April 30, 1935. E. F. RIES 1,999,848

HYDRAULIC LIFT

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Fig. 1.

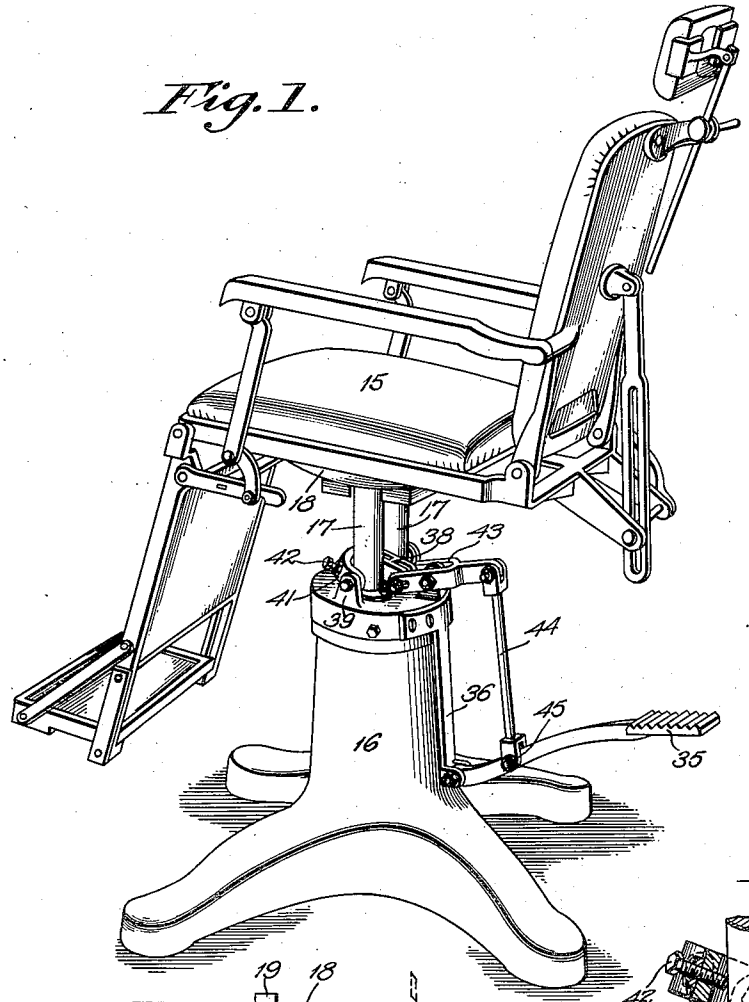


Fig. 2.

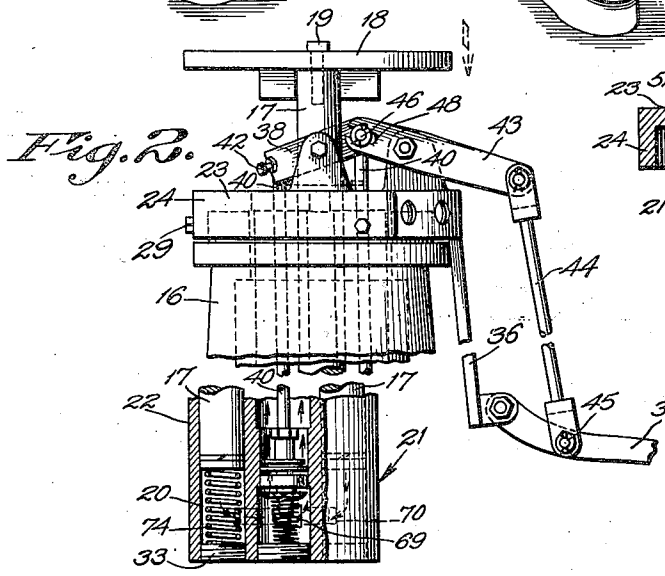
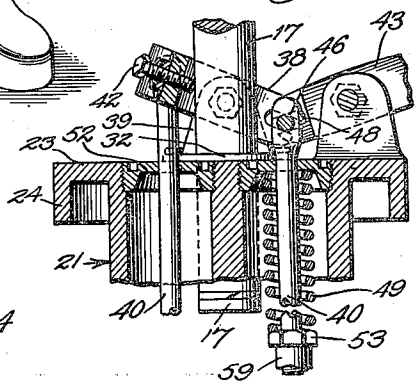


Fig. 3.



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Fig. 4.

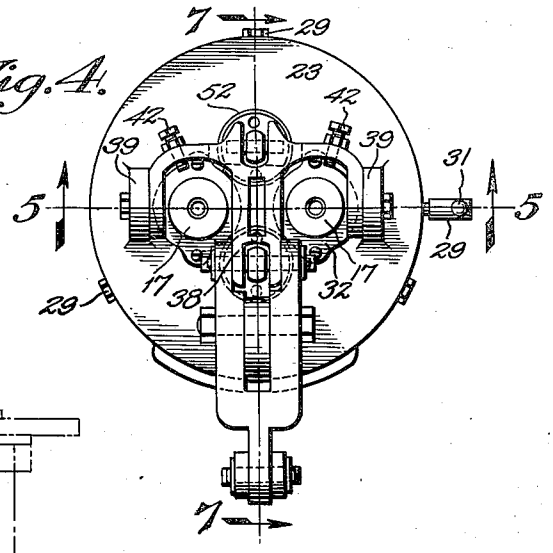


Fig. 5.

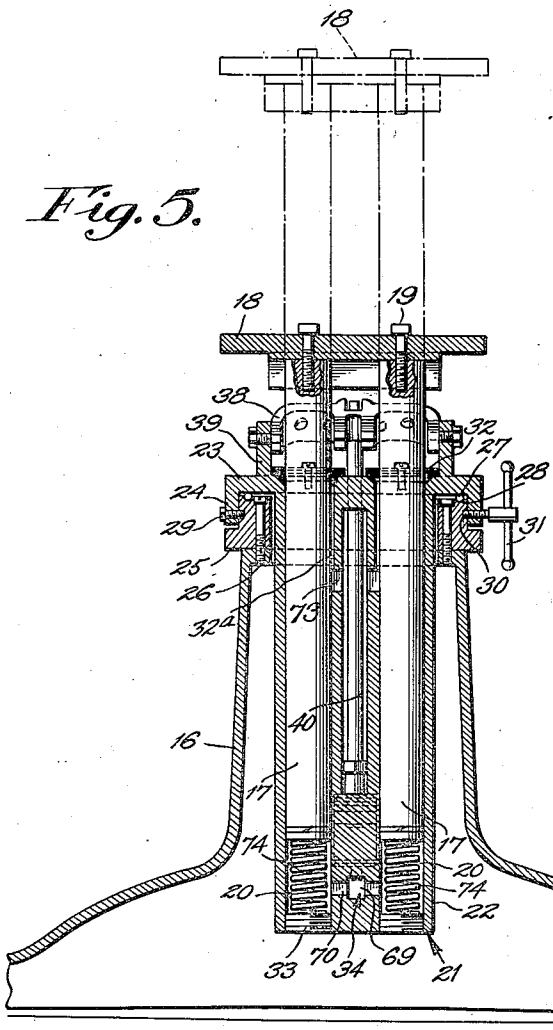
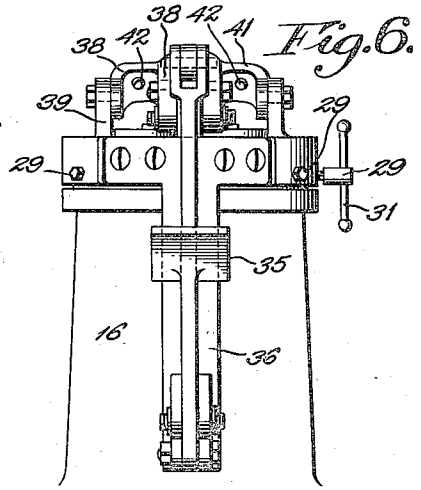


Fig. 6.



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HYDRAULIC LIFT

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Fig. 9.

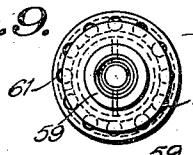


Fig. 11.

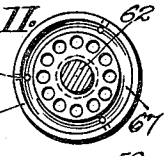


Fig. 7.

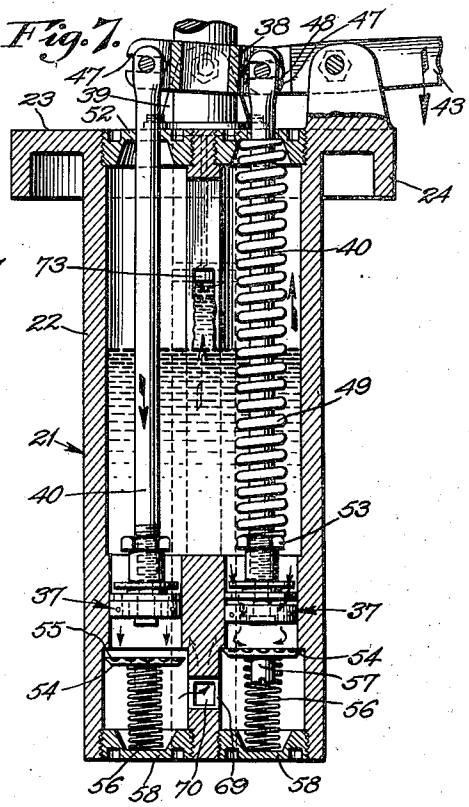


Fig. 10.

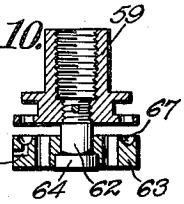


Fig. 8.

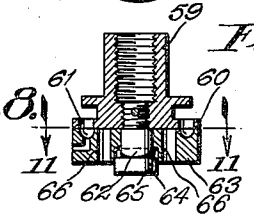


Fig. 12.

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UNITED STATES PATENT OFFICE

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HYDRAULIC LIFT

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Application November 11, 1932, Serial No. 642,278

3 Claims. (Cl. 60—52)

This invention relates to hydraulic lifts, of the type adapted for use in doctor's or dentist's chairs, operating tables etc., adapted to be raised and lowered to dispose the patient at a height or level convenient to perform the professional services. Obviously this class of furniture also includes chairs suitable for use in barber shops, beauty parlors and other establishments of this sort.

This invention comes into being not because of the inadequacy of previous apparatus from the point of view of getting the patient or customer up or down, but is responsive to the thought that it is desirable to raise or lower the patient with the least possible physical sensation to the patient.

The object of the invention is, therefore, to provide compact and highly efficient mechanism for raising and lowering the patient supporting portion of a piece of professional furniture, the raising and lowering to be facilly performed by the administrator of the treatment with the least possible sensation to the occupant of the article of furniture.

Further objects and advantages will be more fully apparent from a description of the accompanying drawings, in which:

Figure 1 is a perspective view of a chair incorporating the present improvements.

Figure 2 is a fragmentary view, certain parts of the view being shown in section and shifted for the purpose of illustrating the position of the treadle and apparatus to permit descent of the chair.

Figure 3 is a fragmentary sectional view illustrating the connection from the treadle to the pumping pistons and showing the chair locked in a particular position of elevation.

Figure 4 is a top plan view of the base or pedestal of the chair, with the chair mounting block removed.

Figure 5 is a sectional view taken on line 5—5, Figure 4, illustrating the mounting and arrangement of the hydraulically operated pistons and their cylinders.

Figure 6 is a fragmentary side view of the top portion of the pedestal illustrating the treadle and general mounting of the rotatable chair support.

Figure 7 is a sectional view taken on line 7—7, Figure 4, detailing the structure of the hydraulic double piston pump and showing the lift pistons at the highest positions with the by-pass functioning.

Figure 8 is an enlarged central sectional view of one of the valves at the base of a pump piston.

Figure 9 is a top plan view of the valve shown in Figure 8.

Figure 10 is a view taken similar to Figure 8, showing the valve in open position.

Fifure 11 is a sectional view taken on line 11—11, Figure 8, detailing the construction of the lower valve element.

Figure 12 is a general view of the pedestal and revolving support for the chair, a portion of the view being shown in section for further illustrating the pump, and the treadle lever being shown in various positions of operation, the full line position indicating position for maintaining the chair in fixed elevated position.

The concept underlying this invention is that it is desirable to elevate the portion of the chair supporting the patient by means of a hydraulic lift device which provides a substantially uniform and even lifting motion. From the point of view of the doctor or person administering the treatment, the foot treadle is not only the conventional instrument used for manipulating the chair, but is the most convenient. The invention, therefore, specifically resides in the particular type of elevating device adapted to be operated by a foot treadle without undue exertion on the part of the operator and adapted to lift the weight of a person gently and uniformly, reducing to a minimum the physical sensation of being lifted.

The invention comprises a two cylinder hydraulic pump adapted to operate plunger mechanism attached to the support for the patient, one piston of the pump being operated by the down stroke of the foot treadle, the other cylinder of the pump being operated by a spring, the power for which is stored in the spring by said downward stroke of the foot treadle. In other words, the downward stroke of the foot treadle both operates one cylinder of the pump for lifting the patient and compresses the spring which in turn executes the upward stroke of the foot treadle and at the same time executes the effective lifting stroke of the other cylinder of the pump.

Therefore, as the operator moves the foot treadle up and down with his foot, the patient is elevated substantially uniformly, evenly and continuously. The thought antecedent to this invention is unusual in that it has not been recognized in the past that the ordinary downward stroke of the foot treadle under the weight of the operator had sufficient power inherent in it both to elevate the patient directly and to

store sufficient power in a spring to continue the elevation during the reverse or return stroke of the foot treadle.

Referring specifically to the drawing, the invention as disclosed consists primarily of a patient support in the form of a chair 15 mounted for rotation and elevation on a pedestal 16, in which pedestal the elevating mechanism is housed. The structure of the chair is not described in detail inasmuch as the present invention is directed entirely to the mounting and lift for this part of the apparatus rather than to the structure of the chair.

The chair is directly mounted on two hydraulically operated pistons 17, 17 by means of an attachment block or plate 18 attached to the upper ends of the pistons by means of screws 19. These pistons extend into the pedestal 16 and are operatively mounted in cylinders 20 as a part of the general elevating unit rotatively mounted on the pedestal or base 16. The main element or body 21 of the hydraulic lift or elevating mechanism includes a cylindrical portion 22 depending into the hollow base 16 and a horizontal supporting flange 23 which includes a downwardly extended lip or flange portion 24 engaged about a circular bearing block 25 fixed to the upper end of the pedestal by screws 26.

A circular arrangement of ball bearings 27 is provided operating in a circular recess 28 in the top of the bearing block 25 and directly supporting the hydraulic lift unit. The lift unit is held in assembly on the bearing block by means of screws 29 disposed laterally through the depending lip or flange 24 and engaged in an annular groove 30 in the bearing block 25. One of these screws has a hand bar 31 at its outer end for hand operation for tightening the set screw into the groove and setting the rotatable chair carrying lift unit in fixed position against rotation.

Suitable oil wiper washers 32 are provided at the upper ends of the cylinders in which the elevating pistons are mounted for preventing oil leakage by way of the cylinder bore. The upper ends of the cylinders are flared for receiving the oil wiped from the pistons, this oil draining back to the reservoir by way of longitudinally disposed grooves 32^a extending to a by-pass slot hereinafter described and communicating with the reservoir.

The lower ends of the cylinders in which the plungers or pistons are mounted are closed by means of plugs 33 and oil is fed to the lower ends of the hydraulic cylinders by means of ports 34 which lead from the cylinders of the pump.

The pump is operated by means of a foot treadle 35. This foot treadle is pivoted at its inner end on a depending pivot bracket 36 which is fixed to the depending flange or lip of the rotatable hydraulic lift unit. The hydraulic pump is duplex including two pistons 37, 37 which operate alternately for forcing the oil into the lower ends of the elevating cylinders. For this purpose a walking beam 38 is fulcrumed on pivot lugs 39 of the main element 21 of the hydraulic unit and has its respective outer ends connected to the upper ends of the respective pistons 37, 37 of the duplex pump by piston rods 40, 40. The pivotal axis of this fulcrumed lever crosses the axis of the elevating pistons and for that reason the lever is formed with pivotal side extensions 41 extending from one end of the lever and curved around the pistons for pivotal attachment on the pivot lugs previously mentioned.

Set screws 42 are provided in the lever 38 and are adapted to engage the elevating hydraulic pistons 17, 17 when the foot treadle is in upper position or in that position in which the chair will be sustained against descent. The action of these screws in sustaining and maintaining the chair in elevated position will be described later in conjunction with certain other coordinated devices.

The treadle lever 35 is connected to the outer end of a fulcrumed operating lever 43 for operating the walking beam 38 by means of a rod 44 extended to an intermediate pivot 45 on the treadle. The inner end of the operating lever 43 is pivotally connected to the pivot 46 between the walking beam and one of the piston rods of the pump. In view of the fact that the pistons and rods of the pump are mounted against lateral displacement from a definite axial position of reciprocation, and since the ends of the beam move on an arc relative to the pivot connections to the piston rods, the walking beam connection to these levers is flexible. To this end the ends of the walking beam are slotted as at 47 and the pivot pins inserted through the upper ends of the piston rods of the beam lie in these slots. The same type of connection is used for the operating lever, the end of this lever being slotted in the same manner as at 48.

As stated before, the hydraulic pump includes two pistons 37, 37. One of these pistons is moved downwardly by downward movement of the foot treadle and upwardly by the expansive action of a coil spring 49 when foot pressure is relieved on the treadle. The reservoir is between the cylinders which are connected by a slot 50 extended between the elevating pistons. The reservoir thus formed and as contained above the pistons supplies the oil to the lift through valves in the pistons operated by movement of the pistons in the respective directions.

The pistons 37, 37 are disposed in cylinder bores 51 formed at the lower end of the hydraulic unit and the piston rods 40 are disposed through guides 52 screwed into the upper end of the ends of the cylinders. The spring 49 of the one piston is disposed under compression between the particular guide 52 and a nut 53 on the rod located just above the piston, thereby constantly exerting a downward force on the piston.

Two valves are provided for each piston, the structure of the piston and its valves being identical for the respective pistons. One of the valves, namely 54, is mounted at the lower end of the cylinder and is urged upwardly against a seat 55 formed by a shoulder in the bore. The valve is urged by means of a compression spring 56 disposed between the valve, about a guide stud 57 thereof, and a closure plug 58 at the extreme lower end of the cylinder.

The other valve contained in each piston is mounted and formed in the following manner: The piston is sectional. One part namely 59 is rigidly fixed on the lower end of the piston rod 40 and includes a main flange 60 including a circular series of ports 61 and forming part of the piston and an axially disposed depending stud 62 for supporting the relatively movable piston part or valve 63. This stud 62 includes a head 64 cooperating with a shoulder 65 formed by a counterbore in the valve element hung thereon. The valve or piston element includes a series of ports 66 circularly arranged on a radius less than that of the radius defining the circular arrange-

ment of ports in the flange of the upper piston section 59.

As shown in Figure 10, when the piston moves upwardly, the lower or movable valve section 63 moves down to rest on the head 64 of a stud 62 leaving a space between the elements whereby the oil will flow downwardly through the upper ports 61 between the plates and downwardly through the ports 66 in the lower element. A circular groove 67 is provided in the top or abutting surface of the lower or valve element 63 on the same radius as the arrangement of ports in the upper element, whereby the oil at all times can enter this groove and pass out the sides of the piston through lubricating passageways 68 extending radially for lubricating the walls of the cylinder and the piston to insure efficient operation of the pistons and working of the valves.

It will be apparent that as a particular piston moves downwardly its contained valve structure will be closed by back pressure against the lower piston or valve section 63, whereas the lower valve 54 in the cylinder will open, the piston then forcing oil past the lower valve and into the lower ends of the elevating cylinders by way of the passageway 34 extending to both cylinders 20 of the lift. At this time the other piston moves upwardly for opening its contained valve permitting oil to flow between the piston and the coordinating valve 54 which is closed at the time.

The outer piston is moved downwardly by foot pressure, at which time the spring 49 operating the other piston is compressed by upward movement of the piston and a piston operating pressure or force built up for operating this piston when the operator relieves pressure on the treadle. This, as stated before, insures a smooth continuous pumping of oil to the elevating cylinders for raising the chair without perceptible jerk.

For the purpose of connecting the lower ends of the pump cylinders to the lower ends of the hydraulic lift cylinders, these respective cylinders of each device are connected by intersecting cross passageways 69, 70.

As shown in Figure 12, there are three positions of importance for the treadle. When the treadle is fully elevated such as will occur when the operator takes his foot off the treadle due to the action of the heavy spring 49 under compression acting on one of the pistons, the walking beam is swung and engages or wedges the stop screws 42 thereof against the elevating plungers at an angle. This action either independently or in conjunction with the closed position of both of the control valves 54 preventing the return of oil from the lift cylinders to the reservoir, locks and maintains the chair in established elevated position.

For further elevation, the operator then depresses the treadle into an intermediate zone or range of movement, indicated in dot and dash lines at 71, where reciprocation of the treadle within this limited intermediate range as induced by combined foot operation and spring operation will accomplish further elevation of the chair, this intermediate range including any of the second general positions for the treadle. When it is desired to permit the descent of the chair, the treadle is fully depressed into the dot and dash position 72 shown in Figure 12, at which time the downwardly moved outer piston 51 contacts the flow control valve 54 as shown in Figure 2 through the medium of the depending stud 62 as shown in Figure 2. This permits the flow of oil from the lower ends of the elevating cylinders back into the pump at a rate of flow resulting in a slow comfortable descent of the chair.

In order to limit the elevation of the chair and elevating pistons, a cross groove 73 is provided between the cylinders of the lift toward the tops thereof, which cross groove or connecting passageway intersects the connection between the cylinders forming the hydraulic pump reservoir. Therefore, when the hydraulic cylinders are filled with oil to the level of this passageway, the oil will then be by-passed back into the reservoir and an idle circulation will result.

In order to limit lowering movement of the chair, springs 74 are provided, one in the lower end of each lift cylinder 20 resting on the closure plug 33 thereof. These springs lie normally expanded in the cylinders and are contacted and compressed by the pistons as they reach lowest position. When the stop springs are compressed an amount in proportion to the weight on the lifting pistons they serve as full and positive stops. Yieldable limiting means are thus provided preventing any jar or abrupt stop as the chair comes down to its limit.

By the present arrangement, the double piston pump, operated by combined foot pressure and spring pressure, and the elevating pistons and cylinders are all contained in the cylindrical element or casing forming the main or body portion 22 of the hydraulic device. The elevation of the chair is uniform and steady with a total elimination of the jerks or interruptions to upward travel as would be caused by interruption in the pumping of oil to the hydraulic pistons. The spring compels the completion of a given cycle of operation.

Having described the invention, I desire to be limited only by the following claims:

1. In a hydraulic lift for professional furniture, a pedestal, a rotatably mounted body for said lift having a main cylindrical portion depending into the pedestal, a pair of hydraulically operated pistons mounted for elevation as a unit in said main element, a pair of pumping pistons mounted in said rotatably mounted body with the common plane of their axes disposed at right angles to the common plane of the axes of the hydraulically operated pistons, leverage means for alternately operating said pumping pistons, said rotatably mounted body including a passageway from the pumping cylinders to the hydraulic lifting piston cylinders, and valves for controlling the flow of fluid under the action of the pump.

2. In a hydraulic lift for professional furniture, a pedestal, a cylinder element mounted for rotation on said pedestal, a lifting piston mounted for vertical reciprocation in a cylinder of said cylinder element, a piston pump mounted in said cylinder element and adapted to pump fluid to the base of said lifting piston, a fulcrumed pump piston operating lever, means for operating said pump operating lever, and an element mounted in said pump operating lever and disposed for engagement with the elevating piston when the pump operating lever is in a predetermined position, said element exerting a lateral wedging action on the elevating piston for locking the same in position of elevation.

3. In a hydraulic lift for professional funiture, a base element, a cylinder element mounted on said base, a hydraulic lift piston mounted for reciprocation in said cylinder element, a double piston pump for pumping fluid to the base of said lifting piston, a fulcrumed lever mounted

on said cylinder element and having its respective ends connected to the respective upper ends of the pump pistons, physical means for swinging the lever in one direction for effective stroke of one pump piston, spring means compressed by said effective movement of said first piston and operative to move the other piston for effective stroke, said fulcrumed lever adapted to engage the elevating piston at an angle, said engagement induced by the spring action on effective stroke of the spring urged piston for wedging the elevating piston in its guide and locking the same in position of elevation.

ELMER F. RIES.