FLUORESCENT LIGHTING FOR REFRIGERATED SPACES AND THE LIKE

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This application is a continuation of my co-pending application, Serial No. 169,211 entitled "Fluorescent Lighting for Refrigerated Spaces and the Like" and now abandoned.

This invention relates to a fluorescent lighting arrangement for refrigerated spaces and more particularly to means for enabling the practical use of standard fluorescent lights at low temperatures.

Although fluorescent lighting has many advantages, it is unsuitable for use at temperatures below approximately 60°F., because the efficiency of the fluorescent tubes decreases rapidly as the temperature drops. At lower temperatures, starting or initial lighting becomes more difficult until a point is reached at which the tubes will not light at all. Hence, fluorescent lighting with standard fluorescent tubes has not been possible or at least practical for refrigerated display cases and other cold areas.

Although special fluorescent tubes have been designed specifically for use at lower temperatures, these tubes give off so much heat as to render them impractical for many low temperature applications, such as for lighting refrigerated spaces.

The present invention provides means for heating the environment around a standard fluorescent tube to enable it to operate at temperatures at which it is efficient. Specifically, this is accomplished by an electrical heating element preferably extending over a substantial portion of the length of the fluorescent tube and provided with a thermostat for regulating the environmental temperature as influenced by the heating element. The heating element can be mounted on the supporting structure or even on a portion of the tube itself.

It is, therefore, a principal object of the invention to provide means by which a standard fluorescent tube can operate in a space which is held at a temperature below that at which normal starting and operation can be expected.

Another object of the invention is to provide an electrical heating element in heat transfer relationship with a fluorescent tube by means of which element the fluorescent tube operates in a warmer environment than the remainder of the surrounding space.

Still a further object of the invention is to provide an improved mounting structure for a fluorescent tube, which structure supports an electrical heating element for raising the temperature of the environment immediately about a fluorescent tube mounted on the structure.

Other objects and advantages of the invention will be apparent from the following detailed description of a preferred embodiment thereof, reference being made to the accompanying drawing, in which:

FIG. 1 is a fragmentary, exploded view in perspective of a refrigerated display case and mounting elements for mounting and electrically connecting a fluorescent tube within the case;

FIG. 2 is a side view of a mounting panel shown in FIG. 1 and further showing wiring associated with the panel;

FIG. 3 is a rear view of the mounting panel shown in FIG. 2;

FIG. 4 is a fragmentary, exploded view in perspective of a refrigerated display case and modified mounting elements for mounting and electrically connecting a fluorescent tube within the case;

FIG. 5 is a fragmentary view in cross section taken along the line 5-5 of FIG. 4;

FIG. 6 is a view in cross section taken along the line 6-6 of FIG. 4; and

FIGS. 7 and 8 are views in cross section of modified fluorescent tube elements embodying the principles of the invention.

Referring to the drawings, and more particularly to FIG. 1, a portion of a refrigerated display case is indicated generally at 10 and includes wall panels 12, frame members 14 and 16, and a door or window 18.

A lighting fixture in accordance with the present invention is fixed to the wall inside the door or window 18 so that it is assumed that the space enclosed thereby is refrigerated to a temperature so low that normal tube operation cannot be obtained. In accordance with the invention a back channel 20 is screwed or otherwise suitably affixed to the frame member 16 and a mounting panel or channel 22 is suitably affixed to the back channel 20. A fluorescent tube 24 is mounted on the panel 22 and a translucent guard 26 is affixed to the panel 22 around the tube 24. A suitable housing or top frame member 28 is located at any convenient location, as above the door 18, and contains a ballast 30 as well as two receptacles 32 and 34. The receptacle 34 is connected to a source of current through lines 36 and the receptacle 32 is connected to a source of current through the ballast 30 and lines 38. The housing or frame member 28 can serve as a lintel above the door 18 or can simply constitute a housing suitably attached to one of the wall panels 12 in an out-of-the-way location.

The fluorescent tube 24 is mounted on the panel 22 by means of a pair of conventional sockets 40 and 42 which are wired in the usual manner with a base 44 of a starter 46 and, in this instance, are connected to a three-pronged plug 48 which is adapted to be plugged into the receptacle 32 and wired with the ballast 30. The plug 48 also provides a ground for the panel 22.

The temperatures within the refrigerated display case 10 are in the neighborhood of 0°F., well below the 60°F. limit which is generally considered to be about the minimum temperature at which a standard fluorescent tube will operate with reasonable efficiency. At temperatures as low as 0°F. it is generally assumed that standard fluorescent tubes are inoperative.

The present invention provides an electrical heating element or resistance wire 50 affixed to the back of the panel 22 by a suitable means such as tape, with the heating element extending in any suitable pattern substantially over the entire length of the tube 24 mounted on the opposite side thereof. One leg of the element 50 is connected directly to a two-pronged plug 52 while the other leg extends through an opening 54 in the panel 22 and is electrically connected in series with a thermostat 56. Any suitable resistance wire configuration can be used, of course, so long as the wattage dissipation thereof is sufficient to cause the necessary temperature rise within the fixture and around the tube 24. The thermostat 56 may be mounted on the front of the panel 22, near the fluorescent tube 24, and is affixed thereto by a suitable bracket 58. A housing 60 is affixed to the front of the panel 22 around the thermostat 56 to limit the effect of the refrigerated space 10 on the temperature which the thermostat senses. The housing does not completely enclose the thermostat 56 but is open on each end so that heat rising by convection from the lamp and resistance wire may be sensed by the thermostat and the circuit to the resistance wire turned on and off to maintain an operative temperature.

An additional wire 62 connects the thermostat 56 to
the plug 52 which is directly connected to a source of current through the receptacle 34. The thermostat 56 is designed to open the connection between the wire 62 and the element 50 when the temperature sensed exceeds, for example 80° F., and to reestablish this electrical connection when the temperature drops to 60° F., for example, the lower limit of temperature being high enough to assure reasonable operating efficiency for the tube 24. The lines 38 which are connected to a current source preferably are provided with a suitable switch 64 which can be closed or opened to control current to the tube 24 while the heating element 50 receives current continuously. In some instances, with heavier heating elements, it may be desirable to supply current to both the element and the tube 24 at the same time and to shut off current to both at the same time.

Referring to FIG. 4, a modified lighting fixture in accordance with the present invention is also affixed to the wall 12 of the same refrigerated enclosure shown in FIG. 1. In this instance, the fixture includes a pair of mounting brackets 66 which are affixed to the wall 12 and spaced apart a distance somewhat less than the length of a fluorescent tube 68. The fluorescent tube 68, which is of a conventional type, is supported by the brackets 66 through a transluent guard 70 which completely encompasses the tube 68 but is slightly shorter. The tube 68 is held in the guard 70 by sealing rings 72 which fit on the upper and lower ends of the guard 70 and engage the periphery of the fluorescent tube 68. Thus, the guard 70 with the tube 68 can simply be snapped on or off the mounting bracket 66. An arcuate elongate housing or supporting means 74 is contiguous to the outside of the guard 70 and extends substantially over the length of the fluorescent tube 68. The arcuate housing can be affixed to the guard 70 by suitable adhesive or can be mechanically affixed thereto by screws, straps, or the like. The housing 74 can be translucent and made of the same material as the guard 70 or can be of metal and have a reflective inner surface, for example. It is preferably located on the back of the guard 70 so as to be between the arms of the brackets 66 when engaged therewith. However, it can be located on any side of the tube 68 and, if translucent, will not seriously affect the light transmitted therefrom. The housing 74 positions and supports an electrical heating element 76 therein which extends substantially over the length of the fluorescent tube 68 in the same manner as the element 50 of the first embodiment. The element in this instance is U-shaped so that the two legs of it are shown in cross section in FIG. 6. However, any number of passes of the wire constituting the element can be made over the length of the tube. The fluorescent tube 68 is connected to a source of current through end sockets 78 which are wired to a plug 80 which can be connected through the usual ballast 30 to a source of current. The heating element 76 also is wired to a plug 82 which again is connected to a suitable source of current in the same manner as in FIG. 1. A suitable thermostat 84 can be located in series with the heating element 76 and can be located within the upper end of the guard 70, as shown in FIG. 5.

A modified guard 86 is shown in FIG. 7, the guard in this instance having an internal housing 88 which contains the heating element 76. In this manner, the heating element 76 is slightly closer to the fluorescent tube 68 and in somewhat better heat transfer relationship with respect thereto.

A further modified guard 90 is shown in FIG. 8, the guard 90 in this instance not being attached to the heating element 76 at all although, of course, it does serve to maintain the heat around the tube 68. In this instance, an arcuate housing 92 for the heating element 76 is mounted directly on the fluorescent tube 68 and can be removably fixed thereto by suitable means such as straps 94 so that the housing 92 can be removed when the fluorescent tube 68 burns out. The housing 92, being affixed directly to the tube 68, provides the best heat transfer relationship for the heating element 76 although it is more cumbersome when the tube 68 must be replaced.

While the embodiments of the invention have been illustrated in connection with an artificially cooled environment, it is to be clearly understood that the invention can be equally applied to outdoor lighting. Thus, the heated fluorescent tubes can be employed in street lights or for lighting the area under a theater canopy, by way of example.

Various modifications of the above described embodiment of the invention will be apparent to those skilled in the art and it is to be understood that such modifications can be made without departing from the scope of the invention if they are within the spirit and tenor of the accompanying claims.

I claim:

1. A lighting structure for an artificially-cooled space, said structure including a mounting panel having a pair of spaced sockets supporting thereon, an electrical heating wire mounted on the side of said panel opposite said sockets and extending substantially the distance between said sockets, a thermostat mounted on the said same side of said panel as said sockets, conductor means connecting said heating wire and said thermostat in series and connected to a power source, a standard, commercially-available fluorescent tube received in said sockets and extending therebetween, a guard of sufficient length to extend substantially the full length of said fluorescent tube and extending therearound and in contact with said panel on each side of said tube to establish a peripherally-enclosed space around said tube, said guard extending beyond said thermostat to enable said thermostat to measure the temperature of the environment within said guard around said sockets for maintaining the temperature within a predetermined range by opening and closing a circuit for said heating wire, and a housing affixed to said panel around said thermostat to limit the effect of the artificially-cooled space on the temperature which said thermostat senses yet enable said thermostat to sense the aforesaid temperature around said sockets.

2. A lighting structure according to claim 1 wherein said fluorescent tube is mounted vertically, said thermostat and said housing are above the tube, and said housing is completely enclosed in front of said thermostat but has open end portions to sense heat rising by convection from said fluorescent tube.

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