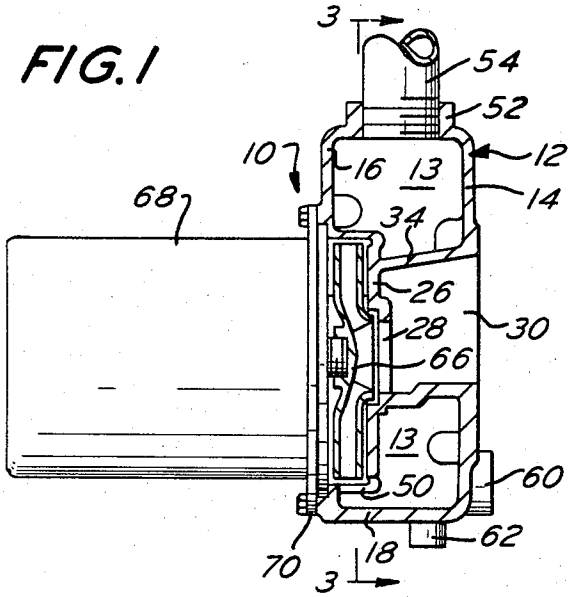
Dec. 17, 1968 H. M. POLLAK ET AL 3,416,456

CENTRIFUGAL PUMP

Filed Nov. 14, 1966

FIG. 1



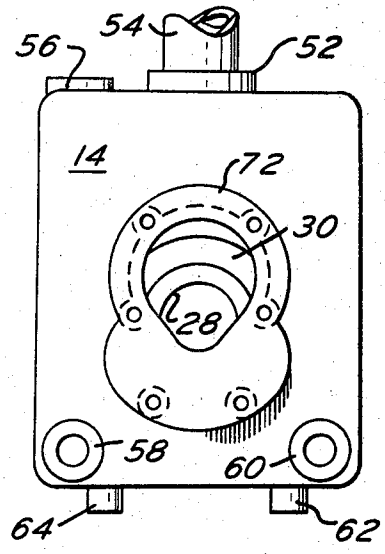


FIG. 2

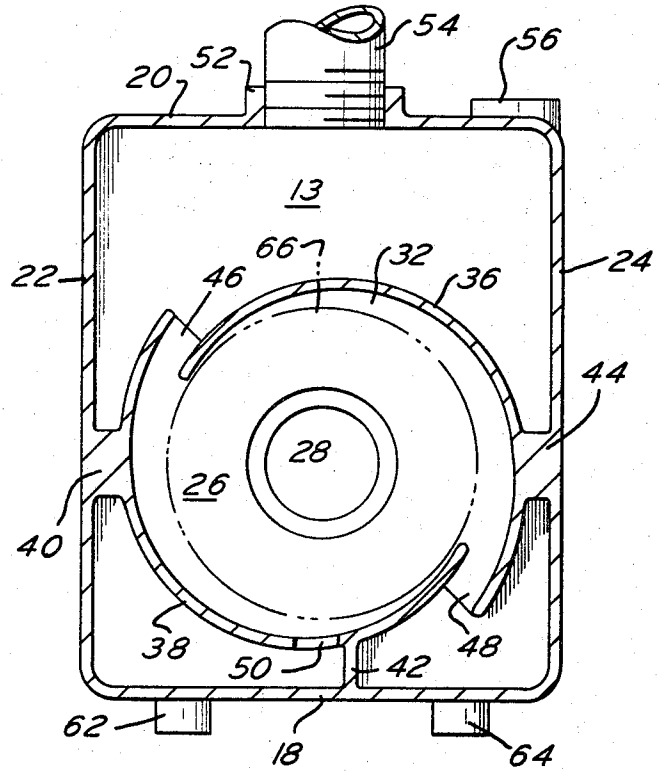


FIG. 3

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CENTRIFUGAL PUMP

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ABSTRACT OF THE DISCLOSURE

The centrifugal pump of the present invention is of the self-priming type having first and second volute discharge ports providing communication between the pumping chamber and the air separator outlet chamber. The volute discharge ports are generally diametrically opposite one another with one of the ports being below the axis of the impeller. A recirculation port provides communication between the outlet chamber and the bottom of the pumping chamber. The recirculation port is spaced from said one volute discharge port by an arcuate distance of less than 120 degrees. Said one volute discharge port performs no function during priming.

In the design of self-priming centrifugal pumps, an effective seal must be maintained so that the atmosphere air cannot short circuit and return to the suction line during the priming cycle. Where multiple discharge ports are employed, it is generally necessary to keep the air separator outlet chamber substantially full of liquid in order to prevent short-circuiting. Such designs requiring a substantially full outlet chamber in order to effect priming have drawbacks since the full chamber is not a practical feature in operation. In the process of shut-down and start-up, some liquid is lost and hand-filling is frequently required. In the pump of the present invention, a proper seal is maintained by the disposition and location of the volute discharge ports.

In the design of self-priming centrifugal pumps, a recirculation of the priming water into and out of the impeller must be provided. It has been suggested heretofore to provide a recirculation point at or near the periphery of the impeller. In some designs, this recirculation port takes the form of a second volute which acts as a recirculation port during the priming cycle and constitutes a volute discharge port during the pumping cycle. Designs which simply provide a hole in the volute for recirculation during priming necessarily decrease efficiency during the pumping cycle. The reason for this is that energy conversion (velocity to pressure) does not occur as liquid flows through the hole in the same manner as it does in a volute. In the pump of the present invention, such energy loses are minimized.

In the pump of the present invention, first and second volutes are provided generally diametrically opposite one another. One of the volutes is below the axis of rotation of the impeller and performs no function during the priming cycle. The discharge port of said one volute is placed in an underwater position in order that the proper seal is accomplished. A recirculation port is placed adjacent the bottom of the pumping chamber and less than 90 arcuate degrees from the discharge port for said one volute. Since the natural process of air rising will cause the liquid in the outlet chamber to be more nearly free of air adjacent said recirculation point, this will allow recirculation of the more nearly air-free water and result in faster priming.

For a given size pump, the throat area of the volute is essentially fixed. Substantially identical pump-hydraulic performance can be obtained by making a dual volute pump wherein summation of the throat areas of the two volutes adds up to the total area of a single volute pump.

In the present invention, the throat area of the individual volutes can be lessened, thereby making it easier to maintain an effective seal in the priming of the pump and thereby require a smaller amount of water in order to prevent short circuits.

On pumps employing a single volute with a recirculation port, a close clearance is required between the cutwater diameter of the volute and the periphery of the impeller. Because of the easier sealing effect of the present invention, the close clearance between the cutwater diameter of the volutes and the impeller periphery is no longer necessary.

By locating the recirculation port less than 90 arcuate degrees from the nearest volute discharge cutwater, the amount of liquid discharged from the port during the pumping cycle is minimized. Because of the sealing problem, single volute pumps normally require the circulation port to be located at positions up to 270 arcuate degrees from the discharge cutwater. As a result thereof, approximately 75 percent of the water discharged from the impeller is subject to leakage out of the recirculation port during the pumping cycle thereby seriously affecting efficiency.

It is an object of the present invention to provide a novel self-priming centrifugal pump.

It is another object of the present invention to provide a dual volute self-priming centrifugal pump wherein one volute does not function during priming since substantially all liquid entering a recirculation port less than 120 degrees from said one volute and adjacent the bottom of the pumping chamber is discharged by the impeller through the other volute.

It is another object of the present invention to provide a self-priming centrifugal pump which is easier to prime and is more efficient.

It is another object of the present invention to provide a dual volute centrifugal pump which is simple, economical to manufacture, and reliable.

Other objects will appear hereinafter.

For the purpose of illustrating the invention, there is shown in the drawings a form which is presently preferred; it being understood, however, that this invention is not limited to the precise arrangements and instrumentalities shown.

FIGURE 1 is a sectional view of the pump of the present invention.

FIGURE 2 is a rear elevation view of the pump in FIGURE 1.

FIGURE 3 is a sectional view taken along the line 3—3 in FIGURE 1.

Referring to the drawing in detail, wherein like numerals indicate like elements, there is shown in FIGURE 1 a centrifugal pump in accordance with the present invention designated generally as **10**. The pump **10** includes a casing designated generally as **12** and which can be made from cast aluminum or other materials. While the casing **12** is preferably cast from one piece, it may be comprised of two or more portions bolted together.

The casing **12** includes side walls **14** and **16** connected to a bottom wall **18**, a top wall **20**, and end walls **22** and **24**. An air separator outlet chamber **13** is defined by the walls of the casing **12**.

A separator wall **26** is provided within the chamber **13**. Wall **26** is provided with a suction port **28** providing communication between a suction chamber **30** on one side of wall **26** and the pumping chamber **32** on the other side of wall **26**. Wall **26** is integral with the side wall **16** by means of volute walls **36** and **38**. Wall **26** is also integral with the side wall **14** by means of the generally conical annular wall **34** which defines the cross section of the suction chamber **30**.

Volute wall **38** is integral with end wall **22** by means of rib **40** and integral with bottom wall **18** by means of rib **42**. Volute wall **36** is integral with end wall **24** by means of rib **44**. The first volute discharge port **46** from the pumping chamber **32** is generally diametrically opposite the second volute discharge port **48**. Port **48** is below the axis of the suction port **28**. A water recirculation port **50** is provided in the volute wall **38** immediately adjacent rib **42** as to be near the bottom of the pumping chamber **32**. Port **50** is spaced from port **48** by approximately **45** arcuate degrees.

The casing **12** is provided on top wall **20** with a boss **52** which is internally threaded. A discharge conduit **54** is threadedly coupled to boss **52**. The top wall **20** may also be provided with a priming port **56** which is closed by a removable plug. One or more drain ports **58** and **60**, closed by a removable plug, are provided adjacent the bottom of casing **12** on side wall **14** to facilitate draining chamber **13**. The pump **10** may be provided with legs **62** and **64** depending from the bottom wall **18**.

An impeller **66** is provided within the pumping chamber **32**. The suction eye of impeller **66** is aligned with the suction port **28**. Impeller **66** is driven by motor **68**. Motor **68** is provided with a flange **70** removably coupled to the side wall **16** by bolts or the like. Side wall **14** is provided with a machined area **72** to which a conduit may be bolted and through which the liquid to be pumped may be introduced into the suction chamber **30**.

In operation, the second volute discharge port **48** is inoperative during priming. Water from chamber **13** is recirculated through port **50** into the pumping chamber **32**. Water entering chamber **32** from port **50** and any air therein discharge through port **46** and separate in chamber **13**. Hence, there is essentially no water left for discharge through port **48**. The water near the bottom of chamber **13** is generally free of air and thereby facilitates faster priming by way of port **50**. A seal is effected due to the fact that port **48** is below the axis of the impeller **66** and below the axis of the suction port **28**. Thus, priming can be effected so long as the amount of water in chamber **13** is up to the lowest edge of port **28**. Since port **50** is less than 120 degrees and preferably only 45 degrees from port **48**, the amount of water discharged from port **50** during the pumping cycle is minimal.

The present invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof and, accordingly, reference should be made to the appended claims, rather than to the foregoing specification as indicating the scope of the invention.

It is claimed:

1. A self-priming centrifugal pump comprising a casing having walls defining a pumping chamber separated from an air separating outlet chamber, a rotatable impeller supported in said pumping chamber, said walls including only first and second volutes, said volutes having overlapping ends and providing direct communication between said chambers, said volutes having discharge ports generally diametrically opposite one another, the discharge port of said second volute being below the axis of rotation of the impeller, the discharge port of said first volute being the only port above the axis of said impeller, the discharge port of said first volute being approximately 45 arcuate degrees from a vertical line passing through the axis of rotation of said impeller, and said pumping chamber wall having a recirculation port near the bottom of the pumping chamber, said recirculation port providing direct communication between said chambers, with said recirculation port being not more than about 90 arcuate degrees from said second volute discharge port.

2. A pump in accordance with claim **1** wherein said casing walls include a separating wall generally perpendicular to the axis of the impeller, said separating wall having a suction port aligned with the suction eye of the impeller, said separating wall being connected to one of the side walls of said casing by walls defining said volutes, and the walls defining said volutes being connected to end walls of said casing by ribs.

3. A pump in accordance with claim **1** including a rib extending from a casing wall to said second volute adjacent said recirculation port, the height of the rib corresponding to the height of said second volute.

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