

April 15, 1930.

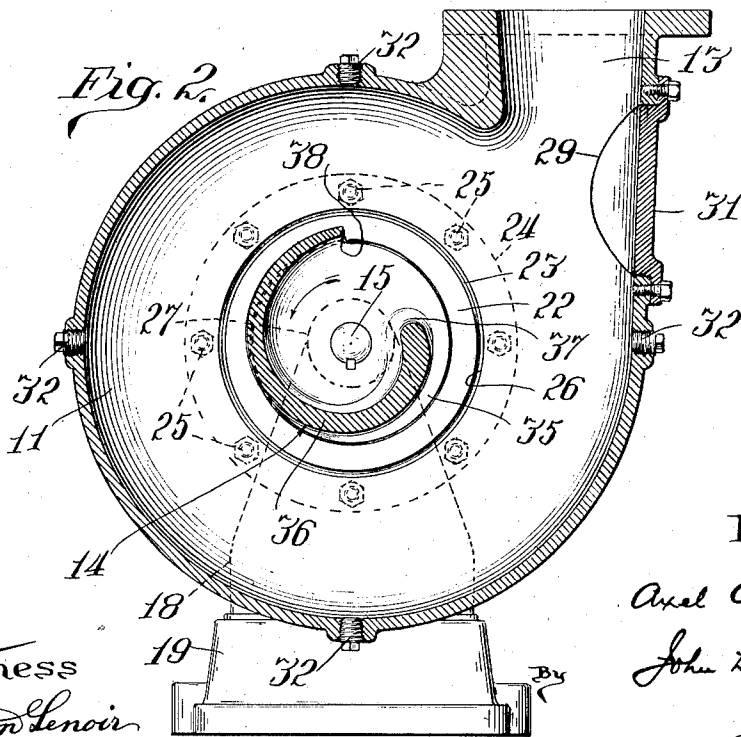
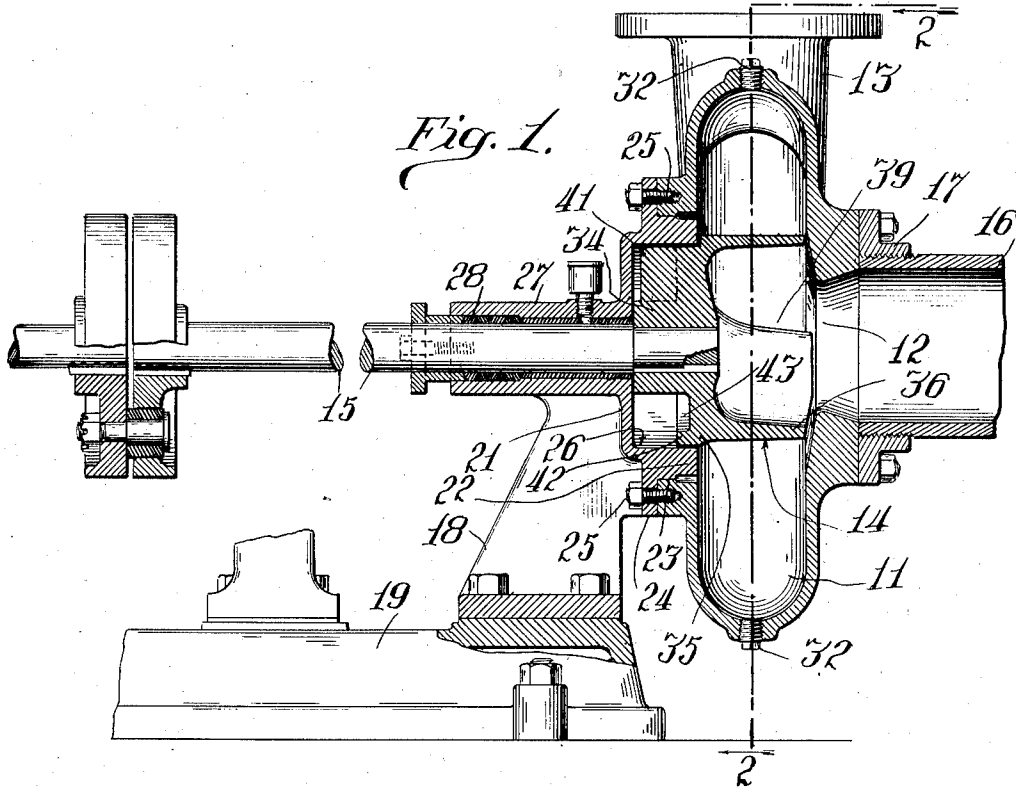
A. O. FABRIN

1,754,992

CENTRIFUGAL PUMP

Filed Dec. 6, 1926

2 Sheets-Sheet 1



Witness
Milton Lenoir

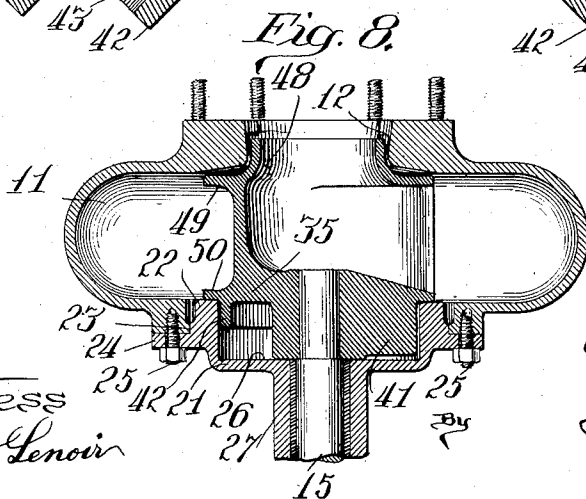
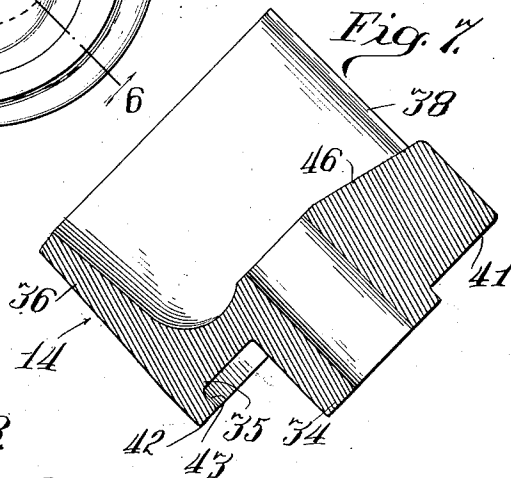
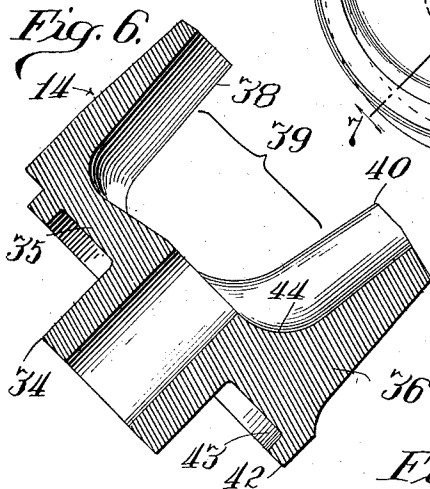
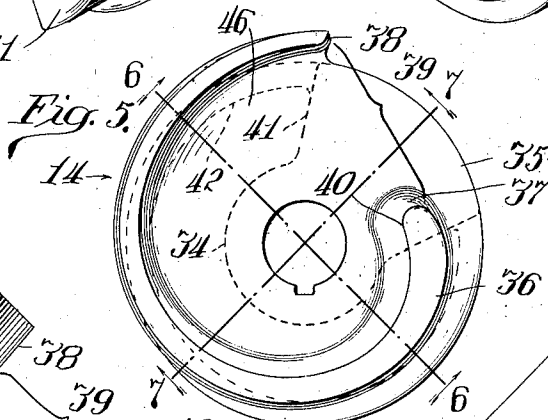
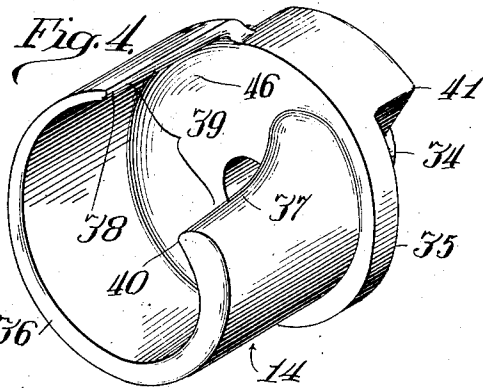
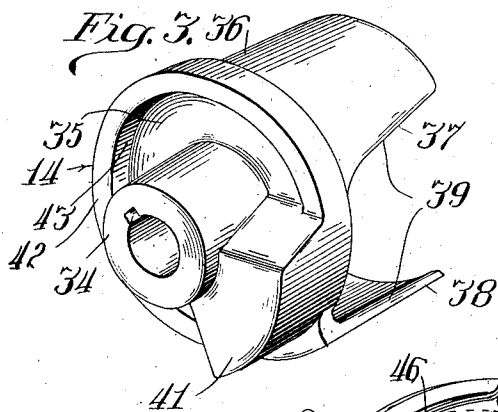
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2 Sheets-Sheet 2



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CENTRIFUGAL PUMP

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The present invention relates to centrifugal pumps, and has particular reference to certain improvements in the impellers or runners of such pumps.

5 The centrifugal type of pump is probably best suited of all pumps to use in situations where the liquid to be pumped is laden with trash, débris and other foreign substances. This property of the centrifugal pump fol-
10 lows inherently from the absence of valves and from the ability of the impeller to pass relatively large articles therethrough. Situations exemplary of the above are where drainage water or unscreened sewage is to be
15 pumped, such liquids frequently containing foreign materials of every conceivable description, such as rags, paper, roots, grass, blocks of wood and even heavy articles, such as stones, scraps of iron, etc.

20 It is one of the principal objects of the present invention to improve upon this characteristic of centrifugal pumps by providing an impeller which will be capable of passing relatively large articles, and which will be
25 capable of passing débris of all description without any possibility of such débris becoming caught or hung up within the impeller. More specifically, this is attained by provid-
30 ing an impeller wherein all of the water is discharged from a single peripheral point on the impeller, as distinguished from splitting or dividing the stream within the im-
35 peller and causing it to discharge from a plurality of peripherally spaced points on the impeller. By compelling all of the liquid and débris to discharge through a single
40 peripheral passage there is avoided the possibility of different portions of a single piece of débris being swept into different outlet passages and thereby becoming hung up
45 within the impeller.

Another object of my invention is to provide a pump of the character referred to and
45 in which the impeller and the surrounding casing wall are so related as to assure that solid materials which enter the impeller will pass readily from the impeller outlet to the
50 casing outlet.

It is a further object of the invention to provide an impeller of the above construction which is balanced in all diametrical planes and therefore balanced in all of its
55 rotative positions. The provision of but a single discharge passage in the periphery of the impeller tends inherently to unbalance the same, but this is effectively overcome in the present impeller, as will hereinafter ap-
60 pear.

Referring to the accompanying drawings illustrating a preferred embodiment of my invention:

Figure 1 is a vertical axial sectional view through a centrifugal pump embodying the
65 invention.

Figure 2 is a transverse sectional view taken on the plane of the line 2—2 of Figure 1.

Figure 3 is a perspective view of the present
70 impeller, viewed from the rear.

Figure 4 is a similar view of the impeller, viewed from the front.

Figure 5 is a front elevational view of the
75 impeller.

Figs. 6 and 7 are sectional views taken on
80 the planes of the diametrical lines 6—6 and 7—7 of Fig. 5, and

Figure 8 is an axial sectional view through a centrifugal pump wherein is embodied a
85 modified form of the present impeller.

Referring to Figs. 1 and 2, the pump comprises a substantially circular pump chamber 11 having a central inlet 12 and a tangential outlet 13. Revolving within this pump
85 chamber is the present impeller unit 14, the latter being mounted on a drive shaft 15 extending rearwardly from the pump. The inlet connection to the pump chamber occurs through any suitable inlet pipe 16 which may
90 be connected to the inlet passage 12 of the pump chamber in any suitable manner, as by screwing this pipe into a threaded collar 17 which is bolted to the front face of the
95 pump chamber.

The pump may be given any suitable
100 mounting, operating with equal efficiency in either vertical or horizontal positions. In Figure 1 I have shown the pump chamber secured to a standard 18 which is bolted to a base plate 19. The standard or bracket 18

is formed with a cup shaped attaching portion 21 which is bolted to the rear side of the pump chamber. The said attaching portion 21 has a forwardly extending circular flange 22 which enters an opening 23 in the rear of the pump chamber, the chamber being secured to the bracket attaching portion by studs 25 which extend rearwardly through holes in a flange 24 extending radially from the attaching portion, and which studs receive nuts at their outer ends. The flanged portion 22 of the attaching portion 21 defines a relatively deep pocket 26 for accommodating a balancing projection protruding from the rear of the impeller, as I shall hereinafter describe.

The shaft 15 is illustrated as having bearing support in a bearing sleeve 27 formed integral with the standard 18, this bearing sleeve being packed by any suitable gland packing 28. Referring to Fig. 2, the pump chamber is preferably provided with a cleaning opening 29 located adjacent the tangential outlet 13 and closed by a removable cover plate 31. A plurality of drain plugs 32 are disposed at different points around the pump chamber.

The impeller 14 comprises a hub 34 and a side wall 35 extending radially therefrom. Projecting from the front face of this side wall is a single spiral vane 36 which curves outwardly from the inner leading edge 37 to the outer trailing edge 38 in spiral or involute form. The gap or passage 39 intervening between these edges 37 and 38 is the sole peripheral outlet through which all discharge occurs.

The radius of the inner frontal edge of the vane 36 at the point 40, just back of the leading edge 37, is equal to or slightly larger than the radius of the pump chamber inlet 12. In the rotation of the impeller this inner edge surface 40 inscribes a circle corresponding to the inlet opening of the impeller; and from the foregoing it will be seen that this circle or inlet opening is as large or larger than the pump chamber inlet 12, so that all pieces of debris capable of passing through the inlet 12 will be capable of entering the center of the impeller. In this regard, it should also be noted that the span of the discharge outlet 39 is substantially equal to or greater than the diameter of the pump chamber inlet 12 and to the diameter of the arc of rotation of this innermost point of the vane, so that all pieces of debris capable of entering the center of the impeller will have free discharge through the outlet passage 39. The radius of the trailing edge 38 of the vane is preferably slightly greater than the radius of the side wall 35, as best shown in Fig. 5.

As clearly illustrated in Fig. 2, the pump casing is so disposed relative to the vane of the impeller that the distance between the point of the vane most remote from its axis

of rotation and the point of the surrounding wall of the casing least remote from such axis, is not appreciably less than the width of the impeller outlet. Preferably, this distance is greater than the width of the impeller outlet, as in Fig. 2, though this may not be essential in all instances, so long as it is not appreciably less than the width of the impeller outlet. This relation between the impeller vane and the casing is advantageous as assuring that solid materials which pass through the impeller outlet will readily pass through the passage extending about the vane and thence to the outlet of the casing.

It will be observed that the leading edge 37 of the vane is constructed relatively thick, and that from this point the vane gradually diminishes in thickness back to the trailing edge 38. The relatively thick leading edge is rounded on a curve, and the trailing edge is comparatively thin, so that the entire vane has a gradually tapered stream-line form for maximum efficiency within the body of liquid. The relatively thick leading edge reinforces this portion of the vane against injury from striking objects conveyed in the stream of water. In addition to having these advantages, the tapered distribution of the metal in stream-line form in the vane also contributes to a balanced construction. The greater mass of metal in the leading edge of the vane compensates for the shorter radius of the vane at this point, and correspondingly, the lesser mass of metal toward the trailing edge of the vane compensates for the greater radius of the vane at this point, thus tending to balance the vane portion of the impeller. Considering the impeller as an entirety, the distribution of metal is such that the vane is counterbalanced on any plane passed through the axis of the impeller, and consequently it rotates smoothly and without vibration. This balancing of the impeller is obtained by having the vane 36 of diminishing cross-section from its leading edge such that the pull of the mass of the impeller at any point within the vane, due to centrifugal force, is equal to the pull of the mass of the impeller at a diametrically opposite point within the vane. The lesser weight of the impeller at the discharge outlet 39, is more particularly compensated for by a balancing segment 41 that protrudes rearwardly from the side wall 35 in a plane coincident with this discharge outlet, such balancing segment being cast integral with the side wall and hub portion, as clearly shown in Fig. 3. The segment 41 and the portion of vane 36 diametrically opposite to the segment are of such relative values as to compensate for the discharge outlet 39. This assures proper balancing of the impeller. The outer surface of this segment is concentric with the circular periphery of the side wall 35, and this segment and a portion of the side wall extends back

into the pocket 26 formed in the rear wall of the pump chamber (Fig. 1) where this balancing segment is protected against debris striking and becoming wound on the segment and hub. A flange 42 projects rearwardly from the side wall 35 adjacent its periphery, this flange extending the surface area of the periphery of the back wall 35 so as to minimize the possibility of small pieces of debris passing into the pocket 26 in back of the impeller. The depth of the recessed area 43 within this flange 42 may also vary at different angular points around the impeller in attaining a balanced construction.

It will be observed from Figs. 5, 6 and 7 that the thickness of the vane 36 increases from the front side of the impeller towards the side wall 35 at the opposite side of the impeller, this giving the effect of sloping inner and outer surfaces on the vane. The inner sloping surface of the vane merges in the side or back wall 35 through a gradual curve 44, the sharpness of which increases towards the outlet passage 39 so as to deflect the liquid and foreign materials toward this point. The outlet passage 39 extends the entire depth of the vane 36, as shown in Fig. 7. The front surface of the side wall 35 is sloped backwardly, as indicated at 46 to increase the depth of the discharge passage in this axial direction.

In Fig. 8 I have illustrated a modified construction of impeller, differing from the preceding embodiment principally in the formation of a shroud 48 on the front side of the impeller. This shroud extends into the inlet passage 12 of the pump chamber and also comprises an outwardly extending flange 49 which constitutes a front side wall for the vane 36. The rear side wall 35 may be formed with a similar flange extension 50. In this construction, part of the counterbalancing metal for counterbalancing the discharge passage 39 may be embodied in the front wall 49 or shroud extension 48.

In each of the foregoing constructions it will be observed that by having the entire discharge occur through the single outlet passage 39 there is no splitting of the water stream, and therefore no tendency for different portions of a piece of debris to be swept into different outlet passages where it might become caught or hung up within the impeller. In the pumps of this type which I have constructed for pumping unscreened sewage etc., the impeller will pass any object which is capable of entering the pump chamber inlet, including such objects as long stringy lengths of rags, pieces of clothing, etc.

What I claim as my invention and desire to secure by Letters Patent, is—

1. An impeller for centrifugal pumps comprising a spiral vane of tapered form diminishing in thickness for its entire length from its leading edge to its trailing edge, said vane

defining a single peripheral outlet for the discharge of all of the impelled liquid, and a counterbalance adjacent to such outlet.

2. An impeller for centrifugal pumps comprising a spiral vane having a single discharge outlet leading from the periphery of said impeller, and a counterbalance adjacent to said outlet and at one side thereof for balancing said vane on any plane passed through the axis of the impeller.

3. An impeller for centrifugal pumps comprising a single spiral vane, the inner leading edge and the outer trailing edge of said vane defining a single outlet passage therebetween leading from an involute pump chamber within the impeller, and means on said impeller adjacent to said outlet for counterbalancing the vane in the radial plane of said outlet passage.

4. An impeller for centrifugal pumps comprising a spiral vane, a supporting wall for said vane, and a counterbalance on the opposite side of said supporting wall, said counterbalance and the vane being so proportioned as to counterbalance said vane on any plane passed through the axis of the impeller.

5. An impeller for centrifugal pumps comprising a spiral vane, defining an involute pump chamber provided with a single peripheral outlet, a supporting wall for said vane, and a counterbalance on the outer side of said supporting wall adjacent to said outlet, said counterbalance and the vane being so proportioned as to counterbalance said vane on any plane passed through the axis of the impeller.

6. An impeller for centrifugal pumps comprising a side wall, a single spiral vane projecting from one side of said side wall, and defining a single peripheral outlet for the impeller between its leading and trailing edges, and a counterbalance on the opposite side of said side wall substantially in the radial plane of said discharge outlet, the counterbalance and the vane being so proportioned as substantially to counterbalance said vane on any plane passed through the axis of the impeller.

7. In a centrifugal pump, the combination of a pump chamber having a central recess formed in one of its side walls, an impeller in said chamber comprising a side wall, a single spiral vane projecting from one side of said latter side wall, the leading and trailing edges of said vane approaching into relatively close proximity and defining a single peripheral outlet for the impeller therebetween, and a counterbalancing segment projecting from the opposite side of said impeller side wall substantially in the radial plane of said peripheral outlet and rotating within said central recess.

8. An impeller for centrifugal pumps comprising a hub, a radially extending side wall, a single spiral vane projecting from one side of said side wall, the leading and trailing

edges of said vane approaching into relatively close proximity to each other and defining a single discharge outlet therebetween, a counterbalancing segment formed integral with said hub and said side wall and projecting from the opposite side of said side wall substantially in the radial plane of said discharge outlet, and a substantially circular flange projecting from the latter side of said side wall.

9. An impeller for centrifugal pumps comprising, a side wall, a single spiral vane projecting from one side of said wall, the leading and trailing edges of said vane defining a single peripheral outlet therebetween, and a counterbalancing segment projecting from the other side of said wall adjacent to and substantially in the plane of said outlet.

10. An impeller for centrifugal pumps comprising a spiral vane having a single peripheral discharge outlet, and a counterbalance adjacent to such outlet, the distribution of the material of the impeller, including the vane, being such that the impeller is balanced on any diametrical plane passing through the axis thereof.

11. In combination in a centrifugal pump, a casing, an impeller operating in the casing and comprising a supporting wall and a single spiral vane on the wall at one side thereof, and a counterbalance on the other side of the wall, said casing having a chamber in its side wall accommodating rotation of the counterbalance with the impeller.

12. In a centrifugal pump, a casing providing a chamber, a rotatably mounted impeller housed entirely within the chamber, said impeller comprising a disc and a single spiral vane projecting from the disc, the leading and trailing edges of the vane defining a single peripheral outlet for the impeller therebetween, the surrounding wall of the casing defining a passage extending above the vane and being provided with an outlet from the passage and an inlet to the impeller, said impeller outlet being of a size to readily pass solid materials entering the impeller through the casing inlet, the distance between the point of the vane most remote from its axis of rotation and the point of said surrounding wall of the casing least remote from said axis being not appreciably less than the width of the impeller outlet.

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