Dec. 19, 1939. G. A. WAHLMARK 2,184,133

FLUID PUMP

Filed April 2, 1937 2 Sheets-Sheet 1

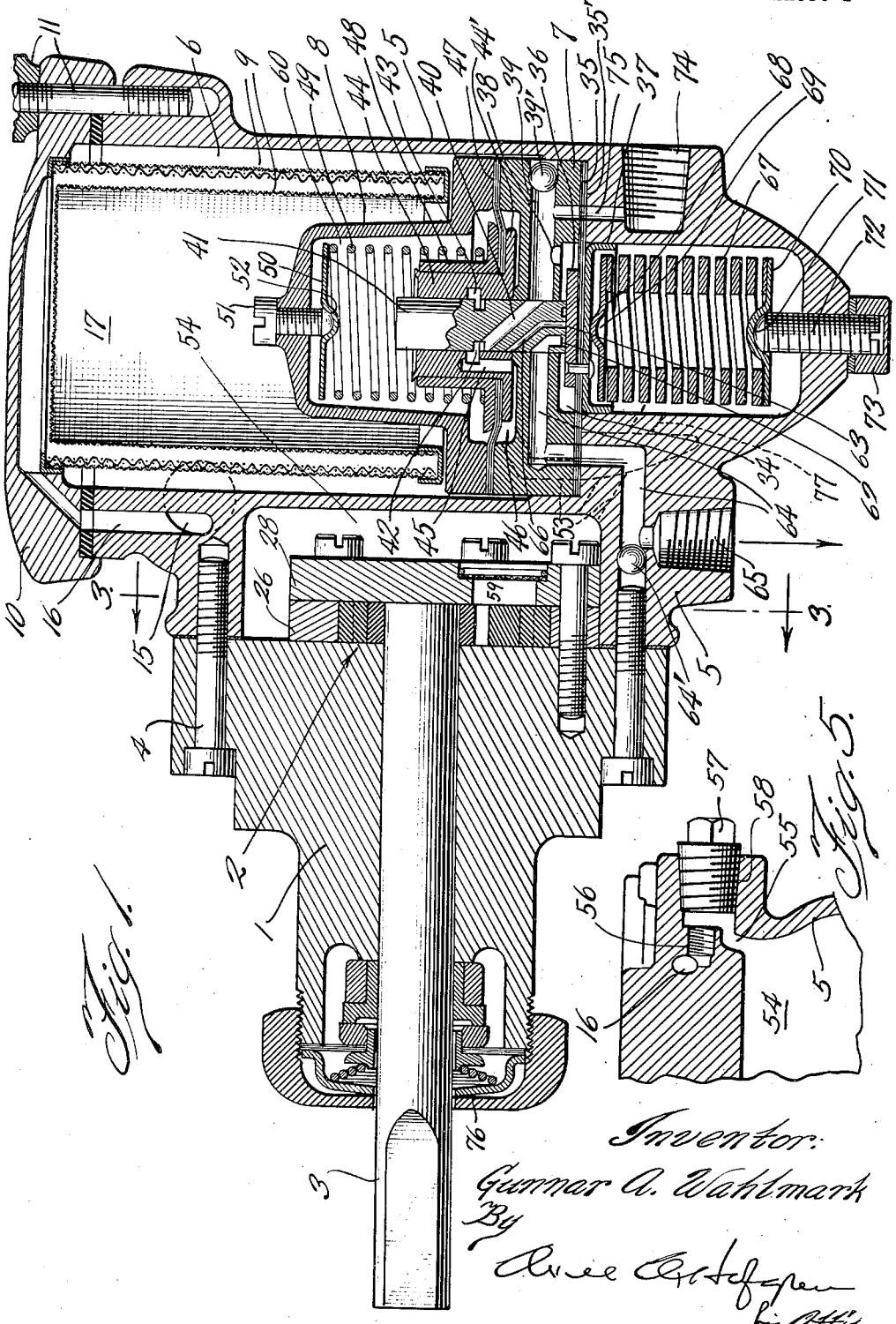

Fig. 1.

Fig. 5.

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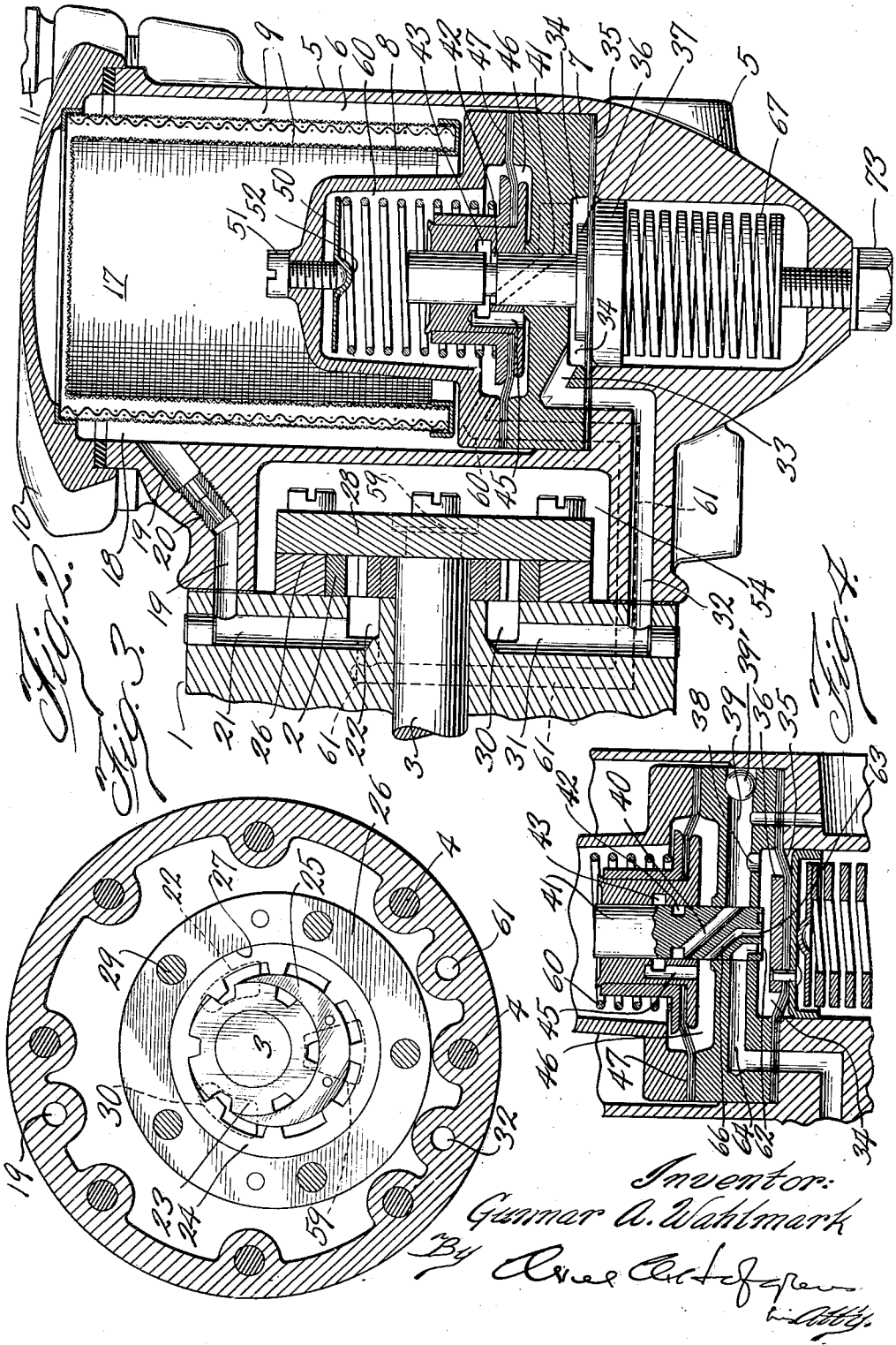

Fig. 2.

Fig. 3.

Fig. 4.

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UNITED STATES PATENT OFFICE

2,184,133

FLUID PUMP

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9 Claims. (Cl. 103—42)

The invention relates generally to a fluid pump and associated control valve device, and more particularly to a discharge control for oil burner pumps.

The principal object of the invention is to provide a new and improved fluid pressure generating and control means for a fluid pressure system operable to initiate discharge of fluid at full pressure and volume, and to end discharge with a sharp cut-off at substantially full pressure and volume.

Another object of the invention is to provide a new and improved fluid pressure generating and control means for a fluid pressure system operable to initiate sudden discharge when the fluid flow from the means reaches a maximum.

Yet another object is to provide a new and improved fluid pressure generating and control means for a fluid pressure system operable to effect sharp cut-off as soon as flow from the means falls below the maximum.

Still another object is to provide a pump and a valve device for controlling the discharge from the pump, the valve operation being designed to by-pass the discharge from the pump until a predetermined pump output is reached, and then immediately to close the by-pass and cause the pump to discharge normally until the volumetric displacement of the pump drops below the predetermined value, at which point the valve device is immediately operable to cut off the discharge and resume by-passing of the fluid.

A further object is to provide a control, for the discharge from a pump, having a pressure responsive valve governing the operating discharge pressure of the pump, and means responsive to the volumetric displacement of the pump for governing the building up of pump pressure.

A further object is to provide a control, for the discharge from a pump, having a pressure responsive valve governing the operating discharge pressure of the pump, a by-pass passage communicating with the discharge in advance of said valve, and valve means responsive either to the suction at the intake of the pump or to the pressure of the by-passed fluid or both, governing the by-pass passage and operable to close the by-pass passage as the pump comes up to full displacement, thereby to compel normal discharge from the pump under the control of the pressure responsive valve and to open the by-pass with a drop in pump displacement.

Other objects and advantages will become apparent from the following detailed description, taken in connection with the accompanying drawings, in which:

Fig. 1 is a longitudinal secton through the preferred form of the invention at the center line.

Fig. 2 is a somewhat diagrammatic longitudinal section slightly to one side of the center of the device, with the pump members rotated 90° in order to show conduits and ports not otherwise clearly visible.

Fig. 3 is a cross section taken on the line 3—3 of Fig. 1, looking in the direction of the arrows.

Fig. 4 is a fragmentary central sectional view of the valve device showing the position occupied by the parts when the pump is running.

Fig. 5 is a fragmentary section showing the return outlet and an internal return leading to the screen chamber.

While there is illustrated in the drawings and shall hereinafter be described in detail a preferred form of the invention, it is to be understood that the invention is not limited to the particular construction and arrangement shown, it being contemplated that various changes may be made by those skilled in the art without departing from the spirit and scope of the invention as expressed in the appended claims.

In the exemplary form of the invention shown in the drawings, there is presented a fuel unit embodying a pump and a control therefor including a compound valve and by-pass system so arranged that, in operation, when fluid is drawn into the pump, it is discharged to the compound valve and by-pass system and in the period during which the pump is picking up speed the fluid so discharged is connected through a by-pass valve back to the pump or the source. By means of an increase in suction, created at the intake of the pump as it picks up speed, or by means of an increase in pressure of the by-passed fluid due to increased displacement of the pump, or by means of both, the by-pass valve is drawn to a closed position forming a pocket within the compound valve device. Immediately upon closure of the by-pass, pressure is built up within this valve device and reacts on another lower valve, controlling discharge from the pump, causing it to snap it open, thereby releasing fluid to the burner nozzle at the full built up pressure and volume of the pump. Subsequently, upon shutting off the pump, the vacuum previously created is broken and the pressure reduced so that a spring working in a direction opposed to those forces opens the by-pass valve and causes a reduction of pressure within the valve device

which in turn causes the lower valve to snap shut and abruptly cut off the direct discharge of fluid before there is any apparent drop in pressure.

To accomplish the purposes and the operation above described, a unitary mechanism, constituting the invention is provided consisting of a pump base 1 to which is secured a housing 5 having a cover 10. A pump 2 of the rotary type is mounted on the base and driven by a shaft 3 journaled in the base, while in the housing there is an inlet 15 for the supply of fluid and an outlet 65 for discharge from the mechanism to a burner nozzle. The housing has a large inner cylindrical chamber forming a strainer cup 6 at the bottom of which is supported a compound valve structure consisting of a lower valve 36 and an upper valve 44, each mounted on a diaphragm. Above the upper valve is a sealed chamber 60 connected with the pump intake and above the sealed chamber, separate and distinct from it, is a screen forming an inner chamber 17. Fluid courses from the inlet 15 into the screen chamber 17, thence to the pump 2 from which it is discharged to the compound valve device. During certain periods the fluid is returned through a by-pass to the pump and during other periods it is forced through the lower valve to the outlet 65.

As shown in the drawings, the structure consists generally of the pump base 1 upon which the rotary pump 2 is mounted and connected to a drive shaft 3 as above described. Secured to the pump base by means of bolts 4 is the housing 5 containing the compound valve mechanism herein referred to. Chamber 6 lies concentrically within the housing 5, and at the bottom of the chamber a valve body 7 is secured to the housing in a conventional manner by screws or other means not shown. A cap 8 is similarly secured to the valve body 7. Also within the chamber 6 is a double screen filter 9 which is held in place by the cover 10 of the housing, secured thereto by means of cap screws 11.

Fluid, such as fuel oil, enters the device at the inlet port 15 (see Fig. 1) and is conducted through a passage 16 into the inner chamber 17 formed by the double screen filter. From the inner chamber 17, fluid passes outward through the mesh of the screen into an annular space 18 surrounding the double screen filter and thence outward through passages 19 and 21 to the pump (see Fig. 2). Within the passage 19 is a restriction 20 for a purpose which will be subsequently described. From the passages 19 and 21 fluid is conducted to an inlet port 22 of the rotary pump 2. The rotary pump, which may be of the type disclosed either in my patent application Serial No. 675,218, filed June 10, 1933, or in my patent application Serial No. 14,017, filed April 1, 1935, is shown more clearly in cross section in Fig. 3 where the elongated inlet port 22 appears at the right. The pump is composed of a toothed rotor 23, which is splined to the shaft 3, and meshes with an internally toothed annular ring 24 positioned eccentrically with the rotor. A crescent member 25 fills the more or less crescent-shaped space between the rotor and the annular ring. For forming the body of the pump itself an annular casing 26 is provided which forms a cylindrical interior 27, and a plate 28 constituting a closure for the cylindrical interior is positioned on the casing. Screws 29 shown in section in Fig. 3 secure the plate 28 and the pump casing 26 to the pump base 1.

After fluid is drawn into the pump at the inlet port 22, it is discharged through an elongated outlet 30 shown on the left side in Fig. 3, after being carried around in the pockets between the teeth of the rotor and the annular ring. From the outlet port 30 (see Fig. 2), fluid is conducted through a conduit 31 in the pump base 1 and through a continuation 32 of the conduit situated in the lower part of the housing 5 from which it passes upward, through an aperture in the diaphragm at the clamped edge thereof, and continues on to a conduit 33. From the conduit 33 in the valve body 7, the fluid flows into an annular chamber 34 formed upon the inside of the valve body.

A laminated diaphragm 35, consisting preferably of an oil-proof fabric, is secured between a shoulder 35' of the housing 5 and the valve body 7 and forms one side of the annular chamber 34. A disk valve 36, which may be of leather, is secured to the diaphragm 35 together with a cup-shaped cylindrical member 37 attached on the opposite side to lend rigidity to the valve element thus assembled. After entering the chamber 34, following initiation of pump operation, the fluid flows immediately through an aperture 38 (see Fig. 1), a lateral conduit 39 and thence upwardly through a passage or conduit 40. The conduit 40 is formed in a plug-like cylindrical member 41 which is securely sealed concentrically within the valve body 7. About midway of the plug-like member, an annular groove 42 is cut which forms a terminus for the conduit 40. It will be noted that the lateral conduit 39 is effectively sealed from the outside by means of a ball 39' of slightly larger dimension, driven into the passage during the course of manufacture.

Adjacent the annular groove 42 is positioned a corresponding annular groove 43 which is cut in the inner surface of a sliding sleeve valve 44. A conduit 45 extends longitudinally from the annular groove 43 and forms a connection from the conduit 40 to an annular chamber 46 formed on the upper side of the valve body 7. A laminated annular diaphragm 47, preferably of oil-proof fabric, together with the sleeve valve 44, forms an upper wall for the annular chamber 46. At its inner periphery the diaphragm 47 is clamped between a flange 44' on the valve and a right angle clamping ring 48 encircling the sleeve valve and fastened tightly to it, while at its outer periphery the diaphragm is clamped between the valve body 7 and the cap 8. The sleeve valve is depressed into the position shown in Fig. 1 by means of a spring 49 capped by a washer 50 which is adjusted in place by means of a screw 51 fitting into a semi-spherical depression 52 in the top of the washer. The fluid after arriving in the annular chamber 46 passes outwardly through a by-pass conduit or passage 53 into a chamber 54 formed within the left side of the housing 5 which surrounds the pump.

In the set-up shown, provision is made for return of excess fluid from chamber 54 directly to the screen chamber 17 by means of passages on one side of the mechanism, invisible in Fig. 1 because of their position, but which are shown in detail in Fig. 5. Passages 55 and 56, thus shown, conduct fluid from the chamber 54 to the passage 16 which, as has been previously described, leads from the inlet port 15 to the screen chamber. The passage 56, furthermore, is threaded so that it can be closed by a plug for an alternate set-up. Should it be desired to conduct the excess fluid back to the supply tank, a large plug 57 can be removed from a threaded

return port 58 and a small plug inserted in the passage 56 to seal it off. Then a pipe or tube leading to the supply tank can be connected to the threaded return port 58. Another connection for the partial recirculation of oil is a screened opening 59 shown in the plate 28 located at the lower part of the chamber 54. When there is fluid in the chamber, as is usually the case, the fluid may flow by gravity into pockets between the teeth of the rotating pump members should they be not quite full or the fluid may act as a primer for the pump at the initiation of operation.

When the pump is started at slow speed, the course of fluid through the valve device is from the pump around through the described circuit and back to the chamber 54, and the fluid continues to pursue that course until the pump reaches full speed. At full speed means to be presently described become effective to change the course.

As shown herein, the means effective to change the course of the fluid is responsive to two forces which vary with the displacement of the pump, namely, the suction at the inlet of the pump and the pressure of the by-passed fluid, though either might be employed alone. To that end a sealed chamber 60 is formed by the cap 8 over the upper side of the upper diaphragm 47, around the space occupied by the spring 49. A suction duct 61 (see Fig. 2) leads from the sealed chamber 60 through apertures made in the clamped portion of the diaphragm back to the inlet port 22 of the rotary pump. As the pump picks up speed, the restriction 20 in the inlet conduit 19 causes the formation of a considerable vacuum which is transmitted through the duct 61 to the sealed chamber 60. To build up the pressure of the by-passed fluid, the passage 53 is here made small and restricted and thus sufficiently resists the flow to cause a building up of pressure. This pressure acts on the underneath side of the valve member 44 tending to raise the valve in opposition to the spring 49. Accordingly, when the pump speed has been built up to a certain amount, the vacuum and the pressure become sufficiently great to overcome the force of the spring 49 and consequently the sleeve valve member 44 is drawn upwardly shutting off communication from the conduit 40 to the annular chamber 46. This position is most clearly shown in Fig. 4. When the passage 40 is closed, the annular chamber 34 becomes a dead-end and the full speed pump pressure immediately builds up a fluid force in the annular chamber sufficient to snap the lower diaphragm 35 downwardly. The movement of the diaphragm downwardly carries with it the disk valve 36 thereby uncovering an outlet port 62 and an auxiliary by-pass port 63. The outlet port communicates with a conduit or passage 64 which leads outwardly to the threaded outlet 65 to which a nozzle may be connected. The diaphragm 35 is suitably apertured where the passage 64 intersects the same. A bleed conduit 66 connects the auxiliary by-pass port 63 with the annular chamber 46 on the upper side of the valve body from which there is a direct communication through the conduit 53 and the chamber 54 to the intake side of the pump. By means of the bleed conduit 66, a pressure is maintained in chamber 46 to aid the vacuum in maintaining the main by-pass closed. It is believed apparent that, while both suction and pressure are here employed, either might be employed alone by a proper adjustment of the tension of the spring 49 and the extent of restriction in the passage 19 or the passage 53. Use is again made of a ball seal consisting of a ball 64' positioned to seal the passage 64 laterally from the outside after it is initially drilled during the course of manufacture.

It will be observed from the foregoing that, when the pump has reached the proper speed, there will be a closing of the normally open by-pass followed by a sudden opening of the discharge passage leading to the nozzle. It will be further observed that, since the size of the opening leading to the nozzle is somewhat larger than the size of the bleed conduit leading to the valve device, fluid in quantity will be first fed to the nozzle. However, because of the fact that the capacity of passage 64 is insufficient to conduct all of the fluid pump, a surplus of fluid will be present and that will be sent somewhat axially through the smaller bleed conduit back through a part of the normal by-pass system to the pump inlet. By this arrangement the operation of the pump is cushioned and a smooth vibrationless operation is assured at all times.

As soon as the power is shut off and the pump ceases operation, the suction set up by the restriction 20 in the intake conduit 19 will be immediately reduced to a negligible quantity and the pressure in chamber 46 will also be reduced. The reduction in suction being transmitted immediately to the chamber underneath the cap 8 will reduce the suction above the upper diaphragm and the tension in the spring 49 will then immediately be sufficient to push the sleeve valve downward to open the normally acting by-pass. As soon as the by-pass is opened, communication from the annular chamber 34 back to the pump intake will be immediately reestablished and the pressure against the lower diaphragm will be released. The release therefore of pressure against the lower diaphragm will be effective to permit the disk valve 35 to snap back into place under strong spring tension, abruptly closing the outlet port and auxiliary by-pass port and immediately stopping discharge to the nozzle before the pressure has been appreciably reduced. There will accordingly be produced a quick shut-off of fluid at the nozzle while the pressure of the fluid is at its maximum.

Normally the lower diaphragm 34 is held upwardly in a closed position by a heavy helical spring 67 which has at its inner end a washer 68 having a concentric semi-spherical knob or button 69 bearing pivotally against the cup-shaped chamber 37. At the lower or outer end the helical spring 67 has a second washer 70 having a semi-spherical depression 71 at the center in which the correspondingly shaped end of a screw 72 is inserted. A cap 73 fits over the bottom end of the screw 72 and acts as a locking and sealing device after the screw 72 has been turned in or out to adjust the spring pressure against the lower diaphragm 35. A threaded aperture 74 supplies a connection for a gauge and communicates by means of a passage 75 through a suitable aperture at the edge of the diaphragm, with the annular chamber 34 and consequently is always responsive to the discharge pressure from the pump. A vent passage 77 relieves any tendency toward an air cushion behind the lower diaphragm.

At the left of the pump base there is a rotating seal 76 which may be of a type illustrated by Patent No. 2,015,979, but which does not form a part of this invention. The purpose of a seal

of this sort is to confine the fluid completely within the unit.

The embodiment of the pump and valve as herein described may be used as a control device for an oil burner. When put to such a use, delayed action of the valve controlling the discharge performs a double function. When the current is turned on to start the pump, a fan of the usual sort, connected to the burner box, is simultaneously started. No volume of air which the fan is capable of injecting into the burner box is immediately sufficient to supply oxygen for complete combustion of fuel which might be injected. Consequently, when a device as described herein delays the injection of fuel into the firebox, there will have been previously introduced a sufficient volume of air to effect complete and efficient combustion when fuel oil is finally injected, at the nozzle, at its maximum pressure. A similar economy is effected when the fan and motor are shut off. Since at this stage the volume of air being forced into the burner box drops off immediately upon a slowing up of the fan, there would be insufficient air to burn completely fuel oil which would continue to be injected due to an otherwise gradual slowing up of the pump. In the apparatus herein described, as soon as the fan is cut off, the supply of fuel is likewise instantaneously cut off and no partial or incomplete combustion is allowed to take place.

There has thus been provided a novel and efficient pump and fluid control means which operates instantaneously at full pressure and at a proper time, and which cuts off the fluid supply at practically full pressure as soon as the demand for it ceases. The device is adjustable to various pump capacities and discharge pressures and supplies a mechanism suited to an infinite variety of circumstances.

I claim as my invention:

1. A fluid pressure generating and control mechanism comprising, in combination, a base, a housing secured to said base and having an inlet for connection to a source of fluid, a pump mounted on said base having an intake port communicating with the interior of said housing and a discharge port, said pump being operable to generate suction at the intake port and pressure at the discharge port, a screen in said housing interposed between the intake of the housing and the intake of the pump and a delayed actuation valve mechanism disposed in said housing and controlling the discharge from said pump comprising a valve body having a recess in one face thereof forming part of a chamber communicating with the discharge port of the pump, a flexible diaphragm clamped between said valve body and an annular shoulder in said housing completing said chamber, a valve seat in said chamber having a main discharge passage opening therethrough, a valve element carried by said flexible diaphragm so as to be responsive to the pressure in the chamber controlling said main discharge passage, means for urging said valve element normally to engage said seat and prevent discharge through said main passage, a recess formed in the opposite face of said valve body to constitute part of a second chamber, a duct leading from said first chamber to said second chamber, an annular flexible diaphragm, a cap securing the outer periphery of said annular diaphragm between said cap and said valve body, a movable valve element clamped to the inner periphery of said annular diaphragm and with said diaphragm completing said second chamber and controlling the duct leading from said first to said second chamber, a discharge duct leading from said second chamber, means normally urging said movable valve element to maintain said second chamber in communication with said first chamber to prevent the building up of pressure within the first chamber sufficient to open the valve disposed therein, and a conduit for communicating the suction at the intake of said pump to the interior of said cap for actuating said movable valve element to close said duct when the suction reaches a predetermined value.

2. A fluid control system comprising a strainer cup, a pump feeding therefrom having an inlet passage and a restricting means in the inlet passage for initiating suction when the pump is in operation, means forming an outlet conduit from the pump, a delay valve mechanism in the outlet conduit comprising a first valve member having a body portion forming a chamber always in communication with said conduit and a movable wall for the chamber including a diaphragm and a valve element mounted thereon, means forming a pocket adjacent the diaphragm having a shoulder at the edge thereof for securing the diaphragm to the body portion, a valve seat in the chamber and a spring supported in the pocket and mounted against the diaphragm for normally closing the valve member, means forming a first conduit communicating with the valve seat for regular fluid discharge, means forming a second conduit of smaller capacity communicating between the valve seat and the pump inlet for releasing surplus fluid; a second valve member having a body portion shaped to form a second chamber, means forming a conduit to the first valve member from the second chamber, a diaphragm forming one wall of the second chamber, and a sleeve valve mounted thereon having a cylindrical seat within the second chamber operable to open and close said conduit, means forming a by-pass from the second valve chamber to the pump inlet, means forming a sealed chamber on the outside of said second valve diaphragm enclosing a spring for normally depressing said diaphragm to a position for opening said sleeve valve, and means forming a duct leading from the sealed chamber to the pump inlet on the pump side of the restricting means for admitting suction to the diaphragm when the pump is in operation the suction being effective to draw the diaphragm and sleeve valve to a closed position, thereby forming a closed compression chamber within the delay valve mechanism immediately subject to pump pressure and operable to move the first valve element against its spring to an open position to allow direct discharge of the fluid.

3. A fluid control system comprising a source of fluid supply, a pump having an inlet and a restricting means in the inlet for producing suction when the pump is operated, means forming an outlet conduit from the pump, a delay valve mechanism in the outlet conduit comprising a valve member having a body forming a chamber always in communication with said conduit and means forming a pocket adjacent the chamber, said chamber having a movable wall including a flow restricting valve element mounted thereon, a valve seat in the chamber and resilient means supported in the pocket in contact with the movable wall for normally holding the wall and valve element in a position for seating the valve element against the valve seat, means forming a first

conduit communicating with the valve seat for discharge of fluid, means forming a second conduit communicating between the valve seat and the pump inlet for releasing surplus fluid, and means forming a return conduit from the valve mechanism having a valve device therein for opening and closing the return conduit and a passage from the valve device to the source of supply, said valve device having a chamber provided with a movable partition supporting one element of the valve device, means forming a sealed space on the outside of the movable partition enclosing a resilient means for normally depressing the partition and the supported element to a position for opening said valve device, means forming a communication between the sealed space and the pump inlet on the pump side of the restricting means for admitting suction to the diaphragm when the pump is in operation, said suction being effective to draw the supported element of the device to a closed position, thereby forming a closed compression chamber in the delay valve mechanism immediately subject to pump pressure and said pump pressure being operable to move the flow restricting valve element against its resilient closing means to an open position to allow direct discharge of the fluid from the valve mechanism simultaneously with a release of surplus fluid.

4. A fluid control system including a source of fluid comprising a pump having an inlet and a restricting means therein for producing suction and an outlet for discharging fluid under pressure, means forming an outlet conduit from the pump, a delay valve mechanism in the outlet conduit comprising a body forming a chamber always in communication with said conduit, a valve seat in the chamber and a spring pressed valve element movable against the seat for normally closing the valve mechanism, means forming a first conduit communicating with the valve seat for the discharge of fluid, and means forming a second conduit in communication between the valve seat and the source of fluid for releasing surplus fluid, a second valve mechanism having a body including a chamber, and means forming a passage from the second valve mechanism to the delay valve mechanism, having therein a valve element for opening and closing said passage forming part of the second valve mechanism and yieldably retained in a normally open position, means forming a return passage from the second valve mechanism to the pump inlet, casing means forming a sealed space on the outside of the last named valve element, and means forming a communication therefrom to the pump inlet on the pump side of the restricting means for conducting suction to the last named valve element when the pump is in operation, said suction being effective within the sealed space to draw the yieldable valve element to a closed position, thereby shutting off the return passage and forming a closed compression chamber in the delay valve mechanism subject to pump discharge pressure, said pressure being operable to move the first named spring pressed valve element to open position to allow direct discharge of the fluid and a simultaneous release of surplus fluid.

5. In a control mechanism for a fluid system including a source of supply and a pump having an inlet conduit with means therein for creating a suction and a discharge conduit, the combination of a delay valve device for normally closing the discharge conduit and a second valve device comprising a chamber, one wall of said chamber including a movable element and a valve mounted on said element, means forming a conduit from the chamber to the source of supply, means forming a normally open by-pass from the chamber to the delay valve device, said by-pass being controlled by said second valve device, a normally closed by-pass from the delay valve device to the pump, means subject to pump suction operable to close the normally open by-pass when the pump is in operation, and means subject to pump pressure to open the normally closed by-pass and to simultaneously open the discharge conduit from the pump.

6. A fluid control system including a source of supply for fluid and means for generating fluid pressure, means forming a discharge conduit from said generating means, a delay valve device in the conduit comprising a chamber having a valve seat, a movable wall and a valve carried by the wall, means forming an open passage from the chamber to the source of supply, said valve device having a cover member over the outside of the movable wall forming a closed compartment and a vent from the compartment to the source of fluid supply, there being an adjustable resilient means in the compartment positioned against the movable wall, said valve seat being normally closed by the valve carried by the movable wall, and means forming a discharge outlet together with means forming a by-pass outlet from the valve seat to the source of supply simultaneously operable by the valve when the fluid pressure is sufficient to open said valve against the adjustable resilient means.

7. A fluid control system including a source of supply for fluid and means for generating fluid pressure, means forming a discharge conduit from said generating means, a delay valve device in the conduit comprising a chamber having a valve seat and a valve member movable with one wall thereof, said valve device having a cover member adjacent the valve member forming a closed compartment and a vent from the compartment to the source of fluid supply, resilient means in the compartment operable normally to press the valve member against the valve seat to close it, and means forming a direct discharge outlet together with means forming a by-pass outlet from the valve seat to the source of supply, jointly operable by the valve member when the fluid pressure is sufficient to open said valve member against the resilient means.

8. In a fluid system including a source of supply and a pump, having inlet and discharge passages thereto, a control mechanism for minimizing disturbances in the pump comprising a valve device for attachment in the discharge passage from the pump including a valve having its outlet port in interrupted communication with the discharge passage, and means in the device for holding the valve normally in a yieldably closed position for shutting off the flow of fluid from said passage, said valve device having also a by-pass system for normally connecting the discharge passage with the source of supply comprising means forming an open primary by-pass having capacity sufficient to accommodate the entire pump discharge at speeds below full speed, and means forming a secondary by-pass having capacity sufficient to accommodate a portion only of the pump discharge at full speed, said secondary by-pass having an entrance thereto positioned adjacent the normally closed valve, a valve member in the primary by-pass, and means for automatically closing said primary by-pass when

the pump reaches full speed, said discharge at full speed being operable upon the normally closed valve to instantly open the secondary by-pass simultaneously with the opening of the normally closed discharge passage.

9. A control system for minimizing disturbances in fluid pumps including a valve mechanism for attachment in a discharge line from a pump comprising a valve element, an outlet positioned for communication with the discharge line and means for holding said valve element in a yieldably closed position for shutting off the flow of fluid from the discharge line to the outlet, means forming a primary normally open by-pass from the valve mechanism having capacity sufficient to accommodate the entire pump discharge at speeds below full speed and valve means in the by-pass in communication with the pump and automatically operable to close said by-pass when the pump reaches full speed, and means forming a secondary by-pass having a capacity sufficient to accommodate a portion only of the pump discharge at full speed and having an entrance thereto positioned adjacent the valve element, said valve element being subject to discharge pressure from the pump and operable thereby to simultaneously open the discharge line and the secondary by-pass upon closing of the primary by-pass.

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