Aug. 29, 1944. H. R. OWEN 2,357,057

LIGHTING FIXTURE

Filed June 15, 1943 2 Sheets-Sheet 1

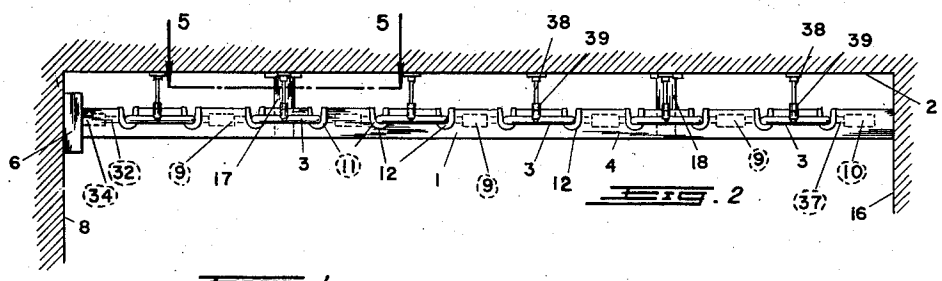
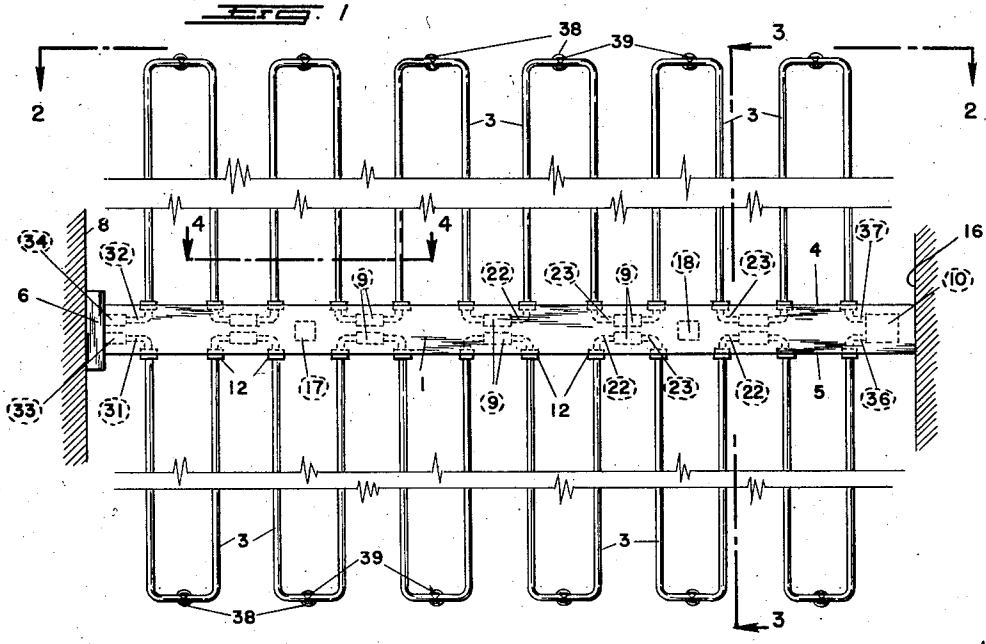


Fig. 2

Fig. 1



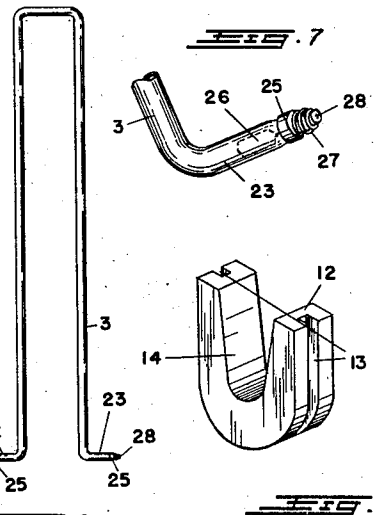


Fig. 7

Fig. 8

Fig. 6

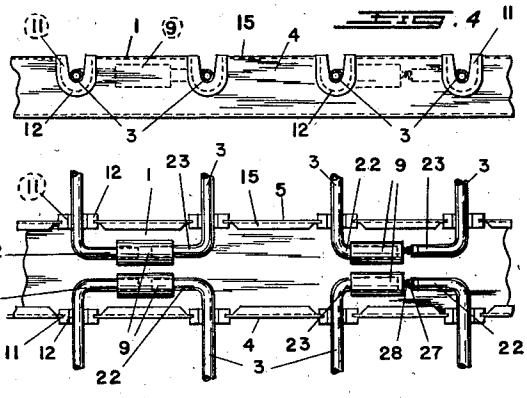


Fig. 4

Fig. 5

INVENTOR.

Harold Ray Owen

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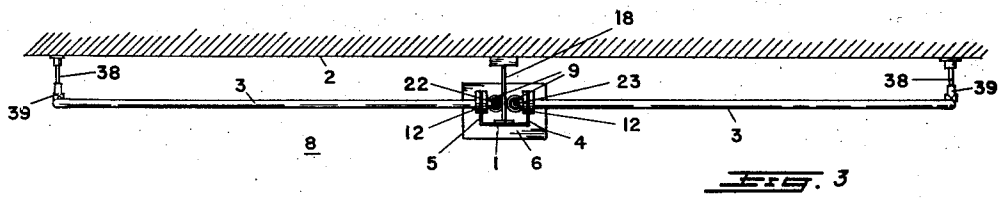
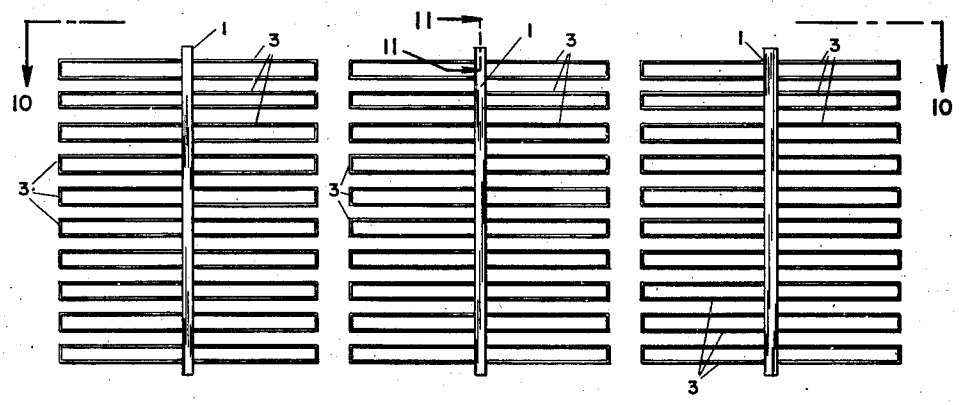


Fig. 3

Fig. 9



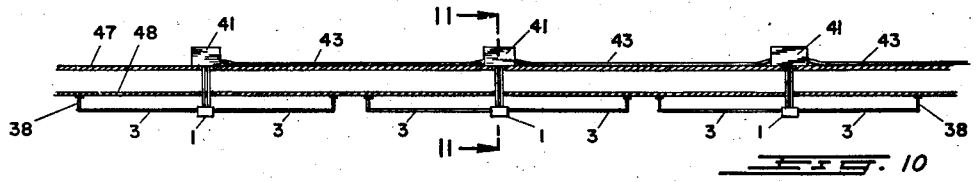


Fig. 10

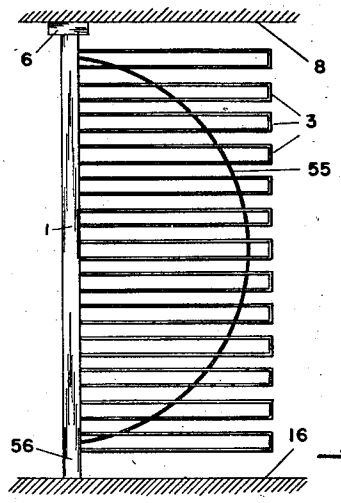


Fig. 12

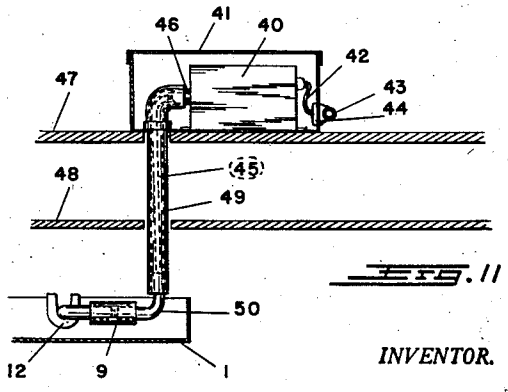


Fig. 11

INVENTOR.

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Patented Aug. 29, 1944

2,357,057

UNITED STATES PATENT OFFICE

2,357,057

LIGHTING FIXTURE

Harold Ray Owen, Los Angeles, Calif., assignor to Electrical Products Corporation, Los Angeles, Calif., a corporation of California

Application June 15, 1943, Serial No. 490,925

4 Claims. (Cl. 240—1)

This invention relates to lighting fixtures employing gaseous conduction lighting tubes and is directed to the production of lighting installations for large interior spaces, such as factory floors and general office spaces, which will provide uniform, well distributed illumination without glare by means of simple and relatively low cost fixtures which will operate for long periods of time at high efficiency and with a minimum of tube replacement.

In the lighting of extended work areas it has been found that the efficiency of mechanics and office workers is materially enhanced by the provision of illumination which approaches the conditions of natural daylight in the open. The ideal artificial illumination therefore, is that in which light reaches the working levels from all directions from above with no light emission area within view of such surface brilliance as to produce glare.

It is an object of this invention to provide this desirable type of illumination by means of a fixture and tube combination which will provide a grid coverage of an entire interior ceiling by evenly spaced runs of tubing making terminal contact in one or several straight narrow troughs with a minimum of mechanical construction and the complete elimination of high voltage wiring except for short connections from the transformers to the first tubes in certain special cases.

Areas of moderately large size may be easily covered by a single trough with its associated tubes, while very large areas may be covered by a number of such units, it being a further object hereof to produce an arrangement of low voltage feeders, transformers, troughs and tubes which may be used to cover as extensive an area as desired with each transformer localized to its individual unit and substantially eliminating the high voltage wiring.

It is known that the efficiency of gaseous conduction lighting tubes increases with the length of the individual tube, all other specifications being the same. This is due to the fact that the non-light producing losses take place mainly at the electrodes, and hence, the longer the tube the lower the proportionate loss. It is an object of this invention to provide fixtures utilizing tubes of considerable unit length and further to use tubes of simple form which may be easily built and handled and not liable to excessive breakage in normal use.

Furthermore the life expectancy of such illuminants is also a function of conditions at the electrode which make for eventual depletion of the gas content. These conditions are progressive in nature once they have set in, but are greatly retarded if the initial volume of gas contained in the tube is sufficiently high. Tubes of the lengths which may be used in my fixtures may be expected to burn the normal numbers of hours per day for many years without replacement except for such causes as accidental breakage, because of the large volume of gas which they initially contain.

Another object is to provide a fixture to which the tubes may be readily connected and disconnected and electrical connections between the tubes made by a simple slip sleeve fitting over the adjacent electrodes of serially related tubes.

Another object of one form of the invention which is particularly adapted for the lighting of extensive factory floors is to provide a simple arrangement of trough and tubes exposed to view below the ceiling with the bulky elements of the transformers installed above the ceiling or roof.

A further object is to produce a fixture which in disassembled form may be packaged in compact containers requiring little space in storage and shipping, but which makes up an extensive tube system when installed.

Additional objects of the invention will be apparent from the following specification taken in connection with the drawings in which I show certain preferred embodiments thereof. In the drawings, the same reference numeral appearing in several views is to be taken as indicating the same or the equivalent part throughout. The invention is to be understood as not limited to the specific forms thereof shown, but as capable of numerous modifications under the scope of the claims and embracing all substantial equivalents of the terms thereof.

Figure 1 is a bottom view of a fixture comprising a single trough with tubes branching in two directions from it, with the transformer installed at one end of the trough.

Figure 2 is a side elevation of the same as indicated by the line **2—2** in Figure 1.

Figure 3 is a sectional view of the same taken as indicated by the section line **3—3** in Figure 1.

Figure 4 is a sectional view on an enlarged scale of a small section of the fixture taken as an elevation and indicated by the section line **4—4** in Figure 1. Figure 5 is a view from above of this same portion of the fixture showing the slip sleeve connection between the tubes and is taken as indicated by the line **5—5** in Figure 2.

Figure 6 is a plan view of a single tube. Figure 7 is a perspective view enlarged showing a

suitable flexible spring contact arrangement for the ends of the electrodes. Figure 8 is a perspective view enlarged of one of the insulating saddles for supporting the ends of the tubes.

Figure 9 is a bottom view of an installation of three troughs with tubes branching in both directions from each such as might be used to illuminate an extensive factory floor space, the transformers being installed above the roof and out of sight in this view.

Figure 10 is a sectional view of this installation through the ceiling and roof taken as indicated by the section line 10—10 in Figure 9.

Figure 11 is a sectional view through the transformer installation with its connection to the trough taken as indicated by the section line 11—11 in Figures 9 and 10.

Figure 12 is a bottom view of a fixture comprising a single trough with tubing branching from it in one direction only and with a single curved tube completing the circuit from one end of the trough to the other so as to eliminate wiring in the trough.

In Figure 1 and its associated views I show a fixture comprising an elongated trough, indicated by numeral 1 which is mounted in position below the ceiling 2, a plurality of U-form gaseous discharge lighting tubes 3, 3, etc., which branch outward from the sides 4 and 5 of the trough in a grid formation covering the adjacent ceiling areas, the transformer 6 which is mounted to the wall 8, the sliding sleeves 9, 9, etc., covering the junctions between the tube terminals, and the jumper connector 10 making contact between the ends of the tube series opposite to the transformer. The branches of the U-tubes rest in notches 11, 11, etc., along the upper edges of the sides and, in the preferred construction shown, saddles of insulating material, indicated by 12, 12, etc., are positioned in these notches to form an insulating support for each tube. These saddles have grooves 13, shown in Figure 8 to position them in the notches and seats 14 to receive the tubes. The upper edges of the sides may be flanged between the saddles as indicated by 15 in Figure 5 for stiffening.

The trough may be mounted from wall to wall as shown in Figures 1 and 2 with the end opposite the transformer mounted direct to wall 16, or by any other suitable means held in its proper position. In these views it is shown with additional ceiling support from the brackets 17 and 18. It may if desired, be supported entirely from the ceiling and be shortened clear of the walls with the transformer in any other desired position.

The spacing of the trough from the ceiling is determined so as to give fairly uniform distribution of light over the ceiling to lower the surface brilliance and also to give free access to the sleeve connections within the trough through the open space along the top.

The U-tubes are preferably unitary tubes although they may be jointed tubes if desired. The expression "U-form gaseous conduction lighting tubes" as used in the claims is intended to cover a U-formation of a single or several tubes. The tubes, indicated by 3, 3, etc., have each two terminal electrodes, indicated by 22 and 23 in Figures 5 and 6, turned from each other and at right angles to the branches of the tube. Thus, as the tubes are positioned in series along the sides of the trough, adjacent terminals of adjacent tubes are turned toward each other. Contact is made between these paired electrodes by any suitable means. I prefer to use some type of sliding spring contact so that the tubes when inserted in position make automatic contact with each other. A suitable spring contact is shown in Figure 7. Here a metal ferrule 25 is cemented to the end of the tube and soldered to the lead wire which extends through the seal from the electrode 26. A coil spring 27 is soldered to the ferrule with the free end carrying the contact cap 28.

Each of the junctions so formed is covered by an insulating slidable sleeve which may be slid back over one of the terminals to fully expose the other of any pair. These sleeves, indicated by 9, 9, etc., may be of glass, porcelain or any other approved material. A similar arrangement may conveniently be used to complete the connection between the ends 31 and 32 of the two lines of tubing and the terminals 33 and 34 of the transformer. The opposite ends of the lines of tubing may be connected together by a jumper connection of any suitable type. Here I have indicated by broken lines such a jumper 10 connecting the terminals 36 and 37.

With this invention a very extensive work space area can be covered with tubing in uniform grid distribution with the minimum of mechanical construction and with little or no high tension wiring. In these views, no high tension wiring at all is used as the tubes make direct contact with the transformer terminals and form the complete high voltage circuit in themselves. The entire installation when broken down goes into long and narrow packages which are easily handled.

In the installation of the fixture, the trough is mounted in position and the transformer connected through low tension leads in any approved manner to the service wiring. Support brackets 38, 38, etc., are mounted from the ceiling to hold the extreme ends of the U-tubes with as many intermediate brackets as may be desired. These supports may be quite simple, a plain rod, such as shown, sufficing. Generally, an insulator of glass or porcelain 39 is desirable, the tube being wired to it with soft copper wire according to accepted practice.

In installing the tubes, they are set in place in the saddles, or directly against the metal in the notches when saddles are not used, and the outer ends tied up to the support brackets. One of the electrodes of each junction pair is raised sufficient to slide over it one of the sleeves 9. These electrodes are then droppd back in place in the saddles and the sleeves slid over the junctions to complete the installation.

When a tube is removed for service, and another is not immediately available, a simple jumper can be inserted in its place and the fixture continued in service without interruption.

In Figure 5 I show an enlarged view looking down into the trough from above the fixture. On the left side of this figure two opposite junction pairs of terminals are shown with the sleeves 9 in place insulating the junctions. On the right side I have shown two junction pairs with the sleeves moved back over one terminal of each pair exposing the other terminals to permit of removal of the tubes.

Figure 9 is a bottom view of an installation of three troughs with tubes branching from both sides of each trough. Such an arrangement may be used to cover a very extensive factory work floor with additional units added to any desired number. Figure 10 is a sectional view of such

an installation in which the transformers are positioned above the roof with the high tension connections from the transformers to the troughs passing down through conduits of insulating material.

As seen in the enlarged view of Figure 11, each transformer **40** is installed in a metal box **41** with its low tension leads **42** connected to the feeders in the conduit **43** through the conduit **44**. The high tension leads **45** from the terminals **46** pass down through the roof **47** and the ceiling **48** through the jointed insulating conduit **49** to one end of the trough. A convenient terminal arrangement for these leads is a simple elbow member of glass **50** through which the leads are carried to contact caps which make direct contact with the tubes. The junctions thus formed are protected by slidable sleeves in the same manner as the junctions between the tubes.

Numerous other arrangements of the transformer may, of course, be used. For some types of installations the transformer may be located at the center of the trough and feed in both directions. The same details here given permit of all such modifications without departing from the purview of the invention.

In Figure 12 I show a bottom view of an installation in which tubing branches from one side only of the trough. In this construction I use a return tube **55** which completes the connection from the end **56** of the trough opposite to the position of the transformer thus eliminating the use of a high tension wire in the trough to complete the circuit.

Having thus described my invention, what I claim is:

1. The combination with an interior ceiling of a lighting fixture comprising: an elongated open-top trough suspended along and a short distance below the ceiling, said trough having a series of notches along the upper edges of each side thereof, a series of elongated U-form gaseous conduction lighting tubes positioned along each side of said trough in grid formation covering the adjacent ceiling areas with the ends of the tubes resting in said notches and the terminals thereof within the trough, the two terminals of each of said tubes being turned from each other so that adjacent terminals of adjacent tubes are turned toward each other and make contact with each other at their ends through suitable contact means, a slidable insulating sleeve covering each of the junctions so formed of such length that it may be slid back over one of the terminals of the junction pair to fully expose the other terminal to permit of ready removal of individual tubes, additional ceiling suspension means supporting the outer ends of said tubes, a transformer at one end of the trough with its terminals connected to the end terminals of the tube series so formed, and a cross connection between the end terminals of the tube series at the opposite end of the trough.

2. The combination with an interior ceiling of a lighting fixture comprising: an elongated open-top trough suspended along and a short distance below said ceiling, said trough having a series of notches along the upper edges of each side thereof, a saddle of insulating material positioned in each of said notches, each of said saddles having a slot opening to the upper end thereof for the reception of a branch of one of the lighting tubes below described, a series of elongated U-form gaseous conduction lighting tubes positioned along each side of said trough in grid formation covering the adjacent ceiling areas with the ends of the tubes resting in said slots in said saddles and with the tube terminals within the trough, the two terminals of each of said tubes being turned from each other so that adjacent terminals of adjacent tubes are turned toward each other and make contact with each other at their ends through suitable contact means, a slidable insulating sleeve covering each of the junctions so formed of such length that it may be slid back over one of the terminals of the junction pair to fully expose the other terminal to permit of ready removal of individual tubes, additional ceiling suspension means supporting the outer ends of said tubes, a transformer at one end of the trough with its terminals connected to the end terminals of the tube series so formed, and a cross connection between the end terminals of the tube series at the opposite end of the trough.

3. The combination with an interior ceiling of a lighting fixture comprising: an elongated open-top trough suspended along and a short distance below said ceiling, said trough having a series of notches along the upper edge of one side thereof, a series of elongated U-form gaseous conduction lighting tubes positioned along said trough in grid formation covering the adjacent ceiling area with the ends of said tubes resting in said notches and the terminals thereof within the trough, the two terminals of each of said tubes being turned from each other so that the adjacent terminals of adjacent tubes are turned to each other and make contact with each other at their ends by suitable contact means, a slidable insulating sleeve covering each of the junctions so formed of such length that it may be slid back over one of the terminals of the junction pair to fully expose the other terminal to permit of ready removal of individual tubes, additional ceiling supports supporting the outer ends of said tubes, a transformer at one end of said trough with one of its high voltage terminals connected to the corresponding end terminal of the tube series so formed, and an additional elongated lighting tube extending from one end of said trough to the other end in a decorative formation crossing the grid formation of the first said tubes with its ends similarly resting in notches along the corresponding side of said trough and its terminals within said trough, one of the terminals of the last said tube being connected to the other high voltage terminal of said transformer and the other terminal of the last said tube being connected to the end terminal of the series of U-form tubes to complete the secondary circuit of the assemblage.

4. The combination with an interior ceiling of a lighting fixture comprising: an elongated open-top trough suspended along and a short distance below said ceiling, said trough having a series of notches along the upper edge of one side thereof, a saddle of insulating material positioned in each of said notches, each of said saddles having a slot opening to the upper end thereof for the reception of a branch of one of the lighting tubes below described, a series of elongated U-form gaseous conduction lighting tubes positioned along said trough in grid formation covering the adjacent ceiling area with the ends of said tubes resting in said slots in said saddles and with the terminals of said tubes within the trough, the two terminals of each of said tubes being turned from each other so that adjacent terminals of adjacent tubes are turned to each other and make contact with each other at their ends by suitable contact means, a slidable insulating sleeve cover-

ing each of the junctions so formed of such length that it may be slid back over one of the terminals of the junction pair to fully expose the other terminal to permit of ready removal of individual tubes, additional ceiling suspension means supporting the outer ends of said tubes, a transformer at one end of said trough with one of its high voltage terminals connected to the corresponding terminal of the tube series so formed, and an additional elongated lighting tube extending from one end of said trough to the other end in a decorative formation crossing the grid formation of the first said tubes with its ends similarly resting in slots in saddles positioned in notches along the trough edge and its terminals within said trough, one of the terminals of the last said tube being connected to the other high voltage terminal of said transformer and the other terminal of the last said tube being connected to the end terminal of the series of U-form tubes to complete the secondary circuit of the assemblage.

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