March 28, 1961 P. C. JOHNSON 2,977,168

VERTICALLY ADJUSTABLE SAFETY TABLE FOR NEAR-COUNTER-BALANCED SUPPORTING OF INSTRUMENTS

Filed March 3, 1958 2 Sheets-Sheet 1

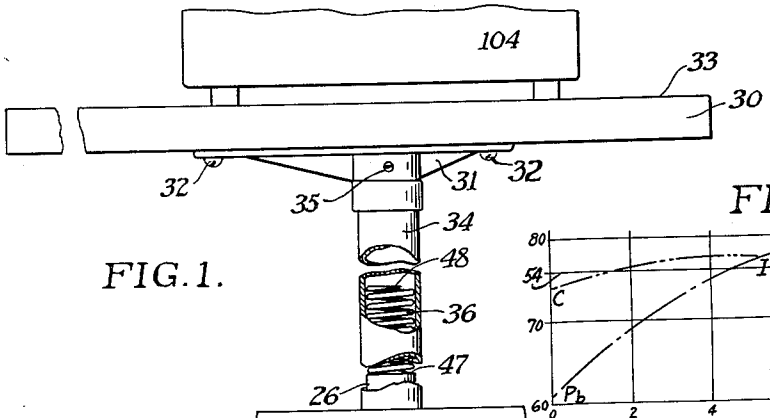


FIG. 1.

FIG. 7.

FIG. 9.

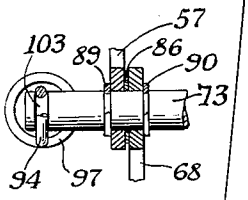


FIG. 8.

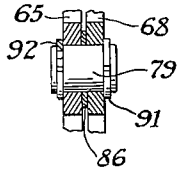
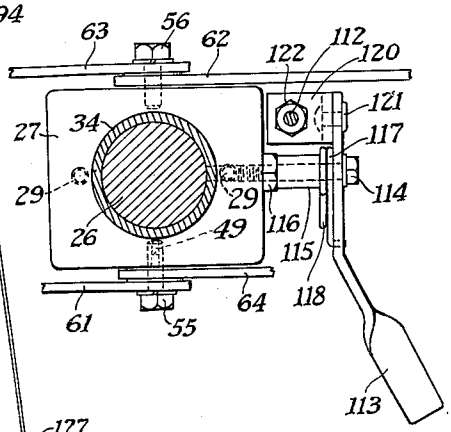


FIG. 6.



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FIG. 2.

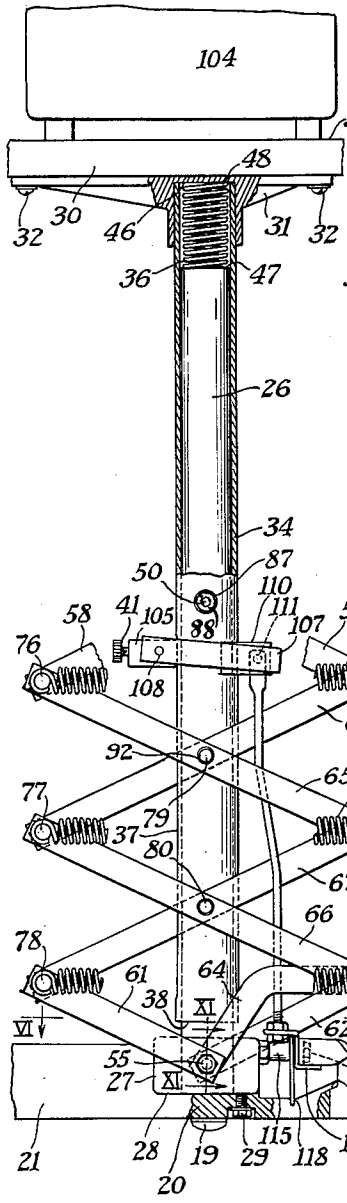


FIG. 4.

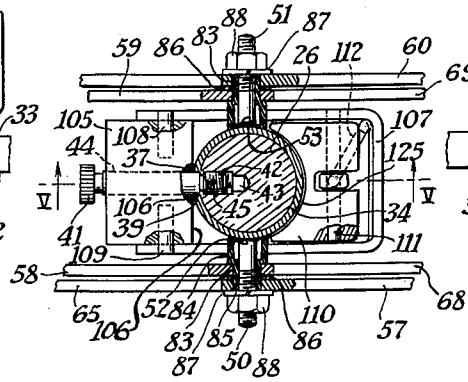


FIG. 5.

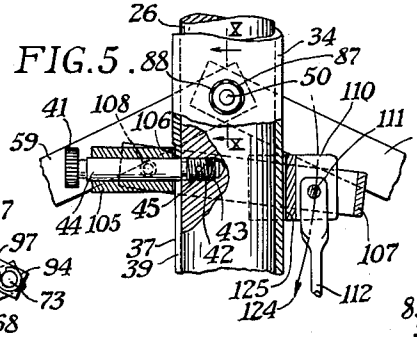


FIG. 10.

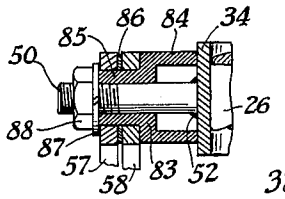


FIG. 3.

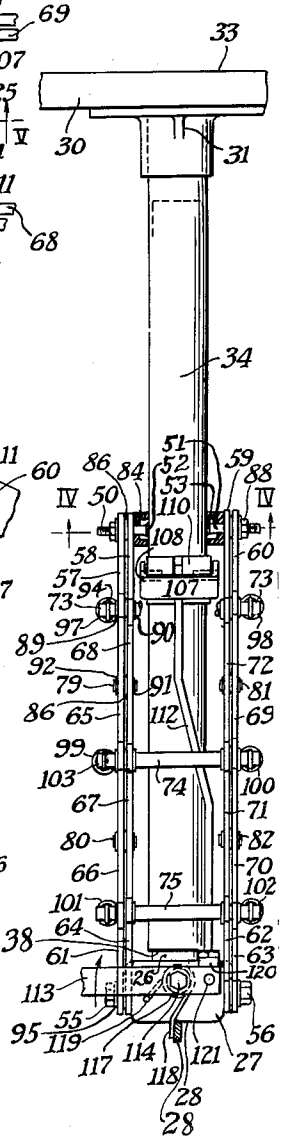
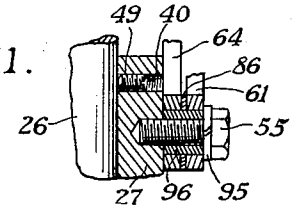


FIG. 11.



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VERTICALLY ADJUSTABLE SAFETY TABLE FOR NEAR-COUNTER-BALANCED SUPPORTING OF INSTRUMENTS

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Filed Mar. 3, 1958, Ser. No. 718,720

7 Claims. (Cl. 311—39)

This invention relates to counterbalanced, adjustable height tables, and more particularly to tables for supporting heavy instruments, and the like.

An object of this invention is to provide a table which will serve as a firm, solid support for instruments such as those which may be used by physicians making an eye examination.

Another object of this invention is to provide a table of the foregoing character which may be easily adjusted to any height within predetermined limits while a heavy instrument is supported thereon.

Another object of this invention is to provide a table of the above character having means which tend to counterbalance the weight of an instrument supported whereby adjustment of the table to elevate or lower the instrument may be conveniently effected by small forces of nearly constant magnitude applied by hand.

A further object of this invention is to provide a device of the above character which, through counterbalancing of at least a substantial portion of the forces tending to effect lowering of the instrument protects the instrument supported, against damage from shocks resulting from violent changes in elevation.

A further object of this invention is to provide a device of the above character having brake means biased to set and preclude movement, particularly downward movement, of the instrument and supporting portion except in response to action by the user.

A further object of this invention is to provide counterbalancing means, at least a portion of which constantly applies forces tending to counterbalance those forces applied by those parts of the device which may be raised and lowered, and a substantial portion of those forces applied by a useful load such as an instrument or the like supported thereon, and which also comprises auxiliary counterbalancing means which are operative within predetermined limits of vertical adjustment, only one of which limits is coincident with a limit of the total range of vertical adjustment.

Another object of this invention is to provide a device of the foregoing character, having means adapted to lock the vertically adjustable portion of the device against downward displacement and being releasable when desired.

A further object of this invention is to provide a device of the foregoing character which cannot be locked against vertical, upward movement into a condition of maximum, vertical extension in response to reduction of the counterbalanced load to a predetermined magnitude substantially less than the magnitude of the counterbalancing forces.

A further object of this invention is to provide an instrument table of the type having at least one telescoping leg, a spring-biased, parallelogram linkage biasing said leg toward extended condition, means interconnecting the telescoping portions of said leg to preclude separation thereof, auxiliary biasing means operative through a portion of the range of adjustment which does not include the portion adjacent and including the position of maximum elevation or extension and means

anchored to one of said telescoping portions and adapted to firmly grip the other of said telescoping portions to preclude retractive or downward movement and to offer substantial resistance to upward movement thereof and being releasable in response to relative movement of said telescoping members toward extended condition and in response to actuation of a release mechanism provided.

A further object of this invention is to provide a device of the above character having counterbalancing means, applying a force which, when supplemented by a hand applied small force of substantially constant magnitude, will counterbalance the weight of the vertically adjustable portions and loads supported thereon whereby slight alteration of the magnitude of the hand applied force permits positive, rapid, adjustment of elevation of the instrument supported with the exertion of very little effort by the operator.

A further object of this invention is to provide a device of the above character having brake means which serve to index the elevatable portion of the instrument support with reference to the non-elevatable portion thereof whereby azimuth rotation of the instrument incident to adjustment of its elevation is eliminated by setting of the brake.

The above and other features and objects of this invention will in part be obvious, and will in part be apparent to those having ordinary skill in the art to which this invention pertains, from the following description and accompanying drawings, in which:

Fig. 1 is a view in side elevation of an instrument supporting table embodying this invention, parts thereof being broken away and parts being shown in section, to more clearly show details of construction and relationship of parts when the table is extended to full or maximum height;

Fig. 2 is a view in side elevation of the table illustrated in Fig. 1, portions thereof being broken away to more clearly illustrate details of construction and show the relationship of parts of the structure when the table is retracted to lowest or minimum height;

Fig. 3 is a fragmentary view in end elevation of a table in a condition corresponding to that shown in Fig. 2, portions thereof being omitted and other portions being broken away to more clearly illustrate the details of construction;

Fig. 4 is a fragmentary view in horizontal section, partly broken away and taken along the line IV—IV in Fig. 3 illustrating co-operation of portions of lock or brake means and telescoping post structure;

Fig. 5 is a fragmentary view in vertical section, partly broken away taken along the line V—V in Fig. 4;

Fig. 6 is a fragmentary view in horizontal section taken along the line VI—VI in Fig. 2;

Fig. 7 is a graphic representation of counterbalancing force plotted against table elevation;

Fig. 8 is a fragmentary view in section taken along the line VIII—VIII in Fig. 1;

Fig. 9 is a fragmentary view in section taken along the line IX—IX in Fig. 1;

Fig. 10 is a fragmentary view in section taken along the line X—X in Fig. 5; and

Fig. 11 is a fragmentary view in section taken along the line XI—XI in Fig. 2.

An instrument table embodying this invention is illustrated in the drawings. The table has a unitary base 20 which in top plan view is generally cruciform. That is, it has a central portion connecting four integral radially extending leg or foot portions exemplified by feet 21 and 22 in the drawings. The foot 21 is representative of three of the feet in that it has a glide 19 secured in fixed relation thereto and adapted to rest upon a supporting surface

such as a floor. Foot 22 has a glide 23 coupled to glide-adjusting screw 24. The glide adjusting screw 24 is in threaded cooperative engagement with foot 22. Rotation of glide adjusting screw 24 serves to advance it axially to increase or decrease the degree of projection of adjustable glide 23 relative to the under side 25 of foot 22. Base 20 is thus adapted to rest firmly upon a supporting surface with three fixedly related glides 19 serving to determine a reference plane relative to which glide 23 may be adjusted through rotation of glide-adjusting screw 24 to place glide 23 in base-supporting relation to the floor or other supporting surface to preclude rocking or other movement of base 20. Glide 23 may be adjusted, that is, advanced or retracted relative to foot 22 through rotation of glide-adjusting screw 24 in order to effect substantially equal distribution of the supported load among the glides 19 and 23.

A right cylindrical column 26 may be fabricated from a suitable metal bar, such as a steel bar. A column base 27 may be provided as an integral part of column 26, or, as shown in the drawings, be separately fabricated and then secured in fixed, co-operating relation to that column. Base 27 may have a bore extending therethrough in perpendicular relation to the bottom face 28 thereof and into which bore a portion of column 26 may be snugly pressed in order that under face 28 of column support 27 extends in radial relation to the axis of column 26. Auxiliary interlocking means, such as set screw 49 in engagement with threads 40 provided in column support 27 (Fig. 11), may be provided to preclude separation of column 26 from column support 27. Column 26 and column support 27 may be secured in fixed relation to base 20 by means such as screw bolts 29, as shown in Figs. 1 and 2. As shown, the heads of bolts 29 may engage a portion of base 20 when the threaded shanks of the bolts 29 extend through an aperture provided in base 20 into threaded engagement with column support 27. Bolts 29, when drawn up tightly, secure face 28 of column support 27 in firm, abutting engagement with a horizontal co-operating face provided on base 20. Thus column 26 is firmly supported in a stationary upright position in fixed relation to and by base 20 and column support 27. A table top 30 has a bracket 31 secured to its under side by means such as screws 32. Bracket 31 has a recess provided therein, the axis of which extends perpendicularly to the upper surface 33 of table top 30. The upper portion of lift tube 34 is snugly received in the recess provided in bracket 31, for example, in a press fit. Thus tube 34 is firmly secured in fixed, co-operating relation with bracket 31 and a set or locking screw 35 may be provided to preclude relative movement of tube 34 and bracket 31 as shown in Fig. 1. Tube 34 has a longitudinal, cylindrical bore adapted to telescopingly receive a portion of column 26. A compression spring 36 may be placed in the bore of lift tube 34 ahead of column 26 which is then inserted behind it. Lift tube 34 has a longitudinal flat exterior face portion 37 disposed in perpendicular relation to a radius thereof. Face 37 extends from adjacent lower end 38 of lift tube 34 to a point substantially midway of the length of tube 34. A straight, elongate, longitudinally oriented slot 39 having closed ends, is provided in the wall of lift tube 34. The longitudinally extending center line of slot 39 coincides with the center line of flat face 37. One end of slot 39 is adjacent but spaced from end 38 of tube 34 while the other end of the slot 39 is disposed adjacent the longitudinal mid-point of lift tube 34 and also adjacent the upper end of flat face 37, nearest to bracket 31. Shoulder bolt 41 has a threaded portion 42 adapted to be received in co-operative threaded engagement with the threads provided in the wall of radially oriented recess 43 provided in column 26. A right cylindrical shoulder portion 44 of greater diameter than threaded portion 42 extends from adjacent threaded portion 42 to adjacent the head of shoulder bolt 41. Shoulder bolt 41 is advanced into recess 43 until the radially extending face of shoulder portion 44 adjacent threaded portion 42 is in firm abutting engagement with the external surface of column 26. A retaining plug 45 of nylon or the like extends diametrally through portion 42 and co-operates with the wall of recess 43 to retain bolt 41 in fixed relation to column 26. Shoulder portion 44 thus extends outwardly from the surface of column 26 through slot 39 in fixed radial relation to column 26. Shoulder portion 44 of shoulder bolt 41 is of a diameter slightly smaller than the width of slot 39 to allow free reciprocation of tube 34 relative to column 26, as shown most clearly in Fig. 4. Shoulder bolt 41 thus precludes any substantial rotation of lift tube 32 relative to column 26 and limits the primary relative movement of tube 34 to reciprocation longitudinally of column 26, the magnitude of such longitudinal reciprocation being substantially equal to one-half the length of lift tube 34.

Spring 36 is disposed in lift tube 34 between face 46 of bracket 31 and end face 47 of column 26. When table top 30 is in a position of full or maximum height relative to base 20 (Fig. 1), one end of spring 36 rests upon the upper end face 47 of column 26, while the upper end 48 of spring 36 is in spaced relation to face 46 of bracket 31. Spring 36 is of such length that it may be compressed from the unloaded condition in which it is shown in Fig. 1 to a condition in which its coils are in or nearly in contact, as shown in Fig. 2, as to effect an overall reduction in the spacing of spring end 48 from the spring supporting upper end face 47 of column 26 by a distance equal to substantially one-half the magnitude of the limited longitudinal reciprocation of lift tube 34 relative to column 26 as determined by shoulder bolt 41 in co-operation with column 26 and tube 34.

As shown in Figs. 3, 4, and 5, I provide a pair of coaxial oppositely extending radially oriented studs 50, 51 secured in fixed relation to tube 34 in any suitable manner such as by welds 52, 53. As shown most clearly in Fig. 4, the axes of studs 50, 51 and lift tube 34 lie in a common plane substantially perpendicular to the common plane of the axes of shoulder bolt 41 and column 26 which latter axis coincides with the axis of lift tube 34.

A primary counterbalancing means is connected to studs 50, 51 which are secured in unitary relation to lift tube 34, as previously explained, and by cap screws 55, 56 to column support 27. The primary counterbalancing means comprises duplicate short link bars 57, 58, 59, 60, 61, 62, 63, angle link bar 64, duplicate long links bars 65, 66, 67, 68, 69, 70, 71, 72, duplicate pivot pins 73, 74, 75, 76, 77, 78, and duplicate linkage pins 79, 80, 81, 82. The portions of the spring biased linkage disposed to the left of tube 34 in Fig. 3, is substantially the same as the portion to the right of tube 34 in Fig. 3, except that link 62 is straight while link 64 is L-shape as shown in Figs. 1 and 2. Link 64 is so shaped to avoid interference between it and pedal 113. Each short link bar 57, 58, 59, 60, 61, 62, 63, has two apertures, one adjacent each end of the bar. Bars 57, 58 are adapted to pivot about the axis of stud 50. As shown in Figs. 3 and 4, a bushing 83 may be interposed between stud 50, tube 34 and links 57, 58. Portion 84 of bushing 83 serves to space link bars 57, 58 from lift tube 34 and a portion 85 of smaller diameter serves as a bearing sleeve interposed between bars 57, 58 and stud 50, as shown in detail in Fig. 10. A spacing washer 86 may be interposed between links 57, 58, and annularly of portion 85, as there shown. A lock washer, such as split lock washer 87, and nut 88 complete the assemblage to retain members 57, 86, 58 and 83 in relation to stud 50 and lift tube 34. Links 59 and 60, stud 51, bushing 83, lock washer 87 and nut 88 are assembled in similar relation as shown in Fig. 4. Long link 68 and short link 57 are pivotally connected by pivot pin 73, as shown in Figs. 1, 2, 3, and 9. As shown particularly in Fig. 9, links 57 and 68 engage the cylindrical

surface of pin 73 between split retaining rings 89, 90, portions of which are received in respective grooves provided in pin 73. A spacing washer 86 is interposed between the adjacent faces of links 67 and 68. Short link 58 and long link 65 are connected in similar manner by pivot pin 76. As shown in Figs. 1, 2, 3 and 8, long links 65 and 68 are pivotally joined by a linkage pin 79 which extends through apertures provided in the middle of the respective links 65, 68. Linkage pin 79 serves to couple links 65 and 68 for scissors-like action. Split retaining rings 91, 92 may be provided in co-operative engagement with grooves provided in pin 79, so as to preclude withdrawal of that pin from co-operative engagement with bars 65, 68. As shown, a spacing washer 86 may be provided annularly of pin 79 between the bars 65, 68. Linkage pin 80 couples links 66 and 67 in a similar manner, while linkage pins 81, and 82, respectively, couple links 69, 72, and 70, 71 in that same way. As shown most clearly in Fig. 3, the linkage pins each serve to couple only two respective link bars, while the pivot pins 73, 74, 75, 76, and 78, each serve to couple four bars in spaced pairs. Short bars 62, 63 are in respective pivotal co-operation with pivot pins 75 and 78 and are in pivotally connected relation in co-operation with a bearing sleeve annularly of and supported by cap screw 56.

As shown in Fig. 11, cap screw 56 extends through lock washer 95 and bearing sleeve 96 into threaded engagement with column support 27. Links 61 and 64 pivotally engage the exterior surface of bearing sleeve 96 between column support 21 and washer 95 and are held in spaced relation by spacing washer 86.

In similar manner, short link 62 and angle link 63 are supported in pivotal co-operation with a bearing sleeve, by cap screw 56.

As shown in Figs. 1, 2 and more particularly in Figs. 3 and 9, tension springs 97, 98, 99, 100, 101, 102, are provided extending between and in co-operation with respective pairs of pivot pins. Thus, tension spring 97 extends between pivot pins 73 and 76 and a similar corresponding spring 98 is in co-operating relation with the right hand ends of those springs as they are shown in Fig. 3. As shown in Fig. 9, a groove 103 is provided annularly of pivot pin 73 adjacent the end thereof outboard of the portion of pin 73 co-operatively engaged by links 57 and 68. Tension spring 97 has a ring-like hook portion 94 which is partially received in groove 103 and co-operates with pivot pin 73 in a manner such that separation of the spring from the pivot pin is substantially precluded. The length of tension spring 97, when not under load, is less than the minimum spacing of pivot pins 73 and 76, so that when the hook-end portions 94 of tension spring 97 are in respective engagement with pivot pins 73 and 76, tension spring 97 is under at least a minimum predetermined tension load at all times. Springs 97, 98 being of substantially the same length, and being coupled to corresponding ends of pair of pivot pins 73, 76, tend to bias those pins toward reduced spacing. Tension springs 99 and 100 co-operate in a similar manner with pivot pins 74, 77, while springs 101, 102 co-operate with pivot pins 75, 78 in a similar fashion. Thus the six springs 97, 98, 99, 100, 101, 102 being continuously loaded in tension, resiliently bias the link bar structure toward maximum elongation. Since the ends of the linkage are respectively anchored to column support 27 by cap screws 55, 56 and to lift tube 34 by studs 50, 51, longitudinal telescoping movement of tube 34 relative to column 26, is directly related to the condition of linkage elongation. Thus, shoulder bolt 41, which serves to limit telescoping reciprocation of tube 34 relative to column 26 to a distance equal to the length of slot 39 less the diameter of shoulder 44, thereby limits variation in linkage length or elongation to a distance of equal magnitude. As shown in Fig. 1, tube 34 is in a limit position of maximum upward displacement in which table top 30 is at maximum elevation and the tension springs 97, 99 and 101, as well as the springs disposed behind them, namely, tension springs 98, 100, 102, are under minimum tension loads. In the other limit position of tube 34, relative to column 26, tube end 38 is adjacent column support 27 (Fig. 2) when the upper end of slot 39 adjacent studs 50, 51 is resting against shoulder 44 of shoulder bolt 41 (Fig. 5). In Fig. 2, the tension springs 97, 99, and 101, as well as springs 98, 100, 102, are subjected to maximum elongation and thus to maximum tension load.

The lifting force exerted by the counterbalancing means upon tube 34 and tending to urge it away from column support 27 is indicated in Fig. 7 which is a graphic representation of increasing elevation from left to right in units such as inches, for example, and of increasing force from bottom to top in unit such as pounds. The solid line extending from P_b through I to P_t represents the effect of the primary, continuously acting counterbalancing linkage. The tension springs 97, 98, 99, 100, 101, 102 are thus adapted for use when an instrument 104 together with those parts of the structure which are elevatable, have a total weight of approximately 80 pounds, as represented by the upper horizontal line in Fig. 7. Thus, at point P_b which corresponds to the position in which the upper end face of slot 39 is in contact with shoulder 44 of shoulder bolt 41, as shown in Fig. 5, the primary counterbalancing means provides a counterbalancing force of approximately 61 pounds. When table 30 has been raised approximately 5½ inches, an elevation corresponding to point I, the primary counterbalancing means provides an upwardly directed force of approximately 77 pounds. At an elevation of approximately 7 inches, the maximum upwardly directed force is provided by the primary counterbalancing means and is of a magnitude of the order of 79 pounds, while in the position of maximum elevation in which the parts are in a relation corresponding to that shown in Fig. 5, the upwardly directed or counterbalancing force provided by the primary counterbalancing means is of the order of 74 pounds.

As previously explained, compression spring 36 is disposed between upper end face 47 of column 26 and face 46 of bracket 31. When table top 30 is in the position of maximum elevation, the upper end 48 of compression spring 36 is spaced from face 46 of bracket 31, a position corresponding to point P_t in the graph Fig. 7. As table top 30 is lowered to a position corresponding to point I of Fig. 7, it will have moved downwardly a distance approximately 4¾ inches, and face 46 will have moved into contacting relation to upper end 48 of compression spring 36. As table top 30 is moved farther in the downward direction, compression spring 36 provides secondary counterbalancing force which is complementary to the force provided by the primary counterbalancing means and represented by the line P_b—I—P_t. The area P_b—I—C—P_b in the graph, Fig. 7, represents the counterbalancing force contributed by compression spring 36 which varies from zero force at point I (5¼ inch elevation) to approximately 13 pounds when table 30 has been moved to minimum elevation, with column 26, tube 34 and shoulder bolt 41 in the relative positions shown in Fig. 5. Thus, the counterbalancing force provided by the counterbalancing means is represented by the line C—I—P_t. This line indicates that points C and P_t are minimum points corresponding to counterbalancing forces of approximately 74 pounds, while the maximum counterbalancing force is 79 pounds, at an elevation of approximately 7 inches, as indicated by the reference character M. The counterbalancing force thus varies approximately five pounds between its minimum and maximum limits. The springs 36, 97, 98, 99, 100, 101, 102, are seletced to provide a force of desired magnitude for counterbalancing a useful load such as a particular instrument resting upon the table top 30. Thus, assum-

ing the total load to be counterbalanced is of the order of 76 pounds, the horizontal line **54** in Fig. 7 represents the constant load and the vertical distance between line **54** and the line C—I—M—P_t, represents the unbalanced load corresponding to the respective position of vertical displacement of table top **30**. Thus, vertical adjustment of the table top **30** of the illustrative embodiment, would, as shown in Fig. 7, require hand application of a supplemental force of the order of 2 to 3 pounds, depending upon the position of vertical displacement of the table top **30** desired. If the useful load is changed, the total counterbalanced load is changed a like amount. To alter the counterbalancing force to a corresponding value, one pair of springs, **97—98**, **99—100**, or **101—102**, may be removed, or removed and a pair of weaker or stronger ones substituted for those removed.

A brake or locking means is provided by means of which the unbalanced forces are utilized to more firmly secure lift tube **34** in fixed relation to column **26**.

Brake block **105** is preferably a rectangular block having a bore adapted to co-operatively receive shoulder portion **44** of shoulder bolt **41** longitudinally along which block **105** is adapted to reciprocate between face **37** of tube **34** and the head of shoulder bolt **41** (Figs. 4 and 5). Block **105** has a flat face **106** which extends in radial relation to shoulder **44** and is adapted to engage face **37** of lift tube **34** in flatwise face-to-face fashion. A generally U-shaped brake frame **107** is secured by brake block pins **108**, **109** in pivotal relation to brake block **105**. A brake shoe **110** is secured in pivotal relation to brake frame **107** by brake shoe pin **111**, the axis of which extends in spaced, parallel relation to the aligned axes of brake block pins **108**, **109**, as shown in Figs. 4 and 5. Brake shoe pin **111** also extends through an aperture provided adjacent one end of brake rod **112** pivotally connecting the rod to brake frame **107**. As shown most clearly in Figs. 6, 1, 3, and 2, a brake pedal **113** is mounted in rocking relation upon brake pedal bolt **114** between the head of bolt **114** and brake pedal spacing collar **115**. Brake pedal bolt **114** extends into threaded engagement with and is supported by column support **27** and is locked in fixed relation thereto by lock nut **116** (Fig. 6). Brake pedal spacing collar **115** encircles the shank of bolt **114** between lock nut **116** and brake pedal **113**. Brake pedal spring **117** has coils encircling brake pedal spacing collar **115**. Arm **118** of spring **117** bears against a portion of base **20**, while a second arm **119** bears against the under side of pedal **113**. Spring **117** biases brake pedal **113** toward clockwise rotation about bolt **114**, as shown in Fig. 3. As shown, an angle lug **102** is pivotally secured to pedal **113** by any suitable means such as rivet **121**. Lug **120**, secured to pedal **113** by rivet **121**, is free to swing about the axis of rivet **121**. Lug **120** has an aperture through which a portion of brake rod **112** is adapted to extend, as shown particularly in Figs. 1, 2 and 6. Brake rod **112** is externally threaded adjacent lug **120** and in threaded co-operation with a pair of lock nuts **122**, **123** disposed on opposite sides of lug **120**. Lock nuts **122**, **123**, are adjusted longitudinally by appropriate rotation so that the effective length of brake rod **112** extending between brake pedal lug **120** and brake shoe pin **111** is such that when brake shoe **110** and break block **105** are in engagement with the opposed faces of lift tube **34**, pedal **113** will extend in substantially horizontal position, as shown in Figs. 1, 2, and 3. When so adjusted, brake pedal **113** will engage edge face **126** of base **20** in the limit position of its movement counterclockwise about bolt **114** in Fig. 3. Brake rod **112** connects pedal **113** and brake frame **107** which, as thus mechanically limited, cannot swing beyond a position in which the axis of pin **111** lies in the plane perpendicular to the axis of column **27** in which place the axis of pins **108**, **109** lies. Lock nuts **122**, **123**, are drawn up in tight abutment with opposite faces of the interposed portion of lug **120** to lock lug **120** and brake rod **112** in substantially unitary relation. Spring **117** biases foot pedal **113** for clockwise rotation, as shown in Fig. 3, and through brake rod **112** coupled to pedal **113** by lug **120**, tends to rotate brake frame **107** in clockwise direction about the common axis of brake block pins **108**, **109** as indicated by arrow **124** in Fig. 5. Such rotation of brake frame **107** serves to tend to displace the axis of pins **108**, **109** and the axis of pin **111** toward the common axis of column **26** and lift tube **34**. That is to say, clockwise movement of brake frame **107** about the axis of pins **108**, **109**, from the position in which it is shown in Fig. 5, tends to reduce the radial spacing of the axis of pin **111** from the axis of column **26** and to reduce the radial spacing of the axis of pins **108**, **109** from the axis of column **26**. Thus, spring **117** serves to bias the brake structure to move flat face **106** of brake block **105** into abutment with flat face **37** of lift tube **34** and to move substantially cylindrical face **125** of brake shoe **110** into conforming face-to-face abutment with an opposed portion of the exterior cylindrical face of lift tube **34** to grip lift tube **34** between brake block **105** and shoe **110**, when the axis of brake shoe pin **111** is nearer to column support **27**, than the axis of brake block pins **108**, **109**. Torsion spring **117** biases brake block **105** and brake shoe **110**, of the brake or locking mechanism, to grip tube **34** so as to secure it against movement relative to column **26** in response to any hand applied, upwardly directed force, the magnitude of which is less than a predetermined magnitude which is smaller than the magnitude of useful load counterbalancing force. Thus, upward and downward adjustment of top **30** and an instrument thereon, is easily effected when the brake or locking mechanism is released by actuation of pedal **113**. However, if pedal **113** is not released, upward adjustment of top **30** requires application of much greater force, while attempted downward adjustment merely serves to more firmly secure tube **34** in fixed relation to column **26** by setting the brake more tightly. As a result, top **30** firmly and steadily supports a counterbalanced load.

It may be noted that incident to setting, under biasing forces, of the brake or lock means, tube **34** is indexed by co-operative engagement of brake block face **106** with flat face **37** of tube **34**. Thus, setting of the brake or lock means results in positive alignment of the tube **34** in a predetermined position of angular rotation while in any position of vertical adjustment. The sum of the load forces tending to move table top **30** and its associated lift tube **34** toward column support **27**, preferably is as nearly equalled by the counterbalancing force applied to lift tube **34** by the spring biased linkage comprising primary counterbalancing means and the secondary or auxiliary counterbalancing means comprising resilient compression spring **36**, as possible. Brake block **105**, being secured by shoulder bolt **41** against axial displacement longitudinally of column **26**, anchors one end of brake frame **107** against movement longitudinally of column **26**. As explained above, spring **117** biases the lock means to grip lift tube **34** in a predetermined degree which results in predetermined frictional engagement between brake shoe **110** and lift tube **34**. Any movement of lift tube **34** toward column support **27** tends to carry brake shoe **110** with tube **34** in the direction of column support **27**. Such movement of brake shoe **110** toward column support **27** is transmitted through brake shoe pin **111** to brake frame **107** and tends to swing same in the direction of arrow **124**. Spring **117** also biases frame **107** to swing in the direction indicated by arrow **124** so that adequate initial frictional engagement exists between tube **34** and shoe **110**, except when the brake or locking means are released as explained below. As previously explained, swinging of brake frame **107** in the direction indicated by arrow **124**, serves to apply forces tending to advance brake lock **105** and brake shoe **110** toward

the axis of column 26 to more firmly grip the interposed lift tube 34. Thus, the greater the uncounterbalanced force urging lift tube 34 downwardly, the more firmly tube 34 is gripped between brake shoe 110 and brake block 105. To permit lowering of table top 30, as desired, the brake or locking mechanism may be released by foot actuation of pedal 113. As shown particularly in Figs. 1 and 2, brake pedal 113 projects through a notch provided in base 20. The edge 126 defining the bottom of the notch serves to limit swinging of brake pedal 113 in counterclockwise direction, as shown in Fig. 3, and I prefer that the limit of such counterclockwise rotation correspond to a position in which the axis of brake shoe pin 111 will lie in a position between that in which it is shown in Fig. 5, and a position in which it coincides with a radial plane of column 26 in which the axis of brake block pins 108, 109, also lies.

It may be noted, as previously explained, that shoulder 44 of bolt 41 co-operates with the longitudinal edge faces bounding slot 39 to substantially preclude rotation of lift tube 34 relative to column 26. However, a small amount of rotation is possible as some play is normally present as free movement of tube 34 on column 26 is desired. Brake block 105 is urged into face-to-face engagement with flat face 37 which surrounds slot 39, when the brake assembly is moved to set and lock lift tube 34 in fixed relation to column 26. The interaction of brake block 105 and flat face 37 incident to application of the brake, serves to index lift tube 34 even more closely than shoulder bolt 41 does, whereby substantially identical orientation of lift tube 34 in relation to column 26 is obtained when the brake is set to interlock those members against longitudinal displacement.

When the load tending to displace table top 30 downwardly toward column support 27 is decreased in magnitude to an extent that the force supplied by counterbalancing means tending to elevate the table top 30, exceeds the sum of the opposed downwardly acting forces and the force necessary to move tube 34 upwardly when the brake is in spring 117 biased engagement therewith, lift tube 34 tends to rise or move away from column support 27 and to carry with it brake shoe 110. Such movement of lift tube 34 tends to swing brake frame 107 in a direction opposite to that indicated by arrow 124, and the brake is thus automatically, partially released, allowing lift tube 34 to move upwardly along column 26 away from column support 27 until the lower end of slot 39 engages shoulder bolt 41. Thus, for example, when instrument 104 is lifted from table top 30, table top 30 will follow instrument 104 upwardly until it reaches its maximum elevation as established by shoulder screw 41. Thus, it is impossible for table 30 to remain in a lowered position from which it might be violently spring-propelled upwardly in response to accidental tripping of foot pedal 113. The spring 117 biases the brake to set to a degree as will provide a drag which may be overcome by a counterbalancing force exceeding the opposed load by slightly less than the minimum useful load for which the device is designed. The counterbalancing means thus also serves as a safety brake release.

The strength of springs 97, 98, 99, 100, 101, 102 and 36 may be selected in accordance with the nature of the load to be supported upon table top 30. The springs, as shown in Fig. 3, are arranged in pairs 97—98, 99—100, and 101—102. The two springs comprising each pair should be of equal strength, but each pair need not be equal to any other pair in strength. In fact, I have found that for lighter weight instruments one pair of springs, for example 101—102, may be omitted. A set of ten springs comprising six of full-strength, two of about three-quarter-strength and two of about one-half-strength, may be provided for the illustrative embodiment. By use of four or six of these springs in paired relation in the parallelogram counterbalancing linkage, the useful load counterbalancing force may be varied within the range of approximately 18 to 100 percent. The particular springs used for a particular useful load are of course, selected to provide a useful load counterbalancing force of a magnitude substantially equal to the useful load force.

Each such combination of springs has a useful counterbalancing-force-curve corresponding to curve C—I—M—P_t of Fig. 7 and each such curve lies within a small range of approximately six pounds, like C—I—M—P_t. Thus in using the device, elevation adjusting forces of substantially similar magnitude need be supplied by the operator, whether a heavier or lighter useful load is supported by the device.

A protective guard or housing 127 may be provided, as shown in Fig. 1, and secured in fixed relation to base 20 by screws 129 which co-operate with means such as lugs 128 in integral relation with base 20.

Having described one preferred embodiment of the invention, it will be apparent to those having ordinary skill in the art to which this invention pertains, that various modifications and changes may be made in the above described, illustrative embodiment without departing from the spirit or scope of this invention and the appended claims.

Therefore, what is claimed as new, and desired to be secured by Letters Patent is:

1. A support means comprising a base, a top, first and second telescoping members disposed between said base and top and in co-operating column-forming relation, said first telescoping member being secured to said base, said second telescoping member being secured to said top and being adapted to receive a portion of said first telescoping member, said second telescoping member being tubular and having a longitudinal flat face parallel to its axis, a longitudinal slot in said flat face parallel to the axis of said second telescoping member, an interlocking member secured to said first telescoping member and extending through said slot, a brake block mounted for reciprocation longitudinally of said interlocking member toward and away from said second telescoping member and adapted to co-operate with said flat face to index said second telescoping member to predetermined position of angular rotation relative to said first telescoping member, a brake frame pivotally secured to said brake block, a brake shoe pivotally secured to said brake frame and adapted to engage a portion of the exterior face of said second telescoping member, said brake frame being swingable and biased to advance said brake block and brake shoe into gripping relation to said second telescoping member in such manner that co-operation of said brake shoe with said second telescoping member effects firmer gripping in response to movement of said second telescoping member toward said base, and means for swinging said brake frame to shift said brake shoe away from said second telescoping member and said base to release said brake and allow movement of said second telescoping member toward said base, an elongate, parallelogram linkage having one of its ends secured in pivotally fixed relation to said base and the other of its ends secured in pivotally fixed relation to said second telescoping member, resilient means biasing said parallelogram linkage toward extended condition, whereby said second telescoping member, top, and a predetermined useful load resting thereon, are urged away from said base by forces substantially counterbalancing the forces acting to advance the second telescoping member toward the base.

2. A device in accordance with claim 1 characterized by the fact that said resilient means biasing said parallelogram linkage are tension springs which bias said parallelogram linkage to urge said second telescoping member away from said base under a force no weaker than the sum of oppositely directed forces attributable to the weight of structural parts of the device adapted to move in unison therewith, and the force necessary to overcome

the predetermined drag of the brake means acting upon said second telescoping member whereby said second telescoping member will be advanced upwardly to its limit position remote from said base when the useful load is reduced to a predetermined size.

3. Support means comprising a first elongate upright member, a second elongate member in telescoping relation to said first elongate member, an interlocking member secured in fixed relation to one of said elongate members and extending into a longitudinal slot having closed ends provided in the other of said elongate members to preclude separation of said elongate members and limit longitudinal movement of the second member relative to the first elongate member, a resiliently biased parallelogram linkage being coupled adjacent one of its ends to said first elongate upright member and adjacent its other end to said second elongate member to resiliently bias said members toward extended relation, and indexing brake means anchored to one of said elongate members and adapted to clampingly grip the other of said elongate members, said brake means being adapted to index the second elongate member to a predetermined position of angular rotation relative to the first elongate member incident to setting of said brake, irrespective of the relative longitudinal displacement of said elongate members and said brake means being adapted to release the elongate member gripped thereby in response to relative movement of said elongate members toward extended relation.

4. Means for counterbalancingly supporting a predetermined load for easy alteration of load elevation comprising a base, a top, first and second telescoping column-forming members coupling said base and top, compressible resilient means adapted to co-operate with said telescoping column-forming members and resist telescoping relative movement thereof within a predetermined range of positions, brake means anchored to said first telescoping member and adapted to indexingly secure said second telescoping member against longitudinal movement relative to said first member and in a predetermined position of angular rotation relative to said first member, means for releasing said brake means, said brake means being biased to predetermined set to offer a predetermined resistance to movement of said telescoping members toward extended column relation and to substantially preclude their relative movement toward telescoped relation, a parallelogram linkage having its opposite ends respectively anchored in fixed relation to said first and second telescoping members, and resilient means biasing said linkage toward extended condition whereby said top is moved to maximum elevation when the load thereon is less than a predetermined portion of the predetermined load to be counterbalanced.

5. A support means comprising a first elongate member, a second elongate member in telescopic relation to said first elongate member, interlocking means interconnecting said members to preclude separation of said elongate members and limit longitudinal movement of the second elongate member relative to the first elongate member, a parallelogram linkage coupled adjacent one of its ends to said first elongate member and adjacent its other end to said second elongate member, spring means extending crosswise of and resiliently biasing said parallelogram linkage toward extended relation, the baising force of said spring means having a maximum value when the telescopic members are at a first intermediate position spaced from the limits of relative movement and decreasing as the elongate members move from said intermediate position in retracting direction, a second spring means mounted on one of said members and engageable by the other of said members when the members are in a second intermediate position adjacent and more retracted than said first intermediate position and in further retracted positions to supplement the force of said first mentioned spring means, said second spring means biasing the elongate members toward extended position, the second spring means being released when the members are in a further extended relation than said second intermediate position, whereby said members are continuously urged toward extended relation by substantially constant total force.

6. A device in accordance with claim 1 characterized by the fact that said interlocking means includes a brake block, that telescoping limiting means secured to said first elongate member and having a cylindrical portion thereof projecting outwardly through a slot in the second elongate member and through said brake block supported on said cylindrical portion for sliding movement toward and away from said second elongate member and for angular rotational movement about the axis of said cylindrical portion, that a U-shape brake frame straddles said second elongate member and is pivotally secured adjacent its ends to said brake block for pivotal movement about an axis perpendicular to the axis of said cylindrical portion, that a brake shoe adapted to cooperatingly engage said second elongate member is secured to said brake frame for pivoting about an axis parallel to the axis of brake frame pivoting, and that telescoping movement of said second elongate member in cooperation with said brake shoe pivots said brake frame to advance said brake shoe and brake block into firm interlocking engagement with said second elongate member and precluding further telescoping movement of said elongate members while remaining in cooperation with said second elongate member so as to release same in response to opposite movement of said second elongate member.

7. A device in accordance with claim 4 characterized by the fact that said interlocking means includes a brake block, that telescoping limiting means are secured to said first elongate member and have a cylindrical portion thereof projecting outwardly through a slot in the second elongate member and through said brake block supported on said cylindrical portion for sliding movement toward and away from said second elongate member and for angular rotational movement about the axis of said cylindrical portion, that a U-shape brake frame straddles said second elongate member and is pivotally secured adjacent its ends to said brake block for pivotal movement about an axis perpendicular to the axis of said cylindrical portion, that a brake shoe adapted to cooperatingly engage said second elongate member is secured to said brake frame for pivoting about an axis parallel to the axis of brake frame pivoting, that telescoping movement of said second elongate member in cooperation with said brake shoe pivots said brake frame to advance said brake shoe and brake block into firm interlocking engagement with said second elongate member and precluding further telescoping movement of said elongate members while remaining in cooperation with said second elongate member so as to release same in response to opposite movement of said second elongate member, and that spring biased linkage urges said brake shoe toward locking engagement to provide a predetermined resistance to movement of said elongate members toward extended relation, said linkage being movable in bias overcoming direction to hold said brake shoe and brake block in released relation to said elongate members, whereby said elongate members may be advanced into telescoped condition as desired under unbalanced downwardly directed forces.

References Cited in the file of this patent

UNITED STATES PATENTS

666,017	Mack	Jan. 15, 1901
709,612	Smith	Sept. 23, 1902
732,418	King	June 30, 1903
920,135	Harrod	May 4, 1909
1,550,944	Beidler et al.	Aug. 25, 1925
2,628,142	Dubach	Feb. 10, 1953
2,645,538	Segal	July 14, 1953
2,792,268	Stanley	May 14, 1957

UNITED STATES PATENT OFFICE

CERTIFICATION OF CORRECTION

Patent No. 2,977,168 March 28, 1961

Philip C. Johnson

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 11, line 64, for "baising" read -- biasing --; column 12, line 7, for the claim reference numeral "1" read -- 5 --; line 9, for "means secured" read -- means are secured --; line 10, for "having" read -- have --; line 33, for the claim reference numeral "4" read -- 5 --.

Signed and sealed this 29th day of August 1961.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

DAVID L. LADD
Commissioner of Patents