

April 14, 1959

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2,881,708

REGULABLE HYDRAULIC APPARATUS

Filed July 8, 1952

FIG. 1

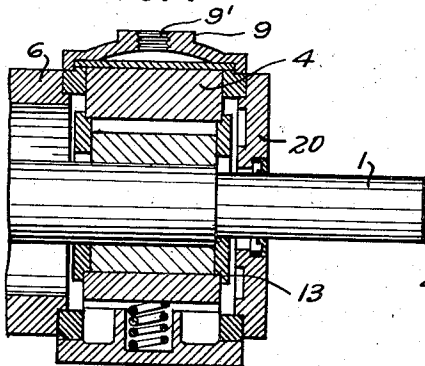


FIG. 2

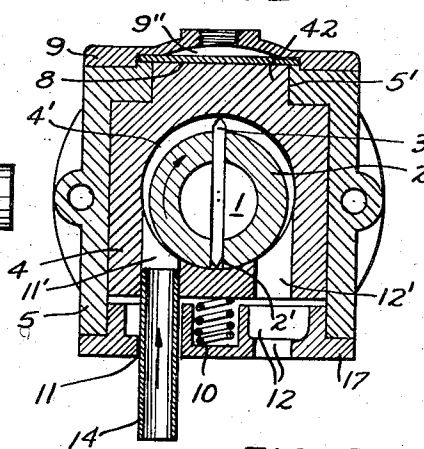


FIG. 3

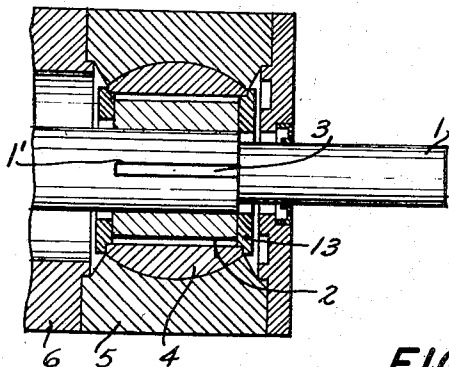


FIG. 5

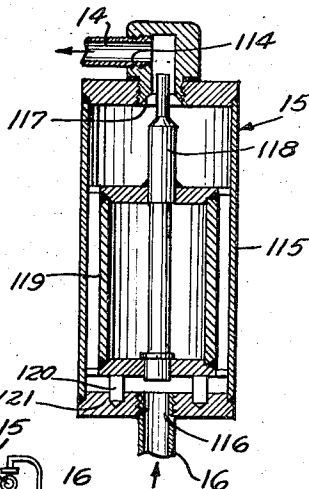
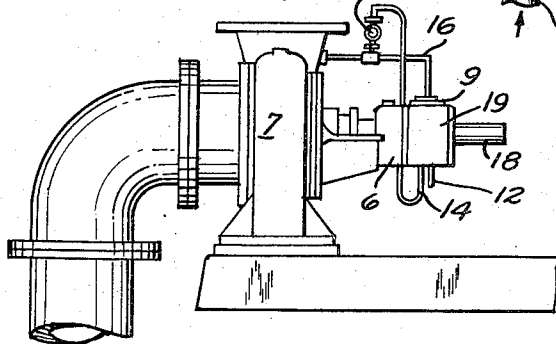


FIG. 4



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2,881,708

REGULABLE HYDRAULIC APPARATUS

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Application July 8, 1952, Serial No. 297,790

Claims priority, application Germany December 24, 1951

4 Claims. (Cl. 103—113)

The present invention relates to a regulable hydraulic apparatus and more particularly to an arrangement in which a regulable exhauster according to the present invention primes a centrifugal pump by evacuating the air from the same and is adjusted to an inoperative position when the centrifugal pump develops a predetermined pressure.

It is an object of the present invention to provide a regulable hydraulic apparatus which may be adjusted to a position in which the output thereof is zero while the frictional losses are a minimum.

It is a further object of the present invention to provide a regulable pump which requires a minimum of driving force when adjusted to an inoperative position.

It is the main object of the present invention to mount a regulable exhauster on the drive shaft of a centrifugal pump and to prime the centrifugal pump by evacuating the air from the same by the regulable exhauster and to adjust the regulable exhauster by means of the pressure produced by the centrifugal pump to zero output while the exhauster is continuously driven by the drive shaft.

According to the present invention a conduit connects the outlet of the centrifugal pump with the inlet means of the regulable hydraulic apparatus. A valve is provided in the conduit which permits passage of air, but closes when entered by a liquid while a further conduit connects the outlet of the centrifugal pump with the operating means of the regulable hydraulic apparatus by which the output of the hydraulic apparatus is varied between zero and maximum output.

The regulable hydraulic apparatus acting as exhauster evacuates air from the centrifugal pump and when the same is primed and starts pumping liquid, the valve closes and liquid passes through another conduit to the operating means and moves the members of the regulable hydraulic apparatus to an inoperative idling position. In this position the regulable hydraulic apparatus still rotates with the drive shaft of the centrifugal pump, but cannot suck liquid from the centrifugal pump since the valve is closed.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings, in which:

Fig. 1 is a longitudinal sectional view of a regulable hydraulic apparatus according to the present invention;

Fig. 2 is a cross-sectional view on line 2—2 of Fig. 1;

Fig. 3 is a sectional view taken on line 3—3 in Fig. 1;

Fig. 4 shows a priming arrangement according to the present invention; and

Fig. 5 is a sectional view of a valve used in the priming arrangement of Fig. 4.

Referring now to the drawings, and more particularly to Figs. 1, 2 and 3, which show a regulable hy-

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draulic apparatus, the shaft 1 is mounted rotatably in supporting means 20. Fixedly secured to shaft 1 is the cylindrical inner member 2. A slot 1' in the shaft 1 coincides with a pair of diametrically arranged slots 2' in the cylindrical inner member, and a vane member 3 is slidably mounted in the aligned slots. The inner rotatable member 2 is surrounded by an outer operating member 4 which is formed with a cylindrical chamber 4', the axis of which is parallel to and spaced from the axis of the cylindrical member 2 in the illustrated operative position of the outer and inner members. The outer member 4 is slidably mounted in the housing 5 and has a projection 42 passing through an opening 5' in the housing 5. A membrane 8 is clamped along the perimeter thereof to the housing 5 by means of a cover member 9 which is provided with an opening 9'. Cover member 9 is curved and defines with housing 5 and the membrane 8 a pressure chamber 9''. End wall members 13 abut against the housing 5 and laterally close the chamber 4' in the same. A closure 17 closes the housing 5 and is provided with inlet means 11 and 12 which communicate with the inlet 11' and the outlet 12' in the outer member 4. A spring means 10 abuts at one end against the closure member 17 and at the other end thereof against the outer member 4, urging the same into the operating position shown in Fig. 2. A shoulder in the housing 5 constitutes a stop means limiting the movement of the outer member 4 under the action of the spring means 10. The outer member is slidably mounted in the housing 5 for movement in a plane defined by the axis of the cylindrical chamber 4' and by the axis of the cylindrical inner member 2, and can be moved against the action of spring 10 to a position in which the axis of the cylindrical chamber 4' coincides with the axis of rotation of the inner member 2. In this position the cylindrical outer surface of the inner member 2 is equally spaced from the cylindrical surface of the chamber 4' in the outer member. Operating means are provided for moving the outer member 4 to the inoperative position in which the axes of the outer and inner members coincide. According to the embodiment shown in Fig. 2 an operating pressure fluid may be applied through the opening 9' to exert pressure on the pressure responsive membrane 8 which bends under pressure and moves the outer member 4 against the action of the spring means 10 until the outer member abuts against the closure 17 which constitutes another stop means for the outer member. In the position in which the outer member 4 abuts against the closure member 17, the axis of the cylindrical chamber 4' coincides with the axis of rotation of the inner member 2.

The device operates as follows:

In the operative position shown in Fig. 2 the vane means 3 partitions the space between the inner member and the outer member into two operating chambers, and during rotation of the inner member in the direction of the arrow the operating chamber communicating with the outlet 12' is reduced in volume, while the operating chamber communicating with the inlet 11' increases in volume so that a fluid may be sucked through the inlet 11 and discharged through the outlet 12.

If the outer member 4 is moved by a pressure fluid admitted through the opening 9' and acting on the membrane 8 to an inoperative position in which the axis of the cylindrical chamber 4' coincides with the axis of rotation of the cylindrical inner member 2, while the vane member slides in the slots of the inner member 2 and of the shaft 1 and retains its position with respect to the outer member, the hydraulic apparatus is inoperative since the two operating chambers defined by the vane member in the inner cylindrical chamber of the

outer member are of constant volume during rotation. In the event that the hydraulic apparatus is mechanically driven, no fluid can be sucked or discharged while in the event that the hydraulic apparatus is a motor, the inner member will not rotate since pressure fluid admitted through port 11 acts symmetrically on the ends of the vane member 3.

By adjusting the position of the outer member 4 in relation to the inner member 2, the output of the hydraulic apparatus can be varied between zero and maximum output.

It is obvious that the relative movement between the outer member and the inner member need not be carried out in the manner illustrated in Figs. 1 to 3, since it is also possible to move the inner member in a stationary outer member, and to produce the force required for the relative movement of the outer member and of the inner member by mechanical operating means or by electro-magnet means.

The pressure fluid for moving the outer member in the embodiment shown in Figs. 1 to 3 may be produced by a hydraulic accumulator or by any compressor or pump.

It is however particularly advantageous to use the regulable hydraulic apparatus according to the present invention in a priming arrangement for a centrifugal pump. Such arrangement is illustrated in Fig. 4 which shows a centrifugal pump 7, a regulable hydraulic apparatus 19 according to the present invention serving as a priming pump, the rotor of which is fixedly mounted on the drive shaft 18 of the centrifugal pump 7, while the housing 5 is secured to the housing 6 of the centrifugal pump as shown in Figs. 1 and 3. The first priming conduit 14 communicates at one end through a closure or check valve 15 with a second pressure conduit 16, and at the other end thereof with the inlet 11 of the hydraulic apparatus. Valve 15 is constructed to permit passage of a gaseous medium, such as air, and to close when liquid enters the valve. The second pressure conduit 16 connects the outlet of the centrifugal pump 7 with the opening 9' in the cover member 9 of the hydraulic apparatus 19 and with the pressure responsive membrane 8.

The construction of valve 15 is shown in Fig. 5. The inlet 116 of the valve is connected to conduit 16, and the outlet 114 is connected to conduit 14. The valve has a casing 115 provided with a valve seat 117 which cooperates with a valve member 118. A float member 119 is fixedly secured to valve member 118 and has two pins 120 guided in matching recesses 121 in the valve casing. The weight of float member 119 is sufficient to keep the valve 15 open in the illustrated position. However, when a liquid enters into the interior of the valve casing 115, the float member 119 rises, and the valve member 118 engages the valve seat 117, and closes the valve.

The priming arrangement according to the present invention operates in the following manner: the shaft 18 is driven by a motor, not shown, so that the inner member 2 of the hydraulic apparatus 19 and the rotor of the centrifugal pump are rotated. The inner and outer members of the hydraulic apparatus 19 are in operative position due to the action of the spring means 10. The hydraulic apparatus 19 acts as a priming pump or exhauster and sucks air from the centrifugal pump through the check valve 15 and the priming inlet conduit 14, and discharges the air through the outlet 12. The pressure exerted through conduit 16 on the membrane 8 and the outer member 4 is negative and acts in the same direction as spring means 10.

As soon as the air is evacuated from the centrifugal pump 7, and centrifugal pump 7 is filled with a liquid, the centrifugal pump 7 presses the liquid through the conduit 16 and the opening 9' against the membrane 8 and moves the outer member against the action of spring means 10 to an inoperative position in which no fluid is pumped by the hydraulic apparatus 19. Simultaneously the liquid discharged by the centrifugal pump into con-

duit 16 closes the valve 15 so that no liquid can enter the hydraulic apparatus 19 which continues to rotate with the drive shaft. In the event that an acid is pumped by the centrifugal pump, the provision of an acid-resistant membrane 8 is particularly advantageous.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of regulable hydraulic apparatus differing from the types described above.

While the invention has been illustrated and described as embodied in a priming arrangement for a centrifugal pump, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be secured by Letters Patent is:

1. A priming arrangement comprising, in combination, drive means; a centrifugal pump driven by said drive means and having an inlet adapted to communicate with a liquid to be pumped and an outlet for the liquid; a priming exhauster continuously driven by said drive means and being movable between an idling position and an operative position, said priming exhauster having an inlet and a discharge opening; an operating member for moving said priming exhauster between said positions of the same, said operating member being movable between an inactivating position in which said priming exhauster is in said idling position and an operative position in which said priming exhauster is in said operative position; means engaging said exhauster and urging said operating member to move to said operative position; movable pressure responsive means connected to said exhauster and engaging said operating member for moving the same from said operative position to said inactivating position; pressure conduit means connecting said pressure responsive means with said outlet of said centrifugal pump so that said pressure responsive means moves said operating member into said inactivating position when liquid under pressure is pumped by said centrifugal pump into said pressure conduit means; priming conduit means connecting said inlet of said priming exhauster with said outlet of said centrifugal pump for drawing a gaseous medium from said centrifugal pump and for thereby drawing the liquid to be pumped into said centrifugal pump, the gaseous medium being discharged through said discharge opening of said priming exhauster; and movable valve means in said priming conduit means and adapted to permit passing of the gaseous medium and to be closed by liquid under pressure so that said valve means automatically close said priming conduit means when said centrifugal pump starts to pump liquid into said outlet thereof and into said priming conduit means whereby no liquid passes into said priming exhauster and all liquid pumped by said centrifugal pump passes through said outlet of the same.

2. A priming arrangement comprising, in combination, drive means; a centrifugal pump driven by said drive means and having an inlet adapted to communicate with a liquid to be pumped and an outlet for the liquid; a priming exhauster continuously driven by said drive means and being movable between an idling position and an operative position, said priming exhauster having an inlet and a discharge opening; an operating member for moving said priming exhauster between said positions of the same, said operating member being movable between

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an inactivating position in which said priming exhaustor is in said idling position and an operative position in which said priming exhaustor is in said operative position; means engaging said exhaustor and urging said operating member to move to said operative position; movable pressure responsive means connected to said exhaustor and including a pressure chamber, and a membrane adjacent said pressure chamber and connected to said operating member for moving the same from said operative position to said inactivating position; pressure conduit means connecting said pressure chamber of said pressure responsive means with said outlet of said centrifugal pump so that said membrane moves said operating member into said inactivating position when liquid under pressure is pumped by said centrifugal pump into said pressure conduit means; priming conduit means connecting said inlet of said priming exhaustor with said outlet of said centrifugal pump for drawing a gaseous medium from said centrifugal pump and for thereby drawing the liquid to be pumped into said centrifugal pump, the gaseous medium being discharged through said discharge opening of said priming exhaustor; and movable valve means in said priming conduit means and adapted to permit passing of the gaseous medium and to be closed by liquid under pressure so that said valve means automatically close said priming conduit means when said centrifugal pump starts to pump liquid into said outlet thereof and into said priming conduit means whereby no liquid passes into said priming exhaustor and all liquid pumped by said centrifugal pump passes through said outlet of the same.

3. A priming arrangement comprising, in combination, drive shaft means; a centrifugal pump driven by said drive shaft means and having an inlet adapted to communicate with a liquid to be pumped and an outlet for the liquid; a priming exhaustor means including an operating member having an inner cylindrical chamber and a sliding vane rotor driven by said drive shaft means and located in said inner cylindrical chamber, said operating member being movable between an inactivating position in which said inner cylindrical chamber is concentric with the axis of said drive shaft means and in which no fluid is pumped by said exhaustor means and an operative position in which fluid is pumped by said exhaustor means and in which said inner cylindrical chamber is eccentric to the axis of said drive shaft means; means in said exhaustor means engaging the same and urging said operating member to move to said operative position, said operating member having permanently the tendency to return from said inactivating position to said operative position; movable pressure responsive means connected to said exhaustor and engaging said operating member for moving the same from said operative position to said inactivating position; pressure conduit means connecting said pressure responsive means with said outlet of said centrifugal pump so that said pressure responsive means moves said operating member into said inactivating position when liquid under pressure is pumped by said centrifugal pump into said pressure conduit means; priming conduit means connecting said inlet of said priming exhaustor with said outlet of said centrifugal pump for drawing a gaseous medium from said centrifugal pump and for thereby drawing the liquid to be pumped into said centrifugal pump, the gaseous medium being discharged through said discharge opening of said priming exhaustor; and movable valve means in said priming conduit means and adapted to permit passing of the gaseous medium and to be closed by liquid under pressure so

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that said valve means automatically close said priming conduit means when said centrifugal pump starts to pump liquid into said outlet thereof and into said priming conduit means whereby no liquid passes into said priming exhaustor and all liquid pumped by said centrifugal pump passes through said outlet of the same.

4. A priming arrangement comprising, in combination, drive shaft means; a centrifugal pump driven by said drive shaft means and having an inlet adapted to communicate with a liquid to be pumped and an outlet for the liquid; a priming exhaustor means including an operating member having an inner cylindrical chamber and a sliding vane rotor driven by said drive shaft means and located in said inner cylindrical chamber, said operating member being movable between an inactivating position in which said inner cylindrical chamber is concentric with the axis of said drive shaft means and in which no fluid is pumped by said exhaustor means and an operative position in which fluid is pumped by said exhaustor means and in which said inner cylindrical chamber is eccentric to the axis of said drive shaft means; means in said exhaustor means engaging the same and urging said operating member to move to said operative position, said operating member having permanently the tendency to return from said inactivating position to said operative position; movable pressure responsive means connected to said exhaustor and including a pressure chamber, and a membrane adjacent said pressure chamber and connected to said operating member for moving the same from said operative position to said inactivating position; pressure conduit means connecting said pressure chamber of said pressure responsive means with said outlet of said centrifugal pump so that said membrane moves said operating member into said inactivating position when liquid under pressure is pumped by said centrifugal pump into said pressure conduit means; priming conduit means connecting said inlet of said priming exhaustor with said outlet of said centrifugal pump for drawing a gaseous medium from said centrifugal pump and for thereby drawing the liquid to be pumped into said centrifugal pump, the gaseous medium being discharged through said discharge opening of said priming exhaustor; and movable valve means in said priming conduit means and adapted to permit passing of the gaseous medium and to be closed by liquid under pressure so that said valve means automatically close said priming conduit means when said centrifugal pump starts to pump liquid into said outlet thereof and into said priming conduit means whereby no liquid passes into said priming exhaustor and all liquid pumped by said centrifugal pump passes through said outlet of the same.

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