Jan. 13, 1970 A. C. PERBAL 3,489,384

TENSION HELD EXTENSIBLE TILTABLE COUNTERBALANCED LAMP BRACKET AND THE LIKE

Filed May 31, 1968 3 Sheets-Sheet 1

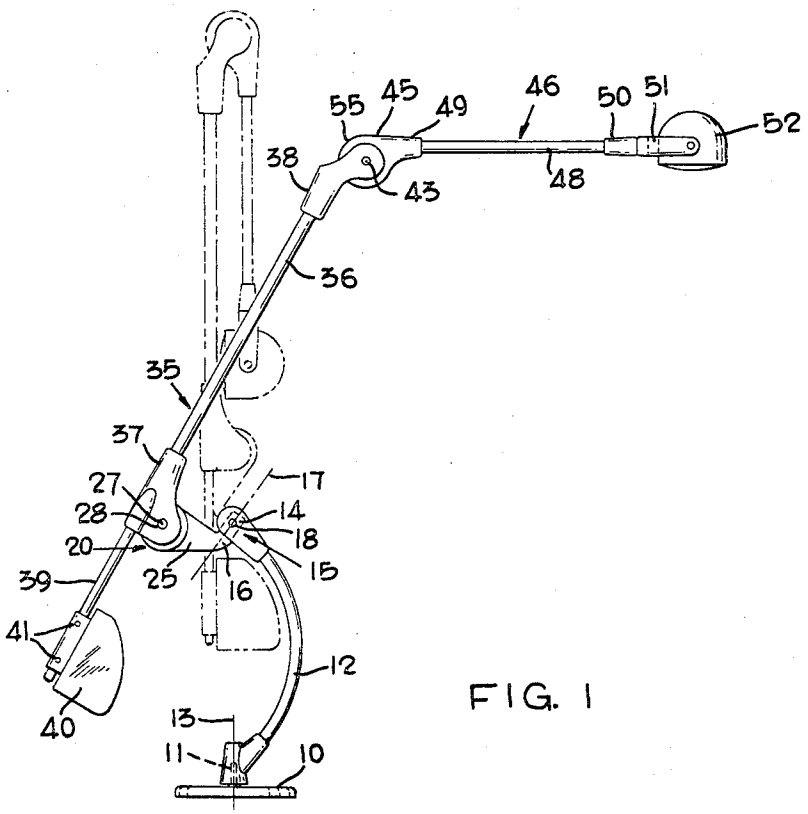


FIG. 1

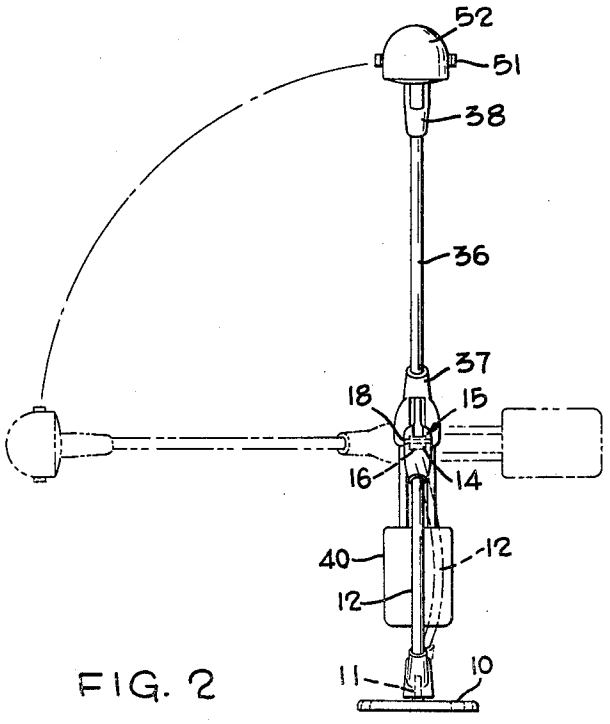


FIG. 2

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TENSION HELD EXTENSIBLE TILTABLE COUNTERBALANCED LAMP BRACKET AND THE LIKE

Filed May 31, 1968 3 Sheets-Sheet 2

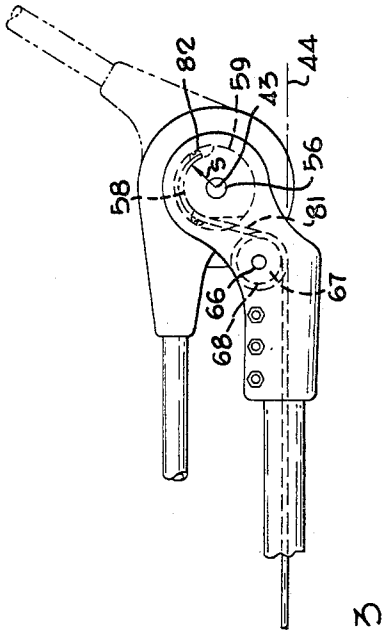


FIG. 3

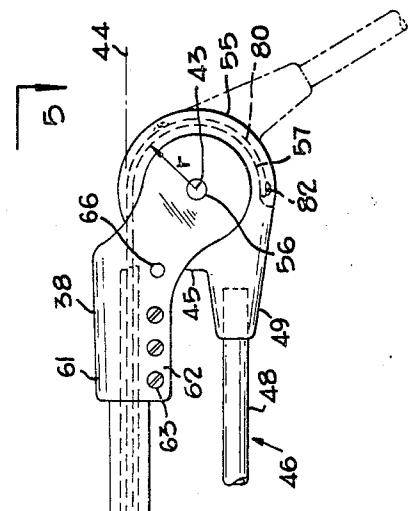
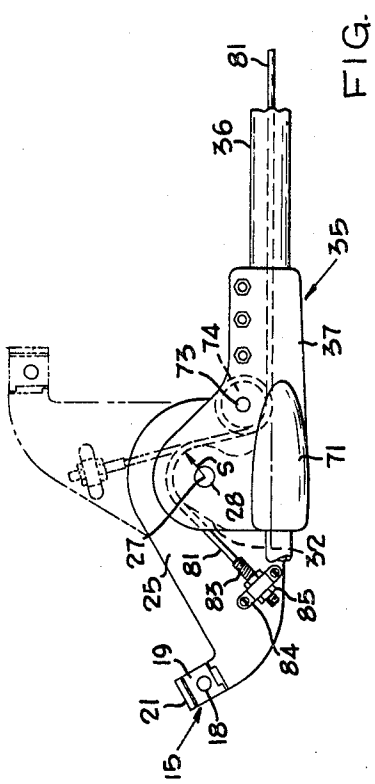
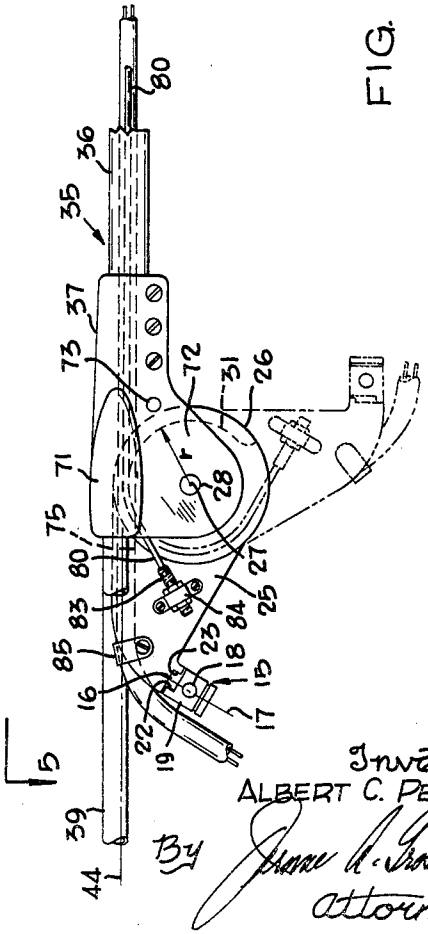


FIG. 4





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TENSION HELD EXTENSIBLE TILTABLE COUNTERBALANCED LAMP BRACKET AND THE LIKE

Filed May 31, 1968 3 Sheets-Sheet 3

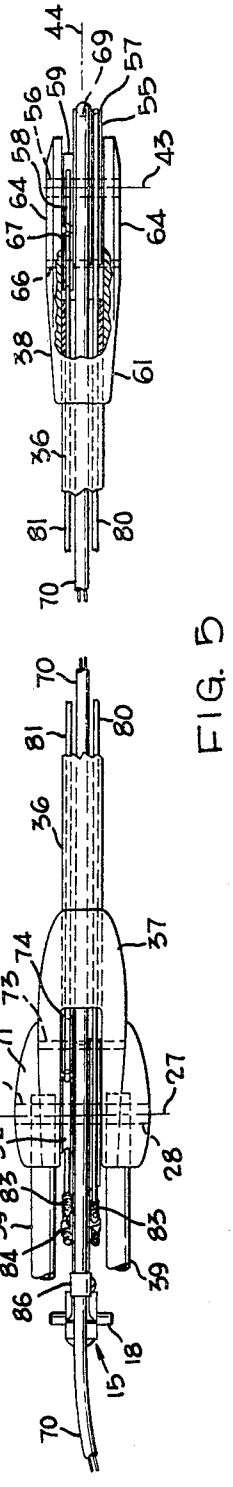


FIG. 5

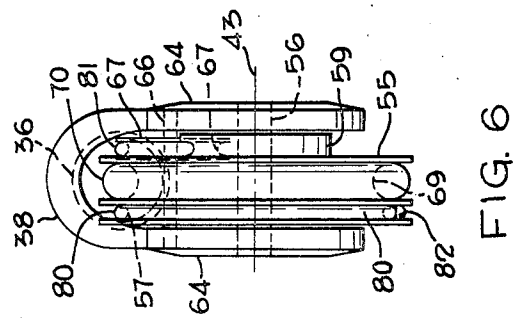


FIG. 6

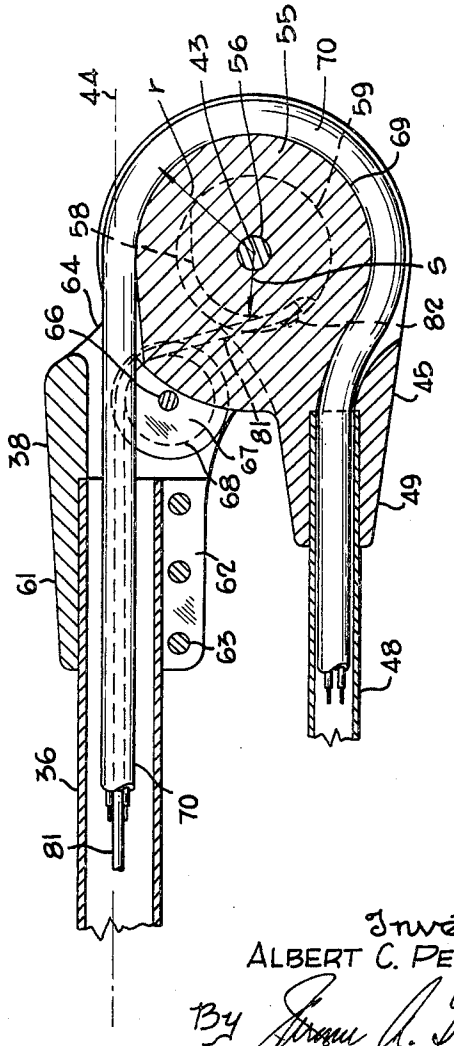


FIG. 7

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TENSION HELD EXTENSIBLE TILTABLE COUNTERBALANCED LAMP BRACKET AND THE LIKE

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Continuation-in-part of application Ser. No. 551,433, May 19, 1966. This application May 31, 1968, Ser. No. 733, 499

Int. Cl. A47f 5/00; A47h 1/10

U.S. Cl. 248—280 9 Claims

ABSTRACT OF THE DISCLOSURE

An improved counterbalanced bracket, on which a lamp or other mass is attached to the forward end of an arm hinged to a tubular lever, has a proportion-maintaining mechanism contained within the bracket elements. These elements include a fulcrum link member in which the bracket is balanced at a support point which provides freedom of angular tilt. Opposed parallelism-maintaining cables extend across knuckles at a hinge joint and at the fulcrum joint, to turn the fulcrum link angularly as the arm is turned in the hinge joint. The hinge and fulcrum joints are offset from the axis of the tube to permit one of the tension cables and the electrical cable to pass straight through it, reciprocating as the joints are turned.

BACKGROUND OF THE INVENTION

This invention relates to extensible brackets for the support of electrical lamps and other articles, which brackets are extensible in a plane through a broad range of positions and degrees of tilt; and is a continuation-in-part of my co-pending application Ser. No. 551,433, filed May 19, 1966, now Patent No. 3,391,890 whose disclosure is herein incorporated by reference. With the invention of my said co-pending application, a balancing mass is projected proportionately rearward as a lamp or other object supported by the forward arm of the bracket mechanism is drawn forward. The proportionality is obtained by maintaining parallelism with a fulcrum link, which extends from the support point to a fulcrum joint, where it supports a lever of the mechanism. At the forward end of the lever is hinged a forward arm, to which a lamp or other article may be attached. In the preferred embodiment disclosed in said co-pending application, the means by which parallelism was acheived is a parallelogram rod, connected between the arm and the fulcrum link member at a point offset from the support point. This offset, together with unique means to provide three degrees of angular movement at the support point, permits the balanced mechanism to be tilted laterally out of the plane in which it is extensible.

The principal purpose of the present invention is to provide another mechanism to maintain such parallelism, especially well suited to support a heavy object when the bracket is tilted out of the plane in which it is extensible. A parallelogram rod offers no support for the weight of such a heavy lamp or other supported object when the supporting mechanism is tilted out of the vertical plane. Further objects of the present invention include providing means to maintain parallelism, which are substantially contained within the lever member and the hinge joint and fulcrum joint, thus protecting the mechanism while giving it an attractive appearance; and to utilize knuckle elements as moving arcs which lead both tension cables and a flexible conduit through a tubular part of the lever. Additional objects will be apparent from the remainder of this specification.

SUMMARY OF THE INVENTION

Generally summarized, and without limitation, the present invention consists of providing a bracket mechanism, of the type shown in my co-pending application, with improved means to maintain correspondence of angular movement between two members jointed to the lever member. These are the fulcrum link member at the fulcrum joint, and the arm member, hinged at the forward end of the lever. By such correspondence of angular movement, parallelism is preserved between a first line, from the fulcrum joint to the support point, and a second line, extending from a hinge joint at the forward end of the lever member to the center of gravity of the forward-extending arm and the masses supported by it.

The new means to provide such parallelism comprises a strong tubular lever member which encloses two tension cables, here designated as a load support cable and a return cable. Both of these extend from the arm member at the hinge joint to the fulcrum link member at the fulcrum joint, over knuckle parts formed integrally with the fulcrum link member and the arm member. The knuckle parts provide circular arcuate track portions at these joints over which the two cables lead in opposite senses, and which rotate as the arm and fulcrum link turn. The hinge joint and fulcrum joint are offset from the axis of the straight tubular lever member by an amount equal to the radius of the knuckle's arcuate track for the level load support cable. A groove in each knuckle part adjacent to this arcuate track permits the flexible conduit, which serves the supported object, to pass over the knuckle parts straight through the tubular lever. On corresponding angular movements of the knuckle parts of the fulcrum link member and the arm member, the conduit will flex over them but will merely reciprocate within the tube part; hence it requires no slack. The return cable, which leads around the knuckle parts in a sense opposite to that of the load support cable, moves in arcuate tracks of smaller radius; it is brought within the tubular lever to the same level as the other tension cable and the electrical cable by small cable guide pulleys in fittings at each joint.

Hence, throughout the range of movements of the extensible mechanism, the tension cables and the flexible conduit are not subject to abrasion. The fairly large diameter tubular lever provides adequate rigidity against bending and torsional deflections when the bracket mechanism is tilted out of the vertical plane.

Where used to support such equipment as studio lights, television cameras and microphones, their flexible electric conduits are well protected from abrasion, and the supported objects may easily be moved throughout a broad range of positions, in perfect balance, and with the bracket tilted to an angle most convenient and unobtrusive. As to other apparatus, such as pneumatic or hydraulic equipment which utilizes a hose or other flexible conduit, the same advantages are afforded.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevational view of an extensible balanced support bracket mechanism embodying the present invention, shown in the vertical plane. The phantom lines show the mechanism in fully folded position.

FIG. 2 is a front view thereof, the phantom lines showing the balanced bracket mechanism tilted laterally out of the vetrical plane into horizontal position.

FIG. 3 is an enlarged fragmentary side view of a portion of the bracket mechanism, showing particularly those parts at the fulcrum joint and hinge joint which are closest to the side from which viewed. The solid lines show the positions of the knuckle parts at these joints when in

fully folded position; the phantom lines show their positions at the other limit of their range of movement.

FIG. 4 is a view similar to FIG. 3, as viewed from the opposite side.

FIG. 5 is a view of the same parts as seen along line 5—5 of FIG. 3.

FIG. 6 is a further enlarged right end view of FIG. 5.

FIG. 7 is an enlarged sectional view of the right end portion of FIG. 3, enlarged similarly to FIG. 6.

DESCRIPTION OF THE PREFERRED EMBODIMENT

For supporting the present extensible bracket mechanism, pivoting base means similar to that shown in my co-pending application is utilized. A base plate **10** has a vertical spindle **11** on which pivots a bent member **12** which bends away from and returns to the vertical pivot axis **13** established by the spindle **11** at a support point **14** spaced above the base plate **10**. This point serves to balance the bracket mechanism, to be described, at the center of gravity of all masses including the bracket mechanism and the object or objects supported thereby. Pivoting about the vertical axis **13** provides a first degree of freedom of angular movement at the support point **14**. Trunnion means generally designated **15**, such as shown in my co-pending application, provide a lateral horizontal axis at the support point **14** permitting a second degree of freedom of angular movement. Frictional restraint against inadvertent movement about such axes may be provided.

Within the trunnion means **15**, the swiveling end **16** of a fulcrum link member generally designated **20** is held aligned to provide an axis **17** of angular movement of the balanced mechanism. On this axis **17** movement is provided over a range of at least 90° to each side of a central vertical plane. The axis **17** is at all time perpendicular to the axis of the trunnion means **15**, and itself turns in a vetrical plane with turning of the trunnion means which affords the fulcrum link member **20** a range of movement about the lateral trunnion axis **15** of approximately 120°. A typical position in use is that shown in solid lines in FIG. 1, wherein the axis **17** is inclined downward and aft; whereas in the folded position, shown in phantom lines in FIG. 1, the axis **17** is rotated upward about 90°. Where, as in FIG. 1, the axis **17** is not horizontal, tilting of the balanced mechanism from the vertical plane to horizontal plane, as shown in FIG. 2, will be accommodated in part by movement about the other axes, including a pivoting movement of the bend member **12** about the vertical axis, as shown in phantom lines in FIG. 2.

The detailed construction of the trunnion member **15** and swiveling end **16** is shown in FIGS. 3 and 4. The trunnion member **15** has trunnion pins **18** extending outward from a hollow cylindrical housing **19**. The swiveling end **16** passes through the hollow cylindrical housing **19** and has a head **21**. Tilting about the axis **17** is limited by tilt stop portions **22, 23** on both sides of the cylindrical housing **19** and swiveling end **16**.

The link member generally designated **20**, so mounted at the support point **14**, has a flat sided, somewhat triangular body portion **25** commencing in an apex at the swiveling end **16** and terminating in a broad, rounded knuckle part **26** having a fulcrum joint axis **27** through which passes a fulcrum pin **28**. The knuckle part **27** may be formed by casting, and includes two indented circular arcuate cable track portions **31, 32**. At the side seen in FIG. 3, the track portion **31**, for the support cable to be described, has a radius *r* about the fulcrum axis **27** as shown in FIG. 3. At the opposite side of the knuckle member **26**, the arcuate track portion **32** for the return cable, to be described, is formed to a smaller radius *s* about the fulcrum axis **27**. Because the bottoms of these cable track portions **31, 32** are curved, the term "radius" as applied thereto is used throughout this specification and claims to refer to the radial distance to the midheight of the cable or flexible conduit supported therein.

The track portions **31, 32** are formed in planes parallel to each other, perpendicular to the fulcrum joint axis **27**. As will be seen from FIGS. 3 and 4, they are formed only partly around the knuckle part **26** over arcs sufficient to permit the support cable and return cable, to be described, to lead in opposite senses over said track portions **31, 32** through a range of approximately 120° of angular movement.

A lever member generally designated **35** is mounted on the fulcrum joint axis. The lever member includes a straight load support tube part **36** having a sturdy wall whose inside diameter is ample to accommodate the cables and conduit hereafter described and having at its ends a fulcrum joint fitting **37** and a hinge joint fitting **38**. Mounted in and projecting aft from the fulcrum joint fitting **37**, the lever member **35** has a pair of counterbalance rods **39**, with a counterbalance mass **40** held thereon by set screws **41** by which its position may be adjusted.

The fitting **38** at the forward end of the load support tube **36** positions a lateral hinge joint axis **43**, offset from the straight axis **44** of the tube portion **36**. The position of the lateral fulcrum axis **27** is equally offset by the fitting **37**. The amount of their offset equals the radius *r* of the circular arcuate track portion **31** of the knuckle part **26** of the fulcrum link **20**.

A flat-sided arm member joint fitting **45**, having an integral knuckle part as hereafter described, is mounted at the hinge joint axis **43**; it supports a forward arm member, generally designated **46** including a tube **48** mounted in a socket **49** of the joint fitting **45**. At the opposite, forward end of the tube **48** is an article attachment fitting **50** which, in the embodiment illustrated, has a swiveling yoke **51** mounting an electric lamp head **52** of conventional design. Other types of attachment fittings might be employed, as well as other supported articles.

The knuckle part **55** at the hinge axis **43** is generally similar to the fulcrum knuckle part **26** heretofore described. A hinge pin **56** at the hinge axis **43** mounts the arm joint fitting **45** to the lever hinge joint fitting **38**. At the side shown in FIG. 3 (the lower side shown in FIG. 5) the knuckle part **55** is cast or molded to provide an indented circular arcuate track portion **57**, whose radius *r* equals the radius of the corresponding track portion at the fulcrum link knuckle part **26**. On the opposite side, as shown in FIG. 4, the knuckle part **55** is indented to provide another arcuate track portion **58**, having a smaller radius *s*, corresponding to the radius of the corresponding track at the fulcrum link knuckle part **26**. The unindented peripheral portion **59** is of slightly larger radius, but nevertheless is substantially smaller than the remainder of the knuckle part **55**.

The lever fittings **37, 38** are of the clevis type, preferably formed by casting. The fitting **38** at the hinge joint is best shown in FIGS. 6 and 7. It has a socket end **61**, counterbored along an axis concentric with the load support tube axis **44**, and is split on its underside where two parallel socket flanges **62** are provided with bolts **63** to clamp them together over the forward end of the load support tube **36**. Outward from the socket end **61** extend a pair of clevis arms **64**, spaced apart from each other a distance slightly greater than the thickness of the flat-sided hinge joint fitting **45**, and hold the hinge pin **56** at the hinge axis **43**.

Within the hinge fitting **38** is a pulley pin **66** extending laterally between the two clevis arm parts **64**, and offset to the same side of the tube axis **44** as the hinge pin **56**. It is spaced sufficiently from the hinge joint axis **43** to provide clearance for the knuckle part **55**, as best shown in FIG. 7. A cable guide pulley **67** on the pulley pin **66** is not centered but, as shown in FIGS. 6 and 7, is aligned with the arcuate track portion **58**. The fact that the peripheral portion **59** of the knuckle part **55** is there of smaller radius than at the opposite side, and that the cable guide

pulley 67 is of still smaller radius, permits the cable guide pulley 67 to be accommodated neatly within the clevis of the hinge fitting 38. The pulley 67 has a cable track indentation 68; its radius (as hereinabove defined) from the axis of the pin 66 equals the amount by which that pin is offset from the tube axis 44.

As best seen in FIGS. 5 and 6, the arcuate track portions 57, 58 of the knuckle part 55 are spaced apart from each other less than the inner diameter of the tube part 36. Parallel to and midway between them, the knuckle part 55 has a circular arcuate groove 69 of the same radius as the arcuate track 57. This groove is rounded to a width sufficient to accommodate a flexible conduit, such as an electrical cable 70. As shown in FIGS. 5, 6 and 7, the cable 70 extends through the precise center of the lever tube 36, over and around the groove 69 in the knuckle part 55, and then through the arm tube 48, to connect to the lamp head 52. Thus ample radius is provided for the electrical cable 70, while the cable guide pulley 67 fits sideward thereof, partly overlapping as shown in FIG. 7, minimizing the overall size of the fitting 38.

The fulcrum joint fitting 37, at the other end of the tube part 36, is formed symmetrically with and has features corresponding identically to those of the hinge joint fitting 38 heretofore described; therefore, their description here will be somewhat shortened. Additionally, it has a pair of parallel socket portions 71 offset sideward of and slightly above the level of the axis 44, in which are mounted the forward ends of the rearward-extending counterbalance rods 39. Included among the corresponding portions are clevis arm portions 72 which hold the fulcrum pin 28; and a lateral pulley pin 73 on which a cable guide pulley 74 is mounted, similarly to the mounting of the cable guide pulley 67. The radii of the cable pulley 74 and the cable track 31 position the cables which lead thereover at the level of the axis 44 fairly close to the inner side walls of the tube part 36. Between the arcuate tracks 31, 32 of the knuckle part 26 is a circular arcuate conduit groove 75, like the conduit groove 69 in the hinge joint knuckle part 55.

As disclosed in my co-pending application, balance may be maintained at the support point 14, regardless of the extension of the bracket mechanism in its plane of extension as shown in FIG. 1, and its lateral tilting as shown in FIG. 2, by maintaining: (1) inverse proportionality between the masses forward and aft of the support point 14 and their respective distances therefrom, and (2) rectilinear alignment of the forward mass center of gravity, the support point 14, and the aft mass center of gravity.

Thus, if the lamp head 52 were offset substantially above or below the axis of the forward arm 46, the forward mass center of gravity might be moved up or down a few degrees from the position of the arm 46 itself. Nevertheless, the angular position of the knuckle part 55 in the hinge joint fitting 38 might be adjusted to compensate for such effect. With such adjustment, any means whereby angular movement of the knuckle part 55 at the hinge joint 38 causes a corresponding simultaneous angular movement of the fulcrum knuckle part 26 at the fulcrum joint fitting 37, will maintain parallelism between a first line, from the support point 14 to the hinge joint axis 27, and a second line from the hinge joint axis 43 to the center of gravity of masses forward of the support point 14.

In the present construction, a load support cable 80 and the return cable 81 are utilized for this purpose. Both are secured at one end to the knuckle part 55 of the arm member 46 of the hinge joint axis 43, and extend therefrom in opposite senses over the arcuate tracks 57, 58 and pass through the tube part 36 of the lever member 35, thence leading in opposite senses over the arcuate tracks 31, 32 in the fulcrum knuckle part 26, and are secured at their other ends to the opposite flat sides of the fulcrum member 20. Comparing FIG. 4 with FIG. 3, the cable guide pulleys 67, 74 serve to lead the return cable 81 through the tube part 36 parallel to and at substantially the same level as the load support cable 80 (the term "level" being precisely applicable only when the mechanism is in the vertical plane as shown in FIG. 1). The electrical conduit 75 is led between them at the same level. At the knuckle part 55 the forwards ends of the cables 80, 81 are secured at the forward ends of the arcuate tracks 57, 58 by screws 82; at their aft ends they have threaded sleeves 83 extending through tension adjustment fittings 84 secured to the opposite sides of the body portion 25, and having nuts 85 which are turnable on the sleeves 83 to adjust the cable lengths. Such adjustment is useful not only to take up any slack, but also to work out the desired relative angularity between the fulcrum link member 20 and the arm member 46. This adjustment, together with the adjustment of the counterbalance mass 40 on the counterbalance rods 39, permits very accurate balance at the support point 14.

Conveniently, the cable 70 is held in fixed position, with reference to the fulcrum link member 20, by a clip 86 attached to it and aligned with the arcuate conduit groove 75.

Referring to FIG. 3, as the knuckle part 55 of the arm joint fitting 45 and the knuckle part 26 of the fulcrum link member 20 undergo corresponding angular movements, the tangential positions of the electrical conduit 70 and of the load support cable 80 and return cable 81, with reference to the groove and tracks in which they operate, will not change. Their only movement relating to the groove and tracks will be a flexing of portions from straight to curved. Thus, the electrical conduit 75 may be led through the tube part 36 over the knuckle parts 26, 55 without any slack from the arm member 46 to the fulcrum link member 20. Since the load support cable 80 and return cable 81 are under constant tension, there will always be clearance within the tube part 36 for the conduit 70. It will be seen from FIG. 3 that with such angular movement, the electrical conduit 70 and the load support cable 80 and return cable 81 will reciprocate side by side through the tube part 36.

Thus the offset of the hinge joint and fulcrum joint by an amount equal to the radius *r*, permits the conduit and cable to lead over the knuckle parts 55, 26 straight throuhg the tube part 36 even when the arm member 46 is fully folded parallel to the lever tube part 36.

The term "load support" cable has been applied to the cable 80 because when the bracket mechanism is in the vertical plane, as in FIG. 1, static loads will be carried by that cable in tension; while the return cable will transmit necessary movement when the lamp head 52 is raised. However, when the mechanism is tilted to horizontal position as shown in phantom lines in FIG. 2, the load support cable 80 and return cable 81 will be involved only in transmitting movements, while the entire static load will be borne by the arm member 46, lever member 35 and fulcrum link member 20. One of the advantages of the present mechanism, in which the cables 80, 81 lead through the tube part 36, is that a tube of requisite inner diameter can easily be of such strength and stiffness as to withstand the torque load resulting from the weight of the lamp head 52, or other supported article, when tilted out of the vertical plane.

The mechanism illustrated may be utilized advantageously to support other types of articles; for example, flexible conduits such as hoses serving hydraulic or pneumatic articles of equipment may be advantageously led over the knuckle parts 26, 55 and through the lever tube 36 and forward arm 48 with the same highly desirable protection from abrasion.

What is claimed is:

1. For use with base means by which the position of a support point is established, a bracket mechanism extensible substantially in a plane for supporting an article in balance at such support point, comprising

a fulcrum link member having a support end pivotally supported at such support point, and extending therefrom to a fulcrum joint having a transverse axis,

a lever member pivotally mounted onto the fulcrum joint and including a load support portion extending forwardly therefrom to a hinge joint having an axis parallel to that of the fulcrum joint, and

an arm member mounted to said hinge joint and extending therefrom to an article attachment end, whereby such an article may be supported,

the lever member further having secured thereto means to balance the bracket mechanism and such an article supported thereby, in combination with,

means contained substantially within the lever load support portion, the hinge joint and the fulcrum joint to maintain parallelism between a first line, defined by the angular position of the fulcrum link member at the fulcrum joint, and a second line, defined by the angular position of the arm member at the hinge joint,

said means to maintain parallelism comprising,

a load support cable and a return cable, both extending from the arm member at the hinge joint to the fulcrum link member at the fulcrum joint, and

knuckle parts at each said joint having circular arcuate track portions in planes perpendicular to the said joint axes and over which said two cables lead in opposite senses,

whereby angular movement in the hinge joint in either sense is so transmitted in tension through one or the other of said cables as to require simultaneous corresponding angular movement at the fulcrum joint.

2. A bracket mechanism as defined in claim **1**, in which

the knuckle parts further have at each said joint a circular arcuate groove of the same radius as at the other said joint, formed in a plane parallel to the plane of the arcuate cable track portions,

whereby a flexible conduit may be led thereover without slack from the arm member to the fulcrum link member.

3. A bracket mechanism as defined in claim **1**, in which

the knuckle parts are integral with the arm member and the fulcrum link member,

whereby simultaneous angular movement of said members relative to the lever member results in no movement of the cables relative to the arcuate track portions of the knuckle parts other than flexing of portions of said cables from straight to curved.

4. A bracket mechanism as defined in claim **1**, in which

the fulcrum link member is provided at its support end with means to tilt the bracket mechanism out of the plane in which it is extensible, and

the load support portion of the lever member between the fulcrum joint and the hinge joint is principally a straight torque resisting tube part, and

the load support cable and return cable extend through said tube part.

5. A bracket mechanism as defined in claim **1**, in which

the load support portion of the lever member is principally a straight tube part having an axis, and

the hinge joint and fulcrum joint are offset from said axis to one side thereof,

whereby to permit the arm member to fold alongside of said load support portion of the tubular member into a position substantially parallel thereto.

6. A bracket mechanism as defined in claim **5**, in which

the amount of said offset substantially equals the radius of one of said circular arcuate track portions of each of the knuckle parts,

whereby the load support cable may lead thereover and pass straight through the tube part to connect the arm member to the fulcrum link member without any intermediate cable guides.

7. A bracket mechanism as defined in claim **6**, wherein

the planes of the cable arcuate track portions of each knuckle part are spaced apart from each other less than the inner width of the tube part, and in which

return cable guide means are provided, adjacent to the arcuate track groove portions in the knuckle parts for said return cable, to lead same through the tube part parallel to and at substantially the same level as the load support cable when the bracket mechanism is in a vertical plane, and in which

a center arcuate groove is formed, in an intermediate plane in each said knuckle, to a radius substantially equal to said offset,

whereby a flexible conduit may lead between the load support cable and the return cable from the arm member through approximately the center of the tube part and to the fulcrum member, and whereby angular movement of the arm member and fulcrum member at the joints reciprocates such flexible conduit and said load support cable and return cable axially side by side within said tube part.

8. A bracket mechanism as defined in claim **6**, in which

the load support portion tube part has fittings at its ends extending to the axis of the fulcrum joint and hinge joint, and

said fittings include cable guide pulleys of smaller radius than the knuckle parts, positioned inwardly adjacent thereto and offset to the same side of said axis,

whereby to direct the return cable through said tube part.

9. A bracket mechanism as defined in claim **8**, wherein

the radius of that arcuate track portion for the return cable in each of said knuckle parts is less than the radius of the arcuate track portion for the load support cable,

whereby said cable guide pulleys may fit more closely to the axis of the said joints and thus minimize the size of said fittings.

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