

United States Patent

Meyer et al.

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[54] LIGHT FIXTURE TOWER

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[52] U.S. Cl. **240/84**

[51] Int. Cl. **F21s 3/10**

[58] Field of Search **240/84**

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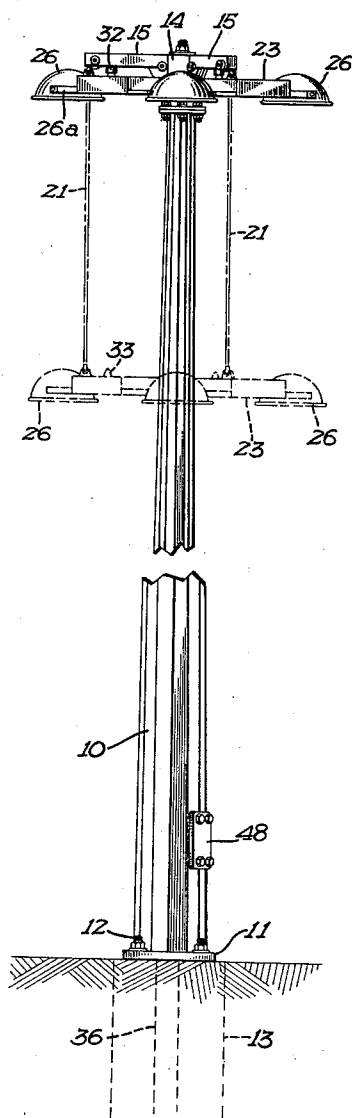
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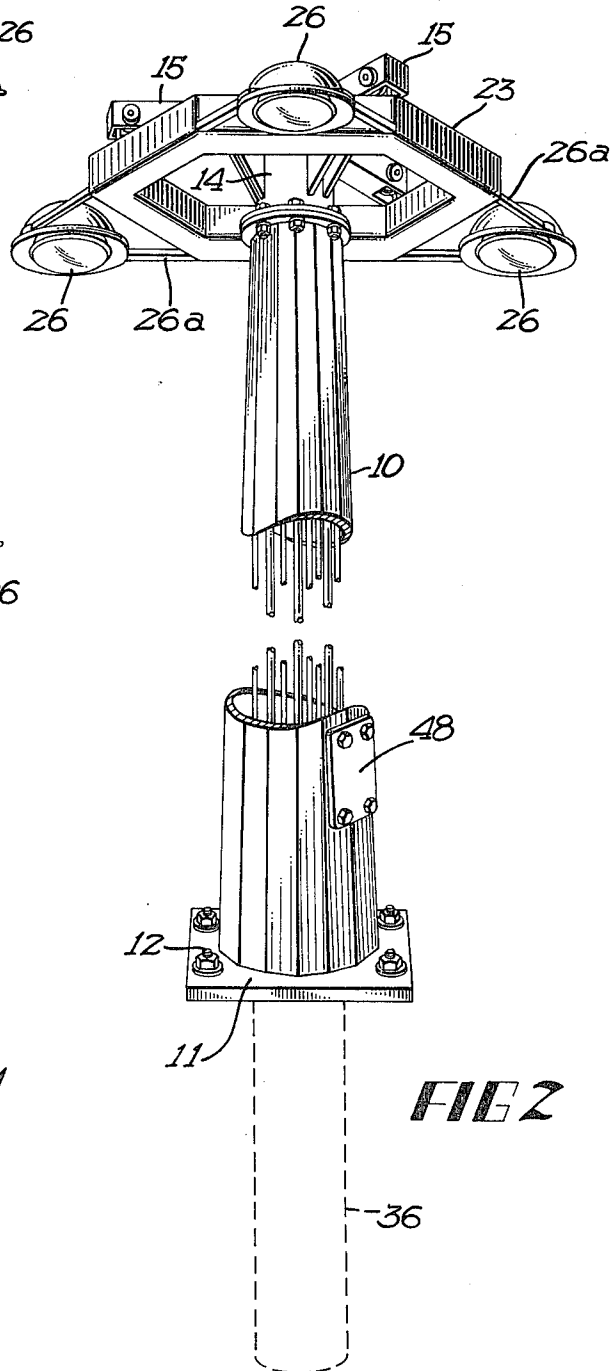
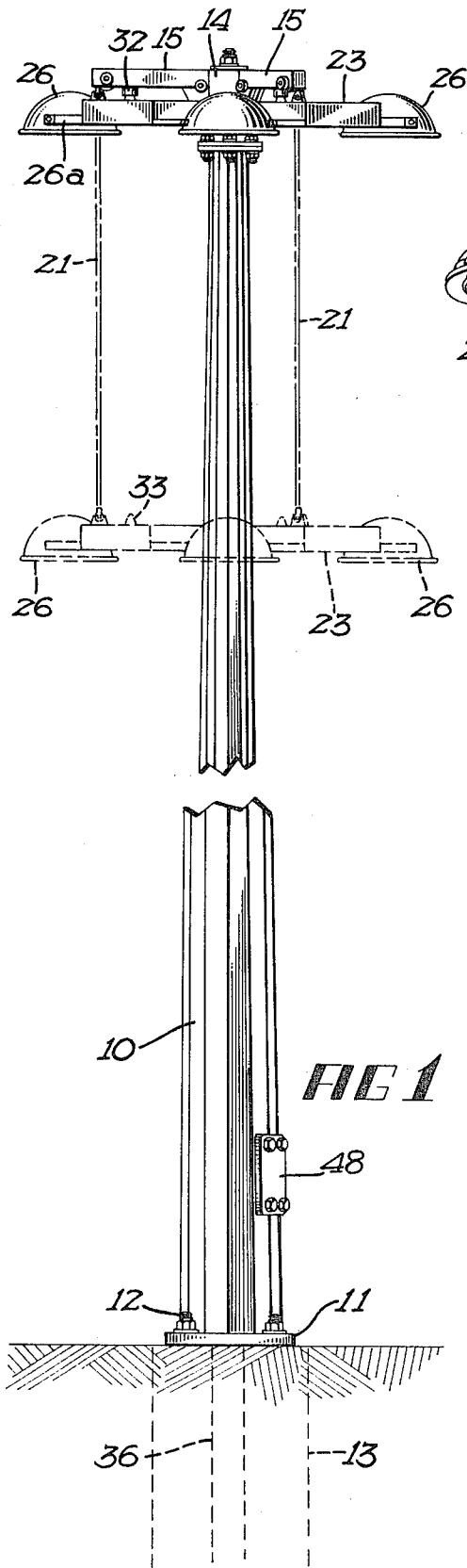
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[57] ABSTRACT

A tower and support for mounting electric light fixtures at elevations up to and exceeding 100 feet above ground level; the fixtures being supported on a separate fixture frame supported on cables confined within the tower and to be lowered for maintenance and service work on the fixtures; the power supplying cable being anchored to the counterweight and traveling upwardly with the counterweight and support cables and being detachably connected to the power source at the base of the tower.

7 Claims, 9 Drawing Figures





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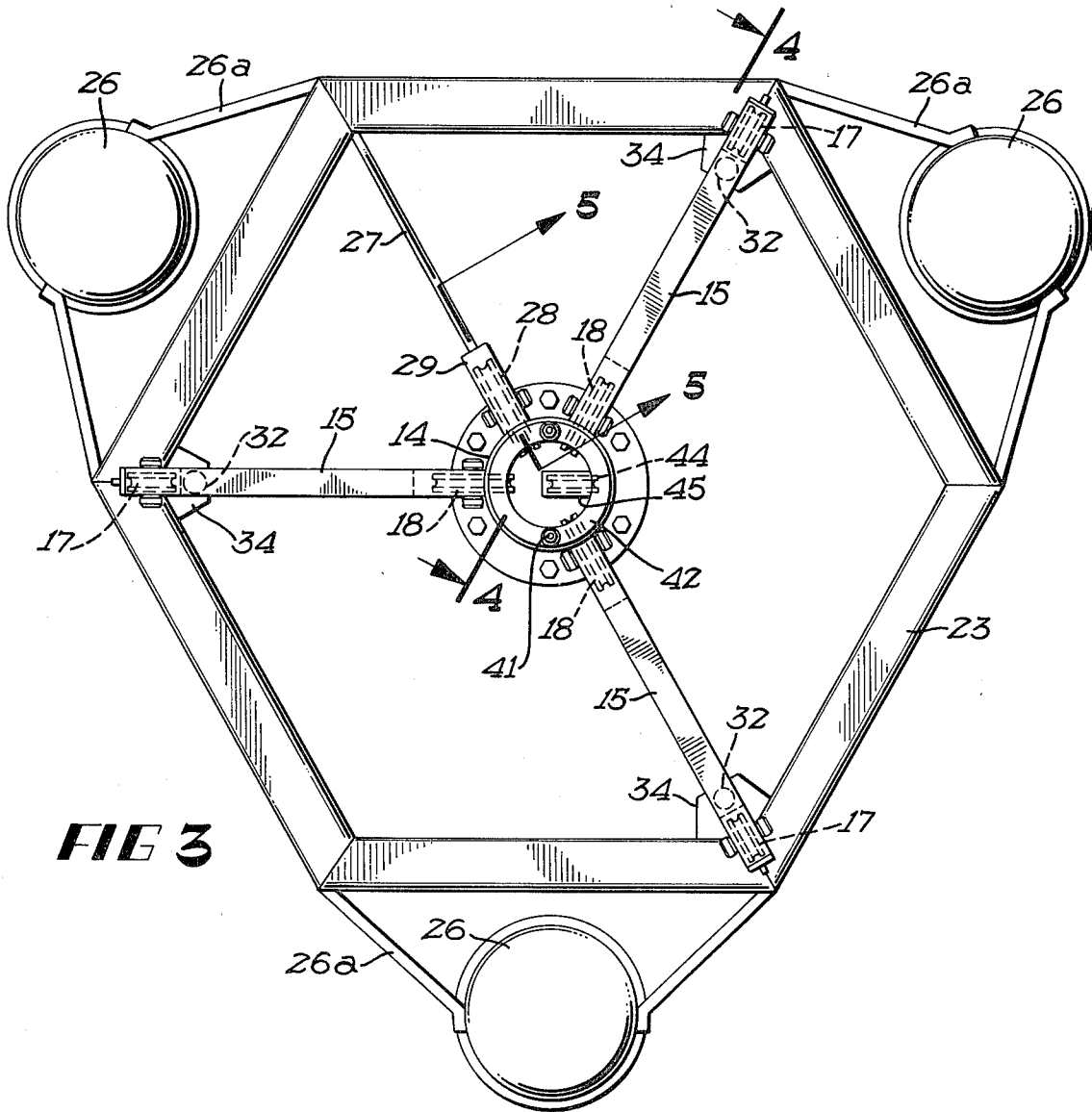


FIG 3

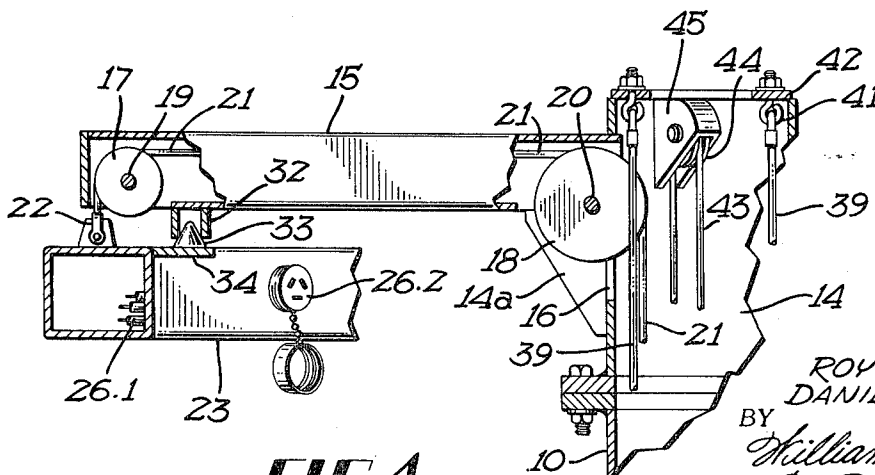


FIG 4

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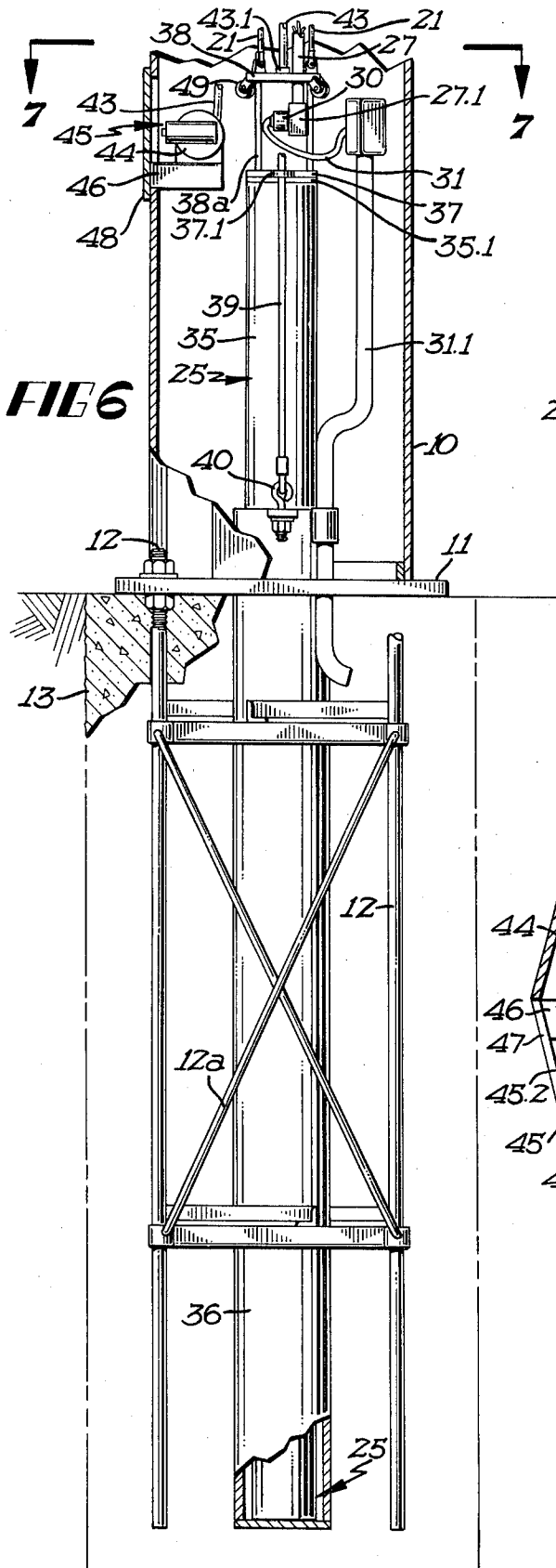


FIG 6

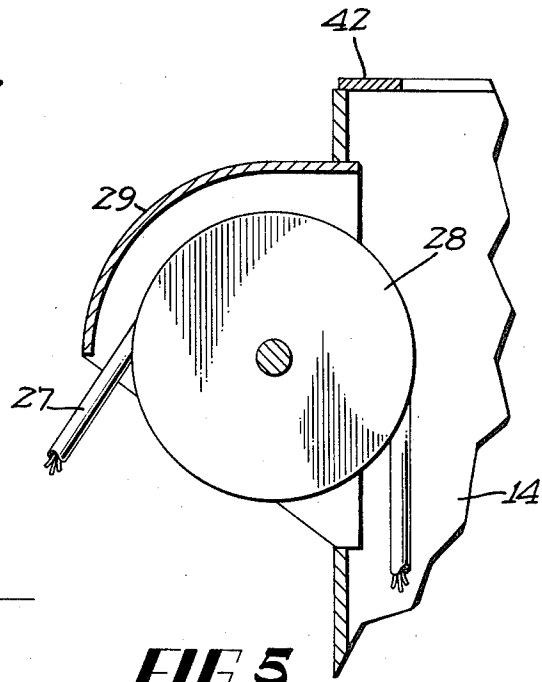


FIG 5

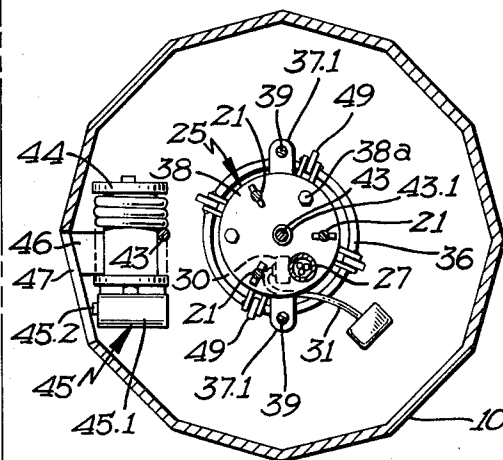


FIG 7

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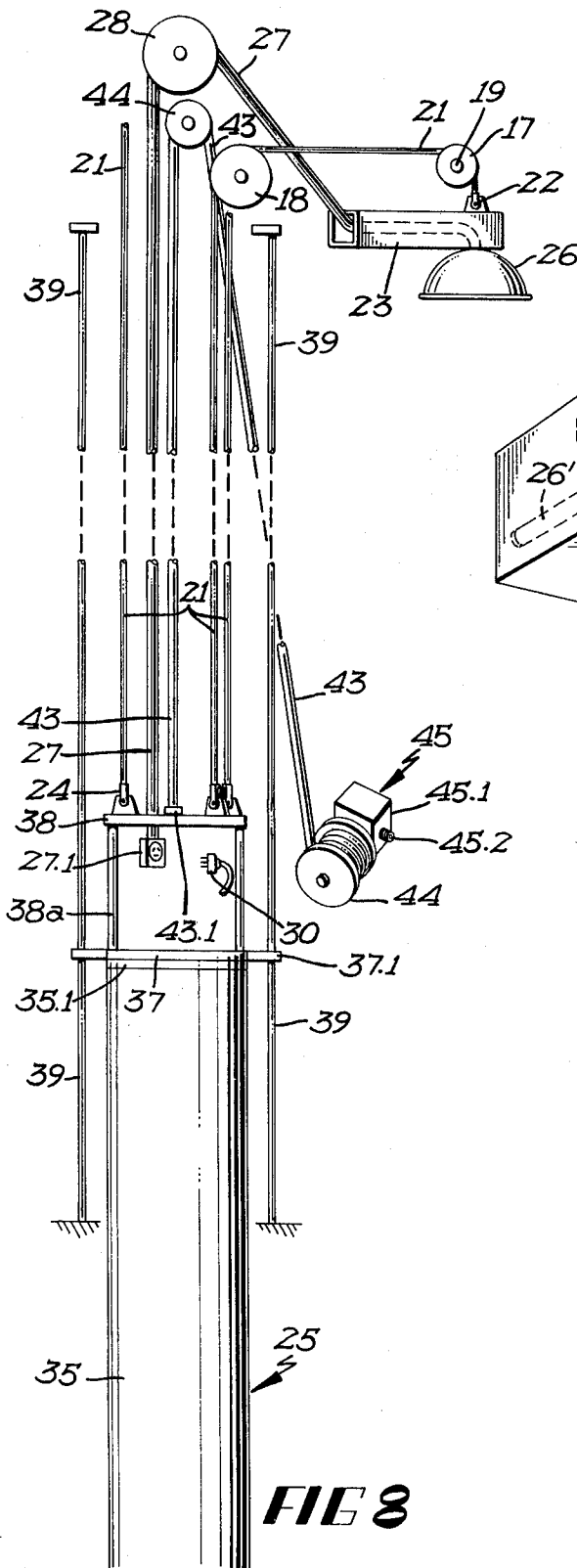


FIG 8

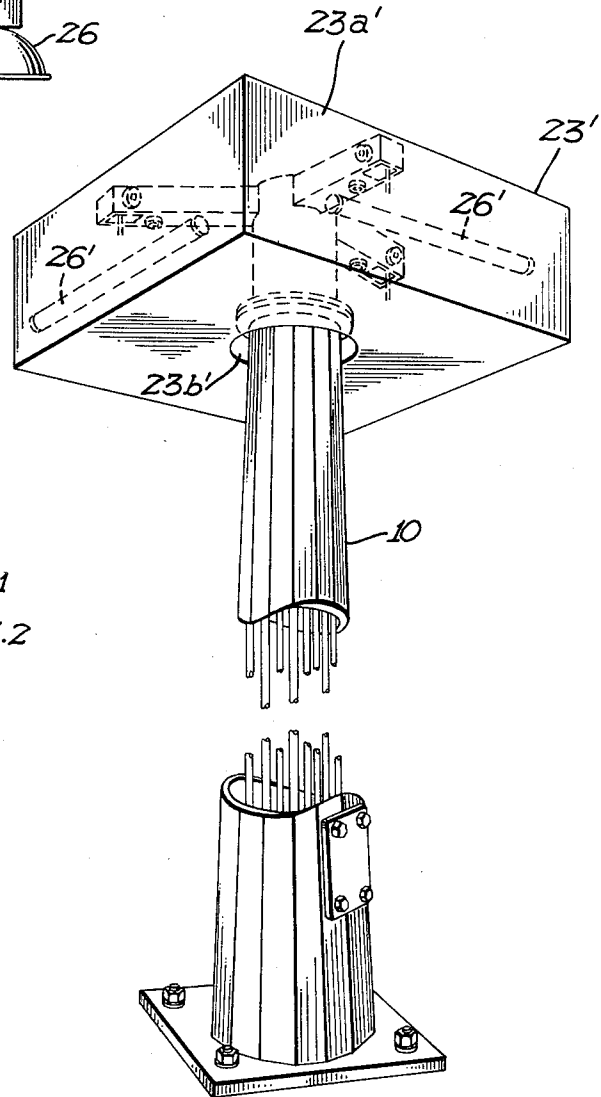


FIG 9

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LIGHT FIXTURE TOWER

BACKGROUND OF INVENTION

Tall light towers, of the type used for illuminating athletic fields and stadiums have supported many light fixtures in stationary position at elevations well in excess of one hundred feet in the past, but it has been necessary for workmen to ascend the tower in order to service these lights, and, of course, expensive special equipment must be provided for ascending the tower safely, and for moving about on the framework when the workman has reached the top of the tower.

Recently, the advances in lighting units have made it possible to illuminate entire highway intersections or expressway interchanges with just a few extremely high intensity light fixtures supported at an extremely high elevation. Likewise, there is a need for supporting other illuminated devices such as signs and advertising display at extremely high locations to signal the presence of motels and service stations to expressway travelers who cannot otherwise see such establishment located remotely from the highways. All such equipment involving lighting elements needs frequent servicing, but such servicing cannot be inexpensively and quickly accomplished with previously known equipment.

SUMMARY OF THE INVENTION

A tower for supporting light fixtures at so high a location as to be extremely hazardous for workmen to reach and maintain the lighting equipment. The light fixtures are supported on a frame separate from the tower which may be lowered to the ground for servicing the equipment carried thereby. The fixture frame is normally in an elevated position and is interlocked to support arms at the top of the tower to prevent swaying of the frame; and the fixture is carried by cables connected to a counterweight at the ground.

Raising the counterweight results in lowering the fixture frame for servicing. Power for the lights is supplied through a power cable anchored to the counterweight and detachably connected to a power source at the base of the tower. A lift cable trained over a sheave at the top of the tower facilitates raising the counterweight, and lowering the fixture frame, by a winch at the tower base.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an elevation view, partly broken away, of the tower and support apparatus, and illustrating the fixture frame partly lowered in dotted lines.

FIG. 2 is a perspective view, partly broken away, and illustrating the present invention.

FIG. 3 is an enlarged top plan view of the top of the tower and support apparatus.

FIG. 4 is a detail section view taken approximately at 4—4 in FIG. 3 with portions of the apparatus broken away for clarity of detail.

FIG. 5 is an enlarged detail section view taken approximately at 5—5 in FIG. 3.

FIG. 6 is an enlarged section view taken on a vertical plane through the base of the tower and footing therefor.

FIG. 7 is an enlarged detail section view taken approximately at 7—7 in FIG. 6.

FIG. 8 is a diagrammatic sketch illustrating the several cables and their arrangements within the tower.

FIG. 9 is a perspective view partly broken away and illustrating a modified form of the tower and support apparatus.

DETAILED DESCRIPTION OF THE INVENTION

The tower 10 is tubular in construction and is fabricated from flat sheet steel into a multi-sided tubular shape which tapers convergently from the base to the top of the tower. The tower 10 has a base plate 11 secured by anchor bolts 12 to the concrete footing 13 which extend down into the ground. Transverse and diagonal bracing 12a is provided for the anchor bolts within the footing.

The top 14 of the tower is fabricated separately as seen in FIG. 4 and is affixed to the main tower by flanges and bolts.

Support arms 15 are affixed as by welding to the top of the tower and project horizontally therefrom in multi-directions. The arms 15 are tubular, and the inner ends thereof align with slots or openings 16 in the adjacent tower sidewall. Bracing plates 14a are preferably provided to assist the arms in carrying the load.

Sheaves 17 and 18 are carried on fixed mounting pins or shafts 19 and 20 adjacent the outer and inner ends of each of the arms 15. Support cables 21 are trained or carried over the sheaves 17 and 18, and are securely attached by fittings 22 to the fixture frame 23. The support cables 21 extend downwardly from the sheaves 18 throughout the entire length of the tower 10, and are fastened by fittings 24 to the counterweight 25, which is sufficient to keep the fixture frame 23 up against the arms 15 as illustrated.

The fixture frame 23 is rigid and tubular, and has a rectangular cross section in the form illustrated. The frame might also have a round cross section. As best illustrated in FIGS. 2 and 3, the fixture frame is hexagonally shaped so as to encompass the tower 10 and its top 14, but of course may have other configurations. The fixture frame 23 carries the electric light fixtures 26 on brackets 26a, and, as illustrated, the frame carries three such fixtures; however, it should be understood that any number of fixtures may be carried on the frame and in such position and orientation as is desired, according to the purpose for which the installation is made. The fixture frame 23 confines the distribution circuits 26.1 for the fixtures 26.

Power is supplied to the distribution circuits and fixtures 26 from a power cable 27 which is trained over and supported by a pulley or sheave 28 supported on a covered bracket 29 which is affixed to the top 14 of the tower. One end of the power cable 27 is affixed, physically, to the fixture frame 23 and is connected electrically to the distribution circuits 26.1; and the other end of the power cable 27 extends down through the entire length of the tower 10 and to the base thereof at which point the power cable is anchored, physically, to the counterweight 25. A rigid receptacle box and receptacle 27.1 is affixed to the counterweight 25 to cooperate with a plug 30 in a detachable electrical coupling to the power source 31 at the base of the tower. As illustrated, the power source may be a short length of flexible cable connected through conduits and receptacles 31.1 to the switch gear and bus bars which supply high voltage electric current for the fixtures 26.

An auxiliary power receptacle 26.2 is mounted on the fixture frame 23 and electrically connected to the distribution circuits 26.1 for facilitating the application of power to the lighting fixtures 26 when the fixture frame has been lowered to the base of the tower, at which condition the plug 30 will have been withdrawn from the receptacle 27.1, thus facilitating upward movement of the counterweight and power cable 27 during lowering of the fixture frame.

Normally the fixture frame 23 is held up against the transverse arms 15 and is prevented from swaying by the interaction between the sockets 32 on the arms 15, and the inserts or projections 33 confined in the sockets 32 and affixed on mounting plates 34 which are welded to the frame ring 23. The inserts 33 are received in the sockets 32 during the normal upward travel of the fixture frame 23 toward the arms 15 so that the fixture frame and the electric light fixtures 26 are prevented from swaying relative to the tower 10 in their normal position.

The counterweight 25 comprises an elongate rigid sleeve 35 constructed of steel pipe and substantially filled with steel bars or rods so that the counterweight 25 will be heavier than the fixture frame 23 together with the fixtures 26 thereon. The steel sleeve 35 normally projects downwardly into a well 36 formed in the footing 13 for the tower 10. The well 36 has a closed bottom and an open top to slidably receive the counterweight 25 therein.

The counterweight also includes a guide plate 37 and an anchoring plate 38, both affixed to the cover plate 35.1 of the sleeve 35 by long bolts 38a so that the anchor plate 38 is rigid with respect to the sleeve 35. Plate 38 has upwardly projecting apertured ears facilitating anchoring the support cables 21 thereon. The receptacle box 27.1 is affixed to the plates 37 and 38 for anchoring the lower end of the power cable 27.

The plate 37 has a pair of transversely outwardly projecting ears 37.1 rigidly connected thereto and apertured to slidably receive the guide cable 39 so as to prevent the counterweight 25, as a whole, from revolving or rotating as it is raised and lowered in the tower 10. The guide cables 39 are affixed as by fittings 40 to the stationary well 36 adjacent the base of the tower, and are affixed as by fittings 41 to the top annular plate 42 which is attached by welding to the top of the tower so that the cables 39 remain essentially stationary at all times.

Normally, the counterweight holds the fixture frame 23 in its elevated position, and, in order to lower the fixture frame 23, the counterweight is raised in the tower 10 through the use of a lift cable 43 which is trained over and suspended from a pulley or sheave 44 mounted in a covered bracket 45 at the top of the tower 10.

One end of the lift cable 43 is attached by fitting 43.1 to the anchor plate 38 of the counterweight 25, and the other end of lift cable 43 is, in the form illustrated, wound on the drum 44 of winch 45 which is carried on the bracket plate 46 which is affixed as by welding to the interior of the tower 10, immediately adjacent the hand hole 47 which is normally covered by a cover plate 48. The winch 45 may be of any suitable type, and may actually be removably mounted in the tower, but in the form shown, the winch 45 has a gearbox 45.1 which may be supplied with mechanical power for

operating the winch by an auxiliary portable electric motor which may be brought to the site by a workman and then detachably coupled to the input drive shaft 45.2 for operating the winch. Such a portable motor may be the type of motor which is ordinarily used for heavy duty drilling, but provided with a special coupling at the chuck.

It will be readily understood that by simply operating the winch 45, the lift cable 43 is wound on the winch drum, and the counterweight is lifted, substantially throughout the entire height of the tower 10 for lowering the fixture frame 23 and the fixtures 26.

The counterweight 25 is provided with a plurality of guide wheels 49, being mounted in suitable brackets attached to the anchor plate 38 so that the counterweight will be guided freely along the interior of the upper portion of the tower wherein the interior dimensions are considerably less than the dimensions of the tower illustrated in FIG. 7, such that the counterweight will not drag along the interior surfaces of the tower.

In the modified form of the invention illustrated in FIG. 9, it is illustrated principally that the shape of the fixture frame 23' may be varied considerably from the shape of the frame illustrated in FIGS. 1, 2 and 3. The fixture frame 23 may have sources of light such as fluorescent tubes 26' incorporated therein and may incorporate translucent panels 23a' for carrying advertising displays and the like. The tower 10 illustrated in FIG. 9 is essentially the same as that described hereinbefore and is provided with similar mounting arms at the top so as to support and stabilize the fixture frame 23' and prevent it from swaying or otherwise moving relative to the tower, except when it is desired to lower the fixture frame. The fixture frame 23' will have an opening 23b' in the bottom of it so as to freely pass downwardly along the tower when the fixture frame is lowered.

In operation, the fixture frame 23 is ordinarily retained at the top of the tower 10. The counterweight 25, reposing in the well 36, maintains the tension on the support cables 21 so that the sockets and inserts 32 and 33 are coupled and the fixture frame and fixtures are retained in stationary position relative to the tower. Power is supplied to the electric fixture 26 from the cable 27 which is supplied with power at the receptacle box 27.1 from the source of power provided by the plug 30 and flexible cable 31. Normally the hand hole cover 48 is in place as illustrated in FIG. 2, and the tower and lighting apparatus appears to be an integral unit.

However, when it is desired to service the light fixtures 26 at the top of the tower, the cover 48 is removed and a source of mechanical power is attached to the input shaft 45.2 of the winch, to prepare for raising the counterweight. The plug 30 is removed from the receptacle box 27.1 so as to uncouple the power cable 27 from the source of power and to free the counterweight for upward movement.

As the winch 45 is operated, the lift cable 43 is wound onto the drum 44 and the counterweight 25 is lifted. As the counterweight moves upwardly in the tower 10, cables 21 lower the fixture frame 23 to the dotted line position shown in FIG. 1 and then to the base of the tower 10 where the fixtures 26 are readily accessible for replacement or repair. While the fixture frame and light fixtures are near the base of the tower,

the test procedures on the fixtures 26 may be accomplished by supplying electric power to the receptacle 26.2 on the fixture frame.

When the maintenance of the fixtures has been accomplished, the winch 45 is operated in reverse to pay off the lift cable 43 from the drum, whereby to lower the counterweight 25 in the tower 10 and cause lifting of the fixture frame 23 into the normal operating position illustrated in FIGS. 1 and 2. The counterweight is prevented from rotating in the tower 10 by the guide cables 39. Transverse movement of the fixture frame 23, during lifting, is minimized because it is being lifted by three separate cables, and, as the fixture frame approaches the arms 15, the lengths of support cables 21 suspended from the pulleys 17 is very short and, as a result, the inserts 33 are accurately guided into the sockets 32 for retaining the fixture frame against any transverse swing or wobbling movement. When the fixture frame 23 has reached its uppermost position against the arms 15 as illustrated, the source of power will be coupled to the cable 27, simply by inserting the plug 30 into the receptacle box 27.1. Detachment of the source of mechanical power from the winch 45, and replacement of the cover plate 48 are the final steps in putting this light tower back into service.

The light tower, which may be well over one hundred feet high, would normally present very serious hazards for a workman to climb up to the fixtures for servicing, but, in view of the present invention which permits lowering the fixtures to the ground for servicing, the maintenance of these towers can be quick and inexpensive, and need not involve any unusual hazards normally associated with tower work. The counterweight, reposing in the well, holds the fixture frame up against the rigid transverse arms, and the support cables 21 which interconnect the frame with the counterweight are not subjected to any substantial wear as they are never wound on drums nor are they exposed to exterior weathering. The power is supplied to an distributed within the fixture frame, and the power cable can be readily and easily physically and electrically uncoupled or disconnected as the counterweight and support cables are allowed to move up the tower as the fixture frame and fixtures are lowered for servicing. Lowering of the fixture frame is accomplished simply by lifting the counterweight through the use of the winch at the base of the tower.

What is claimed is:

1. Apparatus supporting electric fixtures at an elevated location so high as to be dangerous to workmen and difficult to reach and maintain, comprising an elongate, vertical, tubular tower having a top, a base and a hollow interior, said tower secured at its base on a supporting surface, at least three transverse tubular support arms affixed at one end thereof to the top of the tower and extending at their other ends a substantial distance outwardly therefrom in different directions, an opening in the underside of each support arm at the other end thereof, a first rotatable sheave mounted within the other end of each support arm adjacent to and above said opening, a second sheave rotatably mounted within each said support arm at said

one end thereof, a counterweight within said tubular tower, an annular fixture frame disposed in substantial outwardly spaced surrounding relationship to said tower at the top end thereof, a plurality of electric fixtures supported on said frame, self-aligning interfitting socket and tapered projecting means on said frame and on each said arm at the other end thereof spaced inwardly from and in juxtaposition with said opening in each said arm, support cable means secured at one end to said frame and extending upwardly over said first sheave in each said arm and through said arms and over said second sheave and thence downwardly through said tower and secured at the other end thereof to said counterweight, so that said fixture frame is continuously positively held upwardly against the underside of said support arms with said interfitting socket and projecting means interengaged to prevent swaying or transverse movement of said fixture frame but permitting lowering of said fixture frame around said tower when desired, pulley means mounted to the top of said tower, and power cable means connected with a source of electrical energy at the base of the tower and extending upwardly through said tower and over said pulley means, said power cable being operatively connected with the electric fixtures supported on said frame.

2. Apparatus as in claim 1, wherein means are operatively connected with said counterweight for raising and lowering the counterweight in said tower to thereby raise and lower said fixture frame, said power cable being connected to said counterweight, and detachable connection means at the base of the tower for coupling the power cable to a power supply.

3. Apparatus as in claim 2, wherein a pair of linear guide means extend upwardly through said tower between the top and base thereof, and means are on the counterweight operatively engaged with said linear guides to prevent rotation of the counterweight during travel thereof in the tower.

4. Apparatus as in claim 3, wherein a well is beneath the base of the tower for receiving the counterweight when the counterweight is in its normal, lowered position, and said operable means for raising and lowering the counterweight includes a sheave rotatably mounted at the top of the tower, a lift cable trained over the sheave and connected at one end thereof to the counterweight, a winch at the base of the tower and the other end of said lift cable connected to said winch for lifting the counterweight and lowering the fixture frame.

5. Apparatus as in claim 4, wherein said fixture frame comprises a plurality of straight tubular members jointed together at adjacent ends to form a hexagonally shaped frame at the outer ends of said arms.

6. Apparatus as in claim 4, wherein advertising panel means are secured to said frame for displaying advertising material.

7. The fixture supporting apparatus according to claim 1 and the counterweight carrying an electrical receptacle connected to the power cable,

and the power source having a connector plug to fit the receptacle.

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