

[54] **HIGH-LEVEL LIGHT TOWER WITH LIGHT LOWERING DEVICE AND CONTROL SYSTEM THEREFOR**

[75] Inventors: **Ivan D. Rohn**, Washburn; **Richard A. Kleine**; **Charles A. Wright**, both of Peoria, all of Ill.

[73] Assignee: **Rohm Manufacturing Co.**, Peoria, Ill.

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Primary Examiner—Richard C. Queisser

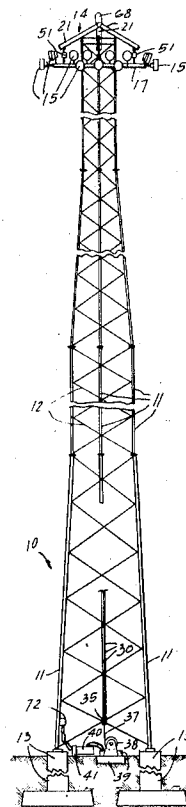
Assistant Examiner—Daniel M. Yasich

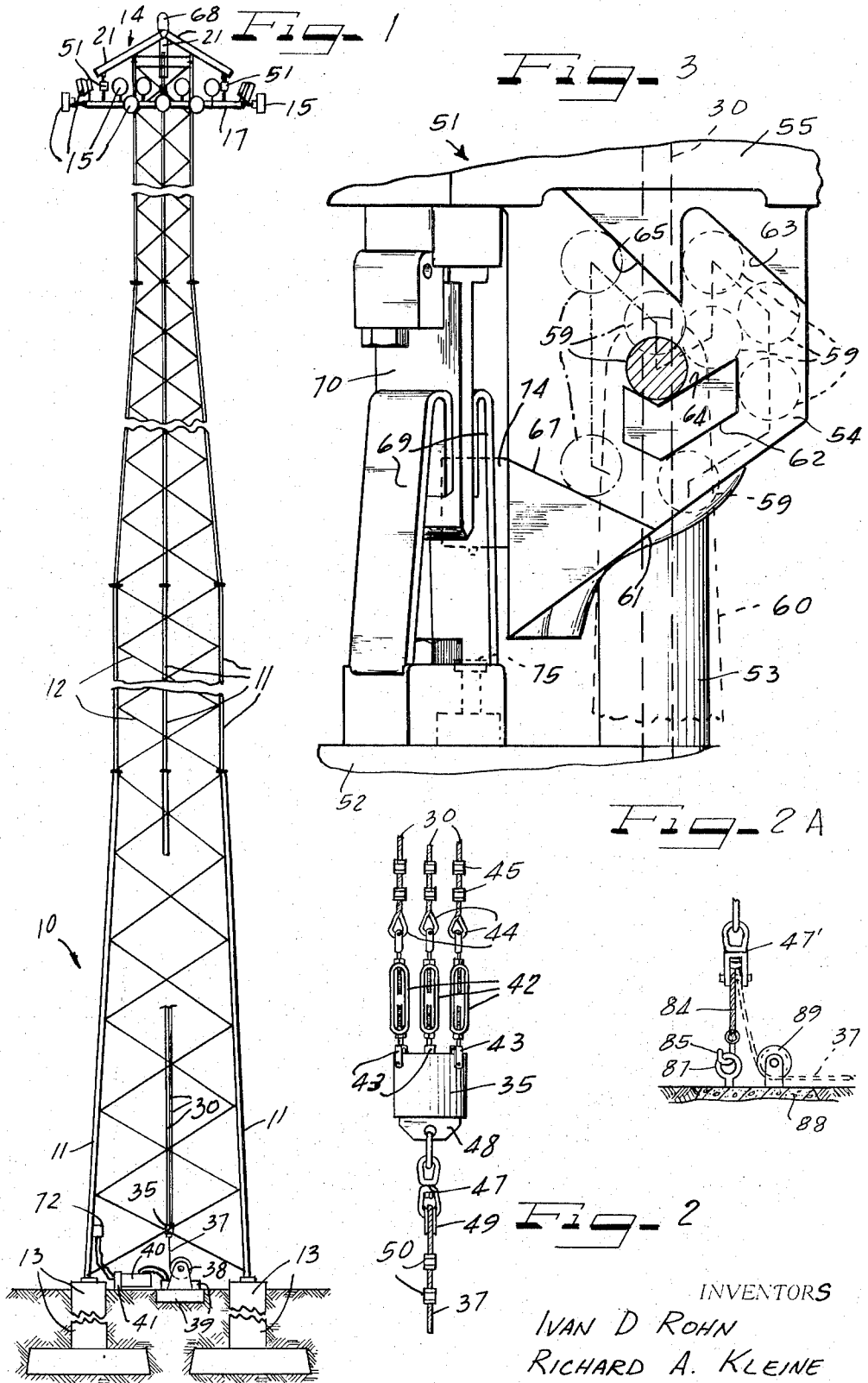
Attorney, Agent, or Firm—Hill, Gross, Simpson, Van Santen, Steadman, Chiara & Simpson

[57] **ABSTRACT**

A high-level lighting tower has a generally ring-shaped illuminating lamp or floodlight supporting carriage device operatively supported from a tower head and releasable therefrom to be lowered by a winch-controlled cable system providing a multi-point carriage suspension. Lowering of the carriage to or adjacent to ground level is enabled. Individual adjustments of the carriage cables is provided for. Special adaptability for multi-leg generally tapering towers is afforded. An electricity supply and electrical control system for the lights has not only electrical connection signalling means but also over-load safety means. An attention-getting device such as a beacon light may advantageously be mounted upon a peak provided by juncture of sloping supporting head arms.

34 Claims, 11 Drawing Figures





BY

Hill, Sherman, Meroni, Gross & Simpson

INVENTORS

IVAN D ROHN

RICHARD A. KLEINE

CHARLES A. WRIGHT

ATTORNEYS

Fig. 4

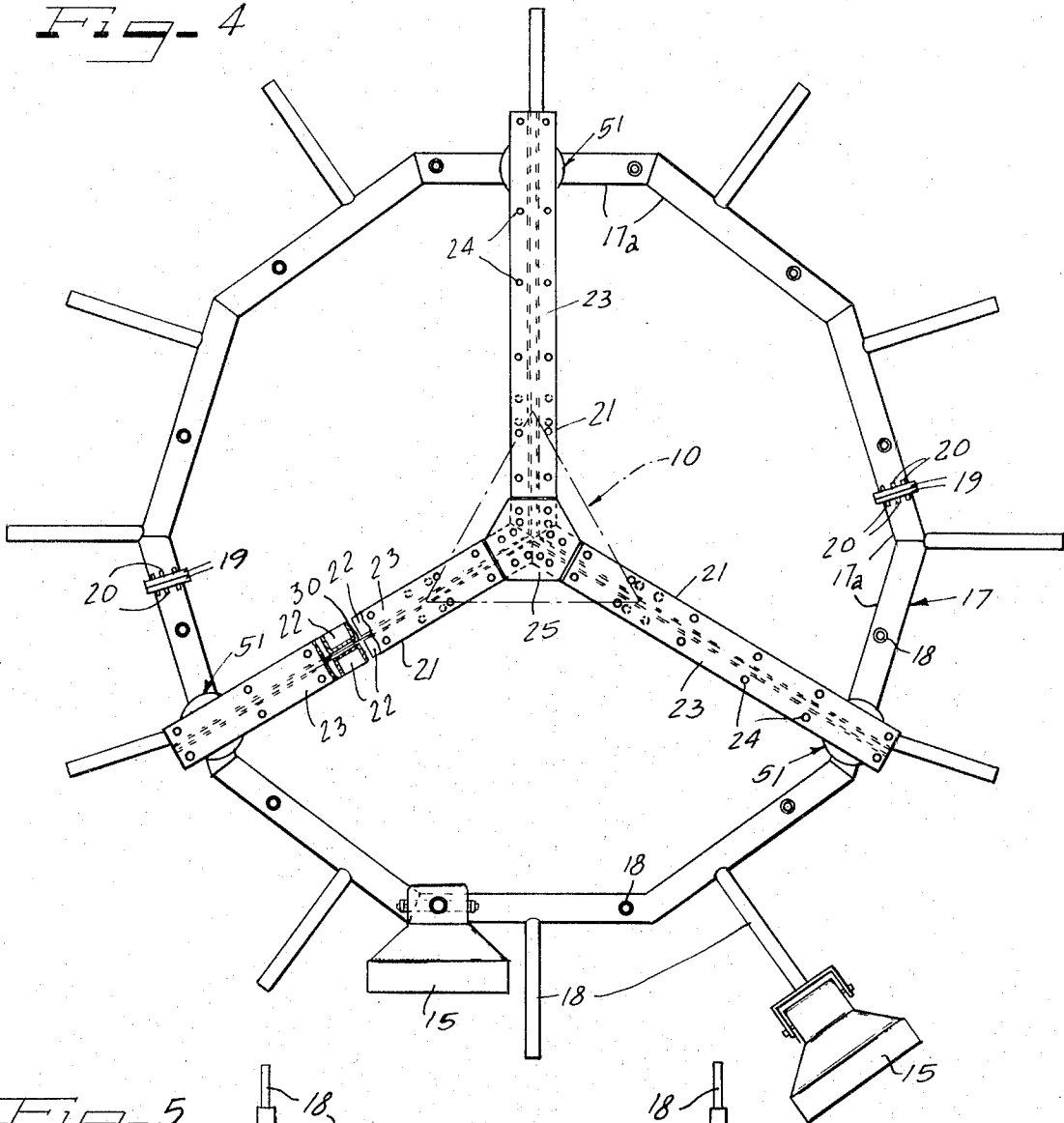


Fig. 5

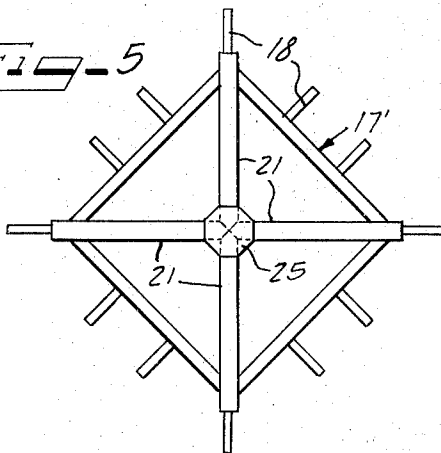
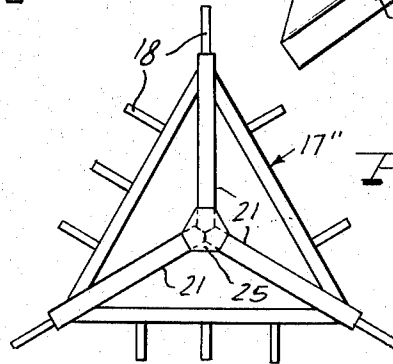


Fig. 6



INVENTORS

IVAN D. ROHN

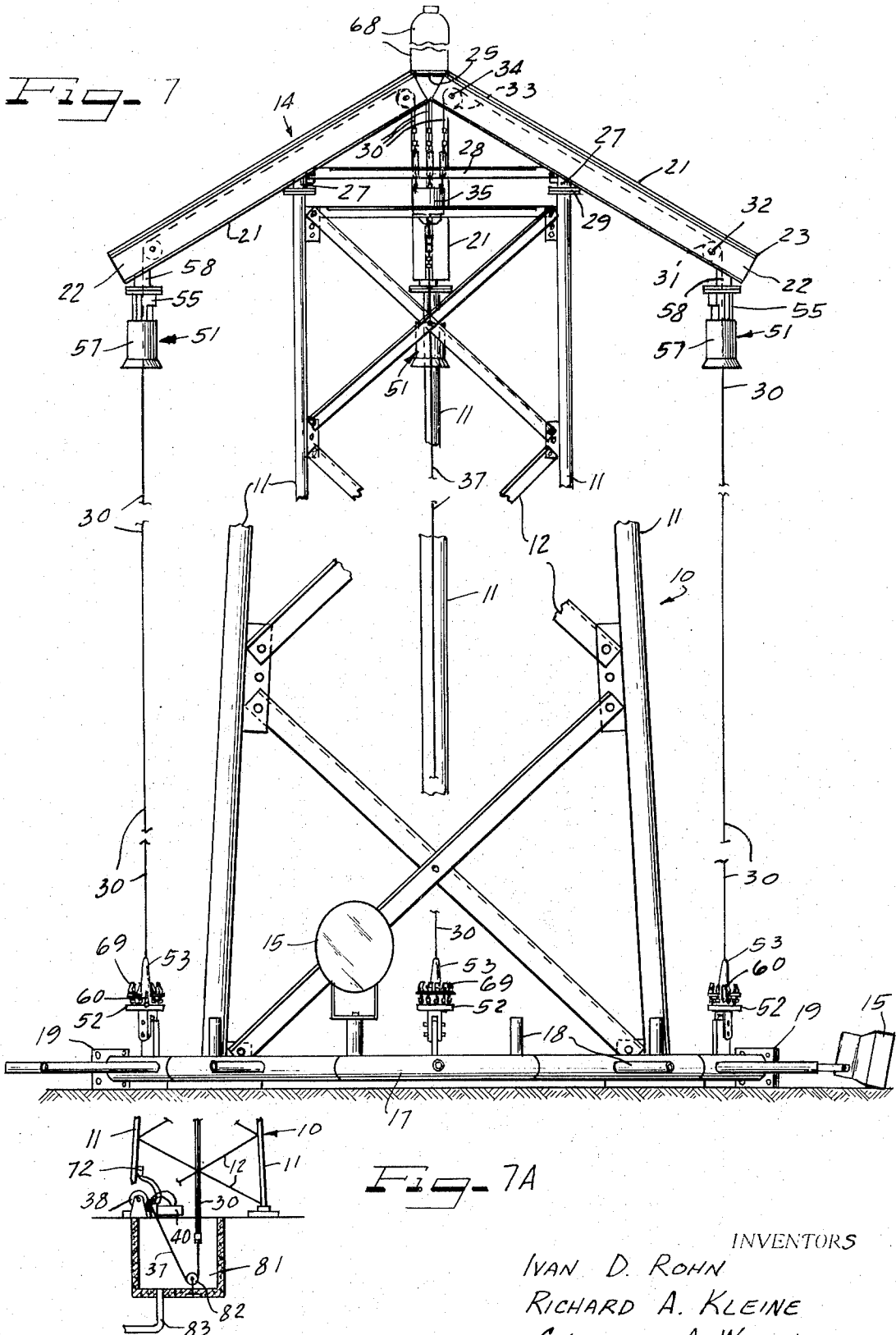
RICHARD A. KLEINE

CHARLES A. WRIGHT

ATTORNEYS

BY

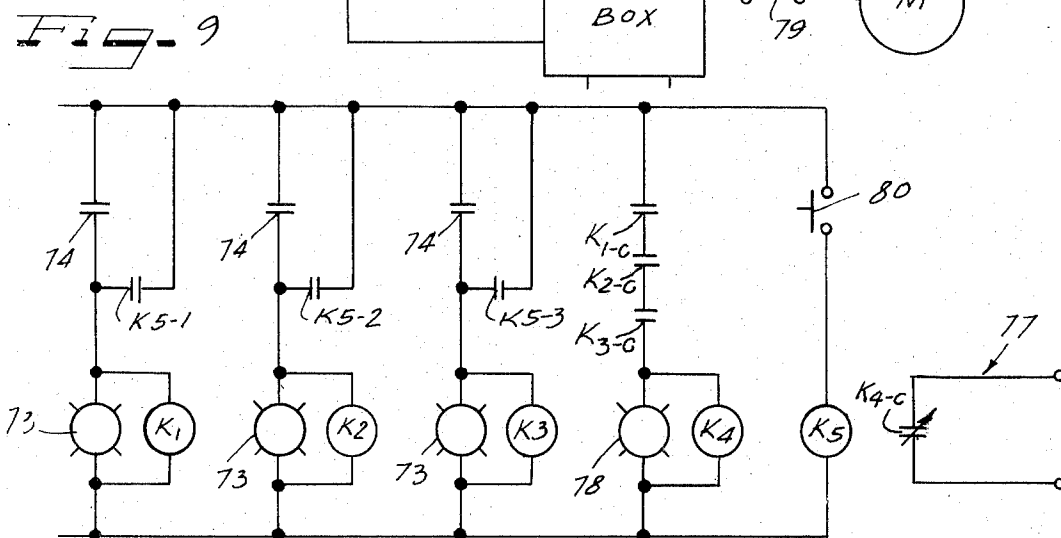
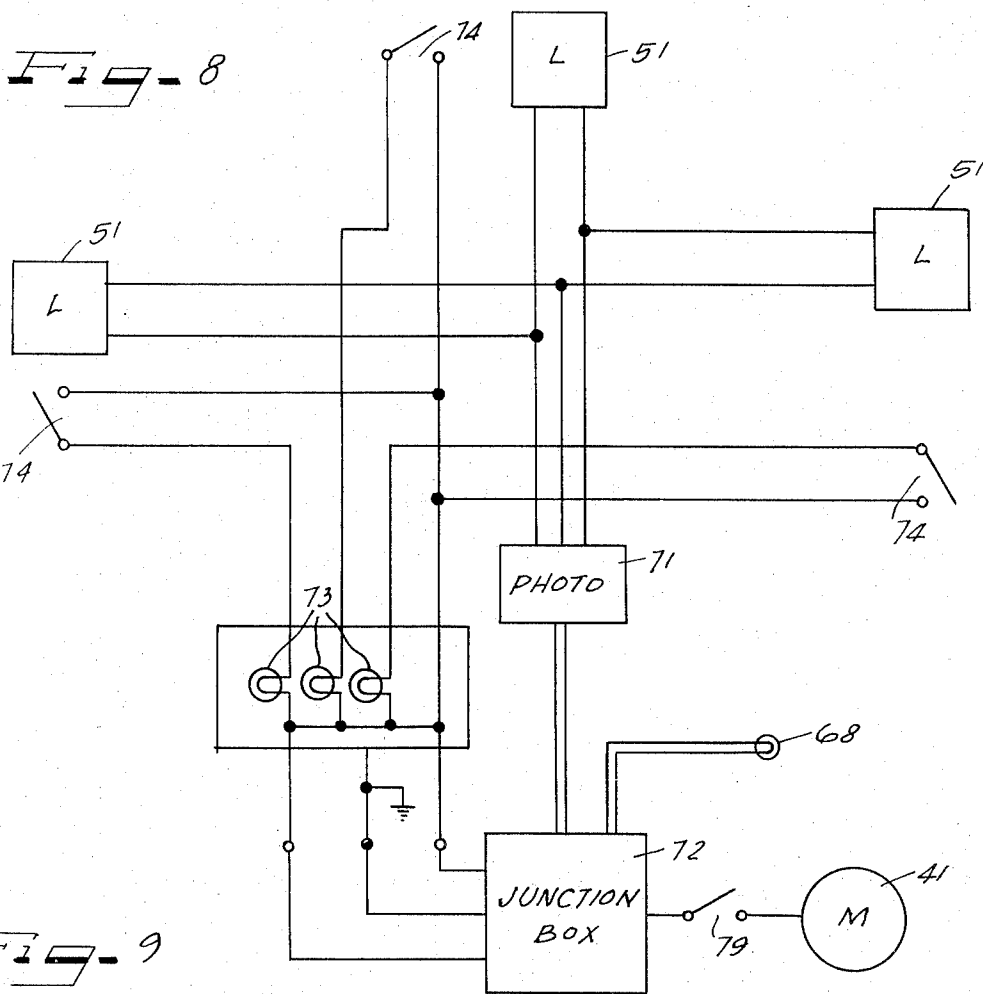
Still, Sherman, Merrin, Cross & Simpson



BY

Hill, Sherman, Meroni, Gross & Sampson ATTORNEYS

INVENTORS
IVAN D. ROHN
RICHARD A. KLEINE
CHARLES A. WRIGHT



INVENTORS

IVAN D. ROHN
 RICHARD A. KLEINE
 CHARLES A. WRIGHT
 & Simpson ATTORNEYS

BY

Will, Sherman, Meroni, Gross

HIGH-LEVEL LIGHT TOWER WITH LIGHT LOWERING DEVICE AND CONTROL SYSTEM THEREFOR

This invention relates to high-level instrument supporting structures, and is more particularly concerned with such structures in the form of towers having new and improved light supporting and lowering means and a control system therefor.

High-level outdoor lighting structures such as towers are particularly useful for area lighting such as at highway interchanges, parking areas, sport field lighting, industrial area lighting, wherever relatively large areas are to be lighted for visibility, nighttime security purposes, and the like. Such structures in the form of masts and towers for supporting the lights are commonly up to 200 feet in height and may be even higher. Servicing of the lamps and auxiliary equipment supported by the top of the structure presents a problem in that where the lamps are fixed in place they can be reached only by a service man climbing to the top of the structure. Although pole mounted lamps have sometimes been provided with means to lower the lamps from the tops of the poles, multi-lamp arrangements have generally been deemed to require rather elaborate guiding and control arrangements, and there has been some difficulty with maintaining headframes level when raising, and preventing wind whip damage during raising and lowering, or tipping due to unbalanced loads.

Multi-leg light towers present a peculiar problem as to adaptation of a lowering device for the lamps, because of the generally upwardly tapering shape of such towers. Because of that shape the upper portion of the tower in each instance is the narrowest, and it is in that area where wind whipping is most likely to cause difficulty when the lowering device is detached from the tower head connections during lowering and raising. Further, the generally ring-shaped lowering device must be of a large enough size or transverse dimension to clear the base and wider portion of the tower resulting in such a great differential in size of the device relative to the upper and narrower portion of the tower that it is virtually impossible to provide any sort of stabilization by guide means in that area.

An important object of the present invention is to overcome the foregoing and other disadvantages, shortcomings, inefficiencies and problems and to provide a new and improved high-level lighting structure, i.e., tower with novel light lowering device and control system therefor.

Another object of the invention is to provide a new and improved light lowering device especially suitable for multi-leg towers.

A further object of the invention is to provide a new and improved suspension for support of a lamp carrying ring adapting it to be raised and lowered safely, especially having regard to the dangers of wind whipping or tipping due to unbalanced load.

Still another object of the invention is to provide a new and improved high-level instrument supporting structure with a carriage adapted to lower the instruments to or adjacent to ground level for servicing.

Yet another object of the invention is to provide a new and improved means for raising and lowering a floodlight supporting carriage in relation to a high-level lighting structure.

A still further object of the invention is to provide new and improved head structure on a high-level lighting structure for supporting a light towering carriage and providing efficient means for supporting a beacon light at an effective height above the lamps.

A yet further object of the invention is to provide improved electrical control for a high-level lighting structure equipped with light lowering means.

Other objects, features and advantages of the invention will be readily apparent from the following description of certain preferred embodiments thereof, taken in conjunction with the accompanying drawings, although variations and modifications may be effected without departing from the spirit and scope of the novel concepts of the disclosure, and in which:

FIG. 1 is a fragmental side elevational view of a high-level instrument supporting structure in the form of a light tower embodying features of the invention;

FIG. 2 is an enlarged fragmentary side elevational view of the connector between the winch cable and the light lowering device manipulation cables;

FIG. 2A shows a modification;

FIG. 3 is a fragmentary illustrative elevational view showing manner in which connection and separation of the hangers is effected in the contact suspension gear means for the light lowering device;

FIG. 4 is an illustrative top plan view of the tower head structure and the light lowering device showing a three-point suspension;

FIG. 5 is a similar top plan view showing a four-point suspension arrangement with a quadrilateral ring carriage;

FIG. 6 is a similar top plan view showing a generally triangular ring carriage;

FIG. 7 is an enlarged fragmental side elevational view of the tower and light lowering device, with the device lowered to ground level;

FIG. 7A is a fragmentary view of a modification;

FIG. 8 is a schematic electrical operating diagram; and

FIG. 9 is a schematic electrical diagram auxiliary to FIG. 8 of an indicator lamp and interlock electrical circuit.

On reference to FIGS. 1 and 7, a high-level instrument supporting structure comprising a light tower 10 is depicted as of the multi-leg type which tapers from a stable base of substantial width to a substantially narrower top section. A plurality of legs 11, herein shown as three, but which may be four, or more if necessary, desirably comprising tubular or angular, or solid steel or aluminum material, are substantially rigidly connected by a suitable arrangement of diagonal brace bars 12. At their base ends the legs 11 are anchored to a suitable foundation such as respective concrete foundation posts or sunken piers 13. On the upper end of the tower is mounted a light carrying head 14 constructed and arranged to support a desired array of floodlights 15 mounted on a generally ring-shaped instrument carriage 17. Support for the floodlights on the carriage 17 is provided by respective stubs 18 rigid with the carriage (FIGS. 4, 5, 6 and 7) which may extend radially outwardly from the carriage or upwardly, or in both directions alternately, as preferred and in keeping with the number of floodlights required for any given installation or to vary the direction or area of coverage of the lighting for any given sector within the range of the tower. The carriage 17 may be made from tubular

material or angular cross section bar stock in angular sections 17a joined rigidly together end-to-end to provide a quite rigid ring able to withstand strong deflectional stresses without damage. To facilitate assembly of the carriage ring it may be constructed in two or more complementary portions, herein shown as two halves provided with joining flanges 19 which are fixedly secured together as by means of bolts 20. While as shown in FIG. 4, the carriage ring 17 is decagonal in shape, it may be of any other greater or less preferred angular shape such, for example, as quadrilateral as shown at 17' in FIG. 5, triangular as shown at 17' in FIG. 6, or other geometric shape suitable for the purpose.

According to the present invention, the carriage 17 is constructed and arranged to enable its assembly, and servicing of the floodlights 15, at or adjacent to ground level and then raising of the carriage into supported relation to the head structure 14, as well as lowering of the carriage from the head structure as desired or required, whereby to avoid the necessity of climbing to the top of the tower to gain access to the floodlights. Further, this raising and lowering is adapted to be accomplished with at least minimum liability of wind whipping damage, even though the tower 10 is of the substantially tapered form from wider base to much narrower head end portion. To this end, the transverse dimensions or diameter of the carriage ring 17 are ample for it to encircle the base end portion of the tower in good working clearance relation when the carriage is at ground level as shown in FIG. 7.

To support the carriage, the head structure 14 comprises a plurality of equally spaced radiating arms greater than two, comprising three in FIGS. 4 and 6 and four in FIG. 5 and arranged in a generally spiderlike relation extending from the center line or axis of the tower to outer supporting terminal ends on a diameter at least as great as the maximum carriage ring diameter or transverse dimensions. As best seen in FIG. 4, each of the arms 21 is desirably constructed of a pair of co-extensive channel-shaped bars 22 disposed in back-to-back spaced relation, with a flat co-extensive top panel bar 23 secured to the top flanges of the bars 22 as by means of bolts 24 to provide a rigid arm on which the top panel bar 23 provides a rain shield. Rain shedding is further facilitated by having the arms 21 sloping outwardly and downwardly from a center connecting plate 25. Support of the arms 21 on the upper ends of the tower legs 11 is effected as by means of respective leg extensions 27 rigid with the undersides of the respective arms, connected together by brace bars 28 and secured by means of attachment or bolt on flanges 29 to the tower legs.

For raising and lowering the carriage 17 relative to the head arms 21, a cable system is provided comprising respective suspension cables 30 for each of the arms 21 secured at one terminal end to the carriage 17 in alignment with that portion of the carriage which underlies the outer terminal end portion of the respective arm. From the carriage 17, each of the cables 30 extends over a pulley 31 mounted rotatably in the space between the outer end portions of the bars 22 of the associated arm 21 on a respective horizontal axle 32. Thence, the cable extends longitudinally through the arm to and is trained over a pulley 33 mounted rotatably between the inner end portions of the arm bars 22 on a horizontal axle 34. From there, each of the cables

30 extends downwardly within the head structure 14 to a common connector 35 to which is connected an operating cable 37 attached to the drum of a winch 38 fixedly mounted within the center of the base of the tower on a foundation 39. Operation of the winch 38 is adapted to be effected hydraulically or electrically by means of a suitable motor 39 which may be an electric motor but is desirably a hydraulic motor motivated by a suitable hydraulic pump 40 which is driven by means of an electrical motor 41. The arrangement may be such that the pump and motor unit and/or winch may be portable and connected to the winch motor 39 when it is necessary to operate the winch.

Connection of the carriage suspending cables 30 with the operating cable 37 is desirably such that not only will the cables 30 be operated in unison, but such that they are adapted to be individually adjusted longitudinally in order to effect accurate, non-skewing or tilting, but substantially perfectly level support of the carriage ring. For this purpose, the connector 35 is desirably or generally ring-shape and each of the cables 30 is attached to a turnbuckle 42 (FIG. 2) having a clevis 43 on its lower end attached to an upper edge of the connector properly equidistantly spaced from the companion clevises. At its upper end each of the turnbuckles 42 has a thimble 44 about which the lower end portion of the respective wire rope of the associated cable 30 is engaged and the end portion spliced onto itself and secured by one or more, herein a pair of, anchoring sleeves 45 located as close as practicable to the thimble 44 so as to require a minimum of head room under the head structure 14 when the carriage 17 has been completely lowered, although by the downwardly and outwardly oblique disposition of the supporting arms 21 (FIG. 7) their cantilever ends are sufficiently lower than the inner ends of the arms to provide substantial head room for the purpose. Connection of the operating cable 37 to the connector ring 35 is preferably effected through a swivel 47 attached at its upper end to a depending central fin 48 rigidly on the lower end of the connector sleeve. Attachment of the wire rope cable 37 to the lower end of the swivel 47 is by wrapping the end portion of the cable over a thimble 49, and splicing such end portion on itself, with anchoring rings 50 holding the splice. Through this arrangement, not only can the individual cables 30 be adjusted for optimum level support of the carriage, but a centered load with respect to the equidistantly spaced cables 30 is applied by the operating cable 37, and freedom from torque strains is assured by the self-adjustment capability of the swivel 47.

Means are provided for hanging the elevated carriage 17 from the arms 21 to relieve the cable system from the dead load except when raising or lowering the carriage. For this purpose, respective separable hangers 51 are mounted in association with each of the arms 21 and the carriage 17. Each of the hangers 51 comprises a member 52 attached to the upper side of the carriage ring 17 and thereon an upwardly extending central hollow guide pin 53 which is engageable in a suitable guide socket in a depending block portion 54 of a member 55 carrying a protective downwardly opening hood 57 and fixedly secured by means of a mounting bracket 58 to the underside of the cantilever end portion of the associated supporting head arm 21. The respective cable 30 extends centrally downwardly through the member 55, the socket in the depending portion 54 and the guide

pin 53 and is anchored to the hanger member 52. In the final increment of raising of the carriage 17, it is caused to overrun a limited desirable distance after the respective guide pins 53 mate with the sockets of the depending portion 54 and a boss 59 extending inwardly on the upper end portion of an upstanding hanger coupling arm 60 pivotally mounted on the member 52 is deflected by a cam surface 61 to then engage a cam surface 62. Thence, as shown in dash flow lines for the boss in FIG. 3, the boss 59 rises to a reversely deflecting cam surface 63 into overlying relation to a supporting cradle 64 into which the boss 59 drops by a slight backing off of the carriage. Thereupon the carriage is supported in dead load relation by the arms 21 independently of the cables, and the cables may be slightly slackened off to relieve tension therefrom and possible stretching as might result from long continued dead load.

When the carriage 17 is to be lowered, separation of the hangers is accomplished by initially raising the carriage to same overrun distance to lift the respective hanger lugs 59 from their cradles 64 to engage a release-deflecting cam surface 65 which, as shown in dot-dash flow lines in FIG. 3, causes the lug 59 to be deflected laterally such that when the carriage is then lowered the lug will clear the cradle and underide it on a decline 67 in the continuing descent of the carriage and until the lug passes the cam surface 61. The carriage is then free to be lowered all the way to ground level or to any convenient elevation near the ground as may be desired for servicing of the floodlights 15.

Desirably, though not necessarily, a beacon light 68, such as a fixed red light or a rotating beacon, is mounted at the peak of the supporting head 14 as on the connector plate 25. This is an advantageous spot for the beacon because it is substantially above the floodlights 15.

If desired, the carriage 17 may support an illuminated sign instead of or in addition to the floodlights 15. If desired, in addition to or instead of the beacon light 68, a sign structure may be mounted on the supporting head structure 14 with suitable illuminating means either carried by the sign itself, by some part of the head structure 14, or the carriage 17. It will be appreciated that considerable flexibility and adaptability is present in the disclosed structure. Instead of individual floodlights 15 circumferentially spaced about the ring of the carriage 17, a bank of floodlights may be carried by the carriage on one part thereof or on different parts thereof, as preferred.

In addition to their function as hangers, the assemblies 51 also serve as electrical connectors for the lamps of the floodlights 15. For this purpose, the lower members 52 of the assemblies 51 are provided with electrical contacts 69 (FIG. 3) which are engaged by complementary electrical contacts 70 carried by the members 55 in the assembled relationship of the members. There are as many of the sets of contacts 69 and 70 as necessary on each of the combination hanger and electrical coupling assemblies 51 as necessary for the particular installation.

In FIG. 8 is depicted an electrical circuit wherein the assemblies 51 are represented by the block diagrams 51 with electrical power connection by way of an automatic photocell control 71 and a junction box 72 which latter, at least, may be mounted in a convenient place adjacent the bottom of one of the tower legs 11 as

shown in FIG. 1. The electrical circuit for the floodlight lamps as well as for the lamp for the beacon 68, and for the motor 41 are connected through the junction box with a suitable power source.

On or in connection with the junction box 72, or as otherwise preferred, a suitable indicator panel and control switch mounting is provided including indicating or signalling means to advise when the carriage 17 has been raised to its maximum desirable height. More particularly, respective indicator or signalling lights 73 (FIGS. 8 and 9) are provided under the control of detector means comprising respective microswitches 74 (FIGS. 3, 8 and 9) which are normally open but are adapted to be closed both when the carriage 17 is overrun upwardly to the desirable limit for orienting the respective coupling bosses 59 with respect to the associated hanger cradle 64, and also to be closed when the carriage 17 is raised to the desirable limit during a disconnect operation. For this purpose, the microswitch 74 is desirably mounted on the depending portion 54 of the upper part of the assembly 51 and a stop 75 is mounted on the lower portion 52 of the assembly in such relative position with respect to the microswitch that in the desirable uppermost limit in each instance, the microswitch will be closed, thereby causing the respective indicator lights 73 to be energized and to indicate the fact of reaching the upper limit. This assures the operator that a proper connection orientation or disconnect orientation has been established with respect to the combination hanger connector assemblies 51.

In addition to illumination of the indicator lamps 73, closing of the microswitches 74 is desirably effective to operate overload safety means for the motor 41. To this end, a motor holding circuit 77 is provided. As the respective microswitches 74 close, and the indicator lights 73 are energized, there are also energized respective relays K1, K2 and K3. Closing of these relays close respective contacts K1-c, K2-c and K3-c, energizing an indicator lamp 78 and relay K4, opening a normally closed contact K4-c in the holding circuit 77, stopping the motor 41. This assures that the cables, the connector hanger assemblies and associated mechanism and apparatus of the tower and light supporting structures will be safe from overload conditions that might be imposed by overrunning of the motor when the carriage 17 has been raised to its maximum desirable limit both when effecting a connection orientation and when effecting a disconnect. Starting of the motor can be effected by manually operating a motor start switch 79. That either the locked condition or the lowering condition is in effect and the motor holding circuit is restored is evidenced by deenergizing of the indicator lights 73 and the indicator light 78.

In order to test the indicator panel before each use, a normally open test switch 80 should be closed while the motor 41 is running. Closing of the switch 80 energizes a relay K5 which closes contacts K5-1, K5-2 and K5-3, simulating closing of all of the three microswitches 74. This produces all of the conditions described when the microswitches 74 close, and all the four indicator lights 73 and 78 will light and the motor holding circuit 77 will open. After ascertaining that the circuits are all functioning, the switch 80 is opened and normal operation effected by restarting the motor 41 to raise or lower the carriage 17.

From the foregoing it will be appreciated that an efficient and advantageous high level instrument supporting structure such as a tower lighting system has been provided embodying a hollow lighting tower having improved structural, hanger, suspension and operating features attaining great stability and safety not only in the locked, hanger-supported operating position of the carriage but also in and during raising and lowering thereof. Rigidity of the angularly related sectional instrument carriage ring and the three or more point equilateral suspension both in the locked-in and cable-supported conditions of the ring effectively resist wind pressure deflection or whipping and enable accurate leveling. During raising and lowering of the carriage, the disclosed suspension affords excellent resistance to wind-induced torque, horizontal and vertical deflections. This has special significance for multi-leg, skeleton structure, generally tapering tower installations where guidance structures in the most wind-vulnerable upper and narrowest reaches of the tower is impractical. Contributing to stability and efficiency are the balanced optimally adjustable manipulating cable system and the pretesting and overload safety features. A unique supporting head structure on the lighting structure provides for the correlation of the instrument carriage hangers and the cable system in a manner to enable lowering the carriage to the ground for servicing. In addition, the supporting head structure provides a peak advantageous for mounting of beacon light or other light or attention-getting means.

Although especially suitable for multi-leg skeleton frame towers at least some features of the invention may be employed in pole or mast types of towers.

In addition to, or instead of, the headroom space afforded by the supporting head 14 the arrangement shown in FIG. 7A may be employed to enable the cables 30 to have a reach such that the carriage 17 can rest on the ground when fully lowered. For this purpose a pit 81 of suitable depth below ground level within the tower base has mounted in its lowest part a pulley 82 about which the operating cable 37 runs from the vertical to the winch 38 which is mounted at a laterally displaced convenient position. The depth at which the pulley 82 is mounted may be such as to afford additional length in the cables 30 at least equal to the length of the connector 35 plus the distances to the most remote cable retaining sleeves 45 and 50. A drain 83 may be provided in the bottom of the pit 81.

With this arrangement, the top or light-carrying head 14 may be constructed flat instead of peaked, if preferred, because the pit will compensate for lack of head room and enable lowering the light supporting carriage to the ground. Of course, where the situation is such as to preclude or for any reason lowering of the carriage to ground level is not desired, the head 14 may be flat or horizontal across or over the arms 21.

Means may be provided, as shown in FIG. 2A, for anchoring the lower end of the cable system after the instrument carriage has been fully raised, and permitting the winch for the cable 37 to be portable with the winch motor, as for example, by having both the winch and motor transportably mounted on a service vehicle such as a truck. To this end, anchoring means are desirably provided below the connector 35, for example, an anchor cable 84 having its upper end attached to the swivel 47' and carrying on its lower end connecting means such as an attachment or hook device 85 releas-

ably engageable with stationary anchoring means such as an anchor eye bolt 87 secured to an anchor block 88 at or below ground level. Thereby, the cable 37 can be detached from the swivel 47' and wound on the portable winch for use at another light tower after the anchor cable 84 has been hooked onto the anchor bolt 87. When the carriage 17 is to be lowered, the cable 37 is trained under a pulley 89 and attached to the swivel 47'. Then the swivel 47' and the upper cable system is pulled down to disengage the carrier hangers and permit the anchor cable 84 to be unhooked, whereafter lowering and thereafter raising of the light carriage may proceed as hereinbefore described.

While the carriage suspension system and method have been shown and described with relation to a frame type structural tower, it should be understood that certain of the inventive concepts here disclosed are useful in other applications, such as on pole type towers or poles. Additionally, while the illustrated carriage suspension system and method are disclosed for the purpose of service lights on a tower or pole, it is also contemplated that other type instruments can be installed on the carriage where servicing may be required.

We claim as our invention:

1. In combination with an illuminating instrument tower;

a head structure having a plurality of lateral supporting arms; means securing said arms to the tower; said arms comprising respective assemblies of angular bars secured rigidly together and sloping downwardly and outwardly relative to the axis of the tower;

a carriage having lights or instruments mounted thereon; and

means for suspending the carriage from the arms to provide at least three points of suspension for maintaining the carriage in a stabilized condition and to permit the carriage to be moved up to an operating position and down for servicing of the instruments at ground level.

2. A combination according to claim 1, in which said bars of each arm are of generally C-shape cross section and secured together in generally back-to-back relation.

3. A combination according to claim 2, including a top plate generally coextensive with and secured to said bars and covering the joint therebetween.

4. A combination according to claim 1, wherein said arms have contiguous inner end portions, and plate means secured to said inner end portions.

5. In combination with a high-level lighting tower having a supporting head and a light lowering device, with interlocking hanger means on said head and said device:

means operative to raise said device to said hanger means;

overload safety control means for said raising means including a detector operated by said device when it reaches a highest desirable relative position with respect to said supporting head;

said hanger means comprising a plurality of hangers;

said means operative to raise said device comprising an electrically controlled motor;

said overload safety control means comprising an electrical circuit for controlling said motor includ-

ing a normally open respective switch associated with each of said hangers;
a respective indicator light and a relay connected to be energized by each of said switches respectively;

an interlock circuit including an indicator light and a relay and operative only when all of said switch-controlled relays are energized;
a motor holding circuit; and
a normally closed contact in said holding circuit opened by energizing of said interlock circuit relay.

6. A combination according to claim 5, including a testing circuit having a normally open switch and a relay therein adapted to be energized by closing of said normally open switch to effect energizing of all of said indicator lights and relays.

7. In combination with a high-level lighting tower having an uppermost reach and a base portion for ground support of the tower, said uppermost reach being of substantially narrower dimensions than the base portion of the tower:

a light mounting carriage of generally ring-shape encircling the tower in free spaced relation and having inside dimensions thereacross to clear said tower base portion and thereby enable lowering of the carriage about the base portion for ground level servicing;

a supporting head structure on the tower providing at least three carriage suspension points disposed in balanced circumferentially spaced relation to the tower axis and to said carriage and being on overhanging portions of said head structure and spaced radially from the axis of said uppermost reach and at least equal to the radius of the carriage ring; and means extending from said suspension points attached to the carriage in balanced circumferentially spaced relation for raising and lowering said carriage relative to said head structure, attaining great stability and effectively resisting wind-pressure-induced torque, deflection or whipping even though no part of the carriage receives stabilizing help from the tower itself.

8. A lighting tower according to claim 7, including means for operating said raising and lowering means provided with overload control means having detectors at said suspension points.

9. In combination with a high-level lighting structure:

a light mounting carriage of generally ring-shape freely encircling the structure free from contact of any part of the carriage with at least the upper portion of the structure;

a supporting head structure on the lighting structure providing at least three carriage suspension points disposed in balanced circumferentially spaced relation to the tower axis and to said carriage; and

means extending from said suspension points attached to the carriage in balanced circumferentially spaced relation for raising and lowering said carriage relative to said head structure, attaining great stability and effectively resisting wind-pressure-induced torque, deflection or whipping even though no part of the carriage receives stabilizing help from the tower itself;

said supporting head structure comprising downwardly and outwardly sloping cantilever arms pro-

viding said suspension points, said arms joining over the center of the tower and providing a peak at a substantial elevation above said suspension points adapted for supporting an attention-getting device.

10. A lighting tower according to claim 9, including a plate structure joining the peak ends of said arms.

11. In combination in a high-level, centrally hollow lighting structure tapering from a stable base of substantial diameter to an upper end portion of smaller diameter:

a generally ring-shaped light mounting carriage encompassing said structure in freely spaced relation and of an inside diameter large enough to clear, and rest upon the ground about, said base portion;

a supporting head structure on said upper end portion of the

lighting structure providing at least three radially extending cantilever arms in circumferentially balanced spaced relation and extending into overlying relation to said carriage;

a raising and lowering cable system for said carriage including respective cables having terminals attached to said carriage;

means for operating said cables from the base portion of the lighting structure;

pulleys at outer ends of said arms for running of said cables thereover spaced radially from the axis of said upper end portion at least equal to the radius of said carriage at the points of attachment of the terminals thereto;

means connecting said cables together within said lighting structure for unison operation by said operating means;

said head structure having a clearance for said connecting means over the hollow center of the lighting structure at a substantial height relative to the outer ends of said arms; and

pulleys on said head structure over said clearance about which said cables are trained and enabling reception of said connecting means in said clearance for lowering of said carriage to the ground at the base of the lighting structure.

12. A combination according to claim 11, including means for individually adjusting the length of each of said cables relative to said connecting means to assure a level relationship of said carriage relative to the outer ends of said arms.

13. A combination according to claim 11, said supporting head structure providing a peak over said clearance and at a substantial height above the outer ends of said arms and adapted to support an attention-getting device such as a beacon.

14. In combination in a high-level, centrally hollow lighting tower having base and head portions:

a supporting head structure on said head portion of the tower providing a plurality of cantilever suspension arms;

a generally ring-shaped light mounting carriage encompassing said tower in spaced relation under said arms;

a raising and lowering cable system for said carriage including respective cables having terminals attached to said carriage;

means for operating said cables from the base portion of the tower; pulleys at outer ends of said arms for running of said cables thereover,

means connecting said cables together within said tower for unison operation by said operating means;

said head structure having a clearance for said connecting means over the hollow center of the tower at a substantial height relative to the outer ends of said arms; and

pulleys on said head structure over said clearance about which said cables are trained and enabling reception of said connecting means in said clearance for lowering of said carriage to the ground at the base of the tower;

each of said arms comprising a pair of co-extensive bars in spaced parallel relation providing a cable-run gap between the outer ends of the arms to the inner ends of the arms and said pulleys being mounted rotatably in said gap.

15. A combination according to claim **14**, including a gapclosing plate on and secured to the tops of said bars and co-extensively therewith.

16. In combination in a hollow high-level lighting tower having a base which is of larger diameter than an upper end portion:

a generally ring-shaped light mounting carriage encompassing said tower in freely spaced relation and being of inside diameter large enough to clear said base portion and rest upon the ground about said base portion;

a supporting head structure on said upper end portion of the tower providing at least three carriage suspension points disposed in balanced circumferentially spaced relation and located a radial distance from the axis of the tower equal to the diameter of said carriage;

respective cables extending from said suspension points for raising and lowering said carriage relative to said head structure;

means between said suspension points and a central portion of said head structure for supporting said cables in running relation so that the cables extend downwardly within the tower;

a single operating cable extending vertically in said tower;

means connecting said respective cables to said operating cable within said tower; and

means for operating said single cable from a position adjacent to ground level;

said head structure having a downwardly opening clearance extending upwardly therein to a height substantially above said suspension points and receptive of said cable-connecting means to enable paying out of said cables far enough to lower the carriage to ground level.

17. A combination according to claim **16**, said connecting means comprising a connector attached to the upper end of said single cable and respective turnbuckles attached to the connector and extending upwardly therefrom and respectively attached to said respective cables for individual adjustment of the respective cables to enable optimum leveling of the carriage relative to said suspension points.

18. In combination with a high-level supporting structure for lights or instruments having an uppermost

reach and a base portion for ground support of the structure:

an instrument carriage of generally ring-shape encircling the structure in free spaced relation and having inside dimensions thereacross to clear said structure base portion and thereby enable lowering of the carriage about the base portion for ground level servicing;

a supporting head structure on the instrument supporting structure providing at least three carriage suspension points disposed in balanced circumferentially spaced relation to an axis of the high-level instrument supporting structure and to said carriage and being on overhanging portions of said head structure and spaced radially from the axis of said uppermost reach; and

means extending from said suspension points attached at points of attachment to the carriage, the suspension points being aligned with the attachment points and being in balanced circumferentially spaced relation for selectively raising and lowering said carriage relative to said head structure in operating and servicing positions.

19. A combination according to claim **18**, including, said raising and lowering means being in part operative within an interior hollow area of said high-level instrument supporting structure between said base portion and said head structure and including rotary ground-anchored structure accessible within said base portion.

20. A combination according to claim **19**, including means on said head portion for running guidance of suspension cables in the raising and lowering of said carriage, an operating cable axially within said interior hollow area engaged with said rotary ground-anchored structure within the base portion, means of substantial length connecting said suspension cables and said operating cable, and means providing between said running guidance means and said ground-anchored structure ample clearance for a cable reach of sufficient length to enable said suspension cables to raise and lower said carriage to and between said operating and servicing positions.

21. A combination according to claim **20**, wherein said last-mentioned means provides a headroom clearance in said head structure for said cable connecting means when the carriage is in a ground lying position.

22. A combination according to claim **20**, wherein said last-mentioned means comprises a pit below ground level within said base portion to receive said connecting means when said carriage is in said operating position.

23. In combination with a high-level supporting structure for lights or instruments having an uppermost reach and a base portion for ground support of the structure:

an instrument carriage of generally ring-shape encircling the structure in free spaced relation and having inside dimensions thereacross to clear said structure base portion and thereby enable lowering of the carriage about the base portion for ground level servicing;

a supporting head structure on the structure providing at least three carriage suspension points disposed in balanced circumferentially spaced relation to an axis of the high-level instrument support-

ing structure and to said carriage and being on overhanging portions of said head structure and spaced radially from the axis of said uppermost reach; and

means extending from said suspension points attached at points of attachment to the carriage, the suspension points being aligned with the attachment points and being in balanced circumferentially spaced relation for selectively raising said carriage relative to said head structure into an operating position and for lowering said carriage into a working position where the carriage lies on the ground about said base portion.

24. In combination with a high-level instrument supporting structure including illuminating lights and having an uppermost reach and a base portion for ground support of the structure:

an instrument mounting carriage of generally ring-shape encircling the structure in free spaced relation and having inside dimensions thereacross to clear said structure base portion and thereby enable lowering of the carriage about the base portion for ground level servicing;

a supporting head structure on the structure providing at least three carriage suspension points disposed in balanced circumferentially spaced relation to the axis of the highlevel instrument supporting structure and to said carriage and being on overhanging portions of said head structure and spaced radially from the axis of said uppermost reach; and

means extending from said suspension points attached at points of attachment to the carriage, the suspension points being aligned with the attachment points and being in balanced circumferentially spaced relation for raising and lowering said carriage relative to said head structure.

25. A combination according to claim **24** including raising and lowering means being in part operative within an interior hollow area of said high-level instrument supporting structure between said base and head portions and including rotary ground-anchored structure accessible within said base portion.

26. A combination according to claim **25**, including means on said head portion for running guidance of suspension cables in the raising and lowering of said carriage, an operating cable axially with said interior hollow area engaged with said rotary ground-anchored structure within the base portion, means of substantial length connecting said suspension cables and said operating cable, and means providing between said running guidance means and said ground-anchored structure ample clearance for a cable reach of sufficient length to enable said suspension cables to raise and lower said carriage to and between said operating and servicing positions.

27. A combination according to claim **26**, wherein said lastmentioned means provides a headroom clearance in said head portion for said cable connecting means when the carriage is in a ground lying position.

28. A combination according to claim **26**, wherein said lastmentioned means comprises a pit below ground level within said base portion to receive said connecting means when said carriage is in said operating position.

29. In combination in a high level centrally hollow supporting structure for lights or instruments having base and head portions:

a supporting head structure on said head portion; a generally ring-shape instrument mounting carriage dimensioned to encompass said instrument supporting structure including said base portion in free clearance relation;

cooperative means on said supporting head structure and said carriage for maintaining the carriage in operating position on the head portion;

said head structure providing at least three carriage suspension points disposed in balanced circumferentially spaced relation to an axis of the instrument supporting structure and to said carriage and being on overhanging portions of said head structure and spaced radially from the axis of said head portion; and

means for raising and lowering said carriage between said operating position and a ground level servicing position including cables operable from within said instrument supporting structure and extending from said suspension points and attached at points of attachment to the carriage aligned with the suspension points and in balanced circumferentially spaced relation thereto.

30. An instrument supporting structure according to claim **29**, including rotary ground-anchored structure accessible within said base portion and operative to actuate said cables for raising and lowering said carriage.

31. A high level hollow instrument supporting structure according to claim **30** including means on said head structure and said head portion for running guidance of said cables in the raising and lowering of said carriage, an operating cable axially within the hollow instrument supporting structure engaged with said rotary ground-anchored structure within the base portion, means of substantial length connecting said cables with said operating cable, and means providing between said running guidance means and said ground-anchored structure ample clearance for a cable reach of sufficient length to enable said cables to raise and lower said carriage to and between said positions.

32. An instrument supporting structure according to claim **31**, wherein said last-mentioned means comprise a headroom clearance in said head portion for said cable connecting means to permit laying of the carriage onto the ground about said base portion.

33. An instrument supporting structure according to claim **31**, wherein said last-mentioned means comprises a pit below ground level within said base portion to receive said connecting means when said carriage is in said working position.

34. In combination with a high-level supporting structure for lights or instruments having an uppermost reach and a base portion for ground support of the structure:

an instrument carriage of generally ring-shape encircling the structure in free spaced relation and having inside dimensions thereacross to clear said structure base portion and thereby enable lowering of the carriage about the base portion for ground level servicing;

a supporting head structure on the instrument supporting structure providing at least three carriage suspension points disposed in balanced circumfer-

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essentially spaced relation to an axis of the high-level instrument supporting structure and to said carriage and being on overhanging portions of said head structure and spaced radially from the axis of said uppermost reach;
a cable system for raising and lowering said carriage relative to said head structure in operating and servicing positions;
said instrument supporting structure being hollow and said cables extending down within the supporting structure;
connector means secured to ends of the cables within

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the supporting structure;
a winch-operated cable removably attachable to the connector means;
anchoring means adjacent to but separate from said base; and
an anchoring cable separate from said winch-operated cable extending from said connector means and having means for releasably connecting the anchoring cable to said anchoring means to permit release and removal of said winch-operated cable from said connector means.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,856,639 Dated December 24, 1974

Inventor(s) Ivan D. Rohn

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Title page, Item 73, for "Rohm" read --Rohn--;

Column 1, Line 13, for "whenever" read --wherever--;

Column 3, Line 61, for "ove" read --over--;

Column 12, Line 15, for "rom" read --from--;

Column 16, Line 4, for "meand" read --means--.

Signed and sealed this 6th day of May 1975.

(SEAL)

Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents
and Trademarks