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A. McNAB

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PUMP

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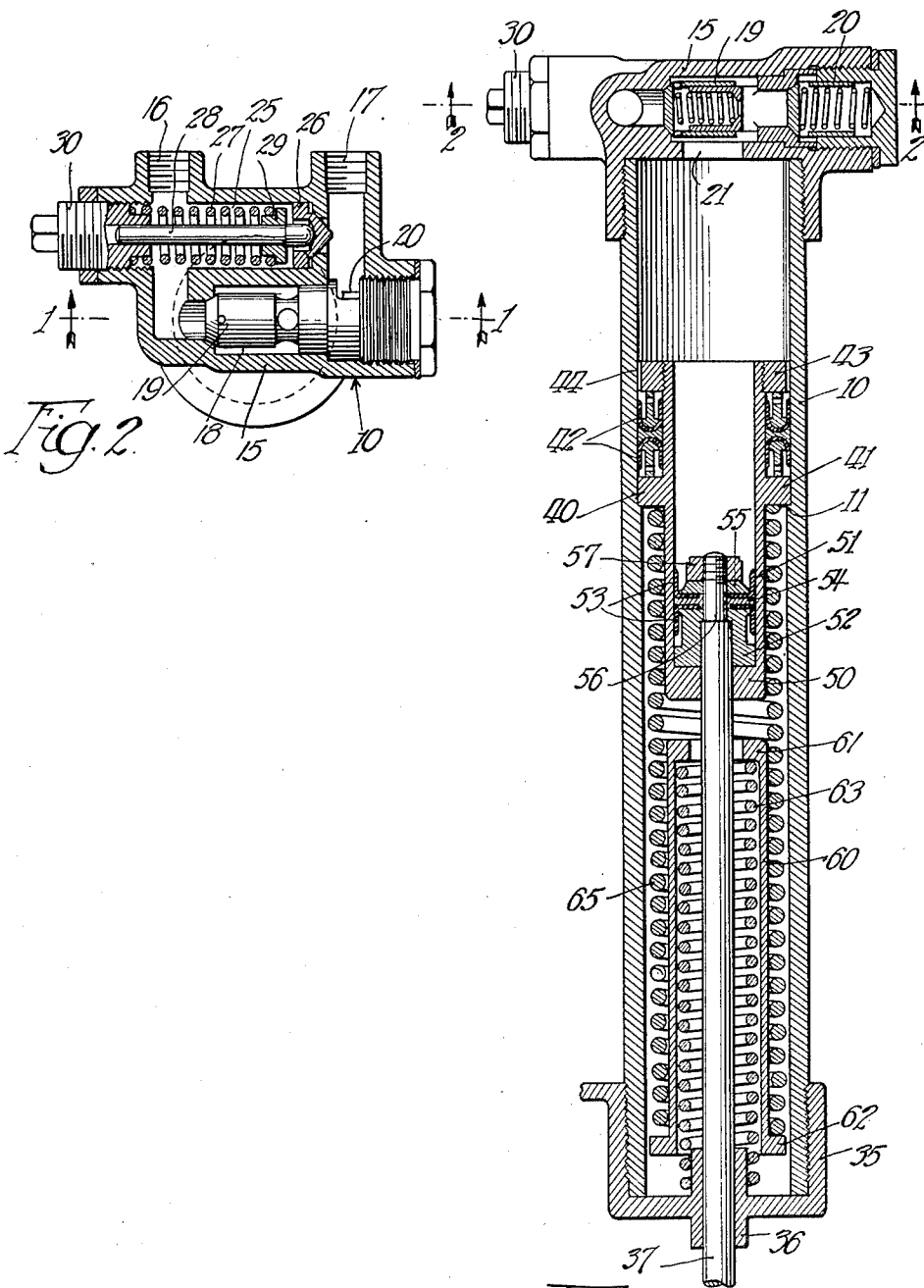


Fig. 1.

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UNITED STATES PATENT OFFICE

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PUMP

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This invention relates to a new or improved pump for use either in compressing liquids or gases, or for use in transferring liquids or gases from one location to another, or for use in effecting a vacuum or reduction of pressure.

A primary object of the present invention is to provide an improved pump that can be operated with efficiency when pumping fluids subjected to comparatively wide ranges of temperature, or which can be alternately used for attaining a high degree of vacuum and for pumping under comparatively great pressure.

A further object of the present invention is to provide such a pump in which the volume of fluid delivered is varied to compensate for the changes in the pressure at which the pump is operated, in order to maintain the load on the pump driving mechanism more constant and to avoid the necessity for comparatively wide changes in the speed at which the pump is operated.

A further object of the present invention is to provide for such compensation in the delivery effected by the pump by means of changes in the effective piston area of the pump and further to effect such changes automatically as the pressure conditions under which the pump is operating vary.

A further object of the present invention is to obtain the above objects by means of a simple and rugged construction that can be readily manufactured at low cost and which involves a minimum number of moving parts that can be readily assembled.

A further object of the present invention is to provide such a pump which can be constructed in a light form, and which will operate under varying conditions with absolute certainty over long periods and with a minimum of attention.

While it will be appreciated from the foregoing remarks that the present invention is applicable to a wide field of use, the present invention has been developed more particularly for use in pumping liquid to effect hydraulic operations, and a preferred example of the invention which is applicable to the raising and lowering of the landing gear

of amphibian aircraft will now be described with reference to the accompanying drawings, in which

Figure 1 is a longitudinal section of the pump on the line 1—1 of Figure 2;

Figure 2 is a transverse section on the line 2—2 of Figure 1.

As illustrated, the pump comprises a body member 10 which forms a major working cylinder. The interior of body member 10 has its upper end of slightly greater diameter than its lower end, with a shoulder 11 formed at the junction of the two interior diameters.

A cylinder head member 15 has a screw-threaded engagement at the other end of body member 10, and said head member has an inlet port 16 and an outlet port 17, each of which communicates with a transversely located passage 18, respectively, by way of an inlet valve 19 and an outlet valve 20, valves 19 and 20 being spring pressed into engagement with valve seats formed in the passage 18. Intermediately of the valves 19 and 20 the passage 18 has an opening 21 which communicates with the interior of the body member 10. The head member is also provided with a second transverse passage 25 for establishing communication between the outlet port 17 and the inlet port 16, this passage 25 serving as a by-pass passage and being normally closed by a valve 26 which is urged into engagement with its seat by means of a comparatively strong spring 27. The valve 26 is mounted independently for sliding movement in the passage 25 and is engaged centrally by an independently mounted sliding rod 28 which carries a collar 29 engaged at one end by the spring 27, the other end of spring 27 being in engagement with an adjustable abutment 30.

The lower end of body member 10 has a screw-threaded engagement with a closure member 35 which is provided axially with an extended aperture 36 for bearing engagement with a piston rod 37.

A major piston 40 comprises a tubular member having an external shoulder portion 41 intermediate its ends, this shoulder portion 41 being in sliding engagement with the large diameter of the interior of body

member 10 and adapted to abut against the shoulder 11. The upper end of tubular member 40 is provided with a packing joint which includes ring members 42 of U-shaped cross-section, these ring members being retained in position between shoulder member 41 and the ring 43 which has a screw-threaded engagement with the upper extremity of the piston member 40. The exterior periphery of ring member 43 is in sliding engagement with the interior of body member 10 and has longitudinal grooves 44 for permitting the access of pressure to the upper ring member 42. The shoulder member 41 and ring 43 with the packing therebetween thus form a large upper end to the major piston 40. At the lower end of the major piston 40 there is provided an internal shoulder 50 having an axial opening through which the piston rod 37 loosely extends. The end of piston rod 37 is provided with a minor piston 51. The minor piston 51 comprises a body member 52, packing members 53 of L-shaped cross-section separated by a ring 54, and a cover ring 55, all secured on a reduced end 56 of piston rod 37 by means of a nut 57. The minor piston 51 thus has a fluid-tight sliding engagement with the cylindrical interior of the major piston 40, said cylindrical interior forming a minor cylinder.

Disposed between the lower end of the minor piston 40 and the closure member 35 is a floating tubular member 60 which has an internal shoulder 61 at its upper end and an external shoulder 62 at its lower end. A coiled compression spring 63 is disposed within tubular member 60 and has one end in abutting engagement with shoulder 61 and its other end in abutting engagement with the closure member 35. A second coiled compression spring 65 has one end in abutting engagement with the shoulder portion 41 of the minor piston 40 and its other end in abutting engagement with the shoulder 62 of the tubular member 60.

In operation the pump is driven by a mechanism which effects the reciprocation of the piston rod 37. The minor piston 51 at all times reciprocates as a unit with the reciprocations of the piston rod 37, and in advance movement of the piston rod from retracted position shown in Figure 1 the major piston 40 will be caused to move as a unit with the minor piston 51 by the action of the springs 63 and 65 so long as the pressure developed is insufficient to overcome the action of the springs. A comparatively large volume of fluid will thus be displaced with each stroke of the combined piston. As soon, however, as the pressure will have been built up to a degree sufficient to maintain the shoulder 41 of the major piston in engagement with the shoulder 11 of the body member 10 and thereafter the minor piston 51 only will reciprocate,

thus delivering a comparatively small volume of fluid under high pressure without unduly increasing the load imposed on the driving mechanism. When the pressure in the system has risen sufficiently the by-pass valve 26 will open and fluid will thereafter circulate through the passage 25, until the operation of the pump driving mechanism is discontinued.

What I claim is:

1. A pump comprising, in combination, a major cylinder; a major piston mounted for reciprocation in said cylinder; said major piston having a minor cylinder open at one end to the pumping surface thereof; a minor piston mounted for reciprocation within said minor cylinder; means for reciprocating said minor piston; resilient means urging said major piston to advanced position; and co-operative stop faces on said minor piston and major piston for limiting the advancement of said major piston and for effecting positive retraction thereof with the retraction of said minor piston.

2. A pump comprising, in combination, a major cylinder and a major piston operative therein; spring means within said cylinder abutting one end thereof and engaging one side of said piston for advancing same towards the other end of said major cylinder; a minor piston operative within a minor cylinder formed in said major piston; means for reciprocating said minor piston; co-engaging faces in said minor piston and major piston for causing said major piston to follow the movement of the minor piston in the retractive movement of the latter; said spring means being of limited strength in relation to the maximum fluid pressure to be operated on; and co-engaging stop faces on said major cylinder and major piston for limiting the retractive movement of said major piston.

3. A pump comprising, in combination, a major cylinder; and a major piston operative therein; spring means within said cylinder abutting one end thereof and engaging one side of said piston for advancing same towards the other end of said major cylinder; a minor piston operative within a minor cylinder formed in said major piston; means for reciprocating said minor piston; co-engaging faces in said minor piston and major piston for causing said major piston to follow the movement of the minor piston in the retractive movement of the latter; and co-engaging stop faces on said major cylinder and major piston for limiting the retractive movement of said major piston; said minor cylinder having one end at all times in communication with said major cylinder.

In testimony whereof I affix my signature hereto.

ALEXANDER McNAB.