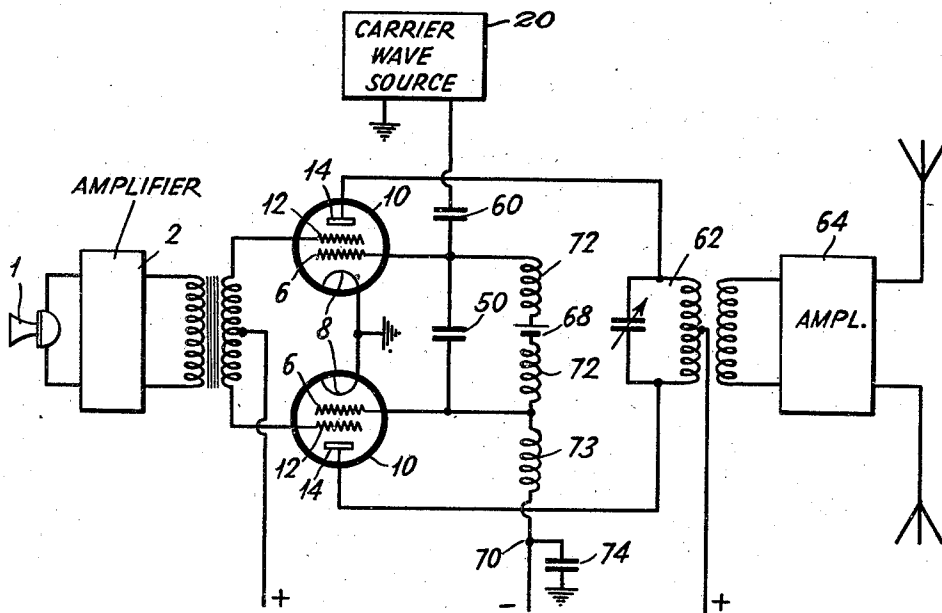
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MODULATOR

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MODULATOR

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Application January 29, 1936, Serial No. 61,259,
now Patent No. 2,134,065, dated October 25,
1938, which is a division of application Serial
No. 524,247, March 21, 1931, now Patent No.
2,074,440, dated March 23, 1937. Divided and
this application March 10, 1938, Serial No.
195,011

4 Claims. (Cl. 179—171.5)

This invention relates to modulators and especially to sideband modulators of the electron discharge device type. This application is a division of my United States application #61,259 filed January 29, 1936, now Patent #2,134,065, dated October 25, 1938, the said application being in turn a division of my United States application #524,247 filed March 21, 1931, now Patent #2,074,440 dated March 23, 1937.

In order to produce sideband energy from carrier energy and energy of a frequency other than the carrier energy while at the same time suppressing the carrier energy, it has been proposed to apply carrier energy to the grids of a pair of triodes cophasally and the other energy, usually modulating energy, to the same grids in phase opposition. By virtue of the fact that the two sources of energy were coupled to the same electrodes, undesired interaction between them frequently took place.

It is an object of this invention to provide a carrier suppression modulator wherein such interaction is effectively prevented. Briefly, to do so, according to my present invention, I use four element or screen grid tubes, or in other words, tubes having more than three electrodes for electron discharge devices, to like pairs of grids of which I apply either the modulating or carrier energy in phase opposition and to the other grids I apply the carrier or modulating energy cophasally. In this manner the energy sources are kept separate and prevented from interacting upon one another.

Sometimes it is desirable that a small amount of carrier energy be transmitted in addition to the sideband energy. Accordingly, a further object of the present invention is to provide an arrangement of electron discharge devices wherein carrier energy is only partially suppressed. More specifically, and one way of doing so, according to the present invention, the grids of screen grid tubes are polarized differently and carrier alternating energy supplied thereto. Other grids of the system are supplied with modulating energy. As a consequence, in the output circuit of the tube arrangement, sideband energy and a certain amount of carrier energy will appear.

Other general objects of my present invention are to provide transmitting and receiving systems utilizing my improved sideband or carrier suppression modulator.

While I have sought to define my invention in its broadest aspects in the appended claims, it may best be understood, however, both as to its structural organization and mode of operation

by referring to the accompanying drawing, wherein the single figure illustrates a carrier suppression system, according to the present invention, wherein the carrier is not totally but only partially suppressed.

Referring to the accompanying drawing, relatively low frequency modulating energy, which may be considered energy of one order of magnitude in frequency, from a suitable amplifier 2 connected with source 1 is applied in phase opposition through the medium of transformer 4 to the screen grids 12 adjacent the anodes 14 of electron discharge devices 10, of the screen grid type. To the control grids 6 or the grids adjacent to the cathodes 8 of tubes 10, there is applied cophasally through condensers 50, 50 from a suitable source 20, carrier potentials or energy which may be considered energy of a different order of magnitude in frequency relative to energy from source 2.

By virtue of the application to the grids of electron discharge devices 10 of energy of different frequencies, there will appear in the output circuit 62 coupled to the devices, energy of frequencies equal to the sum and difference of the frequencies from sources 2 and 20.

The signal modulating energy is applied to the grids 12, as shown, which are those adjacent the anodes of devices 10. The grids 6 of tubes 10 are paralleled for high frequency currents by condenser 50 and are biased or polarized different amounts by source 38 and reactances 72 connected as shown between the grids and by a further reactance 73 to the negative terminal of a source of potential. To prevent the flow of high frequency currents from source 20 in direct current source 38, chokes 72 are inserted in series with the biasing connections. As indicated above, the values of 50 and 50 are such that the high frequency energy from 20 is applied substantially in phase to the grids 6. As an additional safeguard, lead 70 may be grounded for radio frequency currents by condenser 74.

Consequently, carrier energy from source 20 will be fed cophasally to the grids 6 by condenser 50, but, as the grids 6 or grids adjacent the cathodes of tubes 10 are polarized differently, a certain amount of carrier energy will always appear in the output circuit 62 of screen grids 10. The carrier energy and the sideband energy may then be amplified by suitable amplifier 64 and radiated by means of a suitable antenna 66.

Of course, by including in amplifier 64, suitable filters, the carrier energy and one or the other sidebands may be transmitted as desired rather

than transmitting both sidebands and the carrier.

It is obvious that various minor changes will readily suggest themselves to those skilled in the art. Consequently, my invention is not to be
 5 limited to the modifications described, but solely by the scope of the claims which I have appended hereto.

I claim:

1. In a carrier suppression modulator a pair of
 10 electron discharge devices each having a cathode, an anode, a grid adjacent the cathode and a grid adjacent the anode, means for applying cophasally to the grids adjacent the cathodes relatively high frequency energy, a source of modulating potentials, a balanced push-pull circuit
 15 for applying modulating potentials from said source in phase opposition to the grids adjacent the anodes of said tubes, and means connected with the grids adjacent the cathodes and said
 20 cathodes for biasing said grids to different direct current potentials relative to said cathodes.

2. In a system for transferring intelligence from one geographically situated point to another by propagated electro-magnetic wave energy derived
 25 from the flow of high frequency undulatory electrical currents operated upon in accordance with the intelligence to be transmitted, the combination of a pair of electron discharge devices each having a cathode, an anode, a grid adjacent the
 30 cathode and a grid adjacent the anode, means for subjecting the grids adjacent the cathodes of said devices to uni-directional potentials of different values, means for subjecting the same grids to undulatory carrier potentials substantially cophasally, and balanced circuit means for subjecting the grids of said devices adjacent said
 35 anodes to potentials of another order of frequency and in phase opposition.

3. In a balanced modulator for modulating the
 40 electrical waves derived from a source of undulatory energy by means of signalling waves of

another frequency and for preventing reaction between said waves other than said modulating reaction and for controlling the amount of energy of a frequency equal to the frequency of the waves to be modulated in the energy resulting from the modulation, a pair of electron discharge devices,
 5 each having a cathode, a control electrode, an anode, and an auxiliary electrode, a circuit for applying positive potentials to said auxiliary electrodes, means for applying signalling current potentials in phase opposition to said auxiliary
 10 electrodes in said devices, a circuit for applying different values of direct current potential to the control electrodes of said devices to control the balance of said devices and circuits, a circuit for applying the waves to be modulated substantially in phase to the said control electrodes of
 15 said devices, and an output circuit connecting the anodes of said devices in push-pull relation.

4. A signalling system comprising a pair of
 20 electron discharge devices, each having an anode, a cathode, and a plurality of grid-like electrodes, direct current circuits for applying direct current potentials of different values to the electrodes of one pair of like grid-like electrodes in said
 25 devices relative to the cathodes of said devices, a source of carrier wave oscillations, circuits connecting said source of carrier wave oscillations to said same pair of like grid-like electrodes to apply thereto carrier waves in phase, means reactive at the frequency of said oscillations in
 30 said direct current circuits, a second source of oscillations of different frequency, and a balanced push-pull circuit coupled on the one hand to said second source of oscillations and on the other hand to another pair of like grid-like electrodes in said devices to apply thereto oscillations of said different frequency in phase opposition.

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