Oct. 28, 1941. A. J. GRANBERG 2,260,805

PUMP VALVE

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Fig. 1.

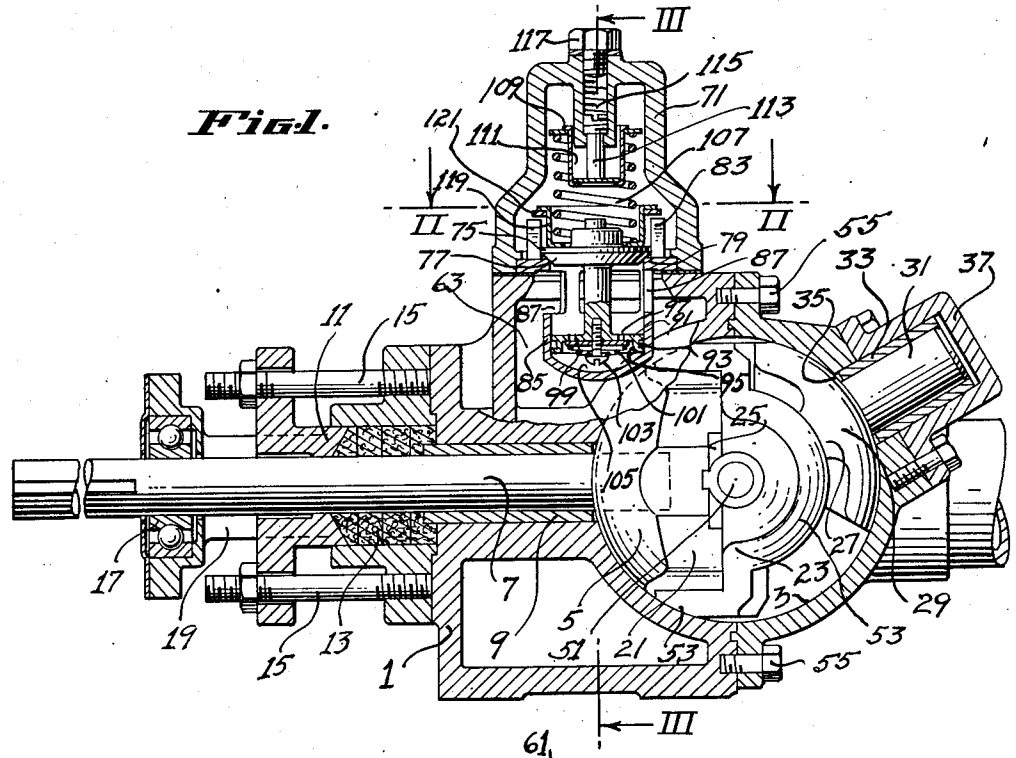
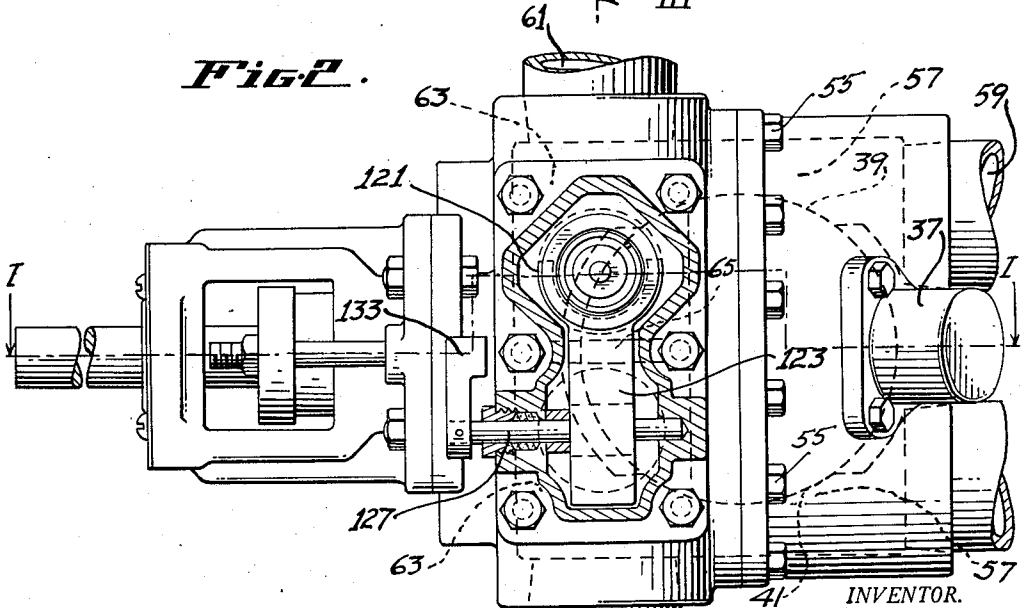


Fig. 2.



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Fig. 3.

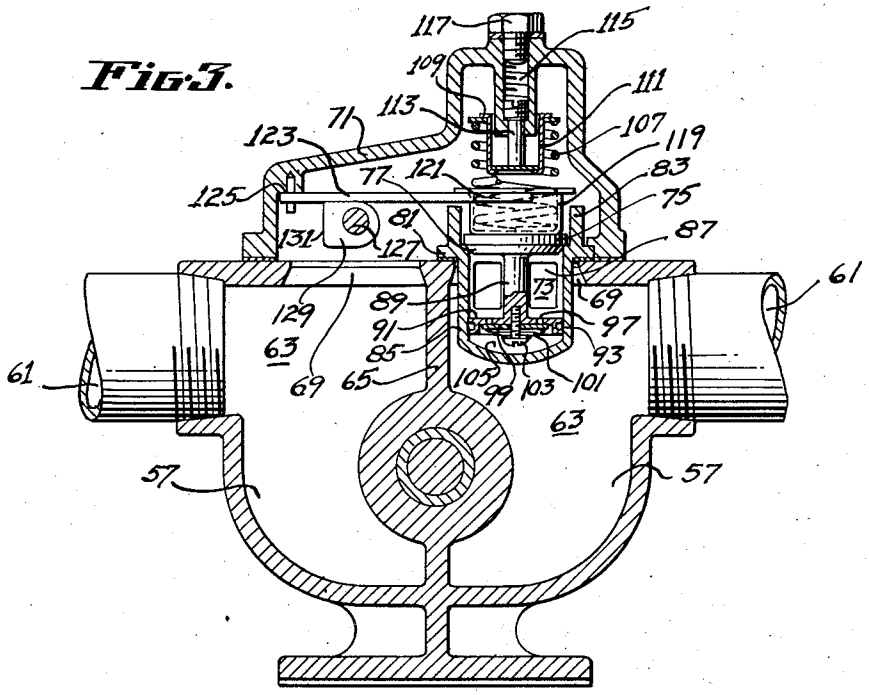
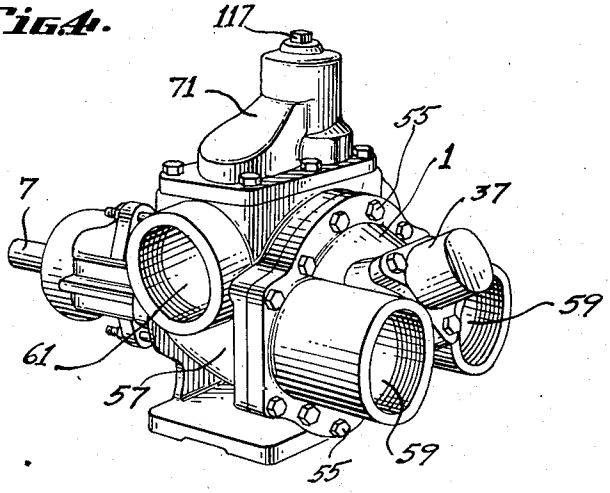


Fig. 4.



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UNITED STATES PATENT OFFICE

2,260,805

PUMP VALVE

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Application December 27, 1938, Serial No. 247,765

3 Claims. (Cl. 251—146)

My invention relates to pumps and more particularly to pressure relief and regulating means therefor. It is of particular application in connection with pumps of the positive pressure rotary type.

An object of my invention is to provide improved means for enabling removal of pumping load from a prime mover, such as a gas engine, to facilitate starting such gas engine without resorting to a clutch mechanism for the purpose.

It is another object of my invention to provide improved means for controlling the pressure developed by a pump.

Another object of my invention is to provide improved means for enabling adjustment of pump operating pressures and pump output while pump is in operation.

Another object of my invention is to provide improved means for enabling variation in pump pressure and output at constant speed of operation.

It is a further object of my invention to enable adjustment of operating pressures and output in pumps of the positive pressure rotary type without necessitating changing of the angle between the pump axes.

It is a further object of my invention to provide means for controlling the maximum pressure developed by a pump.

A further object of my invention is to provide a maximum pressure control means for a pump of the positive pressure rotary type which shall enable operation of such pump in either direction.

It is another object of my invention to provide improved manually controlled means for arbitrarily adjusting the pressure characteristics of a pump.

Additional objects of my invention will be brought out in the following description of the same taken in conjunction with the accompanying drawings, wherein—

Fig. 1 is a side elevational view of my invention, mostly in section taken substantially in the planes indicated by the line I—I of Fig. 2.

Fig. 2 is a view in section taken along the line II—II of Fig. 1.

Fig. 3 is a view in section along the line III—III of Fig. 1.

Fig. 4 is a view in perspective of the pump construction of Figs. I, II, III.

The above figures are substantially to scale.

In general, my invention constitutes an improvement in valves for pumps wherein a passageway interconnecting the inlet and outlet sides of a pump, is normally maintained in a blocked or substantially blocked condition by a valve, which in turn is made responsive to the pressure on the outlet side of the pump, to enlarge the capacity of the interconnecting passageway and relieve the pressure on that side of the pump, when it has reached a predetermined value. The valve among other things is designed to be manually adjustable so that during operation of the pump, the interconnecting passageway normally may be entirely blocked or open to any desired extent, whereby the normally operating pressures of the pump may be adjusted anywhere from zero (full opening of the valve) to a predetermined maximum (valve tightly closed). The construction enabling realization of the above results, embodies novel features which will be pointed out in detail by reference to the drawings, wherein the invention has been illustrated as embodied in a pump of the positive pressure rotary type, and more particularly an improved pump of this character forming the subject matter of a co-pending application of mine, entitled "Rotary pump," Serial No. 162,579, filed September 7, 1937. The invention of the present application, in its broadest aspect, has been disclosed in my patent for "Positive pressure rotary pump," No. 2,129,928 of September 13, 1938, but not claimed therein.

A pump casing 1 is preferably formed in two halves to facilitate the machining of a spherical inner surface 3. A driving head 5 having the shape of a spherical segment is positioned within the chamber and has, extending outwardly therefrom, a driving shaft 7. This driving shaft is journaled in a casing bearing 9 close to the pump chamber, and this casing bearing is prolonged to terminate in a stuffing box assembly comprising a plunger 11 forced against packing 13 by packing bolts 15. The shaft continues, and I prefer to steady the outer end in an outboard bearing 17 mounted on a bracket 19.

Extending inwardly into the pump chamber from the driving head 5 is a pump chamber partition 21 attached to a discoidal piston 23 by hinges 25. In like manner a second pump chamber partition 27 is attached to discoidal piston 23 by similar hinges, and the second partition extends across the piston at right angles to the first partition. This second partition 27 is attached to a driven head 29, also having the shape of a spherical segment, and extending from the driven head is a stub shaft 31.

The stub shaft 31 has its free end supported in a bearing 33 at an angle to the main drive shaft

7, the bearing in turn extending through an opening 35 in the pump casing and supported in a cap 37 covering the opening 35 in the pump casing and constituting a housing for the bearing.

A single inlet port 39 is provided diametrically opposite a single output port 41, although it is to be distinctly understood that these ports are inlet or outlet ports only, in accordance with the direction the pump is to be rotated.

The periphery of the piston 23 has a uniform width of bearing surface around the disc, and this bearing surface is of course a spherical surface so that the disc may both oscillate and rotate within the casing. Four portions of the periphery deviate to form semicircular valve faces 53, each alternate surface extending in the opposite direction so that as the piston is rotated, each port 39 and 41 is opened into a chamber which is on an opposite side of the disc, and the fact that the periphery makes these semicircular divergences allows me to place hinge pins such as shown at 51 in houses 53 formed integral with the disc in diametrical locations and at right angles to each other, to form the main bearings of the toggle connecting the driving and driven head. Thus, the device may be easily assembled and disassembled when the split casing is separated by taking out the bolts 55.

The pump casing 1 is formed with a channel 57 on either side thereof extending toward and terminating in an opening 59 at the rear of the pump, considering the drive shaft end of the pump as the front end. Each of the aforementioned channels is connected by one of the valve openings 39, 41 through the spherical pump chamber wall, with the interior of the pump, and is also provided with an opening 61 directed through and out of the pump casing, laterally thereof. Depending on the direction of rotation of the pump, each of these channels 57 will consittute either the inlet channel or the outlet channel for the pump, and the presence of the two external openings in each channel will enable the simultaneous attachment thereto of two inlet connections or two outlet connections, if desired, the channels being suitably threaded at the openings for this purpose. If only one inlet opening or outlet opening is utilized, the other remaining opening can be capped or plugged.

The casing of the pump is further provided with a pair of duplicate chambers 63 together extending across and to the front of the spherical pump chamber and separated by a partition wall 65, each chamber communicating at one end with that channel 57 adjacent thereto. These chambers 63 are furthermore formed with a central valve receiving opening 69 in the ceiling thereof and a hollow ganged cap 71 supported upon the upper rim surface of the chambers and bolted thereto, serves to provide in combination with the chambers 63 a passageway interconnecting the inlet and outlet channels 57 of the pump.

This interconnecting passageway during operation of the pump is normally closed or open to a desired degree depending upon adjustments to be described, by a chatter proof relief valve 73 which is located in the interconnecting passage where it may be exposed to the pump pressure developed in that chamber connecting with the outlet channel of the pump. This valve comprises a circular valve head 75 having a frusto conical surface 77 adapted to seat upon a valve seat 79 formed by a circular opening in a seating member 81 resting upon the upper edge of that chamber 63 on the pressure side of the pump and retained in place by the bolted cap 71 which spans the valve seat member 81 and clamps it to the pump casing. This valve seat member has integrally formed therewith valve guide means in the form of upstanding posts 83 disposed about the valve seat opening, and a depending cylindrically shaped dash pot 85, the wall of which adjacent the valve seat being provided with openings 87 therein, enabling the admission of liquid thereto from the pressure side of the pump. The valve head 75 has depending therefrom an integral shank 89 extending into the dash pot 85 and terminating in a circular flange 91 having a peripheral groove 93, the flange making a rather snug fit with the inner wall of the dash pot 85 below the openings 87 therein to enable said flange to act as a piston 95. The piston has a perforation 97 or a plurality of such perforations therethrough, intermediate the shank 89 and the piston surface and such openings are covered by a distortable disc 99, spring biased against the under surface of the piston 95 by a conical coil spring 101, which itself is maintained in position by a machine screw 103 extending through the center of the spring 101 and threaded into the shank 89. The compression of the conical coiled spring may be varied by adjusting the machine screw, thereby altering the pressure of the disc 99 against the under surface of the piston 95. The dash pot 85 is rounded out at its lower end to provide a chamber 105 in the dash pot below the piston.

The valve 73 when closed, is maintained in its seated position by a valve spring 107 which bears at one end against the upper surface of the valve head 75 and at its other end, against a washer engaging the under surface of the lip 109 of a flanged cup 111. A valve spring adjusting screw 113, threaded into an opening 115 through the cap 71 directly above the flanged cup 111, is adapted to enter and engage the flanged cup and maintain the valve spring 107 under compression. The degree of compression of the valve spring may thus be controlled by manipulation of the adjusting screw 113. The opening 115 is normally maintained closed by a protecting cap nut 117 threaded therein.

As previously indicated the relief valve 73 occupies that chamber 63 on the pressure side of the pump. In view of the fact that such chamber has communication with the outlet channel, the liquid under pressure in the pump will have access to the dash pot 85 and exert a pressure upon the disc 99 through the perforation 97 in the piston 95. When the outlet pressure of the pump reaches a predetermined value, controlled by the compression adjustment of the disc biasing spring 101, the disc will be distorted away from the perforation allowing the liquid under pressure to be suddenly released into the chamber 105 below the piston thus equalizing the pressure on both sides of the piston and enabling the valve to fly open against the action of the valve spring 107. The result of this action of the valve, is to open the interconnecting passageway to the flow of liquid from the outlet channel back to the inlet channel and bring about a relief of the pressure on the pressure side of the pump. When the pressure in the outlet channel of the pump has been reduced, the valve will start to close under the restoring action of the valve spring 107, but its closing action unlike the opening of the valve,

cannot be sudden since the liquid in the dash pot is trapped in the chamber 105 beneath the piston and must be displaced therefrom. Since such liquid cannot escape through the perforations 97 in the piston, its only manner of exit is between the piston 95 and the contacted surface of the dash pot. The escape can therefore be only gradual, thus retarding the return movement of the valve to its normal position. The valve therefore cannot chatter in operation.

In order to control the normal operating condition of the valve so that the valve may occupy any adjustment position from a fully closed to a fully open position, I provide a flanged cup 119 about the lower or valve head contacting end of the valve spring 107 and engage the flange or lip of the cup by means of a yoke 121 at one end of a lever 123 which is anchored at its other end to an internal shoulder 125 formed adjacent the farther end of the cap 71. A manually operable control rod or shaft 127 extends through the cap transversely of the yoked lever 123, and has affixed thereto within the cap, a cam 129 adapted upon turning of the shaft to ride against the under surface of the lever 123 and raise and lower the same in accordance with the angular position of the cam. The cam is shaped to provide a gradual lift of the lever and at its maximum lifting position, has a flat lift terminating surface 131 for maintaining the lever in such maximum extreme upper position. At all intermediate lifting positions of the cam, due to the curvature thereof and the friction between the cam and the lever, the cam is capable of holding the lever at any of such positions. A handle 133 affixed to one end of the shaft 127 permits of the manual control of the cam adjustment of the lever position referred to.

Lifting of the flanged cup 119 a predetermined distance away from the closed position of the valve head, against the action of the valve spring 107, removes the spring pressure therefrom, allowing the valve to be floated off its valve seat during operation of the pump, and maintain contact against the bottom of the cup 119 by the pressure of the liquid beneath the valve head. The extent to which the valve will rise will depend of course upon the cam controlled lever adjustment. Thus, it will be apparent that the valve may be adjusted to assume a more or less open position during normal operation of the pump and by so adjusting the valve, the pressure developed by the pump may be regulated and determined in advance. The effect of the valve adjustments, as described, alters the flow capacity of the interconnecting passageway and enables the pump to by-pass a certain portion of the liquid handled by the pump, and in controlling the pressure of the pump in this manner, the volume of liquid pumped through the outlet channel is also controlled.

Pumps of the above type are employed quite extensively on trucks for the pumping of petroleum products such as butane, gasoline, and other liquid products of greater or less viscosity, and when employed on trucks, the pumps are usually driven from the truck engine. In starting such engines, it is preferable to remove all load therefrom, and while the pump might be disconnected therefrom by means of a clutch interposed in the drive connection to the pump, such auxiliary apparatus is not required when the pump has incorporated therein the relief valve and manual adjustment as described by me above. The load imposed upon the engine by the pump in the act of starting of the engine, may be efficaciously removed by utilizing the hand control to lift the spring engaging flanged cup 119 to its maximum height above the valve seat. Consequently as a result, the interconnecting passage will in effect be wide open, thus precluding development of any pressure in the pump other than that insignificant pressure necessary to float the valve off its seat.

The reversibility of a rotary pump of the type described by me is not destroyed by the inclusion of the relief valve construction described. The advantages of the relief valve construction may be retained upon reversing pump operation however, merely by removing the same and associating it with the other chamber 63 which was previously on the inlet side of the pump but during reverse operation, will be on the outlet or pressure side.

It will be apparent from the above description of my invention, that I have provided a simple construction capable of fulfilling the objects of my invention, as previously set forth.

While I have described my invention in detail and in combination with a specific type of pump with which it is well fitted for operation, it will nevertheless be apparent that the invention is applicable in a measure to pumps of various types, and I consequently do not desire to be limited in my protection to the specific types disclosed and described by me except as may be necessitated by the prior art and the appended claims.

I claim:

1. In combination with means forming a passageway, a valve seat forming a part of the walls of said passageway, a dash pot having a closed bottom depending from said valve seat and having openings into said passageway adjacent said valve seat, a valve head in engagement with said seat on the opposite side of said seat from said dash pot and having a depending shank extending into said dash pot and terminating in a dash pot piston loosely fitting the dash pot walls, said piston being perforated to enable fluid to reach the underside thereof, a distortable disc resiliently held against said underside to normally close the perforations in said piston, a spring seat mounted for axial movement on the side of said valve head opposite the shank side thereof, a valve spring bearing on said spring seat and a wall of said passageway urging said valve head against said valve seat with said piston normally below the openings in said dash pot, and control means for axially moving said spring seat toward and from said valve head.

2. Apparatus in accordance with claim 1, wherein said spring control means passes through the passageway wall for external operation thereof.

3. Apparatus in accordance with claim 1, wherein said passageway is divided along a plane providing coplanar identical ports and wherein said valve seat is mounted in an arched casing connecting said ports, said casing seating on said passageway walls around both of said ports with said valve seat mounted in one of said ports with said dash pot extending into said passageway, and means for fastening said casing to said passageway walls with said valve seat mounted in either port as desired.

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