Jan. 11, 1938. V. L. DANIELS 2,105,410

OVERLOAD INDICATOR

Filed July 3, 1936

Fig. 1

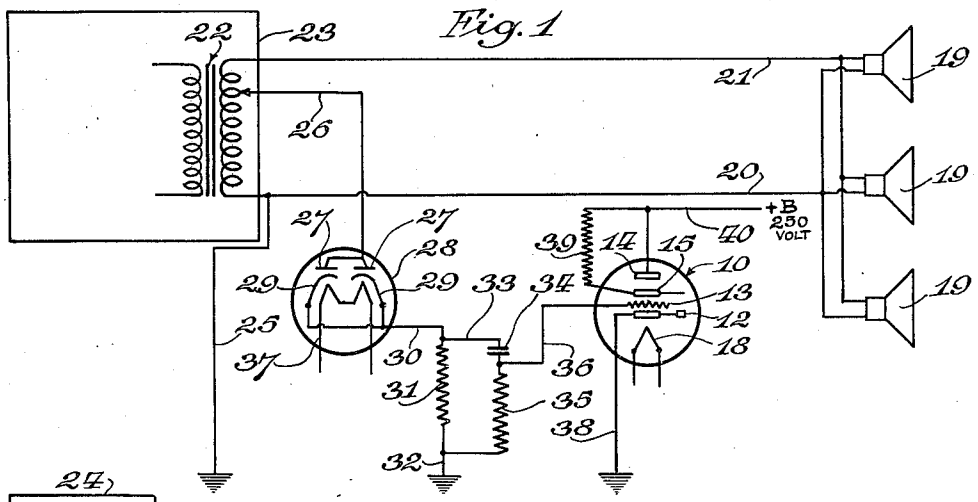


Fig. 2

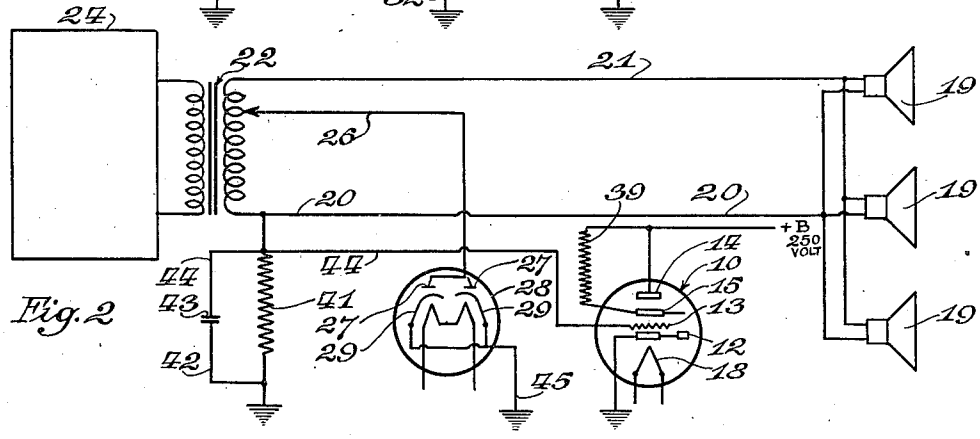


Fig. 3

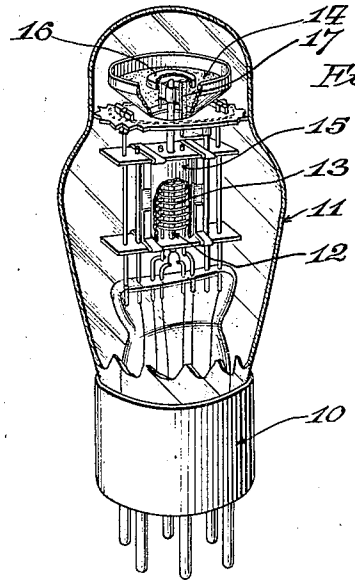


Fig. 4

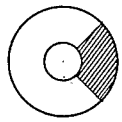
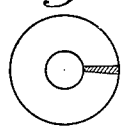


Fig. 5



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OVERLOAD INDICATOR

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4 Claims. (Cl. 179—1)

The present invention relates to an overload indicator for amplifying circuits, such as public address amplifying systems, or the like.

In such public address systems, the speakers are usually located at a point remote from the controlling circuits, so that the operator is greatly hampered in the adjustment of the apparatus in order to secure a maximum efficiency or sound volume without overloading the apparatus. Without such an indicator, it would be necessary to have one person located at the loud speaker to advise the operator by some form of signal as to the operation of the loud speaker, efficiency, overload, distortion, or the like, so that a proper adjustment can be made by the operator.

One of the objects of the invention is the provision of an improved audio overload indicator or a visual volume level indicator which is adapted to be used in amplifier circuits to indicate the overload point of the amplifier output tubes of an amplifier circuit.

Another object is the provision of an improved electrical system of visually indicating the distortion level in connection with an audio amplifier circuit.

Another object is the provision of a system of the class described which is adapted to utilize an electron ray tube, as, for instance, tubes of the indicator type which are commercially known as the 6 E 5 and 6 G 5, for the purpose of indicating overload in an audio circuit.

Other objects and advantages of the invention will be apparent from the following description and the accompanying drawing, in which similar characters of reference indicate similar parts throughout the several views.

Referring to the single sheet of drawings,

Fig. 1 is a circuit diagram of the system adapted to be used when the amplifier circuit is directly grounded;

Fig. 2 is a similar circuit adapted to be used when the output of the amplifier circuit cannot be directly grounded;

Fig. 3 is a vertical elevational view with parts of the tube broken away, showing the electron ray tube of the indicator type, which is preferably used in the circuits of Figs. 1 and 2;

Fig. 4 is a diagrammatic illustration of the appearance of the end of the electron ray tube when the output tubes are not overloaded;

Fig. 5 is another view of the indicator, showing the appearance of the indicator when the point of overload or a maximum efficiency has been reached.

Referring to Fig. 3, the electron ray tube which is utilized in the present indicating circuit is a high vacuum, heater-cathode type of tube designed to indicate visually, by means of a fluorescent target, the effects of a change in the controlling voltage.

Referring to the tube, 10 indicates the tube base, 11 the glass envelope, 12 the cathode, 13 the triode grid, 14 the fluorescent target, 15 the triode plate, 16 the cathode light shield, and 17 the ray control electrode. The same elements are correspondingly designated in the diagrams of Figs. 1 and 2, with the same numerals, the complete tube being indicated by the base numeral 10.

In addition to the elements mentioned, the tube also has a heater filament 18. The ray control electrode 17 is an extension of the triode plate, and therefore has no additional numeral in the wiring diagram.

The operation of an electron tube of this type is well known, and need not be described in detail. The hot cathode 12 provides a source of electrons which are attracted to the positively charged target 14, which is coated with a fluorescent material. Electrons impinging on the coated target, which are reflected to the target, cause the target to glow.

The extent of the fluorescent area can be controlled by means of a third electrode placed between the cathode and target, comprising the ray-control electrode 17.

The pattern developed on the fluorescent target depends on the contour of the target, as well as on the position and shape of the third electrode. With a frusto-conical fluorescent target 14, as shown, and a vertically extending control plate 17 located between the target and the cathode, the patterns developed are substantially as shown in Figs. 4 and 5, including other patterns of greater or less area.

In addition to this, the shadows may actually overlap on overload of the circuit, when the apparatus is suitably adjusted.

Referring to Fig. 1, this is a diagrammatic illustration of the circuit and apparatus required for the application of the electron ray tube as a visual volume level or overload indicator for loud speaker. The apparatus may comprise any suitable number of loud speakers 19, usually connected in parallel by suitable conductors, which are in turn connected by the conductors 20, 21, to the terminals of the secondary of a transformer 22.

This transformer may be comprised in the amplifier itself, as indicated by its inclusion in the

amplifier 23 in Fig. 1, or it may be an external transformer, as indicated by its location external to the amplifier 24, as shown in Fig. 2.

The transformer usually is the output transformer of the amplifier. One side of the transformer secondary, such as, for example, the conductor 21, may be grounded by a conductor 25, and the secondary is provided with an adjustable tap 26, which is set for the right amount of voltage on the transformer secondary to close the shadow of the electron ray tube at amplifier overload point.

The tap 26 may lead to the plates 27 of a rectifier tube 28, the cathodes 29 of which are connected by a conductor 30 to a resistance 31, which is connected to ground at 32. A conductor 33 leads from conductor 30 to a condenser 34, which is connected to another resistance 35, the opposite terminal of which is connected to ground at 32. A conductor 36 leads from a point between the condenser 34 and resistance 35 to the triode grid 13 of the electron ray tube 10.

The heater filament 37 of the rectifier tube 28 is, of course, connected to an appropriate source of energization, and the heater filament 18 of the electron ray tube is also suitably energized. The electron ray tube cathode 12 may be connected by a conductor 38 to ground. The triode plate 15 may be connected through a resistance 39 to the target 14, which is connected to a high voltage source, such as a positive 250 volt battery, by conductor 40.

Referring to Fig. 2, this is a circuit diagram, which may be used where the output of the amplifier cannot be directly grounded. In this case the amplifier has its output conductor 20 connected to ground through a resistance 41. A conductor 42 extends from ground to a condenser 43, the opposite terminal of which is connected by conductor 44 to the upper terminal of resistance 41 in Fig. 2 and extended to connect to the triode grid. In this case the adjustable tap 26 from the output transformer is connected up with the rectifier tube 28 in exactly the same manner, and the cathodes 29 of the rectifier tube are connected to ground by conductor 45. It will thus be observed that all of the other arrangements of the circuit are substantially the same as described with respect to Fig. 1.

The characteristics of the resistor 31 in Fig. 1 and 41 in Fig. 2 depend upon the rectifier load desired. The characteristics of the condensers 34 and 43 and the resistance 35 depend upon the time constant desired.

The operation of the circuit is as follows: The alternating current audio voltages in the output circuit of the amplifier are rectified by the rectifier tube 28 and appear across the rectifier load resister 31 or 41 as pulsating direct current. This charges the condenser 34 or 43 by an amount depending upon the magnitude of these voltages.

In the circuit of Fig. 1, the negative voltage is taken from the resistance 35 for the grid of the electron ray tube operation. In the circuit of Fig. 2 the negative voltage is taken from resistance 41 for the grid of the electron ray tube operation.

This negative voltage in respect to the cathode of the electron ray tube causes the shadow to widen or to narrow in the electron ray tube according to the voltage variations in the rectifier load resister 31 or 41. By setting the A. C. applied voltage on the rectifier by means of the adjustable tap 26 at a proper point, the shadow on the electron ray tube can be made to close just at the overload point of the amplifier output tubes.

The electron ray tube, when used as an audio load indicator or a visual volume level indicator, works from the audio voltages in the audio amplifier by using a very small portion of the power output of the amplifier. When no power is being developed, there is no indication or movement of the shadow, and maximum movement of the shadow will indicate that more power is being developed by the amplifier. The shadow width is constantly changing with the variation of power output of the amplifier, and the voltage applied to the triode grid can be adjusted by adjusting the voltage applied to the rectifier so that the shadow on the electron ray tube closes at overload point of the amplifier output tubes.

It will thus be observed that the volume of the amplifier output may be conveniently adjusted with the apparatus of Figs. 1 or 2, so that a maximum volume is secured at the speaker by adjusting the volume to the overload point, as indicated by the electron ray tube.

An indication of the type of Fig. 5 is exemplary of that when the output tubes are approaching overload and the speakers are at maximum volume. This adjustment may be made by the operator without assistance from any other party, or without any attention to the action of the loud speakers themselves, once the tap 26 has been satisfactorily adjusted.

This enables an operator who is not familiar with electrical circuits or characteristics of amplifiers to operate an amplifier at maximum efficiency, without getting undesirable distortion. A public address system may be so operated with an indicator of the class described as to make the speech audible over the maximum amount of area or distance from the loud speaker, without any chance of the operator overloading the tubes or adjusting the volume to such an amount that there will be more than the permissible amount of distortion.

While I have illustrated a preferred embodiment of my invention, many modifications may be made without departing from the spirit of the invention, and I do not wish to be limited to the precise details of construction set forth, but desire to avail myself of all changes within the scope of the appended claims.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States, is:

1. In an amplifier circuit, the combination of an amplifier with a remote speaker energized by said amplifier, and an indicator for indicating the overload point of said amplifier, comprising an electron ray tube of the indicator type, said electron ray tube having its grid controlled by voltages derived from an output circuit of said amplifier, the voltage on said grid being so arranged that the indicator tube indicates the limit of desired volume at the speaker.

2. In an amplifier circuit, the combination of an amplifier with a speaker and an indicator for indicating the overload point of said amplifier, comprising an electron ray tube of the indicator type, said electron ray tube having its grid controlled by voltages derived from the audio frequency circuit, and rectified by a rectifier tube connected to a portion of the output transformer windings.

3. In an amplifier circuit, the combination of an amplifier with a speaker and an indicator for indicating the overload point of said amplifier,

comprising an electron ray tube of the indicator type, said electron ray tube having its grid controlled by voltages derived from the audio frequency circuit, and rectified by a rectifier tube connected to a portion of the output transformer windings, and impressed upon a suitable resistance.

4. In an overload indicator for amplifier circuits, the combination of an electron ray tube of the indicator type, with means for energizing the grid of the tube, with voltages controlled by the volume of current in the audio circuit, comprising a speaker and an audio transformer having a primary and a secondary, suitable circuits from the secondary of the transformer to said speaker, an adjustable tap on said secondary leading to a rectifier tube, the output of said rectifier tube being connected to the grid of said indicator tube, means for energizing the other electrodes of said indicator tube, and means for connecting a return circuit from said indicator tube to said secondary, the voltage on said grid being so adjusted that the indicator tube indicates the maximum permissible volume at the speaker.

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