BUSWAY-MOUNTED MULTIPLE FIXTURE LIGHTING SYSTEM WITH READY ACCESS

Robert D. Gustine, Ann Arbor, Mich., assignor to General Electric Company, a corporation of New York
Filed Aug. 8, 1967, Ser. No. 659,207
Int. Cl. F21s 7/00
U.S. Cl. 240—9

3,524,050

ABSTRACT OF THE DISCLOSURE

A multiple fixture lighting system using busway-mounted lighting fixtures, including two separate sections of busway, each section having lighting fixtures mounted thereon. The sections of busway are supported at opposite ends of two adjacent parallel rows of roller type busway support hangers. For cleaning and lamp replacement purposes, each section of busway is rolled to the opposite end of its row of hangers during which movement each fixture passes a single station from which maintenance may be performed.

BACKGROUND OF THE INVENTION

Field of the invention

My invention relates to a multiple fixture lighting system affording ready access for cleaning and replacing lamps in the lighting fixtures, and more particularly, to such a system for use with lighting fixtures which are mounted on electrical power distribution systems of the enclosed busbar type commonly referred to as "busways."

Description of the prior art

In accordance with the prior art, it has been the customary practice in industrial and commercial installations to support a continuous run of busway on a plurality of spaced busway support hangers which are suspended from the ceiling of the particular installation. Lighting fixtures are mounted on the busway and are electrically connected thereto whereby the busway serves both as a support means and as a source of electrical power for the fixtures.

Although this type of installation provides a dependable, easy to install, and relatively inexpensive lighting system, it, along with most other forms of lighting systems, has proven to be difficult to clean and replace lamps in the fixtures. The fact that the lighting fixtures are commonly mounted at a substantial height makes the task of cleaning and replacing lamps in the fixtures difficult in and of itself. Even more important, however, from the standpoint of performing maintenance is the fact that such lighting fixtures are often located over operating machinery, etc., which makes them practically inaccessible for purposes of cleaning the fixture and/or replacing burned out bulbs. In these instances, the only alternative is either to shut down the machinery whereby production of the industrial concern suffers, or else perform the maintenance outside of normal working hours which increases the cost of maintenance.

One approach which has been tried by the prior art in an effort to simplify the task of performing maintenance on busway-mounted lighting fixtures involves mounting the lighting fixtures in such a manner that they may individually be lowered from the ceiling. This, however, does not solve the problem of how to perform maintenance on lighting fixtures which are located over operating machinery, etc. Further, to provide each lighting fixture with such a lowering means increases substantially the overall cost of the lighting system.

Besides industrial and commercial installations, an other area in which the use of busway-mounted lighting fixtures is contemplated is that of lighting indoor swimming pools. Here maintenance problems are further complicated by the fact that the lighting fixtures positioned over the pool itself are virtually inaccessible with water in the pool, and accessible only with difficulty at other times.

OBJECTS OF THE INVENTION

It is therefore an object of the present invention to provide a multiple fixture lighting system affording ready access for cleaning and replacing lamps in lighting fixtures.

It is another object of the present invention to provide such a lighting system which permits cleaning and maintenance on a "run" of busway-mounted lighting fixtures to be accomplished from a single location.

A still further object of the present invention is to provide such a lighting system which permits maintenance to be performed on high-mounted busway type lighting fixtures even when access from directly under the fixture in its normal position is not available.

SUMMARY OF THE INVENTION

In accordance with the present invention, there is provided a multiple fixture lighting system comprising a first series and a second series of lighting fixtures. Means is provided supporting the first series of lighting fixtures in a first position in a row extending from adjacent a given location outwardly therefrom in a predetermined direction along a predetermined straight line. Other means is provided supporting the second series of lighting fixtures in a first position in a row extending from adjacent the aforementioned given location outwardly therefrom in a direction substantially opposite to the predetermined direction and along a line extending parallel to and spaced away from the predetermined straight line of the row of first lighting fixtures. The means supporting the first row of lighting fixtures includes means for slidably moving the fixtures in series relation to a second position wherein the first row of fixtures extends from adjacent the given location in a direction opposite the predetermined direction and in line with the predetermined straight line but with its opposite end adjacent the given location. The means supporting the second row of fixtures likewise includes means for slidably moving the fixtures of the second row to a second position in which the second row is in line with its first position but in which the opposite end of the second row of fixtures is adjacent the given location. In the process of moving the fixtures in the described manner, each of the fixtures of the first and second series of fixtures becomes accessible for servicing from the given location as it passes from its first position to its second position or from its second position to its first position. Means is also provided connecting all of the lighting fixtures to a source of electric power.

The invention will be more fully understood from the following detailed description and its scope will be pointed out in the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings,

FIG. 1 is a schematic representation of a busway-mounted lighting system in accordance with the present invention;

FIG. 2 is a schematic representation of the lighting system of FIG. 1 during the process of lamp cleaning and/or replacement;

FIG. 3 is a schematic representation of the lighting system of FIG. 1 following completion of cleaning and/or replacement of lighting fixtures;
FIG. 4 is an end view of a busway section suitable for use with the present invention;
FIG. 5 is a perspective view of a roller type busway support hanger suitable for use with the present invention;
FIG. 6 is an end view of the busway section of the type shown in FIG. 4, with a reinforcing member or "strength beam" attached, and with a lighting fixture of one suitable type shown in dotted lines;
FIG. 7 is an enlarged end view of the reinforced busway section, lighting fixture assembly of FIG. 6 illustrated as supported by a busway support hanger of the type shown in FIG. 5;
FIG. 8 is a semi-schematic perspective view of the two sections of busway of FIG. 3, including the electrical interconnection therebetween;
FIG. 9 is a perspective view similar to FIG. 8 but with the sections of busway in the positions shown in FIG. 1;
FIG. 10 is a schematic representation of a busway-mounted lighting system including a plurality of runs of busway in accordance with the present invention;
FIG. 11 is an end view of another type of busway illustrated connected to the busway section 10A which is suitable for use with the present invention;
FIG. 12 is a schematic representation of the busway-mounted lighting system of FIG. 11.

DESCRIPTION OF A PREFERRED EMBODIMENT

Referring now to the drawings, and more particularly to FIGS. 1, 2, and 3 of the drawings, a pair of sections 10A and 10B of a run of busway, each having a plurality of lighting fixtures 11 affixed thereto, are illustrated as being supported on roller-type busway support hangers 12. (The circles shown may be taken as corresponding to the rollers 40 of the hangers 12 of FIG. 5.) The hangers are arranged in parallel rows with about three feet of space between rows. In FIG. 1, busway section 10A is illustrated at a first position designated by reference letter A while busway section 10B is at position B.

FIG. 2 shows busway section 10A being rolled along or through the busway support hangers 12 moved in the direction of arrow 13, i.e., to the left as viewed in that figure. This movement may be accomplished either manually or by the use of suitable motor-operated means. Similarly, busway section 10B is shown as being moved in the direction of arrow 14, i.e., to the right. As busway section 10A moves from position A to position B, it passes a station designated by reference letter C where cleaning and replacement of lamps of the lighting fixtures 11 affixed to busway section 10A takes place. This same station C also serves as a maintenance station for busway section 10B, as the latter moves from position B to position A. Preferably, maintenance station C is located between the rows of busway support hangers 12 at a point which is approximately halfway along the length of the row. The exact location, however, of maintenance station C will, of course, depend on considerations such as available floor space to set up the necessary equipment such as a ladder, all needed to reach the busway-mounted lighting fixtures 11.

In FIG. 3, the busway sections 10A and 10B are illustrated as having completed their travel from position A to position B, and from position B to position A, respectively. During the course of this movement, each of the lighting fixtures 11 affixed to busway section 10B passes the maintenance station C where the necessary cleaning and replacement of lamps of the lighting fixtures is performed. Ordinarily, by virtue of the close proximity of the busway sections 10A and 10B, a single worker positioned at station C can perform the needed operations on the lighting fixtures of both sections of busway. The busway sections 10A and 10B may be allowed to remain in the position illustrated in FIG. 3 until such time as cleaning and replacement of lamps of the lighting fixtures 11 affixed thereto is once more required. This maintenance may then again be accomplished from station C by merely moving the busway sections 10A and 10B back to the positions they originally occupied, i.e., the positions illustrated in FIG. 1.

The sections of busway 10A and 10B may be of any suitable type. However, for purposes of illustrating the invention, each section of busway 10A and 10B may be considered to be of the type shown in FIGS. 4, 6, and 7. This type of busway is described in detail in U.S. Pat. 3,181,102, issued Apr. 27, 1965, to J. A. Fehr, Jr., assigned to the same assignee as the present invention, and it will be only briefly described here.

Referring to FIG. 4, the busway 10 comprises a housing having a top wall 15, side walls 16 and 17, and base flanges 18 and 19. The flange 18 is made wider than the flange 19 for the purpose of providing a means of ensuring the correct polarization of fixture plugs when they are electrically connected to the busway 10, this function being described more specifically in the aforementioned patent. Within the housing are a pair of busbars A and N, which are captured in corresponding longitudinally extending hollow cavities 20A, 20N of a flexible insulating body 20. The insulating body 20 comprises a suitable resilient material such as elastomeric polyvinyl chloride. Each of the cavities 20A, 20N has a longitudinally extending slot opening 20A', 20N' that faces the plane of the flanges 18, 19.

The busbars A and N comprise hollow tubular members having interrupted edges spaced apart to provide longitudinally extending slots in register with the slots 20A', 20N' respectively. The slots 20A', 20N' and the busbar slots in register therewith provide openings for admitting the stab contacts 21 of a fixture plug 22 such as that shown in FIGS. 6 and 7. The construction of the fixture plug 22 is disclosed in U.S. Pat. 2,273,103 issued Sept. 13, 1966 to E. A. Ericson, assigned to the same assignee as the present invention, and as such will not be further described here, except to note that the terminal contact portions (not shown) of the stab contacts 21 are electrically interconnected within the housing by the fixture plug 22 to wires (not shown) extending from the lighting fixture 11. A common method of securing the fixture plug 22 to the housing 11 of the lighting fixture 11 is by means of screws, or other similar fastening means (not shown) preferably in the manner described in the aforementioned Ericson patent. The fixtures 11 may be of any suitable type, but in the preferred embodiment, as best illustrated in FIGS. 6 and 7, the lighting fixtures 11 are each intended to house a pair of fluorescent lamps 23.

As further shown in FIGS. 6 and 7, the busway 10 with lighting fixture 11 affixed thereto is mounted in a substantially U-shaped reinforcing member or "strength beam" 24 having a top wall 25 with flanges 25a and 25b extending outwardly therefrom, and a pair of side walls 26, 27. The strength beam 24 has a plurality of spring steel clamp members 28 fastened at spaced intervals along the inside surface of the top wall 25 thereof. Each of the spring steel clamp members 28 has a top wall 29 which is secured in juxtaposed relation to the inside surface of the top wall 25 of the strength beam 24 such as by riveting 47, or by other suitable means. Depending from the top wall 29 of the spring members 28 are a pair of arm portions 30, 31 having their end portions 30a and 31a, respectively, bent inwardly. Cooperating with the end portions 30a and 31a are a pair of tabs 30b and 31b also bent inwardly from the arm portions 30 and 31, respectively. In mounting the busway 10 on the strength beam 24, the top wall 15 of the busway 10 is snapped into the support 28 whereby the flange portions 15a and 15b of the top wall 15 of the busway 10 are locked between the end portion 30a and tab 30b and end portion 31a and tab 31b, respectively, of the support 28.

As described earlier, the sections of busway 10A and 10B are each supported on a plurality of rollers type
busway support hangers 12. The type of hanger utilized in the preferred embodiment of the invention is illustrated in FIGS. 5 and 7. As shown therein, the busway support hanger 12 includes a threaded hanger rod 32 which when in use has one end suitably secured to the ceiling of a given installation (not shown) and the other end of the hanger rod 32 is threaded into an elongated one-piece swivel nut 33. The nut 33 is rotatably mounted in an opening (not shown) suitably provided in the L-shaped member 34 by means of a spring clamp 35, or other suitable means whereby one portion 33a of the swivel nut 33 is on the one side thereof. By rotating the swivel nut 33, the hanger rod 32 and thereby the busway support hanger 12 may be adjusted relative to the ceiling of the particular installation thereby ensuring that each run of busway supported thereby is and remains level. The busway support hanger 12 further includes a substantially U-shaped member 36 having a bottom wall 36a, upstanding side walls 36b and 36c, and a pair of depending end walls 37 and 38, metal fasteners 39 (only one shown) being utilized to ensure that the depending end walls 37 and 38 remain at the desired angle relative to the bottom wall 36a of the U-shaped member 36. The end flanges 25a and 25b, respectively, referred to is preferably welded to the respective edges of the side walls 36b and 36c. A roller 40 is rotatably mounted in each of the depending end walls 37 and 38 for a purpose to be more fully described hereinafter. Each of the depending end walls 37 and 38 further includes a V-shaped portion 37e and 38e respectively from which a pair of tabs 37f, 37g, 38f, and 38g respectively are bent outwardly. As best seen in FIG. 5, each of the V-shaped portions 37e and 38e receives a cable 41. The cables 41 serve to align the rows of busway support hangers 12, and help guide the sections of busway as they are moved along support hanger 12. A further function of the cables 41 is to prevent rotation or pivoting of the U-shaped member 36 relative to the hanger rod 32 as a busway section is moved along the busway support hangers 12. It is therefore important that the cables 41 when installed be sufficiently tight to prevent play in the cables 41 relative to the busway support hanger 12. The tabs 37f, 37g, 38f, 38g which crimp the cables 41 to the V-shaped portions 37a and 38a respectively, further decrease the possibility of play in the cables.

As can be seen in FIG. 7, the rollers 40 engage the flanges 25a and 25b respectively, of the strength beam 24 thereby permitting the section of busway to be rolled along the row of busway hangers. By having the rollers 40 engage itself, there is less stress imposed on the housing of the busway. However, in some instances it may be desirable to omit the use of a strength beam and have the rollers 40 engage the outwardly extending flanges of the busway housing.

Referring now to FIGS. 8 and 9, the adjacent ends of the busway sections 10A and 10B are electrically connected by means of power feed-in boxes 42 and 43, and wires 44 and 45 to a control power source 46. The boxes 42 and 43 which are of the type well-known in the art are removably mountable at either end of the busway sections. Thus, when it is necessary to move the busway sections 10A and 10B for cleaning and lamp replacement purposes, the feed-in boxes are merely disconnected from one end of the busway sections and then reconnected at the other end thereof when the maintenance is completed. It will of course be apparent that power may be fed in at the remote end of one of the busway sections, in which case the adjacent ends would be merely electrically interconnected by suitable means to connect the busway sections in series. Further, when a large area is to be lighted, a plurality of pairs of offset busway sections arranged as shown in FIG. 1 are utilized, forming a plurality of rows. Each of these rows includes a pair of adjacent sections 10A and 10B of busway having lighting fixtures 11 mounted thereon as previously shown and described in connection with FIGS. 1, 2, and 3 of the drawing and electrically connected to a source of power such as power conductor 10C.

In FIG. 12, there is illustrated another embodiment of the invention utilizing a "trolley" type busway such as described in detail in U.S. Pat. 2,536,282 issued Jan. 2, 1951 to H. J. Hammerly et al., assigned to the same assignee as the present invention.

As shown in FIG. 11, the busway utilized in this embodiment comprises a housing 48 within which is supported a plurality of busway 49, 50, and 51. The busways 49, 50, and 51 are hollow and of trapezoidal cross-section and supported in U-shaped insulators 52 at intervals along the length of the housing 48. The insulators 52 are secured between the grooved or indented portions 48a and 48b of the housing 48 above a channel-like portion of the housing 48 formed by the side walls 53 and the inturned flanges 54.

A fixture supporting plug 55 of the slidable or "trolley" type is provided, having an insulating body 56 with extension 57 which carries contacts 58. The flanges 54 constitute tracks for rollers 60 which are arranged in pairs, each pair rotatably mounted on a shaft 61, at opposite ends of the fixture plug 55. The contacts 58 are electrically interconnected within the insulating body 56 of the fixture plug 55 to the lighting fixture 11'. Any suitable means such as screws (not shown), etc. may be utilized to fasten the insulating body 56 and thereby the fixture plug 55 to the lighting fixture 11'. As with the lighting fixture 11 illustrated in FIG. 7, the lighting fixture 11' preferably houses a pair of fluorescent lamps 23'.

Referring to FIG. 12, two busway sections 10' and 10" are utilized in this embodiment, each extending the full width of the area to be lighted. In this form, the busway sections 10' and 10" are fixedly mounted under the busway housing.
7 determined direction and in line with said predetermined straight line but with its opposite end adjacent said given location;

8 (f) said means supporting said second series of lighting fixtures including means for slidably moving said fixtures of said second series to a second position in which said second series of lighting fixtures is in line with its first position but in which the opposite end of said second series of lighting fixtures is adjacent said given location, whereby each of said fixtures of said first and second series of lighting fixtures becomes accessible for servicing from said given location as it passes from said first position to said second position and from said second position to said first position; and

(g) means connecting all of said lighting fixtures to a source of electric power.

2. A multiple fixture lighting system as set forth in claim 1 wherein said means supporting said first series of lighting fixtures and said means supporting said second series of lighting fixtures each comprises an electric busway section including an elongated rigid metallic housing having a plurality of electrical busbars supported therein in insulated relation and means electrically connecting each of said fixtures to said busbars in said busway section.

3. A multiple fixture lighting system as set forth in claim 2 wherein:

(a) said means supporting each of said first and second series of lighting fixtures also comprises a row of spaced busway support hangers, each of said hangers having at least one supporting roller; and

(b) said busway housing including at least one track portion supported by said rollers of said hangers whereby said housing may be slid longitudinally on said rollers along said row of hangers from a first position corresponding to a first position of said lighting fixtures to a second position corresponding to a second position of said lighting fixtures.

4. A multiple fixture lighting system as set forth in claim 3 wherein said system also comprises means electrically connecting the ends of said busbars of said busway sections which are adjacent said given location to a source of electric power.

5. A multiple fixture lighting system as set forth in claim 2 wherein each of said busway sections includes a portion projecting in a direction opposite the corresponding row of lighting fixtures with respect to said given location and wherein said means for slidably moving said fixtures comprises means slidably supporting said lighting fixtures on said busway sections.

References Cited

UNITED STATES PATENTS
2,536,282 1/1951 Hammerly et al. ------ 191—48
2,969,438 1/1961 Herrmann.
2,975,512 3/1961 Soames -------------- 240—9
3,064,121 11/1962 Greene -------------- 240—2
3,181,102 4/1965 Fene -------------- 339—21

NORTON ANSHER, Primary Examiner
D. S. STALLARD, Assistant Examiner

U.S. Cl. X.R.
191—48; 240—51.11; 339—21