Sept. 3, 1946. H. R. OWEN 2,406,896

GASEOUS DISCHARGE TUBE LIGHTING FIXTURE

Filed June 15, 1943

Fig. 1

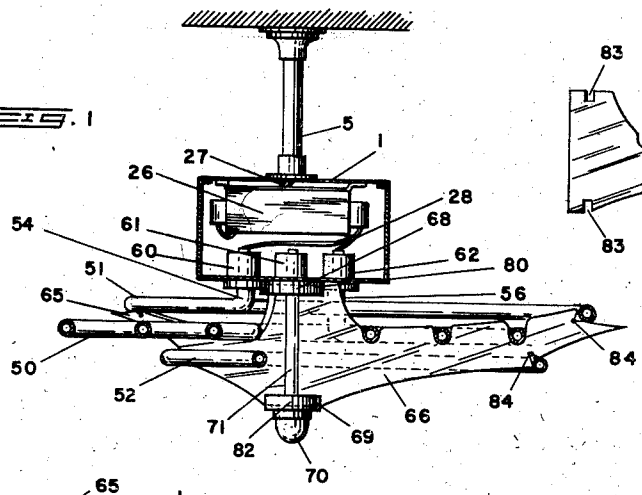


Fig. 7

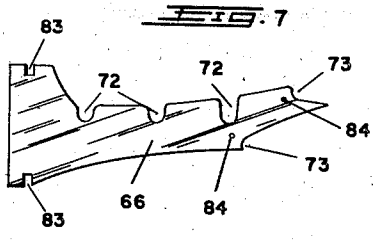
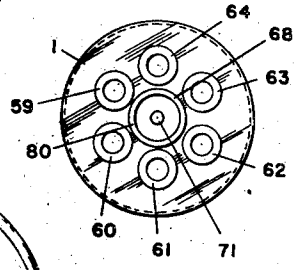


Fig. 3



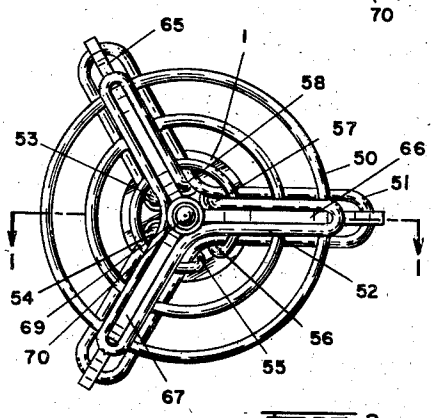


Fig. 2

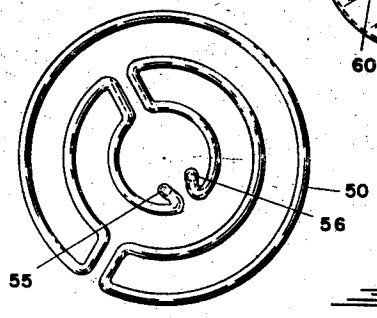


Fig. 4

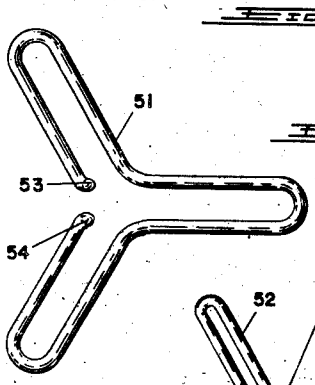


Fig. 5

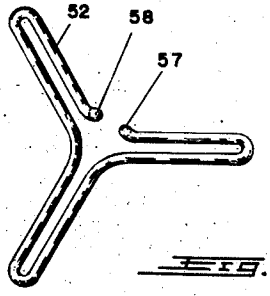


Fig. 6

INVENTOR

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GASEOUS DISCHARGE TUBE LIGHTING FIXTURE

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Application June 15, 1943, Serial No. 490,926

1 Claim. (Cl. 240—78)

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This invention relates to lighting fixtures of the general type utilizing high voltage, cold cathode, gaseous conduction lighting tubes as the illuminants, and is directed to the production of fixtures which will be highly attractive in appearance, efficient in their utilization of electric energy, productive of uniform illumination over extended areas without glare, and which will operate over long periods of time with the minimum of tube replacement.

High voltage, cold cathode lighting tubes are known to be highly efficient and to have greatly extended life spans (when produced in units of sufficient length) as compared with low voltage, hot cathode tubes now in common use. This is due to the fact that, in both types of illuminants, a substantial percentage of the losses take place at the electrodes and in the immediate vicinities thereof. The most important loss is that due to electrode drop, the energy being dissipated as heat and in mechanical action of positive ion bombardment of the cathode. A small amount of light developed at the electrodes incident to this loss is generally of no use in illumination and is also to be counted as loss. Metallic particles sputtered from the electrodes by positive ion bombardment are deposited on the tube walls around and for a substantial distance along the tube from the electrodes. This deposit further contributes to deposition or condensation of particles of mercury, together causing a very material loss of light as the tubes age by shielding off radiation originating in the main discharge column.

These losses are independent of the tube length and hence, the longer the individual tube units, the higher the efficiency. The life expectancy of the tube is also a function of the conditions at the electrodes. Adsorption of gas by the material of the electrode and entrapment in the layer of sputtered material on the tube walls lowers the gas pressure and ultimately increases the resistance of the main discharge column to such a value that the tube will not operate at the voltage normally applied to its terminals. The greater the length of the tube, the greater the amount of gas initially contained and the longer it will take for the pressure to fall to the failure point.

However, the gain in life expectancy increases much more rapidly than the increase in length. This is due to the fact that positive ion bombardment which causes sputtering, gas occlusion and the lowering of gas pressure, itself increases rapidly as the gas pressure falls, so that deterioration is a progressive process once it sets in. Thus by making the tubes long enough so that the process does not set in early, the life of the tubes may be indefinitely extended. Practically, cold cathode tubes of twenty feet or more of length have life expectancies many times that of hot cathode, low voltage tubes now in common use.

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Another factor making for preference of high voltage tubing is the fact that hot cathodes are severely damaged by sputtering during the starting intervals when the electrodes are being heated. Installations subject to frequent switching show excessive tube replacements, an objection entirely absent with cold cathode tubing.

Despite these advantages, high voltage tubing has not found the same general acceptance for interior illumination as low voltage tubing, due mainly to the fact that tubes of sufficient length to evidence these advantages to the extent desired have not been well adapted to fixtures esthetically and commercially acceptable when built according to the prior art practices.

Early attempts at the production of high voltage fixtures had to do with grids of closely spaced tubes. It was found that this resulted in more intense illumination transverse of the tubes than lengthwise and unsatisfactory light effects. Further, the close parallel spacing of the tubes gave rise to electrostatic effects and accumulation of dirt on the tube walls. Attempts were then directed to open spacing of the tubing in circuitous designs. Generally this tubing extended outward from a central housing containing the transformer and terminals with the tubing spread over a considerable area. This gave very satisfactory illumination and low unit surface brightness. However, the early designs were harsh and mechanical in appearance, and introduced objections in the designs of the housings and disposition of the tube terminals.

It is an object of this invention to provide for the construction of fixtures having central housings containing the transformers and terminal receptacles and carrying tubing in considerable unit lengths spreading outward in attractive designs around the housings, well spaced to evidence low surface brightness to avoid glare and electrostatic effects, with all terminals reaching the center of the fixtures, with no obvious connecting portions such as are present in spiral or similar designs, with the maximum of total footage covering a given area, and having mechanical qualities adequate to the requirements of this service.

It is a further object of the preferred forms of this invention to provide fixtures with the tubing extending in the main into free space around the

housings so as to produce a combination of direct and indirect lighting by ceiling reflection, and further, while providing housings adequate to contain the transformers and terminal receptacles, to cause them to become inconspicuous by so lighting them that they merge into the ceiling areas.

I have discovered that the effect of symmetrical designs of concentric figures with radial arms which is very attractive may be had by certain novel combinations and convolutions of tubing in superposed grids in which all of the terminals may be made to return to the center of the designs. The individual tube units are of considerable length but so compact as to be easily handled, and all of the tubing contributes to the illumination, there being no undesired or black-out sections.

The designs present the effect of pluralities of concentric figures, such as circles, squares, or other geometric or fanciful figures overlaid by radial spikes or arms. The radial arms are preferably of paired tubes, or rather U-tube in formation with the terminals at the center of the design. In these designs a single tube may be convoluted to follow the outlines of a plurality of the concentric figures, passing from one figure to the next along radial lines close to and paralleling the radial arms of the designs. This important result is possible because of the fact that the effect of continuous circuitous figures may be had without actually illuminating all of each figure, provided that the interruptions come at the locations of the radial arms.

The important object is thus served that fixtures may be produced in which several compact grids may be used in a design extending over a much larger area than the size of the individual grids, the grids being so associated and connected to each other as to form a sturdy mechanical structure. It is an object hereof to superpose grids of tubing so as to form truss-like assemblies extending away from the housing as self-supporting tube formations to simplify the construction.

Further objects of the invention will be apparent from the following specification taken in connection with the drawing.

The invention is shown in certain preferred embodiments in the accompanying drawing in which:

Figure 1 is a sectional view of a fixture employing one grid of circuitous tubing and two grids of radial arms to produce a novel effect of depth. In this form of the invention I also illustrate the use of reenforcing members in the tube structure.

Figure 2 is a bottom view of the fixture shown in Figure 1, indicating by section line 1—1 the plane of the view of Figure 1.

Figures 3, 4, 5 and 6 are bottom views respectively of the housing enclosing the transformer and the receptacles for the tube terminals, the grid of circuitous tubing, the upper grid of radial arms of tubing, and the lower grid of radial arms of tubing.

Figure 7 is an elevation of one of the reenforcing members.

In the drawing, the same reference numeral appearing in several views is used to indicate the same or the equivalent part throughout.

In Figure 1 and associated views I show a fixture having two courses of tubing in the arm design and one course of tubing in the concentric figure design. An effect of depth is thus produced. In this design I have embodied a set of reenforcing members extending outward between the branches of the arms, serving as a mount for the tubing and as a diffusing member to improve the light distribution.

The fixture housing, indicated by numeral 1, is hung from the ceiling of the room in which it is installed by the conduit 5 through which pass the low voltage leads 27 to the transformer 26 which steps up the voltage to the potential necessary to light the tubes. Suitable receptacles, opening downward to receive the upturned terminals of the tubes, are connected to the transformer by the high voltage leads 28. Any of the standard circuit connections may be used.

The upper course of radial tubing is indicated by 51. It consists of a single tube with the electrodes 53 and 54 extending upward into the receptacles 59 and 60 in the housing. The lower course of radial tubing is also a single tube 52 with electrodes 57 and 58 entering the receptacles 63 and 64. The arms of the upper course are longer and wider than those of the lower course to produce the desired attraction effect.

The middle course of tubing, representing the design of concentric figures, also consists of a single tube 50 with electrodes 55 and 56 entering the receptacles 61 and 62. This tube is convoluted along the outlines of three circles, passing from one to the next by radial sections which parallel branches of the arms of the radial tubes, the electrodes being at the center.

A cup washer 68 is welded to the bottom of the housing in the central position with the rim 80 turned downward. A bolt 71 is also welded in the assembly central with the washer. On the bolt the cup washer 69 is pressed upward by the nut 70 with its rim 82 turned upward. Three radial plates or reenforcing arms 65, 66 and 67 are positioned in the spaces between the branches of the arms of the radial tubes and are caught and securely held by engagement of the rims of the cup washers in the notches 83, as seen in Figure 7. The upper edges of these arms are notched at 72, 72, etc., to receive the tube of the middle course. The tubes of the upper and bottom courses are held in the notches 73, 73, by ties through the holes 84, or by any other suitable means. This arrangement provides a simple and durable construction which may be quickly assembled, disassembled and shipped with little danger of breakage. A suitable material for the arms is translucent cast Bakelite, although any other suitable material may be used.

The invention may be variously modified and embodied in lighting fixtures and installations within the purview of the claim, embracing all substantial equivalents thereof.

Having thus described my invention, what I claim is:

A lighting fixture including: a central housing provided with receptacles to receive and make contact with the ends of a pair of gaseous conduction lighting tubes, a pair of gaseous conduction lighting tubes extending outward from and around the same along a pair of adjacent parallel planes in a decorative design of radiating arms and concentric figures; the first of said tubes being convoluted in a design of double branched radiating arms with the return bends at the extremities of the same, and the second of said tubes being convoluted in a design of concentric circuitous figures starting from the center and following a portion of the innermost figure and proceeding to the next outer figure along a course closely paralleling a portion of a single branch of one of the said radiating arms of the first said

tube, thence following a portion of the next outer figure and proceeding to the third figure along a course closely paralleling a single branch of a different one of said radiating arms of the first said tube and ultimately returning from the outermost figure to the center of the design by following a course closely paralleling the opposite branch of the same individual arm of the first said tube from that followed by the second tube in each passage from one figure to the next,

whereby the interruptions of continuity of the circuitous figures occur between the two branches of individual arms and of a different arm from one of said circuitous figures to the next; and tube support members supported from the housing and extending in vertical planes between the two branches of each of the radiating arms of the first said tube and supporting said tubes.

HAROLD RAY OWEN.