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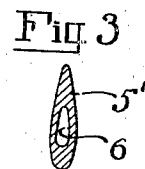
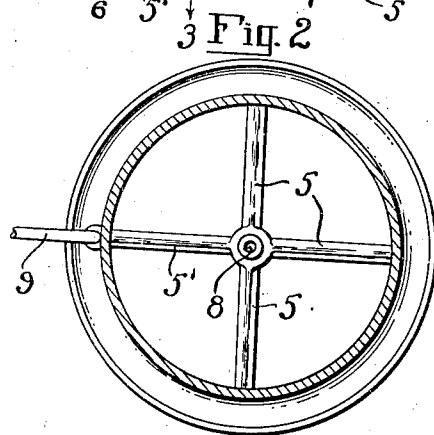
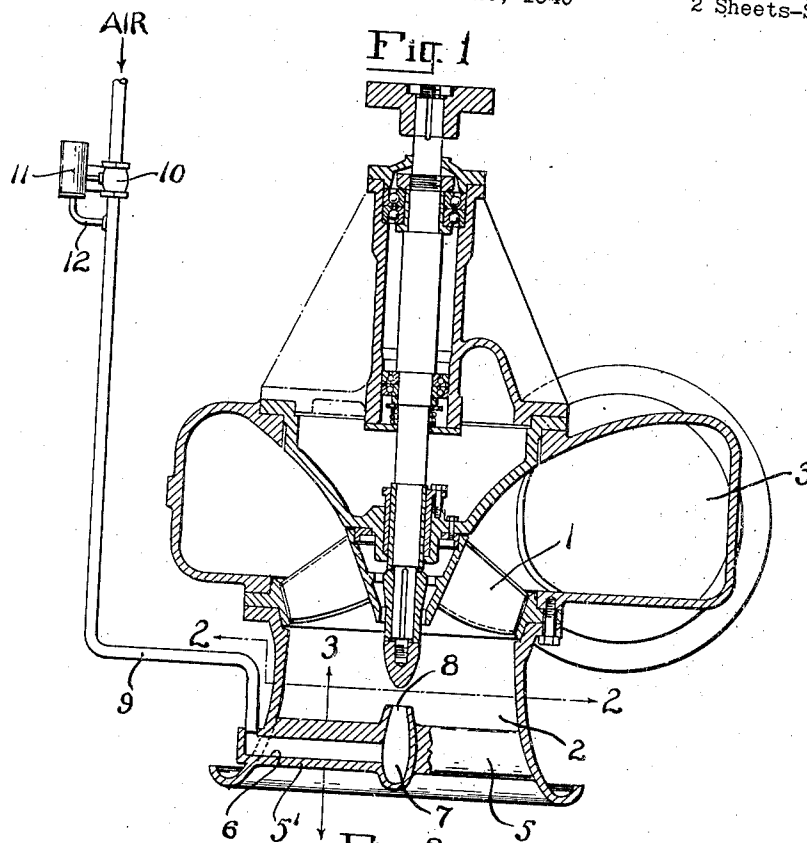
L. F. MOODY

2,262,191

PUMP

Filed June 26, 1940

2 Sheets-Sheet 1



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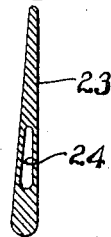
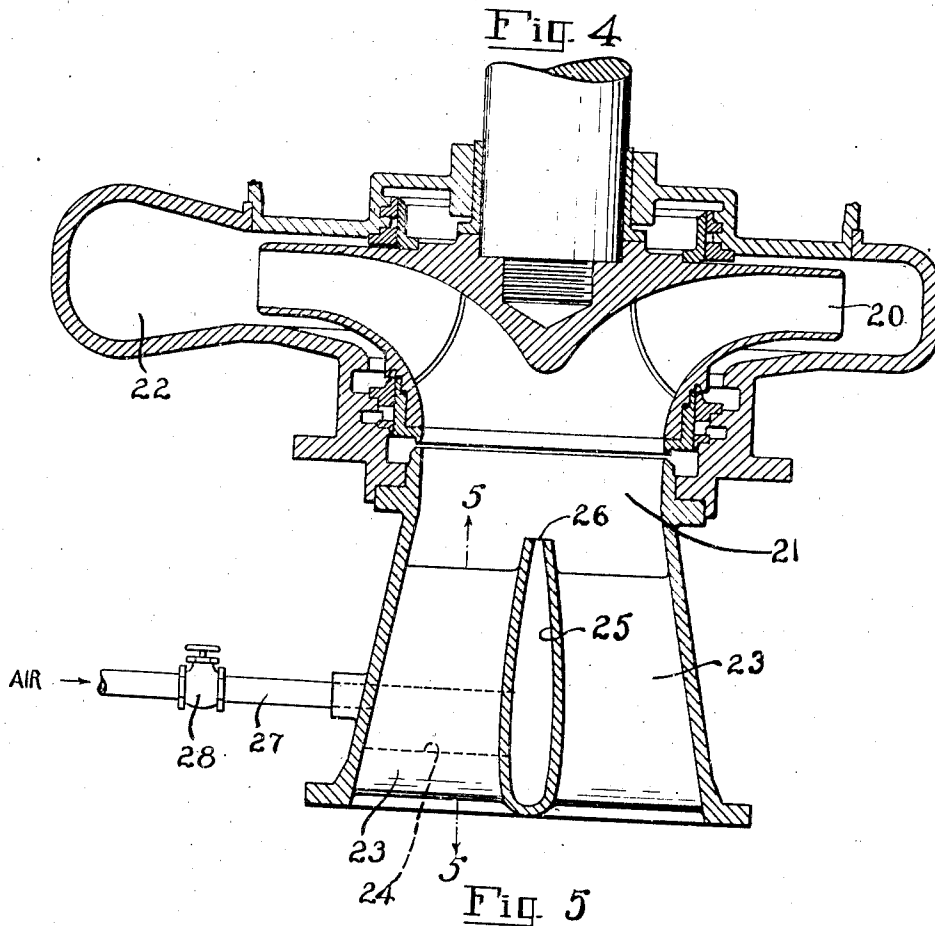
L. F. MOODY

2,262,191

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Filed June 26, 1940

2 Sheets-Sheet 2



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2,262,191

PUMP

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Application June 26, 1940, Serial No. 342,465

4 Claims. (Cl. 103—111)

This invention relates to pumps, and more particularly to means for preventing cavitation and for preserving steady flow in propeller and other centrifugal pumps.

In centrifugal pumps and particularly propeller pumps operated at off-normal discharge capacities, strong whirl of the fluid pumped may be created in the suction space or inlet of the pump and propagated against the flow of the impeller. Such whirl increases towards the axis according to the law of constancy of moment of momentum and creates a void around the axis in the form of a tubular cavity. Condensable vapor accumulates in such cavity and its sudden condensation under unsteady flow conditions causes disturbances similar to explosions, generating local pressures which attack the metal of the pump, resulting in pitting of the pump parts with corresponding reduction in their longevity and efficiency. Moreover, the repeated formation and collapse of such vapor filled space, known as "cavitation," interferes with the steady flow operation of the pump and may cause serious vibration.

It is an object of the present invention to provide means which will prevent or reduce the formation of such vapor filled spaces or cavities in the pump suction space, will relieve the high local vacuum, and replace water vapor with air, and consequently eliminate pitting of the pump parts, surging in the pump discharge and unstable performance of the pump.

More specifically the present invention comprehends the prevention of the formation of vacuous or vapor filled cavities or spaces about the axis of the suction space of a centrifugal pump by the provision of radial guide vanes and the introduction, preferably through the vanes, of air under atmospheric or higher pressure into such cavities or spaces to break up the formation of the cavities and prevent the detrimental effects of their formation on the pump structure and its performance.

With these and other objects in view, as may appear from the accompanying specification, the invention consists of various features of construction and combination of parts, which will be first described in connection with the accompanying drawings, showing a pump of the preferred form embodying the invention, and the features forming the invention will be specifically pointed out in the claims.

In the drawings:

Figure 1 is a vertical section through a centrif-

ugal pump of the propeller type constructed in accordance with the present invention.

Figure 2 is a horizontal section on the line 2—2 of Figure 1.

Figure 3 is a detail section of the line 3—3 of Figure 1.

Figure 4 is a vertical section through a modified form of the pump showing the invention applied to a centrifugal pump of the closed impeller type.

Figure 5 is a detail section on the line 5—5 of Figure 4.

Referring more particularly to the drawings, Figures 1 to 3 inclusive show a centrifugal pump of the propeller type in which an open propeller 1 is provided for pumping the fluid. The propeller 1 takes or draws the liquid from the suction or inlet space 2 and discharges it into the volute 3, as is usual in such pump construction. Although illustrated in combination with a volute casing pump, the invention is equally applicable to propeller pumps having diffusion vanes in place of the volute.

As pointed out above, it sometimes occurs that when a pump of this type is operating at off-normal discharge capacity, particularly, strong whirl is created in the suction space leading to the propeller 1. Such whirl increases toward the axis of the pump and creates a void or tubular cavity around the axis which becomes vapor filled, resulting not only in the pitting of the pump parts, but also in irregular flow through the pump. The present invention comprehends means for the prevention of the formation or reduction of such voids or tubular cavities or the eliminating of high vacua and the presence of water vapor in such cavities as remain, thus eliminating their detrimental effects, and includes a plurality of radially extending axial guide vanes 5 at or near the entrance to the suction space 2.

These vanes 5 are stream-lined in cross-section according to the direction of flow of liquid through the suction space 2 so as to cut down and avoid to a certain degree initial whirl in the suction space. One of the vanes, namely the vane 5', is provided with a passage or opening 6 extending longitudinally therethrough which opens out at its discharge and into a chamber 7 formed at the inner junction of the various guide vanes 5. The chamber 7 has its outlet opening upwardly, as shown at 8, in a line with the axis of rotation of the pump. The outer or inlet end of the passage 6 has an air supply pipe 9 con-

nected thereto which may receive air from any suitable source, either direct from the atmosphere or from a source of air under pressure (not shown).

A valve 10 is placed in the pipe 9 and this valve is operated by any approved type of pressure actuated operating means, generically indicated at 11. This pressure actuated valve operating means 11 may be of any approved type which may be purchased upon the open market, and it has its operating pressure connection 12 with the pipe 9 between the valve 10 and the outlet 8 so that the member 11 will be controlled and actuated by the pressure at the outlet 8, or in other words, by the pressure at the axis or vertical center of the suction space 2. Thus, when a tubular cavity or void is formed about the axis of the suction space 2 the pressure in such void being considerably below the normal pressure and below atmosphere, will act on the member 11 and open the valve 10 to admit air under a pressure greater than the pressure in the tubular cavity into the tubular cavity through the passage 6 and chamber 3. Such air will break up the tubular cavity and fill the void, thus avoiding cavitation and preserving the steady flow of liquid through the pump.

The breaking up of such tubular cavities or voids in the pump suction will also eliminate surging and unstable performance of the pump and eliminate vibration, which would be the result thereof.

Only one of the vanes 5 has been shown as provided with the air passage 6, although four of such vanes have been shown, but it is to be understood that any desired number of vanes may be provided and that any desired number of such vanes may be provided with air passages, without departing from the spirit of the present invention.

The modified form shown in Figures 4 and 5 is, in essentials, the same as the form shown in Figures 1 to 3 inclusive. In this latter construction shown in Figures 4 and 5, however, the invention is shown as applied to a centrifugal pump embodying a closed impeller 20, which receives the liquid to be pumped through the suction space 21 and discharges it into the volute 22. In this modified form the radially extending axial guide vanes 23 are relatively wide in proportion to the width of the vanes 5 as shown in Figures 1 to 3, but it is to be understood that the width of such vanes is a matter of design, depending upon the requirements of the particular pump with which they are associated. The vanes 23 are stream-lined in the direction of liquid flow, and one of them is provided with an air passage 24, the outlet end of which opens into the chamber 25. The outlet 26 of the chamber 25 is on

the axis of rotation of the impeller 20 and opens upwardly or inwardly towards the impeller.

Air is supplied to the passage 24 and chamber 25 through a suitable air supply pipe 27, which has a valve 28 therein. The valve 28 is shown as manually operated, but it is to be understood that a pressure actuated valve structure such as shown in Figure 1 may be substituted for the manually operated valve, if it is so desired.

The operation of the modified form of pump is the same as the operation of the form disclosed in Figures 1 to 3 inclusive.

It will be understood that the invention is not to be limited to the specific construction or arrangement of parts shown, but that they may be widely modified within the invention defined by the claims.

What is claimed is:

1. In a centrifugal pump, means for supplying air to whirl created cavities in the suction space of the pump comprising, air passage forming means extending into said suction space and having its outlet arranged to discharge air into the suction space in an axial direction substantially at the axis of the pump, and means controlled by the pressure of the suction space about the outlet of said air passage forming means for controlling the delivery of air into the suction space.

2. In a centrifugal pump, means for supplying air to whirl created cavities in the suction space of the pump comprising, a radial guide vane in said suction space, said vane having an air passage therein opening out into the suction space at the pump axis, means for delivering air to said air passage, and means controlled by the pressure in the suction space about the outlet of said air passage for controlling the delivery of air into the suction space.

3. In a centrifugal pump, means for supplying air to whirl created cavities in the suction space of the pump comprising a plurality of radially extending axial guide vanes in the suction space, at least one of said vanes having an air passage therein opening out into the suction space at the pump axis, an air supply pipe connected to said passage, a valve in said pipe, and pressure actuated means controlled by the pressure in the suction space about the outlet of said air passage for operating said valve.

4. In a centrifugal pump including a casing, means for supplying air to whirl created cavities in the pump comprising a vane in said casing provided with an air passage having an inlet for air from the exterior of the casing and opening out into the casing at a point for delivering the air to the whirl created cavities, and means controlled by the pressure within the pump casing for controlling the delivery of air into the casing through said passage.

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