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ELECTRONIC WARNING SIGNAL APPARATUS FOR CARBON ARC LAMPS

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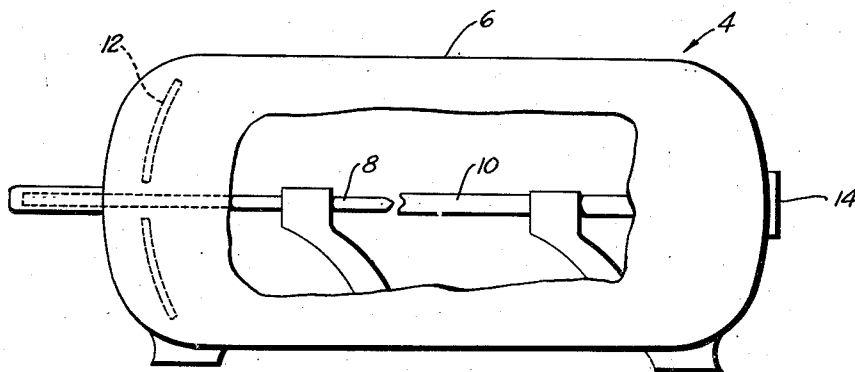


FIG. 1

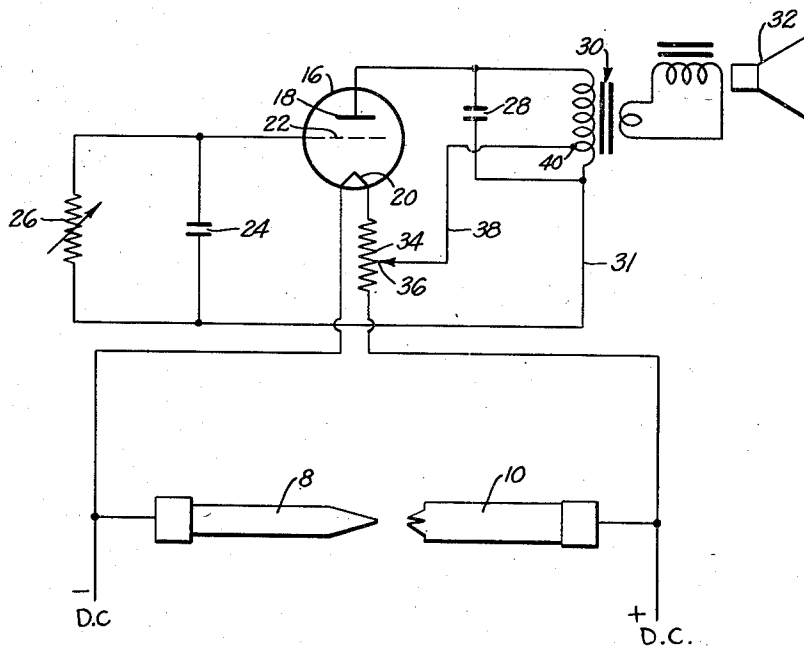


FIG. 2

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ELECTRONIC WARNING SIGNAL APPARATUS FOR CARBON ARC LAMPS

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4 Claims. (Cl. 315—135)

(Granted under Title 35, U. S. Code (1952), sec. 266)

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

This invention relates to warning devices and more particularly to a warning device for use in a carbon arc illumination circuit.

Carbon arc circuits have been used in many different illumination devices, such as searchlights and movie projector systems. In such devices the gap between the carbons is initially set, and thereafter the carbons gradually are moved toward each other as the carbons are consumed by a feed mechanism which automatically maintains the arc gap and, consequently, the required illumination intensity.

Arc flicker or failure in these lamps may be attributed to several causes, such as improper adjustment of the feed mechanism, defective carbons, or changes in the carbon arc supply voltage, and, when these failures occur in a movie projector installation they may cause an interruption in the film projection which is always a source of annoyance and inconvenience to the movie patrons.

One type of warning system devised for projection arc lamps utilizes a photo electric cell which is actuated by the intensity of the arc illumination, but, as can be expected, such a system has several disadvantages, such, for instance, as the fact that it is relatively expensive due to its necessarily complicated structure, and, further, it requires adjustments which are entirely too critical for projection arc lamps.

A broad objective of the invention is to provide a simple, inexpensive and stable electronic warning device for carbon arc lamps.

More specifically, another object is to provide an audible electronic warning device which is actuated by arc supply voltage changes and which can easily be easily adjusted to operate under varying voltages and carbons.

Further objects are to provide a warning device using an audio oscillator tube having no moving parts to affect its operation, and to provide a device which is compact, simple and economical to operate.

Yet another object is to provide a carbon arc warning device that is readily adjustable to operate with varying degrees of sensitivity.

These and other objects will become apparent from the detailed description and the accompanying drawing.

According to the invention a warning device is provided for a carbon arc circuit which will indicate to the operator any change in the arc voltage that may affect the desired operation of the circuit. The device comprises an electronic oscillator tube which may be arranged in a Hartley circuit connected across the arc supply voltage. When a triode oscillator tube is used the filament may be connected directly across the arc voltage supply with the plate and grid connected through a tank circuit and a grid leaking condenser circuit. The tank circuit may have a coupled output transformer associated, preferably, with a permanent magnet type of loudspeaker which provides

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an audible signal when the tube oscillates. The plate may be connected to the filament through one portion of the transformer primary winding by a tapped connection from a potentiometer in the filament circuit, the remaining portion of the transformer winding functioning as a feedback to the grid.

The preferred embodiment is shown in the drawing in which Fig. 1 somewhat diagrammatically illustrates one type of conventional projection arc lamp with which the warning device of this invention may be employed; and Fig. 2 is a wiring diagram of the warning device.

Referring to the drawing, projection arc lamp 4 includes a housing 6 mounting negative and positive carbons 8 and 10, respectively, the carbons being supported in an appropriate manner to permit a longitudinal feed such as will maintain the proper arc across the carbon heads. The carbons usually are supplied with a D. C. voltage, which may vary from about 30 to 100 volts, depending on the capacity of the lamp, and the illumination created by the arc is reflected by mirror 12 through front 14 of the casing.

The above apparatus is illustrative only of one type carbon arc circuit in which the warning device of this invention can be used. In carbon arc lamps used with film projectors, it is particularly important to maintain a continuous and stable illumination, and to accomplish this result it is necessary to maintain the correct voltage across the carbons. If for any reason the arc voltage increases, such as may be caused by a defective carbon, improper feed adjustment or even a line voltage change, the arc may flicker or go out completely, while this difficulty can be prevented if the operator takes immediate remedial steps. These operators have many other duties that prevent constant vigilance, thus a warning device is highly useful to positively notify the operator of the condition.

A wiring diagram of the warning device is shown in Fig. 2 and comprises basically an oscillator tube 16 having a plate 18, a filament 20, and a grid 22. The tube preferably is arranged in a so-called Hartley circuit which in the present case consists of a grid leak circuit with a condenser 24 and a variable resistor 26, and also a tank circuit having a condenser 28 and an output transformer 30 connected in parallel. The tank and grid circuits are connected by a conductor 31, and the transformer has its secondary winding connected to a loud speaker 32 which furnishes the audio warning signal when the tube oscillates.

Filament 20 is connected in a circuit across the arc supply voltage, the filament circuit being provided with a potentiometer or voltage divider 34 tapped at 36 and connected by a conductor 38 to an intermediate position 40 of the transformer primary winding to supply the plate and grid with the arc supply voltage.

During normal arc voltage, tap 36 of potentiometer 34 is set to provide a positive potential on the plate and grid which is below that required to start oscillation. When the normal operating arc supply voltage increases to an extent such as might adversely affect the arc, the resulting voltage change is sufficient to increase the potential between the plate and grid and the filament and the tube starts firing. An increased current flowing in the plate circuit sets up a magnetic field in the plate portion of the transformer primary winding which induces a voltage in the grid portion of the transformer winding and provides a voltage feed-back that is impressed on the grid to drive it more positive. The grid being more positive draws an increased current from the filament and the excess electrons that cannot leak off rapidly enough through variable resistance 26 accumulate on the condenser 24. As the plate current reaches saturation, the field in the plate winding ceases to increase, and the field around the grid winding collapses to eliminate the feed-back voltage,

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When the grid becomes sufficiently negative due to the accumulations of electrons, the tube cuts off. Oscillation will not start until sufficient negative charge has leaked off the grid through the variable resistor 26 to restore it to its initial positive potential to permit firing. Tube oscillations will continue in this cycle of operation until the excess operating arc voltage is reduced by the operator and restored to the normal value.

The audio oscillator can be set so that an increase of about 5 volts in the arc voltage will cause the tube to oscillate. An increased sensitivity of the warning device is obtained by influencing all the elements of the tube by the change of arc voltage so that less voltage change is required to initiate or stop oscillator operation. It is apparent that the speaker diaphragm is the only moving part in the entire warning device and such vibrations cannot jar the setting of the carbons. Instead of an audio oscillator, it is possible to use a R. F. oscillator actuating a relay connected to a sound or light producing device. When it is desirable for the warning device to indicate a decrease in the arc voltage supply below a normal operating level, the oscillator may be arranged to oscillate continuously during normal operating conditions, and to stop oscillating when the voltage decreases below a predetermined limit. Thus the oscillator circuit may be used to indicate an increase or decrease in the carbon arc voltage above or below a predetermined level.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is, therefore, to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

I claim:

1. A warning device for use with a carbon arc circuit comprising an electronic oscillator tube having plate, grid

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and filament elements all arranged in a circuit adapted to be connected across the voltage supply for the carbon arc circuit, and means operable by the oscillator to indicate a change of said voltage when the voltage varies a predetermined amount.

2. A warning device for use with a carbon arc circuit comprising an electronic oscillator tube having plate, grid and filament adapted to be supplied with a voltage from the carbon arc voltage supply, said filament connected across the voltage supply and being provided with a potentiometer for varying the potential applied to the plate and grid elements, said plate and grid being connected through a tank and grid leaking circuits and connected to the tap of the potentiometer, and means operable by the oscillator tube to indicate a change of the voltage in the carbon arc circuit when the voltage varies a predetermined amount.

3. The combination of a projection arc lamp circuit having an arc voltage supply, an electronic oscillator connected to said supply, an output transformer coupled to said oscillator and associated with a sound producing device whereby to indicate a change of the voltage across the carbons when the voltage varies a predetermined amount.

4. The combination of a projection arc lamp circuit having an arc voltage supply, an electronic oscillator connected to said supply, a warning means coupled to the output of said oscillator whereby to indicate a change of the voltage across the carbons when the voltage varies a predetermined amount.

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