

May 15, 1945.

F. MIESS

2,376,071

CENTRIFUGAL PUMP

Filed Aug. 27, 1940

2 Sheets-Sheet 1

FIG. 1.

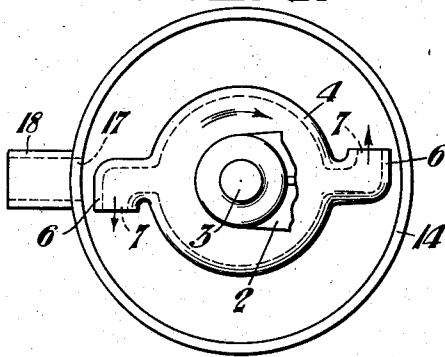


FIG. 4.

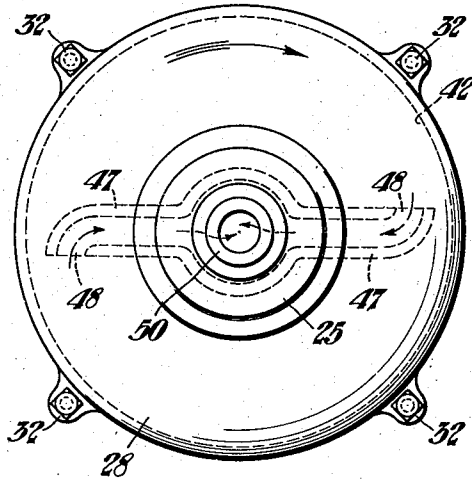


FIG. 2.

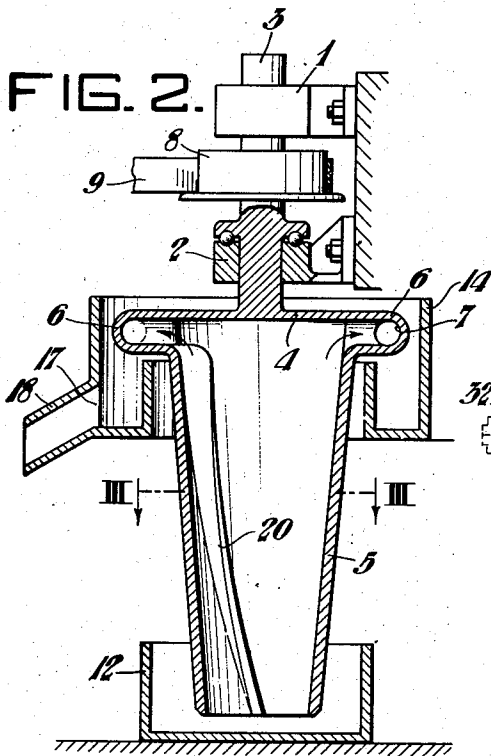


FIG. 5.

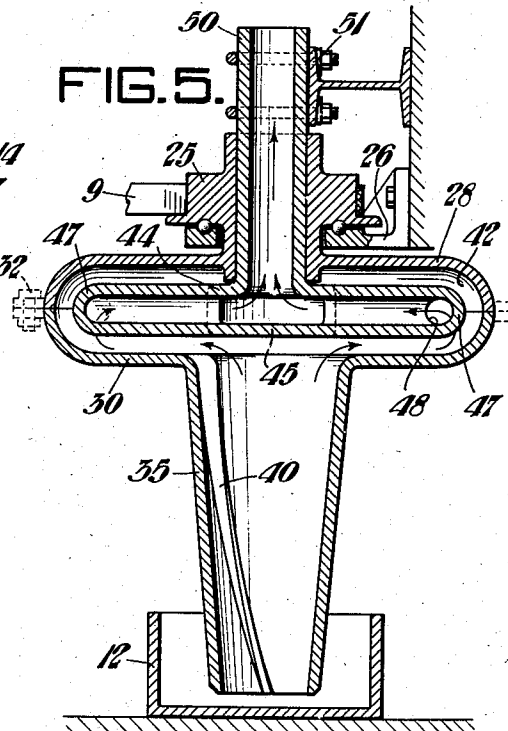
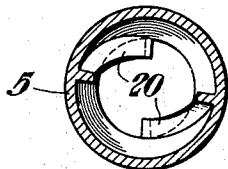


FIG. 3.



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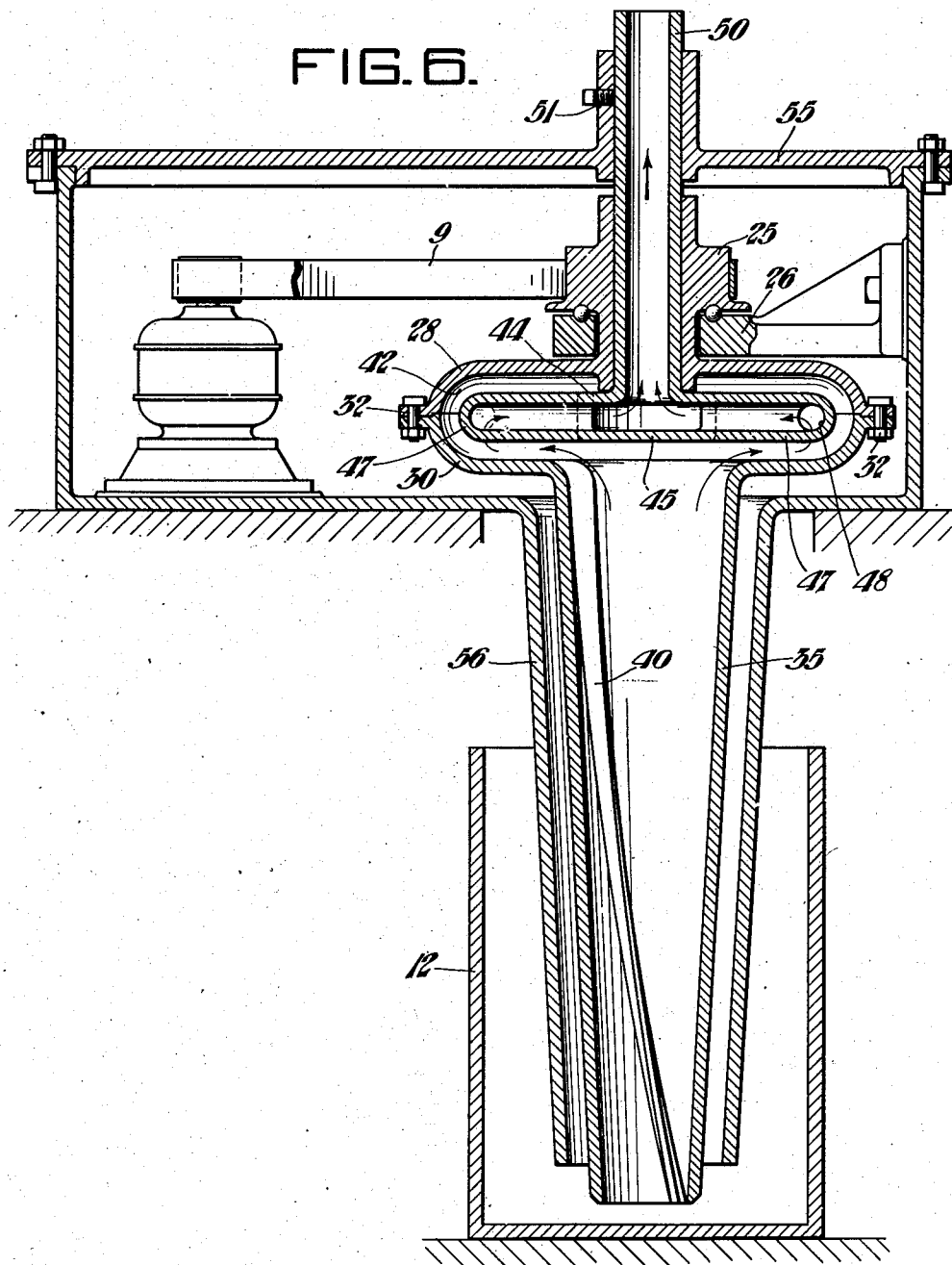
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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

2,376,071

CENTRIFUGAL PUMP

Fred Miss, Gary, Ind.

Application August 27, 1940, Serial No. 354,432

2 Claims. (Cl. 103—101)

This invention relates to centrifugal pumps and more particularly to one which may be used for handling and distributing mercury in an electrical ignition apparatus, although not limited thereto.

Centrifugal pumps of conventional design comprise a stationary casing, a rotary impeller within the casing, a shaft for supporting and motivating the impeller, packing glands around the shaft where it passes through the casing, and bearing means for supporting the shaft for rotation. Such centrifugal pumps are subject to rapid wear and consequent loss of efficiency when handling gritty or other destructive liquids, and this is particularly true of the rotary impeller and the packing glands. Another difficulty with such pumps is that unless they are submerged, priming is required, and this is easily lost by a slight leakage in the packing glands or "foot" valves of the pumps.

It is among the objects of the present invention to provide a centrifugal pump which overcomes the shortcomings of prior art devices in that it eliminates the necessity of packing glands, is self-priming, and requires no "foot" valve.

Another object is the provision of a centrifugal pump which is of extremely simple and inexpensive design, consisting fundamentally of a rotating element which serves as both the casing and the rotary impeller.

The foregoing and other objects will become apparent after referring to the drawings.

In said drawings:

Figure 1 is a plan of the top of the pump of the present invention;

Figure 2 is a vertical elevation showing part of the pump in section;

Figure 3 is a sectional view on the line III—III of Figure 2;

Figure 4 is a view similar to that of Figure 1 but showing a modification;

Figure 5 is a vertical, sectional elevation of the modified form of Figure 4; and

Figure 6 is a view similar to that of Figures 2 and 5 but disclosing still another modification.

Referring more particularly to the drawings, the numerals 1 and 2 designate a pair of spaced bearings, the shaft-receiving apertures of which are in vertical alignment and are adapted to receive a shaft 3 which depends therefrom and has integrally formed at the lower end thereof a right angular flange 4 from which there depends a tubular housing 5 which takes the shape of an inverted frusto-cone. Immediately below the flange 4, the upper, and therefore largest, portion

of the casing 5 is provided with a pair of radially opposite tubular extensions 6, the side faces of which are provided with reversely disposed apertures 7, whereby the said apertures may face a given direction of rotation of the casing 5. Between the bearings 1 and 2 the shaft 3 has secured thereto a pulley 8 to which there is connected a belt 9, the latter deriving energy from any suitable source (not shown). Disposed immediately beneath the lower portion of the casing 5 is a sump 12 which is adapted to receive the liquid to be pumped. Beneath, and closely adjacent, the upper portion of the casing 5, and accordingly the flange 4 which is integrally formed on the bottom of the shaft 3, is a stationary annular trough 14. This annular trough 14 provides an outer wall which extends upwardly beyond the horizontal plane of the upper surface of the annular flange 4 and a concentric inner wall which is closely adjacent the outer surface of the upper portion of the flange 5 and terminates immediately below the tubular extensions 6. The lower portion of the outer wall of the annular trough 14 is provided with an aperture 17 with which there is connected a spout 18. This spout 18 is connected (not shown) with the instrumentality to which the liquid is to be pumped; and a return pipe (likewise not shown), is connected to the sump 12, thus providing a circuit.

According to the manner of operation of the device of the present invention, it will be found that when the sump 12 is continuously provided with sufficient liquid to rise upwardly into the lower portion of the casing 5, rotation of the latter at sufficient speed will cause the liquid to acquire the motion of the rotating casing and tend to cause it to rise along the side walls thereof. Centrifugal force will cause it to flow outwardly through the apertures 7 in the tubular extensions 6 in the direction of the arrows of Figures 1 and 2. The liquid is made to flow in the manner described as long as liquid continues to enter the bottom of the casing 5 from the sump 12. One essential is that the liquid must enter the casing 5 nearer its axis of rotation than the point at which it leaves the upper portion of the said casing. The shape of the said casing is to a large extent immaterial so far as its ability to function is concerned. However, the inverted frusto-cone is preferable from the standpoint of efficiency, and principally to enable the entering liquid to more readily attain the rotary motion of the casing. In addition, the inner surface of the casing is preferably provided with

opposed helical vanes 20 which enhance the attainment of the rotary motion of the liquid.

The foregoing embodiment is adapted for use where it is desired to lift the liquid and permit it to flow away by gravity. The device of the present invention is, however, readily adaptable to work against pressure and in this connection, attention is directed to Figures 4 and 5, wherein there is illustrated a form which is in most respects similar to the embodiment of Figures 1 and 2, except that there is provided what is equivalent to the sealing of the annular trough 14. Herein the numeral 25 designates a pulley which is mounted on a suitably supported bearing 26 for rotation on a vertical axis. Integrally connected to the bottom of the pulley 25 at a position slightly below the bearing 26 is an annular flange 28 which is suitably connected to a spaced parallel annular flange 30 as by means of the ears and nuts and bolts collectively designated at 32. The mid-portion of the flange 30 is downwardly diverted into an inverted frusto-conical casing 35, the axis of which is coincident with the axis of the pulley 25. In the manner of the embodiment of Figures 1 and 2, the casing 35 extends downwardly into a sump 12 and carries on its inner surface a pair of opposed helical vanes 40. According to the construction and arrangement of the flanges 28 and 30 of the embodiment of Figures 4 and 5, there is provided therebetween a hollow basin 42 in which there is disposed in spaced relationship with respect to the inner surfaces of the walls thereof a pair of spaced parallel flanges 44 and 45 which carry a pair of radially opposite tubular extensions 47 which are provided with reversely disposed apertures 48. Referring again to Figure 5, the mid-portion of the flange 44 terminates in a tubular shaft 50 which extends upwardly through the pulley 25 and is secured against rotation therewith by means of a suitable clamping bracket 51.

The operation of the embodiment of Figures 4 and 5 is as follows:

Upon the rotation of the pulley 25, the casing 35 forces the liquid to rise from the sump 12, move through the interior thereof in the direction of the arrows of Figures 5, through the apertures 48 in the tubular extensions 47 carried by the flanges 44 and 45, inwardly to the bottom of the hollow tube 50 and upwardly therethrough. It is evident that the liquid in the space around the stationary apertures 47 is under pressure from centrifugal force, since the liquid is rotating with the casing 35. Since there is no centrifugal pressure in the stationary tube 50 or the stationary tubular extensions 47 carried by the spaced annular flanges 44 and 45, it is further evident that the liquid under pressure in the casing 35 will discharge through the openings 48 in the stationary tubular extensions 47 and the stationary tube 50.

Referring to Figure 6 of the drawings, I have shown a second modification which differs only from that of Figures 4 and 5 by the addition of a stationary air-tight jacket 55 for that portion of the device which is disposed above the casing 35. This air-tight jacket 55 carries a lower communicating inverted frusto-conical extension 56 which is concentric with the rotary casing 35. The function of the jacket 55 is to permit depression of the liquid level inside the jacket below the liquid level outside of the said jacket by means of gas under suitable pressure, thereby eliminating the friction which would exist between the casing 35 and the surrounding liquid, if it were

not displaced by the said gas. The pressure of the gas in the jacket 55 is proportional to the difference between the outside and inside liquid levels and therefore can be used to control the starting and stopping of the pump.

While I have shown and described several specific embodiments of the present invention, it will be readily understood by those skilled in the art that I do not wish to be limited exactly thereto, since various modifications may be made without departing from the scope of the invention as defined by the appended claims.

I claim:

1. A centrifugal pump adapted to lift liquid from a sump containing the liquid to be pumped, the said pump comprising a substantially vertically disposed rotatable tubular casing having its upper end abruptly expanded into an enlarged head defining an annular liquid-receiving compartment, stationary means in the head in concentric relation thereto for receiving liquid from the liquid-receiving compartment, the said concentric stationary means having oppositely directed tubular extensions communicating with oppositely disposed liquid passage ports through the concentric means, the said ports extending through the said extensions and having liquid intake openings in end portions of the extensions while being disposed in a horizontal plane, the said intake openings of the ports projecting in a direction tangential to the rotation of the rotatable casing and in opposition to the direction of rotation of the rotatable casing, the intake openings of the ports being spaced at a greater distance from the axis of rotation of the tubular casing than the peripheral wall of the lower end of the tubular casing, stationary vertical discharge means for conducting liquid under pressure vertically upwardly from the said concentric stationary means, mechanism for rotating the casing, the said tubular casing having an open lower end forming a liquid intake opening, a gas-tight hood enclosing the said enlarged head and mechanism for rotating the casing, the said hood having a depending portion enclosing the rotating casing and forming a housing therefor, the depending portion of the hood being adapted to extend into the liquid being pumped, the said liquid thereby forming a seal for the hood, and an upstanding portion of the hood forming a sleeve for the stationary vertical discharge means in gas-tight relation therewith.
2. A centrifugal pump adapted to lift liquid from a sump containing the liquid to be pumped, the said pump comprising a substantially vertically disposed rotatable tubular casing having its upper end abruptly expanded into an enlarged head defining an annular liquid-receiving compartment, stationary means in the head in concentric relation thereto for receiving liquid from the liquid-receiving compartment, the said concentric stationary means having oppositely directed tubular extensions communicating with oppositely disposed liquid passage ports through the said concentric stationary means, the said ports extending through the said extensions and having intake openings in end portions thereof while being disposed in a horizontal plane, the said intake openings of the ports projecting in a direction of rotation tangential to the rotation of the rotatable casing and in opposition to the direction of rotation of the casing, the said intake openings of the ports being spaced at a greater distance from the axis of rotation of the tubular

casing than the peripheral wall of the lower end of the tubular casing, stationary vertical discharge means for conducting liquid under pressure vertically upwardly from the said concentric stationary means, mechanism for rotating the casing, the said tubular casing having an open lower end forming a liquid intake opening, a gas-tight hood enclosing the enlarged head and mechanism for rotating the casing, the said hood having a depending portion enclosing the rotating casing and forming a housing therefor, the depending portion of the hood being adapted to extend into the liquid being pumped, the said liquid thereby forming a seal for the hood, the

5 said depending portion of the hood being of inverted frusto-conical shape substantially concentric with the rotating casing of the pump and containing a gas under sufficient pressure to depress the liquid within the housing to a level below that of the liquid outside of the housing, thereby reducing friction between the pump casing and surrounding liquid, the pressure of the said gas controlling starting and stopping of the 10 pump, and an upstanding portion of the hood forming a sleeve for the stationary vertical discharge means in gas-tight relation therewith.

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