

Feb. 12, 1946.

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2,394,931

CENTRIFUGAL PUMP

Filed Dec. 9, 1943

2 Sheets-Sheet 1

FIG. 1

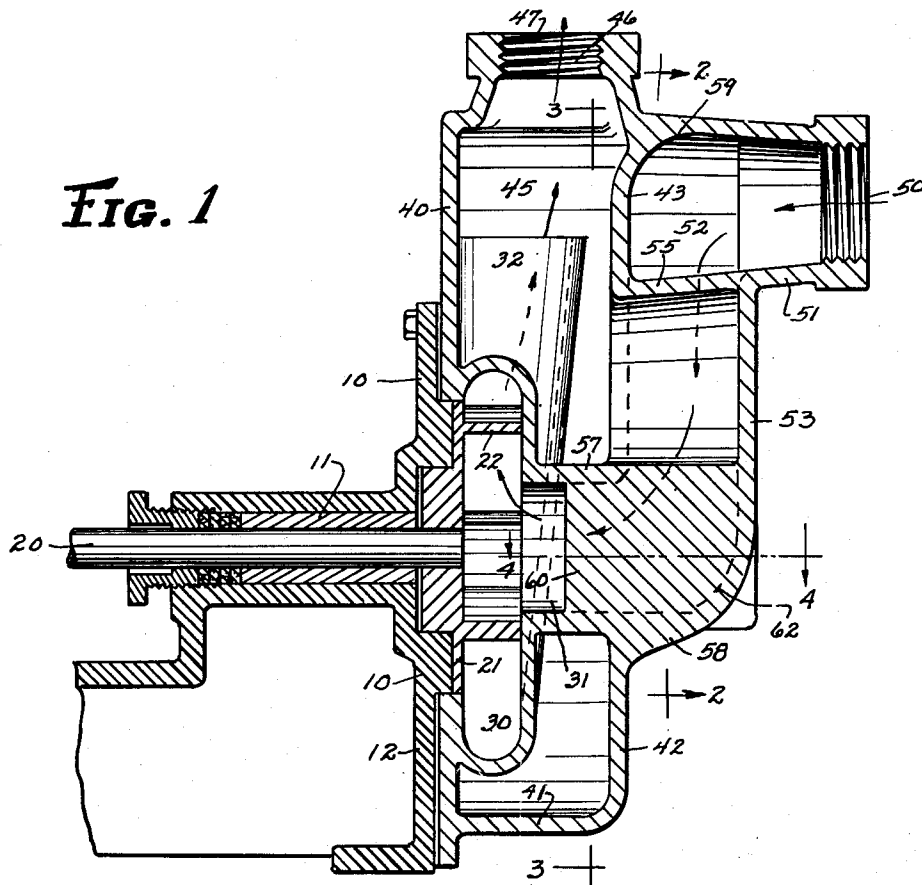
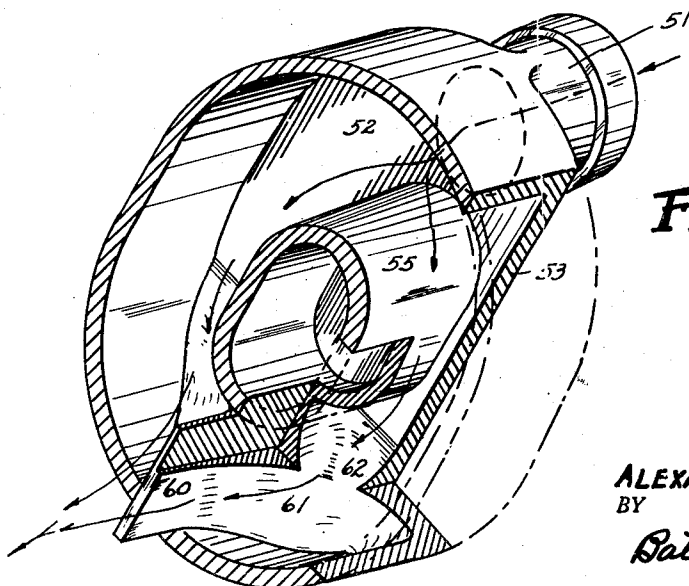


FIG. 2



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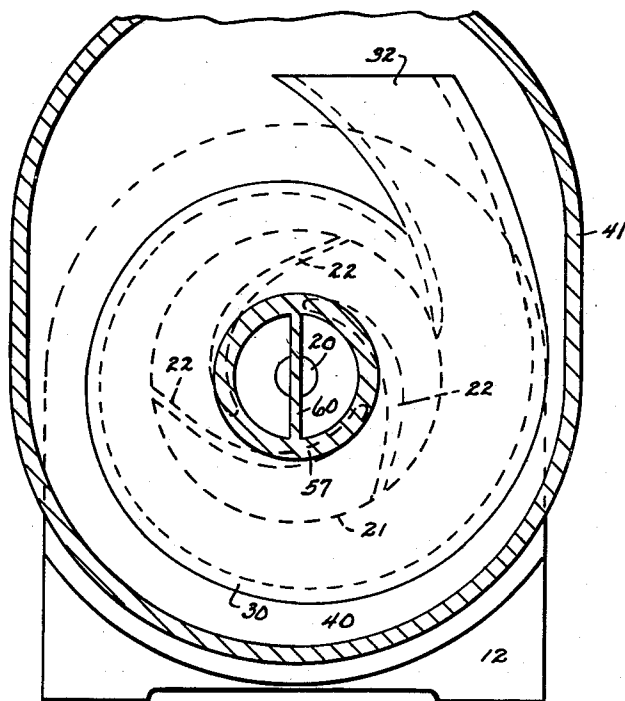


FIG. 3

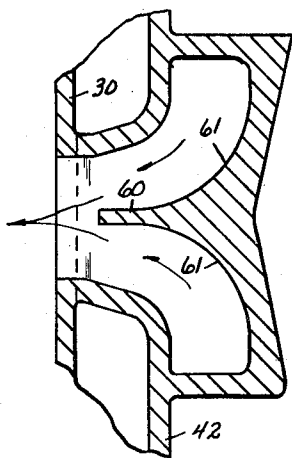


FIG. 4

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UNITED STATES PATENT OFFICE

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CENTRIFUGAL PUMP

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11 Claims. (Cl. 103—103)

This invention relates to an improvement in the suction passageway to the impeller of a centrifugal pump, the general object being to improve the efficiency of the pump.

Other objects of the invention are to prevent undesirable cavitation and whirling of the liquid as it passes to the impeller, thereby increasing the efficiency and preventing undue noise in the operation of the pump.

Another object is to reduce the loss by friction as the liquid travels through the whirl-preventing means.

Still another object is to prevent clogging of the suction passageway by extraneous matter drawn in by the suction created by the rotating impeller.

It is also an object of this invention to locate the suction opening to the pump above the impeller to retain priming liquid about the impeller, in a manner which shall not sacrifice the efficiency effected by the whirl-prevention and the streamlined guiding of the liquid.

It is likewise one of the objects of this invention to provide the prevention for whirling and the streamlined passageway leading thereto from the suction inlet of the pump to the impeller eye, all in the form of a self-contained unit which may be readily attached to a pump as a substitute for the usual suction admission conduit thereto.

Other objects contributing to the efficiency of the pump will be apparent from the following detailed description of a preferred embodiment thereof illustrated in the drawings.

In the drawings, Fig. 1 is a vertical axial section through a centrifugal pump and having my improved suction passageway; Fig. 2 is a sectional perspective of the walls defining the suction passageway, the plane of the section being indicated approximately by the line 2—2 on Fig. 1, and with some of the parts cut away; Fig. 3 is a vertical section through the discharge passageway in a plane indicated by the line 3—3 on Fig. 1 and looking toward the impeller; Fig. 4 is a fragmentary horizontal section in the plane of the impeller axis as indicated by the line 4—4 on Fig. 1.

In Fig. 1, 10 indicates the frame of a centrifugal pump shown as having a bearing sleeve 11. In this sleeve is mounted a shaft 20 on the end of which is the rotary impeller 21 having vanes 22 of a suitable form. The impeller operates in a casing 30, shown as of volute form, leading from a central intake 31 upwardly through a discharging sleeve 32.

Fig. 1 shows the impeller casing as an integral part of the walls defining the suction passageway, about to be described, and also a part of the discharge passageway from the pump, but it may be more convenient in manufacture to make these parts as separate castings tightly secured together.

I will now describe in detail the suction passageway as shown in the different views of the drawings, it being understood, of course, that my invention is not limited to such specific details further than the claims themselves, and the prior art, may require.

The means dividing the suction and discharge conduits to and from the impeller and the impeller casing itself, whether a separate member or an integral part of the suction casing contribute a self-contained device shown as having a vertical front wall 40 adapted to be bolted to a vertical plate 12 of the pump casing frame. Joining this pump wall 40 is a barrel-like portion 41 at the outer end of which is a vertical wall, designated 42, 43, thus providing a general space 45 in which the impeller casing is located. This general space leads to a discharge opening 46 at the top of the unit, the annular wall about the opening being connected with the portions 40, 43 and 45 of the casing so far described. This opening 46 is shown as having an internal thread 47 for the attachment of the delivery pipe.

The suction inlet 50 of the suction unit of this invention is shown as an internally threaded head on a sleeve portion 51 which leads inwardly to a chamber 52 between the wall 43, and an outer wall 53. This chamber 52 is divided by a small barrel portion 55 which leads inwardly from the outer wall 53 of the device and at its upper end joins the lower end of the partition portion 43. Below the barrel 55 the two parts of the passageway 52 are formed into a horizontal circular conduit 57 which joins or is attached to the impeller casing and furnishes the suction conduit thereto. The outer wall 53 of the divided suction passageway leads downwardly and then curves inwardly at 58 to merge with the outer wall 42 of the general passageway.

Within the suction conduit portion 57 is a vertical separator plate 60 located diametrically of the conduit and terminating near the entrance face or eye of the impeller. This vertical separator plate, which is preferably an integral part of the suction unit, is connected with the parts defining the divided passageway 52 by parts having peculiarly formed surfaces to give a stream-

lined guide to the suction liquid. As shown in Fig. 4, and also in Fig. 2 (a portion of which is cut out for clearness of illustration) the vertical walls of the separator 60 curve outwardly at 61 for about a quadrant and also curve upwardly, as indicated at 62, until they merge with the inner face of the back plate 53 of the unit.

It results from the construction above described that the suction liquid, entering through the passageway 50, first turns downwardly into the divided passageway 52, the curved wall 59 at the inner end of the horizontal intake insuring a ready diversion of the incoming liquid downwardly. Likewise the curved top of the inserted barrel 55 gradually divides the liquid so that it readily passes downwardly on opposite sides of such barrel until it reaches the downwardly and forwardly curved wall portion 62, which directs the liquid forwardly where it passes along the curved wall 61 into the suction conduit 57 on opposite sides of the vertical separator 60. The barrel 55 is accordingly a bulbous head on the separator 60.

The separator 60 prevents whirling of the incoming liquid in the suction conduit, and thereby prevents cavitation being caused by the impeller and avoids the reduction in efficiency which would result from such cavitation. It also quite materially reduces the noise of operation, which has frequently happened in centrifugal pumps and is apparently due to the whirling or vibration of the liquid in the intake passageway.

The divided passageway leading to the separator not only forms a conduit having long-sweep easy curvatures for guiding the liquid, but it has the additional advantage of preventing clogging of the suction conduit by extraneous matter or any materials which might build up in a troublesome mass across the end of a mere separator plate. With my special unit, having the bulbous head on the separator, such extraneous matter coming in through the opening 50 strikes on the curved upper end of the barrel 55 and then slides down one side or the other thereof and passes readily downwardly and inwardly on one side or the other of the separator, and to the impeller where it is discharged.

The provision for discharging extraneous matter is an important advantage of my construction, because the centrifugal pumps are frequently used for pumping water containing dirt, vegetable matter or various refuse.

By locating the intake 50 above the impeller, the whole pump when idle may stand full of liquid so as to be self-priming when the pump starts. Though such provision involves turning the stream of suction water downwardly and then inwardly, I have accomplished this by such gradual easy curves that there is little loss in friction or eddy current caused by sudden change in the direction of the course. By reason of the curved walls and the barrel-like separator, providing the divided passageway in the unit, I prevent any sudden changes in the course as the liquid passing inwardly, thence downwardly and dividing around such barrel-like member and thence inwardly on opposite sides of the separator to the impeller.

It will be seen that my suction unit with its impeller casing, whether made of a single casting or of different parts tightly secured together, constitutes a single self-contained unit which may be applied to a pump frame of various styles of pumps about the impeller on the driving shaft.

I claim:

1. In a pump, the combination of a horizontal shaft, a rotary impeller on the end of the shaft, a conduit aligned with the shaft on the opposite side of the impeller, a diametric partition in said conduit, a suction conduit leading from a single entrance and divided and thence leading to opposite sides of said separator.

2. In a pump, the combination of an impeller chamber, an intake orifice, a passageway leading therefrom inwardly and then turning downwardly and then turning inwardly to the eye of the impeller chamber, and a separator in the passageway dividing it into a plurality of streams, said separator having a portion in the conduit adjacent the impeller and having a comparatively large bulbous head in the intermediate portion of the conduit, said head being curved at its distant end to shed extraneous matters to one side or the other of the separator.

3. In a pump, the combination of a rotary impeller, a casing about the impeller having a side entrance and a peripheral discharge, a suction passageway leading to the impeller entrance, and a separator in the suction passageway dividing it into a plurality of streams, said separator being a comparatively thin plate in the portion of the conduit adjacent the impeller and having a comparatively large bulbous head back of such plate, said head being curved at its distant end to shed extraneous matter to one side or the other of the separator.

4. In a pump, the combination with the impeller and its casing of a suction casing comprising a conduit located above the impeller and thence turning downwardly and thence turning inwardly to the central region of the impeller, the inwardly projecting portion having within it a diametric separator extending across it and the downwardly extending portion of the conduit having within it a comparatively large separator member with a rounded top to divide the conduit, the wall of the divided chamber curving downwardly and then inwardly on opposite sides of said diametric separator in the inwardly extending portion of the conduit.

5. The combination with a centrifugal impeller of a suction conduit leading thereto and a separator in the conduit terminating in a comparatively thin partition adjacent the eye of the impeller to prevent whirling of the liquid in the conduit, said separator having an enlarged rounded end adapted to shed extraneous material to either side thereof.

6. The combination of an impeller having vanes defining spaces communicating with a central receiving space, a conduit leading to the central region thereof, a separator dividing the conduit, a divided suction passageway leading to opposite sides of the separator, and a single suction passageway leading to the divided passageway.

7. In a pump, the combination of an impeller rotating on a horizontal axis in an impeller chamber, an intake passageway above the impeller higher than the impeller, said passageway then turning downwardly and then turning inwardly to the eye of the impeller chamber, and a separator dividing such passageway into a plurality of streams, said separator comprising a bridging plate at the inward portion of the passageway and an enlarged head in the downward portion formed to shed material to either side thereof.

8. In a pump, the combination of a frame, a

shaft mounted therein, an impeller on the end of the shaft, a volute casing for the impeller having a side suction opening, a suction passageway to said opening comprising means defining a single intake passageway which is then divided into two conduits, which diverge from each other and then gradually approach each other until they become a single conduit terminating adjacent the intake face of the impeller, and a separator bridging the conduit and having an enlarged head formed to shed extraneous material to either side thereof.

9. The combination of an impeller having a central open space from which the vanes lead outwardly, a casing for the impeller having a central suction inlet registering with said space, an inlet chamber extending downwardly and then turning inwardly to said suction inlet, a partition in the suction conduit extending across it and dividing it into two separated passageways, the forward end of said partition terminating adjacent the impeller and there being downwardly and inwardly curved walls of the conduit leading to opposite faces of the separator.

10. In a pump, the combination of an impeller rotatable on a horizontal axis, a volute casing for the impeller having a central suction inlet, a suction passageway extending inward horizon-

tally from a position higher than the impeller, said passageway then turning downwardly by a gradual curve and then turning inwardly horizontally by a gradual curve, and a separating device in the conduit thus provided between the two horizontal portions thereof, said separating device comprising a rounded head in the downward portion of the passageway gradually merging with a plate extending across the lower horizontal passageway.

11. A suction unit adapted for a centrifugal pump comprising a chamber housing an impeller casing having an eye, a second chamber separated from the first chamber and communicating therewith at said eye, an intake passageway into the second chamber adjacent the top thereof, a separating device in the second chamber dividing it into two downward passageways then turning inwardly toward the impeller, said separating device continuing into the inward portion of said second chamber and terminating in a plate extending across such inward portion, there being downwardly and inwardly curved walls between the part of the separating device in the downward portion and the part thereof in the inward portion of said second chamber.

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