FLUID OPERATED BATHTUB LIFT

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Filed: Jan. 11, 1974
Appl. No.: 432,433

Related U.S. Application Data
Continuation of Ser. No. 167,716, July 30, 1971, abandoned.

U.S. Cl.
Int. Cl.
Field of Search

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ABSTRACT
A bathtub lift system comprises a fluid operated lift composed of three, coaxially mounted tubular members. A main tube is fixed in position on a base and carries within it a sleeve-like thrust tube which carries a piston assembly at its lower end. A tie rod secures the thrust tube to the piston and the outer carrier tube rests on the upper end of thrust tube on a low friction bearing. A chair or the like, is rotatably mounted on the carrier tube. The thrust tube and carrier tube move together axially relative to the main tube under the influence of fluid pressure applied to the piston through the base, to move the chair into or out of a tub or the like. The carrier tube is rotatable through 360° to swing the chair over or exterior to the tub, without transmission of torque to the piston assembly. The chair is secured to the carrier tube by means of a fixed hook member on the carrier tube engaging a horizontal bar on the chair. The chair is prevented from being inadvertently dislodged by a positively locked latching hook which overlaps the engagement of the bar with the fixed hook. The latching hook must be lifted to free the chair from the two hooks.

8 Claims, 7 Drawing Figures
FLUID OPERATED BATHTUB LIFT

This is a continuation of application Ser. No. 167,716 filed July 30, 1971 for "Fluid Operated Bathtub Lift" now abandoned.

BACKGROUND OF THE INVENTION

To the infirm or elderly bathing can be a serious problem since it is often very difficult or impossible for these people to lift themselves into or out of a tub. Even with help the problem exists since manually lifting an adult into or out of a tub is a difficult procedure and the risk of injury to either party is great. Accordingly, mechanical lifting devices have been developed to aid in this operation. These prior art devices, however, have suffered from various shortcomings.

Some of the prior devices have been unduly complicated and cumbersome. This adds to their expense and the likelihood of breakdown, and may limit their use to institutions, whereas many infirm or elderly have need for such lifting devices in their homes. Other prior devices have been unsightly and are difficult to maintain in a sanitary condition due to their construction and submersion, while still others as a result of their non-rigid construction have subjected their users to unnecessary (albeit unfounded) fears of falling or collapse. As will be understood these fears are often magnified out of proportion in those already infirm or at an advanced age.

One real danger, however, occurs with the use of a removable chair on the bath lift. The chair should be well supported and firmly held in use, but be easily removable when desired. It is particularly dangerous when the person in the chair inadvertently lifts the chair which may dislodge it from a hook or catch.

Another problem occurs when the piston is rotated with respect to the main tube of such a bath tub lift. Rotation of the piston will cause fluid leakage under pressure and will substantially shorten the life of the apparatus.

Accordingly, representative objects of the present invention are to provide a bath lift operated by an improved fluid operated lift system, and which is simply and rigidly constructed, operates smoothly, efficiently and easily, is attractive and sanitary, and which lends itself to use in the home as well as in institutions.

A further object of the invention is to provide a bath lift chair and attaching mechanism which will provide ease and safety of operation.

Another object of the invention is to provide a bath lift of the above character in which rotative movement of the chair will not be transmitted to the piston assembly.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

The invention accordingly comprises the features of construction, combinations of elements, and arrangement of parts, which will be exemplified in the constructions hereinafter set forth, and the scope of the invention will be indicated in the claims.

SUMMARY OF THE INVENTION

The present invention relates to a fluid operated lift, and more particularly to a lift system for transporting the infirm or elderly into and out of a bathtub or the like.

The basic lift comprises three, preferably cylindrical tubes co-axially mounted together. A main tube is fixedly mounted to a base through which fluid under pressure can be introduced. The main tube is therefore stationary and serves to mount, support and guide the moving members of the lift.

A sleeve-like thrust tube is mounted within the main tube for axial movement relative thereto. The thrust tube has at its lower end a piston assembly carrying a substantially fixed piston against which the fluid acts to actuate the lift. A carrier tube is mounted over the main tube and rotatably rests on the thrust tube at its upper end, beyond the top of the main tube. The thrust tube is preferably made in two sections which are loosely positioned around a central tie rod which in the preferred embodiment is secured to the piston assembly.

The top of the carrier tube rests upon the top of the thrust tube through a low friction bearing means comprising a bushing of polymeric material positioned over the top of a central positioning rod which fits into the top of the thrust tube to a point short of the central tie rod. The bushing rests on a polymeric washer which is supported on the positioning rod by nuts or the like. A guide plate centers the positioning rod within the upper end of the carrier tube.

The thrust tube and carrier tube move together axially under the influence of fluid pressure on the piston. The use of tubular members mounted together as described results in a relatively rigid construction which is essentially fully enclosed for ease of sanitary maintenance and an aesthetic appearance.

The carrier tube (and its attached chair) are freely rotatable through 360° with a minimum or torque being transmitted from the carrier tube top plate to the piston because of the low friction bearing member.

A chair is rigidly mounted to the carrier tube to complete the stable and rigid assembly of the lift system. The chair is provided with a positive latching means for preventing inadvertent dislodging of the chair. A horizontal bar on the chair frame engages an upturned fixed hook on the yoke bar and is positively held by a downturned, pivotal latching hook having a long end portion overlapping the upturned portion of the fixed hook. The latching hook may be further positively held by a freely pivotable dog which engages a support member to prevent lifting of the latching hook without rotative movement of the dog member. Thus, if the chair is raised the latching hook will retain the chair frame bar and guide it back down into supporting engagement with the fixed hook once the chair is again lowered.

Operation is typically effected through a control valve which may replace the normal bathtub faucet. The control valve is connected to the base of the lift by a feed line. Water under normal line pressure is thus used by regulating its flow to actuate the lift and raise or lower a patient seated thereon. Rotation of the chair to positions over and exterior to the tub is readily accomplished manually, without undesirable rotation of the piston assembly. The vertical movement of the system is mechanically stopped at the full up and full down positions. The construction of the lift permits 360° rotation of the chair so that the lift may be placed in a number of operable positions with respect to a bathtub.
BRIEF DESCRIPTION OF THE DRAWINGS

For a fuller understanding of the nature and objects of the invention, reference should be had to the following detailed description taken in connection with the accompanying drawings, in which:

FIG. 1 is a top plan view showing the bathtub lift system of the invention with a rotated position of the chair shown in phantom lines.

FIG. 2 is a side elevation view of the bathtub lift system of the invention showing it in raised position over a tub, with the lower position of the chair shown in phantom lines.

FIG. 3 is a top view in partial section taken along lines 3—3 of FIG. 2.

FIG. 4 is an enlarged, broken, side elevational view in section of the bathtub lift of the invention.

FIG. 5 is an enlarged partial sectional view taken along line 5—5 of FIG. 4.

FIG. 6 is an enlarged front view of the lift chair partially broken away and in partial section.

FIG. 7 is an enlarged view of the top portion of the carrier tube and thrust tube.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to FIGS. 1 and 2, the bathtub lift system 10 is illustrated in an embodiment which is secured to the floor 12 adjacent the foot 14 of a bathtub 16. It will be understood, however, that the bathtub lift system of the invention can just as easily be positioned adjacent either side of tub 16 or adjacent the head 18 thereof. System 10 may also be secured to a platform or the like adjacent tub 16, or suitably modified to rest on the rim 17 of the tub 16 itself.

As shown in FIG. 4, base 22 preferably comprises a hollow cast metal member 24 which is secured to floor 12 (FIGS. 1 and 2) by a series of bolts 26 or the like extending through a peripheral flange 28. The upper surface 30 of base 22 carries an upstanding cylindrical wall 32 which defines at its interior a fluid pressure chamber 34. A central post 36 extends upwardly through the center of chamber 34 through which passageway 52a connects to tube 54 to form a bleed line from chamber 34. Tube 54 is closed by a cap or plug 56 after air is bled from the chamber. Tube 54 may also be used as an alternate discharge line for water.

The ingress of actuating fluid to and from chamber 34 is provided through passages 38 and line 46 secured as by a threaded coupling 48. As shown in FIGS. 1 and 2, fluid line 46 is then connected to a suitable source of pressurized fluid which is typically the water faucet servicing tub 16. The water faucet is preferably fitted with a control valve 50 (FIGS. 1 and 2) for example of the plug valve type, which typically has one setting which allows water to flow through line 46 to raise the lift, another setting which allows water to drain out of the lift to lower it, a third setting which stops all water flow to stop the lift, and generally two additional settings which allow the tub and any shower connected thereto to be operated in normal fashion. It will be understood, however, that lift system 10 may also be operated from other sources of pressurized fluid separate from the normal town water supply.

Still referring to FIG. 4, a cylindrical main tube 58 is secured, preferably by being press fitted and soldered or welded, over wall 32 of pressure chamber 34 to mount it to base 22. The bottom of main cylinder 58 is further preferably received in a shallow groove 60 running around base of wall 32 to lend added rigidity to the assembly and to accept a soldered or welded joint. As will be seen from the following discussion, main tube 58 is thus positioned to act as a stabilizing guide for lift system 10 during its up and down motions in operation.

As further shown in FIGS. 3 and 4, a thrust member 62 preferably in the form of a cylindrical tube is coaxially mounted within cylinder tube 58 to act as the principal actuating member of lift system 10. Thrust tube 62 is sufficiently smaller in diameter than tube 58 so as to leave a substantial clearance space between it and the interior of main tube 58.

Thrust tube 62 carries at its lower end 62a a piston assembly shown generally at 66, against which the fluid pressure in chamber 34 acts to raise and lower the lift system 10. As shown in FIG. 4, piston assembly 66 comprises a suitably threaded tie rod 68 which holds a cupped elastomeric gasket 70 by means of a lower nut 72. The gasket and piston plate 78 are held against upward movement by nut 76 and the cylindrical tube 62 which fits around nut 76 or rests on nut 76.

Referring now to FIGS. 4 and 7, it will be seen that the top plate 100 is secured to the carrier tube 96 by a plurality of bolts or cap screws 102 which are threaded into shoulder portion 104 of plate 100. The underside of plate 100 rests upon a nylon bushing 99 which is fitted around the upper end 106 of positioning rod 68a and which rests upon a nylon washer 101 which in turn rests upon a nut 103a. Nut 103a secures guide plate 103 between it and nut 103b on the threaded positioning rod 68a. Optionally, there may be provided a nylon washer 105 resting on the top of upper thrust tube portion 62b for additional insurance against transmission of torque from rotation of the carrier tube to the piston assembly 66. Thus the carrier tube rests on the low-friction nylon bushing and is freely rotatable through 360° with the nylon washers 101 and 105 providing further low-friction bearing surfaces for rotative support of the carrier tube. The guide plate 103 centers the upper thrust tube portion 62b within the carrier tube, since the guide plate is preferably circular and has close clearance at its outer edge 103c with the interior surface of carrier tube 96. Positioning rod 68a extends downwardly into the thrust tube portion 62b a distance of about 12 inches and is loosely fitted in the thrust tube portion 62a with clearance between its lower end 68b and the upper end 68c of tie rod 68. Thus the positioning rod 68a and tie rod 68 are spaced apart a sufficient distance to prevent any transmission of torque through the tie rod from the rotation of the carrier tube while the low-friction nylon bushing and one or more washers minimize the transmission of torque from the carrier tube to the thrust tube 68b. In some applications the nylon bushing 99 alone, or other bearing means, may be sufficient as a bearing member.

Referring to FIGS. 3 and 4, it will be seen that the inner diameter of carrier tube 96 is sufficiently greater than the outer diameter of main tube 58 so as to leave an annular clearance space 98 having a predetermined radial dimension R therebetween. In the construction zone, for example, the outer diameter of main tube 58 may be 4.250 inches while the inner diameter of carrier tube 96 may be 4.810 inches, thus leaving a radial dimension R for clearance space 98 of 0.580 inch.
Main tube 58 is provided with an annular plate member 106 which is secured to the upper end thereof by a plurality of bolts 108 which also hold clearance ring 116 in place. As will be more fully explained hereinafter, clearance ring 116 is preferably made of a low friction polymeric material to space the upper end of main tube 58 from the interior of carrier tube 96. The central portion of plate 106 is provided with an opening 110 to permit passage of thrust member 62 therethrough. As seen in FIGS. 4 and 5, the upper portion 62b is separated from the lower portion 62a by an annular stop member 112 held between the two halves of thrust tube 62 by the weight of the carrier tube 96 on the thrust tube. The stop member 112 positively limits the upward travel of the thrust tube 62 (and the carrier tube 96) when the stop member 112 engages plate 106 at the top of main tube 58.

Referring again to FIG. 4, it will be seen that around the lower circumference of the main tube 58 there is provided a clearance ring 118 secured by screws 120 to the main tube. The clearance rings 116 and 118 are preferably made of a tough, low friction plastic material to permit vertical travel of the carrier tube without binding action on main tube 58. Rings 116 and 118 have a thickness (FIG. 5) which is slightly less than the radial dimension R' of clearance space 98. In the example discussed above wherein the radial dimension R is 0.280 inch, the thickness of rings 116 and 118 will typically be in the order of 0.250 inch leaving a clearance of 0.030 inch for axial movement of carrier tube 96. Rings 116 and 118 in the example cited above will also typically have both a height and a radius of curvature on their arcuate sliding surfaces of about one-half inch.

As best seen in FIGS. 8 and 5, the chair 122 for supporting and transporting a person into and out of a tub or the like is preferably detachable from the carrier tube mount 138 which comprises a steel yoke 138 around carrier tube 96 and held thereto as by set screws 145 to provide vertical adjustment of the chair support with respect to the carrier tube. The chair itself may comprise a separate removable back portion 124 and seat 126 along with arm members 132, 133, or an integral “bucket” seat, all of which may be molded of a polymeric material such as polyurethane or polypropylene. The seat 126 is also preferably cut out as at 136 (FIG. 1) to aid in the bating of a patient’s perineum area. The chair assembly further comprises a tubular frame 140 having a horizontal bar portion 140a, two spaced vertical portions 140b preferably integral with the arm engaging portions 140c. The chair is preferably movable from the tubular frame 140 for cleaning, etc.

The chair assembly is held in position on the carrier tube by engagement of the horizontal bar member 140a with the split upturned hook 142 which is secured to the mounting yoke 138. Integral with hook 142 is an upright portion 144 which pivotably supports a large downwardly latching hook 146 on pivot pin 148. The end 146a of hook 146 is curved along surface 146b to engage the top of bar 140a. This curved configuration of latching hook 146 in conjunction with the location of pivot 148 generally prevents the horizontal bar from inadvertently being dislodged from bifurcated hook 142 unless latching hook 146 is manually lifted to remove the horizontal bar 140a. Thus, pivotable hook member 146 drops into position between the bifurcated hook 142 to effectively restrain horizontal bar 140a from being moved forwardly and out of engagement with hook 142 unless hook 146 is first lifted before any upward movement of the bar. If a patient or operator of the device should inadvertently lift up on the chair assembly, bar 140a would engage the curved portion 146b of latching hook 146 and lift it to an upper limit restrained by hook 146. Bar 140a, however, upon being lowered cannot move to the left as seen in FIG. 4 to disengage from the bifurcated hook 142 because of its engagement by hook 146. Thus the bar 140a is guided back into supporting engagement with bifurcated hook 142 when the chair is again lowered to prevent inadvertent dislodging of the chair from its support.

To further assure against inadvertent dislodgement of bar 140a from the bifurcated hook 142, there is provided a freely swinging dog 152 which may be formed as a channel member fitting around hook 146 and secured thereto by a pivot 153. The lower end of dog 152 thus will engage the yoke 138 and will positively prevent latching hook 146 from releasing bar 140a unless dog 152 is manually rotated to permit lifting of hook 146 and removal of the chair 122.

The chair assembly is further stabilized by resting against a plate 150 which is secured as by welding to the bottom of U-shaped bar member 154 and which terminates in a pair of horizontal ends 150a, b, upon which chair frame bars 140b rest. The upper ends of 154a are secured in support cross bar 156 by means such as set screws 158, cross bar 156 being secured to the yoke 138 as by welding. As best seen in FIG. 6, the U-shaped bar 154 fits within the indented portion of bars 140b to provide a limit of lateral motion of the chair while the chair support bars 140b rest upon the ends of plate 150.

The position of the chair can thus be altered by positioning of the ends 154a within support member 156. As the ends 154a are positioned more to the left or right as seen in FIG. 4, the tilt of chair assembly 122 is changed because of the relationship of the chair support pivot point as horizontal bar 140a is held by the bifurcated hook 142 in fixed position while the rest plate 150 will have its horizontal position changed. Thus, a slight inward or outward adjustment of the bar ends 154a will result in a substantial change in angle of seat 126 to the horizontal. Thus, the chair assembly is fail-safe from the standpoint that it cannot be inadvertently dislodged from its hook 142 unless the locking hook 146 is consciously lifted to permit the release of horizontal support 140a. Further, because the chair assembly is pivoted about hook 142 and rests upon cross plate 150, a slight change in the horizontal position of the end members 154 will provide the desired angle of seat 126.

Operation
To use lift system 10, chair 122 is first manually rotated from the position shown in FIG. 1 where it is positioned directly over tub 16, to the position shown by dashed lines in FIG. 1 where chair 122 is exterior to tub 16. It will be noted that such manual rotation may be readily accomplished with little effort since carrier tube 96 can rotate 360° around the main tube 58.

Once in the exterior position, the operator turns control valve 50 to the “down” setting which allows water to drain out from pressure chamber 34. This permits
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thrust member 62, attached carrier tube 96 and chair 122 secured thereto to gradually lower to a lowered position outside the tub as shown in FIG. 1 in outline. In the lowered position of chair 122, a patient may be readily transferred thereto from a wheelchair, or may position himself thereon with relative ease if he has even a minimum of mobility. The operator then turns control valve 50 to the “up” position which permits water to enter pressure chamber 34 and act against piston assembly 66. This raises thrust member 62, attached carrier tube 96 and chair 122 to their raised position, at which point chair 122 may be readily manually rotated back to the position over tub 16 shown in FIG. 1. If desired, the chair can be rotated a full 360° around the vertical axis of the lift. The operator then turns control valve 50 again to the down position allowing water to be forced out of pressure chamber 34, slowly lowering chair 122 into tub 16 in the position shown by dotted lines in FIG. 2. Due to the positive control and rigid structure of lift 10, this entire procedure may be performed without subjecting the patient to unnecessary fears of falling or collapse. Lift 10 may also be stopped at any intermediate position in the procedure by merely turning control valve 50 to a “stop” position wherein water is neither allowed to enter or leave pressure chamber 34. Once within tub 16 bathing may progress in a normal manner, and when completed the procedure is reversed to again lift the patient out of the tub and position him for return to a wheelchair or for exiting seat 122 under his own power.

If at any time during the operation of the lift the chair 122 is inadvertently raised, the latching hook 146 and dog 152 will retain the horizontal support bar 140a over the upturned bifurcated hook 142 to assure positive re-engagement of the chair frame with the support. When it is desired to remove the chair, dog 152 is held up and latching hook 146 is lifted to permit disengagement of support bar 140a from hook 142.

While lift 10 has been illustrated and described primarily for use in conjunction with a tub, it will be understood that it may be applied to analogous applications such as for lifting patients into and out of a pool for water therapy and the like.

It will thus be seen that the objects set forth above, among those made apparent from the preceding description, are efficiently attained and, since certain changes may be made in the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense. It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described, and all statements of the scope of the invention, which, as a matter of language, might be said to fall therebetween.

Having described the invention, what is claimed is:

1. A fluid operated bathtub lift system comprising, in combination:
   A. a base,
      1. means forming a fluid pressure chamber on said base, and
   B. a cylindrical main tube vertically mounted to said base in substantially fluid-tight relationship about said pressure chamber,

1. and having a bearing member secured adjacent the top of said main tube, a said bearing member having means forming a central opening there-through;

C. a cylindrical carrier tube telescopically mounted for axial and rotational movement over said main tube,
   1. the inner diameter of said carrier tube exceeding the outer diameter of said main tube by an amount sufficient to leave an annular clearance space of predetermined radial dimension there-between,
   2. a top plate attached to said carrier tube;

D. a thrust tube assembly mounted for axial movement within said main tube and carrying means forming a piston assembly adjacent the lower end thereof and rotatably supporting said carrier tube on the upper end thereof, said thrust tube assembly comprising
   1. a thrust tube supported at its lower end on said piston assembly and rotatably supporting at its upper end the top plate of said carrier tube, with said piston assembly and said carrier tube top plate being spaced by a thrust tube around a central rod,
   2. said thrust tube passing through said central opening of said bearing member, and
   3. low friction bearing means on said thrust tube assembly between said carrier tube top plate and said piston assembly;

E. a plurality of clearance rings secured on one of said main tube and said carrier tube at selected spaced positions along the length thereof and extending into said clearance space,
   1. said clearance rings each having a thickness dimension which is slightly less than the said radial dimension of said clearance space, and
   F. human body supporting means mounted on said carrier tube;

2. The bathtub lift system defined in claim 1 wherein said thrust tube assembly further comprises a loosely fitted rod positioned in the upper end of said thrust tube, a guide plate around the upper end of said thrust tube and having at least a plurality of diameters slightly less than the inner diameter of said carrier tube, with said low friction bearing means being positioned on said rod.

3. The bathtub lift system defined in claim 1 wherein said low friction bearing means comprises a bushing made of polymeric material, said bushing resting on a low friction washer, said washer being secured over the top of the upper end of said thrust tube.

4. The bathtub lift system defined in claim 1 wherein said thrust tube is formed in two sections, with a stop member secured around a central rod extending from said piston assembly upwardly between said two thrust tube sections, said stop member limiting upward movement of said thrust tube assembly by engagement of said stop member with said annular bearing.

5. The bathtub lift system defined in claim 1 wherein one of said clearance rings is secured around and adjacent the outer top of said main tube and a second of said clearance rings is secured around the outer bottom of said main tube.

6. The bathtub lift system defined in claim 3 wherein said clearance rings are made of a low friction polymeric material.
7. The bathtub lift system defined in claim 1 wherein said human body supporting means comprises,
G. a hook means secured to said carrier tube for supporting a chair frame;
H. a chair means having a horizontal support bar extending from the hook of said chair and engageable with said hook means; and
I. a latching means pivotally disposed above said hook means and having a downwardly extending end portion engageable with said horizontal support bar from above and overlapping an upturned portion of said hook means, whereby said latching means prevents said horizontal bar from being disengaged from said hook means without lifting of said latching means by other than upward movement of said bar.
8. The bathtub lift system defined in claim 7 wherein said latching means further comprises a dog member rotatably secured to a portion of said latching means and engageable with a portion of the latching means to positively lock the end portion of said latching means into overlapping position with respect to said upturned portion of said hook means.