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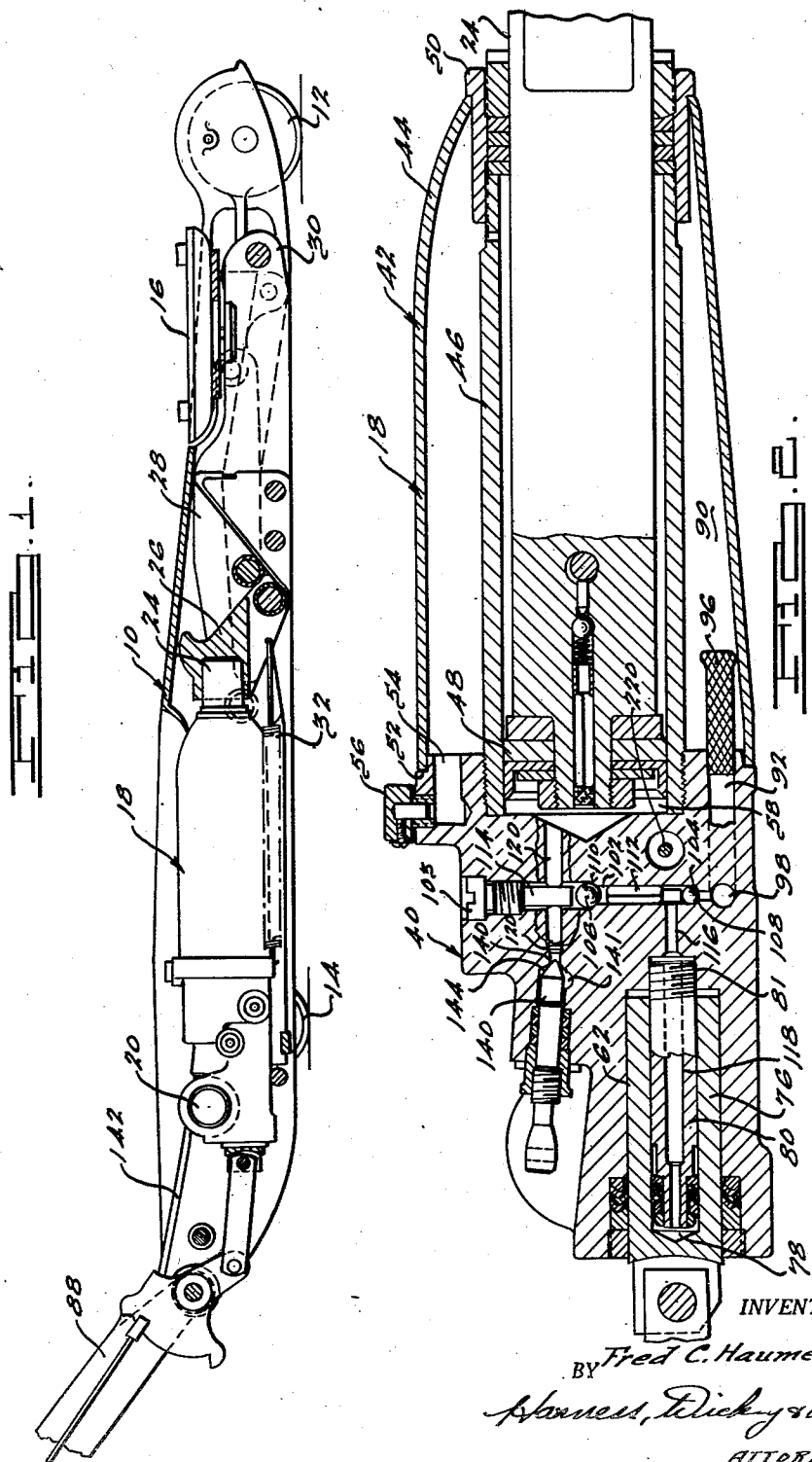
F. C. HAUMERSON

2,447,650

PUMP MECHANISM

Filed April 17, 1944

3 Sheets-Sheet 1



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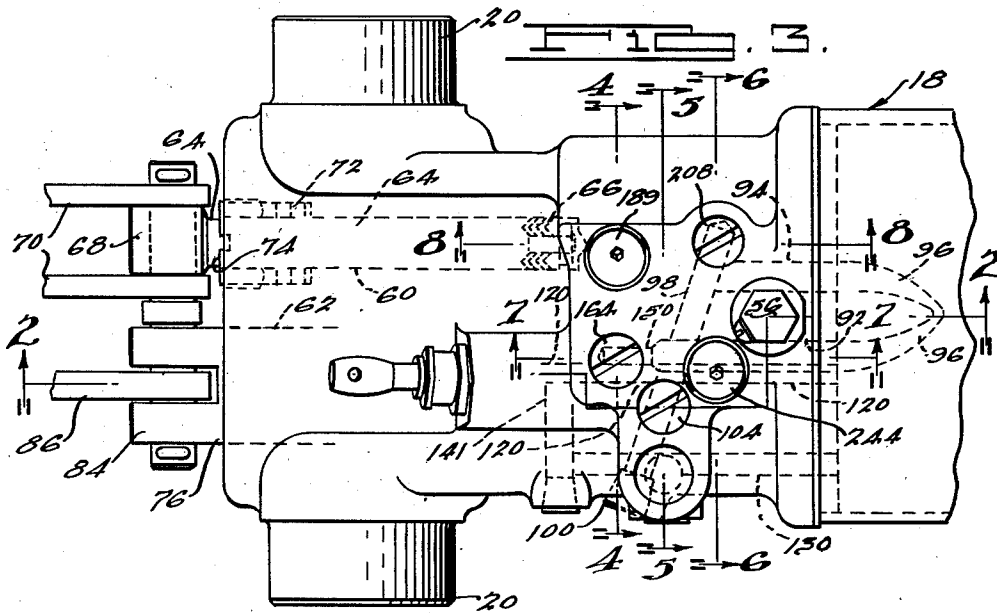
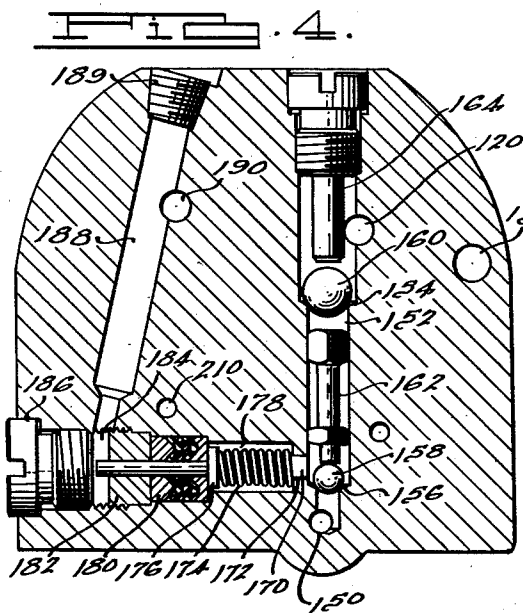
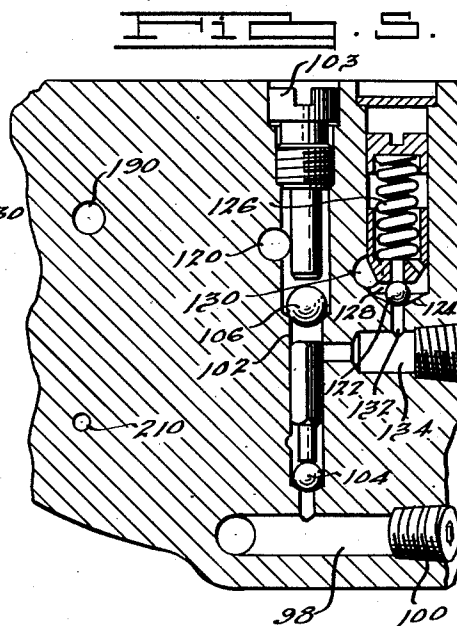
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PUMP MECHANISM

Filed April 17, 1944

3 Sheets-Sheet 2



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PUMP MECHANISM

Filed April 17, 1944

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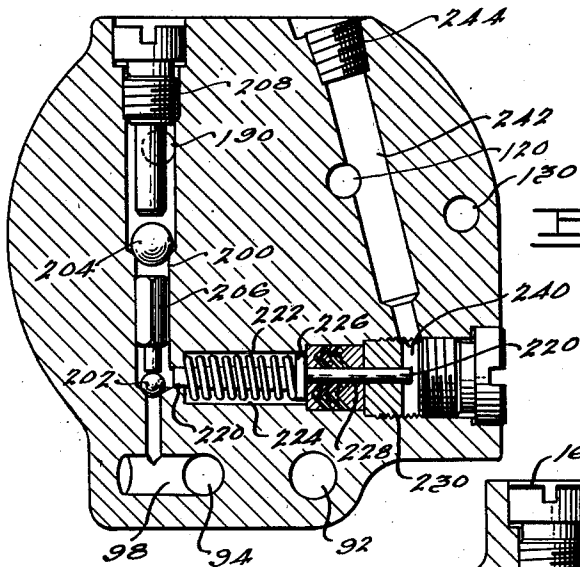


FIG. 6.

FIG. 7.

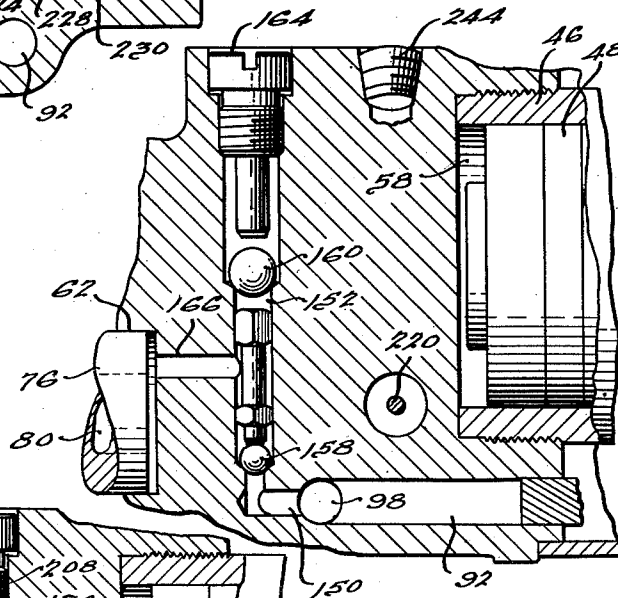
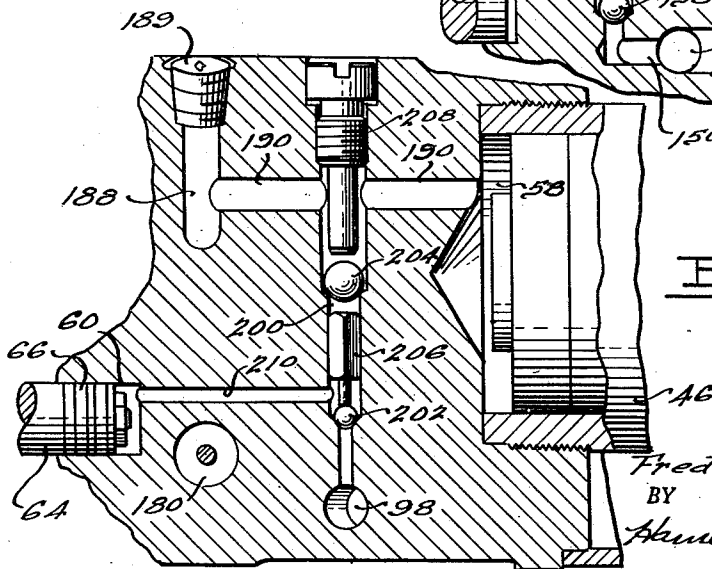


FIG. 8.



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2,447,650

PUMP MECHANISM

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Application April 17, 1944, Serial No. 531,332

2 Claims. (Cl. 103—40)

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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 embodying an improved arrangement for selectively rendering the successive strokes of a pump piston or equivalent element effective and ineffective to transmit fluid from a source of fluid to an associated work chamber; to provide such a structure wherein the just-mentioned arrangement may be caused to operate automatically when the pressure in the work chamber reaches a predetermined value; to provide such a structure embodying an inlet check valve between the source and the pump, and further embodying means to control the position of such check valve so as to selectively render it effective and ineffective to prevent a reverse flow from the pump to the source; to provide such a structure employing a plurality of simultaneously operable pump units and embodying the aforesaid improved arrangement for automatically placing one or more of the pump units into or out of service; and to generally improve and simplify the construction and arrangement of pump mechanisms of the above indicated type.

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 fragmentary view in longitudinal, vertical section of the structure shown in Fig. 1, taken along the line 2—2 of Fig. 3;

Fig. 3 is a fragmentary view in top plan of the structure shown in Fig. 1;

Fig. 4 is a view in transverse, vertical section, taken along the line 4—4 of Fig. 3;

Fig. 5 is a view in transverse, vertical section, taken along the line 5—5 of Fig. 3;

Fig. 6 is a view in transverse, vertical section, taken along the line 6—6 of Fig. 3;

Fig. 7 is a fragmentary view in longitudinal, vertical section, taken along the line 7—7 of Fig. 3; and

Fig. 8 is a fragmentary view in longitudinal, vertical section, taken along the line 8—8 of Fig. 3.

It will be appreciated from a complete under-

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standing 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 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 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 8, 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 50 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 invention, the multiple pump unit 40 may be arranged to accommodate any desired number of pumps, three being shown by way of illustration. The hereinafter described selecting mechanism is arranged to automatically respond to the magnitude of the load applied to the lifting cap 16, and to thereby either cause all three of the pumps, two of the pumps, or only one of the pumps to be effective to transmit fluid from the reservoir to the chamber space 58 behind the piston 48. It will be appreciated that by suitably proportioning the relative sizes of the several pumps, and the loadings at which such pumps are placed in or taken out of service, any desired ratios of handle effort and of lifting speeds can be afforded.

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 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 a packing nut 74 serve to prevent leakage along the piston 64.

The larger cylinder 62 slidably receives a cylindrical member 76, which constitutes the piston of the largest or speed pump unit. Member 76 is provided with a bore 78, which slidably receives the cylindrical piston 80. Piston 80 is threadably secured in a counterbore 81 provided at the inner end of the cylindrical bore 62. Member 76 thus functions both as a piston and as a cylinder, the pump unit comprising member 76 and piston 80 being, in the present case, the so-called power pump, which remains continuously in service. The other two pumps, the cylinders for which are designated 60 and 62, are the intermediate and speed pumps, which are automatically placed in and taken out of service in the hereinafter described manner.

The outwardly projecting end 84 of member 76 is bifurcated, and is pivotally connected to a handle-operated link 86. Referring again to Fig. 1, links 70 and 86 are conventionally connected to a usual ratchet type handle 88, reciprocating movements whereof serve to correspondingly and simultaneously reciprocate members 64 and 76 in their respective cylindrical bores.

Coming now to the fluid circuits through which the above-mentioned pumps serve to transfer fluid from the annular reservoir 90 to the ram chamber 58, a pair of laterally displaced passages 92 and 94, fitted with usual strainers 96, open, at their right-hand ends, into the reservoir 90, and open, at their other ends, into the diagonally extending header passage 98. Passage 98 is drilled in from one side of the pump body, and its outer end is closed by a usual plug 100. Adjacent the plugged end thereof, as shown in Figs. 2 and 5, passage 98 communicates with

a vertically extending, stepped passage 102, the upper end whereof is closed by a removable plug 103. Passage 102 is provided with usual inlet and outlet ball type check valves 104 and 106, which are provided, respectively, with seats 108 and 110. A usual spacer 112 is slidably received in bore 102, between the just-mentioned check valves, and plug 103 is provided with a usual post 114, which limits the upward movement of ball 106. Intermediate the seats 108 and 110, passage 102 communicates with a longitudinally extending passage 116, which opens into the counterbore 81 and which communicates through the axial passage 118 in piston 80, with the previously-mentioned power pump chamber 78. Above the valve seat 110, passage 102 communicates with a longitudinally extending passage 120, which opens directly into the ram chamber 58.

With the above described relation, it will be appreciated that a leftward or intake movement of member 76 enlarges chamber 78 and causes fluid to be drawn into header 98 through the passages 92 and 94. From header 98, the fluid flows past valve 104 and through passages 102, 116 and 118 into chamber 78. Under these conditions, check valve 106 remains closed, either under the influence of its own weight, or under the influence of any fluid pressure existing in the ram chamber 58. During the succeeding rightward or discharge movement of pump member 76, on the other hand, the just-mentioned fluid is forced outwardly of chamber 78, through passages 118 and 116 and thence through passage 102, past ball 106, and through passage 120 into the ram chamber 58. During this stroke, valve 104 is maintained on its seat under the influence of the fluid pressure in passage 102.

In accordance with usual practice, the power pump, comprising piston 80, is provided with a usual spring loaded relief valve 122, which is normally maintained on its seat 124 by means of the biasing spring 126. The chamber 128, associated with valve 122, communicates directly with the reservoir 90 through passage 130 and communicates with passage 102 through a short vertical passage 132 and a plugged horizontally extending passage 134.

In addition and in accordance with usual practice, the present unit employs a conventional release valve 140, which may be turned from the illustrated closed position to an open position, by means of a usual remote connection 142, which may and preferably does extend to the hand grip of the jack handle 88. The previously mentioned relief passage 130 communicates with the chamber 144, associated with valve 140, through passage 141. Chamber 144 also communicates with the ram chamber 58, through the previously mentioned passage 120. It will be understood that by opening valve 140, all fluid in the ram chamber 58 can be directly returned to the reservoir through the just-mentioned release circuit.

The reservoir passage 92 is drilled through and past the header 98 and its inner and reduced end portion 150 opens into a vertical passage 152, associated with the speed pump, the cylinder for which is designated 62. Passage 152 is provided with check valve seats 154 and 156, which accommodate the inlet and outlet ball check valves 158 and 160. Passage 152 is also provided with a usual spacer 162, and its upper end is closed by a plug 164. Between the valves 158 and 160, the vertical passage 152 communicates with a longitudinal passage 166, which opens into the inner end of a cylinder 62 within the annular space

which surrounds the piston 80. Above the outlet check valve 160, passage 152 intersects a longitudinal passage 120, which opens directly into the ram chamber 58.

As thus far described, it will be appreciated that a leftward or intake stroke of member 76 draws fluid from the header 90 into passage 152, past check valve 158 and thence through passage 166 into cylinder 62. During this stroke, valve 160 remains closed. During the discharge or rightward stroke of member 76, the just-mentioned fluid is forced outwardly through passage 166, into passage 152, past valve 160, and thence through passage 120 into the ram chamber 58. During this stroke, valve 158 normally remains closed under the influence of the fluid pressure in line 152.

In accordance with the present invention, the pump unit comprising member 76 and cylinder 62 is automatically taken out of service when the pressure in the ram chamber 58 is at or above a predetermined value, by means which maintain the inlet check valve 158 off its seat. As illustrated, (Fig. 4) this is accomplished by providing a spring-biased operating post 170, which is slidably received in a short bore 172, which opens into the passage 152 in the vicinity of valve 158. Post 170 is normally held in the illustrated retracted position, by means of a compression spring 174, which surrounds it and which is seated between a collar 176, fixed to rod 170, and the base of a counterbore 178.

Post 170 extends through a gland 180, held in place by a packing nut 182, and projects into a small chamber 184. The outer end of chamber 184 is closed by a removable plug 186 and this chamber communicates, through a plugged vertical passage 188, with the longitudinal passage 190, which opens directly into the ram chamber 58. Pressure within chamber 184, and which acts against the outer end of post 170, is thus at all times equal to the pressure within the ram chamber. Such pressure opposes spring 174, it being understood that so long as fluid pressure applied to post 170 is below a predetermined value, spring 174 is effective to maintain post 170 in its left-hand or retracted position. In such retracted position, post 170 does not interfere with the normal opening and closing movements of valve 158.

Assuming now that the load against which the jack is acting is sufficiently high to establish a fluid pressure in the ram chamber 58 which overcomes the biasing effect of spring 174, post 170 is actuated to its projected position in which it prevents a reclosing movement of valve 158. More particularly, it may be assumed that such superior ram pressure is attained during a discharge stroke of the pumping mechanism. During such discharge stroke, the pressure in chamber 184 is substantially equal to the pressure in chamber 152. The latter pressure acts with the spring 174 and post 170 thus remains in its retracted position until the end of the discharge stroke in question. At the beginning of the succeeding intake stroke, on the other hand, the pressure in passage 152, below valve 160, falls to a very low value. Under these conditions, the fluid pressure applied to post 170, through chamber 184, is opposed only by spring 174 and, under the conditions stated, is effective to move post 170 to the right, as viewed in Fig. 4. Since an intake stroke is now in progress, valve 158 may be regarded as already off its seat, and the rightward movement of post 170 thus serves to force valve 158 to the

right-hand side of passage 152, in which the underside of valve 158 rests upon the annular rim of its seat 156. At the conclusion of the intake stroke in question, fluid is forced out of cylinder 62 through passage 166, and the resultant fluid pressure in the lower part of passage 152 tends to reseal valve 158. In the elevated position in which valve 158 is now held by post 170, however, a substantially free and unobstructed return passage 150 to the reservoir, through passage 150 and header 90, is afforded. The just-mentioned seating pressure acting against valve 158 is thus very low and is ineffective to return the valve to the closed position. So long as the ram load remains above the above-mentioned predetermined value, therefore, inlet valve 158 continuously remains in the open position. Accordingly, the intake and discharge strokes of the speed pump serve only to draw fluid from the reservoir into cylinder 62 and return such fluid directly to the reservoir through the inlet circuit. Substantially no handle effort is utilized in producing the just-mentioned transfer of fluid.

Referring now to the fluid circuits associated with the intermediate pump unit 60-64, header 98 communicates immediately adjacent its inner end with a vertical passage 200, which is provided with inlet and discharge ball valves 202 and 204. Passage 200 is also provided with a usual spacer 206, and a closure plug 208. Between the inlet and outlet check valves 202 and 204, passage 200 communicates with a longitudinal passage 210, which opens into the inner end of cylinder 60. The inlet circuit for the intermediate pump unit 60-64 thus extends from the header 98, through passage 200, past the inlet valve 202, and through the passage 210 into cylinder 60. The discharge circuit for this pump extends from cylinder 60, through passage 210, the upper portion of passage 200, past check valve 204, and through passage 190 (which passes through passage 200), into the ram chamber 58. It will be understood that the normal operation of this pump is the same as that of the other pumps.

In further accordance with the present invention, the intermediate pump 60-64 is provided with control means similar to that described in connection with the speed pump. More particularly, a control post 220 is slidably received in a bore which opens into the passage 200 in the region of valve 202. Post 220 is biased to its retracted position by a compression spring 222, which is seated between the end of the counterbore 224 and a collar 226 fixed on post 220. Post 220 extends through a packing gland 228 and a packing nut 230 into a small chamber 240. Chamber 240 communicates, through a plugged vertical passage 242, provided with a plug 244, with the previously mentioned longitudinal passage 120, which opens directly into the ram chamber 58.

As in the case of the speed pump, post 220 is held retracted, so long as the pressure in the ram chamber is below a predetermined value. During the course of the first intake stroke of pump 60-64, which follows a rise in the pressure in the ram chamber above such value, however, post 220 is quickly moved to its projected position, in which it is effective to hold valve 202 in the open position. So long as the ram pressure is above this set value, valve 202 remains open, and the intake and discharge strokes of piston 64 serve only to draw fluid from the reservoir and return it thereto through the inlet circuit.

As mentioned above, the pressure values at

which the respective speed and intermediate pumps are taken out of service may be varied widely to suit different operating conditions. As an example, the pressure settings may be such that when the floor jack is unloaded, as when the lifting cap is being elevated into initial engagement with the load, all three pumps are in service. Each handle stroke thus produces a lifting movement determined by the combined displacements of all three pumps, producing a relatively rapid travel. The initial engagement of the lifting cap with the load, of course, immediately increases the pressure in the ram chamber to a substantial value, and normally the control setting for the speed pump is such that for intermediate loads the speed pump is taken out of service at the time of such engagement. For certain types of such intermediate loads, the resistance to lifting motion may not be substantially increased during the continued travel of the jack. In such cases, the power and intermediate pumps may remain effective throughout the balance of the lifting movement, affording an intermediate lifting rate without requiring an undue handle effort.

In cases where the load is well above an intermediate value, it is desirable to effect the lifting movement by the use of only the power pump. Accordingly, the control setting for the intermediate pump 60—64 is set at a value considerably above the control setting for the speed pump. If and when the load reaches a value corresponding to such higher setting, the intermediate pump is taken out of service. As will be understood, this higher load value may be reached, in certain cases, at the time the load is initially engaged and may be attained, in other cases, during the course of the lifting movement.

The power pump remains continuously in service, as aforesaid, a limit to the force which may be applied to the load therethrough being afforded by the relief valve 122.

To lower the load, as aforesaid, the release valve 140 may be turned to the open position, affording a direct exhaust circuit from chamber 58 to the reservoir. When, during the course of the consequent lowering movement of the jack, the load falls below the respective control settings of the speed and intermediate pumps, the springs 174 and 222 associated therewith become effective to retract their control posts 170 and 220, thereby restoring the corresponding inlet valves to their normally effective conditions.

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 mechanism for transferring fluid from a first space to a second space, pumping means for effecting said transfer, means including a passage between said spaces through which fluid is caused to flow by said pumping means, spaced inlet and outlet valve seats in said passage and valves therefor, means defining a passage opening into said first-mentioned passage between said seats, and a control member movable through said second-mentioned passage into said first-mentioned passage and engageable with said inlet valve for controlling the position of said inlet valve relative to its seat.

2. The structure of claim 1 wherein said control member is operably responsive to the pressure in said second space and is effective when said pressure in said second space attains a predetermined value to hold said inlet valve off its seat.

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