

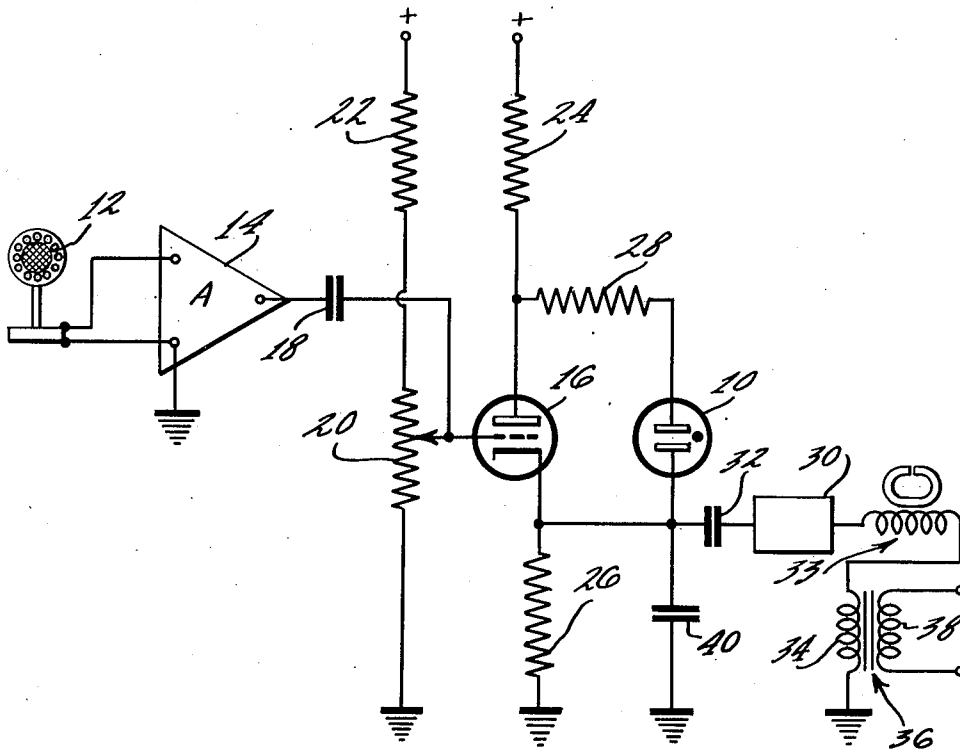
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AUDIO RECORDING LEVEL INDICATOR

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AUDIO RECORDING LEVEL INDICATOR

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This invention relates generally to audio recording level indicators, and more particularly to audio level indicators of the type employing a neon lamp for indicating a predetermined percentage of audio modulation. While neither specifically nor exclusively limited thereto, the audio recording level indicator of the present invention is particularly useful in magnetic tape recorders.

It has been proposed to use a neon lamp as an audio recording level indicator in relatively inexpensive magnetic tape recorders of the type used for home recording. Since the usual neon lamp ignites or fires at approximately 65 volts, its use is generally limited to audio systems having a power stage where signal voltages on the order of 65 volts, or more, are available on the primary winding of an output transformer. In some magnetic tape recorders, especially where cost is a major factor, the usual output transformer may be replaced by less expensive output means, and means other than an audio output transformer must be used for operating the neon lamp.

It is a principal object of the present invention to provide an improved audio recording level indicator of the neon lamp type for use in tape recorders.

It is another object of the present invention to provide an improved audio recording level indicator suitable for use in inexpensive tape recorders of the home type that do not employ output transformers and/or do not otherwise have sufficient signal voltage for firing the neon lamp directly.

It is a further object of the present invention to provide an improved audio level indicator that is simple in construction and operation, economical to manufacture, and yet highly efficient in use.

These and, perhaps, further objects of the present invention are attained in an audio recording system of the type employing a class A, or linear, split load phase inverter amplifier circuit in the last amplifier stage. A neon lamp of the NE51 type, for example, having a firing voltage of approximately 65 volts and an extinguishing voltage of approximately 45 volts, is connected in shunt with the split load phase inverter amplifier tube. An operating potential is applied across the tube, and a D.-C. bias voltage is applied to the grid thereof so that the D.-C. voltage between the plate and the cathode of the tube will be less than the firing potential of the neon lamp, in the absence of an audio signal on the control grid of the tube. The D.-C. voltage between the plate and cathode of the amplifier tube is held substantially constant by returning the control grid thereof to a fixed positive potential bias. By means of this bias voltage, and because of the cathode follower action of the split load phase inverter amplifier, the D.-C. voltage drop between the plate and cathode of the amplifier tube will be substantially independent of tube variations or aging effects. In use, the voltage furnishing the grid bias for the split load phase inverter amplifier is adjusted until the neon lamp just fires with the maxi-

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mum audio signal applied to the amplifier indicating 100 percent modulation.

The novel features of the invention, as well as the invention itself, both as to its organization and method of operation, will be understood in detail from the following description when considered in connection with the accompanying drawing, the single figure of which is a schematic diagram of an audio recording level indicator, in accordance with the present invention, as used in the recording system of a magnetic tape recorder.

Referring now to the drawing, there is shown a recording system of the type employed in home type recorders, and wherein a neon lamp 10 indicates a predetermined level of modulation, say 100 percent modulation. In the recording system illustrated, the audio signals to be recorded are picked up by a microphone 12 and applied to the input terminals of an audio amplifier 14. The amplified audio signals are coupled from the output of the audio amplifier 14 to the control grid of an amplifier tube 16 through a capacitor 18. The movable top of a potentiometer 20 is also connected to the control grid of the amplifier tube 16. One end of the potentiometer 20 is grounded, and the other end thereof is connected to a source of positive potential (not shown) through a resistor 22. It will now be seen that the serially connected potentiometer 20 and resistor 22 comprise a voltage divider for applying a positive D.-C. bias voltage to the amplifier tube 16.

The amplifier tube 16 is the last stage of audio amplification for the audio signals, applied to the microphone 12, and is connected in circuit as a Class A, or linear, split load phase inverter amplifier. The anode of the amplifier tube 16 is connected to a source of positive potential (not shown) through an anode resistor 24, and the cathode thereof is connected to ground through a cathode resistor 26. The resistors 24 and 26 have substantially the same resistance value.

A gas tube, such as the two-electrode neon lamp 10 of the NE51 type, for example, has one electrode connected to the cathode of the tube 16 and the other electrode connected to the anode of the tube 16 through a current limiting resistor 28, for the purpose hereinafter appearing.

The output from the amplifier tube 16 is taken from the cathode thereof and applied to a pre-emphasis network 30, represented in block-diagram form, through a capacitor 32. The pre-emphasis network 30 may comprise a resistor and a capacitor connected in parallel in a manner whereby low frequency audio signals are attenuated and high frequency audio signals are accentuated, in accordance with practices well known in the art. The output of the pre-emphasis network 30 is connected to a recording head 33, and the output thereof is connected to ground through the secondary winding 34 of a high frequency bias transformer 36. The primary winding 38 of the transformer 36 is adapted to be connected across a source of high frequency oscillations (not shown), in a manner well known in the art. The junction of the neon lamp 10 and the capacitor 32 is connected to ground through a capacitor 40. The capacitor 40 has a value such that it functions as a low impedance path for high frequency signals, such as the high frequency bias, and as a relatively high impedance path for audio signals.

The operation of the audio recording level indicator, in accordance with the present invention, will now be described. Let it be assumed that with an operating potential across the split load phase inverter amplifier circuit comprising the amplifier tube 16, the anode to cathode potential is about 40 volts when no audio signal is applied to the grid of the tube 16. Let it also be

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assumed that an audio signal of ± 12.5 volts peak represents 100 percent modulation. An audio signal of 12.5 volts peak is now applied to the grid of the amplifier tube 16, and the movable tap on the potentiometer 20 is adjusted until the neon lamp 10 just fires.

If it is assumed that an input audio signal of say 12.5 volts peak to the grid of the amplifier tube 16 will cause the voltage at the cathode of the tube 16 to drop substantially 12.5 volts, due to cathode follower action, and will cause the anode of the tube 16 to go positive by substantially 12.5 volts, it will be seen that a voltage of substantially 65 volts will appear between the anode and cathode of the tube 16. This anode-cathode voltage is now sufficient to fire the neon lamp 10 and thereby indicate 100 percent modulation. Thus, when adjusted as described, audio signals applied to the microphone 12, amplified by the amplifier 14 and applied to the last stage amplifier 16, via the capacitor 18, cause the neon lamp 10 to fire when the audio signals at the grid of the tube 16 are 12.5 volts, or in excess thereof. The amplified audio signals are applied from the cathode of the tube 16 to the recording head 33 via the capacitor 32 and the pre-emphasis network 30. A person making a tape recording will speak or sing, for example, into the microphone 12 with an audio amplitude such that the neon lamp 10 will light occasionally thereby indicating that the recording is being made with proper modulation.

With the recording arrangement shown and described, it will be noted that the split load phase inverter amplifier circuit, comprising the amplifier tube 16, may be used for the push-pull driving of a power amplifier in play-back with suitable circuit connections (not shown), well known in the art.

Thus, there is shown and described herein, an audio recording level indicator wherein a portion of its firing potential is derived from its anode-cathode voltage of the last amplifier stage, and wherein the remaining firing voltage is obtained from the audio signal. Since the voltage at the grid of the last stage amplifier is substantially near the voltage of the cathode thereof, changing tubes or aging effects thereof will not affect the accuracy of the audio level indicator. Also, with the recording arrangement shown and described, it will be noted that the audio signals are fed to the recording head from a low impedance source, the cathode of the split load phase inverter amplifier tube. It has been found that with normal variations in the operating potentials and variations in the neon lamps, an accuracy in the order of ± 3 db is available using the audio recording level indicator in a recording system of the type described.

What is claimed is:

1. An audio level indicator comprising a tube having a cathode, a grid and an anode, a cathode resistor connected to said cathode, an anode resistor connected to said anode, means to apply an operating voltage between said anode and said cathode through said resistors, a neon lamp, means connecting said lamp between said anode and said cathode, means connected to said grid to apply a fixed bias voltage thereto to cause said tube to conduct continuously, and means connected to said grid to apply audio signals thereto, said voltage across said tube being less than the firing potential of said lamp in the absence of audio signals to said grid and greater than said firing potential of said lamp when said audio signals to said grid exceed a predetermined magnitude.

2. An audio level indicator comprising a tube having a cathode, a grid and an anode, a cathode resistor connected to said cathode, an anode resistor connected to said anode, means to apply an operating voltage between said anode and said cathode through said resistors, a neon lamp, means connecting said lamp between said anode and said cathode, means connected to said grid to apply a fixed bias voltage thereto and to cause said tube to conduct continuously, and means connected to

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said grid to apply audio signals thereto, said voltage across said tube being less than the firing potential of said lamp in the absence of audio signals to said grid and greater than said firing potential of said lamp when said audio signals to said grid exceed a predetermined magnitude, and said anode resistor and said cathode resistor having substantially the same resistance.

3. An audio level indicator comprising a tube having a cathode, a grid and an anode, a cathode resistor connected to said cathode, an anode resistor connected to said anode, means to apply an operating voltage between said anode and said cathode through said resistors, a neon lamp, means connecting said lamp between said anode and said cathode, means connected to said grid to apply a fixed bias voltage thereto and to cause said tube to conduct continuously, means connected to said grid to apply audio signals thereto, said voltage across said tube being less than the firing potential of said lamp in the absence of audio signals to said grid and greater than said firing potential of said lamp when said audio signals to said grid exceed a predetermined magnitude, and said means connecting said lamp between said anode and said cathode comprising a current limiting resistor.

4. An audio level indicator comprising a tube having a cathode, a grid and an anode, a cathode resistor connected to said cathode, an anode resistor connected to said anode, means to apply an operating voltage between said anode and said cathode through said resistors, a neon lamp, means connecting said lamp between said anode and said cathode, means connected to said grid to apply a fixed bias voltage thereto and to cause said tube to conduct continuously, means connected to said grid to apply audio signals thereto, said voltage across said tube being less than the firing potential of said lamp in the absence of audio signals to said grid and greater than said firing potential of said lamp when said audio signals to said grid exceed a predetermined magnitude, and said tube and said anode resistor and cathode resistor connected thereto comprising a class A split load phase inverter amplifier circuit.

5. In a recording system of the type wherein audio signals are amplified and applied to a recording device, an audio recording level indicator comprising a two-electrode gas tube, a split load phase inverter amplifier circuit comprising an amplifier tube having a grid, means connecting said gas tube in shunt with said amplifier tube, means to apply a fixed voltage to said grid and to cause said amplifier tube to conduct continuously, means to apply said audio signals to said grid, and said amplifier circuit comprising means to apply across said amplifier tube a voltage less than the firing potential of said gas tube in the absence of audio signals to said grid and greater than said firing potential when said audio signals to said grid exceed a predetermined magnitude.

6. In a recording system of the type wherein audio signals are amplified and applied to a recording device, an audio recording level indicator comprising a two-electrode gas tube, a split load phase inverter amplifier circuit comprising an amplifier tube having a grid, a cathode and an anode, means connecting said gas tube across said amplifier tube, means to apply a fixed voltage to said grid and to cause said amplifier tube to conduct continuously, means to apply said audio signals to said grid, said amplifier circuit comprising an anode resistor connected to said anode, a cathode resistor connected to said cathode, and means to apply an operating voltage to said amplifier tube through said anode and cathode resistors.

7. In a recording system of the type wherein audio signals are amplified and applied to a recording device, an audio recording level indicator comprising a two-electrode gas tube, a split load phase inverter amplifier circuit comprising an amplifier tube having a grid, means connecting said gas tube across said amplifier tube, means to apply a fixed voltage to said grid to cause said ampli-

fier tube to conduct continuously in operation as a class A linear amplifier, means to apply said audio signals to said grid, and said amplifier circuit comprising means to apply across said amplifier tube a voltage less than the firing potential of said gas tube in the absence of audio signals to said grid and greater than said firing potential when said audio signals to said grid exceed a predetermined magnitude.

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