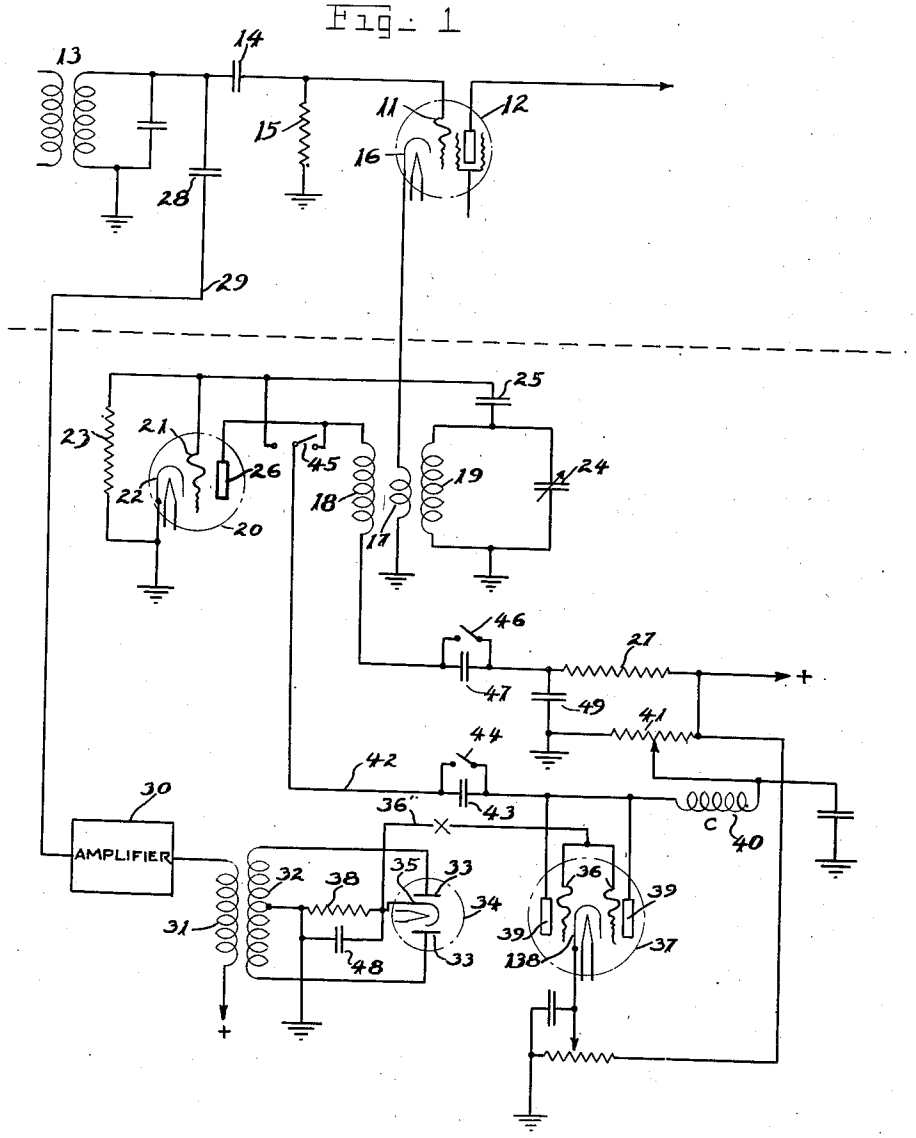
July 30, 1940. P. M. HAFFCKE 2,209,330

SIGNAL CONTROLLED VARIABLE IMPEDANCE FOR SUPPRESSING STATIC

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Fig. 1



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SIGNAL CONTROLLED VARIABLE IMPEDANCE FOR SUPPRESSING STATIC

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Fig. 2

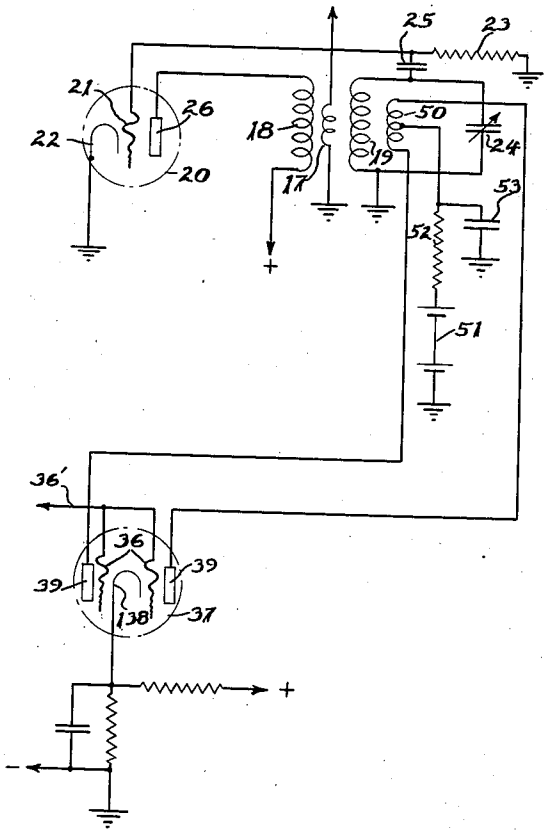
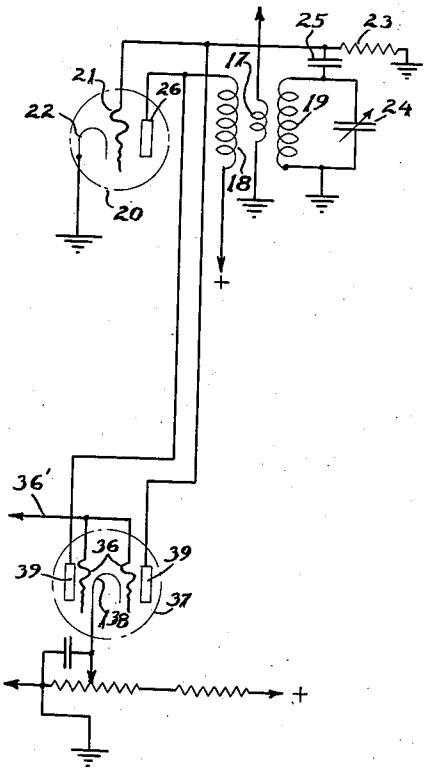


Fig. 3



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SIGNAL CONTROLLED VARIABLE IMPEDANCE FOR SUPPRESSING STATIC

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Fig. 4

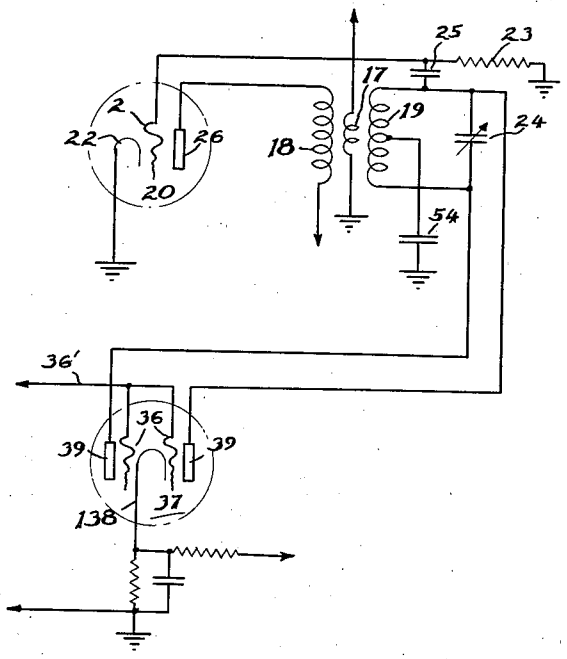
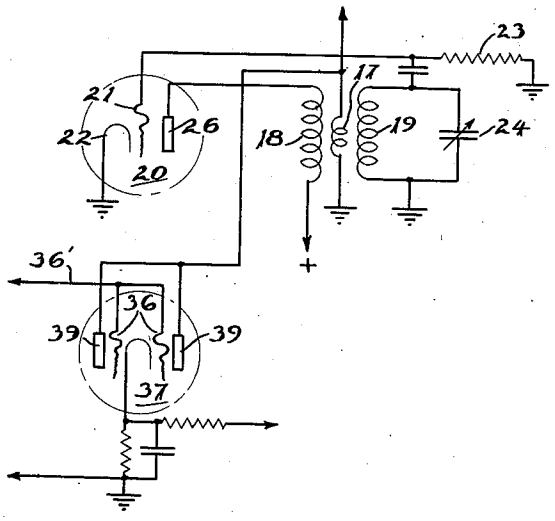


Fig. 5



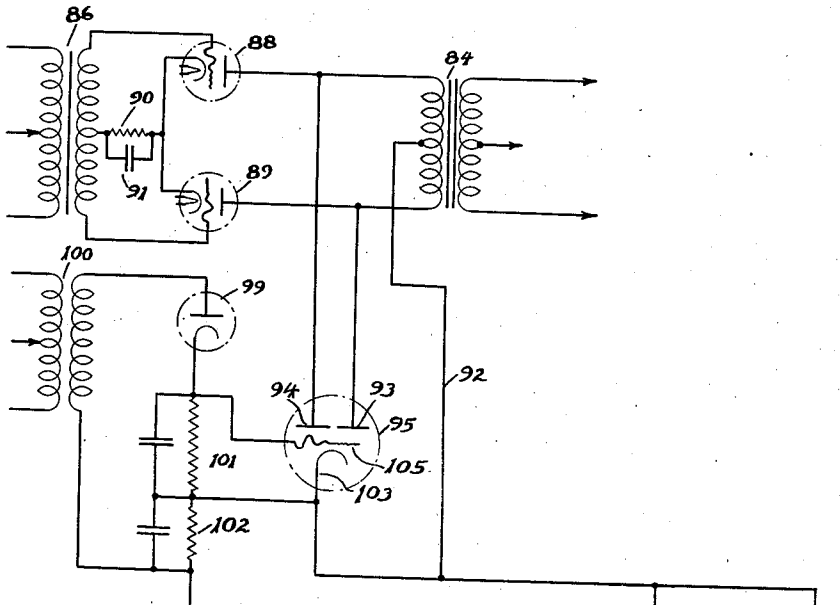
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SIGNAL CONTROLLED VARIABLE IMPEDANCE FOR SUPPRESSING STATIC

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Fig. 10



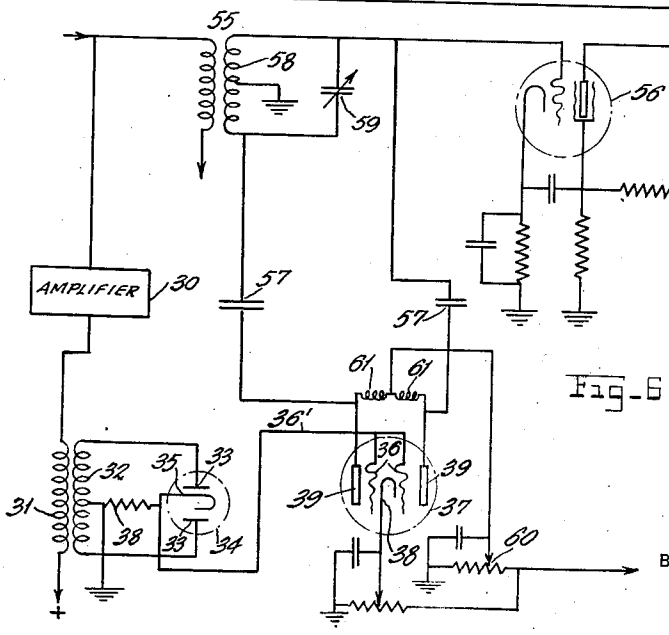


Fig. 6

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SIGNAL CONTROLLED VARIABLE IMPEDANCE FOR SUPPRESSING STATIC

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Fig. 7

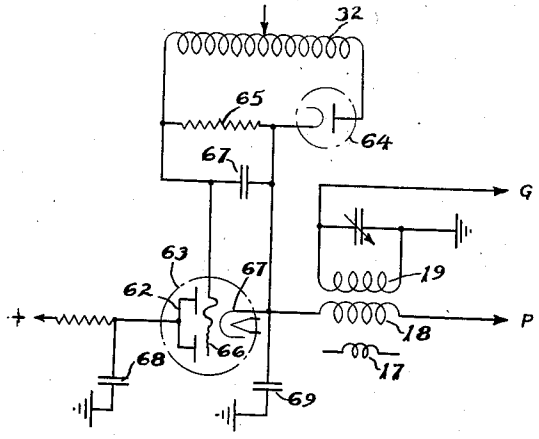


Fig. 8

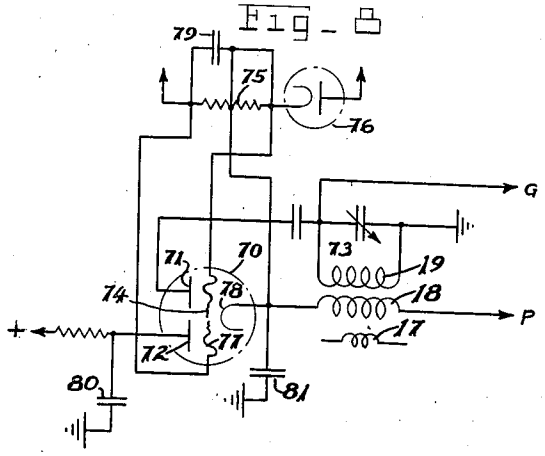
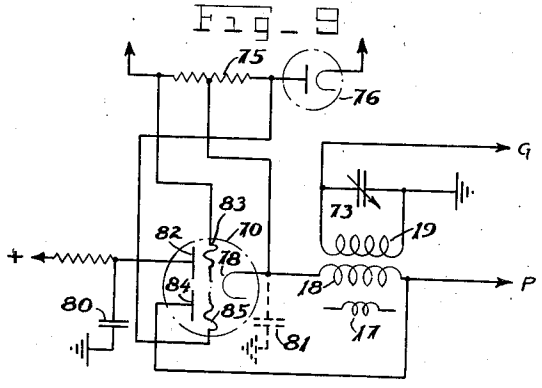


Fig. 9



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UNITED STATES PATENT OFFICE

2,209,330

SIGNAL CONTROLLED VARIABLE IMPEDANCE FOR SUPPRESSING STATIC

Philip M. Haffcke, Washington, D. C.

Application August 26, 1936, Serial No. 97,990

21 Claims. (Cl. 250—20)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

This invention relates to preventing the noise due to static from being transmitted through a heterodyne radio receiving system to the audio output, and more particularly to controlling, by the impulses of static, a variable impedance preferably associated with a local oscillator circuit, though it may be applied to other parts of the system, to prevent the production of sound due to the static impulses.

Among the numerous objects of this invention are:

To associate with one or more circuits of an oscillator a variable impedance responsive to static that will detune the oscillator and cause the oscillator to cease to beat against the incoming signal wave for the duration of the static impulse;

To change the frequency of the oscillator by means of a static-responsive variable impedance so that the beat frequency will not pass the following tuned stages or will be not of audible frequency;

To provide a variable impedance operatively related to an oscillator to permit received energy of normal working amplitude to pass without affecting the operation of the oscillator but which will, upon receiving energy of greater amplitude, be effective to damp out the oscillations of the oscillator;

To provide a method of operating a vacuum tube network wherein the excess amplitude of received energy due to static is applied to render the heterodyning ineffective and thereby silence the device for the duration of such excess amplitude.

To control, by the amplitude of received radio frequency energy, a variable impedance operatively associated with a portion of a radio receiver circuit whereby abnormal amplitudes will so change the value of said impedance for the duration of the excessive amplitudes that no audible effect of static surges appears.

In the drawings:

Fig. 1 is a circuit diagram showing a variable impedance in the form of a vacuum tube connected across the oscillator circuits to change the values of those circuits;

Fig. 2 illustrates the vacuum tube coupled to constitute an additional load on the oscillator circuit when the tube is operating;

In Fig. 3 the variable impedance tube is connected to both the grid and the plate circuit of the oscillator;

Fig. 4 illustrates the variable impedance connected as a full wave shunt across the grid coil of the oscillator;

Fig. 5 shows the variable impedance connected as a short circuit for the coil in series with the cathode of the detector tube associated with the oscillator;

Fig. 6 depicts the variable impedance connected across the input to an amplifier;

Fig. 7 shows the variable impedance in series in the plate supply to the oscillator;

In Fig. 8 the variable impedance both shunts the grid coil of the oscillator and works as a series variable resistance in the plate voltage supply to the oscillator;

In Fig. 9 the variable impedance acts both as a series variable resistance in the plate supply to the oscillator and as a variable impedance across the plate coil thereof;

Fig. 10 discloses a variable impedance in the form of a full wave rectifier acting across the output of two tubes in push-pull, together with another tube in the plate supply of the push-pull tubes.

The present method of preventing noises due to static disturbances from appearing in the audible output of a radio receiving set depends upon completely silencing the set for the duration of such disturbances, which are in general of such short duration that the brief intervals of silence will not be noticeable, but even in those cases where they are apparent the effect is much less disagreeable and results in smaller interruption of reception than when crashes of static occur. This is effected by connecting a signal controlled variable impedance to the set in various ways suitable to effect the desired result.

By way of exposition and explanation, the variable impedance is herein disclosed as a vacuum tube of the high mu type designed for Class B operation, biased to cut off the plate current and thus act as an extremely high impedance across the circuits to which it is connected, the grid being connected to have amplified and rectified radio frequency voltage impressed thereon. When the amplitude of the received signal voltage does not go above the normal working value the tube does not affect the operation of the set, but when it is sent into the working part of the E_G—I_P curve by swinging the grid strongly positive due to excess signal amplitude the plate impedance immediately drops to a low value and the audible output of the set is reduced substantially to zero for the duration of the excess amplitude.

It is well known that an oscillating circuit will

not cease oscillating instantly, but will persist for several cycles, growing progressively weaker, and also, when first excited, the oscillations will not reach their maximum amplitude instantly but rather build up progressively until the maximum is reached. This lag in building up and dying out is advantageous in my system, as it rounds the otherwise sharp corners of the envelope when the above mentioned tube goes into and out of operation, which eliminates more or less the danger of shocking the following stages into oscillation.

Fig. 1 is a circuit diagram of my invention as applied to a receiver having the grid 11 of first detector tube 12 coupled to a tuned input 13 by a condenser 14 and having the usual grid leak 15. Cathode 16 of tube 12 is in series with a coil 17 that is coupled to plate coil 18 and grid coil 19 of oscillator tube 20 whereof the grid 21 is connected to cathode 22 by grid leak 23 and to variable resonance circuit consisting of coil 19 and variable condenser 24 by a condenser 25. Plate 26 of tube 20 is connected to a source of positive potential through coil 18, resistance 27, and condenser 28 that may be shunted by switch 29.

Connected to the input of tube 12 by condenser 28 and conductor 29 is a high gain variable transconductance amplifier 30 operating on the principles disclosed in my copending application, Ser. No. 87,404, filed June 26, 1936, wherein the ratio of static to signal is greatly increased by shifting the bias to the steep part of the characteristic curve so that static that would normally appear in the output 31 at perhaps 5 db. greater than the signal output will be raised to an effective value on the order of 50 db. higher. Coupled to coil 31 is a coil 32 having its terminals connected to anodes 33 of a rectifier tube 34 whereof the cathode 35 is connected by conductor 36' to grids 36 of tube 37 and through impedance 38 to the midpoint of coil 32 and to ground. However, instead of the amplifier 30 ahead of rectifier tube 34, a D. C. amplifier of suitable characteristics may be connected between rectifier 34 and tube 37 as indicated at X. Tube 37 is biased to cut-off at normal signal amplitudes, and functions as a high impedance across the particular circuit of oscillator 20 to which it may be connected.

Tube 37 is a Type 53 or similar tube designed for Class B operation. If a constant bias of two to five volts negative be applied to the grids 36 the impedance across the cathode 138 and anodes 39 will be very high, yet a small positive bias on grids 36 will cause the plate impedance to fall to a few thousand ohms. Plates 39 are connected through radio frequency choke 40 and variable resistance 41 to the source of positive potential. Plates 39 may be connected by conductor 42, condenser 43 or switch 44, and switch 45 to either the plate circuit or the grid circuit of tube 20, though ordinarily instead of employing switch 55 there will be a permanent connection to one or the other of these circuits, and when tube 37 goes into operation as a low impedance it will act as a very low resistance shunted across coil 18 or coil 19, depending upon the circuit to which tube 37 is connected. The voltage impressed upon plates 39 is sufficient to insure a change in impedance adequate to effect the desired results when tube 37 passes current.

It is apparent that the potential of grids 36 will depend upon the flow of current from rectifier tube 34 through impedance 38 due to voltages set up in coil 32 by fluctuations of output of amplifier 30 in coil 31, and impedance 38 is of such value this potential is two to five volts lower than that on cathode 138 while the amplitude of the energy through coil 31 is within the normal working range and tube 37 is blocked, but when that amplitude becomes excessive, as when the signal is affected by static, the increased flow through impedance 38 will make grids 36 positive with respect to cathode 138 and tube 37 will pass current with concomitant large decrease in the impedance of tube 37. A by-pass condenser 48 will in some cases improve the operation of the device.

When switch 46 is closed condenser 47 is shunted and has no effect on the plate supply of tube 20, and with switch 44 open the condenser 43 will pass radio frequency currents through tube 37 to ground when the impedance of the tube is lowered by grids 36 being swung positive due to radio frequency energy of amplitude above the normal working range being supplied to rectifier 34, it being understood that switch 45 is closed to make connection with one of the works of the oscillator. When switch 46 is open and switch 44 is closed the condenser 49 serves as a by-pass to ground and the supply to plate 26 of oscillator 20 is shunted through radio frequency choke 40, switch 44 and conductor 42, the switch 45 being closed to the plate circuit. When the impedance of tube 37 is lowered by excessive currents through rectifier 34 the potential applied to plate 26 is decreased and the oscillator is detuned. It is apparent that, depending upon circuit values and applied biasing potentials, the oscillator may be silenced or its frequency so changed that there is no audible output due to the beat frequency being out of the audible range, for the duration of the operation of tube 37 as a low impedance, which condition is co-extensive with the duration of excessive amplitudes of received radio frequency energy.

In the embodiment of my invention illustrated in Fig. 2 the plates 39 of variable impedance tube 37 are respectively connected to the opposite ends of coil 50 that is closely coupled with the coils 18 and 19 of the oscillator network, and thus tube 37 functions as a load across the oscillator. The battery 51, which may be the common power supply for the receiving set, may or may not be used, connected through a resistance 52 or without that resistance, to lower the minimum impedance of the tube 37 during the periods of operation of that tube. The condenser 53 provides a by-pass for radio frequency currents. The other elements are the same in structure and function as are the like numbered elements of Fig. 1.

Fig. 3 shows one plate 39 of variable impedance tube 37 connected to the grid circuit of oscillator 20 and the other plate connected to the plate circuit of the oscillator, which gives a double damping effect.

Fig. 4 discloses the use of the variable impedance tube 37 as a full wave shunt across the grid coil 18 of oscillator 20; which gives full wave damping in the oscillator grid circuit. Tube 37 is connected in series with condenser 54, which is of several times the capacity of tuning condenser 24 and will therefore offer little impedance to radio frequency currents tending to flow through the anode circuits of tube 37. If the capacity of condenser 54 be of smaller value than that of tuning condenser 24 it will, when the tube 37 is passing current in response to excessive amplitude, effectively alter the fre-

quency of the oscillator so that the intermediate frequency generated will be other than that for which the intermediate frequency stages of the receiver are tuned, and hence the resulting intermediate frequency will not be passed.

The variable impedance tube 37 is shown in Fig. 5 as being connected to the cathode lead of the mixing tube. The coils 18 and 19 in the oscillator tube circuits should be closely coupled to pick-up coil 17, and the passing of current by tube 37 will then sufficiently alter the constants of the circuits to prevent audible effects due to static, either by detuning the oscillator or by damping.

Fig. 6 illustrates the application of the variable impedance tube 37 to reduce the output of radio frequency transformer 55, which may be an interstage transformer used as the input to amplifier or detector tube 56. Plates 39 are connected, through condensers 57, across center tapped secondary 58 of transformer 55 and thus acts as a full wave impedance of low value when the tube 37 is passing current, the AC on one half of the cycle going through one of the plates 39 and the cathode connections and through the other plate 39 on the other half of the cycle, when the grids 36 are swung into the operating portion of the E_g—I_p curve. Thus, when the condensers 57 are large, tube 37 acts on each half of the wave much as a variable non-inductive resistance of equal value across the tuning circuit 58—59. However, when the condensers 57 are small (of the order of .00025 mf.) the action is that of an additional capacity in parallel with condenser 59 across secondary 58. Potentiometer 60 permits adjustment of the positive potential applied to plates 39 to secure the proper internal impedance in tube 37, the radio frequency chokes 61 being interposed between plates 39 and the source of positive potential.

In Fig. 7 the variable impedance tube 63 is in series in the oscillator plate supply, with its anode 62 connected to the source of plate supply and its cathode 67 connected to plate coil 18 of the oscillator, the grid coil and the pick-up coil of the oscillator being designated 19 and 17, respectively, as above. When the input to rectifier 64 through secondary 32 is of normal amplitude the voltage drop caused by the current from rectifier 64 through resistance 65 is small and the bias impressed on grid 66 of tube 63 due to the drop through resistance 65 does not materially affect the plate current through the tube 63 and coil 18, but when excessive amplitudes are received the relatively large current through resistance 65 impresses on grid 66 a negative potential that will, with proper circuit values, reduce the plate potential on the oscillator to cut-off. Condenser 67 and the connections to ground through condensers 68 and 69 may be used or omitted as operating conditions may indicate.

The embodiment in Fig. 8 employs the variable impedance to attain a dual effect; one, to control the plate supply as in Fig. 7 and two, at the same time either to damp the grid circuit of the oscillator or throw it out of tune. The variable impedance tube 70 has two anodes 71 and 72, respectively connected to grid circuit 73 of the oscillator and in series in the plate supply of the oscillator, the latter as in Fig. 7. Current through anode 71 is controlled by grid 74 connected to the high voltage end of resistance 75 in the output of rectifier 76 and anode 72 cooperates with grid 77 connected to the low voltage end of that resistance, cathode 78 being connected to the mid-point of resistance 75 to adapt it to cooperate with both grids while they function oppositely during surges of static. The several elements are suitably biased so that while the received energy is of normal amplitude grid 74 substantially cuts off anode 71 while grid 77 permits free flow of current in the plate supply circuit including anode 72 and cathode 78. However, when excessive surges are impressed upon rectifier 76 the grid 74 is, due to the effect of resistance 75, made strongly positive with respect to cathode 78 and current passes from grid circuit 73 of the oscillator into the coil 18 and the oscillator plate circuit, while simultaneously grid 77 is swung negative to interrupt the plate supply. Whether condensers 79, 80 and 81 are used depends upon operating conditions. Condenser 81 may have a capacity of .001 to .0005 mf. to avoid introducing too great time factor. It is apparent that tube 71 acts both as a shunt across the grid coil 19 of the oscillator and as a signal controlled variable resistance in the plate supply of the oscillator.

Fig. 9 is in general similar to Fig. 8, anode 82 controlled by grid 83 acting as a variable resistance in the plate supply of the oscillator while anode 84 controlled by grid 85 functions to vary the impedance across plate coil 18. It is believed the operation is apparent from the foregoing description of Fig. 7.

While transformers 86 and 87 in Fig. 10 are indicated as being audio frequency transformers, it is to be understood that the embodiment disclosed in this figure may be used with equal success on a radio frequency stage. Tubes 88 and 89 are connected in push-pull to the secondary of transformer 86 and have a common grid leak 90 and condenser 91. Plate supply for tubes 88 and 89 is through conductor 92 connected to the center tap of the primary of transformer 87, to the opposite ends of which the plates of these tubes are connected. Anodes 93 and 94 of variable impedance tube 95 are respectively connected to the plates of tubes 88 and 89 and thus tube 95 acts as a full wave variable impedance constituting a load of comparatively low resistance across tubes 88 and 89 to absorb the shock of quickly cutting off the plate current of those tubes when excessive surges are received, thus smoothing the operation. Variable impedance tube 96 is connected with the cathode 97 and anode 98 in series with the source of plate supply and conductor 92 so that it exercises control over the plate supply as above described in connection with the similar hook-up in Fig. 7. Radio frequency energy is fed to rectifier 99 through transformer 100 and the current through the rectifier traverses series resistances 101 and 102. Grid 105 of tube 95 is connected to the high voltage end of resistance 101, grid 106 of tube 96 is connected to the low voltage end of resistance 102 and cathodes 103 and 104 of tubes 95 and 96, respectively, are connected between those resistances. The tubes are all so biased that while the energy put into rectifier 99 is within the normal working range of amplitude tubes 95 and 96 have little effect on the operation of the system of which tubes 88 and 89 are a part, but when excessive surges are impressed upon rectifier 99 the grid 105 is swung positive and tube 95 functions as a low impedance load across tubes 88 and 89 and grid 106 is made strongly negative, which cuts off or greatly reduces the plate supply to tubes 88 and 89. When my invention is applied as in Fig. 10 to a radio

frequency stage the circuit parameters must be suited to the frequency involved, the input to the push-pull tubes should be from the same source as the input to the rectifier tube, and there should be no reaction between the controlled circuits and the rectifier that will interfere with the rectifier preamplifier receiving an unaltered signal.

In all the embodiments above described, the various tubes are so biased that the variable impedance tube has little effect upon the operation of the receiving system so long as the received energy is of normal amplitude. If it is found that there is a perceptible reduction of normal output due to the variable impedance tube another stage of amplification can be added to overcome it.

From the foregoing exposition of my invention it is apparent that the signal controlled variable impedance may be applied to the circuits of tubes used as buffers, detectors, amplifiers, etc.

The foregoing specific applications of my invention are to be construed as being given by way of explanation and illustration and not by way of limitation, since those skilled in this art will perceive other combinations whereby the principle of a signal controlled variable impedance for reducing the audible output from a radio receiver for the duration of received impulses of excessive amplitude may be utilized.

This invention may be manufactured and used by or for the Government of the United States of America for governmental purposes without payment of royalties thereon or therefor.

I claim:

1. In a radio receiving system, a detector tube having an anode, a control grid and a cathode, an oscillator tube having an input and an output network each of which includes a coil, said coils being coupled together, a coil in the cathode circuit of said detector also coupled with the said coils, a rectifier tube, means to apply radio frequency energy to control the output of said rectifier tube, a tube connected across a network of said oscillator and normally constituting a high impedance, means connecting the output of said rectifier to control the output of the last mentioned tube whereby the output of said rectifier in response to excess amplitude of radio frequency applied to said rectifier will reduce the impedance of said last mentioned tube to a relatively low value, and voltage divider means connecting the output of the last mentioned tube and of the oscillator to a source of positive potential.

2. In a radio receiving system, a detector tube, an oscillator unit associated with said detector to modify the output thereof, variable impedance means of normally high value connected to the output of said oscillator, and means responsive to above-normal amplitudes of received radio frequency energy associated with said impedance means to reduce the impedance thereof for the duration of such above-normal amplitudes and thereby damp out the oscillations of said oscillator.

3. In a radio receiving system, a detector tube, an oscillator unit associated with said detector to modify the output thereof, a tube of normally high impedance connected to the output of said oscillator, and means responsive to above-normal amplitudes of received radio frequency energy connected to said last mentioned tube to reduce the impedance thereof for the duration of such above-normal amplitudes and thereby damp out the oscillations of said oscillator.

4. In a radio receiving system, a detector tube, an oscillator unit, including a resonant network, associated with said detector to modify the output thereof, a tube of normally high impedance associated with the resonant network of said oscillator unit, and means responsive to above-normal amplitudes of received radio frequency energy connected to the last mentioned tube to reduce the impedance of said last mentioned tube for the duration of said above-normal amplitudes and thereby detune said resonant network.

5. In a radio receiving system, a detector tube, an oscillator unit associated with said detector to modify the output thereof, variable impedance means of normally high value associated with the output of said oscillator, and means responsive to above-normal received energy to reduce the impedance of said means and thereby so change the circuit values of said oscillator unit that oscillation will not continue.

6. In a radio receiving system, means including an oscillator unit for heterodyning an incoming wave, means responsive to the amplitude of the incoming wave, and means controlled by the last mentioned means to vary the impedance of said unit to damp out the oscillation of said unit, and thereby prevent the production of sound of audible frequency for the duration of wave amplitudes above a predetermined value.

7. In a radio receiving system, means including an oscillator unit for heterodyning an incoming wave, means responsive to the amplitude of the incoming wave, and means controlled by the last mentioned means to vary the impedance of said unit to prevent the production of beat frequency for the duration of wave amplitudes above a predetermined value.

8. In a radio receiving system, means including an oscillator unit for heterodyning an incoming wave, means responsive to amplitudes of the incoming wave above the desired maximum signal-reception value only, and means controlled by the last mentioned means to vary the impedance of said unit to change the beat frequency in the output of said oscillator for the duration of wave amplitudes above a said signal-reception value.

9. In a radio receiving system, a vacuum tube and an operating network immediately associated therewith, a second tube provided with elements to pass current on both halves of a wave and biased to have normally a high impedance having its output connected to said network, means responsive to the amplitude of incoming radio frequency waves when such amplitude is above the maximum desired signal-reception value only, and means controlled by said means and operatively connected to said second tube to reduce the impedance of said second tube to a low value for the duration of amplitudes of either half of incoming waves above said maximum desired signal-reception value.

10. In a radio receiving system, a vacuum tube and an operating network immediately associated therewith, a second tube provided with elements to pass current on both halves of a wave and of high amplification factor biased to have normally a high impedance having its output connected to said network, means responsive to the amplitude of incoming radio frequency waves when such amplitude is above a predetermined value only, and means controlled by said means and operatively connected to said second tube to reduce the impedance of said second tube to a low value for the duration of above-normal amplitudes of either half of incoming waves.

11. In a radio receiving system, an oscillator tube, a variable impedance in the anode supply

circuit of said oscillator, means responsive to the amplitude of an incoming wave, and means controlled by said means and connected to said variable impedance to raise said impedance to a high value for the duration of above-normal amplitudes of incoming waves.

12. In a radio receiving system, an oscillator tube, a second tube having its output circuit in series in the anode supply circuit of said oscillator, a rectifier tube having its output connected to the grid of said second tube, and means operatively related to said rectifier to impress radio frequency voltages thereon, the biasing on said second tube being such that it normally passes current but upon reception of above-normal voltage amplitudes by said rectifier tube the said second tube is biased to cut-off for the duration of such amplitudes.

13. In a radio receiving system, a pair of vacuum tubes connected in push-pull, a first variable impedance connected across the outputs of both of said tubes, a second variable impedance connected in series in the common anode supply of said tubes, and means responsive to the amplitude of received radio frequency energy to keep the first of said impedances at a high value when said amplitude is in the normal operating range and simultaneously to keep said second impedance low but to reverse the values of said impedances while the said amplitude is above a predetermined value.

14. In a radio receiving system, a pair of vacuum tubes connected in push-pull, a variable impedance connected in series in the common anode supply of said tubes, and means responsive to the amplitude of received radio frequency energy to keep said impedance at a low value when said amplitude is within the normal operating range but to raise said impedance to a high value when said amplitude is above a predetermined value.

15. In a radio receiving system, a pair of vacuum tubes connected in push-pull, a first tube having two anodes, a grid and a cathode, the anodes being each respectively connected to the output of one tube of said pair, a second tube having its anode and cathode connected in series in the common plate supply of the tubes of said pair, a rectifier tube, means to impress radio frequency voltages thereon, a series resistance connected to the cathode of said rectifier, means connecting the grid of said first tube to the high voltage end of said resistance, means connecting the grid of said second tube to the low voltage end of said resistance, and means connecting the cathode of said first tube to said resistance at a point intermediate the ends of the resistance but nearer the low voltage end thereof.

16. In a radio receiving system, a pair of vacuum tubes connected in push-pull, a tube having two anodes, a grid and a cathode, the anodes being each respectively connected to the output of one tube of said pair, a rectifier tube, means to impress radio frequency voltages thereon, a resistance in series with the cathode of said rectifier, means connecting the grid of said tube to the high voltage end of said resistance and means connecting the cathode of said tube to a point of lower voltage on said resistance.

17. In a radio receiving system, a pair of vacuum tubes connected in push-pull, an impedance tube having a cathode and an anode connected in series in the common plate supply of the tubes of said pair and also having a grid, a rectifier tube, means to impress received radio voltages on said rectifier, a resistance in series with the cathode of said rectifier, means connecting the grid of said impedance tube to that end of said resistance that is negative as to the potential drop due to current from said rectifier and means connecting the cathode of said tube to a point on said resistance that is more positive as to said potential drop.

18. In a radio receiving system having a signal transfer channel, a tube of high amplification factor not a part of said channel but associated with a portion of the said channel to constitute a variable impedance and so biased as normally to have no appreciable effect on the operation of said system, a rectifier tube fed from said channel and operatively connected to the aforesaid tube to change the impedance thereof and thereby so alter the circuit values as to prevent audible output for the duration of excessive amplitudes of radio frequency energy impressed on said rectifier tube and means to impress radio frequency energy on said rectifier.

19. A method of eliminating audible effects of static from the output of a radio receiver that includes an oscillator having an associated network, which comprises increasing the static-to-signal ratio of received radio frequency energy, rectifying the energy with said increased ratio, and applying said rectified energy as a factor to maintain a high impedance across at least a portion of the said network when the amplitude of said energy is within the normal operating range but to reduce said impedance to a low value while said amplitude is above normal, thereby preventing the production of audible beat frequency for the duration of said excessive amplitude.

20. A method of eliminating audible effects of static from the output of a radio receiver that includes an oscillator having an associated network, which comprises rectifying received radio frequency energy together with any static impulses affecting the same, and applying said rectified energy as a factor to maintain a high impedance across at least a portion of the said network when the amplitude of said energy is within the normal operating range but to reduce said impedance to a low value while said amplitude is above normal, thereby preventing the production of audible beat frequency for the duration of said excessive amplitude.

21. A method of eliminating from the output of a radio receiver audible effects of static, which comprises rectifying, during periods only when static above a predetermined amplitude is present, received signal-bearing radio frequency energy together with any static impulses affecting the same, and applying the rectified energy effectively to reduce a supply of energy necessary to transfer the signal carried by said radio frequency energy.

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