March 2, 1943. M. B. BECK 2,312,617

FLUORESCENT TUBE LIGHTING FIXTURE

Filed Aug. 20, 1940

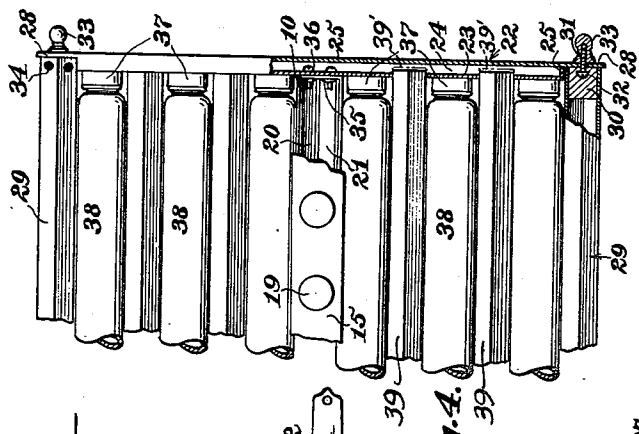

Fig. 4.

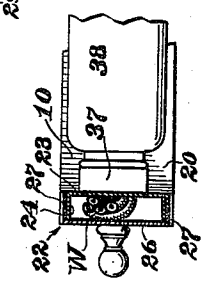

Fig. 6.

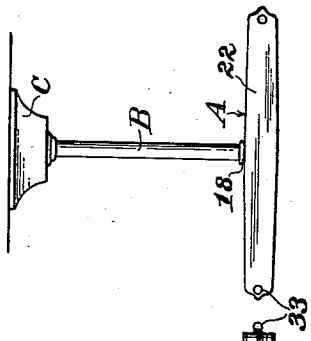

Fig. 2.

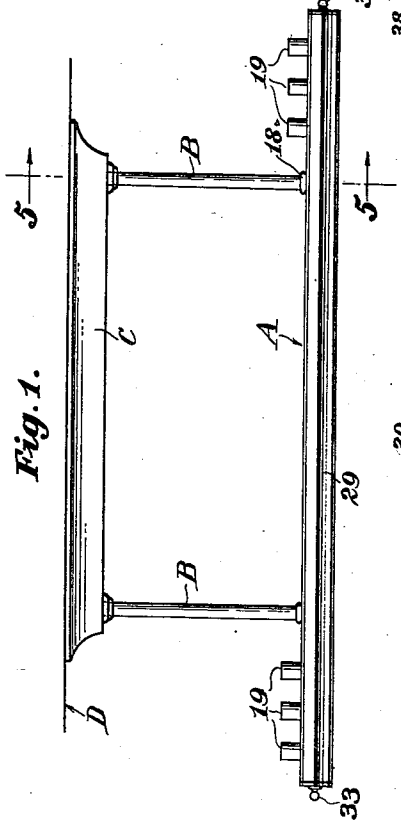

Fig. 1.

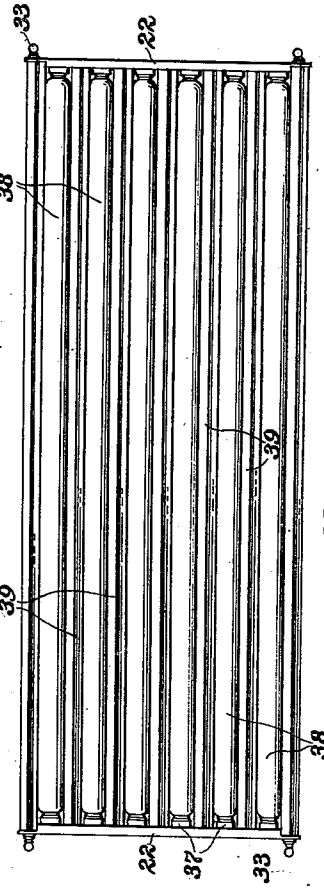

Fig. 3.

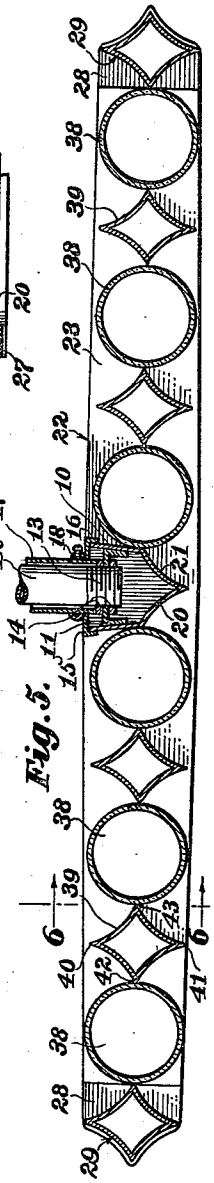

Fig. 5.

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FLUORESCENT TUBE LIGHTING FIXTURE

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5 Claims. (Cl. 240—78)

This invention relates generally to lighting fixtures, and more particularly it relates to lighting fixtures in which the illuminant is of the fluorescent tube type.

The general object of my invention is the provision in a lighting fixture of the character mentioned of a simple effective and inexpensive construction.

A further object of my invention is the provision in a lighting fixture of the fluorescent tube type of means for preventing the action of one tube on other tubes and thereby reducing their efficiency.

A further object of my invention is the provision in a lighting fixture of the fluorescent tube type of a construction whereby a high degree of compactness without loss of efficiency may be attained.

Among the objects of my invention is also the provision in a lighting fixture of the fluorescent tube type of a construction whereby the light from all surface portions of each tube is caused to travel along paths that avoid said tube and all other tubes of the fixture.

Among the more particular objects of my invention is further the provision in a lighting fixture of the fluorescent tube type of a construction for obtaining indirect as well as direct illumination.

These objects and other objects as will hereinafter appear or be pointed out are attained in the illustrative embodiment of my invention shown in the drawing, in which:

Figure 1 is a side elevational view of one embodiment of my invention;

Figure 2 is an end elevational view thereof;

Figure 3 is a bottom plan view thereof;

Figure 4 is a fragmentary plan view on an enlarged scale of a portion of the tube supporting frame and the tube portions being broken away to disclose the underlying construction;

Figure 5 is a fragmentary transverse sectional view on an enlarged scale, substantially on the line 5—5 of Figure 1 looking in the direction of the arrows, the wiring being omitted for clearness; and

Figure 6 is a fragmentary sectional view substantially on the line 6—6 of Figure 5 looking in the direction of the arrows.

One of the main causes of light loss in fluorescent tube installations is the absorption of rays given off by a tube either by itself or by other tubes, where the installation comprises more than one tube. Elimination of this source of loss is rendered difficult by the requirements of compactness and of shielding from glare. According to my invention I provide a system of reflecting surfaces by the aid of which substantially one half of the light from each tube is caused to travel downwardly giving direct illumination, while the remaining light is caused to travel upwardly toward the ceiling and the upper portions of the walls, from which it will be reflected, thereby giving indirect illumination. These reflecting surfaces are so arranged that the light reflected thereby will travel along a path that avoids the tube it proceeded from, whereby absorption by the emitting tube is prevented, and at the same time the reflecting surfaces act as shields that will prevent rays from any tube reaching and being absorbed by any other tube of the fixture.

More specifically, I arranged a plurality of fluorescent tubes in spaced, parallel relation, with their longitudinal axes lying in a plane, and intermediate each pair of tubes I position a reflecting arrangement, which in the illustrative embodiment disclosed herein is shown by way of example, as in the form of a tube of diamond-shaped cross-section having two opposed angles or apices lying in the aforementioned horizontal plane containing the longitudinal axes of the tubes, while the remaining two angles or apices lie in a vertical plane. The outer surfaces of these tubes are suitably treated to make them efficient reflecting media for the emanations of the fluorescent tubes. For example, they may be of aluminum with their surfaces suitably treated to make them reflecting, or the surfaces may be oxidized. Again, to give another example, the tubes might be of steel, with chromium-plated reflecting surfaces.

The reflecting tubes are preferably of such horizontal extent that they substantially fill the space between adjacent tubes, whereby the emanations from the upper half of the tube will be prevented from traveling downwardly, and vice versa.

Practical considerations, such as manufacturing tolerances necessitated by factors such as interchangeability of parts and difference in coefficients of expansion of the various materials used may call for spacing, which, however, will be kept to the minimum, except where particular requirements make spacing other than the minimum desirable.

In vertical extent the reflecting tubes are so dimensioned that shielding of the tubes from each other will be effected. For this purpose I may make the vertical height of the reflecting tubes equal to the diameter of the fluorescent tubes. As a practical matter, a vertical dimension slightly less than this may be found, from a practical standpoint, to be satisfactory, as will be understood from an analysis of the light emission from the fluorescent tubes.

I have found reflecting tubes of the character described to be applicable to a system of fluorescent tubes spaced according to the rule prescribed by the manufacturers of such tubes for

obtaining the best results, which requires a spacing of approximately two and three quarter inches for tubes one and one half inches in diameter. Using these specifications the reflecting tubes have a horizontal dimension approaching one and a quarter inches as nearly as practicable, as explained hereinabove, and a vertical dimension of one and one-half inches or slightly less.

To further increase the effectiveness of the reflecting tubes, I have shown their walls slightly concaved in transverse section, whereby parabolic reflection in one plane may be approximated.

Referring now to the drawing for a detailed disclosure of the illustrative embodiment of my invention, I have shown at A an illuminating system which is supported from the ceiling by supporting members B depending from a canopy C which is hung from the ceiling D in any suitable or preferred manner, such as any of the conventional ways now in ordinary use.

The illuminating system A is shown as comprising an elongated channelled member 10, provided with a pair of transverse brackets 11 each apertured so as to receive within such aperture the end of a pipe or conduit 12 which constitutes the core of each support B. Each pipe 12 has its end threaded as shown at 13 and held in place in said aperture by a pair of lock nuts 14.

The channelled member 10 is shown closed at the top by a cover 15 suitably apertured to permit the pipe 12 to pass therethrough, and this cover is shown as provided with flanges 16 which may be sprung into place over the side walls of the channelled member 10. Each pipe 12 is shown surrounded by a finishing tube 17 which also passes through the aforesaid aperture in the cover 15, and seated on said tube is shown a seating or slip ring 18 which is secured in place in the conventional manner by a set screw. It will be observed that the slip ring 18 serves to lock the cover 15 in place on the channelled member 10.

It will be understood that the pipes 12 of the supports B, in addition to their supporting function, serve as conduits for the electric wiring by means of which the fluorescent tubes in the illuminating system A are connected to the source of power and to auxiliaries of the conventional type, which may be located within the canopy C, if desired, or at some other point. The channelled member 10 also serves to conduct said wiring.

When it is desired to have access to the wiring it is merely necessary to loosen the slip rings 18 and to raise them, after which the cover 15 may be raised by sliding it over the finishing tubes 17 a sufficient distance to make the wiring accessible.

The cover 15 also serves to support starters 19, one for each fluorescent tube, which are conveniently arranged to plug into receptacles carried by the cover 15 on its under side, while the starters themselves are carried on the upper side of the cover 15.

The lower portions of the channellel member 10 have their walls 20 and 21 contoured and surfaced so as to form part of the reflecting system, as will be explained more fully hereinafter.

Attached at its midportion to each end of the channelled member 10 and extending transverse thereto, is a hollow frame section 22 comprising an inner member 23 provided with outwardly extending flanges 24 and 25 (see Figures 4, 6), and an outer member 26 provided with inwardly extending flanges 27 adapted to overlie the flanges 24, as shown in Figure 6, so that the inner member 23 nests within the outer member 26.

A portion 28 of each member 26 extends beyond the member 23, and serves as a seat for the end of a reflecting tube 29, generally of diamond-shaped cross-section, however with its sides slightly concaved, so as to secure approximate parabolic reflection. The tubes 29 are secured to the portions 28 in any suitable or preferred manner. I have shown for this purpose a plug 30, contoured so as to fit into the end of the tube 29, and having the head 32 of a screw 31 imbedded therein so as to be rigid therewith. The end of the screw passes outwardly through an opening in the portion 28 and is engaged in trreaded relation by a knob 33, by means of which the plug may be clamped to the said portion 28 (see Figure 4). In order to hold the plug 30 in place in the tube 29 I have shown screws 34 passing through the walls of the tube 29 and into threaded engagement with the plug (see Figure 4).

On viewing Figures 2 and 5 it will be observed that the members 22 are shown as decreasing in vertical width or height from their mid portions to their end portions. This serves to eliminate superfluous material and eliminate bulk and to impart more pleasing outlines to the fixture.

It will be observed that the members 22 are hollow and will therefore serve as conduits for the wiring W (see Figure 6) which also passes through the channeled member 10, as already explained. It is therefore obvious that the connection between the members 22 and 10 must be of a character to allow passage of the wiring from one to the other. I have shown the connection between said members in the form of a flange or flanges 35 on the ends of the channeled member 10, into which pass screws 36, having their heads seating on the member 23. In order to provide the necessary space for the wiring, the flanges 35 are made of limited extent, so as to obstruct the passage as little as possible.

Mounted on the inner wall of the member 23 at spaced intervals are sockets 37, each adapted for the reception of an end of a fluorescent tube 38, six such tubes being shown, by way of example, although obviously any other number may be used.

Between each pair of fluorescent tubes 38 is positioned a reflecting and shielding tube 39, these being of a cross section substantially as described for the tubes 29. Their mounting is however shown different from that of the tubes 29. It consists of an opening provided in each of the members 23 into which an end of the tube 39 may be inserted and in which it is slidable. The tubes 39 are made of a length that exceeds the distance between the members 23 but is somewhat less than the distance between the members 26. In this way the tubes 39 have a limited play in their setting even after completed assembly. This play is indicated in Figure 4 by the dot and dash lines 39'.

This mounting for the tubes 39 is found very convenient during the process of assembling the fixture, which consists in attaching one of the members 22 to the channel 10 and to one end of each of the tubes 29, then positioning the tubes 39, then adding the section 23 of the other member 22 and finally the section 26 is added. The

advantage of limited longitudinal adjustability in the tubes 39 during these final steps is found to be considerable. Obviously however other ways of mounting the tubes may be found equally satisfactory or even preferable for particular purposes.

It will be observed that each of the reflecting tubes 39 is generally diamond-shaped in cross section, and that two of its apices 40, 41 are vertically aligned and the other two 42 and 43 horizontally aligned and each in close adjacency to the fluorescent tube 38, so as to substantially obstruct the space between each pair of fluorescent tubes and prevent the passage of light from the surface of the upper half of each fluorescent tube, below the fixture, and the passage of light from the lower half of the fluorescent tube above the fixture. As already explained, practical considerations will not ordinarily permit the attainment of this ideal condition.

The surfaces of the reflecting tubes 39 are made reflecting in any suitable or preferred manner, as already explained, and are also preferably concaved in transverse cross-section, so as to obtain an approximation of parabolic reflection.

By spacing the apices 40 and 41 a distance equal to the diameter of the tubes 38, as shown, complete shielding of each fluorescent tube 38 from its neighbor will be effected, where the fluorescent tubes and the reflecting tubes are mounted at the same level.

The horizontal spacing of the apices 42 and 43 is determined by the compactness desired in the fixture as well as by the optimum spacing recommended by tube manufacturers already mentioned.

It will be observed that the lower surfaces 20 and 21 of the channel member 10 are contoured and dimensioned similarly to the corresponding surface of the reflector tubes 39 and perform similar functions.

It will further be observed that only the inner surfaces of each of the tubes 29 is directly effective in relation to the fluorescent tubes 38. However an ornamental touch is added by making these tubes also of diamond shaped cross section, and there is a manufacturing advantage in the greater uniformity of material so secured.

While I have herein disclosed one illustrative embodiment of my invention, it will be understood that it may be embodied in many other forms, as will be obvious to those skilled in the art, without departing from the spirit thereof, and that the disclosure herein is by way of illustration merely and is not to be interpreted in a limiting sense, and that I do not limit myself other than as called for by the prior art and the terms of the claims.

Having thus described my invention and illustrated its use, what I claim as new and desire to secure by Letters Patent, is:

1. In a fluorescent tube lighting fixture, a main channeled member, means for mounting fluorescent tubes carried by said member, said member being open at the top, a cover adapted to close the open top of said member, at least one tubular support for supporting said main member from a ceiling attached to said main member at an interior point thereof, an opening in said cover through which said support may pass and whereby said cover is slidable on said support, and means adjustable vertically on said tubular support and adapted in one of its adjusted positions to clamp said cover in place.

2. In a fluorescent tube lighting fixture, a horizontally extending elongated channeled member, a cover for said member, tubular means for supporting said channeled member from a ceiling, said tubular means passing through said cover whereby the cover is slidable on said tubular means, horizontally disposed sectioned end members supported from said channeled member and said end members being hollow and communicating with said channeled member so as to serve together with said channeled member and said tubular means as a passage for wiring, sockets for the fluorescent tubes carried by said end members and starters for said tubes carried by said cover.

3. In a fluorescent tube lighting fixture, a horizontally extending elongated channeled member, a cover for said member, tubular means for supporting said channeled member from a ceiling, said tubular means passing through said cover whereby the cover is slidable on said tubular means, horizontally disposed sectioned end members supported from said channeled member, said end members being hollow and communicating with said channeled member so as to serve together with said channeled member and said tubular means as a passage for wiring, sockets for fluorescent tubes carried by said end members and starters for said tubes carried by said cover, said end members being readily detachable, whereby on raising the cover of the said channeled member the wiring for the starters will be readily accessible and whereby on detaching portions of said sectioned end members, wiring for the sockets will be readily accessible.

4. In a fluorescent tube lighting fixture, a supporting frame comprising a central channeled member, hollow transverse end members each constituted by a pair of interfitting sections, means for removably attaching the inner section of each of said end members to said central channeled member, means for removably securing the opposed end portions of the outer sections of said respective end members together so as to hold them in place on said inner portions of said end members and mounting means for fluorescent tubes carried by said inner section of each end member.

5. A lighting fixture for industrial illumination to give a light distribution throughout a room which is uniform in the working plane, said lighting fixture being open at the top and bottom so as to permit the light to be distributed upwardly and downwardly, said lighting fixture comprising a frame for supporting a plurality of fluorescent tubes in parallel spaced relation and elongated reflectors disposed between adjacent tubes, said reflectors being each constituted by concave reflecting surfaces meeting each other in four outwardly directed apices spaced 90° apart, with a pair of oppositely disposed apices lying in the horizontal plane containing the longitudinal axes of the two tubes immediately to opposite sides thereof and being in substantial contact with the surface of said pair of tubes whereby the illumination emanating from each tube is sharply cut off at said plane into two components, with one component distributed generally downwardly and laterally partly by reflection and with the other component distributed upwardly and laterally also partly by reflection and adapted to be redistributed laterally and downwardly by reflection from the ceiling so as to supplement the distributed illumination from the lower half of the tubes to give an illumination which is uniform in the working plane.

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