

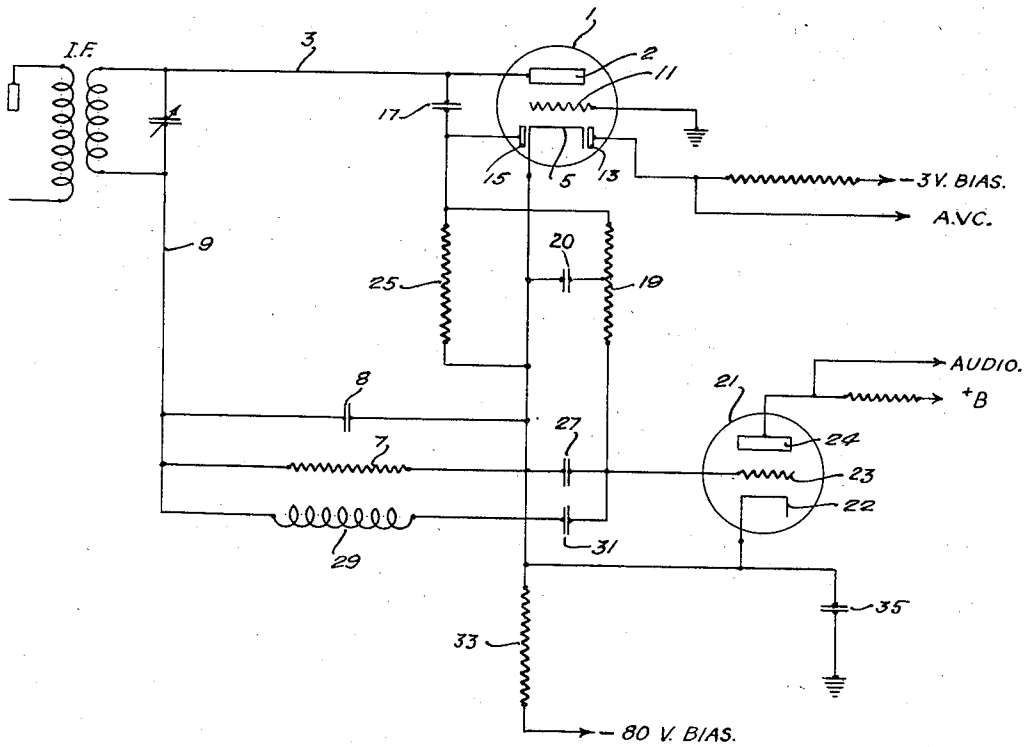
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NOISE SUPPRESSOR FOR RADIO

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NOISE SUPPRESSOR FOR RADIO

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13 Claims. (Cl. 250—20)

This invention relates to radio circuits, and more particularly to a detector circuit associated with an automatic volume control and an inter-station noise suppressor. Such a circuit is commonly called a quiet automatic volume control, or is abbreviated, Q. A. V. C.

The usual circuit of this type has an audio amplifier tube which is biased back to a definite threshold value. The incoming signal must be greater than this value in order to have the tube pass audio currents, and thus strays and atmospheric noise are prevented from passing through the audio amplifier. Thus until this time the custom has been to bias an audio amplifier element with a negative potential equal to the minimum clear signal voltage. The invention herein presented controls the action of the rectifier and allows no audio voltage to be developed until the signal is above a predetermined voltage, and by utilizing the amplification factor, or mu, of the tube the control potential may be the desired signal voltage divided by mu, instead of being an equal potential as formerly.

The primary object of this invention is to provide a quiet automatic volume control circuit which will be more efficient in action.

Another object is to provide a control system in which fewer circuits and elements are involved.

A further object is to provide a control system which will be more economical to manufacture and less difficult in maintenance.

Still a further object is to provide a system of control which results in less audio distortion.

Other objects and advantages will in part be obvious and in part be explained in detail when the specification is read in view of the accompanying diagram.

The drawing is a diagrammatic representation of a circuit embodying the invention and showing a detector tube and the associated first audio tube.

Referring more specifically to the drawing, the numeral 1 represents a detector tube which is now available commercially under the designation "type 55". The plate 2 is connected by lead 3 with the preceding amplifier stage, and the tube cathode 5 is connected through resistance 7 to the lead 9 which also is connected to the output of the preceding amplifier stage. A high frequency bypass condenser 8 is shunted across resistance 7. The signal is thus applied across the detector rectifier and the audio voltage is developed across the resistance 7. The term "detector rectifier" is used to differentiate between the rectifier which supplies audio frequency to the suc-

ceeding amplifier and the other diodes, which will be referred to as "control rectifiers". The incoming carrier wave is impressed across the plate 2 and cathode 5, and rectification occurs between these two elements in the same manner as the familiar diode rectification. The conductance of the space path between these elements, and consequently the rectifying action, is controlled as follows. Interposed between the tube elements 2 and 5 is a control grid 11, which is grounded. By varying the potential of the cathode 5 with respect to the control grid, the rectifying action of elements 2 and 5 can be controlled at will. The cathode 5 is also common to other diode plates 13 and 15. The diode plate 13 constitutes part of an automatic volume control of well known form and construction which need not be here explained. The diode plate 15 is connected to the preceding amplifier stage through a high frequency coupling condenser 17 and lead 20. This condenser 17 excludes audio frequencies and passes only signal frequencies.

A filter resistance 19 is connected between the diode plate 15 and the control grid 23 of a first audio tube 21, which also has a cathode 22 and a plate 24. An audio frequency bypass condenser 20 is connected between the cathode 5 of tube 1, and an intermediate tap on resistance 19. By this means the audio component of the diode control rectifier which includes the plate 15 is filtered from the output and only a direct current biasing voltage is impressed from this source upon the audio control grid 23. Between the diode plate 15 and the detector cathode 5 is a biasing resistance 25. The rectified voltage of the foregoing diode appears across resistance 25, and is led through resistance 19 to bias the control grid 23 of audio tube 21 as before stated. A high frequency bypass condenser 27 is connected between detector cathode 5 and the lead joining resistance 19 and audio grid 23. A high frequency filter net is thus created, including resistance 19, condenser 27 and condenser 8, and which removes all frequencies except audio from the input of the tube 21. A radio frequency choke 29 takes off the audio voltage across resistance 7, and blocks higher frequencies. The audio voltage is then led through audio coupling condenser 31 to the audio grid 23. A self bias resistor 33 is common to the cathode circuits of both the detector and audio tube. An audio frequency bypass condenser 35 is connected between the audio tube cathode 22 and ground.

The operation of the system is as follows. Under a no signal condition the biasing diode

15 rectifies no current, and the audio grid 23 is at zero potential. The audio tube 21 consequently draws a heavy plate current which must flow back through resistance 33 in its return to the audio cathode 22. The fixed negative bias of 80 volts which is placed on resistance 33 is more than cancelled out, and a small positive bias results from the flow of the plate current through the circuit. The cathode 5 of the detector tube 1 is connected to the positive end of resistance 33 and is maintained positive in the same degree. Under these conditions the grounded detector grid 11 is negative with respect to the cathode 5, and no rectification can occur between the cathode and plate 2.

When the signal occurs it is placed on the plates 2 and 15. Plate 15 is not blocked and so starts rectifying the signal. The voltage developed goes through resistance 19 and builds up a negative bias on the audio grid 23. This bias results in a lower plate current flowing through the plate-cathode circuit of audio tube 21 and the included resistance 33. As the plate current drops off, the fixed 80 volt bias is no longer cancelled out and the upper end of resistance 33 goes negative, carrying the detector cathode 5 with it. Since the cathode 5 is below ground potential, the grid 11 no longer blocks rectification between the cathode and detector plate 2. The audio voltage appearing across resistance 7 is taken off through the radio frequency choke 29 and coupling condenser 31 and is impressed on the audio tube grid 23 and through the amplifier. The grid controlling potentials may thus be so small as to be ineffective in the ordinary system, but in this present invention their effective value is calculated by multiplying the control potential by the amplification factor of the associated tube. This permits a far greater noise delay action with the voltage variations generally available in such circuits, and the additional step of blocking the first audio tube is not necessary. The application of either a positive or negative control voltage directly on a diode element requires the removal of said voltage to substantially zero in order to prevent distortion occurring in the rectifier. When rectification is controlled by a grid, the action is effective only when the grid is negative with respect to the cathode, and as long as the grid is either zero or positive, no distortion will be introduced into the output.

It will be apparent that many changes and modifications may be made without departing from the true spirit and scope of this invention as expressed in the specification and in the following claims.

Having described the invention, what is claimed is:

1. In a radio receiving apparatus, a detector having a plurality of elements, means for impressing a received signal across two elements of said detector, a control element interposed between said two elements, and rectifying means responsive to signal input for varying the potential relation between said control element and an element of said detector, whereby the current flow between said first named two elements may be regulated.

2. In a radio receiving apparatus, a detector having a plurality of elements, means for impressing a received signal across two elements of said detector, a control element interposed between said two elements, and rectifying means responsive to signal input for varying the poten-

tial of a detector element relative to said control element, whereby the current flow between said first named two elements may be regulated.

3. In a radio receiving apparatus, a detector having a plurality of elements, means for impressing a received signal across two elements of said detector, a control element interposed between said two elements, said control element having an unchanging potential with respect to ground, and rectifying means responsive to signal input for varying the potential of a detector element relative to said control element, whereby the current flow between said first named two elements may be regulated.

4. In a radio receiving apparatus, a detector having a plurality of elements, means for impressing a signal across a cathode and a cold element of said detector, a control element interposed between said cathode and cold element, and rectifying means responsive to signal input for varying the potential relation between said control element and said cathode, whereby current flow between said cathode and said cold element may be regulated.

5. In a radio receiving apparatus, a detector having a plurality of elements, means for impressing a signal across a cathode and a cold element of said detector, a control element interposed between said cathode and cold element, said control element having an unchanging potential with respect to ground, and rectifying means responsive to signal input for varying the potential of said cathode relative to said control element, whereby current flow between said cathode and said cold element may be regulated.

6. In a radio receiving apparatus, a detector having a plurality of elements, means for impressing a signal across a cathode and a cold element of said detector, a control element interposed between said cathode and cold element, said control element being maintained at ground potential, and rectifying means responsive to signal input for varying the potential of said cathode relative to said control element, whereby current flow between said cathode and said cold element may be regulated.

7. In a radio receiving apparatus, a detector having a plurality of elements, means for impressing a signal across two elements of said detector, a control element interposed between said two elements, a rectifier responsive to signal input, and means controlled by said rectifier for varying the potential relation between said control element and an element of said detector, whereby the output of said detector may be regulated.

8. In a radio receiving apparatus, a detector having a plurality of elements, means for impressing a signal across two elements of said detector, a control element interposed between said two elements, said control element having an unchanging potential with respect to the ground, a rectifier responsive to signal input, and means controlled by said rectifier for varying the potential relation between said control element and an element of said detector, whereby the output of said detector may be regulated.

9. In a radio receiving apparatus including an audio amplifier tube, a detector having a plurality of elements, means for impressing a signal across two elements of said detector, means interposed between said two detector elements for controlling current flow between said two elements, means for imposing a negative bias upon one of said two detector elements, and connecting

means associated with said audio amplifier tube for altering said bias in response to the flow of space discharge current in said tube.

5 10. In a radio receiving apparatus including an audio amplifier tube, a detector having a plurality of elements, means for impressing a signal across two elements of said detector, means interposed between said two detector elements for controlling current flow between said two elements, 10 means for imposing a negative bias upon one of said two detector elements, and connecting means associated with said audio amplifier tube for lessening said bias in response to the flow of space discharge current in said tube.

15 11. In a radio receiving apparatus, a system for suppressing interstation noise, which comprises a detector having a plurality of elements, circuit means for impressing a received carrier wave across two elements of said detector, a control element interposed between said two elements, an auxiliary tube, means for increasing the space discharge current of said tube in the absence of a received carrier wave, means responsive to said increased current for imposing 20 a blocking potential upon one of said elements, means for reducing said current upon the occurrence of a received carrier wave, and means responsive to said reduced current for removing said blocking potential.

30 12. In a radio receiving apparatus, a system for

suppressing inter-station noise, which comprises a detector having a plurality of elements, circuit means for impressing a received carrier wave across two elements of said detector, a control element interposed between said two elements, an audio amplifier tube, means for increasing the space discharge current of said tube in the absence of a received carrier wave, means responsive to said increased current for imposing a blocking potential upon one of said elements, 5 means for reducing said current upon the occurrence of a received carrier wave, means responsive to said reduced current for removing said blocking potential, and means for impressing the output of said detector upon a control grid of 15 said audio amplifier tube.

13. In a radio receiving apparatus, a system for suppressing inter-station noise, which comprises a detector having a plurality of elements, circuit means for impressing a received carrier wave 20 across two elements of said detector, a control element interposed between said two elements, an additional rectifier connected to said circuit means, an auxiliary tube, means for varying the plate current of said tube in response to the output of said additional rectifier, and means operating in response to said plate current for imposing and removing a blocking potential upon one of said elements. 25

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