

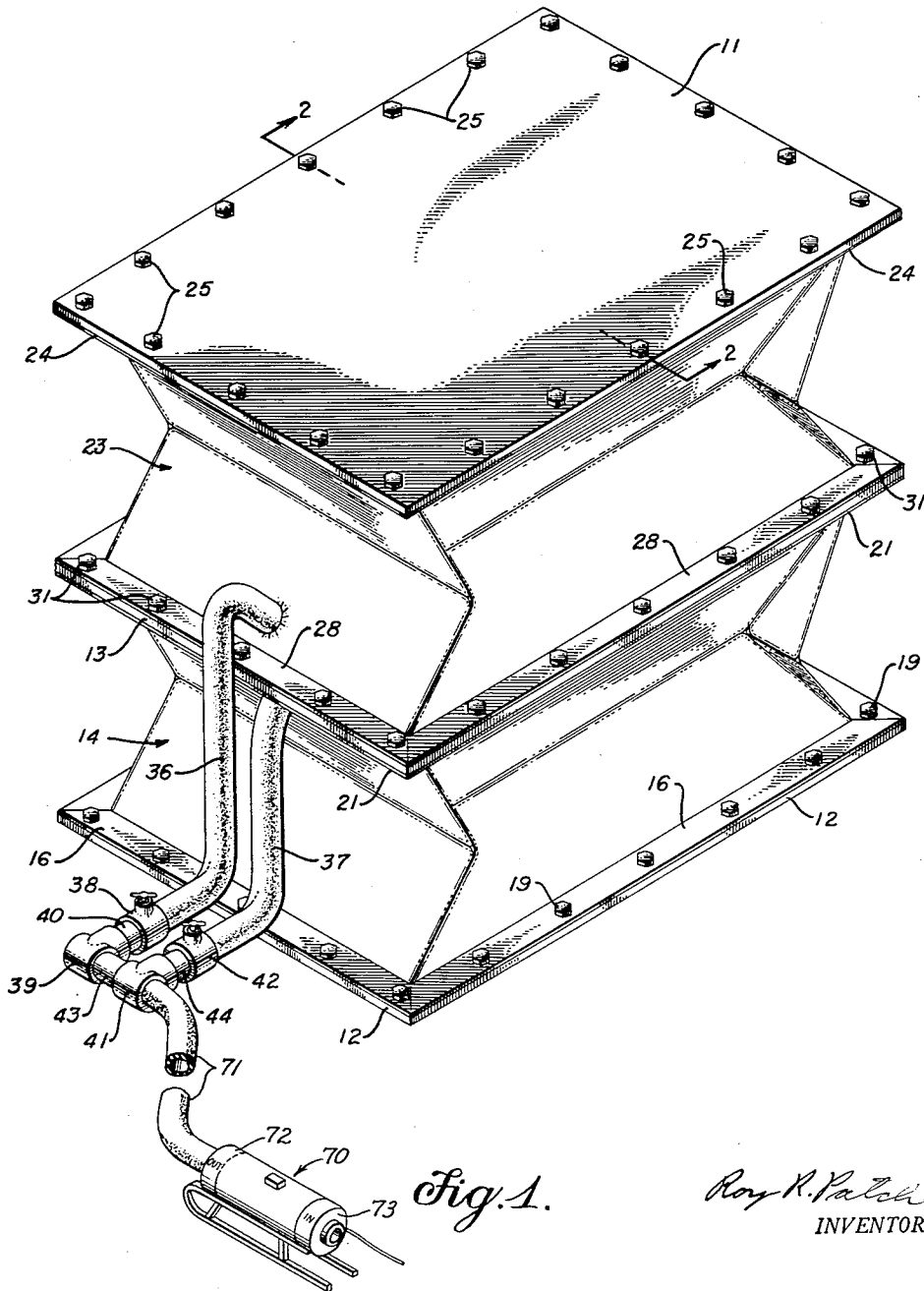
Jan. 2, 1962

R. R. PATCHEN
CONSTRUCTION JACK

3,015,470

Filed July 25, 1958

3 Sheets-Sheet 1



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R. R. PATCHEN
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Fig. 2.

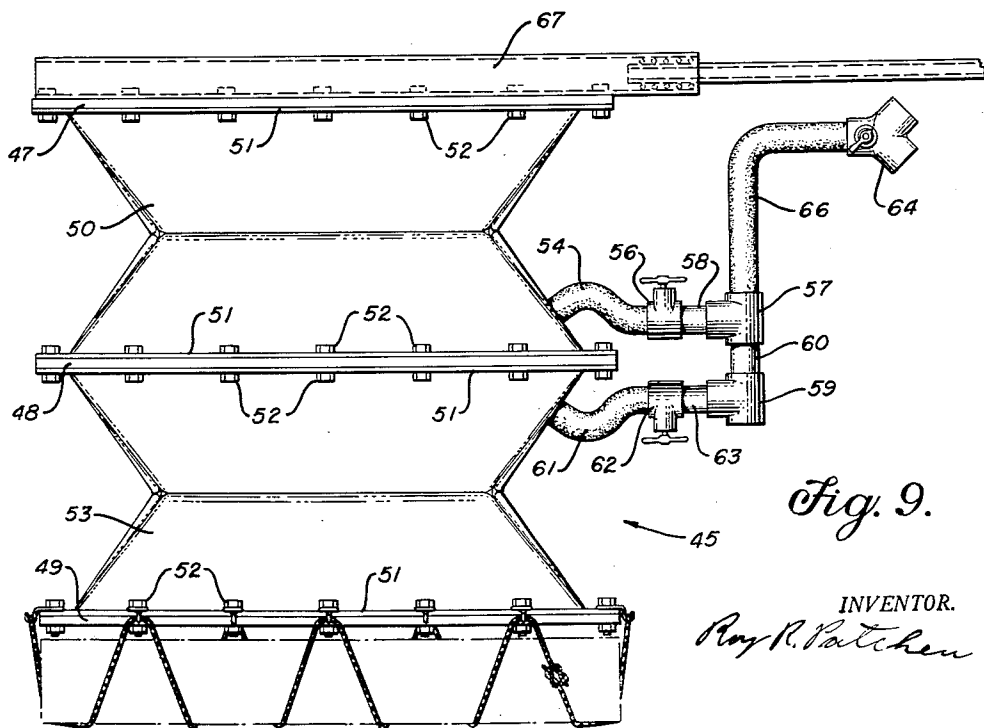
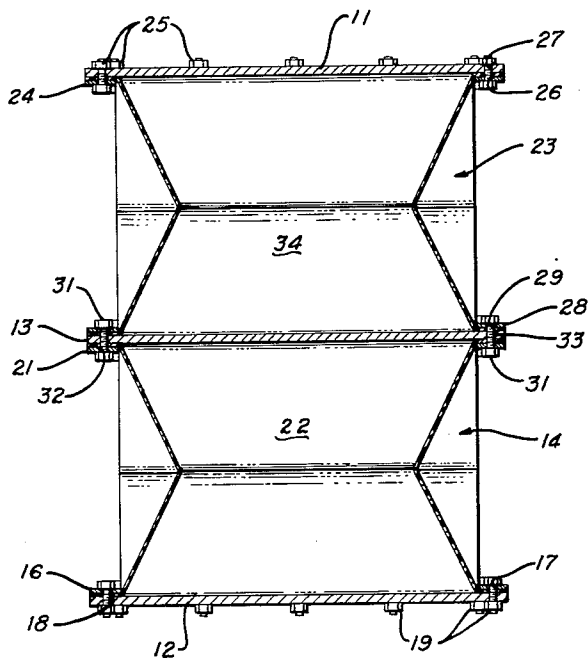


Fig. 9.

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Fig. 5.

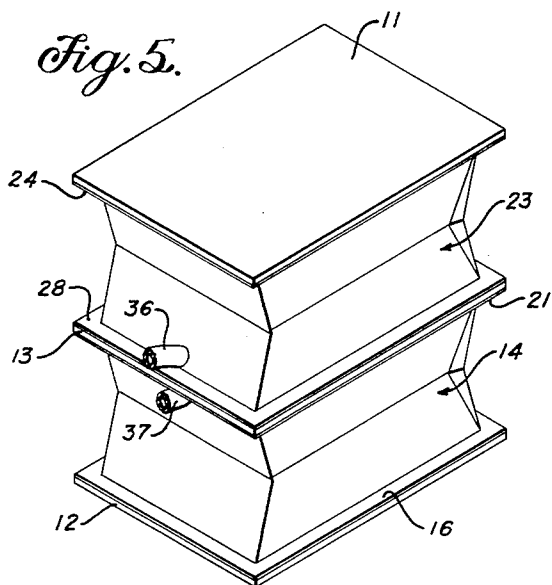


Fig. 4.

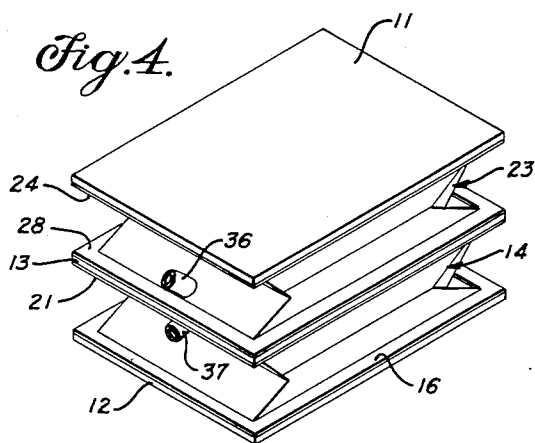


Fig. 3.

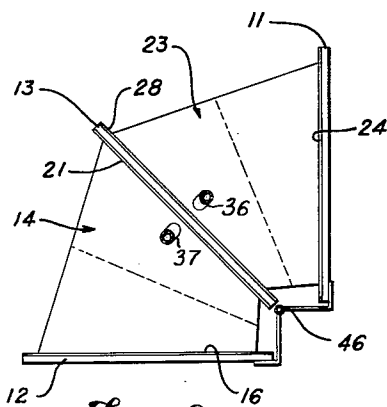
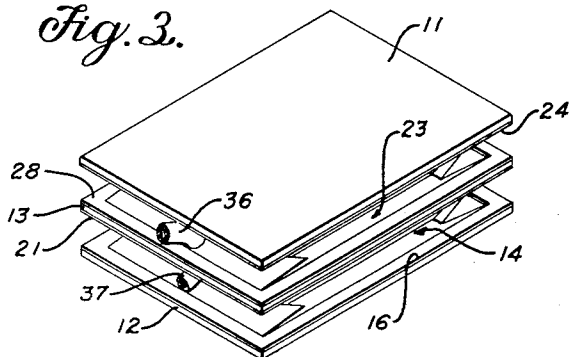


Fig. 8.

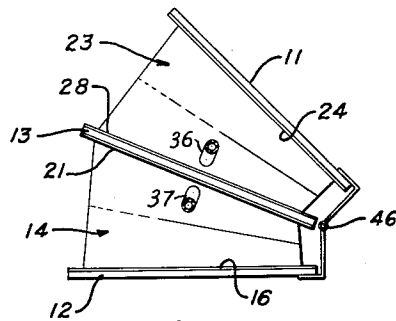


Fig. 7.

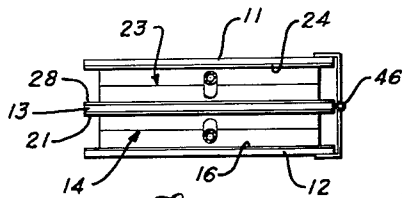


Fig. 6.

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CONSTRUCTION JACK

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4 Claims. (Cl. 254-93)

This invention relates to an improved lift jack which is constructed to serve primarily for lifting precast concrete slabs to an elevated position. It is further constructed to permit it to be utilized as an ordinary jack for lifting weighty objects and the like.

Heretofore, various means have been devised to lift precast concrete slabs to an elevation. These lifting means are usually left in place to form part of the construction, i.e., the pillar or post to support the load. This type of lifting apparatus adds greatly to the cost of the construction, therefore, I have invented an air lift jack.

An object of the present invention is to provide a light weight portable lift jack.

Another object of the present invention is to provide a lifting jack having a large rectangular area lifting surface.

A further object of the present invention is to provide a jack using low pressure air as a lifting agent.

Still another object of the present invention is to provide a jack having a 90° (or right angle) pivoted swinging lift to the horizontal.

Still a further object of the invention is to provide a jack having a vertical lift.

Yet another object of this invention is to provide a jack capable of having a vacuum drawn thereon to provide a lifting agent.

Yet a further object of this invention is to provide a lifting apparatus that can be used as a portable workman's platform.

Even yet another object of this invention is to provide a lifting apparatus which may hoist a structural member and then temporarily suspend it while hoisting another lower structural member into position or while hoisting a permanent vertical support (wall or column) into position.

Still yet another object is to provide a plurality of parallel connected jacks so that the forces exerted on structural members will be negligible, i.e., less than the static forces when the structure is completed;

Other objects and advantages of this invention will become apparent, to one skilled in the art, from the following description taken in connection with the accompanying drawings illustrating preferred embodiments of my invention and in which like reference numbers are employed to designate like parts throughout the several views.

FIG. 1 is a detailed perspective view of a preferred embodiment of my present invention;

FIG. 2 is a cross-sectional view taken on line 2-2 of FIG. 1, further showing the construction thereof;

FIG. 3 is a perspective view illustrating the rest or deflated position in accordance with this invention, wherein apparatus later to be vertically hoisted to higher positions are formed on top;

FIG. 4 is a perspective view similar to FIG. 3 but illustrating the invention in its intermediate, or partly inflated, vertical position;

FIG. 5 is a perspective view of the same structure illustrated in FIGS. 3 and 4 but showing the invention in its fully raised and inflated vertical position, wherein the apparatus has been hoisted into the position which it will occupy;

FIG. 6 is an end view of the jack in the deflated position whereas one side of the jack is pivotally clamped;

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FIG. 7 is an end view showing the jack partly pivotally inflated;

FIG. 8 is an end view showing the jack fully pivotally inflated wherein the apparatus to be hoisted has been hoisted from a horizontal position about a pivot to a vertical position which it will occupy, and

FIG. 9 is a side elevational view showing other embodiments of this invention, where the top of the jack is vertically fixed, a vacuum capable of being drawn thereon so as the bottom of the jack may be lifted, hoisting apparatus affixed thereto.

Referring now to the drawings and specifically to FIGS. 1 and 2, there is shown an air actuated jack comprised of a rectangular top plate 11, a bottom plate 12 similar to plate 11, and a rectangular intermediate plate 13. The top, bottom and intermediate plates 11, 12 and 13, respectively, being constructed of a lightweight nonporous material (Masonite or aluminum) that will hold or resist the passage of air therethrough.

A flexible nonelastic bellows 14 (nylon reenforced plastic) is fixed to the outer edges of the bottom plate 12 by a holding strap 16, having a number of spaced-apart apertures 17 therethrough. The bottom plate 12 also has apertures 18 about the outer edges thereof and aligned with the aperture 17 of the strap 16. The bellows 14 is secured between the lower surface of strap 16 and the upper surface of bottom plate 12 by suitable fasteners 19. It will be noted from the above description, that bellows 14 is affixed to the bottom plate 12 in such a manner that air cannot escape from the bellows 14 between bottom plate 12 and the edge of the bellows affixed thereto. The bellows 14 is further connected to the intermediate plate 13 by a strap 21. The bellows 14 and strap 21 are fastened to plate 13 in the same manner as the securing of plate 12 and strap 16, described above.

Referring to FIG. 2, it will be seen that bottom plate 12, intermediate plate 13, and bellows 14, forms an air chamber 22, the operating function to be described later in the specification.

A second flexible nonelastic bellows 23 is secured between the lower outer surface edge of top plate 11 and a holding strap 24 by suitable fasteners 25 passing through apertures 26 and apertures 27 in strap 24 and plate 11, respectively. Likewise, the bellows 23 are sealed between the upper edge of intermediate plate 13 and another securing strap 28, having aperture 29 therethrough. Suitable fasteners 31 secures straps 28 and 21 to intermediate plate 13, and apertures 32 and 33, aligned with aperture 29, are provided in strap 21 and plate 13, respectively, to provide a passage for fasteners 31. Plate 11, side wall of bellows 23 and intermediate plate 13, defines another air tight chamber 34, which function will be described hereinafter.

As seen in FIG. 1, there are two flexible air supply hoses 36 and 37, one extremity which is hermetically sealed to bellows 23 and 14, respectively. The other extremity of hose 36 is connected to valve 38, which is coupled to a T 39, by a nipple 40. One leg of the T 39 is coupled to a leg of another T 41 by a nipple 43. The T 41 is further connected to a valve 42 by a nipple 44, said valve 42 being connected to an extremity of hose 37. The unused leg of either T 39 or 41 is coupled to a regulated air supply 70 by means of a flexible hose 71. Preferably this air supply 70 is an ordinary vacuum cleaner of the tank type which usually comprises of both blower and suction ends 72 and 73, respectively. Depending on what purpose the air actuated jack is to be put to, i.e., whether it is to be expanded or collapsed, the hose 71 is connected to the blower end 72, of the air supply 70, or the suction end 73. The other unused leg of the T is coupled to either another jack unit, or capped, as may be required.

As an example for the operating of the air jack (FIGS. 3, 4 and 5) let us assume that a horizontal concrete slab of considerable area is to be vertically hoisted and the floor slab has been poured and cured, a plurality of deflated jack units are positioned in suitable spaced-apart relation upon the slab. Forms, defining the area of the second slab are then built about the jack. Suitable spacers and/or paper is then placed upon the top of the jacks so that they will not become part of the second slab. The slab is then poured and cured by conventional means. (If more than one slab is to be hoisted, the jacks are placed between each tier of slabs with the spacer and paper placed in between.) The slabs are poured as described above and are maintained in parallelism, each with the others.

The deflated jack units (FIG. 3) are connected in parallel to the regulated air supply 70, and the valves 38 and 42 (FIG. 1) are opened to let low pressure air pass through hoses 36 and 37 into air chambers 22 and 34 (FIG. 2) whereby differential atmospheric pressure will be exerted between the inside and outside walls of both bellows 14 and 23. As shown in FIG. 4, the jacks begin to inflate because of air from air supply passing into chambers 22 and 34 exerting an equalized pressure between the bottom and intermediate plates 12 and 13, and the intermediate and top plates 13 and 11 of each jack unit.

Because the plates 11, 12 and 13 are nonflexible, the flexible nonelastic bellows 14 and 23, unfold. However, being nonelastic they will not expand sideways and therefore will cause intermediate plate 13, top plate 11 to rise, hoisting the concrete slab. Continuous inflation of the jack further unfolds bellows 14 and 23 (FIG. 5), raising plates 11 and 13 until the limits of the bellows are reached. When the concrete slab has been hoisted to its desired height, valves 38 and 42 are closed, sealing pressurized air into chambers 22 and 34, thus maintaining the jack at the height desired.

Deflation of the jack is accomplished by opening valves 38 and 42 and connecting T 39 or 41, either to the atmosphere or the suction end 73 of air supply 70, or to a vacuum pump (suction side of air compressor or blower). When the slab has been hoisted to the desired height, the slab can be laterally moved to any desired position to match the ultimate permanent supports. Weight of the slab will collapse the bellows and the slab will be lowered to rest upon its permanent supports. The bellows will be completely collapsed as the vacuum extracts the air from bellows 14 and 23 to the folded portable position shown in FIG. 3, whereupon the jack may be moved to another site and the inflating procedure described above, repeated.

Another example of operation of the construction jack is to raise a wall to its vertical position after the wall has been constructed in a horizontal position and it is desired to raise the wall to its vertical final resting position. A plurality of parallel disposed jacks are placed beneath the horizontal wall to be raised and are connected to a compressed air supply as explained above. The jacks are of the same construction as described in FIG. 1, with the addition of a hinge clamp 46 (see FIGS. 6, 7 and 8), which is secured on one side thereof. Air is pumped into deflated jack chambers 22 and 34 (see FIG. 6) through T's 39 and 41, valves 38 and 42, and air inlet hoses 36 and 37. As air is pumped into the chambers, hinge clamp 46 (FIG. 7) prevents one side of bellows 14 and 23 from unfolding.

Referring to FIGS. 7 and 8 of the drawings, the opposite side of bellows 14 and 23, from hinge clamp 46, are unfolded as more air is pumped into the chambers. Top plate 11 and intermediate plate 13 will pivot about clamp 46, hoisting the wall to its vertical position.

A modification of my invention, as viewed in FIG. 9, is a vacuum lift jack 45, constructed similarly to the jack described in FIGS. 1 and 2. Vacuum jack 45 is comprised of a vertically stationary top plate 47, a vertically

movable intermediate plate 48 and a vertically movable bottom plate 49. A flexible nonelastic bellows 50 is vacuum sealed to top plate 47 and intermediate plate 48 by suitable sealing clamp 51 and fasteners 52, respectively. There is another flexible nonelastic bellows 53, which is vacuum-sealed to intermediate plate 48 and bottom plate 49, by sealing clamp 51 and suitable fasteners 52, respectively.

Hermetically sealed to bellows 50, is a flexible vacuum take-off hose 54, one extremity of which is connected to a valve 56. One leg of a first T 57 is coupled to valve 56 by a nipple 58, and the other leg of the T 57 is connected to one leg of a second T 59 by a nipple 60. A second flexible vacuum take-off hose 61 is hermetically sealed to bellows 53, and the other extremity is connected to a valve 62. Valve 62 is further connected to a leg of T 59 by a nipple 63.

T 59 may also be further series connected to additional vacuum jack units 45 (similar to the jack described in FIGS. 1 and 2) or plugged. The T 57 is also coupled to additional vacuum jack units 45, or connected to the inlet side of a two-way Y type selector valve 64, by a flexible hose 66. One leg of the two-way selector valve 64 is connected to a vacuum pump (not shown), while the other leg of the valve 64 is atmospherically connected.

Top plate 47 becomes the stationary member and is provided with a pair of drawer-glides 67. The movable members of drawer-glides 67 are secured in parallel spaced-apart relationship on the upper surface of top plate 47 by any suitable means, such as fasteners 52. The immovable members of drawer-glides 67 are fixably secured to suitable frame works (not shown), i.e., extending above the bed of a pick-up truck, for example, to permit the horizontal movement of vacuum jack 45.

In operation, the closed vacuum jack 45 is run out to the extremity of drawer-glide 67. Selector valve 64 is selected for atmospheric or positive pressure and valves 56 and 62 are open. Atmospheric or positive pressure will enter flexible nonelastic bellows 50 and 53 through selector valve 64, flexible hose 66, open valves 56 and 62 by way of T's 57 and 59 and their respective fittings, flexible hoses 54 and 61 which are sealed to bellows 50 and 53, respectively. The pressure entering the bellows will cause intermediate plate 48 and bottom plate 49 to move vertically downward until the open limits of bellows 50 and 53 are reached or until the valves 56 and 62 are closed. Also, the downward movement of plates 48 and 49 will stop when the bottom plate 49 comes into contact with the object to be hoisted, wherein the upper surface of the object is within the open limits of the bellows. The object to be hoisted may be attached to bottom plate 49 by suitable vacuum clamps, hooks, chains or other means (not shown), or as shown in the drawing by a rope passing over hooks attached to the bottom plate by fasteners 52. When the object is ready to be hoisted, the selector valve 64 is selected for vacuum. A negative pressure is drawn on bellows 50 and 53, extracting the air, thus causing the bellows to collapse. As the bellows close, plates 48 and 49 will vertically rise, hoisting the object attached to the bottom plate. Again referring to the bed of a pick-up truck as an example, when the hoisted object has been raised by the closing of the bellows as a vacuum is drawn thereon, so that it clears the bed of the truck, valves 56 and 62 are closed to maintain the present negative pressure within bellows 50 and 53, and the vacuum pumping is discontinued. The vacuum jack 45 is now in condition to be horizontally moved along drawer glides 67 attached to top plate 47. The jack is horizontally moved until the hoisted object is over the bed of the truck, at which time selector valve 64 is selected for atmosphere or positive pressure, the valves 56 and 62 are opened to allow the hoisted object to be lowered and comes to rest upon the truck bed.

While I have described but a limited number of em-

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bodiments of the invention, it is understood that many modifications and changes can be made therein without departing from the spirit and scope of the invention and it is not my desire, therefore, to limit the invention, except as pointed out in the appended claims.

I claim:

1. A differential pressure actuated construction jack operable to lift weighty objects, the combination comprising a top member, a first bellows sealed to said top member, a bottom member, a second bellows sealed to said bottom member, an intermediate member disposed between said top member and said bottom member, said intermediate member having said first bellows and said second bellows sealed thereto, a first hose sealed to said first bellows through which differential pressure of said first bellows is controllable from below atmospheric pressure to above said pressure, a second hose sealed to said second bellows through which differential pressure of said second bellows is controllable from below atmospheric pressure to above said pressure, separate control means for said first and said second bellows to control air pressure separately in each bellows.

2. A differential pressure actuated construction jack as defined in claim 1 having a means operable to supply positive pressures through said first hose and said second hose to the interior of said first bellows and said second bellows thereby expanding said first and said second bellows whereby said top member and said intermediate member and said bottom member are adjusted relative to each other.

3. A differential pressure actuated construction jack operable to lift weighty objects, the combination comprising a top member, a first foldable bellows sealed to said top member, a bottom member, a second foldable bellows sealed to said bottom member, an intermediate member disposed between said top member and said bottom member, said intermediate member having said first bellows and said second bellows sealed thereto, a first hose sealed to said first bellows, a second hose sealed to said second bellows, a means operable to control dif-

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ferential pressures between the interior and exterior of said first and said second bellows from below atmospheric pressure to above atmospheric pressure operable through said first and said second hose, and a control means selectively operable to adjust said top member and said intermediate member and said bottom member to either of two different displaced movements relative to each other.

4. A pressure actuated construction jack operable to lift weighty objects, the combination comprising a top member, a first foldable bellows sealed to said top member, a bottom member, a second foldable bellows sealed to said bottom member, an intermediate member disposed between said top member and said bottom member, said intermediate member having said first bellows and said second bellows sealed thereto, said top member and said intermediate member in combination with said first bellows defining a first substantially rectangular shaped chamber, said bottom member and said intermediate member in combination with said second bellows defining a second substantially rectangular shaped chamber, a first hose sealed to said first bellows, a second hose sealed to said second bellows, a pump means operable to control differential air pressure of said first and said second bellows through said first hose and said second hose, and separate control means for said first chamber and said second chamber separately operable for controlling the expanding and collapsing of said first and said second bellows from below atmospheric pressure to above atmospheric pressure whereby said top, intermediate, and bottom members are adjusted relative to each other.

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