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SIGNALING

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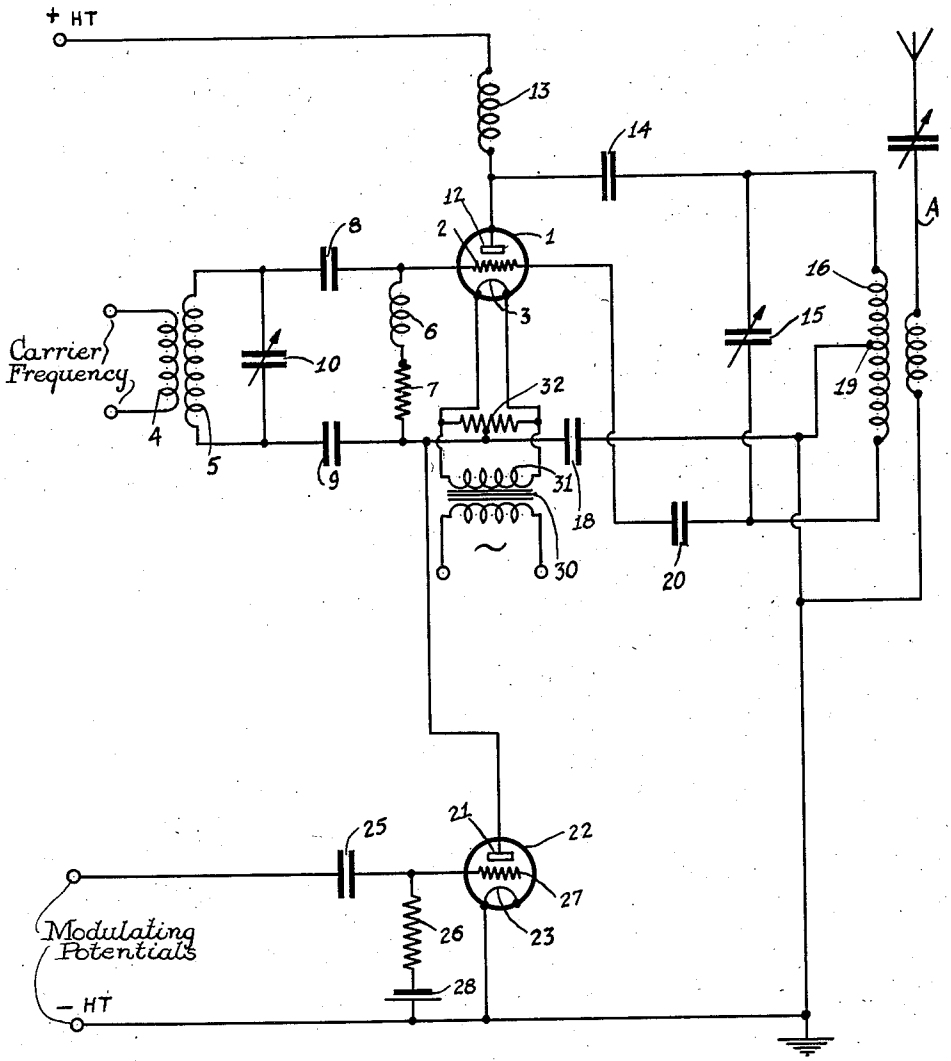

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SIGNALING

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This invention relates to electrical modulation arrangements and more particularly to means for modulating a thermionic valve continuous wave transmitter suitable for use in radio transmission by speech, tones or the like.

There are many known forms of modulation systems each presenting its own particular advantages and disadvantages. For example in one well known system a valve generator or amplifier of high frequency currents is subjected to modulation by varying the voltage applied to the anode, the said anode voltage variation being commonly accomplished by means of a modulating valve connected in parallel with the generating or amplifying valve in conjunction with an iron-cored auto-transformer or choke coil which is common to the anode supply circuit for the two valves. Alternatively the modulating valve may be connected to one winding of an iron cored double winding transformer and the generating valve (or amplifying valve as the case may be) to the other winding of the transformer there being employed either two sources of anode voltage or a common source.

Modulation systems of this kind involve a certain amount of complication and loss of efficiency if a high percentage of modulation is required, more particularly if large powers have to be dealt with. Moreover the employment of iron cores in the transformers or chokes tends to produce distortion.

These disadvantages may be avoided by arranging the modulating valve in series with the generating or amplifying valve and varying the resistance constituted by the modulating valve by applying the modulating voltages to the grid of the modulating valve. In such arrangements, which may be termed series valve modulating arrangements, variation of the internal resistance of the modulating valve will give rise to a corresponding variation in the actual anode voltage applied to the generating or amplifying valve. Such series valve modulating arrangements although known and although offering theoretical advantages as compared to the other systems of modulation arrangements hereinbefore described, have not been widely utilized owing to certain technical difficulties which occur. Obviously the modulating valve may be connected either on the high tension side or on the earthed side of the generating or amplifying valve. In the former case the cathode of said generating or amplifying valve and the oscillatory circuit associated therewith can be earthed but the cathode of the modulating valve, the source of negative grid bias voltage, and the source of audio frequency modulating voltages must be insulated for substantially the full potential of the anode supply voltage, owing to the fact that the modulating valve is on the high tension side of the generating or amplifying valve. In the latter case, i. e. when the modulating valve is connected on the earthed side of the generating or amplifying valve the cathode of the said modulating valve can be earthed and the various input circuits therefor disposed in a convenient manner but the oscillatory circuit of the generating or amplifying valve will now be at high potential and this leads to difficulties due to stray capacity effects.

The principal object of the present invention is to provide an improved series valve modulating arrangement wherein these difficulties are obviated.

According to this invention in a series valve modulating system in which the modulating valve is connected in series on the low tension side of a high frequency generating or amplifying valve, the output oscillatory circuit associated with the said generating or amplifying valve is associated therewith through condensers of such value that the said oscillatory circuit may be connected to earth substantially without affecting the operating of the transmitter as a whole. The coupling condensers should be of a high reactance to modulating frequencies, and of low reactance to the high frequencies and the oscillatory circuit may then be conductively connected to earth.

The invention is illustrated in the accompanying drawing which shows diagrammatically one way of carrying out the invention.

Referring to the drawing the radio transmitter therein represented comprises an amplifying valve 1 which receives high frequency oscillations from a generator or other suitable source (not shown) said oscillations being applied between grid 2 and cathode 3 of the said amplifying valve through a coil 4 coupled to a coil 5 in the grid circuit of 1. The grid circuit of the amplifying valve includes the usual grid stopping choke 6 and grid leak resistance 7 which are connected in series with one another between grid 2 and cathode 3, the choke being adjacent the grid. The grid and cathode are coupled through a pair of coupling condensers 8, 9, one 8, in the grid lead and the other 9 in the cathode lead, to the ends of a tuned input circuit 5, 10 whose inductance 5 is constituted by the secondary of a transformer whose primary is the coil 4. The anode 12 of the amplifying valve 1 is connected

through a choke 13 to the source of anode potential (not shown) and is also coupled through a coupling condenser 14 to one end of a tuned output circuit 15, 16 the cathode of the amplifying valve being coupled through a similar coupling condenser 18 to a tapping point 19 on the inductance 16. The end of oscillatory circuit 15, 16 remote from the condenser 14 is coupled to the grid of the amplifying valve through a neutralizing condenser 20. The neutralizing condenser 20 and the tapping point 19 are so chosen that the effect of the internal capacity of the amplifying valve is substantially neutralized. Of course, any other known method of neutralizing from the anode circuit to the grid or from the grid circuit to the anode may be adapted if desired.

The output circuit is coupled to a suitable utilization circuit e. g. a valve or valves of higher power than the valve 1 or as shown to an aerial A which is earthed at G as also is the tapping point 19. The junction point of the grid stopping choke 6 and the grid leak 7 may, if desired, be connected through the usual by-pass condenser (not shown) to the cathode end of the grid leak which latter point is connected also to the anode 21 of a modulating triode 22 whose cathode 23 is connected to earth and to negative terminal of the source of anode potential and across whose grid circuit are applied telephonic or other modulating potentials. Such modulating potentials are applied to the grid 27 through a suitable coupling condenser 25 the grid side of which is also connected to the cathode of the said modulating valve through a suitable resistance 26 and bias battery 28 in series. The cathode of the amplifying valve 1 is heated by electrical energy supplied through an iron cored transformer 30 fed from an ordinary low frequency alternating current supply. The ends of the secondary 31 of the transformer are connected to the ends of the cathode 3, which is bridged by a suitable resistance 32 whose center point is connected to one side of the condenser 18 as shown so as to reduce any tone modulation due to the use of alternating current heating. Obviously an insulated battery or dynamo may be employed for heating if desired, and obviously also the cathode of the amplifying valve may be of the indirectly heated type.

Where however the cathode is heated through a transformer as illustrated, this transformer should be constructed to possess as low a capacity between primary and secondary windings and between the secondary winding and the core as possible in order that high modulating frequencies shall not be by-passed to earth.

With this arrangement best results as regards depth of permissible modulation will be obtained if the grid bias applied to the modulating valve be such that in the static or unmodulated condition the potential drop across the modulating valve is somewhat greater than that across the amplifying valve. The condensers coupling the anode and cathode of the amplifying valve to the tuned oscillatory output circuit should be of such value that their reactance at the high frequencies is comparatively small, while their reactance at the highest modulating frequencies employed is great. If this condition be satisfied the output oscillatory circuit may be earthed as described substantially without affecting the operation of the transmitter and substantially without any appreciable distortion over the frequency spectrum normally required for high quality speech and music.

If the cathode of the amplifying valve be heated through a transformer as described and if the said transformer be of sufficient high inter-winding capacity, this said capacity may constitute the coupling condenser between the cathode and the tuned output oscillatory circuit, thus enabling a separate coupling condenser to be dispensed with. It is preferable however to employ the arrangement hereinbefore described and to make the interwinding transformer capacity as small as possible. Alternatively, of course, instead of coupling the cathode of the amplifying valve to the tuned circuit by means of a condenser 18 as illustrated, the cathode may be directly connected to the tuned circuit and a condenser inserted in the lead between the said tuned circuit and earth.

In some cases the coupling condensers 8 and 9 shown in the drawing as coupling the tuned input circuit 5 and 10 to the grid and cathode of the valve 1 may be dispensed with and the said tuned grid circuit directly connected to the grid and the cathode points.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed I declare that what I claim is:—

1. Signaling means comprising a thermionic triode having an input circuit connected between the control electrode and cathode thereof, an output circuit including an inductance having one terminal connected to the anode of said triode the other terminal connected by way of a neutralizing capacity to the control electrode, a point on said inductance being connected by way of an audible frequency blocking capacity to the cathode of said triode and means for modulating the signals in said triode including a second triode having its anode electrode connected to the cathode of said first named tube and its cathode connected to said point on said inductance, whereby the impedance of said last named condenser is in parallel with the anode to cathode impedance of said second named triode, and a source of modulating signals connected with the input electrodes of said second named triode.

2. A radio or high frequency transmitter including, a high frequency oscillation relay valve having anode and cathode electrodes, and a control electrode energized by the oscillations to be relayed, means for modulating the oscillations relayed by said valve comprising, a modulating valve having anode and cathode electrodes, an alternating current output circuit tuned to the frequency of the oscillations to be relayed and connected to the anode and cathode electrodes of said relay valve through condensers, a direct current circuit connecting the anode to cathode impedances of said valves in series, and a circuit connecting the anode to cathode impedance of said modulating valve in parallel with one of said condensers, said one of said condensers being of high reactance to modulating frequencies and low reactance to high frequencies, whereby said output circuit may be conductively connected to earth without affecting the operation of the transmitter.

3. A transmitter as claimed in claim 2 in which the high frequency oscillation relay valve has its interelectrode capacity neutralized to prevent any undesired feedback.

4. A high frequency thermionic relay including, a thermionic valve having its control grid

and cathode electrodes energized at high frequency, an oscillation circuit comprising an inductance and a capacity in parallel, means for connecting one terminal of said oscillation circuit to the anode of said valve, a neutralizing capacity connecting the other terminal of said oscillation circuit to the input electrode of said valve, a capacity connecting a point on said inductance to the cathode of said valve, said capacity being of high impedance to oscillations of audible frequency, and means for modulating the oscillations relayed by said valve comprising, a thermionic modulator valve having its control grid and cathode connected to a source of modulating potentials and its anode to cathode impedance connected in parallel with said capacity, and a circuit connecting the cathode of said modulator valve to said point on said inductance and to ground.

5. A device as recited in claim 2 in which the direct current circuit connecting the anode to cathode impedances of said valves in series is adapted to be connected with a source of direct current potential, and in which said circuit is such that the potential drop across the impedance between the anode and cathode of said modulator valve is somewhat greater than the potential drop across the impedance between the anode and cathode of said relay valve.

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