

March 23, 1937.

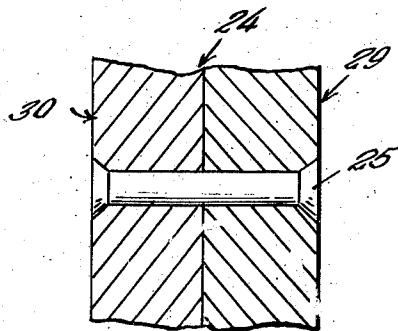
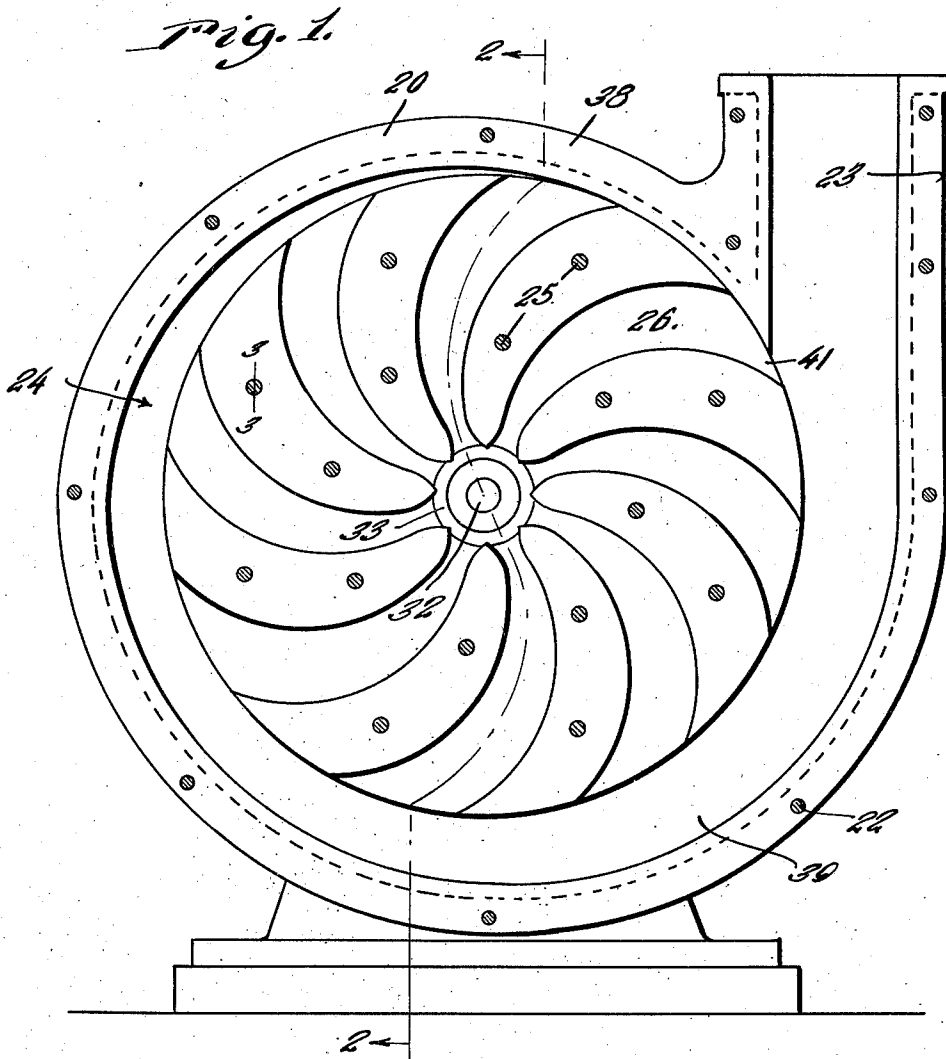
W. S. HOLDAWAY

2,074,650

CENTRIFUGAL PUMP

Filed Jan. 24, 1934

2 Sheets-Sheet 1



Inventor

W. S. Holdaway

By *Oliver A. O'Brien*
Attorney

March 23, 1937.

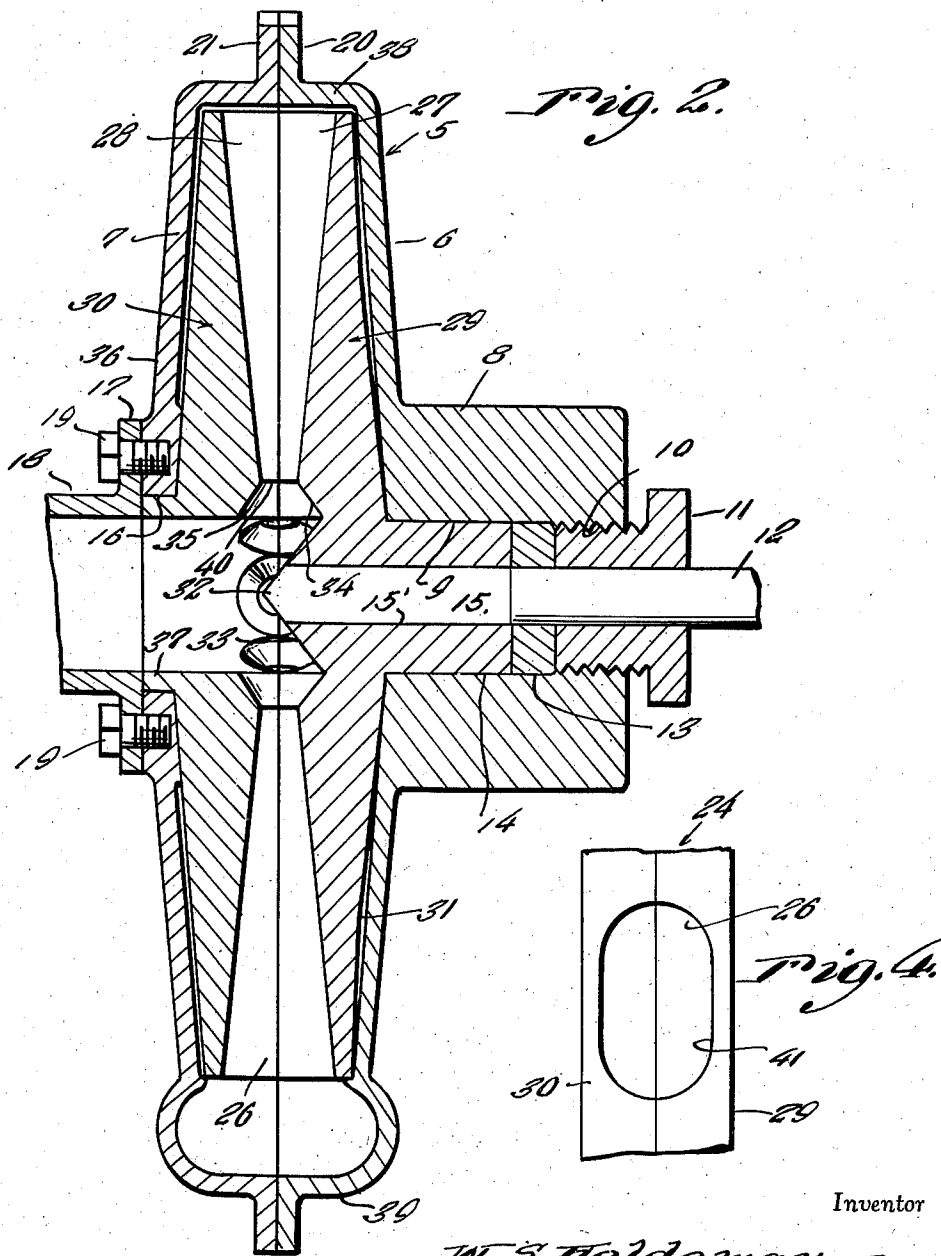
W. S. HOLDAWAY

2,074,650

CENTRIFUGAL PUMP

Filed Jan. 24, 1934

2 Sheets-Sheet 2



Inventor

W. S. Holdaway

By Clarence W.'Brien Attorney

UNITED STATES PATENT OFFICE

2,074,650

CENTRIFUGAL PUMP

William S. Holdaway, Los Angeles, Calif.

Application January 24, 1934, Serial No. 708,124

1 Claim. (Cl. 103—115)

My invention relates generally to centrifugal pumps, and particularly to a centrifugal pump having a runner designed to operate in a conventional type of casing which greatly increases the fluid impelling activity of the pump.

It is an important object of my invention to embody in a centrifugal pump runner diverging radial fluid passages having a Venturi action on the principles of the Daniel Bernoulli theorem, which have not heretofore to my knowledge been utilized in the construction and arrangement of centrifugal pump runners or impellers.

Other objects and advantages of my invention will be apparent from a reading of the following description in connection with the drawings, wherein for purposes of illustration I have shown a preferred embodiment of my invention.

In the drawings:—

Figure 1 is a sectional elevational view showing one side of the runner and one of the sections of the casing.

Figure 2 is a transverse vertical sectional view through Figure 1, taken approximately on the line 2—2.

Figure 3 is an enlarged transverse vertical sectional view taken approximately on the line 3—3 of Figure 1.

Figure 4 is an elevational view of a portion of the periphery of the impeller showing the shape of the opening of the fluid passages.

Referring in detail to the drawings, wherein like numerals refer to like parts throughout the same, the numeral 5 generally designates a conventional type of two part casing composed of the inside section 6 and the outside section 7. The inside section 6 has an axially extending heavy frame portion 8 having the axial bore 9, an outer end portion of which is reduced in diameter and threaded as indicated by the numeral 10. Into the threaded outer end portion of the bore 9 is threaded a packing nut 11 through which the impeller shaft 12 passes rotatably. The packing nut or gland 11 is in compressing relation to a packing ring 13 which is forcibly abutted with the adjacent end of the hollow stub shaft 14 in which the squared end 15 of the shaft 12 is fixed.

The outside casing section 7 has an axial opening 16 around which is bolted the flange 17 of the suction conduit 18. The fastening bolts are designated 19. Peripheral flanges 20, 21 on the inside and outside casing sections, respectively, are fastened together by bolts 22.

Both of the casing sections have the generally circular form indicated in Figure 2 with the

tangentially arranged discharge conduit portion 23. It will be noted that the circular runner or impeller 24 is arranged eccentrically within the casing so that its periphery runs very closely to the upper portion of the interior of the casing adjacent the outlet conduit portion 23, and that the periphery of the runner is spaced at a uniformly increasing distance from the interior of the periphery of the casing, proceeding in a counterclockwise direction, until the maximum spacing is reached immediately adjacent the outlet conduit portion 23.

The runner or impeller 24 is composed of a pair of similarly made sections which are connected by radially and circumferentially spaced bolts 25 which are located in the regions between adjacent pairs of fluid passages 26, which are formed by registering recesses 27, 28 in the runner sections 29, 30, respectively. The opposite sides of the runner are slightly beveled in conformity with the bevel of the interior wall of the casing sections, but the outer side of the impeller section 29 has a concave irregularity 31 which creates a greater spacing of this side of the section of the impeller from the interior side wall of the casing 6 than would be afforded by a uniform bevelling of the said side of the impeller section 29. Projecting axially from the outer side of the impeller section 29 is the stub shaft 14 whose bore 15 extends completely through the runner section 29 as shown in Figure 2. In this bore extends the squared portion 15 of the runner shaft 12 whose inner end protrudes from the inner side of the runner section 29 and is conically formed as indicated at 32. The conical shaft end protrudes at the apex of a conical formation 33 which is defined by a V-shaped annular recess 34 which surrounds the conical shaft end 32 and defines a portion of the outwardly converging inlet 35 of the fluid passages. It will be noted that the conical shaft end 32 projects axially beyond the inner side of the impeller section 29 and beyond the plane which passes through the center of the inlet openings 35 of the fluid passages 26.

The impeller section 30 has its outer side slightly spaced from the inner wall of the casing section 7 by virtue of the provision of an annular shoulder 36 which surrounds the opening 16 in the casing section 7 and against which the outer side of the impeller section 30 bears. It will be noted that the outer side of the runner section 30 has an annular neck 37 which projects through the opening 16 and has its radially outward side in bearing relation to the surface of the opening 16.

The outer end of the neck 37 is in bearing relation to the adjacent end of the suction conduit 18 which has a portion arranged radially inwardly and in concentric relation to the opening 16 in the casing section 7. It will be noted that the outer side of the runner section 29 has a portion immediately adjacent the stub shaft 14 in bearing relation to the adjacent part of the inner wall of the casing section 6.

It will be noted that the upper part of the casing indicated by the numeral 38 is comparatively flat and merges in a counter-clockwise direction into an oval form indicated by the numeral 29 at the bottom of Figure 2 which continues into and forms the outlet conduit portion 23. It will be noted that the opposite sides of the oval portion 39 bulge beyond the outer sides of the casing, thereby increasing the fluid conducting capacity and decreasing the resistance to the passage of the impelled fluid to and through the outlet conduit portion 23.

The fluid passages 26 taper in cross section radially outwardly from the outward end 40 of the radially outwardly converging inlet portions 35. The inlet portions 35 are arranged at equally circumferentially spaced intervals, and the mouths or discharge orifices of the fluid passages designated 41, which are seen to have an oval form (see Figure 4) are similarly uniformly circumferentially spaced on the periphery of the runner or impeller. The mouths are circumferentially displaced in a clockwise direction with respect to the intake orifices 35 of the fluid passages, and the intake orifice and the outlet orifice of each fluid passage 26 is connected by a passage of outwardly increasing cross section having a uniform curvature substantially illustrated in Figure 1. The walls of the fluid passages 26 range from circular at the point 40 near the inner end thereof to oval at the mouth 41 as shown in Figure 4. Thus the fluid passages 26 diverge in opposite lateral and opposite circumferential directions from the point 40 to the periphery of the runner or impeller.

Reference may be had to "Text Book on Hydraulics," 2nd Edition, Revised, page 42 and page 79 (George E. Russell of the Massachusetts Institute of Technology, Henry Holt and Company

New York, 1915) for an exposition of the principles underlying the present applicant's use of the Bernoulli theorem in the construction and arrangement of his fluid passages in the runner or impeller shown and described herein. Applicant's fluid passages are constructed on the Venturi principle, having walls which diverge radially outwardly in the manner shown. Applicant believes himself to be the first person to apply the principles of the Bernoulli theorem to the impeller of a centrifugal pump, although others may have approached in some respect or accidentally thereto. A true application of these principles to an effective degree has not heretofore been made.

While a standard type of impeller casing has in effect been utilized by me to house my new and improved runner, the combination of these obtains a degree of simplicity and efficiency in a rotary centrifugal pump not heretofore attained, an improvement of fifty percent or more in capacity being available with no greater power application. Any suitable means of applying rotative power to the outer end of the impeller shaft 12, such as a belt pulley and powered belt (not shown) will be suitable for operating the impeller.

Although I have shown and described a preferred embodiment of my invention, it is to be definitely understood that I do not desire to limit the application of the invention thereto, and any change or changes may be made in material and structure and arrangement of parts within the spirit of the invention and the scope of the subjoined claim.

What is claimed is:—

In a centrifugal pump, a rotor formed with an axial chamber having an inlet at one side, a plurality of circumferentially spaced Venturi passages in said rotor and having their radially outward ends terminating in circumferentially elongated discharge openings and their radially inward ends terminating in flaring radially inwardly facing mouths opening directly into said axial chamber, said Venturi passages having non-radial portions curving away from the direction of rotation of the rotor, said non-radial portions being located radially outwardly from said flaring mouths.

WILLIAM S. HOLDAWAY.