Nov. 30, 1926. 1,608,547

J. O'F. CLARK

ROTARY FEED CENTRIFUGAL PUMP

Filed Jan. 5, 1925

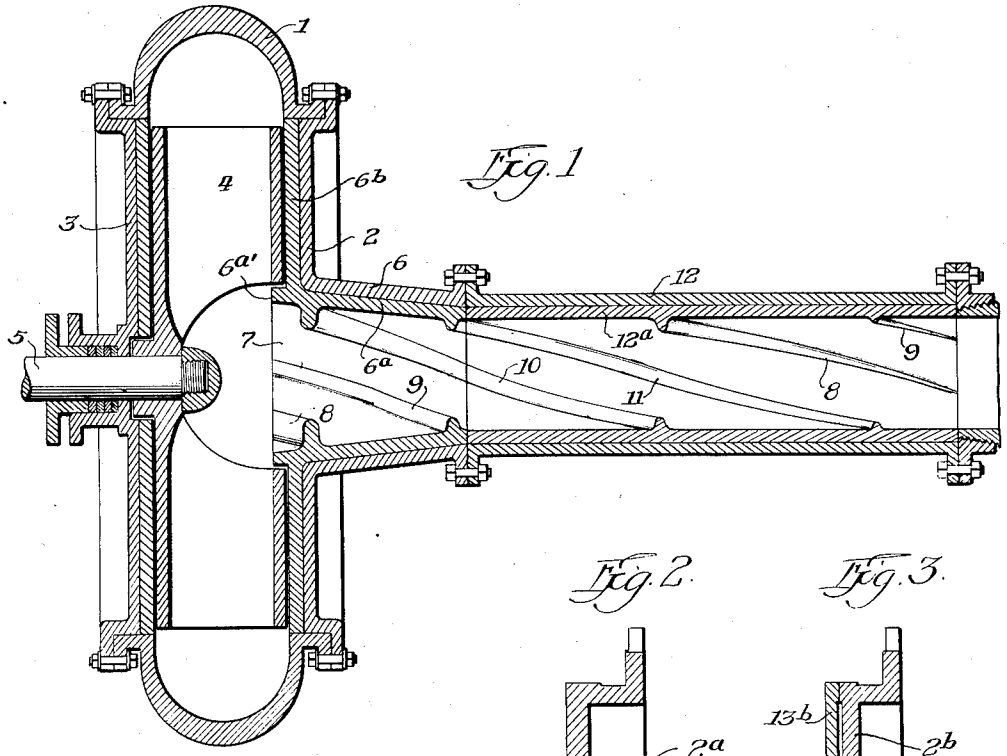


Fig. 1

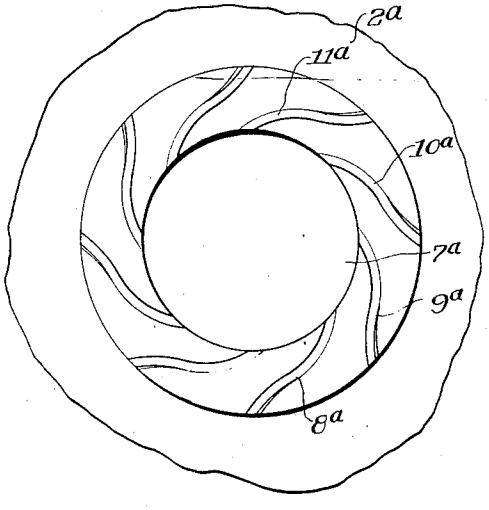


Fig. 4

Fig. 2

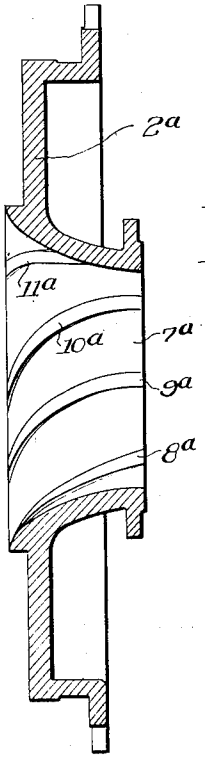
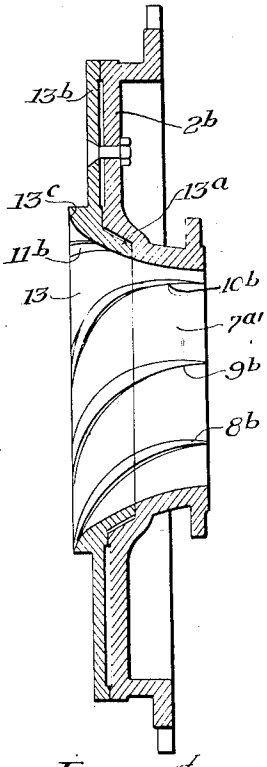


Fig. 3



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UNITED STATES PATENT OFFICE.

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ROTARY-FEED CENTRIFUGAL PUMP.

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This invention relates to centrifugal pumps of the type in which an impeller, rotating about an axis within a shell, receives a column of fluid in the direction of its axis and diverts the same by centrifugal force in directions radial thereto and particularly pumps of this general class in which, for the sake of efficiency, the rotating member and corresponding walls of its shell are defined by substantially parallel planes perpendicular to its axis of rotation, and receive the fluid through a stationary barrel that terminates at or within one of the said planes, thereby leaving the rotating member with impelling channels that are relatively long in the radial direction. In pumps of this type, gravel and other solid matter, which frequently is borne in with the column of fluid, works serious injury to those parts of the mechanism which are immediately concerned with diverting the material from its axial to its radial course, owing to the momentum of the solid matter in one direction or its inertia that opposes setting up motion in the other direction; this condition being particularly aggravated by the relatively abrupt change of direction incident to delivery of the fluid within the plane of the rotor and near its center, or at the inner ends of the relatively long impelling channels.

Now, the object of the present invention is to reduce, in a substantial and beneficial degree, the forces which work the injury referred to; and the invention proceeds upon the principle of setting up a rotary or vortical motion in the column of fluid and any solid matter contained therein, during the feeding of the column through a stationary suction intake of the pump, for instance, by developing rifling within a suitable portion of the feed channel, or constructing the same with spirally arranged lands or ribs and causing the material to reach the center of the impeller at a point radially within its peripheral points of discharge with an inherent centrifugal force, already present in the fluid, that initiates the radial movement immediately the material escapes from the confining wall of the intake, so that impingement of the solid matter against the surfaces of the impeller will be at relatively ineffective angles and largely reduced in force. In the preferred embodiment of the invention, the suction intake increases in diameter toward the impeller, and may even be flared in a constantly increasing ratio, but within a low angle of flaring in order not to detract too much from the radial dimension of the impelling channel; and the vanes which develop the rifling within the intake are of spiral form, increasing in both depth and pitch as they proceed inward, so as to progressively build up the speed of rotation of the fluid column.

In order that the invention may be fully understood, several embodiments thereof are illustrated in the accompanying drawing, in which—

Figure 1 is an axial section of a pump in which one form of the present invention is embodied.

Figure 2 is a similar view of the suction side wall of the pump, with a modified construction of intake.

Figure 3 is a view similar to Figure 2, showing a similar design of intake developed in part by a protecting liner; and

Figure 4 shows an inside elevational view of the intake opening of Figures 2 and 3.

1 represents the shell of a pump, 2 the suction side wall, and 3 the back wall. The impeller 4, rotatably mounted within the shell 1 through means of the shaft 5, is defined by substantially transverse planes so that its impelling passages are relatively long in the radial direction. The suction side wall 2 is constructed with a deep flange or barrel 6 through which is formed the suction intake 7 that delivers a column of fluid to the impeller in the direction of the axis of the shaft 5, near the center of the impeller and radially within the periphery at which the impeller discharges. In order to reduce the violence of impact of solid matter entering with the column of fluid, as it reaches the inner wall of the impeller or is picked up by the radial walls thereof, the intake 7 is designed with lands or ribs 8, 9, 10, and 11 that develop rifling within the feed channel capable of setting up a rotary or vortical motion in the column of fluid passing therethrough; these lands or ribs being of such height and pitch as will insure the desired effect and preferably increasing in both height and pitch inwardly. The lands preferably extend, not only through the suction opening provided by the barrel 6 of

the suction side plate, but into the tubular extension or feed pipe 12 as well, the lands tapering and preferably increasing in pitch progressively through both the feed pipe and the barrel. Preferably also the lands will not be formed directly upon the barrel 6 of the tubular extension 12, but upon liners 6^a and 12^a adapted to said members, so that it will be practicable and convenient to replace the rifling within these members whenever it wears down to proportions that would render it inefficient. The liner 6^a preferably terminates in a plane $6^{a'}$ within the impeller 4, so as to protect that wall of the latter which is presented toward the suction side; and said liner may also be designed with an integral wear plate 6^b that overlies the inner surface of the suction side wall 2.

As suggested in Figure 2, the suction side wall 2^a may be adapted for convenient replacement in the pump when worn, and have its suction intake 7^a with rifling lands 8^a, 9^a, 10^a and 11^a formed integrally with it, and said suction intake may, as shown, be of a form in which the flare or increase in diameter inward toward the impeller is at a constantly increasing ratio so that by the time the material is released to the impeller, it will have assumed, under centrifugal force, a direction approaching still nearer the radial direction of movement induced by the impeller.

As shown in Figure 3, the suction side wall may take the form 2^b, with the suction intake $7^{a'}$ formed in part integral therewith and in part of a liner 13 and with ribs 8^b, 9^b, 10^b and 11^b continuing from the one part to the other; and the liner 13 will have a flange 13^a entering a recess of the side plate 2^b, a wearing face 13^b overlying the inner face of the side wall 2^b, and a lip 13^c which constitutes a protection for the outer wall of the impeller, in that it receives the impingement of the incoming material until the latter is free to enter the impeller.

While I have shown and described rifling lands as the means for setting up rotary motion of the column of fluid and its contained solid matter, delivered axially to a rotary pump, it is to be understood that the scope of the invention will also include any other suitable means for setting up such a rotary motion and developing a centrifugal force in the material by the time it reaches the impeller.

I claim:

1. A centrifugal pump, comprising a shell, an impeller rotating within the shell, said impeller and corresponding walls of the shell being defined by planes substantially transverse to the axis of rotation, and a stationary feed barrel delivering axially to the impeller, near its center, and at a point located radially inward from the discharging periphery of the impeller; said feed barrel being constructed with spiral lands developing a vortical motion in the fluid within the stationary barrel before the fluid reaches the impeller.

2. A centrifugal pump, comprising a shell, an impeller rotating within the shell, said impeller and corresponding walls of the shell being defined by planes substantially transverse to the axis of rotation, and a stationary feed barrel delivering axially to the impeller, near its center, and at a point located radially inward from the discharging periphery of the impeller; said feed barrel being constructed with spiral lands developing a vortical motion in the fluid within the stationary barrel before the fluid reaches the impeller; said feed barrel enlarging in diameter toward the impeller but at a relatively low ang'e of flaring, thereby releasing the fluid with latent centrifugal force to a relatively long radial action of the impeller.

3. A centrifugal pump, comprising a shell, an impeller rotating within the shell, said impeller and corresponding walls of the shell being defined by planes substantially transverse to the axis of rotation, and a stationary feed barrel delivering axially to the impeller, near its center, and at a point located radially inward from the discharging periphery of the impeller; said feed barrel being constructed with spiral lands developing a vortical motion in the fluid within the stationary barrel before the fluid reaches the impeller; the feed barrel increasing in diameter toward the impeller at a relatively low angle of flaring, and the depth of the lands increasing toward the impeller.

4. In a centrifugal pump, a suction intake constructed with deflecting lands that induce rotation in the column of fluid entering the pump; said suction intake increasing in diameter and said lands increasing in depth toward the impeller.

5. In a centrifugal pump, a rotary impeller having radially extending impelling channels and defined by substantially parallel walls transverse to the axis of rotation, a shell having suction and back walls conforming substantially to the said planes of the impeller, and a feed barrel delivering to the impeller near its center and at a point located radially inward from the discharging periphery of the impeller; said feed barrel being stationary and having its inner wall constructed with spiral lands to induce vortical action in the fluid delivered by it; and the said wall of the feed barrel being integral with the suction of the shell.

6. In a centrifugal pump, a rotary impeller having radially extending impelling channels and defined by substantially parallel walls transverse to the axis of rotation,

a shell having suction and back walls conforming substantially to the said planes of the impeller, and a feed barrel delivering to the impeller near its center radially inward from the discharging periphery of the impeller; said feed barrel being stationary and having its inner wall constructed with spiral lands to induce vortical action in the fluid delivered by it; and the said wall of the feed barrel being integral with the suction wall of the shell and continuing substantially axially to a point within the radial plane of the channels of the impeller.

7. In a centrifugal pump, a shell having a peripheral discharge port and a suction wall in a plane substantially perpendicular to the axis of rotation of the pump and constructed with an axial intake terminating at a point radially inward from the discharge port, an impeller rotatably mounted in said shell, having a wall conforming to said suction wall and open at its center to receive fluid from said axial intake, and a feed barrel substantially concentric with and extending in the direction of the axis of rotation of the pump, constructed with internal lands increasing in depth and pitch toward and terminating at the intake of the shell.

8. In a centrifugal pump, a shell having a suction wall in a plane substantially perpendicular to the axis of the pump, a rotary impeller in said shell conforming substantially to said suction wall, a stationary feed barrel delivering through said suction wall near the center of the impeller and at a point radially inward from the periphery of the impeller, and a feed pipe connected with said feed barrel; said feed pipe and feed barrel being constructed with integral lands, the lands of the barrel being arranged in continuation of those of the pipe.

9. In a centrifugal pump, a shell having a suction wall in a plane substantially perpendicular to the axis of the pump, a rotary impeller in said shell conforming substantially to said suction wall, a stationary feed barrel delivering through said suction wall near the center of the impeller and at a point radially inward from the periphery of the impeller, and a feed pipe connected with said feed barrel; said feed pipe and feed barrel being constructed with integral lands, the lands of the barrel being arranged in continuation of those of the pipe; the pipe being of substantially constant diameter, and the barrel increasing in diameter inward, and the lands increasing in depth progressively through the pipe and the barrel.

Signed at Chicago Heights, Illinois, this 26th day of December, 1924.

JOHN O'FALLON CLARK.