July 9, 1968 A. C. PERBAL 3,391,890

EXTENSIBLE, TILTABLE, COUNTERBALANCED LAMP BRACKET

Filed May 19, 1966 2 Sheets-Sheet 1

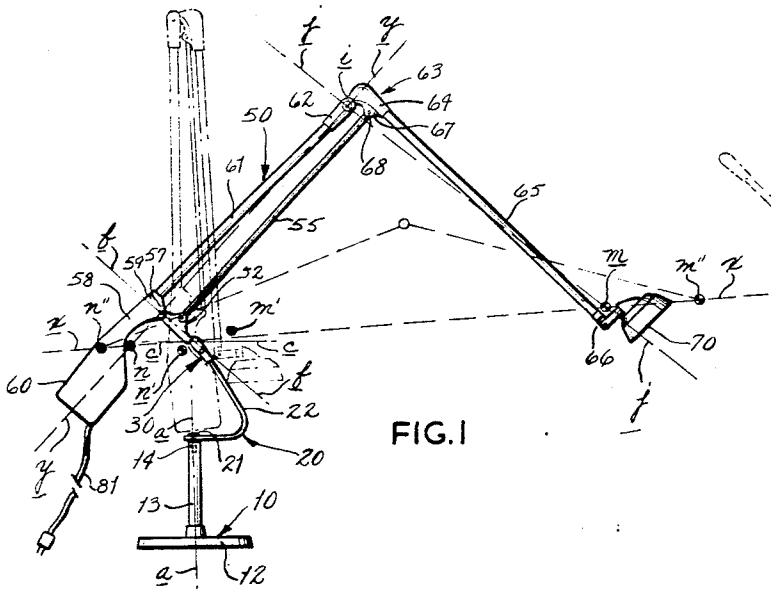


FIG. 1

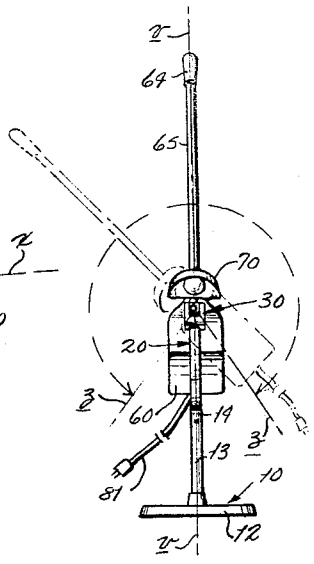


FIG. 2

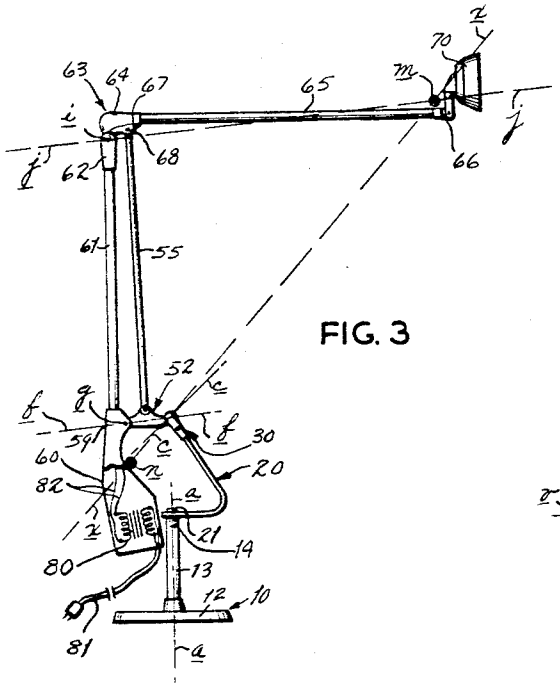
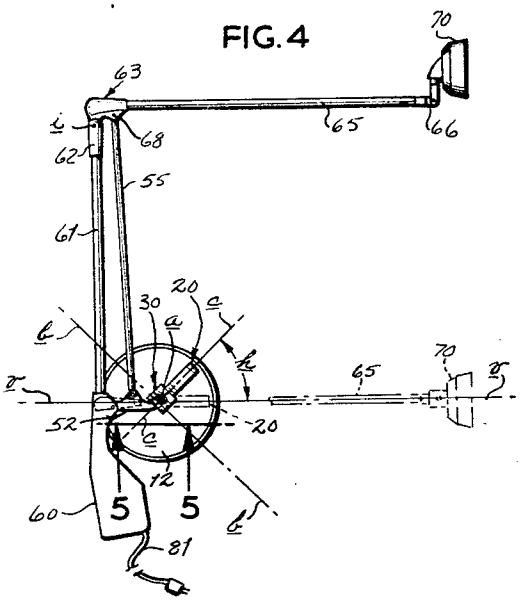


FIG. 3

FIG. 4



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Filed May 19, 1966 2 Sheets-Sheet 2

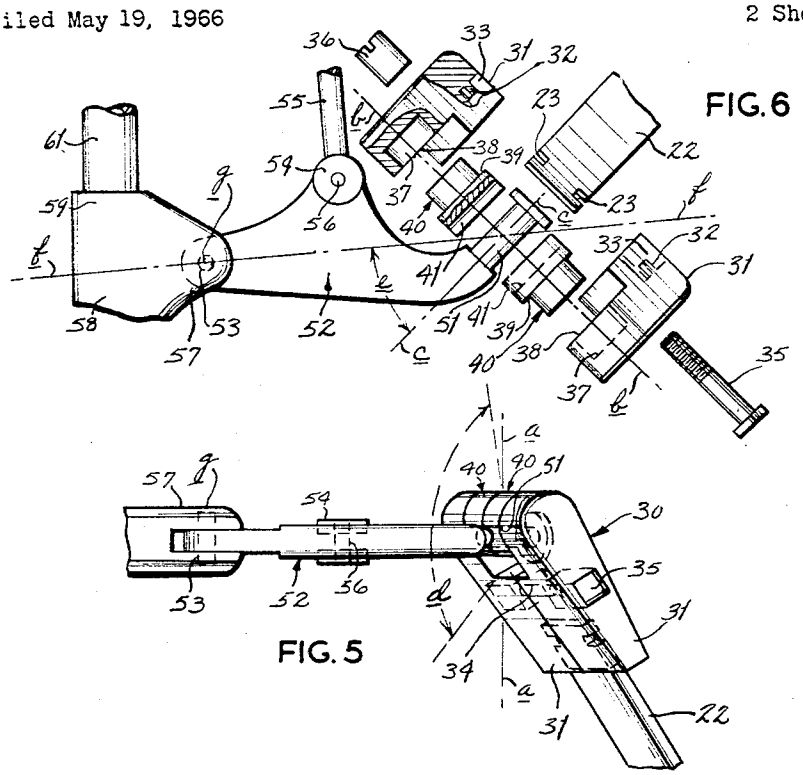
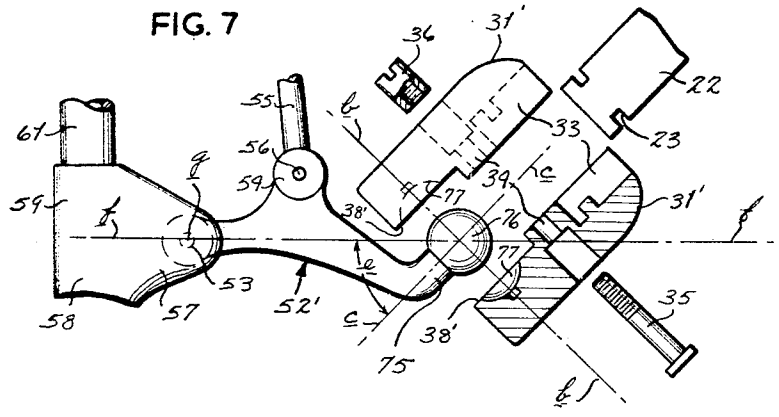


FIG. 6

FIG. 5

FIG. 7



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United States Patent Office

3,391,890

Patented July 9, 1968

3,391,890

EXTENSIBLE, TILTABLE, COUNTERBALANCED LAMP BRACKET

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Filed May 19, 1966, Ser. No. 551,433
11 Claims. (Cl. 248—280)

ABSTRACT OF THE DISCLOSURE

A freely extensible bracket, for electric lamps and the like, projects a mass-balance aft as the bracket head is extended forward of a tilt-permitting support point. Proportion-maintaining mechanism keeps the center of gravity at the support point, regardless how the bracket is extended and tilted. When the bracket head is a lamp, the mass balance may be a transformer in the lamp circuit.

This invention relates to extensible brackets for the support of electric lamps and other articles, and particularly to brackets which are extensible through a broad range of chosen positions and degrees of tilt.

In prior adjustable brackets for electric lamps and the like, such as shown in my U.S. Patent Nos. 2,200,518, 2,299,251 and 2,665,102, balance in a chosen position within a single plane has been achieved by the use of varying spring forces. The mechanisms employed were so complex as to be likely to possess, inherently, a substantial amount of friction. The bases required for such brackets for lamps were usually large in size, both to balance the lamps and to house auxiliary electrical elements, such as the transformers used in fluorescent lamps. Such spring balance mechanisms usually had to be adjusted as the tilt of the base portion was changed (for example, when used on drawing boards). Spring mechanisms are incapable of balancing out vibratory impulses exerted on the support masses; hence, when such a lamp is mounted on a factory machine, the machine's vibrations may cause the lamp to move from the position in which it was set. Such brackets have not heretofore possessed universal tiltability; thus where a lamp head was to be positioned at an angle of tilt or twist, it was necessary to mount it on a separate friction-mount (as shown in my U.S. Patent No. 2,334,436) to permit such tiltable positioning.

The purposes of the present invention are generally to overcome these deficiencies in the prior art. Specifically the present purposes include providing a bracket which projects a mass-balance element rearward as the lamp head or other supported article is extended forward, balancing it precisely regardless how far it is extended. Other purposes are to provide for tilt of the bracket, i.e. of the plane in which it may be extended and retracted, and to render the bracket independent of the slope of the base which supports it. Still other purposes include utilizing such a bracket as part of a unique electric lamp of the type requiring auxiliary elements, such as transformers or batteries, in which the weight and volume of base support and housings are minimized, and in which the lamp head may be maintained balanced at a tilt angle by the same balance means which maintains the position of the lamp head.

For balancing and tilting in more than one plane, the extent of angular movement of a conventional ball joint has not proved to be entirely adequate. Hence an additional purpose of the present invention is to provide suitable support means including a support point characterized by a sufficient degree of three-axis freedom to achieve the other purposes, and yet which can be readily controlled by the user.

Generally summarizing the present invention, I provide a support bracket of extensible, proportion maintaining geometry, to project a mass-balancing element aft as the lamp head or other supported article is extended forwardly. The center of gravity of the masses so mounted coincides with or is close to the support point; and the proportion-maintaining mechanism preserves the center of gravity location throughout the range of extended positioning and regardless how tilted. A key element of this geometry is a link, which in the mid-range of its movement slopes up and aft. To give this link three-axis freedom, in the preferred embodiment I mount it on a swiveled fitting to a horizontal balancing hinge, which in turn is supported on the top extension of a pivoted base. This top extension slopes from the support point forward and down and then aft in a bend, back to the pivot axis of the base. When the bracket is folded, the mass-balancing element fits neatly into the bend. Applied to an electric lamp having in circuit heavy-weight auxiliaries such as transformers or batteries, I utilize these as the weighty mass-balance elements, and house them on the aft-projecting part of the mechanism. Since the center of gravity of the balanced elements coincides closely with the support point regardless how the lamp is extended or tilted, the base is both small in size and light in weight.

In the accompanying drawings:

FIG. 1 is a side elevation of a counter-balanced electric lamp embodying the present invention. Its fully-folded position is shown in phantom lines. The dashed lines show the lamp's geometry in fully extended position.

FIG. 2 is a front elevation of the lamp of FIG. 1, the phantom lines showing same in laterally tilted position.

FIG. 3 is a side elevation similar to FIG. 1 showing the lamp head raised.

FIG. 4 is a top plan view showing the lamp tilted laterally from the FIG. 3 position, which is indicated in phantom lines.

FIG. 5 is an enlarged fragmentary view of the support point means, taken along lines 5—5 of FIG. 4.

FIG. 6 is a top view of those portions shown in FIG. 5, partially exploded and broken away.

FIG. 7 is a view similar to FIG. 6 of an alternate support point means, the portions at the right side thereof being shown rotated into the plane of the drawing.

The principal portions of the embodiment of the invention shown in the drawings are generally designated as the base **10**, a pivoted bend **20**, support point means **30**, an extensible bracket of proportion-maintaining geometry **50**, a lamp head supported thereby **70** for forward extension from the support point, and the mass balance housing **60** containing the weighty electrical element **80** which are projected rearwardly as the lamp head is extended forwardly. As later discussed, the center of gravity of all masses balanced on the support point **30** remains in the same place regardless how the lamp head may be extended and tilted. The base **10** thus may be very small. Shown is a disc-like base plate **12** supporting at its center a vertical hollow tube stem **13**. A simple bearing **14** inserted into the upper end of the stem **13** provides a vertical pivot axis *a—a*. Mounted in the top thereof by a pin **21** is the pivoted bend **20** at whose upper end is the support point means **30**, supported by it vertically above and in alignment with the pivot axis *a—a*. The pivoting bend is preferably constructed as a curved rigid arm **22** bent from flat steel strip, thus to serve as pivoting support structure. The top end of the arm **22** has locking notches **23**, shown in FIGS. 6 and 7, in both of its edges. Its forward and downward slope from the support point **30** is utilized as hereinafter mentioned.

The support point means **30** is constructed, not as a simple lateral hinge to give freedom of movement in a

vertical plane only, nor as a conventional three-degree-of-freedom ball or universal joint. Instead it is characterized by two degrees of freedom, to which is added in effect the freedom of movement provided about the vertical pivot axis *a—a*. Referring to the enlarged fragmentary views in FIGS. 5 and 6, the notches **23** of the arm **22** hold molded support point halves **31**, by interlocking of the projections **32** into their molded strap accepting cavity **33**. Aligned lateral bore portions **34** receive a square-headed machine screw **35** and nut **36**, which hold the parts in assembly and also provides an adjustable amount of friction to opposed cylindrical sockets **37**, whose inward-presented faces **38** define a clevis and bear against the outer annular faces **39** of a pair of trunnion mounts generally designated **40** having inwardly-presented semi-cylindrical bushing portions **41** which define a swiveling axis *c—c*. The trunnion mounts **40** are received within the sockets **37**. Pressure by the end faces **38** against the outer trunnion mount faces **39** so holds the bushing portions **41** together to provide in effect a cylindrical bushing about the swiveling axis *c—c*, perpendicular to the lateral balancing axis *b—b*, as defined by the cylindrical sockets **37**.

Held on the axis *c—c* by the bushing portions **41** is the headed swiveling rod portion **51** of a mechanical link **52** for the proportion-maintaining mechanism of this invention. Due to the upward and aft slope of the upper portion of the arm **22**, the assembly consisting of the link **52** and the trunnion mounts **40** are movable in the clevis defined by the inward-presented faces **38**, through a large useful angle *d* shown in FIG. 5, which angle may approach 180°. All or most of the useful range of the angle *d*, through which the swiveling axis *c—c* may move, will be normally out of coincidence with the vertical pivot axis *a—a*. As long as they are out of coincidence, the link **50** will have in effect three degrees of angular freedom. Contrary to general impression, it is not necessary that all the axes be perpendicular to each other. FIG. 2 shows angular tilt out of the vertical plane *v—v* about the swiveling axis *c—c* when it is nearly horizontal as in FIG. 1. However when tilted downward as in FIG. 3, there is a corresponding freedom of angular tilt, as shown in FIG. 4, hereafter referred to.

The alternate embodiment of FIG. 7 shows certain identical portions which are similarly numbered, whose description is not repeated, and certain functionally-similar portions correspondingly numbered with the added designation prime (′). For clarity, the molded support point halves **31′**, together with the upper end of the arm **22** of the pivoted bend **20** are shown in FIG. 7 rotated into the plane of the drawing. The support point halves **31′** have inwardly-presented clevis end faces **38′** which, when the parts are assembled by the screw **35** and nut **36**, have a spacing substantially equal to the diameter of the rounded neck portion **75** on the modified link generally designated **52′**. This neck portion **75** is cylindrical about the link swiveling axis *c—c*. Onto the neck portion **75** is formed a larger-diameter spherical head generally **76**; it is clamped between partial-spherical recesses **77** formed in the end faces **38′**. The spacing of the recesses **77** within the faces **38′** leaves flat face portions which fit closely against the cylindrical neck **75**; hence the link **52′** cannot be rotated about an axis through the ball **76** perpendicular to the plane of the drawing FIG. 7. Thus the ball-and-socket joint, provided by the ball head **76** and the partial-spherical recesses **77**, does not permit three degrees of freedom, but only two. As with the embodiment of FIG. 6, these two degrees of freedom are adjustably controlled by tightening the nut **36**. The third degree of freedom is provided by rotation of the pivoted bend **20** about the pin **21**. Axis *b—b* is perpendicular to the end faces **38′**.

The link **52** extends along a line designated *f—f*, hereinafter referred to as the "line of the link," from the support point at the intersection of the swiveling axis *c—c* with the lateral balancing axis *b—b*. The line *f—f* does not conform with the swiveling axis *c—c*, but is at a substantial angle *e* thereto which may be approximately 45° as shown in FIG. 6. This serves to set the swiveling axis nearly horizontal when the bracket is adjusted to the FIG. 1 position, and keeps it out of coincidence with the vertical pivot axis *a—a* throughout the broad range of useful settings within the angle *d*.

The effective length of the link **52** is its length from said intersection to a fulcrum *g* having a transverse fulcrum pin **53**. Generally above the "line of the link" *f—f* as shown in FIGS. 3, 6 and 7 (or forwardly as shown in FIG. 1), the link **52** has an enlarged clevis boss **54** in which a parallelism-maintaining rod **55** is pivotally secured by a pivot pin **56**.

Parallelism is maintained by the jointed geometry in a plane which, when the bracket is untilted as in FIGS. 1, 2 and 3, coincides with the vertical plane *v—v*. The bracket may be rotated out of the vertical plane *v—v* to any selected angle within the large range of angular tilt *z—z* shown in FIG. 2.

If the jointed geometry be first arranged in the plane *v—v* with the lamp head raised in the position shown in FIG. 3, and then tilted 90° out of the plane *v—v*, the resulting configuration will be as shown in the plan view FIG. 4. Prior to such out-of-plane tilting, the swiveling axis *c—c* would be inclined approximately 45° below horizontal as shown in FIG. 3, and the pivoted bend **20** would project forward toward the lamp head **70** as shown in the dashed lines of FIG. 4. On tilting within the range *z—z* through an angle of 90° as shown in solid lines in the plan view FIG. 4, the entire link **52** including its swiveling axis *c—c* is brought from its inclined FIG. 3 position into a horizontal plane. To permit and adjust for this change in position of the swiveling axis *c—c*, the lateral balancing axis *b—b* assumes the angular position shown in FIG. 4, by causing the pivoting bend **20** to rotate about the axis *a—a* out of the vertical plane *v—v* through an angle designated *h*, shown as approximately 45°.

Onto the fulcrum pin **53** is pivotally mounted the clevis fitting part **57** molded to project from the under side of an aft lever portion **58**. The aft lever portion **58** has at its forward end an integral tube-receiving socket **59** from which it extends aft to an enlarged mass balance housing portion **60**, formed curvingly to fit within the bend **20** as shown in phantom lines in FIG. 1.

The tube-receiving socket **59** holds a tubular portion **61** which extends generally forward when the lamp head **70** is extended forward of the base **10** as shown in solid lines in FIG. 1. The normally forward end of the tubular lever portion **61** is received within an aft molded socket part **62** of a hinge joint fitting generally designated **63** and having a hinge pivot axis *i* parallel to the fulcrum pin **53**. From the pivot axis *i*, and supported in the forward socket part **64** of the hinge joint fitting **63**, there extends a tubular arm **65** which (in the FIG. 1 solid line position) projects normally forwardly to a forward attachment means **66** on which the article to be supported (here the lamp head **70**) is adjustably mounted.

Mounted to project along the under side of the forward socket part **64** is a forward clevis **67**, having a pivot pin **68** connecting the forward end of the parallelism-maintaining rod **55**. Since the pivot pins **68** and **56** have axes parallel to each other and to the fulcrum pin **53** and the hinge axis *i*, and since the spacing of the forward fulcrum pin **68** from the hinge axis *i* corresponds substantially with the spacing of the aft pivot pin **56** from the fulcrum *g*, the rod **55** together with its end fittings to the link **52** and forward socket part **64** serves as parallelism-maintaining means.

A center of gravity designated *m* is found, accurately or approximately, for those masses which the mechanism will project forward as the lamp head **70** is extended forward; these include the arm **65** and its end connections

and the supported lamp **70** or the other article attached thereto. The length of the rod **55** is fixed so that the center of gravity *m* will be supported along a line *j—j* extending from the hinge axis *i* and parallel to the line of the link *f—f*. The rod **55** preserves this parallelism regardless whether the lamp head **70** be in the vertical plane *v—v* in a usual position such as shown in full lines in FIG. 1, or in the folded position shown in phantom lines, or in the fully extended position shown by the triangular outline. Such parallelism is also maintained regardless of extent of rotation about the lateral balancing axis *b—b*, as when the lamp head **70** is tilted up to the FIG. 3 position; and regardless of tilt through an angle *z—z* out of the vertical plane *v—v*, such as in tilting from the FIG. 3 position to the FIG. 4 position.

A weighty mass balancing element (which may be the electrical transformer **80** hereinafter referred to) and any supplementary balancing mass which may be required, is affixed within the mass balance housing portion **60**, and so positioned therein as to establish an aft center of gravity *n* for the masses which project rearwardly as the lamp head **70** is extended forwardly. Generally these masses include the tubular lever portion **61** and the molded aft lever portion **58**, its mass balance housing portion **60**, the mass balancing transformer **80** and any other mass balancing elements. Such center of gravity *n* is positioned at the intersection of a straight line *x—x*, which extends from the forward center of gravity *m* through the support point **30**, with a line *y—y* extending from the hinge axis *i* through the fulcrum pin **53**. The ratio of the weight acting at the aft center of gravity *n* to those at the forward center of gravity *m* must be inversely proportional to the ratio of their distances from the support point **30**, taken along the line *x—x*.

This achieves perfect balance, regardless whether the jointed members are moved to the fully folded position shown in phantom lines, in which the forward center of gravity is designated *m'* and the aft center of gravity is designated *n'*; or into the fully extended position in which said centers of gravity are designated *m''*, *n''* respectively. This is for the reason that with parallelism maintained between the line of the link *f—f* and the line *j—j*, the rear center of gravity *n* (or *n'* or *n''*) will be the apex of similar triangles; extending the supported article forward with reference to the support point **30** will so tilt the always-parallel lines *f—f* and *j—j* as to project the center of gravity *n* rearwardly, maintaining their linearity along line *x—x* through the support point **30** and the precise inverse proportionality of their distances from the support point **30**. (Stated somewhat differently, regardless of the extension, rotation or tilt, the combined centers of gravity of all masses supported on the support point **30** will always be precisely at said support point.)

By reason of such maintained linearity and proportionality, an important new result is achieved. Considering tilting out of the plane *v—v*, as shown in FIG. 2: since *m* and *n* always lie along a straight line *x—x* through the support point **30**, the balance of the lamp is in no way disturbed by rotation around this line.

This discovery makes possible the use of a small light weight base **10**. The bracket is thus readily manipulated either by grasping the lamp head **70** (or other supported article) or the mass balance housing portion **60**, or any other movable part. Joint friction is therefore not necessary for balance. However, some joint friction may be introduced to prevent extremely small forces, such as inadvertent touching, from causing the lamp to swing out of chosen position. The screw **35** is a convenient means for introducing such friction, as tightening it applies pressure to induce such friction through the trunnion mounts **40** about both the lateral balancing axis *b—b* and the swiveling axis *c—c*. With some light degree of friction being a practical necessity, the use of such friction also permits less rigorous accuracy in locating the forward center of gravity *m* and the aft center of gravity *n* linearly at inversely proportionate distances from the support point **30**.

When the bracket mechanism is moved to fully closed upright position shown in phantom lines in FIG. **1**, the line *j—j* will become nearly vertical, and the line of the link *f—f* will tilt upward parallel thereto. This raises the mass balance housing portion **60** to set it within the gap provided by the pivoting bend **20**. A dimensional requirement to achieve this fit is, that the spacing of the enlarged portion of the mass balance housing **60** from the fulcrum *g* is slightly greater than the length of the link measured from the lateral balancing axis *b—b* to the fulcrum *g*.

An exemplary embodiment of the bracket so described is its utilization as part of the counterbalanced electric lamp illustrated in FIGS. 1–4, wherein a weighty electrical element such as a transformer **80** is housed in the housing portion **60** and is wired in circuit with the lamp head **70**. Thus, the mass of the transformer **80** aids in counterbalancing the relatively lighter weight of the lamp head **70**. In this embodiment, 110 volt current flows through the external lamp cord **81** leading through the housing **60**, to the transformer **80**, from it, lower voltage current flows through the connectors **82** which extend from the housing **60** through the tubular lever portion **61** and hinge joint fitting **63** and the tubular arm **65** to connect to the lamp head **70**. Extending the lamp head **70** forward projects the transformer **80** and housing **60** rearward; hence it is convenient that the cord **81** need not extend through the support point **30** though the pivoting bend **20** or base **10**.

In other types of lamps, associated weighty electrical elements suitable for the lamp's purpose may be substituted for the transformer **80**; for example batteries, capacitors, etc. Thus the present invention may be put to many uses, such as light-weight portable lamps, heavy studio lighting equipment, therapeutic lamps, and lamps mounted upon factory machines. It is also excellent for readily adjustable microphone brackets and kindred uses. Since only the lever **50** and arm **65** are wired, it is easy to substitute base structure appropriate for any use.

The present extensible counterbalanced bracket construction is of particular value when used on vibrating machinery. Heretofore extensible machine-mounted lamps have required much joint friction to hold them in fixed position. Spring-balanced lamps are not well suited for such use, because the vibratory or periodic accelerations applied to the lamp heads cannot be balanced out by a spring force, which does not depend upon mass and inertia.

With the present invention, however, periodic accelerations applied to each element of the balanced masses hold the remainder in balance, and do not therefore cause the lamp to change its geometry. If the balanced masses be thought of as being divided between the forward masses at the center of gravity *m* and at the aft masses of the center of gravity *n*, the vibrations transmitted to them through the support point means **30** are balanced by proportionate reactions at each. Thus only a small frictional force applied through the screw **35** is necessary to preserve the jointed geometry at any position of extension, rotation and tilt.

Variations in the number and type of elements making up the jointed geometry and the parallelism-maintaining means, and other modifications in utilization of the present bracket structure, may be readily devised. Accordingly the present invention is not to be construed narrowly, but rather as fully co-extensive with the claims hereof.

I claim:

1. An adjustable bracket adapted to support an article in balance throughout a range of positions and angles, comprising

base means to establish the position of a support point,

an extensible bracket mechanism balancedly supported thereon and having a forward means to attach such an article supportingly, and including

a link having a supported end and fulcrum means spaced from said supported end,
a lever pivotedly mounted onto the fulcrum means and extending forward therefrom to a hinge joint,
an arm mounted to said hinge joint and extending therefrom to such forward means to attach such an article,
means extending between the link and the arm to maintain parallelism between a first line from the supported end of the link to its fulcrum means and a second line from the hinge to substantially the center of gravity of masses forward of the support point including the arm and such article attached thereto, and
means to apply to said lever a balancing force aft of the support point whereby to maintain the mechanism balanced at said support point regardless of its extension,
characterized in having
means to support said supported end of the link with three degrees of freedom of angular movement at said support point, and further characterized in that
said means to maintain parallelism is offset spacedly from the support point,
whereby said spaced offset permits the extensible mechanism a wide range of arcuate movement including lateral tilting about said support point.

2. An adjustable bracket as defined in claim **1**, wherein
said means to apply a balancing force comprises
a portion of said lever extending aft from the fulcrum and
a weighty mass-balancing element thereon,
the mass and position of said element being such that a straight line from said center of gravity of masses forward of the support point and extending aft therethrough will substantially intersect the center of gravity of the mass-balancing element and the lever, regardless of the extension of the bracket mechanism,
whereby lateral tilting will not disturb the balance of the mechanism at the support point.

3. An adjustable bracket as defined in claim **1**, wherein
the means to maintain parallelism includes
a rod mounted between the link, at a point spacedly offset from the support point, and the arm at a point spacedly offset from the hinge point.

4. An adjustable bracket as defined in claim **1**, wherein
said means to support the end of the link with three degrees of freedom includes
means defining a vertical pivoting axis and
means defining an axis for lateral tilting, extending from the support point angularly out of coincidence with said first line to the fulcrum means and below said line when said extensible bracket is at the mid-point of its range of lateral tilt about such axis,
whereby said lateral tilting axis remains out of coincidence with the vertical pivoting axis when the link is so tilted that said first line is vertical.

5. An adjustable bracket as defined in claim **2**, wherein
the said means to establish the position of the support points serves as means to provide the degree of freedom about a vertical axis, and includes
a base and a member pivoting vertically therein and having a bend away from such vertical axis,
whereby to provide a space along said axis to accommodate the mass-balancing element when the fulcrum means above the said supported end of the link.

6. An adjustable bracket adapted to support an article in balance throughout a range of bracket positions and angles, comprising
base means to establish the position of a support point,
an extensible bracket mechanism balancedly supported thereon and extensible in a plane,
said extensible mechanism including a forward attachment means for supporting such an article and being of a type having a point of balance, for said extensible mechanism and such attached article, and interconnecting means to maintain said point of balance at the support point regardless of the extension of said mechanism, in combination with
means to support said extensible mechanism with three degrees of freedom of angular movement about said support point,
said means comprising
means, operable between the base means and the support point, to establish a first axis of angular movement through the support point,
means, rotatable on said first axis, to establish a second axis of angular movement substantially perpendicular thereto and intersecting same at said support point, and
means, operable between the extensible mechanism and the support point, to establish a third axis of angular movement through said intersection substantially perpendicular to said second axis and, by rotation thereabout, variable in its angular relation to said first axis,
whereby desired arcuate movement of the extensible bracket about any axis through the support point not coincident with any one of said three axes is accommodated by relative rotation of said means which establish said three axes.

7. An adjustable bracket as defined in claim **6**, wherein
the means to establish said second axis includes a trunnion-mounted bushing, and
the means to establish said third axis includes a rod portion swivel-mounted in said bushing.

8. An adjustable bracket as defined in claim **6**, wherein
said means to establish said second and third axes includes
a ball and socket joint having means to confine relative movement to movements about said second and third axes.

9. An adjustable bracket as defined in claim **6**, wherein
said third axis lies in the plane in which said bracket mechanism is extensible,
whereby lateral tilting of said plane of extension may be effected about said third axis through angles greater than 90° to each side of center.

10. An adjustable bracket as defined in claim **9**, wherein
the member of the extensible mechanism by which it is supported at the support point is a link having a useful range of angular movement in said plane about said second axis as the mechanism is extended, and
its said range of movement has a mid-point at which the angle made by the third axis with the first axis is substantial,
whereby the third axis is maintained out of coincidence with the first axis through a substantial part of said useful range of movement thereby to maintain unimpaired such relative rotation accommodating arcuate movements not coincident with any axis.

11. An adjustable support bracket as defined in claim **9**, wherein
the said first axis is substantially vertical and
the said second axis is substantially horizontal and lateral with respect to the extensible bracket mechanism, and wherein
at the said mid-point of useful range of movement about the second axis, the third axis is substantially fore and aft.

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