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PEAK CLIPPER INDICATOR

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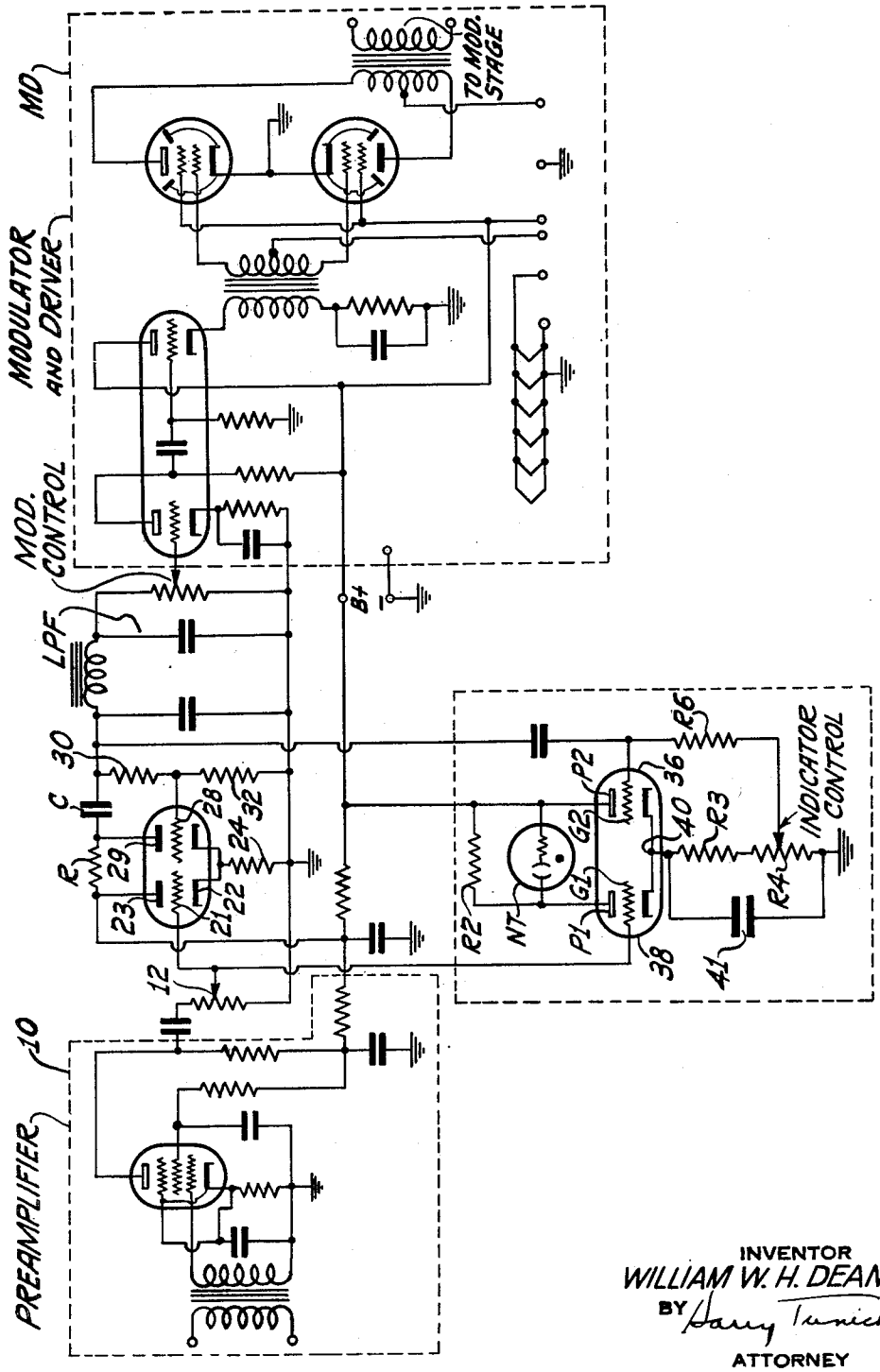


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## PEAK CLIPPER INDICATOR

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3 Claims. (Cl. 177—311)

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This application is a continuation-in-part of my copending application, Serial No. 768,319, filed August 13, 1947, which ripened on June 5, 1951, into Patent No. 2,555,533.

This invention relates to a peak clipper indicator to be used with the type of simple inexpensive peak clipper which uses but two tube structures which may be in a single envelope. Such a clipper is simple and of low cost, is highly efficient, linear to the point of clipping and clips cleanly and symmetrically on both positive and negative peaks.

In order to facilitate adjustment of my novel clipper to the desired degree of clipping, I have devised a simple indicator of low current drain which when added to the clipper load, may still allow joint operation with existing equipment to which it is applied.

My clipper and indicator form a unit which may with advantage replace clippers in existing equipment using the same or may be used in equipment not now using a clipper. Then improvement in communication equal to a power increase of five or ten times is obtained with substantially no actual increase in power used.

Other advantages to be attained by the use of my invention appear from a detailed description which follows. In the description which follows, reference will be made to the accompanying drawing wherein the single figure illustrates a peak clipping amplifier arranged in accordance with my invention and the same with an improved indicator for indicating the point at which clipping takes place.

In the drawing, the rectangle 10 designates a preamplifier in which the modulation is amplified as desired. This amplifier may be conventional and includes in its output a level control potentiometer 12, the tap on which is connected to the control grid 21 of an electron discharge tube having an anode 23 and a cathode 22. This electron discharge tube may be in a separate envelope or in the same envelope with a second electron discharge device having its anode 29 connected to a direct current source by a plate load resistor R. The cathode return resistor 24 is connected between the cathodes of both tubes and ground. The control grid 28 of the second tube is driven by voltages produced in the cathode resistor 24 because such control grid is connected to the grounded end of resistor 24 through a resistor 32.

The tube structures, as described, constitute a peak limiter of the type disclosed in Crosby Patent 2,276,565, dated March 17, 1942. In accordance with one aspect of my invention, however, the

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anode of the second tube is coupled by condenser C and resistors 30 and 32 to the common grounded point and a point between the resistors 30 and 32 is connected to the control grid 28 to provide degeneration in the system to improve linearity in the amplification up to the clipping point. Clipping introduces harmonic distortion and the clipped voltages are fed through a low pass filter LPF before further amplification in the modulator and driver MD. The filter is necessary to remove higher order harmonics of the speech voltages generated by the clipper action.

The clipping indicator tube is of the type comprising a double triode in a single envelope, although separate tubes may be used here as in the limiter. The control grid G1 of the first section 38 of this tube is connected to the movable point on the potentiometer resistor 12. The anode P1 is connected by a resistor R2 to the direct current potential source. The cathodes of both tubes 36 and 38 are tied together at point 40 and connected to ground by a resistor R3 and potentiometer R4. A point on the potentiometer R4 is connected by the resistor R6 to the control grid G2 of tube 36. The anode P2 of this tube is connected to the direct current source. An indicator in the form of a neon tube NT is connected in shunt to the resistor R2.

A bypass capacitor 41, having a capacitance value of at least 0.25 microfarad, is connected between common cathode point 40 and ground, or in other words across the common indicator cathode resistors R3 and R4. This bypassing of the indicator cathode resistors eliminates a feedback circuit which would be formed by the common impedance of such resistors (when unbypassed) between the input grid 21 and the output plate 29 of the clipper tube; thus, oscillation in the clipper tube is prevented.

In operation, the peak clipper is in physical make-up similar, in part at least, to the limiting amplifier described by Crosby in his above-identified patent. In the description that follows, it will be assumed that the reader is familar with the operation of Crosby's limiter. My clipper is to be used on speech signals and the operation obviously must be linear up to the clipping point. To obtain such operation, a degenerative feedback circuit for the last tube stage including resistors 30 and 32 is provided. The resistors 30, 32 are unbypassed so that signal voltages are fed to grid 28. This reduces the distortion which would take place in the clipper without such feedback. The degree of clipping is adjusted by movement of the tap point on potentiometer 12, as clipping starts when the plate current of the

tubes becomes zero. The use of feedback extends the linear portion of the tube characteristic as zero plate current is approached. In operation, then, both grids are at ground potential in the absence of signals, since both tubes then are conducting, as governed by the bias placed on the grids by cathode resistor 24. The current in the tubes is then insufficient to bias them to cut off. When signal is applied, the positive cycles on grid 21 cause the cathode current to increase and the increase in potential drop in resistor 24 makes the common cathodes more positive relative to ground, which has the same effect as making the grid 28 more negative and grid limiting in the positive halves of the modulation cycles takes place in this tube structure. The negative potential of the modulation cycles drives grid 21 to cut off, so that full wave limiting takes place in the tube. The amplification, however, is linear, for reasons pointed out above, up to the point at which clipping takes place. As grid 28 approaches the negative potential at which cut-off would take place because of the potential drop in resistor 24, the plate current variation is almost linear with respect to the grid voltage variation because of the feedback from anode 29 to grid 23. The first tube is connected as a cathode follower and hence 100 per cent feedback exists at grid 21; therefore, linearity on negative half cycles is good.

The extent of clipping is indicated as follows: If no signal is applied the adjustment at potentiometer R4 is such that grid G1 of tube 38 is biased to cut-off and tube 33 has a positive potential on its grid G2 and draws a small amount of current through cathode resistors R3 and R4. This is because the entire potential drop in these resistors is effective in fixing the bias on G1 whose direct current circuit includes part of potentiometer 12 also. Only part of this potential drop is effective on the grid G2, so that G2 has a smaller negative bias than G1.

Signal is fed from the preamplifier output, as adjusted in level at the potentiometer 12, to the grid G1. Clipped signal is fed from the anode 29 of the clipper stage to the grid G2 through condenser C and an unnumbered condenser. The preamplified signal on the grid G1 is ineffective to overcome the cut-off bias, until it reaches a predetermined peak value, because the amplified clipped signal on the grid G2 keeps tube 38 conductive and the amplified current is rectified in the plate circuit of tube 38 to produce a potential drop in R3 and R4 which holds the grid G1 past cut-off with negative bias which is even higher than that when no signal is applied. The amplified clipped signal on the grid G2 is of fixed magnitude or level, so that as the signal fed from the preamplifier output at 12 to the grid G1 increases a point will be reached at which the negative bias on the grid G1 is overcome and current will flow to plate P1, through the high resistor R2. The potential drop in resistor R2 is sufficient to flash the neon bulb NT. The point at which the signal from the preamplifier 10 overcomes the bias on G1 is determined by the differential between the no-signal biases on grids G1 and G2, which is controlled by adjustment of the potentiometer R4, and on the amplitude of the clipped wave applied to G2. The latter depends on the gain characteristic of the clipper stage. The potentiometer R4 may then be calibrated to show the differential between the biases on grids G1 and G2 and with this set as desired, the level control potentiometer 12 is adjusted so that the signal magnitude is such that peaks thereof drive tube 38 and the neon tube NT flashes on the signal peaks which exceed the desired level.

Using the constants listed below the clipper stage has a voltage gain (below clipping) of 5 and the indicator flashes at approximately 20 db of clipping. By varying the tap point of G2 on the cathode resistor R4 different clipping levels and different clipper stage gains may be handled.

| | | |
|---|---|---|
| Resistor 12 | megohm | 1 |
| Resistor R | ohms | 47,000 |
| Resistor 30 | do | 270,000 |
| Resistor 32 | do | 2,700 |
| Resistor 24 | do | 2,700 |
| Resistor R2 | do | 270,000 |
| Resistor R3 | do | 100,000 |
| Resistor R4 | do | 2,000 |

Clipper tube type 6SL7GT.
Indicator tube type 6SN7GT.
NT is a ¼ watt neon tube.

The primary advantage claimed for the indicator of this invention is that it takes its reference from the signal itself and thus directly compares the amplitudes of the clipped and unclipped waves. No elaborate voltage stabilization is required.

What I claim to be my invention is as follows:

1. In apparatus to indicate the amount of clipping which takes place in a clipper amplifier having an input on which voltages representing speech are impressed and an output from which clipped speech voltages are derived, two tube structures each having electrodes including an anode, a cathode and a control grid, bias circuits for the grids including a cathode return resistor a portion of which is common to both grid circuits, the arrangement being such that one tube structure is conductive and the other nonconductive, connections for applying unclipped signal voltages to the grid of the nonconductive tube structure and signal voltages from the output of the clipper amplifier to the grid of the conductive tube structure, whereby the negative bias on the grid of the nonconductive tube structure increases due to the potential drop in the common portion of said resistor until clipping starts in said clipper amplifier and the voltage on the grid of the conductive tube structure becomes fixed, so that conduction starts in the nonconductive tube structure when the signal voltage reaches a critical amplitude, a neon tube connected to the anode of said last tube structure, said neon tube flashing when conduction starts in such tube structure, and means for adjusting the resistance value of the resistor common to the grid circuits to thereby adjust the point at which the cut-off potential on the grid of the nonconductive tube structure is overcome by the unclipped signal voltages.

2. In apparatus to indicate the amount of clipping which takes place in a clipper amplifier having an input on which voltages to be clipped are impressed and having also an output from which clipped voltages are derived, two electron control devices each having an anode, a cathode and a control electrode, means for supplying unidirectional potential to the anode-cathode circuits of the two devices, a common impedance in the anode-cathode circuits of the two devices through which current flows when said devices conduct, means for applying different portions of the potential developed across said impedance as biases to the control electrodes of said two devices, thereby to bias one device to conduction and the

other to non-conduction, an impedance and a gas tube in parallel in the anode-cathode circuit of one device, connections for applying unclipped signal voltages to the control electrode of the non-conductive device and clipped signal voltages to the control electrode of the conductive device, and means for adjusting the bias on at least one of said devices to change the difference between the biases on the two devices to thereby adjust the point at which the cutoff potential on the control electrode of the non-conductive device is overcome by the unclipped signal voltages.

3. In apparatus to indicate the amount of clipping which takes place in a clipper amplifier having an input on which voltages to be clipped are impressed and having also an output from which clipped voltages are derived, two electron control devices each having an anode, a cathode and a control electrode, an indicator connected to the anode-cathode circuit of one device and actuated by current flow in such device, connections for applying unclipped voltages obtained from the amplifier input to the control electrode of said one device and clipped voltages obtained from the amplifier output to the control electrode of the other device, means for supplying unidirectional potential to the anode-cathode circuits of the two devices, a common impedance in the anode-cathode circuits of the two devices through which current flows when said devices conduct, means for applying different portions of the potential developed across said impedance as biases to the control electrodes of said two devices, whereby current flow in said other device biases said one device to be non-conductive, the increased current flow in said other device resulting from the application of clipped voltages thereto biasing said one device further in the non-conductive direction.



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