June 19, 1962 R. W. LESTER 3,040,169

FLUORESCENT TUBE FIXTURE

Filed March 5, 1959

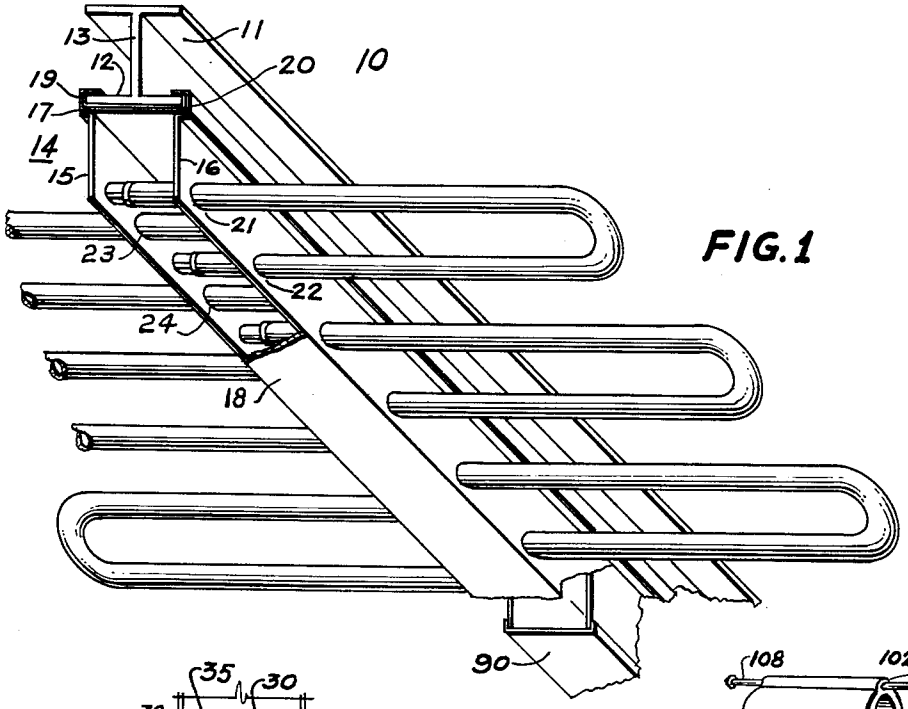


FIG. 1

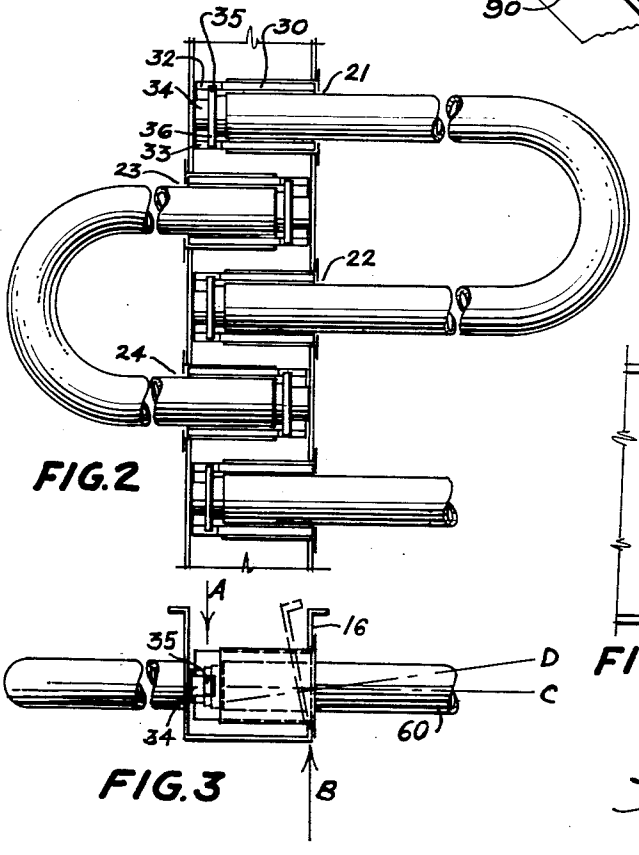


FIG. 2

FIG. 3

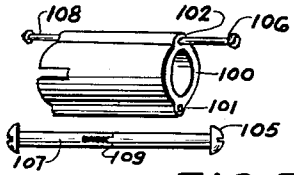


FIG. 5

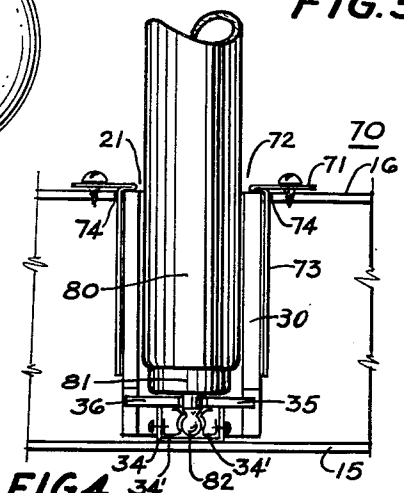


FIG. 4

INVENTOR.

Robert W. Lester

BY

Thomas & Thomas

United States Patent Office 3,040,169 Patented June 19, 1962

3,040,169

FLUORESCENT TUBE FIXTURE

Robert W. Lester, Mount Vernon, N.Y., assignor to Transolite Corporation, New York, N.Y., a corporation of New York

Filed Mar. 5, 1959, Ser. No. 797,382
13 Claims. (Cl. 240—11.4)

This invention relates to fluorescent light tube fixtures and, in particular, is concerned with an advantageous form of fluorescent tube fixture employing hairpin shaped tubes, characterized by its capacity to support the tubes directly without the use of hardware of any kind on most of the length of the tube.

In conventional fluorescent lighting systems the fixture units are provided with ballasts and the straight tube requires a fixture which is, in general, several inches longer than the tube in order to provide for support of the long tubes used. These mechanical considerations have further implications when the tubes are actually in use. Thus, for example, the four foot tube is a common piece of equipment and is very popular in commercial buildings. This is because the single tube of that length gives a large amount of light, can be relatively easily handled, and the four foot fixture is small enough to find use in many spaces. A six foot tube is not nearly as common as the four foot tube, simply because it becomes a bit unwieldy to handle. That is, a tube having a small pin terminal at each end being six feet in length becomes difficult to handle by a single operator, because the straight line fixture requires accurate alignment and a spring mounted socket at least at one end to receive such a tube.

The twelve foot tube and sixteen foot tube are unknown to commercial installations, largely because they create a severe storage problem and handling problem when brought from location to location within a given building. This is largely because doors are usually only seven or seven and a half feet high.

It is observable in large installations, for example, in modern office buildings, where hundreds of fluorescent lighting fixtures may be used, that the entire installation becomes a substantial engineering task from the standpoint of wiring, mechanical support of fixtures, tubes, translucent ceilings, and the like. The installation requires a large amount of highly skilled labor, and a substantial expenditure to complete.

It is the fundamental object of this invention to obviate substantially all of the disadvantages of the straight line tube installations through the use of a modified fluorescent tube with fixture characterized by its providing sockets in a single channel to simplify the installation, and also by its use of hairpin type tubes, which are also supported by the channel.

It is a further object of the invention to provide the single channel mount for the hairpin type U tubes and to simplify the mechanics of the installation by providing a modified socket mount within the channel so that no external support of the tube outside of the channel itself is required.

Other objects and advantages of the invention will in part be obvious and in part appear hereinafter as the description proceeds.

The invention, accordingly, is characterized as a fluorescent tube fixture having a fundamental channel form. The fixture thereby being self-contained, having all sockets and ballasts and wires for firing the tubes carried within the channel and, in addition thereto, having mechanical structure arranged within the channel so that individual hairpin tubes are carried thereby. More specifically, the structure involves a mount for the hairpin tubes which are characterized by its being a sleeve having an opening on one face of the channel adapted to receive the tube and

carrying the socket floating to eliminate mounting for making electrical contact with the tube at the other end of said sleeve on the other face of the said channel, the tube being supported by the socket-channel structure in a fashion such that a couple is exerted on the tube over the terminal few inches of the ends of the tube, thereby to support the tube adequately in place without the use of any additional hardware.

The invention therefore is embodied in the fixture comprising the features of construction, combinations of elements and arrangements of parts hereinafter to be described in greater detail.

A more detailed understanding of the invention may be developed by reference to the drawings conjointly with reference to the specification.

In the drawings,

FIGURE 1 represents a perspective view of a beam support for a fixture embodying the principle of this invention with the channel bottom laid open to show the internal staggered arrangement of sockets and supports for the ends of the hairpin tubes;

FIGURE 2 is a plan view of the channel with the bottom open showing in somewhat greater detail the staggered arrangement of tubes, sockets and sleeves for providing details of the support;

FIGURE 3 is a transverse section across the channel or a longitudinal section along the axis of one of the tubes to show the relationship of the several parts;

FIGURE 4 is a modified version of the structure for holding the end of a tube substantially in accordance with FIGURE 3, but in modified form. FIGURE 5 shows more detail.

Referring now to FIGURE 1, **10** represents a structural beam spanning the area to be lighted. The beam has upper flange **11**, lower flange **12** and web **13**. The details of construction of a special beam suitable for being propped between the walls of a structure are described in my copending patent application, Serial No. 804,181, filed April 6, 1959, now issued as United States Patent 2,986,246, and Serial No. 742,391, filed June 20, 1958. The only feature of the beam necessary for consideration in connection with this invention is the provision of axial support at approximately ceiling or fixture height over an area to be lighted.

Hence, in FIGURE 1, **14** represents a channel member having sides **15** and **16**, top **17**, bottom **18**, and upwardly extending members, **19** and **20**, U-shaped and suitable for engaging the lower web of the I beam in sliding engagement, so that the portion of the channel fixture may be thereby fited on to the web of the said I beam and simply slid into position.

The fixture itself is essentially all contained in the channel member **14**, which carries ballasts and means for bringing wires to the ballasts and therefore to individual sockets.

Each of the sides **15** and **16** of the channel, at spaced intervals throughout its length, carries openings therein suitable for mounting the supports and sockets for the fluorescent tubes. This side **16**, for example, carries openings **21** and **22**, while side **15** carries openings **23** and **24**, as shown in greater detail in FIGURE 2.

With the provision of these openings, in staggered relationship on opposite sides of the channel, it becomes possible to mount sockets for hairpin tubes and simultaneously to provide mechanical support for the tubes by means of the channel itself.

Thus, aligned with opening **21** is plastic sleeve **30** which is of a length to pass from one face of the channel to the other and bears against the opposite inside face of the channel. Actual mechanical connection may be provided, though it is not necessary. The sleeve **30** is preferably slotted at its end to give slots **32** and **33** means for receiv-

ing socket **34**. Accurate alignment of the socket with the axis of the sleeve is accomplished by receiving the ears **35** and **36** of the socket within the slots **32** and **33** respectively.

This structure for a U tube is duplicated at spaced intervals farther down the channel at opening **22**. The openings **23, 24** provide access to the channel for the ends of other hairpin tubes to be carried by the respective sockets. At each of these the sleeve, slots, the socket and respective ears of the socket are reproduced. As shown in detail in FIGURES 3 and 2 the sleeves are mounted against the supports and carry the slots and sockets by means of the ears. The corresponding pattern of openings, sleeves, sockets is built into the opposite face of the channel and the ends of the tubes may be alternated as shown in FIGURE 2.

Referring to FIGURE 3 which shows a sectional view taken along the axis of one of the tubes, the relationship of the several parts will be seen. Here, any tube **60** is shown in place. Diagrammetically, by means of arrows A and B, the orientation of the forces developed by the socket and sleeve are shown. Thus it will be seen from FIGURE 3 that there is developed at the end of the tube a couple which is composed of two equal and oppositely directed forces acting on the tube at an interval of a few inches, corresponding to the width of the channel. Since the size of tube used dictates the size of ballast, and the ballast is encased in the channel, the larger tubes will have wider channels. In general, however, the channel width need not be more than $\frac{1}{10}$ to $\frac{1}{12}$ of the length of the U of the tube.

In FIGURE 4 a modified version of the structure is shown. Herein the plastic sleeve corresponding to **30** is shown, but in order to provide for the contingency which arises when a socket develops a defect so as to become inoperative and require replacement, the opening **21** is enlarged so that the sleeve **30** can be removed directly without dismantling the fixture. Keeper **70** which consists of external flange member **71**, defining a central orifice **72** large enough to pass a tube and corresponding approximately to the inside diameter of sleeve **30**, is fitted within the opening and tubular extension **73** is formed large enough to receive the outside diameter of the plastic sleeve **30** and extend substantially across the channel. By means of the detent ring **74** around extension and also by providing a slit in the supporting sleeve member **73**, it is possible to form the flange support as a single stamping, which is press-fitted into the orifice **21** in the side of the channel to hold the entire socket-sleeve assembly in place. Accordingly, with the development of a defect in a socket it becomes necessary simply to pry the flange member **71** out, slide it out of the channel and thereupon to lift the plastic tube member **30** out and at the same time to reach the socket to replace it.

With the showing of FIGURE 4, the functioning of this device will be quite apparent.

FIGURE 4, being in section illustrates an additional feature of the hardware. Socket **34** conforms to conventional dimensions for fluorescent tubes, but the female portion is equipped with spring electrical contacts **34'** so that the tube **80** having its end **81** equipped with grooved pin **82** is firmly and positively engaged in the socket. Thus electrical contact is made and one point for support of the tube established.

In the structure as shown in FIGURES 1, 2, 3 and 4, the practical and installation advantages will be quite apparent from the geometry.

Thus, under normal circumstances, using straight line tubes, fixtures for mounting tubes longer than four feet become heavy and unwieldy. In addition, the tubes themselves, once length passes four feet, become quite unwieldy and accordingly, offer little commercial attraction. By means of this structure which provides for the mounting of a tube in hairpin form from a single plane, it becomes possible to handle the equivalent in U-form of tubes which would be 8 feet long in straight line construction. Actually, formed in accordance with this invention, I have found it possible to support 4-foot hairpin tubes employing a channel which is only four inches wide. In fact, the factor of approximately one inch of channel width per foot of the length of the U is a reasonable empirical factor to employ in design. Actually six foot tubes have been adequately supported from four inch channels but inasmuch as the length of the U becomes so great, I prefer to use a channel which may be as much as six inches in width for hanging six foot U tubes. Such tubes, it will be obvious, are the equivalent of 12-foot straight line tubes.

Further refinements of the design will be apparent from an inspection of FIGURE 1, where there is shown a snap-on bottom cover **90** for the channel. This cover merely utilizes sheet metal in the form of a broad based U placed so that when the cover is fitted into place on the formed open bottom channel, it slides up to or around the openings provided for receiving the ends of the U tubes. It will also be apparent that the bottom face of the channel can be either cut out or formed from transparent plastic, if so desired. However, since this form of installation is used principally in connection with the provision of luminous ceilings over large rooms, it will be apparent that the few inches of light which are lost by placing the ends of the tubes within a channel are of no real consequence. As a matter of operating experience, it is a common observation that a U tube or any fluorescent tube will develop a dark area over the first few inches of the end of the tube. Accordingly, what has previously been an aesthetic disadvantage in the application of straight line tubes to lighting installations becomes an actual advantage in the practice of this invention, because the area of the tube which normally becomes the unsightly dark section is hidden within the channel by virtue of the hardware used in mounting and that dark section itself is utilized as part of the support for the tube.

It will be seen from the description of FIGURES 1, 2, 3 and 4, particularly FIGURE 1, that the fixture with its variants is particularly suited for adaptation to the lighting of large areas where the installation of large numbers of fluorescent fixtures to carry the corresponding tubes is desired. Thus, in the channel, the necessary ballasts for firing the tubes can be mounted and, as indicated in FIGURE 1, the ballasts will be mounted generally on the surface which is indicated to be the top of the channel. The channels may be of any length desired, but conveniently are made about 4 feet long so that they will receive three pairs of U tubes. Spaced within the channels are the sockets to provide electrical connection to the tubes. Also, the channel provides ample room for the passage of electrical wiring from ballast to ballast and from ballasts to sockets. That is, the electrical wiring is a mechanical detail forming no part of the invention and, inasmuch as the channel provides ample room for the wiring, it can be done without difficulty. Accordingly, utilizing only a single structural member which may be a beam spanning the room, and may be made in accordance with the special design described in my copending application, Serial No. 804,181, filed April 6, 1959, now issued as United States Patent 2,986,246, and Serial No. 742,391, filed June 20, 1958, now Patent No. 3,003,602, issued October 10, 1961, all of the hardware necessary for providing ample high-level illumination in the room is provided. Furthermore, the U tubes are favorably mounted in the channel with no external support over any portion of the tube extending out from the channel itself.

The details of the fixture, namely those involved with the couple or cantilever type support for the U tube itself, as shown in FIGURES 2 and 3, may be varied to suit the application involved. Actually, with the formation of the sleeves in accordance with the description of FIGURES

2, 3 and 4, small amounts of play may be provided at the openings so that the equipment is easily assembled, and, equally important, is easily disassembled to permit replacement of a defective socket where this is called for. For example, the structure shown in FIGURE 4 is particularly well suited for the purpose in that with failure of a socket, it is necessary merely to pry loose the disks which appear on the outside of the channel. That is, the flange is pried loose and the accompanying metal sleeve slipped out of the channel. Thereupon, the remainder of the hardware supporting the tube may be removed, because it is floating free, in that the plastic sleeve may be slipped out of place and the socket remaining is merely connected into the circuit by means of a conventional pair of wires. Simple disconnecting of the wires permits removal of the socket and accordingly, replacement.

It will be apparent from the description of the hardware in connection with FIGURES 1 and 2 that the possibilities for variation in design of the fixture and numbers of fixtures to be mounted in tandem or parallel rows across a space may be varied to suit the architect or engineer who is handling the design of a particular installation. In general, an installation of tubes in straight line relationship approximately as shown in FIGURE 1, will be suitable. The spacing may be varied in that the tubes need not be placed as close together as shown and the interlaced arrangement of sockets can be merely an arrangement of alternate pairs faced in opposite directions. Usually, an installation in a room of ordinary dimensions, for example, approximately 15 to 20 feet in width, can be adequately lighted by a single span corresponding to the beam **10** of FIGURE 1 and a double row of hairpin tubes, one set extending from each side of the span, the U's of the tubes being five to six foot U's. In a square room approximately 15 to 20 feet square, a single fixture in the center of the room having a plurality of 6 or 8 foot U's pointed toward the several sides and corners of the room either from a square or octagonal centrally placed fixture is useful.

In FIGURE 3 the manner in which the support for the tube is developed by the forces A and B being exerted over the terminal few inches of the tube is illustrated. Here, also, by means of the lines C and D, there is illustrated the mechanism by which the tubes may be cocked at angles to the horizontal to attain novel lighting effects, particularly in outdoor installation. That is, commonly with modern architecture, a building may have a large overhang supported at an angle extending upward in order to "capture sunlight" during the day. Such architectural arrangements on buildings create the possibility and even the need of utilizing novel lighting effects at night and this fixture is adaptable to the cocking of fluorescent tubes to match such angles. As indicated in FIGURE 3, this can be done with a flush mounting of the sleeves on the side of the channel to attain the horizontal result. Cocking can be achieved by having the side of the channel tilted inward as shown in dotted lines to achieve the upwardly tilted axis C or the sleeve hardware itself can be cocked to a downward angle with appropriate shims to achieve the result. Since the geometrical end result of a tilted axis of the tube is being sought the details of the hardware may vary. In general, more finished fixtures and a more workmanlike job is achieved by developing the inclination of the axis of the tube by inclining the sides of the channel.

Details of an additional preferred form of sleeve for supporting the tubes are shown in FIGURE 5. There sleeve **100** is formed with a circular opening as shown. Integral therewith are diametrically opposed extensions **101** and **102** which extend the length of the sleeve. Holes in the respective extensions run the length of the sleeve also. Screws **105** and **106** mate with elongated nuts **107** and **108** respectively with the joints enclosed within the respective opening in extension **101** and **102**. That is, the preferred form of screw is like that shown in **105**—**107** where one end is a female section **107** which threads onto the male section **105** to form a butt joint at **109**.

The sleeve thus formed is aligned with channel openings as shown in FIGURES 2–3–4 and adjacent screw holes are aligned with the sleeve holes corresponding to **101** and **102**. The heads of the screws engage the sides of the channels and a firm mount of the sleeve between channel walls is thus formed.

The various forms of plastic sleeve described are preferably molded of high impact strength resin, such as styrene. Actually any resin may serve because very little heat is generated by the lamps.

Though the invention has been described with reference to only a limited number of examples it is to be understood that variants thereof may be adopted without departing from its spirit or scope.

What is claimed is:

1. A fixture for supporting hot cathode fluorescent tubes in fixed relationship to a space to be lighted, which comprises, a channel means of substantially greater length than width, said channel means having two parallel sides arranged to be supported in a position wherein said sides will be substantially parallel to the floor of the space, thereby to provide a raceway extending in fixed parallel relationship to the floor of the space to be lighted, spaced staggered openings in the said parallel faces of said channel, the said openings on the opposite faces being offset from each other, sleeves extending from said openings to the opposite side of said channel member, means to hold said sleeve in fixed relationship to the said channel member, a socket held in each of said sleeves substantially adjacent to said face of said channel, the sleeve having an inside diameter sufficient to pass a fluorescent tube of standard dimensions, whereby said tube is supported entirely from the end thereof within said socket, said fixture providing support for said tube through the exertion of a couple on the end.

2. A fluorescent tube assembly in accordance with claim 1, wherein the channel carries two sets of sockets, each set consisting of pairs of sockets spaced to accommodate a hairpin tube, one set of said sockets being situated adjacent to one inside edge of the outer casing of said fixture, the receptacle portion of said socket being directed toward the opposite face of said channel and being aligned with an opening in said channel to receive the end of a fluorescent tube, each pair of sockets being offset longitudinally of the outer casing relative to the other pair of sockets, a pair of sockets situated adjacent to one side edge of the outer casing being adapted to receive the ends of a U-shape fluorescent light tube extending across the opposite side edge of said outer casing, and support means for said fluorescent tube comprising a sleeve extending substantially from the opening in one face of said channel to the opposite face of said channel where said tube socket is mounted.

3. In an assembly for carrying U-shaped hairpin fluorescent tubes which is characterized by the mounting of sockets on an inside face of a channel and receiving the end of a fluorescent tube through an opening in the opposite face of said channel thereby to develop a couple to support said tube between said socket and the opposite face of said channel, the improvement which comprises providing a plastic sleeve extending from the opening in one face of said channel to the opposite inside face of said channel, said sleeve also carrying the socket to receive the end of said fluorescent tube, and support means for said sleeve comprising a metal sleeve adapted to surround said plastic sleeve and further carrying a transversely arranged flange which is formed to hold said sleeve and socket assembly in fixed tube receiving relationship to the said two faces of said channel.

4. A channel in accordance with claim 1 wherein the fluorescent tube sockets mounted within said channel are

alternately oppositely oriented, whereby tubes mounted therein are interlaced within the channel.

5. An illuminating system for a space which comprises a structural member spanning said space along an axis defining a center of illumination, said structural member being held in fixed spaced relationship in said space at a level approximating the level of conventional illumination, a web member downwardly extending from said structural member, an electrical fixture carried by said web member, said electrical fixture being characterized by its having on its upward face a pair of oppositely mounted U-shaped members adapted to grasp said web, a channel carried thereby, staggered openings on opposite faces of said channel, said openings in each instance being in spaced pairs to receive the individual ends of individual U tubes, the openings further being aligned with sockets on the inner opposite face of said channel, thereby to provide for access for each of the U tubes to a corresponding pair of sockets by passing through one side of the channel to reach sockets mounted on the other side of the channel, whereby when U tubes are mounted in place they are supported by a couple developed over the end of the U tube by means of its physical connection to the socket and its resting on the sleeve in a side of the channel.

6. A fixture for supporting fluorescent tubes in fixed relationship to a space to be lighted, which comprises, a channel means of substantially greater length than width, said channel means having two parallel sides arranged to be supported to provide a raceway extending in fixed relationship to the floor of a space to be lighted, space openings in the said faces of said channel, the said openings on opposite faces being offset from each other, means extending from said openings substantially to the opposite face of said channel member in fixed relationship to the said channel member, sockets held in floating position in each of said means substantially adjacent to said face of said channel, the means having an inside diameter sufficient to pass a fluorescent tube of standard dimensions, whereby said tube is supported entirely from the end thereof by said socket, said fixture providing support for said tube through the exertion of a couple on the end.

7. A fixture for supporting fluorescent tubes in fixed relationship to a space to be lighted which comprises a base suitable for receiving the two ends of a U-shaped fluorescent tube, said base being suitable for being supported in fixed relationship to a space to be illuminated, openings in said base arranged in pairs to receive the ends of fluorescent U-shaped tubes, means extending from said openings into said base, said means being held in fixed relationship to said base, sockets held in floating position in each of said means with limited amount of play, the means for holding said socket having an inside diameter sufficient to pass a fluorescent tube of standard dimensions so that said tube may electrically engage said socket, said tube thereby being supported entirely from the end thereof by said socket and said means carried by the base.

8. A fixture in accordance with claim 7, wherein said base has sides which are substantially parallel and arranged to be supported perpendicular in a space to be lighted and means for receiving the tubes are held so that the axis thereof is substantially parallel to the floor of the space to be lighted.

9. A fixture in accordance with claim 7, wherein said means for supporting the tubes is mounted so that the axis thereof is at a small angle to the horizontal.

10. A lighting fixture which is characterized by the combination of hairpin type U tubes, wherein an individual tube has a U shape, having the two ends thereof separated from each other by a predetermined distance, with a base for supporting said tube from its ends, said fixture providing electrical contact at the ends of the tube and also a downward force at the ends of the said tube, the fixture further providing at a distance spaced approximately $\frac{1}{12}$ to $\frac{1}{10}$ the length of the tube from the electrical contacts, a support providing an upward force on the tube, said tube ends being further characterized by indented end pins in the tubes, whereby when the tube is set in place, a major portion of the length thereof extends outwardly to an illuminated volume free of any external support and the ends thereof are subject to the couple developed by the electrical fixture to support the tube itself.

11. The fixture combination in accordance with claim 10 in which the electrical contacts in the fixture are spring sockets which positively engage the indented end pins of said tube.

12. In an electrical fixture characterized by structure useful for receiving the ends of fluorescent tubes and enclosing a few inches of the ends of such fluorescent tubes, means for supporting the tubes by exerting force only on the ends thereof thus enclosed, which comprises a spring socket carried by the fixture in combination with a tube supporting collar carried by said fixture a few inches from said socket.

13. In combination with the fixture in accordance with claim 12, a U tube of hairpin form characterized by its having end contact pins circumferentially indented to a diameter less than the maximum diameter at a point between the end of the tube and the extreme outward end of the electrical contact pin.

References Cited in the file of this patent

UNITED STATES PATENTS

2,357,057	Owen	Aug. 29, 1944
2,888,657	Green	May 26, 1959

FOREIGN PATENTS

853,772	Germany	Otc. 27, 1952