TABLE TOP SUPPORT

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ABSTRACT

Vertical adjustable support for a table top utilizing a spring assembly to counterbalance the table top at any of an infinite number of levels and to cooperate with a compressive locking mechanism actuated by a conveniently positioned simple manual control member to effect a stable, rigid columnar structure at selected adjusted height levels of the table top.

7 Claims, 13 Drawing Figures
TABLE TOP SUPPORT

BACKGROUND OF THE INVENTION

This invention pertains to utility tables and, more particularly, to a vertical, adjustable, central support for such tables.

A versatile table, especially one that can be easily adjustable as to height, finds many applications where space is at a premium, such as in small apartments, hotel rooms, and trailers. A table that can be readily raised to a height comfortable for dining and as easily lowered to a level satisfactory for card playing is very desirable. A table which may be readily, selectively adjusted to an infinite number of height levels within a wide range of vertical movement so as to serve a multiplicity of additional functions such as a cocktail table, a coffee table, a television table, or to support a typewriter has added desirable advantages.

Tables prior to this invention, with vertical height adjustment features, have rather severe deficiencies in the nature of either having complex and expensive adjustable support means with complicated and awkward manipulative locking arrangements, or are structurally inadequate for their purported utility.

SUMMARY OF THE INVENTION

Accordingly, it is a main object of this invention to provide a safe, and inexpensive vertical adjustable structure which functions to support a table top at an infinite number of height levels.

It is a principle object of this invention to provide a centrally located table support which can be easily adjusted to provide an infinite number of table top height levels and thus be adapted to the personal requirements of the user for a variety of purposes such as dining, sewing, game playing, typing, television support, etc.

It is another object of this invention to provide a vertical, adjustable support for a table top which may be locked in an infinite number of vertical positions to form a strong, rigid columnar structure which can safely sustain loads in excess of two hundred pounds.

It is another object of this invention to provide a convenient, novel locking means for holding the table top positively in an infinite number of selected adjustable positions of elevation.

It is still another object of this invention to provide a novel lock assembly which may be engaged or disengaged by simple control movements of a single manual control member. Additionally, an important object of the invention is the provision of a single manual control member for the locking mechanism in a fixed location related to the table top. Thus, regardless of the selected vertical adjustable height of the table top, the single manual control member is, at all times, positioned directly beneath the under surface of the table top where it is most suitable for convenient manipulation.

It is a further object of this invention to provide a table top vertically adjustable support which maintains the table top in a weight balanced condition in any of an infinite number of height levels even though the provided locking mechanism is disengaged.

It is another object of this invention to provide a table top vertically adjustable support which is non-rotatable and prohibits the table top from pivoting about its base when the table top is selectively positioned at any of an infinite number of height levels above the base, regardless of whether the provided locking arrangement is engaged or disengaged.

It is yet a further object of this invention to provide a table top vertically adjustable support which is yieldably biased at any position of elevation and which permits easily lowering or raising the table top throughout the complete range of vertical movement irrespective of the fact the table top is supporting a reasonably substantial load such as a typewriter.

The objects of this invention are accomplished in a structure which is comprised of a first hollow tubular member depending from a table top at a central location and slidably positioned in telescopic relationship with a second stationary hollow tubular column which rises vertically from a base. The combined weight of the table top and the depending vertically movable tubular column is balanced by the upward biasing force of a spring assembly located in the space within the telescoped tubular columns. A novel cam action lock arrangement serves to wedge the telescoped columns in close contact so as to form a rigid columnar structure at any of an infinite number of extended positions of the first tubular member in relation to the stationary tubular member. A single manual control member for the novel cam action lock is located at the top of the movable first tubular member and directly beneath the table top. In this manner, the manual control member is conveniently located at the table top height regardless of the selected vertical position of the table top. Additionally, both of the tubular members are provided with a vertically linear series of embosses in their respective peripheral surfaces which extend in a line substantially along the entire length of the respective columns. The embosses are designed for mating relationship and cooperate to constrain any rotary movement of the tubular columns relative to each other without substantially affecting the vertical slidable movement of the first column depending from the table top.

Various types of biasing springs and structural arrangements for supporting the spring means are suitable for purposes of this invention. Regardless of the spring configuration, it is essential that the spring means be substantially matched with respect to its biasing force, to the combined weight of the table top and the depending tubular column. In practice, a spring means is usually employed which has a biasing force slightly in excess of that which is necessary to counterbalance the table top. This practice permits the spring assembly to accommodate a contemplated load to be supported by the table top. When the weight of the table top and the depending movable tubular column are counterbalanced by the biasing force of the spring, it is only necessary to overcome the frictional forces within the system to effect an upward or downward motion of the table top. These forces are substantially equal and, when a spring means with a near zero gradient biasing force is employed, the external force necessary to adjust the vertical position of the table top is uniform regardless of the extension of the movable tubular member from the stationary tubular column.

For aesthetic and economic reasons, it is necessary to employ tubular columns having a reasonably small diameter. Therefore, it is important that the spring means, having the necessary biasing force to counterbalance the table top, be designed to effectively function in a minimum of space. It is also important that the spring assembly used have a minimum gradient biasing force throughout the range of the spring extension or compression. The features of a substantially zero gradient biasing force and smallness of spring size relative to size of biasing force are found in a spring means of the spirally wound tape-like type.

It is to be observed that, although alternate spring means may be employed, it is a significant feature of the present invention that the spring means counterbalancing the table top is hidden within the telescoped tubular structure and cooperates in operation with the novel cam action lock arrangement which is controlled by a simple manually controllable member located at table top height to provide selective adjustment of the vertical elevation of the table top at any of an infinite number of height levels with a minimum of effort and, in cooperation with the mating embosses, ensures a rigid, non-rotatable columnar structure at any of the extended positions of the telescoped tubular columns.

The foregoing features and other distinct advantages of the invention will become more readily apparent from the following detailed description of preferred embodiments when taken in connection with the accompanying drawings.
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BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an elevation and partial sectional view showing the vertical adjustable support telescoped members in a partially extended position biased by a substantially zero gradient spring carried on a stationary support rising from a base. FIG. 2 is a sectional view taken on line 2—2 in FIG. 1 showing the compressive lock assembly and the configuration of the aperture for the manual control out-of-round cam action rod members. FIGS. 3 and 4 are sectional views of a plurality of substantially zero gradient springs carried on a stationary support as required for a greater spring upward biasing force than that which is supplied by a single spring.

FIG. 5 is a sectional view of the vertical adjustable support as when adjusted to have maximum height and showing an alternate arrangement of a zero gradient spring assembly to effect a substantially constant upward biasing force to the movable tubular member which depends from the table top.

FIG. 6 is a detailed view of the wear plate supported at the top of the movable column and showing the method of attaching the outer ends of the zero gradient springs to the wear plate.

FIG. 7 is a sectional view corresponding generally with the disclosure of FIG. 5 but showing the vertical, adjustable support as when adjusted to have minimum height.

FIG. 8 is a sectional view as taken at a 90° angle from the sectional view of FIG. 5 showing the vertical adjustable support as when adjusted to have partial extension and also shows a front view of the sheave assembly.

FIG. 9 is an enlarged isometric view of the vertical movable spring support shown in FIGS. 5, 7 and 8.

FIG. 10 is a bottom view of the vertical movable spring support shown in FIGS. 5, 7 and 8.

FIGS. 11 and 12 are sectional views corresponding generally with the disclosure of FIG. 8 but showing arrangements of pluralities of springs as required for a greater spring upward biasing force than that supplied by a single spring.

FIG. 13 is an enlarged sectional view of an alternate compound locking structure as required for exceptionally heavy table top loads.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. 1, a fixed outer tube or hollow cylindrical column 10 is secured to a bottom plate 11 by an assembly pin 12. The assembly pin also secures a bottom cap 13 to the bottom plate 11. The fixed outer tube is recessed within and attached to a bottom 14 by means of the bottom plate 11 and a cover plate 15. The design and configuration of the base is not critical to the invention. It is, however, essential for adequate table top stability that a movable base be of sufficient area and weight commensurate with the area size of the table top and any contemplated unbalanced loads to be supported by the table top. In those instances where the table is to be permanently installed as, for example, on a boat deck, the bottom plate 11 is fastened to the deck and the cover plate 15 is deleted.

A vertical movable cylindrical hollow inner tube or column 17 depends from a top plate 18. The top plate has a number of apertures for attachment, as by means of screws, to the bottom of a table top 16. The flared bottom end 17a of the movable tube 17 snugly telescopes within the outer tube 10. A significant difference in the outside diameter of the inner tube and the inside diameter of the outer tube throughout the major portion of each tube length is purposely provided in order to effect an annular space between the tubes of a size sufficient to accommodate a supporting cable, as will be described later in an alternate version of an embodiment of the invention. It is, therefore, essential that the bottom portion 17a of the movable tube be accurately flared an amount sufficient to provide a snug fit with the outer tube 16, but not excessively to the point where a frictional force greatly impedes the desired telescopic movement of the movable tube 17 within the outer tube 10.

The upper portion of the inner tube 17b is concentrically positioned within the outer tube 10 by means of a plastic O-ring 20, such as Nylan, Nylatron or the like, retaining a substantially circular recess in the inner wall located near the top end of the outer tube 10. The inwardly tapered upper portion of the outer tube 10a and the O-ring 20 restrict the upward movement of the bottom flared portion 17c of the movable inner tube 17 and prevent separation of the tubular assembly.

A roller stand assembly 21 rises vertically within the space defined by the outer tube 10 and the inner tube 17 from the bottom cap 13 and is attached thereto by screws 22. The roller stand assembly is constructed of flat stock shaped in a U-form to effect two rigid upright members rising from a base section secured to the bottom cap 13. A spring 23 is mounted near the top and between the two upright members of the roller stand 21. The spring 23 is a coil metal band which resists uncoiling with a force that does not increase with linear displacement. The outer end of the spring 23a has an aperture 23b therein to facilitate attachment to the lower end of the inner tube 17b by means of a spring clip 46. The coiled portion of the spring 23 is carried about a drum or roller 24. The drum is secured to the roller stand members 21 by a cylindrical pin or spindle 25 about which the drum is free to rotate. The spindle 25, about which the drum is journaled, extends through apertures in the roller stand members and is retained therein by means of Nylan bearings 26.

In operation, the spring 23 is urged toward a normally coiled configuration. As the weight of the table top, assisted by a slight external force necessary to overcome the stabilizing effect of the frictional forces in the mechanism, moves the inner movable tubular column downward to telescope within the stationary column, the coiled portion of the tape-like spring unwinds to form a straight metal strip of increasing length. It is the incremental transconfiguration of the spring from a coiled to a straight attitude which produces the substantially constant biasing force and consequently affords a substantially constant upward force to the inner tube 17 at any position of spring extension.

The substantially constant upward biasing force of the spring 23 is selected to be sufficient to just counterbalance the weight of the table top 16 and its depending tubular members 17. In operation, the table top 16 may be easily positioned at any of an infinite number of elevations within the vertical movement limitation of the inner tube by a small external force necessary to overcome the frictional drag inherent in the system. Therefore, once the table top is located at the desired level, as by a slight hand pressure, it will remain in the selected position in a balanced state even though the cam-locking mechanism is in an unlocked position. In those instances where the weight of table supported contemplated loads are known and are considerable, such as a typewriter, the spring assembly size can be selected to provide an approximately matching biasing force to accommodate the weight of the table top plus the contemplated load and thus facilitate the table top elevation adjustment level with a minimum of manual effort and insure a balanced state in any height level position.

A cam 27 is retained in position at the lower end of the inner tube 17a by two flexibly connective cam control rods 28 extending upwardly within the inner tube 17 to a point beneath the top plate 18. The cam 27 is constructed of a flat metal circular plate with a peripheral edge contoured downwardly and outwardly and tapered to form a snug fit with the inner walls of the flared bottom portion of the inner tube 17 and the inner wall of the outer tube 10. In operation, an upward displacement of the cam in relation to the bottom edge of the flared section of the inner tube 17 forces the flared wall of the inner tube in close contact with the wall of the outer tube. The compressive action provided by the upward motion of the wedge-like configuration of the cam throughout its entire circumference effects strong frictional forces between the contacting surfaces of the two tubes to form a substantially positive lock which prevents any movement of the tubes relative to each other.
As shown in FIG. 2, the cam control rods 28 slidably pass through apertures in a circular wear plate 29 which rests on and is firmly supported by four emplacements 30 in the wall of the inner tube 17 near its top end. The cam control rods 28 also slidably pass through apertures in a shim 31 overlying and resting on the wear plate 29. The cam control rods 28 have circular apertures 32 located near their upper ends. The apertures in the cam control rods are aligned with diametrically opposing slotted apertures 33 in the wall of the inner tube 17 beneath the top plate 18. The wear plate 29 and shim 31 are positioned at the upper end of the inner tube 17 in relation to the circular apertures 32 in the cam control rods 28 to provide a non-cylindrical passageway through the wall of the inner tube 17 and the cam control rods 28.

Again referring to FIG. 1, a non-cylindrical rod 34 is rotatably mounted in the apertures in the wall of the inner tube 17 and the apertures in the cam control rods 28 so as to engage the cam control rods with the firmly supported wear plate 29 and shim 31. The non-cylindrical rod 34 is shaped to conform with the configuration of the passageway formed by the above-mentioned apertures and the positioning of the wear plate and shim. True shim size, an fit in FIG. 4, is the cylindrical rod within the foregoing described aligned aperture and compensates for any undue slack in the cam control rod linkage with the cam 27. The rod 34 is extended a convenient distance horizontally outward from the inner tube 17 and terminates in a right angle bend to conform to a handle 35 for manual rotation of the rod. Thus, the handle forms a simple manual control element for rotation of the non-cylindrical section of the rod 34.

Locking the mechanism is accomplished by rotating the handle 35 from its straight down position, as shown in FIG. 1, through a 90° arc to a position substantially parallel with the horizontal bottom surface of the table top 16. Movement of the handle 35 causes the non-cylindrical rod 34 to rotate and effect a cam lifting action on the cam control rods 28. The upward displacement of the cam control rods 28 lifts the cam 27 which wedges the inner tube 17 tightly against the outer tube 10 to form a rigid columnar structure.

From the aforementioned description, it should be observed that the cam 27 is operated through suitable linkage by a control member which is conveniently located at substantially table top height regardless of the level to which the table top 16 is adjusted.

The aforementioned locking mechanism, when in the locked position, in addition to constraining the telescoped tubular member commonly preventing the tubular member depending from the table top from rotating within the stationary tubular column attached to the base. Since it is desirable that rotation of the table top be constrained when it is being adjusted in height level or remaining at a balanced state with the locking mechanism disengaged, adequate provision has been made to prevent rotation of the inner tube within the outer tube regardless of whether the locking mechanism is engaged or disengaged. This is accomplished by having both of the tubular columns constructed with a section of their respective walls embossed substantially along their entire length. The embossments are designed to be matching and snugly mating and, as shown in FIG. 4, the emboss 36 on the inner wall of the outer stationary tube 10 cooperate with the embosses 37 on the vertical movable inner tube 17 to prevent rotation of the inner tube (and the table top) when the vertical adjustable structure is in the unlocked position.

For satisfactory operation of the mechanism, it is essential that the upward biasing force of the spring 23 substantially match the weight of the table top 16. Therefore, heavier table tops requiring a correspondingly greater spring biasing force can be accommodated by using a multiplicity of springs in a laminar or stage arrangement or in combination of these two arrangements as shown in FIG. 3.

In laminar arrangement 38, the spring tape-like metal strip members are overlaid upon each other to form a single laminated member of two or more individual spring metal strips which are urged to form a closely coiled spring of laminated strip material. When arranged in laminar fashion, the plurality of springs 38 react, as to the strength of their individual biasing forces, in an additive manner.

As also shown in FIG. 3, in stage configuration, the coiled portion of individual springs 23 or spring laminations 38 are independently supported by the roller stand 21. Each of the coiled portions are carried about their respective drum or roller 24 which are secured, one above the other, to the roller stand members by spindles 25 about which the drums are journaled and free to rotate. Each of the spindles extends through apertures in the roller stand members and is retained therein by means of Nylon bearings 26.

When a multiplicity of springs 23 or spring laminations 38 are arranged in two stages, as shown in FIG. 3, the resulting biasing force of the springs is uniformly distributed to the inner tube by arranging the spring assembly such that the springs (or spring laminations) are paired as oppositely wound coils carried on the roller stand 21 and having their respective straight end portions extending downwardly at opposite sides of the roller stand 21 and attached to diametrically opposite sides of the bottom end 17a of the inner tube by means of the spring clips 25. The laminated and stage configuration and the combined laminated and stage configuration of the springs provide a biasing force substantially equal to the sum of the biasing forces of the individual springs.

In practicing this invention, it is preferable to utilize springs with equal biasing forces of approximately ten pounds each. Therefore, a table top requiring a counterbalancing biasing force of 50 pounds can be obtained with as many as five springs laminated and carried on one roller 24 affixed to the roller stand 21. However, better lateral load equalization can be effected by employing two spring stages, one stage having 3 spring laminations and the second spring stage having 2 laminated spring strip members. When a biasing force in excess of that produced by five spring laminations is required to counterbalance the weight of the table top, it is necessary to employ a laminated-stage configuration arrangement. In order to counterbalance an extremely heavy table top or a table top supporting a very heavy load, a suitable number of spring stages in excess of two are mounted on the roller stand and affixed to the bottom end of the inner tube as shown in FIG. 4.

A modified method of mounting the spring 23 is shown in FIG. 5. As shown, the coiled end of the spring is carried about a drum 24. The drum is secured to a vertically movable member depending from the table top from rotating within the stationary tubular column attached to the base. Since it is desirous that rotation of the table top be constrained when it is being adjusted in height level or remaining at a balanced state with the locking mechanism disengaged, adequate provision has been made to prevent rotation of the inner tube within the outer tube regardless of whether the locking mechanism is engaged or disengaged. This is accomplished by having both of the tubular columns constructed with a section of their respective walls embossed substantially along their entire length. The embossments are designed to be matching and snugly mating and, as shown in FIG. 5, the embores 36 on the inner wall of the outer stationary tube 10 cooperate with the embores 37 on the vertical movable inner tube 17 to prevent rotation of the inner tube (and the table top) when the vertical adjustable structure is in the unlocked position.

The linear vertical movement of the bug within and relative to the movable inner tube 17 is guided by the bearings 40 in slidable contact with the two cam control rods 28 located within and at diametrically opposite sides of the inner tube 17, as shown in FIGS. 7 and 8. The bearings 40 cooperate with the tabs 42 constructed on the sides of the bug to assure linear vertical motion. FIG. 9 more clearly illustrates the details of the bug 39 configuration, the manner of mounting the drum 24 on the bug 39 and the mating of the bug tabs 42 with the cam control rods 28. FIG. 10 is a bottom view of the bug 39 showing its positioning in the inner tube with relation to the cam control rods.

As shown in FIGS. 7, 8, and 11, a cable 43 attached to, and depending from, the bottom of the bug 39 passes around a sheave 44 which is rotatably mounted at the bottom of the inner tube 17a and through a slot in the wall of the inner tube and extends upwardly in the space between the inner movable tube 17 and the outer stationary tube 10 and terminates and is affixed to the wall of the outer tube near its top end. FIG. 5 shows the positioning of the bug 39 in relation to the inner
tube 17 and the extension of the cable 43 when the spring 23 is substantially fully coiled around the drum 24 and the movable inner tube 17 is extended to its maximum height in relation to the stationary outer tube 10.

FIG. 7 illustrates the positioning of the bug 39 in relation to the inner tube 17 and the extension of the cable when the spring is substantially fully unwound about the drum 24 and the movable inner tube is completely retracted within the outer stationary tube 10. FIG. 8 shows the position of the bug 39 with the inner tube 17 partially extended from the outer tube.

In operation, when an unbalancing force is applied to lower the table top 16, the inner tube 17, in its downward movement, exerts a downward pulling force on the bug 39 through the fixed length cable 43. The downward force on the bug is counterbalanced by the upward substantially constant biasing force of the substantially zero gradient spring which is urged toward a normally coiled configuration, thus providing controlled uniform motion of the table top and depending inner tube and maintaining the table top in vertical balance in any of an infinite number of selected levels within the extremities of extension of the inner tube.

Where necessary to counterbalance the weight of a heavy table top, a biasing force greater than that obtained from a single spring member is provided by a suitable multiplicity of spring member laminations and, if a still greater biasing force than that which is provided by five laminations of spring members is required, a dual spring assembly arrangement is employed. As shown in FIG. 11, the dual spring assembly arrangement consists of paired springs (or spring laminations) as oppositely wound coils carried on the bug with their respective straight end portions extending upwardly within the inner tube at opposite sides of the bug 39 and attached to diametrically opposite sides of the wear plate 29 by means of the provided notched clips 41 as shown in FIG. 6.

In those instances where an extremely large spring biasing force is required, more than two spring stages are employed and situated on a suitably designed bug 39 as shown in FIG. 12.

In those instances where the vertical adjustable structure is required to support very heavy loads, an alternate locking arrangement may be provided. As shown in FIG. 13, a lock rod 45 vertically extending along and affixed to the inner wall of the outer stationary tube 10 and having a serrated facing, cooperates with matching serrations on the flanged bottom portion of the inner tube 17 to positively, compressively lock the inner tube 17 in place when it is wedged against the locking rod 45 by the cam 27.

Although preferred embodiments of the present invention have been described hereinabove, it will be understood that the scope of the present invention is not to be limited by such embodiments, but rather is to be determined by the following claims.

What is claimed is:
1. A vertically adjustable table comprising in combination;
   a. a base,
   b. a table top,
   c. a fixed hollow cylindrical tube extending upwardly from the base,
   d. a movable cylindrical tube depending from the table top and telescopically assembled within the fixed hollow cylindrical tube, said movable cylindrical tube having a flared bottom portion for slideable movement within the fixed hollow cylindrical tube,
   e. a sheave rotatably mounted within the annular space defined by the flared bottom portion of the movable cylindrical tube,

   6. spring supporting means within the movable cylindrical tube and vertically movable relative to the movable cylindrical tube,

   7. a substantially zero gradient biasing spring means countering the table top, the biasing spring having a coiled portion carried by the spring supporting means and an outer end portion extending upwardly and attached to the upper end of the movable cylindrical tube,

   8. a fixed length cable attached to the spring supporting means and extending downwardly around the sheave through an aperture in the flared bottom portion of the movable cylindrical tube and upwardly through the space between the fixed hollow cylindrical tube and the movable cylindrical tube depending from the table top and terminating and attached to the top end of the fixed hollow cylindrical tube,

   9. a cam located at the lower end of the movable cylindrical tube functioning to wedge the lower end of the movable cylindrical tube against the fixed hollow cylindrical tube extending upwardly from the base and thereby locking them against relative motion,

   10. upright cam control rods engageable at their lower ends with the cam and extending upwardly within the movable cylindrical tube to a point beneath the table top, and

   11. means at the underside of the table top to vertically move the upright cam control rods relative to the movable cylindrical tube to actuate the cam.

2. The invention of claim 1 including means for preventing rotation of the movable cylindrical tube depending from the table top relative to the fixed hollow cylindrical tube extending upwardly from the base.

3. The invention of claim 1 wherein the substantially zero gradient biasing spring means comprises a plurality of strips of metal laminated and having their inner ends formed into a coiled portion including a plurality of convolutions in a substantially common radial plane and having substantially straight outer ends, said substantially zero gradient spring means coiled portion carried by the spring supporting means and the outer plurality of substantially straight ends extending upwardly and attached to the upper end of the movable cylindrical tube.

4. The invention of claim 1 wherein the substantially zero gradient biasing spring means counterbalancing the table top comprises a plurality of biasing springs, each of said biasing springs formed of a strip of metal having an inner end formed into a closely wound helix in a common plane with adjoining convolutions in tight engagement upon one another and a substantially straight outer end, said plurality of biasing springs having wound portions carried by the spring supporting means and the outer plurality of ends extending upwardly and attached to the upper end of the movable cylindrical tube.

5. The invention of claim 1 wherein a plurality of substantially zero gradient spring coiled portions are carried by the spring supporting means within the movable cylindrical tube and the substantially straight outer ends extend upwardly and are attached to the upper end of the movable cylindrical tubes.

The invention of claim 1 including embossment means for preventing rotation of the cylindrical tube depending from the table top relative to the fixed, hollow, cylindrical tube extending upwardly from the base.

7. The invention of claim 1 wherein the cam located at the lower end of the movable cylindrical tube functions to wedge the lower end of the movable cylindrical tube against a serrated facing locking rod extending vertically along and fixed to the inner wall of the fixed hollow cylindrical tube.