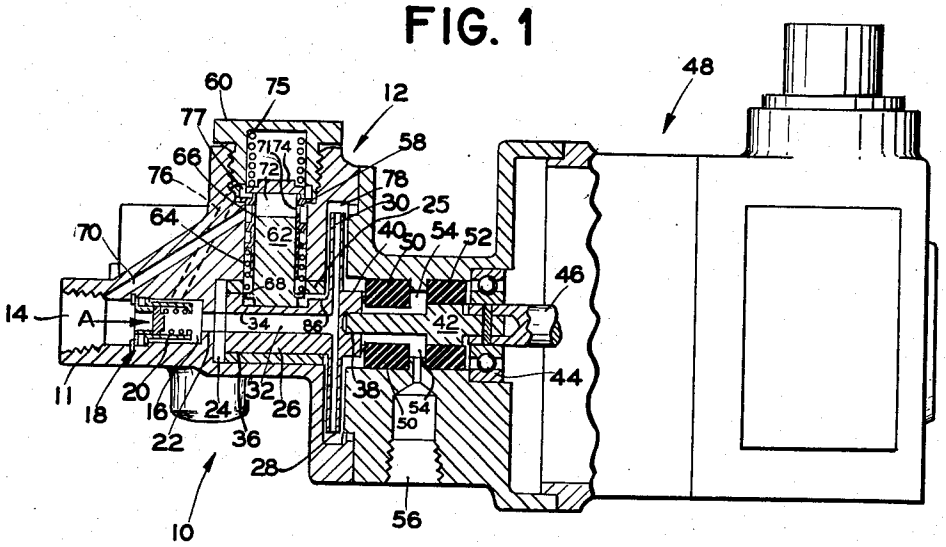
Jan. 19, 1954 H. TROEGER ET AL 2,666,393

SELF-PRIMING CENTRIFUGAL PUMP

Filed Sept. 28, 1949

FIG. 1



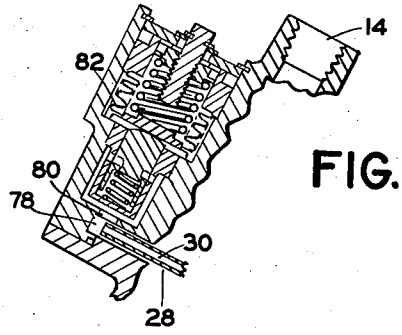


FIG. 3

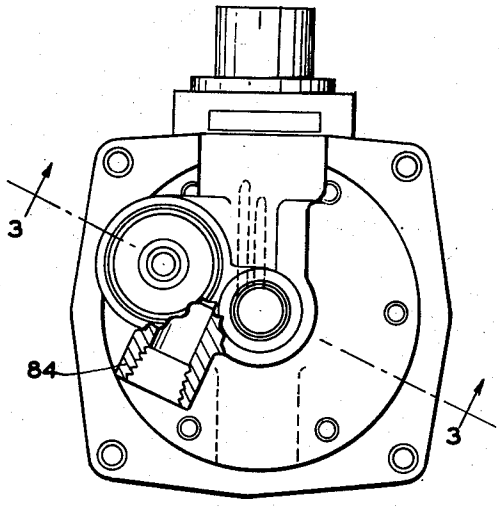


FIG. 2

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SELF-PRIMING CENTRIFUGAL PUMP

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The present invention relates to pumps and more particularly to those of the centrifugal self priming type.

The invention consists in the combination with an engine driven pump of a reciprocating type of priming pump which is mounted so as to be operative before the engine driven pump begins to handle fluid, and inoperative after the engine driven pump has begun to pump fluid in sufficient quantity.

A centrifugal liquid pump consists essentially of a rotary impeller, or rotor having passages extending from the center to the periphery thereof. The pump operates by the inertia or centrifugal throw of the liquid in these passages. A centrifugal pump will only function when it has liquid in its rotor. Therefore, a centrifugal pump will not start in operation if it must lift the liquid to be pumped, and will stop operation or become air bound if it does not have a continuous supply of liquid.

It is therefore one of the objects of the present invention to provide a novel type of self priming centrifugal liquid pump which will start operating immediately and wherein the priming means will be automatically rendered inoperative once the centrifugal pump begins pumping liquid.

Another object of the invention is to provide a pump of the above indicated nature wherein the moving parts are a minimum.

Still another object of the invention is to provide a self priming centrifugal liquid pump free from expensive and complicated gearing.

Still another object of the invention is to provide a self priming centrifugal liquid pump wherein a positive displacement pump is used for priming an impeller, and pressure from the impeller then renders the priming means inoperative once the centrifugal pump is in operation.

Another object of the invention is to provide centrifugal pumping apparatus of the type indicated which is of very rugged construction and upon which upkeep will be reduced to a minimum.

Another object of the invention is to provide a pumping unit embodying means for initially priming the pump, and for priming the pump at any time it loses its suction, and to provide means of said type which are relatively simple in construction and require no delicate adjustments.

Another object of the invention is to provide an efficient and compact arrangement of the above indicated nature.

The foregoing and other objects and advantages will appear more fully hereinafter from a consideration of the detailed description which follows, taken together with the accompanying

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drawing wherein one embodiment of the invention is illustrated by way of example. It is to be expressly understood, however, that the drawing is for the purposes of illustration only and is not to be construed as defining the limits of the invention.

Referring now to the drawings, wherein like reference characters designate like parts,

Figure 1 is an elevation in section of the pumping unit attached to the driving motor.

Figure 2 is an end view of Figure 1.

Figure 3 is a portion of a sectional view taken along the line 3—3 of Figure 2.

Referring now to the drawing and more particularly to Figure 1, a pump 10 has a casing 11 including a cylindrical portion 12 perpendicular thereto. A pipe threaded inlet 14 communicates with a chamber 16 which is blocked off by a check valve 18. The check valve 18 is of a type commonly employed in the art, and will permit flow only in one direction, herein indicated by the arrow A, and then only upon overcoming the force of a spring 20 which tends to bias the valve towards closed position.

The chamber 16 thereupon communicates through a passage 22 with the interior of a chamber 24 which houses a cylindrical sleeve bearing 25 in which is rotatably mounted the shaft 26 of the rotor or impeller 28. The rotor or impeller 28 contains one or more internal passages 30 which communicate with the hollow 32 of the shaft 26 which is a usual feature of similar devices, except that the shaft 26 contains an exterior groove 34 eccentrically cut about its outside surface 36 for reasons hereinafter explained. A slot 38 in the hub 40 of the shaft 26 engages in some suitable manner the driving shaft 42 which in turn passes through the inner race of a ball bearing 44 to engage the power shaft 46 of the driving motor 48. Annular seals 50 and 52 disposed about the shaft 42 tend to prevent any leakage which in any event would be collected in chamber 54 and conducted out through the drain 56.

The cylindrical portion 12 of the casing 10 has an interior bore 58 accessible by means of the threaded cap 60. The bore 58 extends into the chamber 24 but is sealed from direct communication therewith by sleeve bearing 25 and hollow shaft 26. Bore 58 houses a piston 62 which during the priming operation abuts the eccentric groove 34 of the shaft 26. A spring 64 anchored at one end to a stationary sleeve 66 and at the other end to a flange 68 on the piston 62 tends to keep the piston 62 positioned against the eccentric groove 34.

A passageway 70 leads from the inlet 14 to a port 71 formed in the sleeve 66 and which communicates the passageway 70 with an intake chamber 72 about and above the piston 62 and a valve 74 normally maintained in contact with sleeve 66 by means of spring 75 forms one wall of said intake chamber.

A second passageway 76 leads from the priming pump discharge chamber 77 to the chamber 16 on the downstream side of the check valve 18.

Referring now to Figures 1 and 3 combined, the openings 30 in the impeller 28 lead into an annular chamber 78, one portion thereof (Figure 3) leading by means of passage 80 to a pressure throttling valve 82 of a type well known in the art, and hence to the pump outlet 84, and another portion thereof communicating by means of passageway 86 to the groove 34 at the underside of the piston 62.

Having thus described the invention, it will now be apparent to those skilled in the art that when the inlet 14 is connected to a source of liquid and the pump 10 is driven by the motor 48, the eccentric groove 34 in the turning shaft 26, abutting against the piston 62, will cause said piston to travel up and down within the sleeve 66 thereby creating a suction at each stroke in the intake chamber 72. Fluid will in consequence be drawn from the inlet 14, up the passageway 70, through the port 71 which is uncovered by the downstroke of the piston 62 and into the chamber 72. Upon the upstroke of the piston 62 the port 71 will be closed by the piston 62 and fluid will be trapped in the chamber 72, and the force of spring 75 will be overcome thereby lifting the valve 74 and permitting the fluid to pass into the chamber 77 whereupon it will be driven down the passageway 76 into the chamber 16 in the downstream side of the check valve 18, and therefrom into the hollow 32 of the shaft 26 to provide priming for the impeller 28.

The radial passages 30 thereupon pass the liquid centrifugally into the annular chamber 78 from whence it passes through the passageway 80 and the pressure throttling valve 82, to the outlet 84.

When sufficient priming liquid has thus been provided to the chamber 16 and pumped out by the impeller 28, a reduced pressure is necessarily produced in the chamber 16 and in the hollow 32 of the shaft 26, whereupon the pressure against the valve 18 on the upstream side will overcome the spring 20 to open the valve, and permit the liquid to enter the hollow 32 of the shaft 26 directly from the inlet 14.

The centrifugal impeller 28 having thus commenced pumping at rapidly increasing capacity, the manner in which the priming means are suspended is as follows:

The passageway 86 connects the annular centrifugal pump chamber 78 to the groove 34 at the underside of the piston 62, thereby pressure fluid is transmitted to the underside of piston 62. As the impeller 28 takes over and begins to pump liquid at pressure the piston 62 will be held from its eccentric groove 34 against the force of the spring 64 by the fluid pressure from the impeller 28 and will not operate.

In the event that the fluid pressure created by the impeller 28 drops to a value insufficient to overcome the force of the spring 64, the piston 62 will be urged against the eccentric groove 34 and the priming process will begin again.

The pressure throttling valve 82 is set to a desired value so that the fluid delivery pressure of the pump cannot become excessive and is thereby regulated.

It is to be noted that the structure and the arrangement of the device provides a self primer for a centrifugal liquid pump which is driven from the same shaft as is the centrifugal pump, without complicated and expensive gearing and with a minimum of moving parts, and which operates only until positive pressure is built up by the centrifugal pump, at which time the primer is made automatically inactive, thereby leaving the impeller 28 as the only moving part.

There are thus provided self-contained means for priming a centrifugal pump which are of economical and rugged construction, compact in arrangement, and yet positive and reliable in operation.

Although only one embodiment and one application of the invention has been illustrated and described, other changes and modifications in the form and relative arrangement of parts which will be apparent to those skilled in the art may be made without departing from the spirit and scope of the invention.

What is claimed is:

1. In a centrifugal pump driven by a motor, the combination comprising a casing including an inlet and an outlet, a through bore and an impeller chamber in said casing in axial alignment with said inlet, a check valve in said bore restricting the flow from said inlet to a predetermined pressure, a bearing in said bore, an impeller in said impeller chamber having a hollow shaft rotatably mounted in said bearing, said hollow shaft having an open end communicating with said inlet downstream of said check valve, the interior of said impeller communicating with the interior of said hollow shaft, the exterior of said hollow shaft being grooved to form an eccentric cam surface, a driving shaft attached to said impeller and adapted to be driven by said motor, a second bore in said casing perpendicular to said first bore and extending through said bearing and isolated from said through bore by said bearing and hollow shaft, a first sleeve concentric within said second bore, a movable piston within said sleeve, spring means anchored to said sleeve normally urging said piston against said cam surface, a liquid intake chamber in said second bore above said piston, a passage in said casing from said inlet to said intake chamber including a port in said sleeve, a discharge chamber in said second bore, a valve controlling communication between said intake and discharge chambers, a passage in said casing from said discharge chamber to said through bore downstream of said check valve and upstream of the open end of said hollow shaft, a pressure throttling valve of predetermined setting intercommunicating said impeller chamber and said outlet, passageway means from said impeller chamber opening to said second bore below said piston to conduct fluid pressure to the underside of said piston to overcome said spring means and render said piston inoperative thereby preventing priming liquid flow from said inlet to the downstream side of said check valve upon said impeller operating to open said check valve and pump liquid directly from said inlet.

2. In a self-priming motor driven centrifugal pump, the combination comprising a casing including an inlet and an outlet, a first bore and an impeller chamber in said casing in axial alignment with said inlet, a bearing in said first

bore, an impeller in said impeller chamber having a hollow shaft communicating with the interior of said impeller and rotatably mounted in said bearing, said hollow shaft having an open end adjacent to and in communication with said inlet, a check valve of predetermined setting in said inlet upstream of the open end of said hollow shaft, a second bore in said casing perpendicular to said first bore and extending through said bearing, said first and second bores being isolated from each other by said bearing and hollow shaft, the exterior surface of said hollow shaft being grooved to form a cam surface, a piston within said second bore normally contacting said cam surface, an intake chamber in said second bore above said piston, a first passage in said casing from said inlet upstream of said check valve to said intake chamber, a discharge chamber in said second bore, a valve in said second bore controlling communication between said intake and discharge chambers, a second passage in said casing from said discharge chamber to the downstream side of said check valve and upstream of the open end of said hollow shaft, a pressure regulating valve intercommunicating said impeller chamber and said outlet, passageway means from said impeller chamber to the underside of said piston, a motor, a driving shaft connecting said motor to said impeller to rotate said impeller and hollow shaft thereby actuating said piston to pass liquid from said inlet through said first and second passages to the end of said hollow shaft bypassing said check valve to effect said impeller to pump said liquid to said outlet and beneath said piston, to overcome said predetermined setting and open said check valve and raise said piston above and out of contact with said cam surface.

3. In a self-priming centrifugal pump, the combination comprising a casing having an inlet, a check valve in said inlet, a bore in said casing communicating with said inlet, a hollow shaft rotatably supported in said bore and having an open end disposed adjacent to and in communication with the downstream side of said check valve, an impeller on the opposite end of said hollow shaft, the open end of said hollow shaft forming the inlet of said impeller, a chamber in said casing about said impeller, a cam surface on said hollow shaft, a cylinder in said casing having a piston mounted for reciprocation therein, an intake chamber in said cylinder above said piston, a discharge chamber in said cylinder, valve means controlling communication between said intake and discharge chambers, a first passageway in said casing from said inlet upstream of said check valve to said intake chamber, a second passageway from said discharge chamber to the downstream side of said check valve and upstream the open end of said hollow shaft, spring means holding said piston in contact with said cam surface on said hollow shaft for operating said piston to draw liquid from said inlet through said first passageway into said intake chamber and to force the liquid from said intake chamber through said valve means, discharge chamber and second passageway to the open end of said hollow shaft to prime said centrifugal pump.

4. In a self-priming centrifugal pump, the combination comprising a casing having an inlet and an outlet, a bore in said casing downstream of said inlet, a hollow shaft rotatably mounted in said bore and having an open end adjacent to and communicating with said inlet, an impeller on the other end of said hollow shaft, the interior of said hollow shaft communicating with the interior of said impeller, an output chamber in said casing surrounding said impeller and communicating with said outlet, said impeller being constructed and arranged to provide a flow of fluid from said inlet through said hollow shaft and impeller to said output chamber upon rotation of said impeller, a check valve of predetermined setting mounted in said inlet upstream of the open end of said hollow shaft to control the flow of liquid through said inlet to the open end of said hollow shaft, said check valve closing said inlet when said impeller is stationary, by-pass passageway means in said casing from said inlet upstream of said check valve to downstream of said check valve for by-passing said check valve and to deliver liquid to the open end of said hollow shaft from said inlet upstream of said check valve, valve means controlling flow through said by-pass passageway means, said hollow shaft having an exterior groove forming a cam surface, pumping means including a piston normally engaging said cam surface and actuated thereby for pumping liquid from said inlet to the open end of said hollow shaft through said by-pass passageway means and valve means, and other passageway means between the output chamber and the underside of said piston, and turning means attached to said impeller and operative to rotate said impeller and hollow shaft whereby said pumping means delivers liquid from said inlet through said by-pass passageway means and valve means to the open end of said hollow shaft to prime said impeller to overcome said predetermined setting of said check valve and open the same to permit liquid to flow from said inlet through said hollow shaft to said impeller, and said other passageway means serving to deliver liquid pressure from said output chamber to the underside of said piston to disengage said piston from said cam surface.

5. In a self-priming liquid centrifugal pump, the combination comprising a casing having an inlet and an outlet, a check valve in said inlet, a bore in said casing downstream of said inlet, a hollow shaft rotatably mounted in said bore, said hollow shaft having an open end communicating with said inlet through said bore, an impeller on the other end of said hollow shaft having its interior communicating with the interior of said hollow shaft, an impeller chamber in said casing disposed about said impeller and communicating with said outlet, said impeller operative upon rotation to provide a flow of liquid under pressure from said inlet through said check valve, hollow shaft, impeller and impeller chamber to said outlet, a cam surface formed on said hollow shaft, priming means including a cylinder in said casing, liquid passageway means in said casing connecting said cylinder to the upstream and downstream sides respectively of said check valve, a piston in said cylinder operatively engaged with said cam surface, valve means in said cylinder operated by said piston and controlling flow through said liquid passageway means, said piston operative to pump liquid through said passageway means from said inlet to the open end of said hollow shaft bypassing said check valve, driving means operatively connected to said impeller for rotating said impeller and hollow shaft, and means for disengaging said piston from said cam surface comprising a passageway between said impeller

chamber and the underside of said piston, said disengaging means being operative in response to the pressure developed in said impeller chamber by said impeller.

6. In a self-priming centrifugal pump, the combination comprising a casing having an inlet and an outlet, a bore in said casing downstream of said inlet, a hollow shaft rotatably mounted in said bore and having an open end adjacent to and communicating with said inlet, an impeller on the other end of said hollow shaft, the interior of said hollow shaft communicating with the interior of said impeller, an output chamber in said casing surrounding said impeller and communicating with said outlet, said impeller being constructed and arranged to provide a flow of fluid from said inlet through said hollow shaft and impeller to said output chamber upon rotation of said impeller, a check valve of predetermined setting mounted in said inlet upstream of the open end of said hollow shaft to control the flow of liquid through said inlet to the open end of said hollow shaft, said check valve closing said inlet when said impeller is stationary, a cylinder in said casing, a piston mounted for reciprocation in said cylinder, an intake chamber in said cylinder above said piston, a first passageway from said inlet upstream of said check valve to said intake chamber, a discharge chamber in said cylinder, valve means controlling flow between said intake and discharge chambers, a second passageway from said discharge chamber to the open end of said hollow shaft, a cam surface on said hollow shaft, spring means urging said piston into contact with said cam surface whereby rotation of said hollow shaft reciprocates said piston to pump priming liquid from said inlet through said first passageway, intake chamber, valve means, discharge chamber and second passageway to the open end of said hollow shaft, and impeller sustained liquid pressure means operative on said piston to intermittently cut out said piston upon said priming liquid reaching a sufficient pressure.

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