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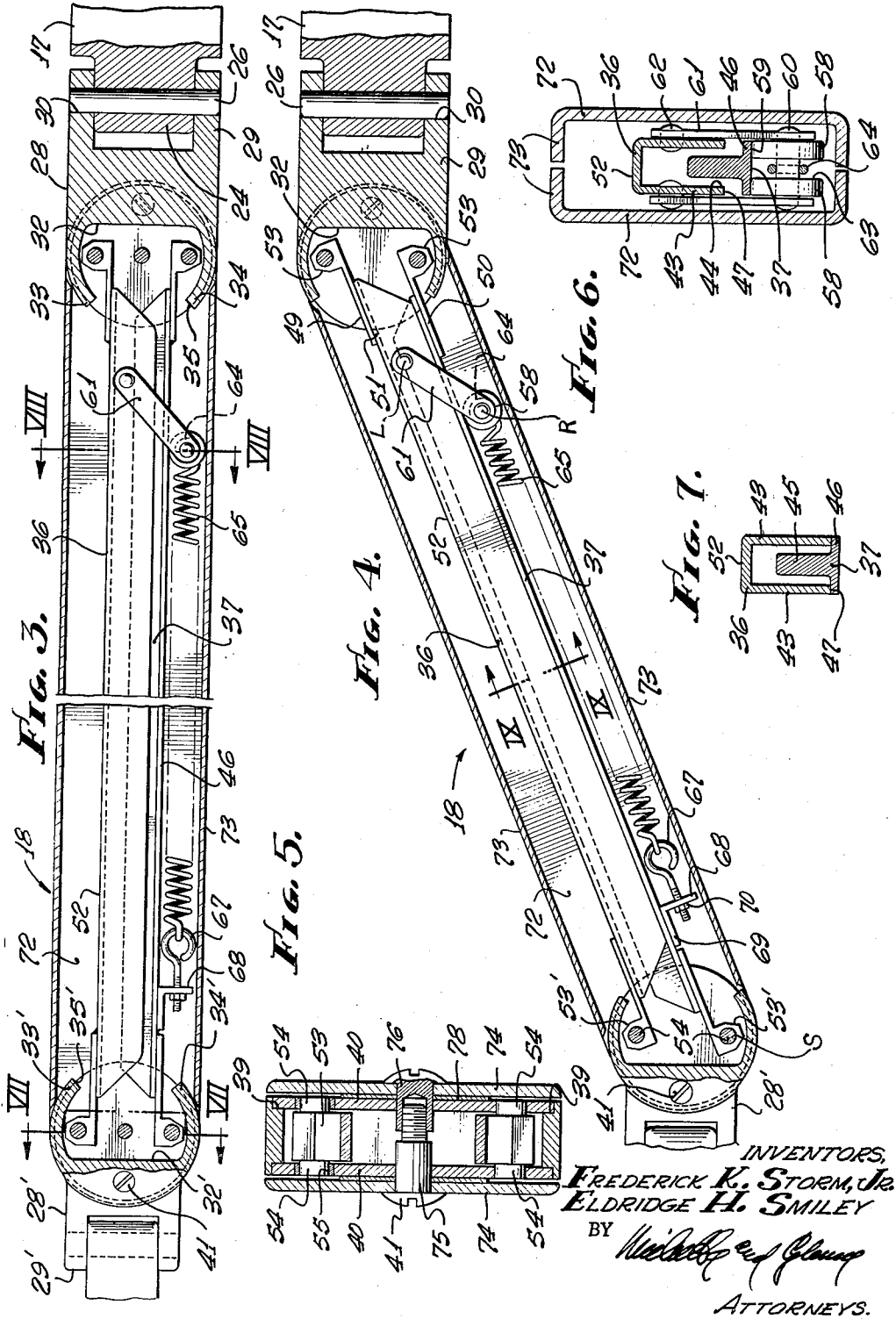
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BALANCED MOUNTING MEANS FOR A SURGICAL LAMP

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BALANCED MOUNTING MEANS FOR A SURGICAL LAMP

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This invention relates to a balanced mounting means for an object and more particularly to an apparatus for virtually universally movably supporting in counter-balanced relation a surgical or dental lamp whereby the lamp may be readily positioned and adjusted laterally and vertically to selectively direct light rays to a desired selected area or portion of a patient to be illuminated.

Generally speaking, the apparatus of the invention has utility wherever an object or lamp is supported for adjustable vertical movement at a distance from a fixed support member. Dental lamps for example are usually supported so that they can be readily positioned and moved in front of a dental patient and yet provide ample room for the dentist to operate on the patient from any position. Prior proposed dental lamp mountings and devices have included relatively heavy, cumbersome and complexly constructed apparatus. Such prior proposed apparatuses were of large, heavy members and were not attractive in design or appearance. Such construction was required by the type of dental lamp heretofore used and by the problem of supporting a heavy object at substantial distance from a standard or wall supporting the lamp.

This invention contemplates a novel design and construction of an apparatus for mounting an object at a considerable distance from its fixed support, base or standard. The invention contemplates a construction which is relatively light in weight and which presents a new and attractive appearance. The present invention provides for an apparatus in which concealed precisely adjustable counter-balancing means are provided for virtually uniformly balancing a dental light throughout a selected vertical pathway spaced from a horizontal axis whereby the dental light may be adjustably smoothly positioned in a facile manner into a selected position.

The primary object of this invention therefore is to disclose and provide a novel balanced mounting means for an object vertically and laterally adjustably positioned in spaced relation to a fixed support.

An object of this invention is to disclose and provide a novel design of a counter-balanced parallelogram system for adjustably supporting a relatively heavy object at one end of the system.

Another object of this invention is to disclose and provide a lamp mounting apparatus in which a surgical lamp may be supported in novel manner.

A more specific object of this invention is to disclose and provide a balanced object mounting means including a movably adjustably positionable supporting means for such an object, said support means including a pair of parallel support members arranged in nested relation and in which counter-balancing means extend between the ends of said nested support members and include a pressure means in variable pressure engagement with one of said members during vertical movement of the support means.

Still another specific object of this invention is to disclose and provide such a support means for an object mounting means wherein a pair of torque resistant members extend between opposite ends of said support members.

A further object of this invention is to provide an object mounting means including torque resistant members

wherein adjustable friction means are provided between said torque members and end mounting means for parallel support members.

Generally speaking, the invention contemplates a surgical lamp mounting including a pair of spaced apart end mounting means for a movable support means connected between said end mounting means and providing relative vertical movement with respect thereto. The support means may include a pair of parallel nested support members each having a longitudinal axis, each of said members being connected at each end to the associated end mounting means at a pivotal connection lying outwardly of the longitudinal axis of the respective member, the pivotal connections forming a parallelogram system. Counter-balancing means for such support means may include a pressure roller having pressure engagement with one of said members between the ends of said one member and supported by a link pivotally connected to the other member. The pressure roller is also connected to one end of a coil spring extending along said members adjustably for selectively varying the tension of the spring to regulate pressure engagement of the pressure roller against the support member.

It will be readily understood by those skilled in the art that many and other advantages of this invention will be readily apparent from the following description of the drawings in which an exemplary embodiment of the invention is shown.

In the drawings:

FIG. 1 is a side elevational view of an apparatus embodying this invention, phantom lines indicating the support means and lamp in horizontal position.

FIG. 2 is a top view of FIG. 1.

FIG. 3 is an enlarged sectional view of the support means shown in FIG. 1, the section being taken in a vertical plane bisecting the support means.

FIG. 4 is a sectional view of the support means taken in the same plane as FIG. 3, the support means being directed downwardly.

FIG. 5 is a transverse sectional view taken in the plane indicated by line VII—VII of FIG. 3.

FIG. 6 is a sectional view taken in the transverse plane indicated by line VIII—VIII of FIG. 3.

FIG. 7 is a transverse sectional view taken in the plane indicated by line IX—IX of FIG. 4.

In FIG. 1 and FIG. 2, there is shown an apparatus generally indicated at 15 embodying this invention. Apparatus 15 may include a fixed support at 16 upon which may be pivotally mounted for movement about a vertical axis V_1 , a base member or arm 17. Pivotally connected to the outer end of base member 17 and for movement about a vertical axis V_2 may be an adjustably positionable support means 18, said support means 18 being movable horizontally and vertically as later described. At the outer end of the support means 18 may be pivotally mounted for movement about a vertical axis V_3 , a surgical lamp device 19.

The fixed support 16 is only partially illustrated, it being understood that fixed support 16 may be a suitable standard base of selected design; or may include a bracket fixture attached to a wall in suitable manner. It should be noted that fixed support 16 may provide suitable means (not shown) for providing a pivotal connection having vertical axis V_1 to permit horizontal swinging movement of the base arm 17 about said vertical axis. In this example, the fixed support 16 may be provided with an upstanding pin 21, said upstanding pin being received within a bore provided in a hub 22 provided on the inner end of base member 17. Such a pivotal connection may be provided with anti-friction means so that the arm 17 may be swung easily and readily in a horizontal plane.

The base member 17 may be of any suitable construction to provide strength and rigidity for supporting the adjustable support means 18 and the remote lamp device 19. For this purpose base member 17 may be made of a suitable metal or reinforced plastic material of suitable section. In this example, it is contemplated that the base member 17 may be made of an integrally internally reinforced molded plastic material so as to provide a shape and appearance such as shown in the drawings. The outer end of base member 17 may be provided with a reduced section 24 having a vertical bore 25 to receive therein a pivot pin 26 serving to connect the outer end of base member 17 with the inner end of the support means 18. It will be noted that the vertical disposition of the pivot pin 26 provides means whereby the support means 18 may be horizontally swung about vertical axis V_2 and relative to horizontal swinging of base member 17 about axis V_1 .

A particular feature of this invention lies in the construction of support means 18. The support means 18 may include a pair of substantially identically constructed end mounting means 28 and 28'. Like parts of the end mounting means 28, 28' will be given like reference numerals with a prime sign. Each end mounting means 28', 28 may comprise a suitable casting or a lightweight metal alloy. Each end mounting means 28, 28' includes a pair of spaced apart lugs 29, 29', the legs 29 receiving therebetween reduced section 24 of the base member 17 and secured by pin 26 extending through aligned ports 30 in lugs 29.

Opposite from lugs 29, 29' each end mounting means 28, 28' may be of generally C-section and provided with recess 32, 32', each recess 32, 32' being defined by partially circular inwardly curved top and bottom walls 33, 33' and 34, 34'. The transverse edges of walls 33, 33' and 34', 34 define therebetween opening 35, 35' through which may extend adjacent ends of support members 36 and 37. The top and bottom walls 33, 33' and 34, 34' may be rabbeted as at 39 to afford a seat therein for circular dish-like side walls 40 which define the side walls of recess 32 and which may be secured to the end mounting means as by a screw assembly 41.

As best seen in FIGS. 6 and 7, support member 36 is of channel section inverted so that side walls 43 of member 36 provide a longitudinally extending bottom opening 44. The support member 37 is of T-section and stem 45 of the T extends upwardly and centrally between side walls 43 and longitudinally of the member 36. Cross flange 46 of member 37 has sufficient width so as to underlie bottom edges 47 of the walls 43. Such nested arrangement of support members 36 and 37 positions the neutral longitudinal axes of said support members in proximate relation. The vertical arrangement of side walls 43 of the inverted channel support member 36 and stem 45 of the T-section support member 37 provides a rigid construction which resists bending of said members 36 and 37 and which affords a compact nested support means of strength and lightweight.

At each end of each member 36 and 37 may be provided pivot brackets 49 and 50 respectively, each of said brackets being of virtually identical construction and each including a base web 51 secured as by welding to the top wall 52 of the channel section member 36 and to the bottom surface of cross flange 46 of T-section member 37. At the end of each bracket 49 and 50 may be outwardly directed pivot portions 53 and 53' respectively of relatively thick section. Each pivot portion 53, 53' may be provided with a pair of coaxial oppositely and outwardly directed trunnions 54 which may be received in bushings 55 secured in ports in side walls 40 on the end mounting means 28. The axis of each pair of trunnions 54 lies horizontal and in outwardly spaced relation to the neutral longitudinal axes of support members 36 and 37. The axes of the pairs of trunnions 54 are arranged as a parallelogram system. It will therefore

be readily apparent that the support means 18 may be moved vertically about the horizontal axes of the trunnions 54 through a vertical pathway which may be limited by contact of the members 36 and 37 with the transverse edge face of the top and bottom walls 33 and 34.

It should also be noted that as shown in FIG. 6, when support members 36 and 37 are in horizontal position the bottom edge faces 47 of walls 43 of the channel section support member 36 are spaced from the inner longitudinal marginal surfaces of flange 46 of the T-section member 37. This spacing is predetermined so that when the support members are moved vertically, the bottom edge faces 47 of the channel section member 36 will engage and contact the inner marginal surfaces of the flange 46 on the T-section to provide a stop means limiting movement of the support means in a vertical direction.

The vertically movable support means 18 may be provided with counter-balance means so that the dental lamp may be adjustably vertically positioned with facility as desired. The counter-balance means may comprise a pressure roller or element 58 having pressure engagement as at 59 (FIG. 6) against a bottom longitudinal surface of the inverted T-section support member 37. The pressure roller 58 may be pivotally mounted on a pin 60 extending beneath the support member 37 and having its opposite ends engaged in aligned ports in bottom ends of a pair of links 61, said links 61 being pivotally mounted at their opposite ends on pins 62 and each carried by a wall of the inverted channel member 36. The pressure roller 58 may be provided with a central circumferential groove or recess 63 providing space for insertion of a hooked end 64 of a tension coil spring 65 which extends longitudinally beneath support member 37. At its opposite end the coil spring 65 may be connected to an eye bolt 67 which may be threadably adjustably mounted in a leg 68 of an angle bracket 69 which may be secured to the bottom face of the inverted T-section support member 37 adjacent the end of said member 37 opposite to the end of member 36 to which links 61 are connected. A nut 70 is threaded on the shank of eye bolt 67 to provide adjustment thereof. Locknut means (not shown) may be employed, if desired.

It will thus be apparent from a consideration of FIGS. 3 and 4 that when the support means 18 is in horizontal position, coil spring 65 is under selected tension to cause pressure roller 58 to bear with selected pressure engagement against the bottom face of the T-section support member 37. When the support means 18 is moved to either downwardly or upwardly inclined position as illustrated respectively in FIGS. 6 and 1, coil spring 65 is tensioned in an amount different than the selected tension and pressure roller 58 maintains pressure against the bottom surface of the support member 37. The selected pressure force to be applied when the support means is in horizontal position should be sufficient to counter-balance the largest effective force moment which the dental lamp exerts by gravity about the pivotal connection at the inner end of support means 18.

It should be noted that the axis of pressure roller 58 is located at a vertex R of a triangle further defined by the axis S of the pivotal connection 54 of the outer end of support member 37 to mounting means 28' and the pivotal axis L of the pivotal connection at 62 of link 61 to the support member 36. Only one side of this triangle has fixed length, namely, side R—L defined by link 61. The side R—S of the triangle extending between pressure roller 58 and pivotal connection 54 at the outer end of member 37 varies and tends to shorten in length when the support means is moved from lowermost, downwardly inclined position to uppermost, upwardly inclined position. In such movement, it will be noted that the tendency of the spring 65 is to decrease its length and thereby reduce the amount of spring force acting on pressure roller 58. Likewise, the longest side S—L of the

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triangle defined by the link pivotal axis 62 and pivotal connection 54 at the outer end of support member 37 tends to shorten its length during such movement from lowermost position to uppermost position of the support means, because axis L of the link moves through an arc about the pivotal axis of the inner end of support member 36 and axis S of pivotal connection 54 at the outer end of support member 37 pivots about the inner pivotal axis of member 37. The roller 58 moves laterally with respect to side S—L and in horizontal position of the support means, roller 58 is spaced a maximum distance from side S—L of said triangle as measured by the altitude of the triangle from R to side S—L. When the support means moves either upwardly or downwardly from horizontal position, the roller 58 is moved into varied spaced relation to the long side S—L of the triangle. Such lateral movement compensates to a pre-selected amount for the change in length of the side R—S of the triangle along which the coil spring extends and thus tends to vary or modify the tension of the spring caused by movement of the support means. Since the spring tension forces vary in proportion with the amount of deflection of the spring, such lateral movement of the pressure roller results in a modification of the spring force so that in each position of the support means the force applied by the pressure roller to support member 37 is such that virtually uniform operation is secured when the support means is moved upwardly or downwardly from any selected position.

Means are provided on support means 18 to resist torsional twisting of the members 36 and 37 about their neutral longitudinal axes. In this example, the torque resisting means includes a pair of torque arms 72 of channel section which may extend for the entire length of support means 18 and on which flanges 73 terminate adjacent to end mounting means 28, 28' to provide an end web portion 74 adapted to be secured to each end mounting means as shown in FIG. 5. Side walls 40 of the recess 32 in each end mounting means may be provided with axial ports aligned with axial ports in the end web portions 74 of the torque arms 72. A self-lubricating washer 78 of suitable plastic or synthetic material such as Teflon may be positioned between each side wall 40 and end web portion 74. Through said aligned ports and washers 78 may be inserted a screw bolt assembly having a headed stud portion 75 engageable with a headed sleeve portion 76. The screw bolt assembly 75, 76 permits the torque arms 72 to turn about said end-mounting means. At the same time the construction of the screw bolt assembly is such that upon tightening of sleeve portion 76 on the stud portion 75 the end web portions 74 may be drawn more tightly together and into frictional engagement with the self-lubricating washer 78. Thus tightening of the screw bolt assembly 75, 76 against washers 78 may provide a selected amount of frictional resistance to the pivotal movement of the support means 18 about end mounting means 28. Likewise at the other end of the support means 18 the tightening of the screw bolt assembly 75, 76 upon the walls 40' of the end mounting means 28' will provide selected frictional resistance to facilitate positioning of the lamp device 19 carried at the outer end of support means 18.

It will thus be noted that the selected frictional resistance at both ends of support means 18 co-acts with the compensating forces applied by the spring 65, roller 58 and link 61 combination to provide an easily controlled floating smoothly operable mounting means for the dental lamp whereby only light actuating or pressure force is required to be applied to move the lamp to any selected position. The counter-balance system above described is operable in such a manner that even though only light fingertip touching is required to move the dental lamp to selected position, the lamp will stay and remain in any selected position. In effect, the counter-balance means is so precisely arranged that the lamp virtu-

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ally floats to and from selected positions upon light pressure and guiding control of a hand of an operator.

It may also be noted that the torque arms 72 with their inturned opposed channel sections provide in effect an enclosure for support members 36, 37 so that the outward appearance of the support means 18 may conform with the outward appearance of the base member 17 and the design of the lamp mounting construction. Space available above the top inverted channel section support member 36 and the top flanges 73 on torque arms 72 may be utilized as a conduit for electrical cord to connect with the dental lamp, such cord not being shown in this example.

The lamp device 19 may be pivotally mounted for movement about the vertical axis V_3 as by a pin 80 extending through spaced lugs in end mounting means 28' and a reduced portion 81 positioned between said lugs and forming an integral part of a yoke-shaped member 82 of the device 19. The yoke-shaped member 82 may be provided with spaced apart elements 83 each provided with a pivotal connection at 84 to a side of a lamp housing 85 for pivotally mounting lamp housing 85 about a horizontal axis.

Handle means 87 may be carried by housing 85 to facilitate grasping and positioning of lamp device 19. Handle means 87 may include a bottom transversely extending handle portion 88 beneath and parallel to the bottom wall of housing 85 and spaced slightly rearwardly from the front of said housing. The handle portion 88 merges with side handle portions 89 which may extend upwardly along and parallel to side walls of housing 85 and each of which terminate in an inturned end 90 connected to the housing side wall adjacent the top thereof. It will thus be readily apparent that the handle means 87 may be readily grasped beneath the housing or at either side to change the position of the lamp device to direct light therefrom to a selected area.

It will be readily apparent to those skilled in the art that the apparatus of this invention provides a balanced mounting means for a surgical lamp device 19 which may be readily selectively positioned throughout a relatively large three-dimensional vertical zone to direct light beams to a selected area to be illuminated on a patient. The lamp device 19 is provided relative movement about vertical axes at V_1 , V_2 and V_3 and is provided relative movement about horizontal axes at 84 and at the pivotal connections at each end of the support means 18 to respective end mounting means 28, 28'.

It should be particularly noted that the support means 18 may be readily adjusted so as to provide smooth uniform movement between selected positions and may be selectively vertically positioned with relatively little effort because of the lightweight construction of the lamp mounting apparatus and because of the counter-balancing arrangement within the support means 18. Adjustment of the balancing of the lamp device 19 in vertical positions is readily accomplished by adjustably tightening screw bolt assemblies 75, 76 and by adjustment of the tension of the spring 65. Movement of the lamp device in a vertical direction counterbalanced by the spring, link and pressure roller assembly is smooth and easily controlled because of the rolling pressure engagement of the pressure roller 58 on the surface portion of support member 37.

It will be understood that while support members 36 and 37 have been illustrated as being of inverted channel section and inverted T-section, the two members may be reversed in position if so desired or the two support members may be of different section. The compactness of the support member arrangement is achieved by positioning the neutral axes of the support members in close proximity as shown so that the neutral axes lie between and inwardly of the pivotal connections providing the parallelogram system.

It will be understood by those skilled in the art that

various changes and modifications may be made in the balanced mounting means for an object as described above and that such changes and modifications may fall within the spirit of this invention. All such changes and modifications coming within scope of the appended claims are embraced thereby.

We claim:

1. In an apparatus for virtually uniformly counter-balancing a surgical lamp device positioned in spaced relation to a fixed support, the provision of: a pair of spaced apart end mounting means, one of said end mounting means having a pivotal connection to a lamp device, and the other of said end mounting means having a pivotal connection to a support; a movable support means connected between said end mounting means and affording vertical movement of a lamp device and uniformly counter-balancing said lamp device in selected vertical positions, said support means including a pair of parallel support members each connected at each end to the associated end mounting means, and counter-balancing means including a pressure roller pivotally mounted from one of said members and having rolling pressure contact with a smooth, substantially straight surface of said other member between the ends of said other member.

2. In an apparatus stated in claim 1 wherein said parallel support members include a member of channel section and a member of T-section spaced from each other when in a horizontal position, the stem of the T-section member being nested within the channel member.

3. An apparatus as stated in claim 2 wherein the edges of said U-section member engage extremities of the flange of the T-section member when said members are moved from a horizontal position for limiting vertical pivoted movement of the adjustable support means.

4. An apparatus as stated in claim 1 wherein said counter-balance means includes a link pivotally connected to said one of said support members in spaced relation to the end thereof, said pressure roller being carried by the opposite end of said link member, and spring means carried by said other of said support members and connected to the roller carrying end of said link member for biasing said roller against said smooth surface on said other of the support members.

5. An apparatus as stated in claim 4 including an adjustable connection on one of said support members for said spring means to vary said tension on said spring means.

6. A counter-balance system for a pair of parallel support members, each pivotally mounted at opposite ends and adapted to support a load adjacent one end, said members being spaced from each other in a horizontal position and engageable when moved from the horizontal position for limiting vertical movement of the counter-balanced system, comprising: a pressure means co-acting with and interconnecting said members and including a rigid member pivotally connected to one support member intermediate its end, a resilient member connected to the other support member and extending therealong for pivotal connection to said rigid member, and a pressure applying element carried by said rigid member and pressed against a smooth, substantially straight surface of said other support member by said resilient member.

7. A parallelogram counter-balanced system comprising in combination: a pair of parallel members each having a longitudinal axis and each member being pivotally mounted at opposite ends about horizontal pivotal axes spaced from its longitudinal axis; resilient yieldable means interconnecting said members at longitudinally spaced points lying between said pivotal axes at ends of said members; and means including a pressure element supported by the resilient means in variable pressure contact with a longitudinal smooth substantially straight surface on one side of one of the pair of members whereby said members are provided smooth balanced movement about their pivotal axes.

References Cited in the file of this patent

UNITED STATES PATENTS

187,361	Davis	Feb. 13, 1877
803,980	Borden	Nov. 7, 1905
1,272,845	Peck	July 16, 1918
2,231,137	Ohm	Feb. 11, 1941
2,502,510	Daugert	Apr. 4, 1950
2,608,367	Boltuch	Aug. 26, 1952
2,777,944	Koch	Jan. 15, 1957