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MODULATION SYSTEM

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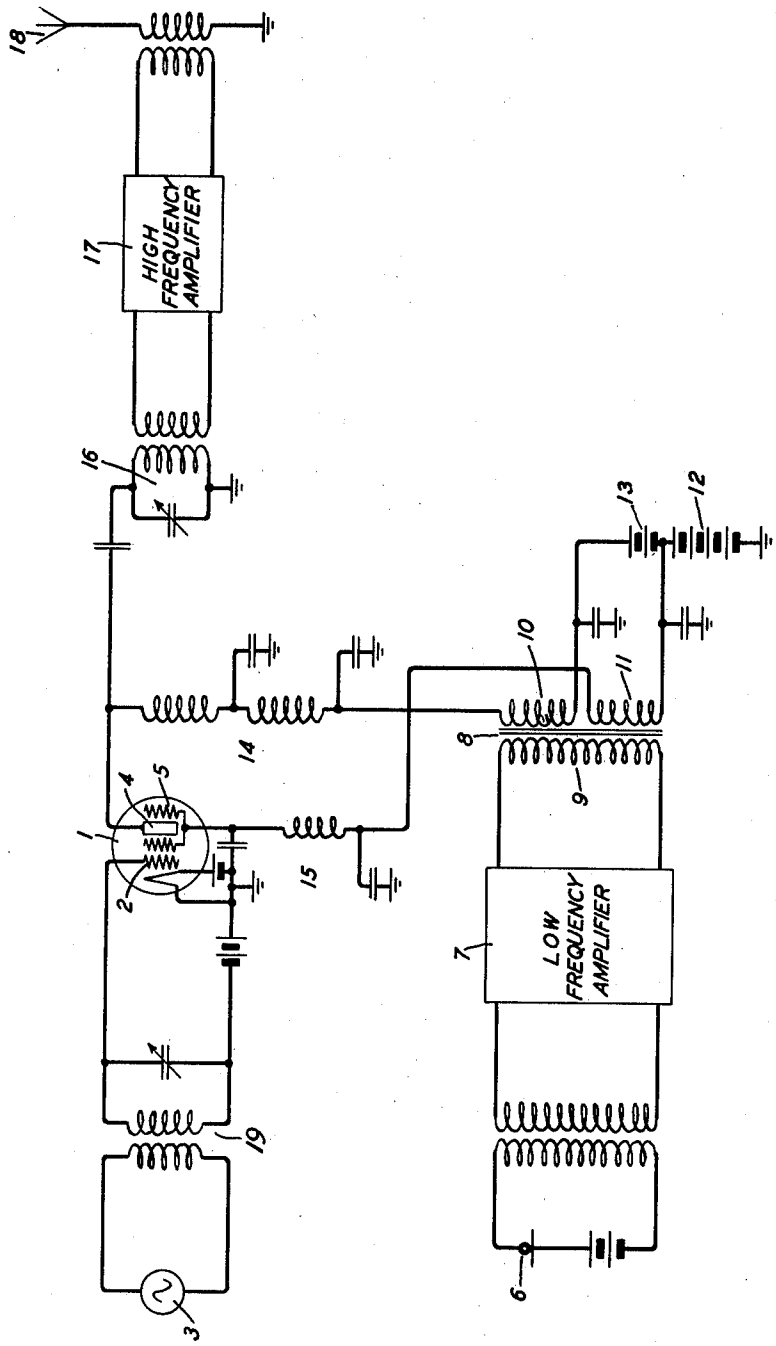

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MODULATION SYSTEM

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4 Claims. (Cl. 179—171)

This invention relates to modulating systems and more particularly to systems using as a modulating device four-element space discharge tubes of the screen-grid type.

An object of the invention is to increase the modulated output obtainable from screen-grid type modulators.

Another object is to prevent interaction between the carrier input circuit of a modulator and the output circuit for the modulated wave.

In accordance with the invention an unmodulated carrier wave is impressed upon the control grid of a screen-grid tube and the modulating wave is impressed simultaneously and in like phase upon both the screen electrode and the anode, the values of the screen and anode impressed voltages being maintained in a definite relationship.

By this arrangement, since the screen voltage varies simultaneously with the anode voltage, the screen is prevented from blocking the space current to the anode even when the anode voltage is very low and, in consequence, it is possible to apply large voltage variations to the anode with a corresponding increase in the modulation output. At the same time the electrostatic shielding effect of the screen eliminates capacity coupling between the carrier input circuit and the high frequency output circuit, thereby preventing the generation of local oscillations in the modulator circuit.

The arrangement of the invention is particularly advantageous for the modulation of very high frequency waves. In such cases the carrier input circuit and the high frequency output circuit will be tuned to substantially the same frequency and, in the absence of electrostatic screening in the tube, singing will occur very readily. By the present invention such singing is prevented while at the same time a large degree of modulation is made possible.

The invention will be described in detail hereinafter with reference to the accompanying drawing, the single figure of which represents a radio transmitting system embodying the invention.

Reference character 1 indicates a vacuum tube of the screen-grid type arranged to be operated as a modulator in accordance with the invention. The tube has a control grid 2 which is supplied with unmodulated high frequency oscillations by a suitable oscillator 3 through a tuned transformer 19. The plate 4 and screen-grid 5 are supplied with modulating currents produced by a microphone 6 and amplified by a low frequency amplifier 7. A transformer 8 having a primary winding 9 and two secondary windings 10 and 11 serves to impress the modulating current from the amplifier 7 in like phase upon the electrodes 4 and 5. The windings 10 and 11 are connected in parallel across a battery 12 and are so poled that the currents induced in the windings 10 and 11 by a current in the primary windings 9 causes the potentials of the respective electrodes 4 and 5 to increase or decrease together. The normal biasing potential of the plate 4 is made somewhat higher than the potential of the screen-grid 5 by an additional battery 13. A low-pass filter 14 in the plate battery supply circuit and a similar filter 15 in the screen-grid circuit are employed to prevent interaction of high frequency currents in the respective battery supply circuits. The plate circuit has a branch including a resonant network 16 which is tuned for the carrier frequency and designed to pass the modulated high frequency currents. These currents are amplified in a high frequency amplifier 17 and impressed upon an antenna 18.

In the operation of the system illustrated the instantaneous potential of the plate varies in accordance with the fluctuations of the modulating current. Simultaneously the potential of the screen-grid 5 varies in a like manner. Without the simultaneous screen fluctuations, the plate current would not be materially altered or controlled by the fluctuations in the plate potential, due to the fixed shielding effect of the screen-grid. When, however, this latter effect is made to vary in phase with the plate potential the result is obtained that the plate current varies widely in accordance with the fluctuations of the low frequency current, and the high frequency oscillations from the source 3 are correspondingly modulated to a large degree. From a slightly different point of view the plate and screen-grid with their potentials varying in phase with each other may be regarded as constituting an electrode system equivalent to the single plate or anode in a three-element tube. The current passing through this equivalent anode system is modulated in much the same manner as obtains in well known plate current modulation systems disclosed in U. S. Patent 1,442,147, issued to R. A. Heising. The high modulating efficiency of the three-electrode tube is, therefore, obtainable and at the same time the screen grid retains its function of shielding the plate 4 from the control grid 2, thus preventing singing in the modulator circuits and rendering the output and the input circuits independent of each other whereby

they may be tuned or otherwise adjusted without mutual interference.

What is claimed is:

1. A modulating system comprising an electric discharge tube having a cathode, an anode, a control grid, and a screen-grid, a source of carrier waves, a source of modulating current, means connecting said source of carrier waves to said control grid, means connecting said source of modulating current to said anode to produce variations in the voltage between said anode and said cathode, and means connecting said source of modulating current to said screen-grid to produce variations in the voltage between said screen-grid and said cathode, said last mentioned voltage variations being controlled to be substantially in phase with said first mentioned voltage variations and said screen grid constituting an electrostatic screen between said anode and said control grid to substantially prevent regenerative action in said tube.

2. A modulating system comprising an electric discharge tube having a cathode, an anode, a control grid, and a screen-grid, a source of carrier waves, a source of modulating current, means connecting said source of carrier waves to said control grid, means connecting said source of modulating current to said anode and screen-grid in in-phase relation to modulate the carrier waves induced in the anode circuit by said control grid, and an output circuit connected to said anode for transmitting modulated carrier waves, said screen grid being adapted to virtually shield the control grid from regenerative action of said output circuit.

3. A modulating system comprising an electric discharge tube having a cathode, an anode, and a screen-grid, means for effecting high frequency variations in the potential between said anode and cathode, a source of modulating current, a transformer having a primary winding connected to said source of modulating current and a pair of secondary windings connected respectively to the anode and the screen-grid and arranged to impress modulating currents in substantially like phase upon said anode and screen-grid.

4. A modulating system comprising an electric discharge tube having input and output terminals electrostatically screened from each other to substantially prevent regenerative action in said tube, means for effecting high frequency variations in the potential of said output terminal, a source of modulating current, means for causing modulating currents from said source to vary the potential of said output terminal, and means for varying the degree of screening in synchronism with said output potential variations to effect modulation of said high frequency variations under the control of said modulating current.

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