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A. W. BURKS

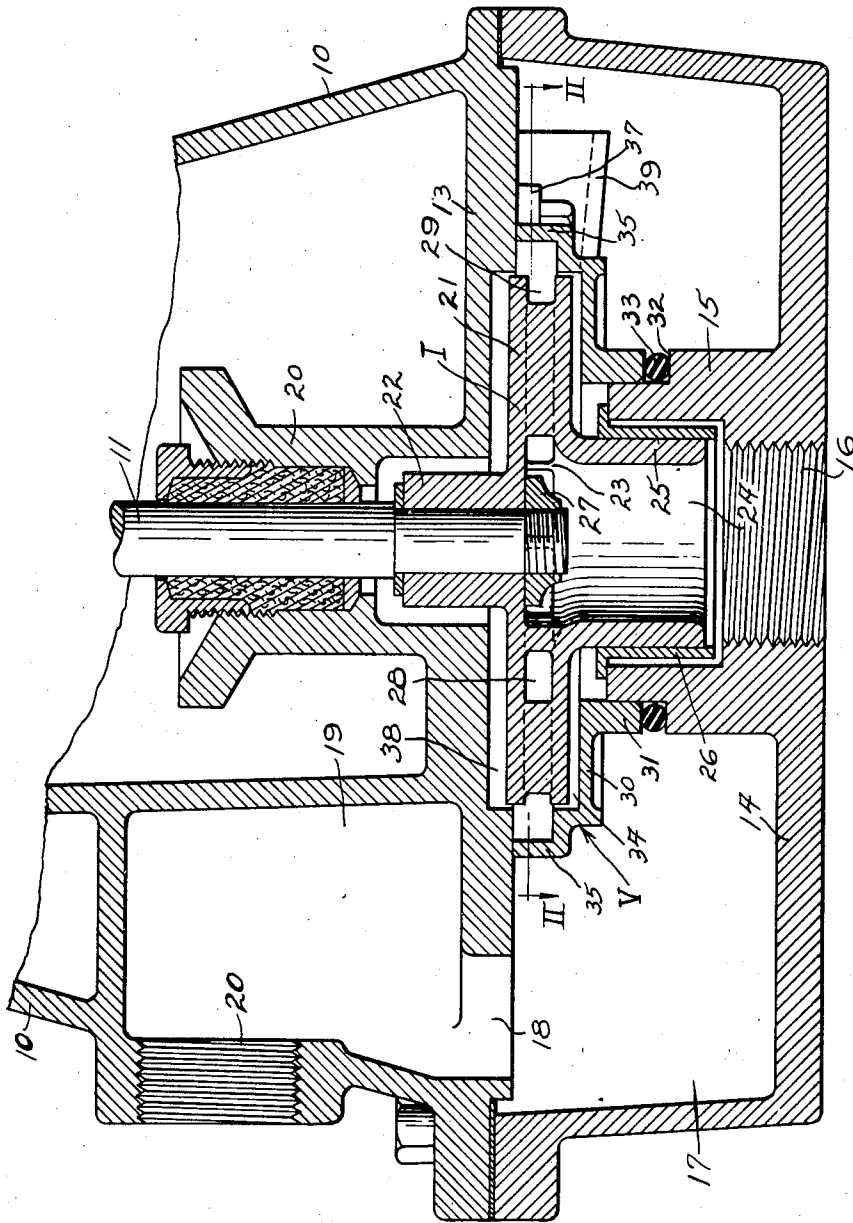
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2 Sheets-Sheet 1

Fig. 1



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Fig- 2

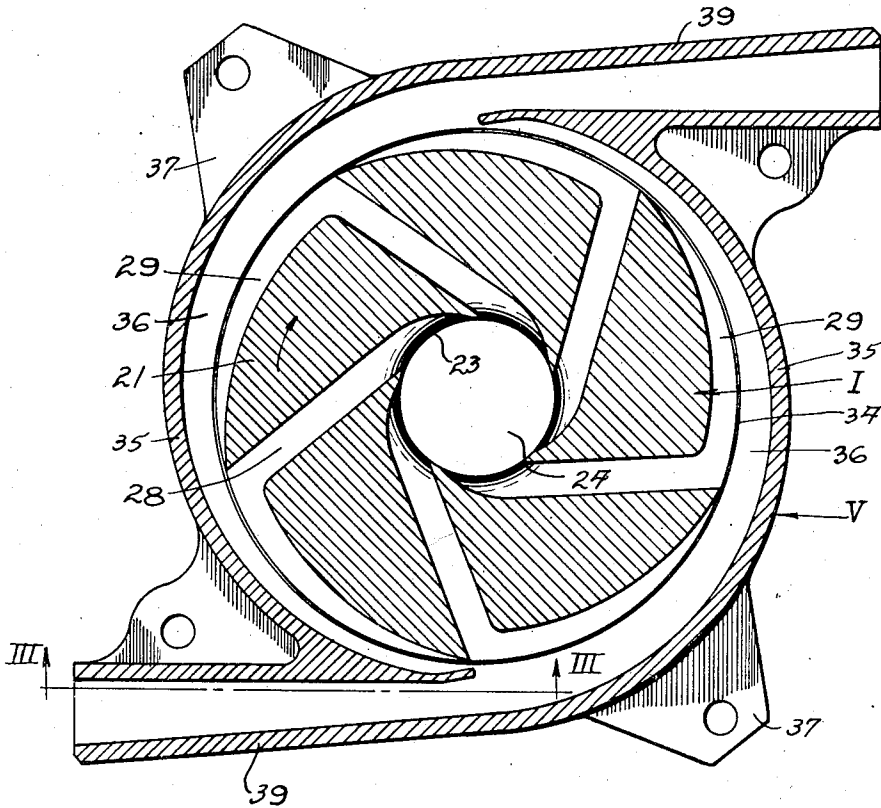
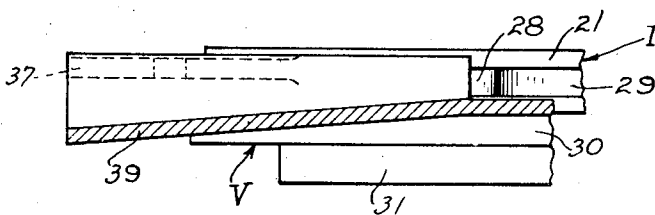


Fig- 3



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My invention relates to rotary pumps of the centrifugal type and concerns particularly improved arrangement and cooperation of flow passageways in the impeller and volute elements in order to simplify the production of these elements and at the same time obtain materially higher efficiency and operation.

An important object of the invention is to provide an impeller element having an axial inlet passageway from which straight centrifugal flow bores or passageways extend through the impeller body to the circular periphery thereof and to provide the impeller element with peripheral channels extending in the wake of the outer ends of the respective centrifugal flow bores with gradually diminishing cross section for receiving the centrifugal flow from the bores for delivery to the volute element of the pump.

A further object is to provide a volute element surrounding the impeller element and provided with raceways or discharge passageways of gradually increasing cross section for receiving the impeller flow from the impeller peripheral channels, and with the volute discharge passageways terminating in straight nozzles extending tangentially from the volute element and of increasing cross-sectional dimension outwardly whereby during flow through the volute raceways and nozzles diffusion of flow will result and velocity head will have been changed to potential or pressure head when discharged from the nozzles.

The above enumerated and other features of the invention are embodied in the structure shown on the drawings, in which:

Figure 1 is a vertical diametral section of the lower portion of a centrifugal pump showing my improved impeller and volute element;

Figure 2 is a section on plane II—II of Figure 1; and

Figure 3 is a section on plane III—III of Figure 2.

Referring to Figure 1, 10 indicates the lower portion of the top housing of a pump which mounts a motor (not shown) for driving the pump shaft 11 which is journaled in a bearing structure 12 extending upwardly from the bottom wall 13 of the housing and at its lower end is secured to the impeller element 1. The base portion 14 of the pump housing is detachably secured to the upper housing 10 and has an up-

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wardly extending annular boss 15 through which extends the fluid inlet passage 16, the volute element V of the pump being disposed between the end of this boss and the lower wall 13 of the top housing 10. The base 14 and the bottom wall 13 define the annular pressure chamber 17 which receives the discharge from the volute element and is connected through passageway 18 with a chamber 19 formed in the top housing 10 from which extends the pump outlet 20.

The impeller 1 shown is in the form of a cylindrical plate or disk 21 from whose upper side extends the hub 22 which receives the lower end of the drive shaft 11. The body 21 has the axial cylindrical chamber 23 which forms a continuation of the inlet passageway 24 provided by the depending annular flange 25 which extends down into the upper end of the inlet boss 15 for inflow of fluid into the impeller from the inlet passageway 16. A sealing bushing 26 surrounds the flange 25 and engages against the upper end of boss 15. The shaft 11 is threaded at its lower end to receive a nut 27 whereby the impeller element is secured to the shaft to rotate therewith.

Referring to Figure 2, centrifugal flow passageways 28 extend from the impeller chamber 23 and terminate at the impeller periphery. These passageways may extend in radial direction but, as shown, they preferably extend in a direction tangential to the chamber 23, and five such passageways are shown, although the number may be different. In the periphery of the impeller body, grooves or channels 29 are provided and extend from the outer ends of the respective passages 28 in a direction opposite to the direction of rotation of the impeller element, the direction of rotation being indicated by the arrow on Figure 2 as being clockwise. Each channel terminates at the outer end of the next passage 28, the radial depth gradually decreasing to zero.

The volute element V of the pump comprises the annular body wall 30 from which depends the annular hub 31 terminating above the shoulder 32 on the inlet boss 15, a sealing ring 33 being interposed between the shoulder and the end of the hub.

The volute element body 30 has the cylindrical recess 34 therein which is concentric with the impeller body 21 and receives the portion thereof below the channels 29. Extending upwardly from

the peripheral portion of the body 30 in axial direction are the walls or flanges 35 which are spaced radially outwardly a distance from the recess 34 to leave raceways 36. The walls 35 abut at their upper ends against the bottom wall 13 of the top housing 10 of the pump frame when the volute element is secured in place as by means of ears or webs 37 extending from the body 30. When the volute element is secured in service position, the raceways 36 will be closed at the top by the frame wall 13. Referring to Figure 1, the housing wall 13 has the cylindrical recess 38 in its under side which is opposed to the recess 34 in the volute element and which receives the upper portion of the impeller body 21 above the channels 29. The impeller element is supported by the drive shaft with its upper and lower faces clear of the bottoms of the recesses 38 and 34, respectively, and with the peripheral channels 29 in alinement with the raceways 36 in the volute element, the cylindrical periphery of the impeller element having running engagement with the cylindrical walls of the recesses.

As shown on Figure 2, two raceways 36 are provided in the volute element extending around opposite sides of the impeller. The raceways lead respectively to nozzle structures 39 extending tangentially in opposite directions from the opposite sides of the volute elements of which they may form an integral part, these nozzles discharging into the pressure chamber 17. Each wall 35 extends in spiral direction from the inner side of the throat of one of the nozzles to the outer side of the throat at the other nozzle so that the raceways 36 are of increasing cross section from substantially zero to maximum cross section. The nozzles are of increasing cross section outwardly so that the fluid flow through the raceways and nozzles will be gradually diffused for change of velocity head into potential or pressure head in the chamber 17 to which the nozzles deliver.

Referring to Figure 2, when the impeller element is rotated, the fluid flows under centrifugal force outwardly through the bores 28 into the channels 29 which function like cams to force the fluid into and along the volute element raceways 36 for outward flow therethrough and the nozzles 39 for discharge of the fluid into the pressure chamber 17 from which the fluid will flow out from the pump through the outlet 20. It has been found by experiment that, in order to get the best performance and greatest efficiency, the cross section area of the receiving ends of the channels 29 should be slightly less than the cross section area of the passages 28. As shown on Figures 2 and 3, the increase in cross section of the nozzle passageways is quite rapid so that any velocity head remaining in the fluid after flow thereof through the raceways 36 will be rapidly converted into potential head so that the discharge outlet from the pump will be under substantially constant pressure.

The form and cooperation of the impeller and volute elements of my invention will effect materially higher efficiency in pump operation and output. The elements are of simple form so that they may be readily and economically produced. By having the centrifugal discharge passageways 28 straight and cylindrical they may be readily formed by simple drilling operation.

I have shown a practical and efficient embodiment of the features of my invention but I do not desire to be limited to the exact construction, arrangement or operation shown and described, as

changes and modifications may be made without departing from the scope of the invention as defined in the appended claims.

I claim as my invention:

1. In a centrifugal pump, an impeller in the form of a disk having an axially located inlet chamber, centrifugal flow passageways of substantially constant cross section in said disk extending in straight lines therethrough from said inlet chamber to the disk periphery, and discharge channels in the periphery of said disk extending from the outer ends of said passageways in the wake thereof during rotation of the impeller, the cross section area of said channels at their ends adjacent to said passageways being slightly less than the cross section area of the passageways and being of gradually decreasing cross area toward their trailing ends.

2. In a centrifugal pump, an impeller in the form of a disk having an axially located inlet chamber, spaced apart centrifugal flow passageways of uniform cross section extending in straight lines to said disk from said inlet chamber to the disk periphery, the disk periphery having discharge channels therein extending rearwardly from the end of each passageway to the end of the next passageway for receiving the centrifugal flow from said passageways when said impeller is rotating, said channels being of gradually decreasing radial depth from their receiving ends to their trailing ends and at their receiving ends having a cross-sectional area less than the cross-sectional area of said passageways.

3. In a centrifugal pump, a volute having two raceways therein and two oppositely directed nozzles extending tangentially from opposite ends thereof and forming continuations and outlets for said raceways, an impeller rotatable within said volute having an axially located inlet chamber, centrifugal flow passageways of substantially constant cross section in said impeller extending in straight lines from said inlet chamber to the impeller periphery, and discharge channels in the periphery of said impeller extending from the outer ends of said passageways in the wake thereof when said impeller is rotated for discharging the centrifugal flow into said raceways, said channels being of gradually decreasing cross area toward their trailing ends.

4. In a centrifugal pump, a volute having a plurality of raceways and tangential nozzle outlets therefor, an impeller within said volute having an axially located inlet chamber, centrifugal flow passageways of substantially constant cross section extending in straight lines through said impeller from said inlet chamber to the impeller periphery, channels in the periphery of said impeller extending rearwardly from the ends of said passageways to receive the centrifugal flow therefrom when the impeller is rotated, said channels being in alinement with the volute raceways and being of gradually decreasing radial depth rearwardly from their receiving ends whereby the bottoms of said channels will function as cams for forcing the received centrifugal flow into and along the volute raceways for discharge from said nozzles.

5. In a centrifugal pump, a volute having a plurality of raceways and tangential nozzle outlets therefor, an impeller within said volute having an axially located inlet chamber, centrifugal flow passageways of substantially constant cross section extending in straight lines through said impeller from said inlet chamber to the impeller

periphery, channels in the periphery of said impeller extending rearwardly from the ends of said passageways to receive the centrifugal flow therefrom when the impeller is rotated, said channels being in alinement with the volute raceways and being of gradually decreasing radial depth rearwardly from their receiving ends whereby the bottoms of said channels will function as cams for forcing the received centrifugal flow into and along the volute raceways for discharge from said nozzles, the cross section area of said channels at their receiving ends being less than the cross section area of said passageways.

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