ABSTRACT

An adjustable height support for chairs, stools or like structures embodies first and second telescoping linearly movable assemblies or units. A gravity responsive wedge locking mechanism on one of said units is rendered inactive or released relative to the other unit by a mere lifting of the one unit carrying the locking device. Releasing of the one unit and allowing the same to drop freely serves to activate the locking device substantially instantaneously. An infinite range of height adjustment is available without the necessity for manual levers, handles or the like.

10 Claims, 5 Drawing Figures
QUICK ADJUSTABLE HEIGHT SUPPORT
CROSS REFERENCE TO RELATED APPLICATIONS

This application contains subject matter in common with copending application Ser. No. 239,035, filed Mar. 29, 1972, for ADJUSTABLE HEIGHT SUPPORT, Gordon R. Snurr, inventor.

The object of this invention is to provide a simplified, reliable and safe height adjustment mechanism particularly adapted for use on stools and chairs but also useful on table pedestals or legs, tilting drafting boards and other similar structures. More particularly, it is desired to provide an adjustable height support of the class described which is quickly operable without the use of release handles, levers or screw devices and does not necessitate moving the support to the extreme up or down position in order to activate some assisting mechanism or device, as is quite common in the prior art. According to the invention, the user of a stool or the like equipped with the height adjusting means may adjust the stool to any desired height position and securely and safely lock the stool in such position by a simple lifting and release operation on a linearly movable component of the structure and without resorting to any outside mechanical devices.

The invention embodies a very simplified locking mechanism which has few parts and is practical to manufacture, thus rendering the structure economical. The safety and reliability of the mechanism allows it to comply with all recent State and Federal industrial safety regulations.

While the invention is applicable to a variety of height adjustable structures, it is thought to be particularly suitable for dentists' and technicians' stools, which must be frequently adjusted by the user without distraction from the primary endeavor of the user.

Various additional features and advantages of the invention will become apparent during the course of the following detailed description.

BRIEF DESCRIPTION OF DRAWING FIGURES

FIG. 1 is a central vertical section through an adjustable height stool embodying the invention showing the locking mechanism in an active locking position.

FIG. 1A is an enlarged fragmentary vertical section through a ball wedge locking mechanism of the support, the mechanism being shown active or locked.

FIG. 2 is a similar view showing the mechanism in the inactive or release position, permitting adjustment of the stool to a desired height.

FIG. 3 is a horizontal section taken on line 3—3 of FIG. 1A.

FIG. 4 is a similar section taken on line 4—4 of FIG. 1A.

DETAILED DESCRIPTION

Referring to the drawings in detail wherein like numerals designate like parts, the numerals 10 and 11 designate relatively movable telescoping assemblies or units, the unit 10 constituting a supporting base unit and the second unit 11 being raised or lowered relative to the unit 10 when effecting the desired height adjustments of the stool. It will be shown that the desired height adjustment can be made by the operator merely relieving the gravity responsive wedge locking means of the weight of the unit 11, followed by the desired raising or lowering of this unit and then releasing the unit so that it drops freely and quickly to automatically engage the locking mechanism. The resulting locking action, after height adjustment, is substantially instantaneous.

Continuing to refer to the drawings, the base unit 10 comprises an upright cylindrical tube 12 having a sturdy disc 13 securely welded in its lower end. Any form of stable base or leg means 14 is rigidly secured to the lower end portion of the tube 12 to support the same vertically. A central vertical cylindrical post or shaft 15 has its lower end welded in an opening of the disc 13 and extends axially and concentrically through the tube 12 and extends above the top end thereof. The top end of the shaft 15 carries a preferably plastic cylindrical head 16, rigid therewith, serving as a guide bearing for the relatively movable unit 11 and also forming an upper and lower limit stop for the movement of the unit 11. It may be seen that the parts thus far described constitute a unit assembly with the individual parts of the assembly in fixed relation to one another.

Instead of the fixed welded joint between the shaft 15 and disc 13, the shaft may be rendered separable from the disc by threading the same into the disc and applying a lock nut to the shaft below the threaded disc. When this is done, the lower end of the tube 12 can also be removably socketed into the base 14 and held therein by the action of the lock nut.

The relatively movable unit or assembly 11 comprises a cylindrical vertical tube 17 of somewhat smaller diameter than the tube 12 and interfitting telescopically therewith. The bore of the tube 17 receives the head or bearing element 16 slidably and a preferably plastic sleeve bearing 18 in the upper end of the tube 12 engages the periphery of the tube 17 to further support and guide the same. Therefore, the relatively movable tube 17 is supported at two axially spaced points for stability and to assure free and unbinding movement of the tube 17 when height adjustments are being made.

The top of the unit 11 carries a suitable stool seat 19 and a conventional low friction bearing 20 is preferably interposed between this seat and the top of the tube 17 to assure free rotation of the stool seat. A sturdy stop ring 21 is welded in the bore of the tube 17 at a predetermined level above its lower end and this ring serves as a limit stop on the upward movement of the unit 11 by contacting the head or bearing element 16. The lower limit of movement of the unit 11 is determined by contact of the element 16 with the bottom of the seat or bearing 20.

The unit 11 further comprises at its lower end a ball wedge locking device or mechanism designated in its entirety by the reference numeral 22. This locking mechanism comprises a bell-like wedge locking body or sleeve divided diametrically into two spaced identical halves or sections 23 mounted in surrounding relationship to the vertical shaft 15. The two sections 23 of the wedge locking body are cylindrically formed externally from their top ends downwardly for most of their lengths so as to fit inside of the bore of tube 17 with some free clearance, as indicated at 24. Near their lower ends, the two locking body sections 23 are externally upwardly conically tapered at 25, and below these tapered portions the sections 23 have short enlarged diameter lower end cylindrical faces 26 approximating the outside diameter of the tube 17. The lower end of
the tube 17 is internally beveled conically at 27 to match the taper of the portions 25 in order to provide a smooth cam-like action during the locking operation.

The elements 23 define an internal cylindrical bore 28 in the upper end portion of the divided locking body and a lower end bore 29 of the same diameter is formed in the lower ends of the elements 23. These bores 28 and 29 surround the shaft 15 loosely in assembly, as shown. Between the bores 28 and 29, the interior faces of the elements 23 are conically tapered upwardly on a steep angle as shown at 30 and this taper extends for a major portion of the lengths of locking body sections 23. Horizontal annular shoulder portions 31 are provided on the elements 23 at their bottoms and below the tapered bore portions 30. These shoulder portions together constitute an annular horizontal supporting ledge for a circular array of wedge locking balls 32 which surround the central shaft 15 and form the primary rigid locking means for the upper unit 11 when the mechanism 22 is activated, as will be described. The locking balls 32 thus occupy the wedge chamber formed between the cylindrical shaft 15 and the conically tapered faces 30 and the balls cannot escape from this chamber and therefore require no separate retaining means. Even when the balls are wedge locked against the shaft 15, they preferably are not in tangential contact with one another but are slightly spaced, FIG. 4, so that relative rotation can occur between the two units 10 and 11. However, as previously stated, to insure easy rotation, the upper seat bearing 20 has been provided.

The two wedge locking body sections 23 are freely suspended on a pair of cross pins 33 which extend through generally tangential through openings 34 in the elements 23 and have their ends projecting into vertically elongated slots 35 provided in the tube 17 near and above the lower end of this tube, FIG. 3. The suspension pins 33 have a loose fit in the slots 35 so that there will be no rubbing of parts. It may be seen that the wedge locking body sections 23 are floatingly supported in the tube 17 in the described manner.

The mode of operation of the adjustable height support or stool is as follows:

Assuming the stool to be initially locked at a given height as indicated in FIGS. 1 and 1A, the weight of the unit 11 including the seat 19 and any load thereon is transmitted axially through the tube 17 to the tapered faces 25 and the lower ends of the free-floating wedge locking sections 23 are cammed inwardly to force the steel balls 32 into wedge locking engagement with the steel shaft 15. The greater the weight borne by the seat 19 the firmer this wedge locking action becomes as the balls 32 attempt to roll upwardly in the tapered chamber between the shaft 15 and conical surfaces 30.

In order to release the locking mechanism 22 for quick adjustment of the structure to any desired height, the user needs only to grasp the seat 19 and support the same in his hands, thus relieving the locking mechanism of the weight of the upper unit 11. As soon as this is done by a slight lifting of the seat 19, the elements 23 and their support pins 33 drop by gravity to the bottoms of the slots 35, FIG. 2, and the tapered faces 25 separate from the beveled face 27 at the bottom of tube 17. This relieves the balls 32 from wedging contact with the shaft 15 and the entire upper unit 11 can now be raised or lowered to any selected height position by an easy linear movement manually. When the selected height is attained, the user merely releases the unit 11 quickly so that the same may drop by gravity. When this is done, the wedge locking mechanism will again be activated substantially instantly and will return to the positive locking condition shown in FIG. 1A where the stool or other support is firmly and safely locked at the selected height.

When the unit 11 is dropped or quickly released following height adjustment, the massive tube 17 carrying the seat will tend to descend much more quickly than the relatively light locking elements 23 and will over-ride these elements, immediately re-establishing the camming engagement between the surfaces 27 and 25 and forcing the elements 23 inwardly against the balls 32 to wedge lock the same. In the instant during which this automatic locking action is occurring, the elements 23 and their support pins 33 will rise relative to the slots 35 and will assume intermediate positions in these slots, such as indicated in FIG. 1A, when the locking is completed. The extreme simplicity of construction and mode of operation should now be apparent without further description.

The terms and expressions which have been employed herein are used as terms of description and not of limitation, and there is no intention, in the use of such terms and expressions, of excluding any equivalents of the features shown and described or portions thereof but it is recognized that various modifications are possible within the scope of the invention claimed.

I claim:

1. An adjustable height support comprising a base unit including a central upstanding shaft, an upper relatively movable unit having telescopic engagement with the base unit and adapted to be raised and lowered relatively thereto, and a gravity responsive wedge locking means on said upper unit and movable with the upper unit and having a lost motion connection with the upper unit allowing limited relative movement between the wedge locking means and the main body of the upper unit when the upper unit is allowed to fall freely relatively to the base unit after being unlocked therefrom, said limited relative movement caused by said free falling of the upper unit being effective to activate the wedge locking means substantially instantly.

2. The structure of claim 1, and said wedge locking means on said upper unit comprising at least a pair of wedge locking bodies loosely pivotally secured to the upper unit in surrounding relationship to said shaft, and engaging wedge locking elements interposed between said wedge locking bodies and said shaft, and interengaging cam parts on said wedge locking bodies and upper unit activated by said relative movement caused by said free falling of the upper unit, said cam parts forcing said wedge locking bodies into wedge engagement with said locking elements and forcing them against said shaft.

3. The structure of claim 2, and said upper unit including a vertically shiftable tube body engaged telescopically over said upstanding shaft concentrically therewith, said wedge locking bodies arranged in the interior of the tube body and between the tube body and shaft, said lost motion connection being formed between the tube body and wedge locking bodies, and said cam parts comprising interengageable beveled faces on the lower end of the tube body and on the exteriors of said wedge locking bodies.
4. The structure of claim 3, and said lost motion connection comprising horizontal suspension pins carried by the wedge locking bodies on opposite sides of said shaft, said tube body having vertically elongated slots adjacent the wedge locking bodies loosely receiving end portions of the suspension pins, whereby the wedge locking bodies may freely pivot on the tube body and may shift axially of the tube body and shaft within the limits of said slots.

5. The structure of claim 4, and said locking bodies having interior steep upwardly tapering conical faces defining an upwardly tapering wedge chamber between said shaft and locking bodies, and said coacting wedge locking element comprising balls disposed in said chamber between said shaft and wedge locking bodies.

6. The structure of claim 5, and a substantially annular horizontal support ledge on the lower ends of said wedge locking bodies at the bottom of said wedge chamber and supporting said balls and preventing the escape of said balls from said chamber, said balls disposed freely in an annular array on said support ledge.

7. The structure of claim 6, and a bearing head on said shaft near the top thereof engaging slidably within the bore of said tube body of the upper relatively movable unit, and a rigid stop element anchored in the bore of said tube body engageable with the bottom of said bearing head to limit upward movement of said upper unit relative to the base unit.

8. The structure of claim 7, and said base unit including an upstanding tube surrounding and enclosing the tube body of the upper unit and said wedge locking means and having a bearing part slidably engaging and guiding the exterior of said tube body and being axially spaced from said bearing head on said shaft.

9. The structure of claim 6, and said wedge locking bodies comprising a pair of diametrically opposed generally cylindrical bodies substantially surrounding said shaft.

10. The structure of claim 1, and a rotary seat on the top of said upper relatively movable unit.