

Aug. 31, 1965

W. A. FARRIS

3,203,670

DOUBLE LINKAGE SUPPORTED TABLE

Original Filed March 20, 1960

2 Sheets-Sheet 1

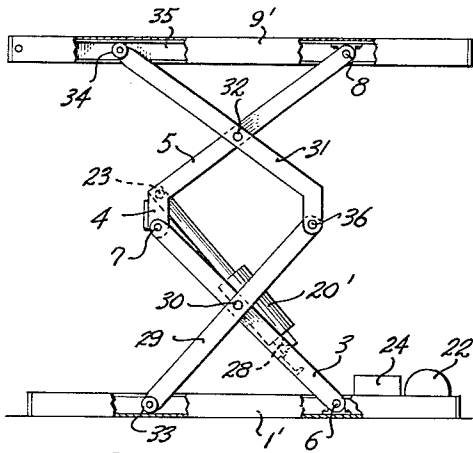


Fig. 1.

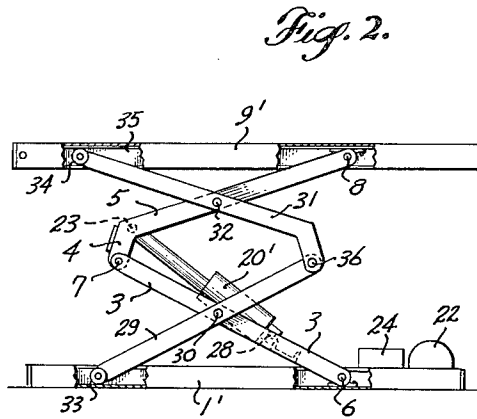


Fig. 2.

Fig. 3.

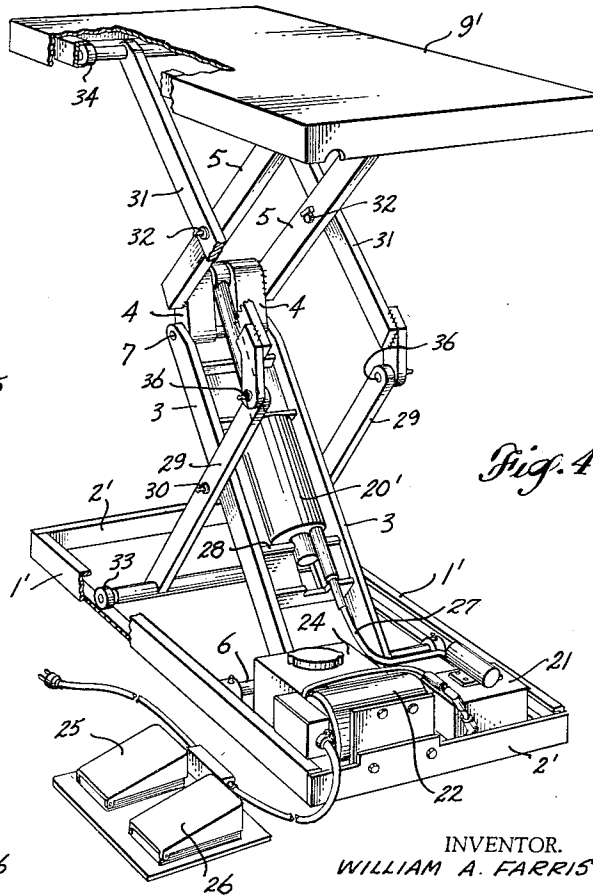
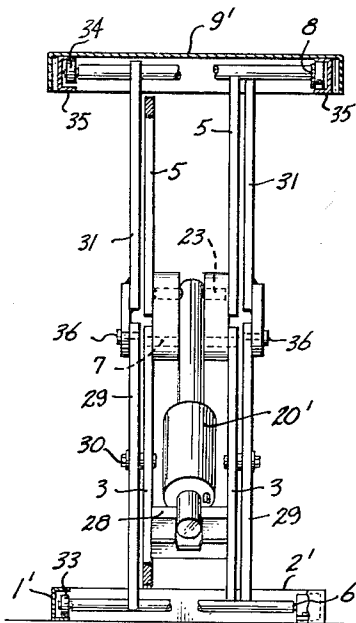


Fig. 4.

INVENTOR.
WILLIAM A. FARRIS

BY
Robert W. Beach

ATTORNEY

Aug. 31, 1965

W. A. FARRIS

3,203,670

DOUBLE LINKAGE SUPPORTED TABLE

Original Filed March 20, 1960

2 Sheets-Sheet 2

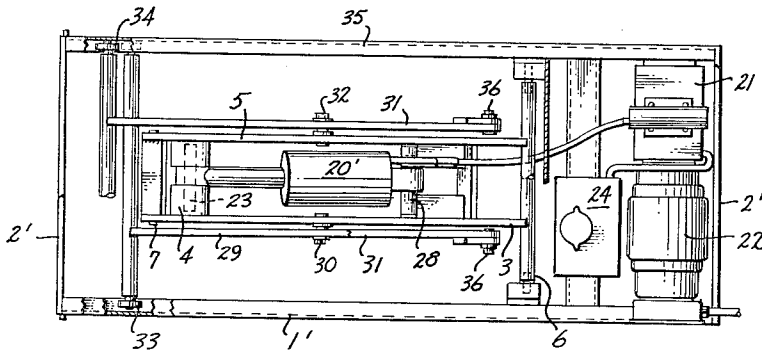


Fig. 6.

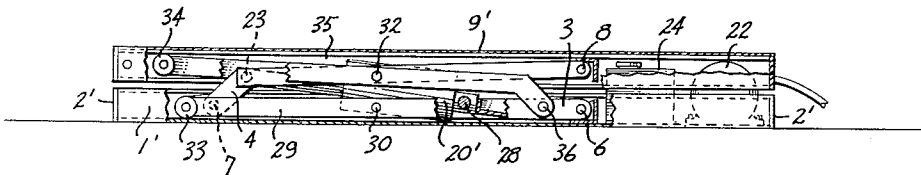


Fig. 5.

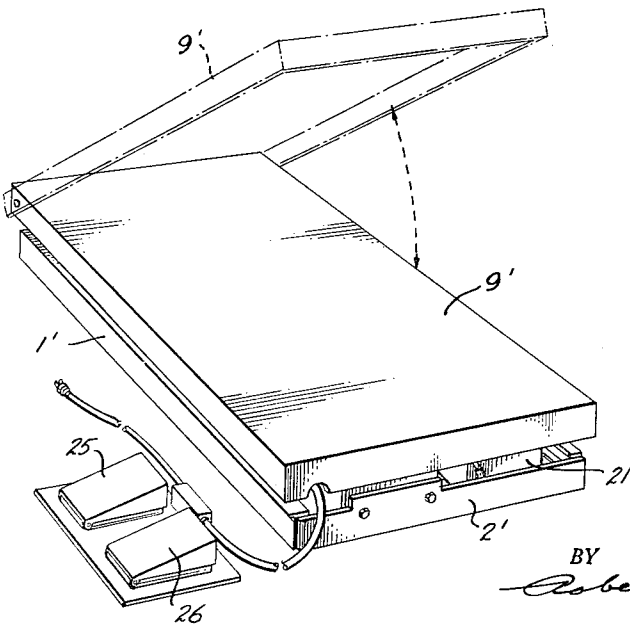


Fig. 7.

INVENTOR.
WILLIAM A. FARRIS

BY
Robert W. Beach

ATTORNEY

1

3,203,670

DOUBLE LINKAGE SUPPORTED TABLE

William A. Farris, deceased, late of Kirkland, Wash., by
Twyla D. Farris, executrix, assignor to American Manu-
facturing Company, Inc., Tacoma, Wash., a corporation
of Washington

Original application, Mar. 20, 1960, Ser. No. 16,711, now
Patent No. 3,110,476. Divided and this application
Apr. 1, 1963, Ser. No. 269,686

5 Claims. (Cl. 254-122)

This invention relates to a table adjustable in height for the purpose of supporting at different heights loads of material to be handled in manufacturing processes such as for feeding to a machine or received from a machine. This application is a division of the prior application Serial No. 16,711 filed March 20, 1960, for a Thurst Linkage Supported Table, now Patent 3,110,476.

The principal object of the present invention is to provide a table variable in height through a wide range from a very low position to quite a high position such as several feet in height. Such variation in height can be effected in small increments, yet a substantial adjustment in height can be accomplished quickly. Another feature is to provide mechanism which will lock automatically to hold the table at a particular elevation without the necessity of performing a special latching or holding operation.

To enable the table to be lowered to a low, collapsed elevation it is necessary to provide compact actuating mechanism, yet it is an object to utilize such mechanism which will support a substantial load. Moreover, such mechanism must be capable of supporting such a load with the table in any elevationally adjusted position.

A further object is to utilize mechanism which will be of simple and comparatively inexpensive construction, although being rugged and requiring a minimum of repair and upkeep.

The foregoing objects can be accomplished by utilizing the combination of dog-leg thrust linkage movable between a folded position with the links substantially parallel when the table is in its lower collapsed position and an extended position with the links disposed at an angle to each other when the table is raised to its uppermost position. Such thrust linkage and stabilizing linkage can be interengaged between a base and the table top combined so that certain links are common to both linkages.

FIGURE 1 is a side elevation of a table incorporating the linkage of the present invention shown in a raised position, parts being broken away.

FIGURE 2 is a side elevation of the table in a lower position, parts again being broken away.

FIGURE 3 is an end elevation of the table in raised position, having parts broken away.

FIGURE 4 is a top perspective of the table, again shown in raised position and having parts broken away.

FIGURE 5 is a side elevation of the table in its lowermost collapsed position, with parts broken away.

FIGURE 6 is a plan of the table, with the top and other parts broken away.

FIGURE 7 is a top perspective of the table shown in its lowermost collapsed position.

Tables adjustable to height have been used for various industrial purposes but it has been difficult to provide simple and economical mechanism for varying the height of such tables which would enable the table to be lowered sufficiently and alternatively enable the table to be raised to a sufficient height for most uses. The structure of the present table satisfies these requirements by employing thrust linkage which will support the table and a load on it and which can be moved to alter the elevation of the table. Stabilizing linkage is provided to maintain the desired attitude of the table, preferably in a horizontal

2

position parallel to the base, in all positions of adjustment. The stabilizing linkage also will control edgewise movement or prevent such movement as the table top is raised and lowered.

In FIGURES 1 to 4, inclusive, the table base is composed of a frame including opposite channels 1', the corresponding ends of which are connected by end bars 2' which may be secured together in any suitable fashion, such as by welding. To the side channels is connected the dog-leg thrust linkage including a supporting link 3 and a bent supported link including a short leg 4 adjacent to the link 3 and a long leg 5. The lower end of the supporting link includes a pivoted bar 6 having its opposite ends journaled in the channel sides 1' of the base frame at a location nearer to the right end of the frame, as shown in FIGURES 1 and 2. The short leg 4 of the upper supported link fits between spaced elements forming the adjacent end of the link 3 and these link ends are pivotally connected together by the pivot rod 7. The end of the supported link leg 5 remote from the supporting link 3 is connected by pivot 8 to the table top 9' at a location nearer the right end of the table top than the left end, as shown in FIGURES 1 and 2, and located directly above the pivot 6.

The links of the dog-leg thrust linkage preferably are in the form of leaf frames as shown in FIGURE 4 so that the linkage cannot twist readily. The thrust linkage itself therefore acts to resist rotation of the table top 9' relative to the base 1', 2' about a vertical axis, but such thrust linkage would not prevent the table top from rocking about the axis of pivot 8 or the linkage from rocking about the axis of the pivoted member 6. Also, such leaf type thrust linkage would not prevent the table top from moving edgewise by conjoint swinging of the linkage relative to the base about the axis of pivot member 6 and relative to the table top about the axis of pivot members 8 even though the two leaves of the thrust linkage maintain a constant angular relationship relative to each other. Stabilizing linkage is provided to prevent such tilting and edgewise shifting of the table top relative to the base.

The stabilizing linkage is integrated with the thrust linkage so that the links of the thrust linkage serve also as links of the stabilizing linkage. Thus the lower link 3 of the thrust linkage cooperates with a link 29 of equal length in each instance and these links are connected by pivots 30 to form a lower cross. Similarly, the upper link 4, 5 of the thrust linkage cooperates with the upper stabilizing link 31 which is of the same length as the link 4, 5 and is bent correspondingly but with its short end bent downward from the longer inclined leg of that link. The link 4, 5 and the link 31 at each side of the table are interconnected by pivots 32 to form an upper cross. The lower ends of links 29 carry rollers 33 received in the side channels 1' of the base and the upper ends of stabilizing links 31 carry rollers 34 received in the side channels 35 of the table top. It is, of course, immaterial whether the rollers are on the ends of the links 29 and 31 or on the ends of links 3 and 4, 5.

Upward swinging the thrust link 3 relative to the base members 1' from the collapsed position shown in FIGURE 5 through the intermediate position of FIGURE 2 to the extended position of FIGURE 1 will cause the stabilizing links 29 to swing upward correspondingly because of the confinement of rollers 33 in the channels 1' and the link connections effected by the pivots 30. Such upward swinging of the links 3, 29 will move the upper ends of these links toward each other as illustrated by a comparison of FIGURES 2 and 1. Such approach movement of the upper ends of these links will cause the lower end of link 31 to be drawn toward pivots 7 because of the

3

pivots 36 interconnecting the upper ends of links 29 and the lower ends of links 31. Since links 31 also are connected to the upper legs 5 of the thrust linkage by pivots 32, the links 31 will be swung upward relative to links 29 in the same manner that link 4, 5 is swung upward relative to link 3. Consequently, a line joining each of the pivots 8 and the axis of the roller 34 on the same side of the table will be maintained parallel to a line joining the lower pivot 6 and the axis of the roller 33 at the same side of the table. In this manner the top 9' will be maintained horizontal parallel to the table base frame.

The elevation of the table 9' can be adjusted and controlled by manipulation of foot controls 25 and 26 operating motor 22, pump 21 and the valve control mechanism. The top 9' merely rests on the upper channels 35 and it can be lifted into the broken line position shown in FIGURE 7 to provide access to the linkage mechanism, the actuator and the pressure fluid supply and control mechanism. The actuator 20' is shown as being of a fluid pressure piston and cylinder jack type. The pump 21 and motor 22 connected to the actuator constitute a self-contained pressure fluid supply. By utilizing a positive displacement pump such as a gear pump or a vane pump and liquid which is substantially incompressible, the actuator 20' can be employed both to effect relative swinging movement of the thrust links and to block such linkage against contracting or folding movement under the influence of the load on the table top 9'.

In order to be effective for raising or holding at a desired height a loaded table top, it is necessary for the actuator 20' to have a reasonably good leverage on the thrust linkage particularly when the thrust linkage is near closed position. As shown in FIGURE 5, a substantial lever arm through which the force of the actuator 20' is applied is afforded by the short leg 4 of the upper link. The most effective leverage is obtained by pivoting the upper end of the actuator to the upper link approximately at the location of the bend in the upper link by a pivot 23. The actuator 20' is shown as having its lower end mounted on a pivot 28 on the lower link 3 of the thrust linkage at a location spaced a considerable distance from the pivot 6 of the link. The length of the lever arm through which the force applied by the actuator 20' acts is always the perpendicular distance from pivot 7 to a line joining the pivots 23 and 28 at opposite ends of the actuator 20'. The effective link-swinging moment of the actuator 20' therefore varies with the angle between the line of thrust of the actuator and a line joining the axes of the pivots 6 and 7 of link 3. The actuator thrust is most effective to swing link 5 when such angle is greatest because the lever arm is then longest.

For a given angular relative movement of the links of the thrust linkage, the elevational movement of the table top 9' is greatest when the table top is in its lowermost position. In progressively higher positions, the elevational movement of the table top is less for a given angular movement of the thrust links. Consequently, it is desirable that the lever arm through which the actuator acts in swinging the linkage be reasonably large when the table top is in its lowermost position of FIGURE 5. The lever arm need not be as great when the links are relatively unfolded as shown in FIGURES 1 and 4. Also, it is desirable to have the line of force of the actuator as nearly parallel as possible to the line joining the pivots of link 3 consistent with compactness of the mechanism when the linkage is in its folded position.

The longer the short leg 4 of the upper link is made and the more nearly its angle with the longer leg 5 approaches a right angle, the greater will be the length of the lever arm on which the actuator 20' acts when the table is in its collapsed position if the link 3 and leg 5 are disposed substantially parallel in such condition of the table and the actuator is connected to a pivot 23 at the location of the bend. On the other hand, the shorter such leg 4 is made, the more compactly the thrust linkage can be

4

folded so long as such leg 4 is long enough to enable the longer leg 5 to be folded in substantially parallel relationship with the link 3. As fluid under pressure is pumped by the pump 21 and motor 22 into the actuator, it will be extended from the position shown in FIGURE 5 toward the position of FIGURE 2 to move the thrust links toward unfolded relationship. As shown by a comparison of FIGURES 2 and 5, it will be seen that the actuator 20' swings with the linkage and substantially through the same angle relative to the base that the supporting link 3 swings as the linkage unfolds.

During the movement of the thrust linkage from the position of FIGURE 5 to the position of FIGURE 2, the lever arm through which the actuator 20' acts increases somewhat in length until the short leg 4 is perpendicular to a line joining the pivots 6 and 7 and as the thrust linkage unfolds farther toward the position of FIGURE 1, the length of the lever arm on which the actuator acts decreases in length. If the thrust linkage were unfolded beyond the position shown in FIGURE 1, the lever arm on which the force of the actuator 20' would act would decrease to an undesirable small length because of the angle of bend between the short leg 4 and the long leg 5 of the upper link. It is not desirable for these legs to be disposed at any smaller angle, although the length of the lever arm would be greater when the thrust linkage is in the fully collapsed position shown in FIGURE 5, because the lever arm would be undesirably short when the linkage is in the extended position of FIGURE 1. An important advantage of the thrust linkage utilized to raise the table top 9' is that the spacing between the base and the table top is determined by the relative movement of the remote ends of the two links as they swing between folded and unfolded positions. Comparatively little separation of the link ends would occur by opening the linkage farther from the position shown in FIGURE 1 to a position in which the links are aligned in coplanar relationship. By use of this mechanism, therefore, a comparatively great movement of the adjustable table top 9' can be effected by compact mechanism.

By providing a reservoir 24 for hydraulic liquid connected to the pump 21 and an elevating control 25 and lowering control 26 which conveniently may be of the foot pedal operated type as shown in FIGURES 1 and 4, the motor, pump and suitable control valves can be actuated to supply liquid under pressure to the actuator 20' for extending it to unfold the linkage 3, 4, 5 and raise the table top or to discharge liquid from the actuator to the reservoir for contraction of the actuator and lowering of the table top. If both control pedals 25 and 26 are released communication from the pump and reservoir to the line 27 connected to the actuator 20' will be cut off so that the amount of liquid in the actuator will be maintained constant. The actuator will, therefore, retain the thrust linkage in a constant position and thus maintain the table top 9' substantially stationary, irrespective of any variation in load on the table top.

What is claimed is:

1. A table adjustable in height comprising a base, a table top, thrust linkage interengaged between said base and said table top and including an upper link, a lower link, pivot means interconnecting said upper link and said lower link and elongated thrust actuator means variable in effective length, reacting between thrust points on said links to effect relative swinging thereof between a folded position supporting said table top in a lowered position and an unfolded position supporting said table top in a raised position, and said elongated thrust actuator means being disposed wholly between said thrust points at all times, stabilizing linkage including an upper link of a length substantially equal to the length of said thrust linkage upper link, disposed in a position crossing said thrust linkage upper link and having its upper por-

5

tion engaged with said table top, a lower link of a length substantially equal to the length of said thrust linkage lower link, disposed in a position crossing said thrust linkage lower link and having its lower portion engaged with said base and pivot means connecting the lower portion of said stabilizing linkage upper link and the upper portion of said stabilizing linkage lower link, pivot means connecting the crossing portions of said thrust linkage upper link and said stabilizing linkage upper link, and pivot means connecting the crossing portions of said thrust linkage lower link and said stabilizing linkage lower link, the links of said stabilizing linkage being swingable relatively by relative swinging of said thrust linkage links and operable to restrain tilting of said table top relative to said base.

2. The table defined in claim 1, in which the actuator means is a fluid pressure jack.

3. The table defined in claim 2, and pivot means connecting the opposite ends of the fluid pressure jack to the upper and lower links, respectively, of the thrust linkage.

4. The table defined in claim 2, lower pivot means connecting the lower portion of the thrust linkage lower link and the base, and fluid supply means connected to the fluid pressure jack and mounted on the base at the side of said lower pivot means remote from the engagement of the stabilizing linkage lower link with the base.

5. A table adjustable in height comprising a base, a table top, thrust linkage interengaged between said base and said table top and including an upper link, a lower link, pivot means interconnecting said upper link and said lower link and elongated thrust actuator means variable in effective length reacting between thrust points on said links to effect relative swinging thereof between a folded position supporting said table top in a lowered position and an unfolded position supporting said table top in a raised position, and said elongated thrust actuator means being disposed wholly between said thrust

6

points at all times, stabilizing linkage including an upper link of a length substantially equal to the length of said thrust linkage upper link, disposed in a position crossing said thrust linkage upper link and having its upper portion engaged with said table top, a lower link of a length substantially equal to the length of said thrust linkage lower link, disposed in a position crossing said thrust linkage lower link and having its lower portion engaged with said base and pivot means connecting the lower portion of said stabilizing linkage upper link and the upper portion of said stabilizing linkage lower link, pivot means connecting the crossing portions of said thrust linkage lower link and said stabilizing linkage lower link, the links of said stabilizing linkage being swingable relatively by relative swinging of said thrust linkage links and operable to restrain tilting of said table top relative to said base, upper pivot means securing one of said upper links to the table top, lower pivot means substantially directly beneath said upper pivot means and connecting one of said lower links to the base, upper movable means interengaged between the other upper link and said table top and guiding such other upper link for movement along said table top as the links of said linkages are swung relatively, and lower movable means interengaged between the other lower link and said base and guiding such other lower link for movement along said base as the links of said linkages are swung relatively.

References Cited by the Examiner

UNITED STATES PATENTS

2,373,848	4/45	Owens	254—113
2,698,199	12/54	Godbersen	298—22
2,829,863	4/58	Gibson	254—8.6
2,928,558	3/60	Bamford et al.	254—8.6
3,110,476	11/63	Farris	254—122

FRANK B. SHERRY, *Primary Examiner.*

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,203,670

August 31, 1965

William A. Farris, deceased, by
Twyla D. Farris, executrix

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 6, line 12, after "link," insert -- pivot means connecting the crossing portions of said thrust linkage upper link and said stabilizing linkage upper link, --.

Signed and sealed this 29th day of March 1966.

(SEAL)

Attest:

ERNEST W. SWIDER

Attesting Officer

EDWARD J. BRENNER

Commissioner of Patents