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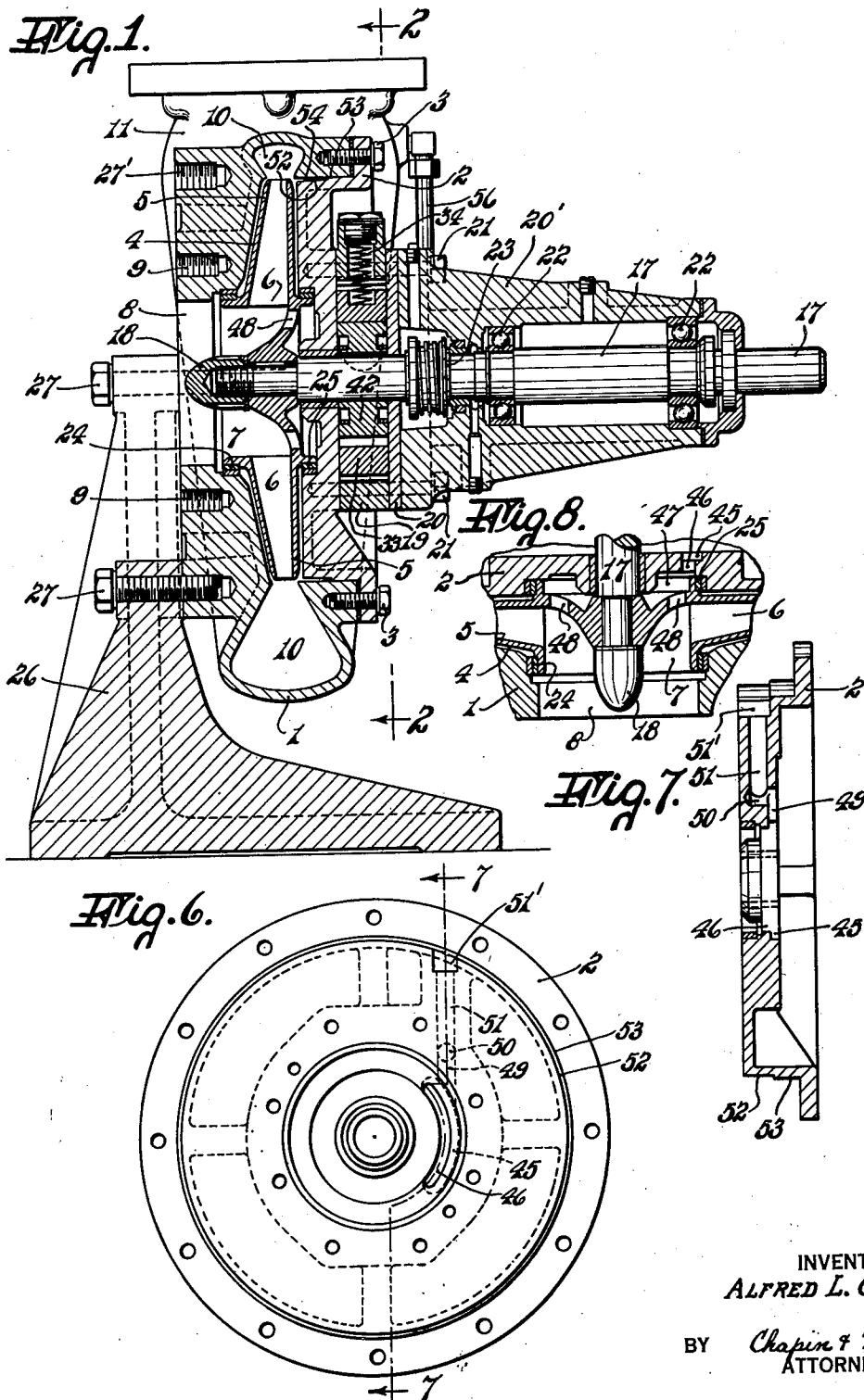
A. L. GRISE

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PRIMING MEANS FOR CENTRIFUGAL PUMPS

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2 SHEETS—SHEET 1



INVENTOR
ALFRED L. GRISE

BY *Chapin & Neal*
ATTORNEYS

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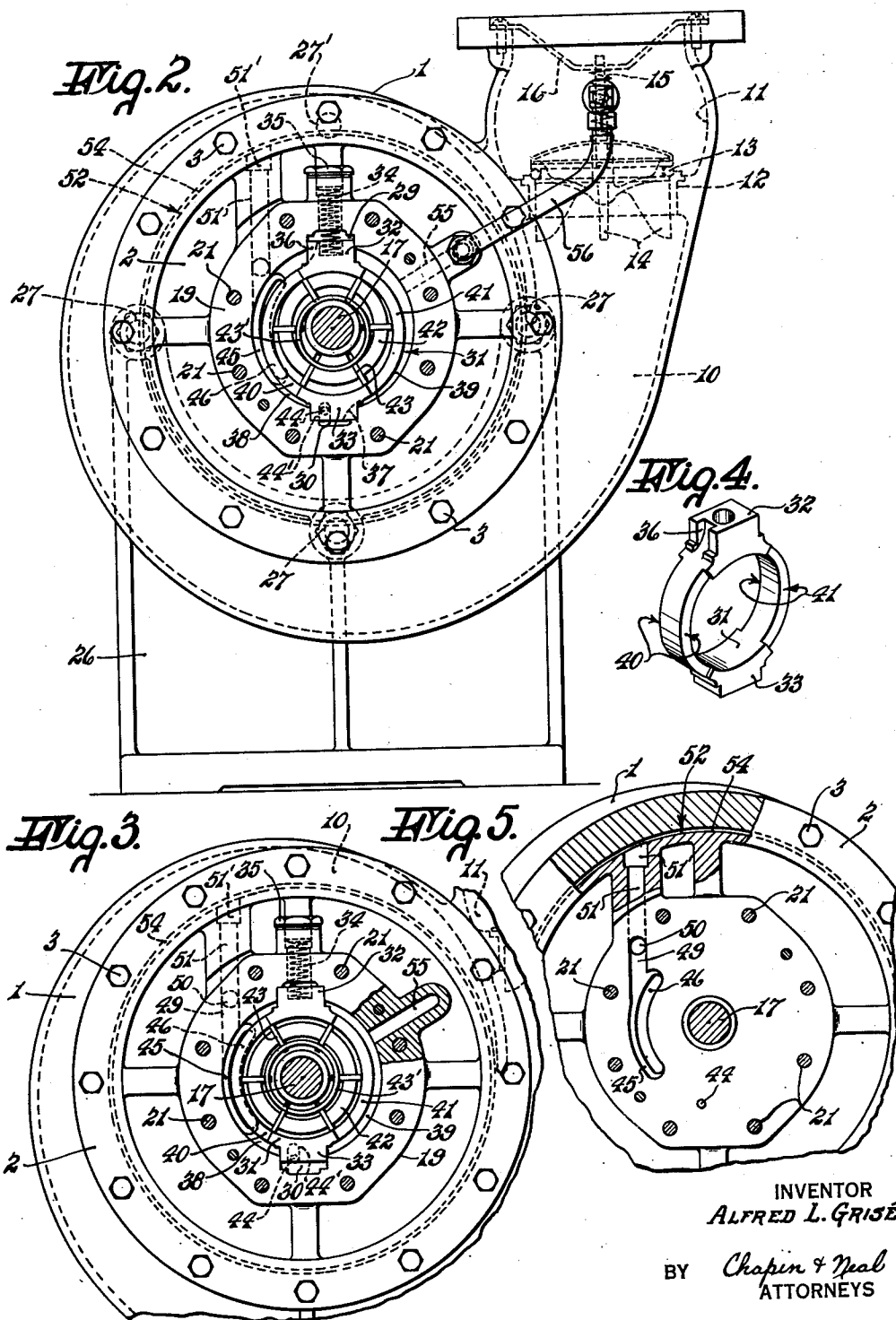
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2 SHEETS—SHEET 2



UNITED STATES PATENT OFFICE

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PRIMING MEANS FOR CENTRIFUGAL PUMPS

Alfred L. Gris , Springfield, Mass., assignor to
Gilbert & Barker Manufacturing Company,
West Springfield, Mass., a corporation of Mas-
sachusetts

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This invention relates to improved priming means for centrifugal pumps.

The invention has for an object the provision of a positively-acting displacement pump of variable capacity, arranged to operate at a high rate to rapidly exhaust air from the casing of the centrifugal pump and its suction pipe and to operate at a substantially less rate, after the centrifugal pump has been primed, and to operate at zero rate when the outlet of the centrifugal pump is closed.

The invention has for a further object the mounting of such a pump on a centrifugal pump, the impeller of which rotates on a horizontal axis, the priming pump having a suction connection to the top of the volute to avoid trapping of any substantial amount of air there by the rise of liquid in the casing of the centrifugal pump, as well as a suction connection to the eye of the impeller.

The invention also has for an object the provision of a standard for supporting the centrifugal pump with its axis horizontally disposed and in any one of a plurality of positions of angular adjustment so that the outlet of the centrifugal pump may be faced in different directions to suit different customers, the main casing of the centrifugal pump having a cover on which the priming pump is mounted and in which a suction connection for exhausting the volute is formed, such cover being capable of being fastened to the casing in a plurality of corresponding positions of angular adjustment so that said suction connection may extend vertically to the top of the volute regardless of the angular position of the main casing.

These and other objects will best be understood from the following detailed description of one illustrative example of the invention in the accompanying drawings, in which:

Fig. 1 is a central sectional elevational view of a centrifugal pump embodying the priming means of this invention;

Fig. 2 is a cross sectional view taken on the line 2—2 of Fig. 1 and showing the variable-capacity priming pump in position for pumping at its maximum rate;

Fig. 3 is a fragmentary cross sectional view, taken similarly to Fig. 2 and showing the priming pump in non-pumping position;

Fig. 4 is a perspective view of the shiftable stator element of the priming pump;

Fig. 5 is a view similar to Fig. 3 with the priming pump removed;

Fig. 6 is an elevational view showing the inner

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face of the cover plate which partitions the pumping chamber of centrifugal pump from the pumping chamber of the priming pump;

Fig. 7 is a sectional view taken on the line 7—7 of Fig. 6; and

Fig. 8 is a fragmentary sectional plan view showing the priming passages between the pumping chambers of centrifugal and priming pumps.

Referring to these drawings, and first to Fig. 1 thereof, the centrifugal pump includes a main casing 1 and a cover 2, secured to the main casing by cap screws 3. These casing members 1 and 2 afford between them a central chamber 4 receiving the impeller 5, which as shown is of the closed type and has a circular series of vanes 6 and a central eye 7, leading to the spaces between the vanes. The main casing 1 has in one side wall a central inlet 8 axially aligned with the impeller and in this wall are a series of tapped holes 9 which enable the flanged end of a suction pipe (not shown) to be fastened to the casing. The main casing (Fig. 2) has formed therein the volute channel 10, surrounding the chamber 4 and the impeller 5 and terminating with an outlet 11. The latter has fixed therein a bushing 12, providing a seat for a check valve 13, which has guide vanes 14 slidably engaging the inner peripheral wall of the bushing. A spring 15, acting between a cross bar 16, which is fixed at its ends to the casing 1 and diametrically spans the outlet passage 11, and the valve holds the latter to its seat until a sufficient pressure is built up in the centrifugal pump to open the valve.

The impeller 5 (Fig. 1) is keyed to one end of a drive shaft 17 and held against a shoulder on such shaft by a nut 18. This shaft extends through the cover 2, through the pumping chamber of a priming pump mounted within a casing 19, through a cover 20 of the casing 19 and into a bearing member 20'. The latter is secured by cap screws 21, which pass through a flange on member 20', through cover 20 and casing 19 and thread into cover 2. The shaft 17 is entirely supported by the ball bearings 22 in member 20'. A suitable seal ring 23 is provided to prevent escape of liquid from the pumps along shaft 17. The impeller has at its outer and inner ends hollow hubs 24 and 25 (Fig. 8), respectively, which fit into openings in the casing 1 and cover 2, respectively, and prevent flow of liquid from the outlet to the inlet side of the impeller through the chamber 4.

The pump, as thus far described, is of old

and well known form and it will serve as an illustrative example of one form of centrifugal pump, in which the priming means of this invention may be embodied. The invention may be used with any centrifugal pump and does not depend on, nor is it limited to, the particular details of construction disclosed.

The centrifugal pump is supported with its drive shaft 17 horizontal by a standard 26 (Fig. 1). The inlet face of casing 1 is clamped against one side face of this standard by three cap screws 27 (Fig. 2) spaced 90 degrees apart. There are four tapped holes in casing 1, spaced ninety degrees apart, and any three of them can be used to receive the three screws 27. The one tapped hole that is not used to receive a screw 27 is marked 27' in Figs. 1 and 2. The casing 1 may be secured to standard 26 in four different positions such that its outlet 11 may point vertically upward, vertically downward, or horizontally to the left or to the right. The standard 26 has a semi-circular recess (Fig. 2) in its upper end to clear the suction pipe and its flange.

The priming pump is of the positively-acting variable-capacity displacement type and is mounted within a housing comprising the hollow casing 19 and the described covers 2 and 20, which as shown in Fig. 1, are applied to and close opposite sides of the hollow casing. The interior of this hollow casing (Figs. 2 and 3) is cylindrical, except for two diametrically opposed recesses therein, each having parallel side walls and forming with their end closures 2 and 20 cylinders 29 and 30. The stator of the priming pump is shown separately in Fig. 4. It is in the form of an annular ring 31 with two diametrically-opposed projections 32 and 33 of rectangular cross section which form pistons and are slidably engaged in the cylinders 29 and 30, respectively, as shown in Figs. 2 and 3. A spring 34, mounted in a radial hole in member 19 and acting between a plug 35, which closes the outer end of such hole, and the piston 32 tends to hold the stator in the position illustrated in Fig. 2. There are slots 36 and 37 (Fig. 2) in the sides of pistons 31 and 32 that enable the cylinders 29 and 30 to communicate with the inlet and outlet chambers 38 and 39, respectively, that are formed between the stator 31 and member 19 in which it is slidable. These chambers communicate at all times with the space within the stator by means of the notches 40 and 41, best shown in Fig. 4. Within the stator is mounted a cylindrical rotor 42 fixed to drive shaft 17 in coaxial relation. This rotor is radially grooved at angularly spaced intervals to slidably receive vanes 43, which are held with their outer edges pressed against the internal periphery of ring 31 by means of two annular rings 43' which are located one in each of two recesses formed in opposite ends of rotor 42.

It is desirable to prevent the stator from being reversed in its casing and to this end a pin 44 (Fig. 3) is fixed to the cover 2 and projects into a groove 44' located in the piston 33 offset from the center line of the latter.

The inlet chamber 38 is connected to the eye of the impeller. In the cover member 2 (Fig. 5) is formed an arcuate groove 45 and an arcuate port 46 of less width than the groove connects the bottom of the groove to a chamber 47 (Fig. 8), formed within the inner hollow hub 25 of the impeller and connected to the eye of the latter by a series of holes 48 in the impeller. The inlet chamber 38 is also connected to the upper part 75

of the volute by a groove 49 (Fig. 5), formed in cover 2 and leading from groove 45 to a hole 50 (Figs. 3 and 5), which is drilled in cover 2 and communicates with the inner end of a hole 51. The latter is also formed in cover 2 and extends outwardly to a notch 51', the outer end of which opens to the outer periphery of a cylindrical part 52 of cover 2 and one side of which opens to the chamber 4. The cover has a cylindrical part 53 which as shown in Fig. 1 closely fits the opening in casing 1. The part 52 lies between the part 53 and the volute 10 and is of slightly less diameter than the opening in cover 2, thereby forming an annular groove 54 (Fig. 5) which communicates throughout its entire circumference with the volute 10. This groove may desirably be used to supplement the passage 50, 51, 51' above described.

The outlet chamber 39 of the priming pump is connected to the outlet 11 at a location beyond the check valve 13. This is effected by a passage 55 (Fig. 3) in casing 19 and a tube 56 (Fig. 1), which connects the outer end of passage 55 with outlet 11.

In operation, the inlet 8 of the centrifugal pump is connected to a suction pipe leading from a suitable source of liquid supply; the outlet 11 of the pump is connected to a delivery conduit, leading to the desired point of delivery and usually having a control valve, which can be opened to various degrees or closed; and the driving shaft 17 is connected to a suitable power source, such as an electric motor, for example. In the initial priming of the pump all the air within the chamber 4 and passage 10 of the casing 12 will have to be exhausted, as well as the air in the suction pipe. The control valve on the delivery conduit will be opened and the motor set in operation to drive both the impeller 5 and the rotor 42 of the priming pump. Initially, the stator 31 of the priming pump will be held by spring 34 in position for the maximum pumping rate. The positively-acting priming pump will draw air from the suction pipe through the holes 48, chamber 47, port 46 and groove 45 and force it out through passage 55 and tube 56 into the passage 11 above check valve 13 and thus the air will have free passage through the delivery conduit which will then be open at its outlet end. The displacement pump will also draw air from the volute passage 10 and the chamber 4 by means of the conduit, comprising the holes 50 and 51 and the notch 51'. Also, the annular groove 54 aids in connecting the volute passage 10 at all points around the impeller 5 to the inlet of the priming pump. This is a desirable feature although it is not necessarily essential for all purposes. It should be noted that the size of outlet pipe 56 is such as to freely pass all the air that the priming pump can pump, when working at its maximum rate. Air continues to be eliminated from the suction pipe until it becomes filled with liquid and then air is eliminated from the centrifugal pump casing and replaced with liquid until the latter is full. The connection of the inlet of the priming pump to the upper portion of the volute avoids the trapping there of any substantial amount of air. As liquid enters the priming pump and is forced outwardly, the tube 56 presents a restriction to its flow, resulting in a rise in pressure which causes the piston 33 to move the stator 31 against the force of spring 34 to decrease the pumping rate. This pressure is not, however, sufficient to shift the pump stator fully into neutral position. When the centrifugal pump is

primed, it forces liquid outwardly opening the check valve 13 and delivery of liquid through the delivery conduit occurs, the rate being controlled by the degree of opening of the control valve. If such valve is partly closed, this will cause a rise in pressure and shift the stator of the priming pump to still further decrease its pumping rate. When the flow is stopped by closure of the control valve, the ensuing rise in pressure will cause the stator of the priming pump to be shifted into neutral position.

As an illustration and without imposing limitations, the one particular example of pump disclosed is constructed to pump liquid at the rate of 200 gallons per minute when driven at the rate of 1750 R. P. M. It is shown one-third size in Figs. 1 and 2. The outlet tube 56 of the priming pump is one half inch copper tubing, which restricts the outflow of liquid sufficiently for the purpose. If a three-quarter inch tube were used the flow of liquid would not be restricted and the priming pump would continue to operate at maximum rate until the delivery conduit was restricted or closed.

The centrifugal pump is so constructed that the casing 1 can be connected to its supporting standard 26 in four positions of angular adjustment. This enables the outlet 11 to be turned vertically upward as shown, vertically downward, or positioned horizontally, facing to the right or left. Also, the cover 2 can be connected to casing 1 in four corresponding positions of angular adjustment so that the conduit 51 may always extend vertically upward to reach the upper part of the volute regardless of which way the outlet 11 faces.

The invention thus provides an improved priming means for centrifugal pumps including a positively-acting displacement pump capable of pumping at a high rate to quickly exhaust air and prime the centrifugal pump and a means for reducing its capacity after the centrifugal pump has been fully primed.

What is claimed is:

1. The combination with a centrifugal pump having an impeller, a driving shaft therefor, a casing in which the impeller is mounted and which is provided with an inlet axially of the impeller and a volute passage surrounding the impeller and terminating with an outlet, and a check valve located in said passage near said outlet and opening outwardly in the direction of liquid flow, of a variable-capacity priming pump, comprising a rotor connected to be driven by said shaft, a stator encompassing the rotor and shiftable to vary the pumping rate, a casing in which the stator is mounted and which has inlet and outlet chambers respectively connected to said inlet and outlet and a cylinder connected to said outlet chamber, a piston connected to said stator and slidable in said cylinder and adapted to be moved by liquid pressure, and a spring for moving the stator in opposition to the piston and tending to hold the stator in its maximum pumping rate position.

2. The combination with a centrifugal pump having an impeller, a horizontal driving shaft therefor, a casing in which the impeller is mounted and which is provided with an inlet axially of the impeller and a volute passage surrounding the impeller and terminating with an outlet, and a check valve located in said passage near said outlet and opening outwardly in the direction of liquid flow, of a variable-capacity priming pump, comprising a rotor connected to

be driven by said shaft, a stator encompassing the rotor and shiftable to vary the pumping rate, a casing in which the stator is mounted and which has inlet and outlet chambers and a cylinder connected to said outlet chamber, a conduit connecting said inlet chamber to the inlet of the centrifugal pump, a conduit connecting said inlet chamber to said volute passage near the upper part thereof, a conduit connecting said outlet chamber to said passage between the check valve and outlet, a piston connected to the stator and slidable in said cylinder and adapted to be moved by liquid pressure, and a spring for moving said stator in a direction opposed to that in which it is moved by liquid pressure and tending to hold the stator in its position for maximum pumping rate.

3. In a centrifugal pump, a two-part casing, an impeller rotatable therein, said casing including main and cover elements, said main casing element having in one wall an inlet axially of the impeller and in an opposite wall an opening axially of and larger in diameter than the impeller, said casing having a passage surrounding the impeller and terminating in an outlet, an outwardly opening check valve in said passage, said cover element having a cylindrical part closely fitting said opening and closing the same and adapted to be secured to the main casing in a plurality of positions of angular adjustment, a variable-capacity priming pump mounted on said cover element and comprising a rotor connected to be driven by said shaft, a stator in which the rotor is mounted, a casing in which the stator is shiftable mounted, spring means tending to hold the stator in its maximum pumping rate position, hydraulic means for moving the stator in opposition to the spring, said priming pump casing having inlet and outlet chambers, a conduit connecting said hydraulic means and outlet chamber to said passage at a point between the check valve and outlet, and a conduit extending from said inlet chamber outwardly in said cover and opening through the inner face thereof near its outer periphery into said passage, and a conduit connecting said inlet chamber to said inlet.

4. In a centrifugal pump, a two-part casing, an impeller rotatable therein, said casing including main and cover elements, said main casing element having in one wall an inlet axially of the impeller and in an opposite wall an opening axially of and larger in diameter than the impeller, said casing having a passage surrounding the impeller and terminating in an outlet, an outwardly opening check valve in said passage, a supporting standard for the pump and to which the main casing may be fastened in a plurality of positions of angular adjustment with the axis of its inlet horizontal, said cover element having a cylindrical part closely fitting said opening and closing the same and adapted to be secured to the main casing in a plurality of positions of angular adjustment corresponding to the first-named positions of angular adjustment, a variable-capacity priming pump mounted on said cover element and comprising a rotor connected to be driven by said shaft, a stator in which the rotor is mounted, a casing in which the stator is shiftable mounted, spring means tending to hold the stator in its maximum pumping rate position, hydraulic means for moving the stator in opposition to the spring, said priming pump casing having inlet and outlet chambers, a conduit connecting said hydraulic means and outlet cham-

ber to said passage at a point between the check valve and outlet, and a conduit extending from said inlet chamber outwardly in said cover and opening through the inner face thereof near its outer periphery into said passage, and a conduit connecting said inlet chamber to said inlet.

5. In a centrifugal pump, a casing including main and cover elements, an impeller rotatably mounted in the casing, a drive shaft for the impeller, the main casing element having in one wall an inlet axially of the impeller and in the opposite wall an axial opening larger in diameter than the impeller and closed by said cover element, the latter having an outer portion closely fitting the opening and an inner portion of less diameter forming with the adjacent wall of the opening an annular groove communicating with the interior of said casing beyond the impeller, said main casing element having a passage surrounding the impeller and terminating in an outlet, an outwardly opening check valve in said passage, a variable-capacity priming pump mounted on said cover element and comprising a rotor connected to be driven by said shaft, a stator in which the rotor is mounted, a casing in which the stator is shiftably mounted, spring means tending to hold the stator in its maximum pumping rate position, hydraulic means for moving the stator in opposition to the spring, said priming pump casing having inlet and outlet chambers, a conduit connecting said hydraulic means and outlet chamber to said passage at a point between the check valve and outlet, and a conduit in said cover connecting said inlet chamber to said groove.

6. In a centrifugal pump, a two-part casing, an impeller rotatable therein, said casing including a main casing element and a cover element, said main casing element having in one wall an inlet axially of the impeller and in an opposite wall an opening axially of and larger in diameter than the impeller, said casing having a passage surrounding the impeller and terminating in an outlet, an outwardly opening check valve in said passage, a supporting standard for the pump and

to which the main casing may be fastened in a plurality of positions of angular adjustment and with the axis of its inlet horizontal, said cover element having one cylindrical part closely fitting and closing said opening and another cylindrical part of less diameter forming with the wall of said opening a groove opening into the casing and facing the impeller, a variable-capacity priming pump mounted on said cover element and comprising a rotor connected to be driven by said shaft, a stator in which the rotor is mounted, a casing in which the stator is shiftably mounted, spring means tending to hold the stator in its maximum pumping rate position, hydraulic means for moving the stator in opposition to the spring, said priming pump casing having inlet and outlet chambers, a conduit connecting said hydraulic means and outlet chamber to said passage at a point between the check valve and outlet, and a conduit in said cover connecting said inlet chamber to said groove.

ALFRED L. GRISÉ.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,447,854	Jennings	Mar. 6, 1923
1,474,708	Drysdale	Nov. 20, 1923
1,890,317	Durbin	Dec. 6, 1932
2,064,421	Erskine	Dec. 15, 1936
2,134,686	DeLancey	Nov. 1, 1938
2,142,275	Lane	Jan. 3, 1939
2,153,360	Auger	Apr. 4, 1939
2,330,558	Curtis	Sept. 28, 1943
2,430,337	Heckert	Nov. 4, 1947
2,464,144	McConaghy	Mar. 8, 1949
2,500,228	Adams	Mar. 14, 1950

FOREIGN PATENTS

Number	Country	Date
371,138	Germany	Mar. 14, 1923