

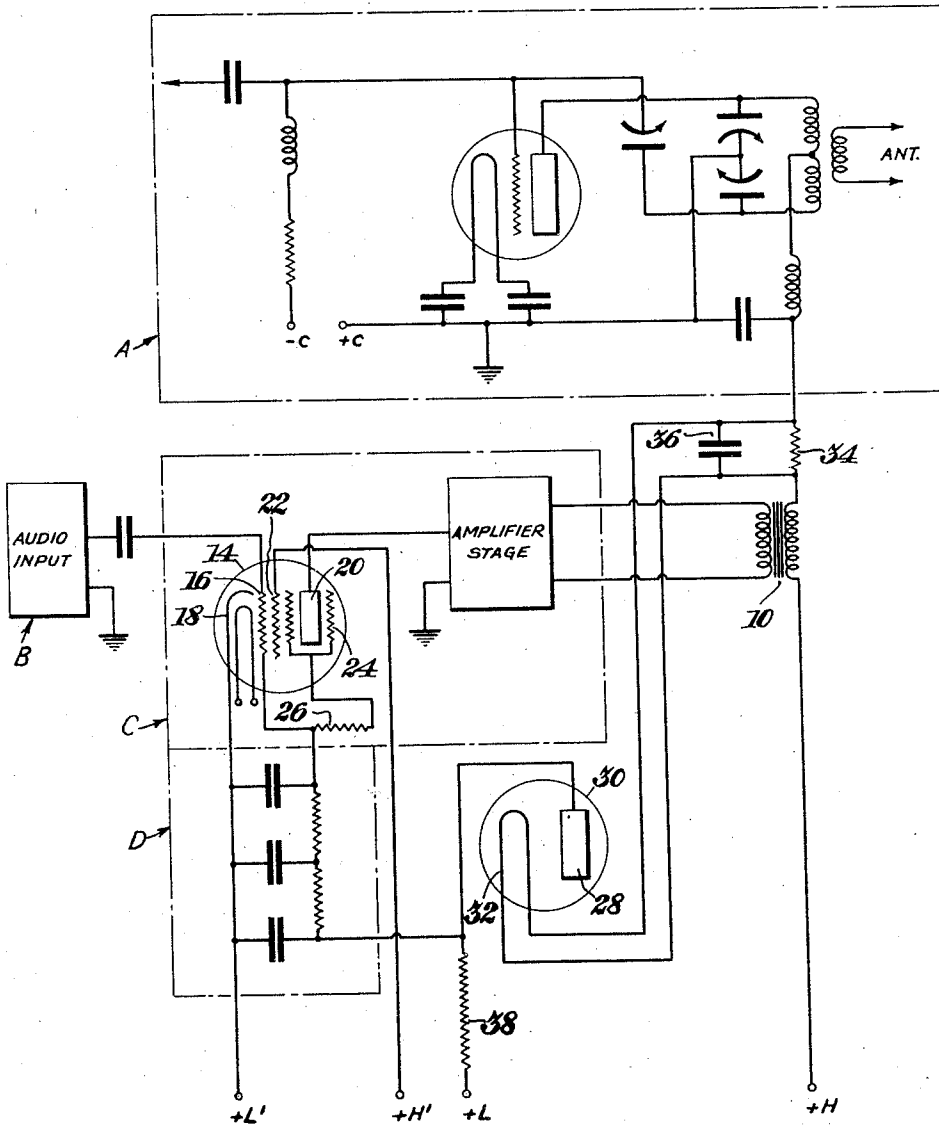
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MODULATION CONTROL

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MODULATION CONTROL

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This invention relates to a modulation control and more particularly to an arrangement for reducing the gain of an audio frequency amplifier supplying an amplitude modulating potential to a radio frequency carrier.

An object of this invention is to provide a novel arrangement for preventing over-modulation of a radio frequency carrier.

Another object of this invention is to reduce the gain of an audio frequency amplifier before over-modulation of a radio frequency carrier takes place.

A further object of this invention is to anticipate over-modulation of a radio frequency carrier by correcting the gain of an audio frequency amplifier before such over-modulation occurs.

A still further object of this invention is to prevent over-modulation of a radio frequency carrier by reducing the gain of an audio frequency modulating amplifier whenever the audio frequency voltage approaches the high potential applied to the plate of the modulated radio frequency amplifying stage.

Other objects and advantages of the present invention will be apparent from a study of the following description of a preferred embodiment thereof, illustrated in the accompanying drawing, in which the single figure illustrates a circuit diagram of a preferred form of gain reducer in accordance with the present invention.

As shown in the drawing the invention may be applied to a conventional radio frequency amplifying stage, generally indicated at A, to the plate circuit of which a suitable audio input B is connected through a conventional audio amplifier C and a transformer 10. The plate of the R.-F. amplifying stage A is supplied with a suitable high potential from source H.

In order to prevent over-modulation of the radio frequency carrier from audio input B and amplifier C, the arrangement in accordance with the present invention serves to reduce the gain of the amplifier C whenever the audio frequency modulating voltage approaches that of the high potential source H. Such gain reduction is preferably applied to an early stage of the audio frequency amplifier C and, in the form of the invention illustrated, the gain of the first audio frequency amplifier tube 14 is controlled. This tube 14 is preferably, although not necessarily, of the pentode type having a control grid 16, indirectly heated cathode 18, plate 20, screen grid 22, and suppressor grid 24.

The control grid 16 is connected to a suitable low potential source L while the cathode 18 is

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connected to a suitable low potential source L', the voltages of such sources being so chosen that under normal operating conditions the tube 14 will provide full gain in its amplifying stage. The screen grid 22 may be connected to a suitable high potential source H', while the suppressor grid 24 is connected to the control grid 16 through a suitable resistor 26.

The plate 28 of a diode 30 is likewise connected to the control grid potential source L, whereas the cathode 32 of this tube receives its power from a suitable resistor 34 serially connected between the modulating transformer 10 and the radio frequency amplifier A. The resistor 34 may be shunted by a suitable capacitor 36 to permit a by-passing of the alternating currents. For purposes to be explained hereinafter, the grid 16 of the audio frequency tube 14 is preferably connected to the plate 28 of the diode 30 through a suitable smoothing network generally indicated at D, while a suitable high resistor 38 is interposed between the potential source L on the one hand, and the plate 28 and grid 16 on the other hand.

The system in accordance with the present invention will operate to reduce the gain in the audio frequency amplifier C to prevent over-modulation of the radio frequency carrier in the following manner: Under normal operating conditions when the audio frequency output is such that there is no danger of over-modulation, the relative potentials L' and L on the cathode 18 and grid 16, respectively, of the amplifier tube 14 will be so chosen that the tube 14 will operate with full gain. As a practical example of the invention, the potential L' may be 53 volts and that of L may be 50 volts. If the potential source H is at a suitable high potential for operating the radio frequency amplifier A, say at 500 volts, the diode 30 whose cathode 32 is connected to this high potential source will not operate, since the potential of its plate 28 will only be 50 volts. However, whenever the negative peak of the modulating voltage from the amplifier C approaches the voltage of the high potential source H to such a degree that the mean effective potential of the cathode 32 drops below the potential of the plate 28, or, in the example given, below 50 volts, the diode 30 becomes conductive. This, in turn, will reduce the potential on the grid 16 to such an extent that the gain of the audio frequency tube 14 will be reduced. Accordingly, the danger of over-modulation of the radio frequency carrier is anticipated and avoided. The smoothing filter network D between the

diode 30 and the grid 16 renders the action sufficiently gradual, and if the resistor 38 is sufficiently high in comparison with the internal impedance of the diode 30 whenever the latter becomes conducting, the circuit will have an asymmetric time constant, being quick to reduce gain and slow to restore the gain to normal.

It will be noted that the cathode of the diode 30 is heated by a portion of the plate current supplied to the radio frequency amplifier A. This is necessary since the diode is operated with its cathode at a high voltage with respect to ground and avoids the use of a filament transformer which would introduce an undesirable large capacity to ground, shunting the secondary of the audio modulating transformer 10.

It will be obvious to those skilled in this art that there are modifications of the preferred embodiment of this invention as described above, which may be made while still embodying the broad novel features of the same. For example, it is to be clearly understood that the voltages mentioned in describing the operation of the invention were given merely by way of example, and that these will vary in accordance with the constants of the circuit and the types of tubes used. While the audio frequency amplifier has been illustrated as comprising a plurality of stages, the invention will operate with a suitable amplifier having one controlled stage. Furthermore, while the audio frequency amplifier tube to be controlled has been illustrated as a pentode, the invention will operate properly with any suitable triode or tetrode. The rectifier illustrated as a diode 30 can be replaced by any suitable rectifying means which is capable of use with the potentials to be used.

Accordingly, while for the purposes of illustration I have described one embodiment of my invention, it is to be understood that I do not intend such invention to be limited thereto.

What I claim is:

1. In combination, a high frequency amplifier, a source of audio frequency, an audio frequency amplifier connected thereto, means for coupling said audio frequency amplifier to the plate circuit of said high frequency amplifier to modulate the output thereof, said audio frequency amplifier including at least one stage having an electron discharge device, a source of one predetermined potential connected to a grid of said electron discharge device, a second source of another predetermined potential connected to the cathode of said electron discharge device, said potentials being so related that full gain through said electron discharge device is normally produced, a source of high potential connected to the plate circuit of said high frequency amplifier, a resistor in the plate circuit of said high frequency amplifier, a diode having its plate connected to the grid of said electron discharge device, and means for connecting the cathode of said diode across said resistor, whereby whenever the mean of said audio frequency modulating voltage and said high potential source falls below the potential on the plate of said diode, the latter becomes conductive and reduces the potential on the grid of said electron discharge device to reduce the audio frequency amplifier gain.

2. In combination, a high frequency amplifier, a source of audio frequency, an audio frequency amplifier connected thereto, means for coupling said audio frequency amplifier to the plate circuit of said high frequency amplifier to modulate the output thereof, said audio frequency amplifier in-

cluding at least one stage having an electron discharge device, a source of one predetermined potential connected to the grid of said electron discharge device, a second source of another predetermined potential connected to the cathode of said electron discharge device, said potentials being so related that full gain through said electron discharge device is normally produced, a source of high potential connected to the plate circuit of said high frequency amplifier, a diode having a plate and a cathode, a resistor having a high value relatively to the impedance of the diode connected intermediate said source of grid potential and the plate of said diode, means connecting said plate to the grid of said electron discharge device, and means connecting the cathode of said diode to the plate circuit of said high frequency amplifier so as to be responsive to the combined impressed audio frequency modulating voltage and said high potential source, whereby, whenever the mean of said audio frequency modulating voltage and said high potential source falls below the potential on the plate of said diode the latter becomes conductive and reduces the potential on the grid of said electron discharge device to reduce the audio frequency amplifier gain.

3. In combination, a high frequency amplifier, a source of audio frequency, an audio frequency amplifier connected thereto, means for coupling said audio frequency amplifier to the plate circuit of said high frequency amplifier to modulate the output thereof, said audio frequency amplifier including at least one stage having an electron discharge device, a source of one predetermined potential connected to the grid of said electron discharge device, a second source of another predetermined potential connected to the cathode of said electron discharge device, said potentials being so related that full gain through said electron discharge device is normally produced, a source of high potential connected to the plate circuit of said high frequency amplifier, a diode having a plate and a cathode, a smoothing filter network intermediate the plate of said diode and the grid of said electron discharge device, means connecting the cathode of said diode to the plate circuit of said high frequency amplifier so as to be responsive to the combined impressed audio frequency modulating voltage and said high potential source, and means for heating the cathode of said diode with a portion of the plate current of said high frequency amplifier, whereby, whenever, the mean of said audio frequency modulating voltage and said high potential source falls below the potential on the plate of said diode, the latter becomes conductive and reduces the potential on the grid of said electron discharge device to reduce the audio frequency amplifier gain.

4. The combination according to claim 1, in combination with a resistor having a high value relatively to the impedance of the diode, connected intermediate the source of grid potential and the plate of said diode.

5. In combination, a high frequency amplifier, a source of audio frequency, an audio frequency amplifier connected thereto, means for coupling said audio frequency amplifier to the plate circuit of said high frequency amplifier to modulate the output thereof, said audio frequency amplifier including at least one stage having an electron discharge device, a source of one predetermined potential connected to the grid of said electron discharge device, a second source of another predetermined potential connected to the cathode of said electron discharge device, said potentials

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being so related that full gain through said electron discharge device is normally produced, a source of high potential connected to the plate circuit of said high frequency amplifier, a diode having a plate and a cathode, a resistor having a high value relatively to the impedance of the diode connected intermediate said source of grid potential and the plate of said diode, a smoothing filter network intermediate the plate of said diode and the grid of said electron discharge device, a

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resistor in the plate circuit of said high frequency amplifier, and means for connecting the cathode of said diode across said resistor whereby, whenever the mean of said audio frequency modulating voltage and said high potential source falls below the potential on said diode the latter becomes conductive and reduces the potential on the grid of said electron discharge device to reduce the audio frequency amplifier gain.

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