

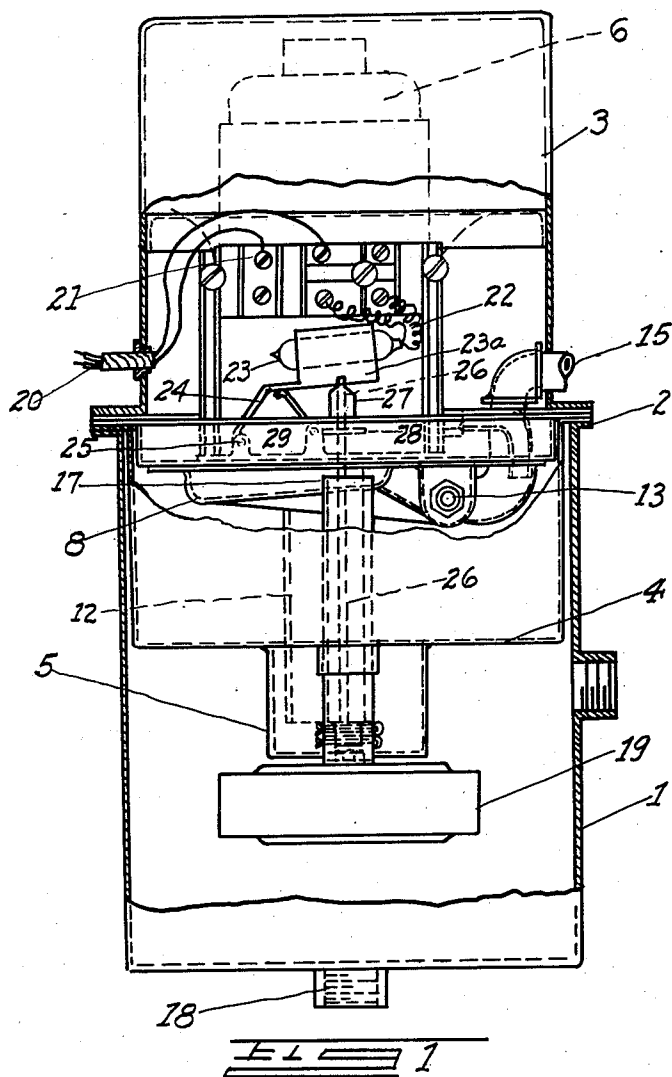
May 12, 1931.

J. H. STEWART

1,804,846

CENTRIFUGAL PUMP

Filed March 24, 1926 3 Sheets-Sheet 1



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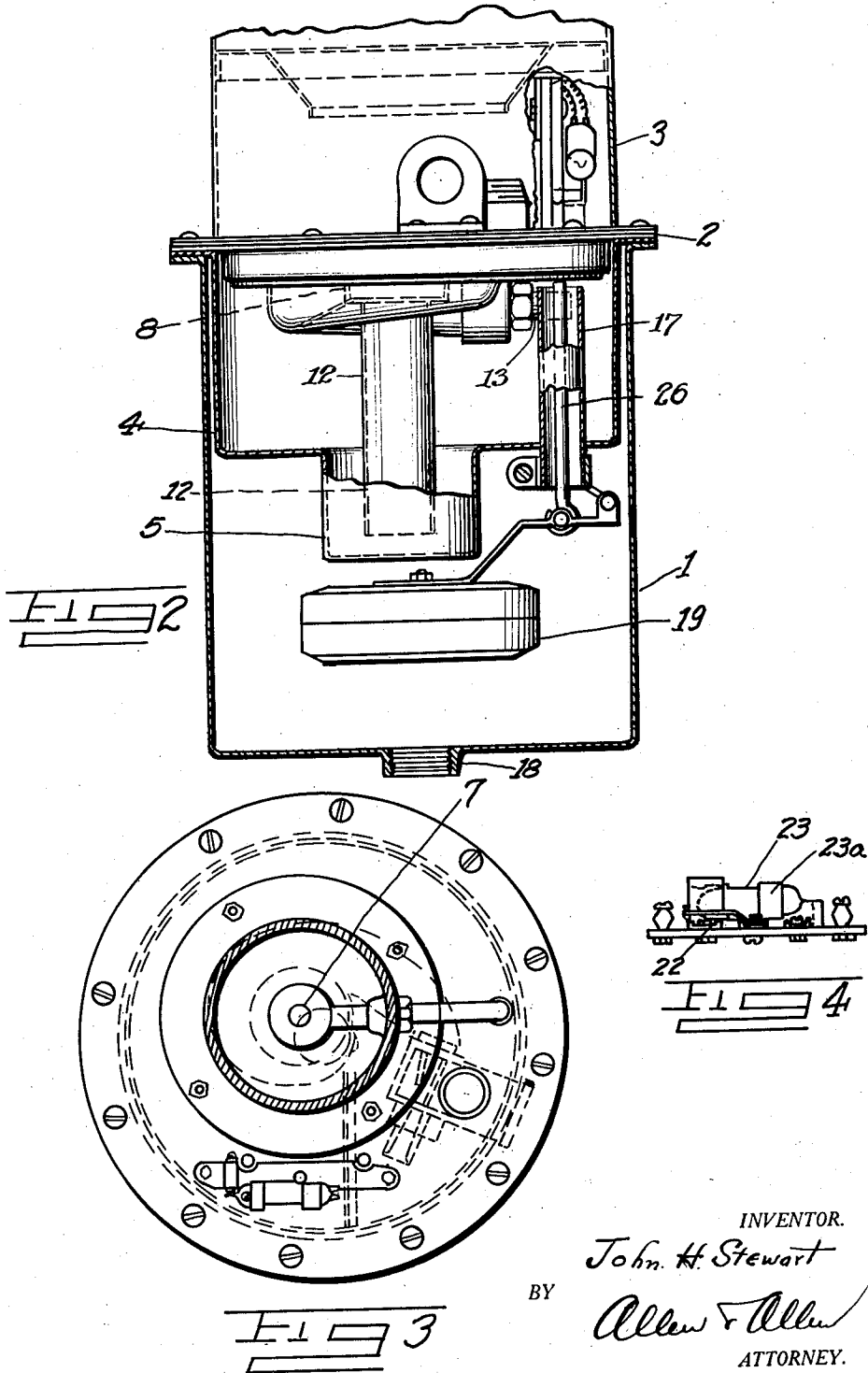
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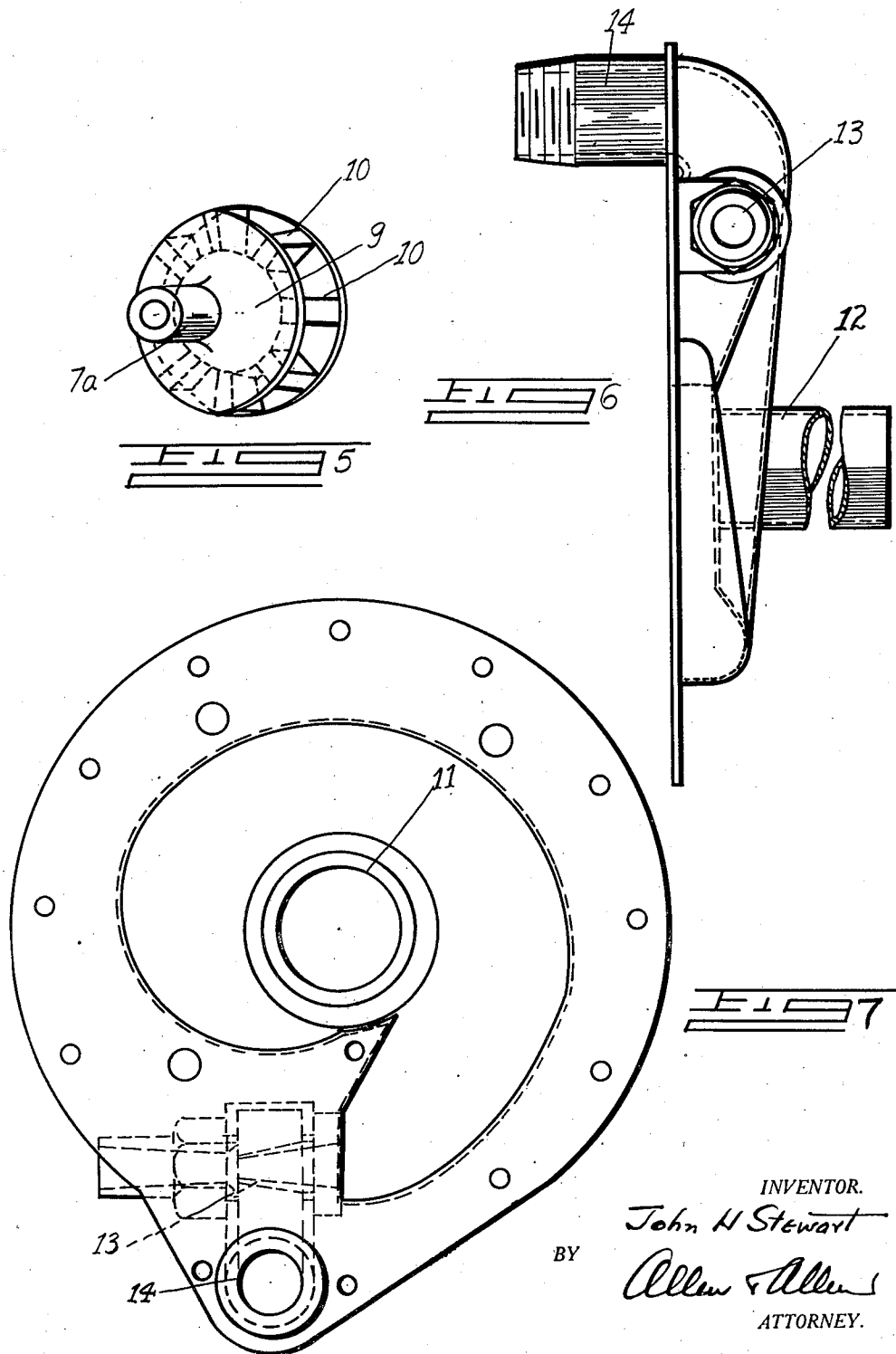
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CENTRIFUGAL PUMP

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My invention relates broadly to centrifugal pumps and particularly to the provision in combination with a centrifugal pump of an ejector for increasing the effectiveness of a pumping and discharging operation.

It is the object of my invention to provide means for automatically priming centrifugal pumps, thereby increasing greatly the field of usefulness of such pumps.

The mechanical principle involved in the operation of centrifugal pumps is well known. A rotor with vanes thereon, projects a flow centrifugally, usually through a cycloid passage in which the volume of flow creates some suction which assists in pulling the oncoming flow to the rotor. Centrifugal pumps when operated on a level with a storage tank, are of great serviceability. The volume of flow which they will provide in a gravity feed system is efficient. They have very few working parts, and aside from the bearings on the spindle of the rotor, they have no wearing parts. The disadvantage of centrifugal pumps heretofore has been that if the supply tank has been more than a few inches below the pump, the lack of self priming power of the pump has rendered them very inefficient and practically inoperative, especially for automatic operation.

For use in many arts such as the fuel oil burner art and the gasoline dispensing art, the regulations of fire underwriters require the disposal of all inflammable liquids in underground tanks. It has not been feasible, therefore, to use centrifugal pumps, which otherwise are admirably suited for this class of work, because of their lack of sufficient suction power, when not primed, to draw the liquid up from the underground tank.

It is to the construction of a centrifugal pump which will operate efficiently regardless of the level of the tank with relation to the pump, that my invention is directed. I accomplish my object primarily by so disposing a Venturi tube in such relation to the discharge of a centrifugal pump, that the action of the tube acts as a suction element which provides a constant supply for the pump at a suitable level within the pump casing to ef-

fectively feed the centrifugal rotor of the pump.

It is a further object of my invention to so arrange an electric control system, that the pump will operate automatically, and by the alternate shutting off and starting of the motor which operates the pump in accordance with the rate of intake and output, so controls the output, that a rate of discharge in accordance with any desired requirements may be provided.

Referring to the drawings in which I have illustrated a preferred structure which has been found of great practical usefulness in combination with a fuel supply system for any oil burning furnace:

Figure 1 is a side elevation with cut away portions showing the preferred arrangement of internal parts.

Figure 2 is a side elevation with cut away portions indicating the parts from a different position from that shown in Figure 1.

Figure 3 is a plan view of the assembly with the cover plate removed.

Figure 4 is a side elevation of the preferred type of electric switch which is used in the control system.

Figure 5 is a perspective view from the upper side of the pump rotor.

Figure 6 is a side elevation and Fig. 7 a plan view of the pump housing assembly in inverted positions and looking in the direction of the arrows.

The assembly is housed in a casing or supply reservoir 1 having a flange 2 at its upper end to which is bolted a cover 3. Within the casing a sump 4 is suitably secured. The dimensions and size of the sump are in accordance with the particular type of pump and the duty it is to perform. For such an installation as that described which is for use in combination with an oil burning furnace I have found that the sump is preferably shaped as indicated with a lower well portion 5 of less diameter than the main portion which acts as a well for the main portion of the sump. A motor 6 is mounted within the cover preferably supported on the flange of the casing and a shaft 7 Fig. 3 from the motor extends vertically downward and is suitably

coupled with the spindle 7a Fig. 5 of the centrifugal pump 8. The centrifugal pump in the simple type illustrated, consists of a rotor or impeller 9, provided with vanes 10, which impell the material pumped through a cycloid passage 11. The supply line 12 to the pump extends down from the rotor into the lower portion of the sump well 5. At the end of the cycloid discharge passage, a Venturi or ejector tube 13 is disposed which has an intake line 14, which extends through the casing as at 15 and is connected with the oil storage tank (not shown). In the embodiment illustrated, I have not specified the distance from the pump casing to the storage tank, but it should be understood in this connection that the distance which my invention will enable a centrifugal pump to pull, will be the same as any suction pipe. It is my understanding that previous to my invention, the average pull of a centrifugal pump, when not primed, is only four or five inches, although in some cases it may be slightly more than such a distance.

The Venturi tube discharges directly into the sump 4, but the pipe or baffle 12, that supplies the impeller, prevents undue churning about of the liquid supply to the impeller. I have found it preferable to dispose the end of the supply line to the pump at the bottom of the well, to be as far removed as possible from the surface of the material in the sump. An overflow pipe 17 extends from the top level of the sump into the casing 1, which acts as a gravity feed reservoir from which liquid may be withdrawn through a pipe 18. From the foregoing description of parts, it should be understood that the principle of operation of the pump consists in using a centrifugal pump to operate an ejector, which ejector supplies all liquid to a point for use. The ejector also maintains a level of liquid at the start and throughout its operation. The ejector is used to fill a reservoir from which the supply is drawn for use, which permits of an automatic operation to be controlled in accordance with the level of liquid in the reservoir. If the supply from the reservoir is not regulated in accordance with the amount which overflows into the reservoir from the sump, either the reservoir will run empty which in the case of feeding an oil burner would result in the fire going out, or the reservoir will fill up. If the reservoir should fill up there would be no flow from the sump and the sump would overflow and the ejector would stop functioning. The operation of the motor should be controlled so that the sump neither overflows nor runs dry. Consequently I have provided a control for the operation of the pump consisting in a float 19 disposed in the reservoir which is connected with controlling means which shuts off the pump at both high and low levels and turns on the pump at all intermediate points

above the low point and below the high point. Thus I automatically control the centrifugal pump so that in accordance with the rate of discharge the pump is turned on and off at such intervals as to constantly keep the reservoir with sufficient liquid therein to supply any desired output.

I preferably operate the motor by electricity so that my preferred control is by means of electrical switches. The lead lines 20 are connected with a panel board indicated at 21 from which lines 22 are connected to a tilting mercury tube 23 which consists of a hollow tube in which a small amount of mercury is disposed. When the mercury tube is tilted to the left as indicated in Figure 1 the lines 22, which are connected with the motor so that when connection is made the motor will run, are out of contact. When the tube is tilted to the right the mercury forms a connecting element for the lines 22 and the motor will consequently operate. The mercury tube is secured in a frame 23a which is mounted on an arm 24 which is pivoted in the frame casing as at 25. It will be obvious that when the float 19 rises to the top of the supply reservoir a rod 26 which is extended from the float and passes through the interior of the overflow pipe 17 will bear against the frame in which the tube is secured and cause it to rock to the left and break the circuit. I have further provided an extension from the rod 26 as at 27 which when the float is at the bottom of the reservoir engages the short arm 28 of a lever 29 also pivoted in the casing and with upward movement of the long arm of this lever the tube is rocked to the left as with the float at the top of the reservoir. Thus I have electrical connections for the motor which are in closed circuit at all times excepting when the float is either at the top or bottom of the reservoir. The mercury tube is so mounted that it tends to fall by gravity to a circuit closing position so that after the motor has been shut down as soon as the float moves from either the top or bottom position the mercury tube rocks and starts up the motor.

Modifications in structure in which similar purposes are accomplished by changes in size and shape of the component parts of systems similar to the one specific embodiment illustrated I consider well within the range of mechanical equivalency.

Having thus described my invention what I claim as new and desire to secure by Letters Patent is:

1. In combination with a centrifugal pump, a Venturi tube disposed at the discharge end of said pump, a sump into which said Venturi tube discharges, a suction pipe from a supply to be pumped connected with said Venturi tube, a suction passage from said sump to said pump, a reservoir below said sump, an overflow from said sump to said

reservoir, and an outlet from said reservoir.

2. In combination with a centrifugal pump, having a source of power, a Venturi tube in the discharge of said pump, an intake supply line connected with the suction side of said Venturi tube, a sump with a suction line from said sump to the intake of said pump, and a gravity flow reservoir with an overflow line from said sump into which said ejector and pump discharge to said reservoir, means for controlling the operation of the source of power in response to change of liquid level in the reservoir.

3. In combination with a centrifugal pump, having a source of power, a Venturi tube in the discharge of said pump, an intake supply line connected with said Venturi tube, a sump with a suction line from said sump to the intake of said pump, and a gravity flow reservoir with an overflow line from said sump into which said ejector and pump discharge to said reservoir, means for controlling the operation of the source of power in response to change of liquid level in said reservoir, said controlling means automatically operable at high and low levels of liquid in said reservoir.

4. A pump having a sump with a pipe from said sump adapted to act as the intake to said pump, a supply reservoir with an overflow pipe from said sump to said reservoir, a discharge output pipe from said reservoir, and means actuated by material discharged from said pump for drawing a supply from a supply source into said sump.

5. Supply means for a pump comprising in combination with a pump, a sump with a pipe from said sump adapted to act as the intake to said pump, a supply reservoir with an overflow pipe from said sump to said reservoir, a discharge output pipe from said reservoir, and means actuated by material discharged from said pump for drawing an intake supply into said pump, a source of power for said pump and a float in said reservoir with means connected with said float for controlling said source of power.

6. In combination with a supply reservoir for a gravity feed pipe, a sump having an overflow into said reservoir, a rotatable power operated pump having a suction line extending into said sump, said pump at its discharge end being provided with a Venturi tube, and a suction line connected with said Venturi tube, whereby the intake to the pump is supplied from the sump and the discharge from the pump operates said Venturi tube to replenish the supply for said sump.

7. In combination with a centrifugal pump, having an intake and a discharge orifice, means connected with said discharge orifice for drawing liquids to approximately the level of said intake orifice, a sump into which said pump discharges, with a gravity reser-

voir below the level of said pump supplied by an overflow from said sump.

8. In a liquid pump, an impeller, a sump in which the impeller acts, a Venturi tube driven by the entire supply from the impeller to fill the sump, and an overflow for delivery from the sump.

9. In a liquid pump, an ejector, an impeller connected to force liquid through the ejector, connections to the low pressure point of the ejector for supplying liquid to the impeller, a vessel in which the impeller acts and into which the ejector discharges, and overflow means for conducting away the liquid emitted by the ejector and impeller into said vessel.

10. In a liquid pump having an ejector, an impeller connected to force liquid through the ejector, connections to the low pressure point of the ejector for supplying liquid to the impeller, and overflow means for conducting away the liquid emitted by the ejector and impeller into a reservoir, said last named means including said reservoir, a motor for the impeller, means controlled by the liquid level in the reservoir for automatically controlling the motor.

11. In a liquid pumping mechanism, an ejector, a centrifugal pump connected to force liquid through the ejector, connections to the low pressure point of the ejector for supplying liquid thereto, means for conserving for action thereon by the impeller a body of liquid supplied by the ejector and overflow means from said means for conducting away the liquid conserved therein, said last named means including a reservoir, and a motor for the impeller, and means controlled by the liquid level in the reservoir for automatically controlling the motor.

JOHN H. STEWART.