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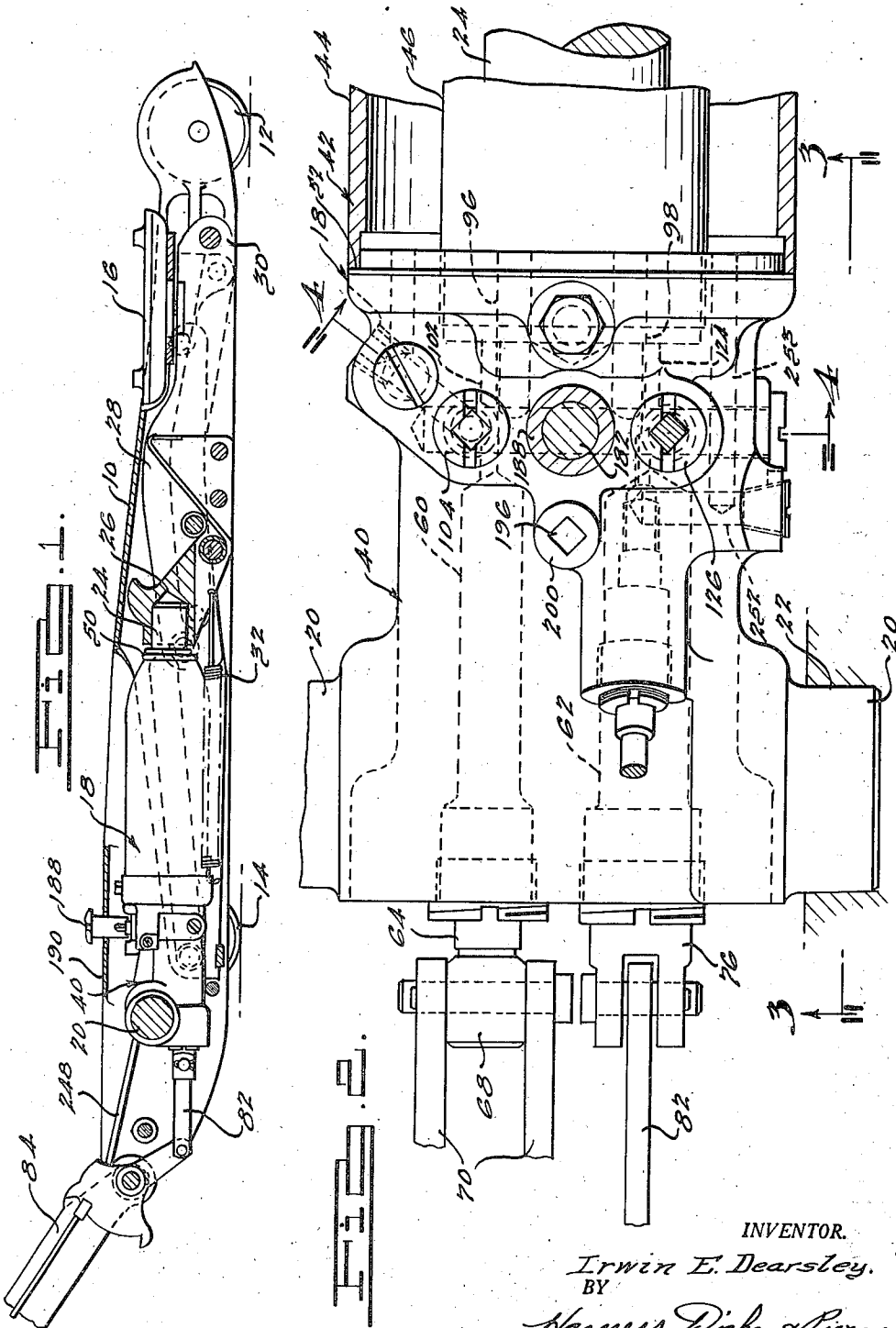
I. E. DEARSLEY

2,439,796

PUMPING MECHANISM

Filed April 6, 1944

3 Sheets-Sheet 1



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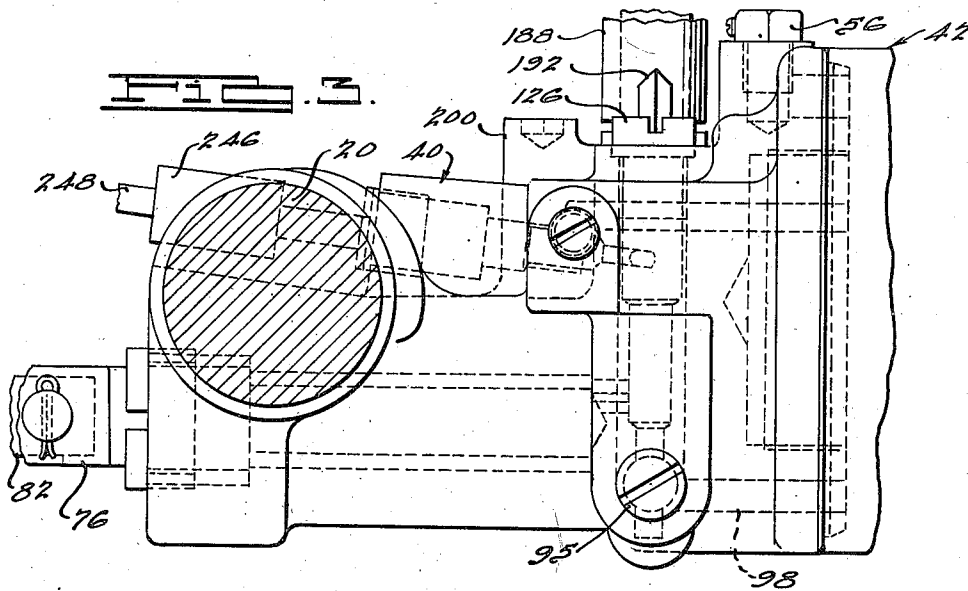
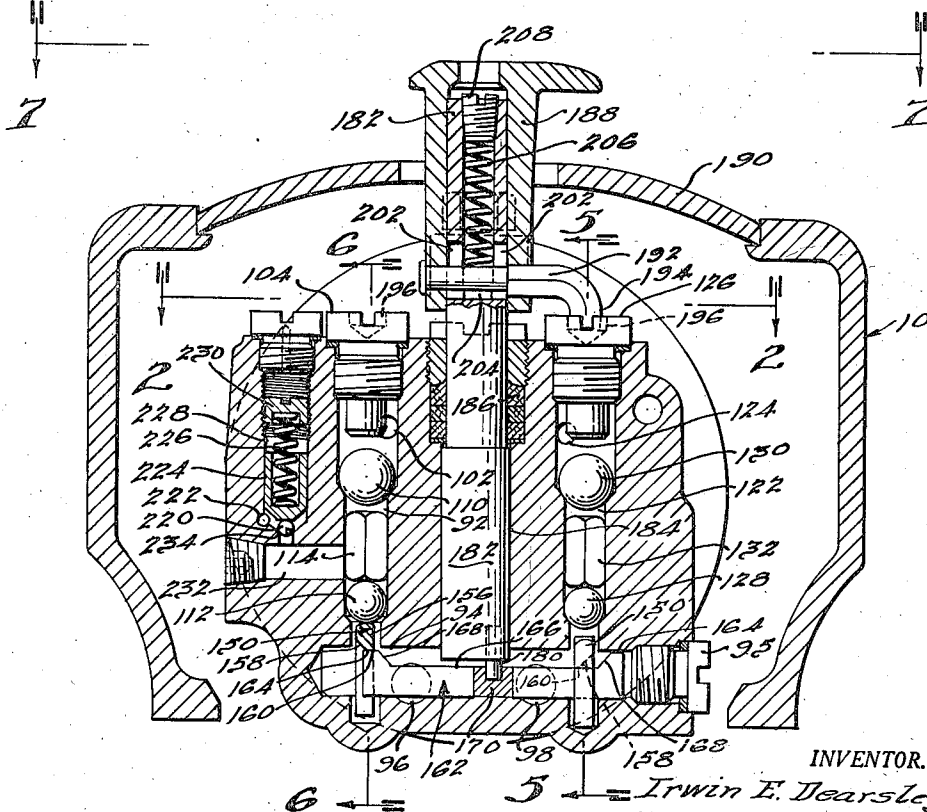
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3 Sheets-Sheet 2



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3 Sheets-Sheet 3

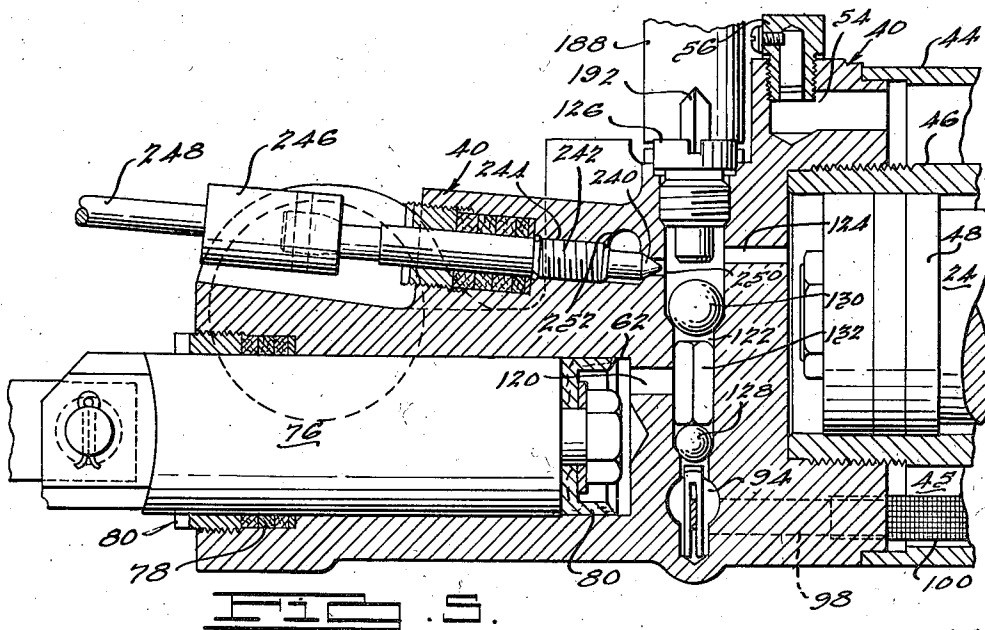
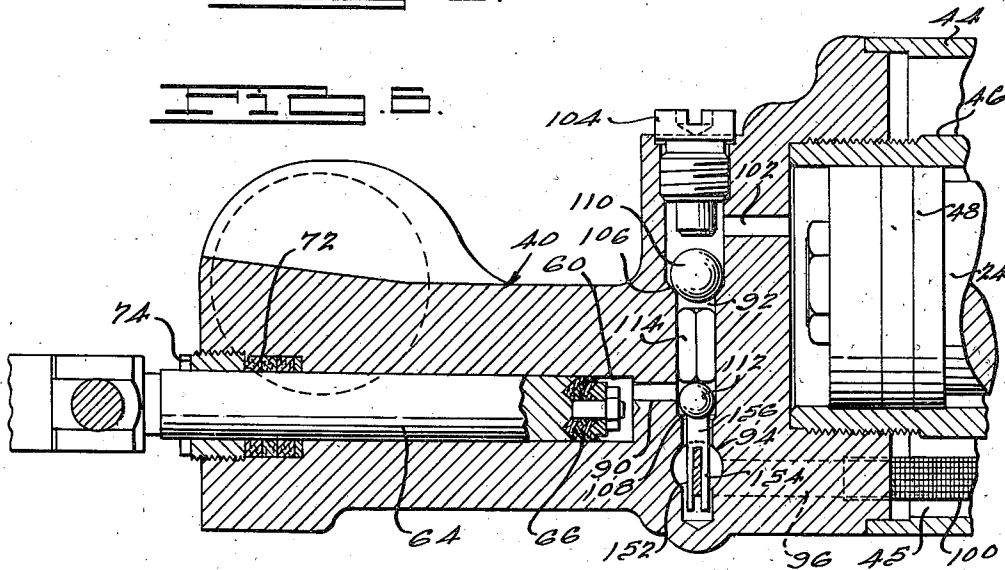
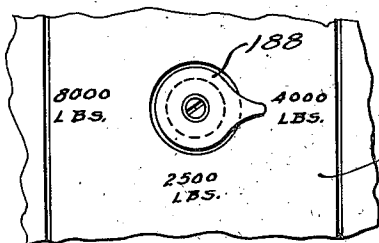


FIG. 7.

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PUMPING MECHANISM

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Application April 6, 1944, Serial No. 529,776

5 Claims. (Cl. 103-41)

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The present invention relates to pump mechanisms well suited for, but not limited to, use with or as a part of hydraulic jack assemblies.

The principal objects of the present invention are to provide a pump mechanism comprising a plurality of pumping elements and operating means therefor, particularly characterized as embodying improved means for rendering the individual elements effective and ineffective at will; to provide such structures wherein the selection between the individual pump elements is accomplished by controlling the fluid circuits which are individual thereto; and to generally improve and simplify the construction and arrangement of pump mechanisms.

With the above as well as other objects in view, which appear in the following description and in the appended claims, a preferred but illustrative embodiment of the invention is shown in the accompanying drawings, throughout the several views of which corresponding reference characters are used to designate corresponding parts and in which:

Figure 1 is a view in side elevation, partly in section, of a floor jack embodying the invention;

Fig. 2 is a plan view of the pump structure employed in the structure of Fig. 1, taken along the line 2-2 of Fig. 4;

Fig. 3 is a view in side elevation, partly in section, taken along the line 3-3 of Fig. 2;

Fig. 4 is a view in vertical transverse section, taken along the line 4-4 of Fig. 2;

Fig. 5 is a fragmentary view in longitudinal section, taken along the line 5-5 of Fig. 4;

Fig. 6 is a fragmentary view in longitudinal section, taken along the line 6-6 of Fig. 4; and

Fig. 7 is a reduced fragmentary plan view, taken along the line 7-7 of Fig. 4.

It will be appreciated from a complete understanding of the present invention that the improvements thereof may be embodied in various different forms and may be utilized for various different purposes. A preferred application of the invention is in connection with multiple pump units for hydraulic jacks and in an illustrative, but not in a limiting sense, the invention is so disclosed herein.

Referring first to Fig. 1, the illustrated floor jack is one which embodies the invention disclosed and claimed in the copending application of Raymond F. Manke, Serial No. 502,780, filed October 17, 1943. For the purposes of the present description, it is sufficient to note that this floor jack comprises a longitudinally extending, relatively low frame structure 10, provided with

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front and rear wheel assemblies 12 and 14, and also provided with a load engaging lifting cap 16. The frame 10 accommodates a hydraulic ram and pump unit 18, which is pivotally supported relative to the frame by means of trunnions 20, which project laterally from the rear end of the unit 18, and are rotatably received in bearings 22 (Fig. 2) provided therefor in the frame structure. The ram piston rod 24, which projects from the front end of the unit 18, carries a head 26, which is coupled to the lifting cap 16 through a linkage which includes the levers 28 and 30. For the purpose of the present description, it is sufficient to note that a projecting or rightward movement of the piston rod 24 causes the cap 16 to be elevated in a substantially linear vertical path. A retracting or leftward movement of the piston rod 24 enables a return of the cap 16 to the illustrated position. As will be understood, such retracting movement may be influenced by the load, as well as by a return spring 32, which is connected between the head 26 and the unit 18.

Referring now particularly to Figs. 2 through 7, the ram and pump unit 18 comprises a multiple pump unit 40, and a combined ram and reservoir unit 42. Unit 42, which may be conventional, comprises an outer, generally cylindrical member 44 and an inner cylindrical member 46. The inner member 46 slidably receives a piston 48, which is secured to the previously mentioned piston rod 24 and is threaded into a counterbore provided in the right-hand end surface of the pump unit 40. The annular space 45 between members 44 and 46 constitutes a reservoir for the operating fluid, preferably oil. It will be understood that a cap 50 (Fig. 1) forms a closure for the right-hand end of the reservoir and that such cap is apertured to accommodate the movements of the piston rod 24. The left-hand end of the outer member 44 is firmly seated upon an annular shoulder 52, provided in the corresponding end of the pump unit 40, all in accordance with conventional practice. In further accordance with conventional practice, oil may be introduced to the reservoir through a passage 54, one end of which opens directly into the reservoir space, and the other end of which may be closed by a plug 56.

In accordance with the broader aspects of the present invention, the multiple pump unit 40 may be arranged to accommodate any desired number of pumps, two being shown by way of illustration. The hereinafter described selecting mechanism is arranged to select either or both of

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the just-mentioned pumps, thereby affording three different operating conditions.

More particularly, the pump unit 40 is illustrated as comprising a unitary body, preferably a casting, which is provided with two laterally spaced, generally horizontally extending pump cylinders 60 and 62. The smaller cylinder 60 slidably receives a cylindrical piston 64, which is provided at its inner end with a usual packing element 66. The left-hand end of the piston 64 projects outwardly of the pump body and is provided with a head 68 to which a pair of handle operated links 70 are pivotally connected. A packing gland 72 and packing nut 74 serve to prevent leakage along the piston 64. The larger cylinder 62 slidably receives a cylinder piston 76, which is provided with packing elements 78 and 80. The outwardly projecting end of piston 76 is bifurcated and is pivotally connected to a handle operated link 82. Referring again to Fig. 1, the links 70 and 82 are conventionally connected to a usual ratchet type handle 84, reciprocating movements whereof serve to correspondingly and simultaneously reciprocate the pistons 64 and 76.

The smaller or power pump cylinder 60 communicates with the reservoir 45 through a short, longitudinally extending passage 90, the vertically extending passage 92, a horizontally extending passage 94, and either of the two parallel longitudinally extending passages 96 and 98, it being noted that the latter passages 96 and 98 are provided with conventional strainers 100. The just-mentioned cylinder 60 also communicates through passages 90 and 92 and a longitudinally extending passage 102, with the interior of the ram cylinder 46. The vertical passage 92, the upper end whereof is closed with a removable plug 104, is provided with an upper conical valve seat 106 and a lower conical valve seat 108. Seats 106 and 108, respectively, accommodate usual ball valves 110 and 112, which are also provided with a usual spacer 114.

As thus far described, it will be appreciated that a leftward or intake movement of piston 64 is effective to draw fluid from the reservoir 45 through either or both of the parallel connected passages 96 and 98, past the ball 112, and through passage 90 into cylinder 60. During such movement, ball 110 remains seated. During a discharge or rightward movement of piston 64, on the other hand, (except as modified by the hereinafter described adjusting elements) fluid is discharged from cylinder 60 through passages 90 and 92, past ball valve 110, and through passage 102 into the ram cylinder 46. During this discharge stroke of the piston 64, ball valve 112 remains seated under the influence of the pressure existing in passage 90 and in that part of passage 92, which is above valve 112.

Similarly, the larger or speed pump cylinder 62 communicates with the reservoir 45 through a longitudinally extending passage 120, a vertical passage 122, the previously mentioned horizontal passage 94, and either or both of the previously mentioned longitudinally extending passages 96 and 98, both of which open into the lateral passage 94. The cylinder 62 communicates with the ram cylinder 46, through passages 120 and 122 and through a communicating longitudinal passage 124. As in the case of the vertical passage 92, passage 122 is provided with a closure plug 126 and conventional inlet and discharge ball valves 128 and 130. These valves are provided with a usual spacer 132.

During an intake stroke of piston 76, fluid is

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drawn from reservoir 45 through either or both of passages 96 and 98, through passages 94, 122 and 120 into cylinder 62. During this movement, ball valve 128 is conventionally lifted from its seat by the differential pressure acting upon it and ball valve 130 remains seated. During a discharge or rightward stroke of piston 76 (except as modified by the hereinafter described adjusting mechanism), fluid is discharged from cylinder 62 through passages 120 and 122, past ball valve 130 and through passage 124 into the ram cylinder 46. During such discharge stroke, valve 128 remains seated, as in the case of valve 112.

As thus far described, each stroke of the handle draws fluid into and discharges it from both of the speed and power pumps, thereby advancing the ram piston 48 at a rate determined by the combined displacements of the two pumps.

Coming now to the selective or adjusting mechanism of the present invention, the inlet ball valves 112 and 128 are provided with similar but oppositely positioned lifters 150, which are loosely received in the lower ends of the corresponding vertical passages 92 and 122. Each lifter 150 is of bifurcated form, having downwardly extending spaced legs 152 and 154, which are joined together at their upper ends by a connecting portion 156, having a rounded upper surface. The lower surface of the connecting portion 156 is provided with an angled portion 158 and a generally horizontal surface 160.

The lifters 150 continuously straddle a shuttle 162, having elevated end surfaces 164, which are connected to the depressed central surface portion 166 by angled cam surfaces 168.

The shuttle 162 is disposed to occupy any one of three positions, consisting of (1) the right-hand position shown in Fig. 4, in which the left-hand elevated surface 164 thereof is engaged beneath the surface 160 of the left-hand lifter 150, thereby enabling the latter to maintain the ball valve 112 in elevated position above its seat; and in which the right-hand elevated surface 164 of the shuttle is displaced from the right-hand lifter 150, enabling it to occupy its lowermost position in which it does not interfere with the normal operation of the ball valve 128; (2) a left-hand limit position in which the left-hand elevated surface 164 of the shuttle is displaced from the left-hand lifter 150, enabling it to assume its lowermost position in which it does not interfere with normal actions of the ball valve 112, but in which the right-hand elevated surface 164 maintains the right-hand lifter in elevated position in which it maintains ball valve 128 off of its seat; and (3) a central position in which both lifters are enabled to occupy their lowermost positions, between the elevated shuttle surfaces 164 and, consequently, do not interfere with normal movements of either of the ball valves 112 and 128.

In the broader aspects of the invention, various means may be utilized to actuate the shuttle between the above-identified different operating positions. In the illustrated instance, manual means are provided for this purpose. More particularly, the central portion 170 of the shuttle 162 is enlarged to provide a bearing opening which receives a crank pin 180 provided at the lower end of a post 182, which is rotatably received in a vertical bore 184 provided in the pump body. In view of the fact that the lower end of post 182 projects into the fluid passage 94, which receives the shuttle 162, suitable packing 186 is provided for the upper end of post 182.

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The upper end of post 182 is provided with an operating handle 188, which as shown projects above the cover plate 190, associated with the frame structure of the jack (Figs. 1, 4 and 7). Connecting means similar to that described below in connection with element 248 may, of course, be provided to enable operation of handle 188 from other positions, for example, at the handle 84. Means are preferably provided to releasably latch the handle 188 in each of its operating positions. To accomplish this, the handle 188 is tubular in form and is slidably fitted over the upper end of the post 182. A locking pin 192 is passed through the handle 188 and is provided with a downwardly turned end portion 194, which is adapted to cooperate with locking recesses 196 provided in the previously mentioned plugs 104 and 126, and in a supplemental plug 200. The pin 192 rides in slots 202 provided in the walls of the counterbored portion 204 at the upper end of the post 182. A spring 206 seated between a stud 208 and the pin 192 serves to continuously urge the handle 188 downwardly. The stud 208 is threaded into the upper end of the post 182.

It will be noticed that rotative movements of the post 182 cause both lengthwise and lateral movements of the shuttle 162 and of the lifters 150. The passage 94, the right-hand end whereof is conventionally closed by the plug 95, and the lower ends of the vertical passages 92 and 122 are large enough to accommodate these lateral and longitudinal movements. It will be noticed, too, that in being moved from its illustrated right-hand position to its left-hand position, the shuttle first enables the left-hand lifter 150 to move to its lowermost position during which the cooperating angled surfaces 158 and 168 engage each other. Thereafter, the right-hand angled surface 168 engages the angled surface 158 of the right-hand lifter and cams it to its uppermost position, in which the cooperating surfaces 160 and 164 engage each other. A reverse operation, of course, takes place during the course of rightward movements of the shuttle 162 from its left-hand position to its right-hand position. Upon release of the lifting force of their associated lifters 150, the ball valves 112 and 128 and their associated spaces 114 and 132 resume their lower positions under the influence of gravity.

In accordance with usual practice, the illustrated power pump is provided with a spring loaded by-pass valve assembly. The assembly comprises a ball 220 which is held on the seat 234 by an adjustable compression spring 226, the tension whereof may be adjusted by plug 230. The seat includes a passage which communicates through a plugged passage 232 with the previously mentioned vertical passage 92. The bore 228 communicates directly with the reservoir 45 through the passage 222. With this arrangement, it will be appreciated that so long as the pressure developed in the passage 92 by the power pump 64 is below a predetermined valve setting, valve 220 remains closed. If such pressure exceeds the value for which this valve is set, valve 220 is lifted from its seat, enabling the fluid discharged from the power pump to be by-passed to the reservoir.

In further accordance with conventional practice, the present assembly is provided with a release valve 240 (Fig. 5) the shank 242 whereof is threaded into a threaded passage 244 provided therefor in the pump body. The outwardly projecting end of the shank 242 is conventionally

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coupled as through a universal joint 246 to a rotatable operating rod 248, which may extend along the handle 84 for convenient access by the operator. Valve 240, when closed, closes off a passage 250, which communicates with the previously mentioned vertical passage 122. When opened, valve 240 connects passage 250 with reservoir return passages 252 and 253 and enables the fluid in the ram cylinder 46 to be returned to the reservoir through passages 124, 122, 250, 252, and 253.

Considering the operation of the system as a whole, the parts are illustrated, as aforesaid, in a position in which the left-hand lifter maintains the associated ball valve 112 in its elevated position. In this position of the shuttle, ball valve 128 is free to act normally. The system is, consequently, adjusted so that the smaller or power pump is ineffective and the larger or speed pump is effective. This adjustment corresponds to an intermediate load capacity, for a given handle effort, and to an intermediate rate of lifting movement. Such adjustment may conveniently be indicated on the cover plate 190, in the region of the handle 188 (Fig. 7).

Assuming now that the jack handle 84 is reciprocated, successive equal intake and discharge strokes of the pump pistons 64 and 76 result. During each such intake stroke, oil is withdrawn from the reservoir 45, through passages 96, 98, 94, 92 and 90, into the power pump cylinder 60; and through passages 96, 98, 94, 122 and 120 into the speed pump cylinder 62. During such oil flow, ball valve 112 is held in the elevated position by its lifter 150 and ball valve 128 is lifted off its seat by the differential pressure acting upon it.

During the following discharge stroke, the pressure in passage 120 and in that part of passage 122, which is above ball valve 128, causes this valve to seat, closing off the inflow circuit. The pressure in the just-mentioned passages, consequently, unseats valve 130 and causes a flow through passage 124 into the ram cylinder 46. This flow develops a pressure therein which initiates the rightward movement of the ram piston 48, thereby initiating the elevating movement of the jack.

The discharge stroke of the power pump piston 64 tends to build up a pressure in passage 114, tending to unseat valve 110. This pressure is, however, very slight, since a virtually unrestricted flow back to the reservoir through passages 92, 94, 96 and 98 is permitted. This flow takes place past the mechanically restrained open ball valve 112.

So long, therefore, as the present adjustment is retained, successive strokes of the handle 84 draw fluid into the speed pump and discharge such fluid into the ram cylinder, continuing the elevating movement at a rate determined by the displacement of the speed pump. Such strokes also serve to draw fluid into the power pump and return such fluid directly to the reservoir. Since the circuit associated with the inactive pump (in this case the power pump) allows a substantially unrestricted flow, it will be appreciated that only a negligible amount of handle effort is involved in circulating the fluid to and from the inactive pump.

The just-mentioned setting of the pump mechanism is particularly suited for lifting loads of intermediate magnitude. For lifting heavier loads, the minimum-speed but maximum-load-capacity setting may be used. To do this, the handle 188 may be lifted so as to release the locking pin 192, after which the handle may be

rotated to its opposite position in which the shuttle 162 and the right-hand lifter co-operate to maintain ball valve 128 off of its seat and to permit normal operation of ball valve 112. It is believed obvious that under these conditions, successive handle strokes serve only to draw fluid from the reservoir into the speed pump and to thereafter return such fluid to the reservoir. Such handle strokes, however, serve to alternately draw fluid from the reservoir into the power pump and to thereafter discharge such fluid into the ram cylinder. By virtue of the smaller displacement of the power pump, each such stroke produces a smaller amount of lifting movement, but, for a given handle effort, produces a greater lifting force.

Under conditions when the jack is either unloaded or relatively lightly loaded, a maximum lifting speed is preferable. To accomplish this, the handle 188 is turned, as before, to its intermediate position, in which the shuttle 162 enables both lifters 150 to drop to their inactive positions. Under these conditions, both the speed and power pumps are active and the lifting rate is determined by the combined displacements of the two pumps.

Although only a single specific embodiment of the invention has been described in detail, it will be appreciated that various modifications in the form, number and arrangement of parts may be made without departing from the spirit and scope of the invention.

What is claimed is:

1. In a pumping system for transferring fluid from a first space to a second space, a plurality of pump units, operating means common to said units, passage means through which fluid is drawn from said first space by said units, said passage means including a portion common to said units and portions individual thereto, valve means in each said individual portion and normally operative to prevent a reverse flow therethrough, and control means common to said valve means for controlling the effectiveness thereof, said control means being movably positioned in said common passage portion.

2. In a pumping system for transferring fluid from a first space to a second space, a plurality of pump units, operating means for said units, passage means through which fluid is drawn from said first space by said units, said passage means

including a portion common to said units and portions individual thereto, valve means in each said individual portion and normally operative to prevent a reverse flow therethrough, and control means common to said valve means for controlling the effectiveness thereof, said control means being movably positioned in said common passage portion.

3. The structure of claim 2 wherein said control means includes a longitudinally movable member having spaced cam surfaces respectively cooperable with said valves.

4. The structure of claim 2 wherein said control means includes a longitudinally movable member having spaced cam surfaces respectively cooperable with said valves, said control means having an intermediate position in which it is out of cooperative relation to said valves and having terminal positions at either side of said intermediate position in each of which it is effective to open a corresponding one of said valves.

5. The structure of claim 2 including a manually operable device for moving said control means so as to selectively open either one of said valves and so as to be out of cooperative relation to said valves.

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