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R. CLIBORN
PUMP IMPELLER

2,835,203

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2 Sheets-Sheet 1

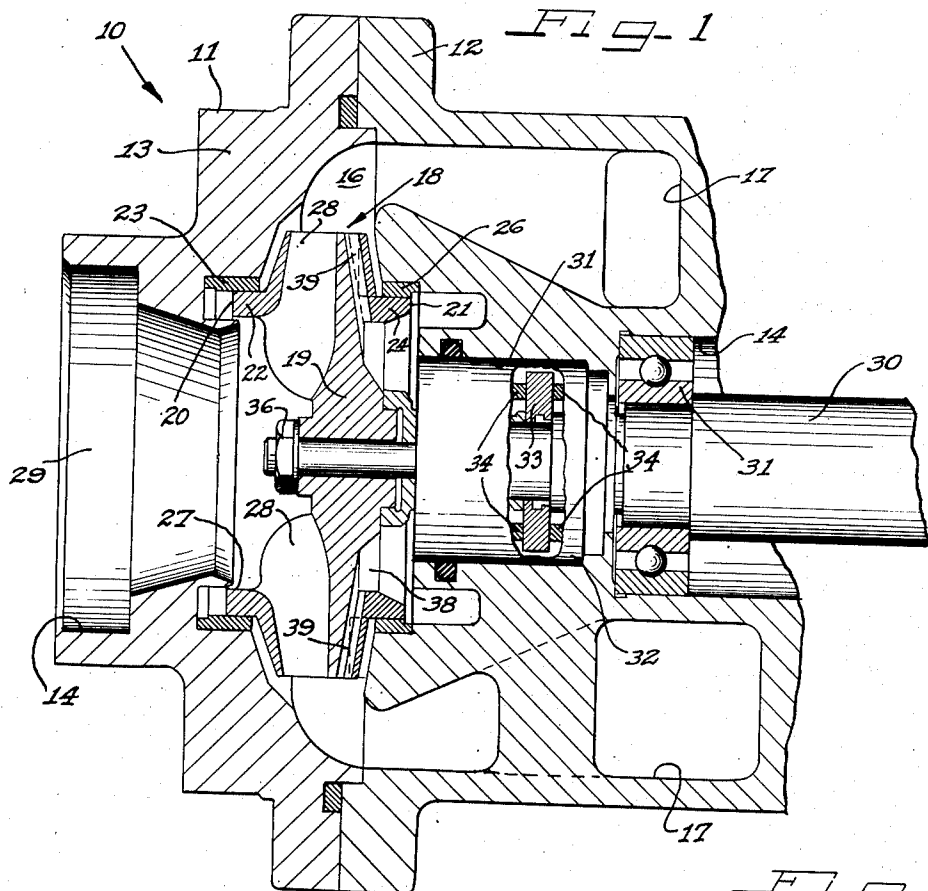


FIG-2

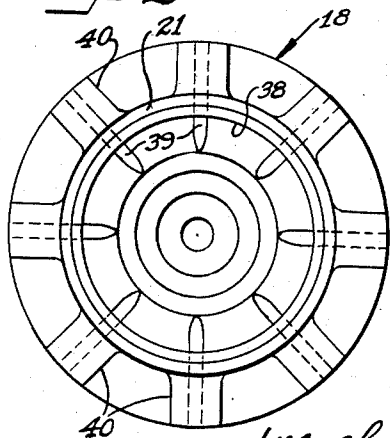
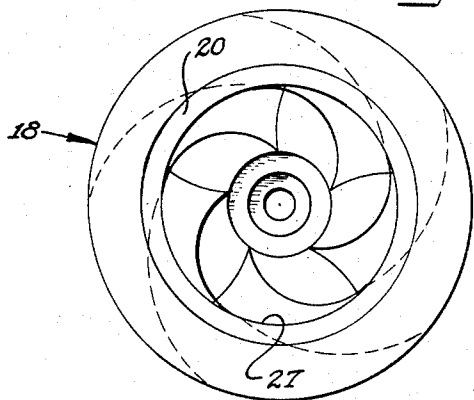


FIG-3



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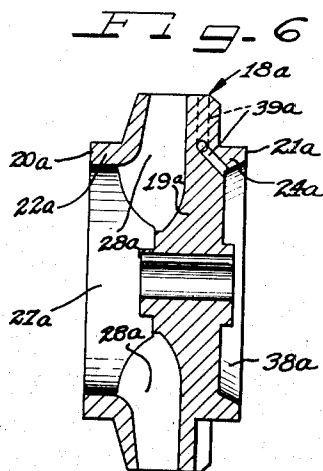
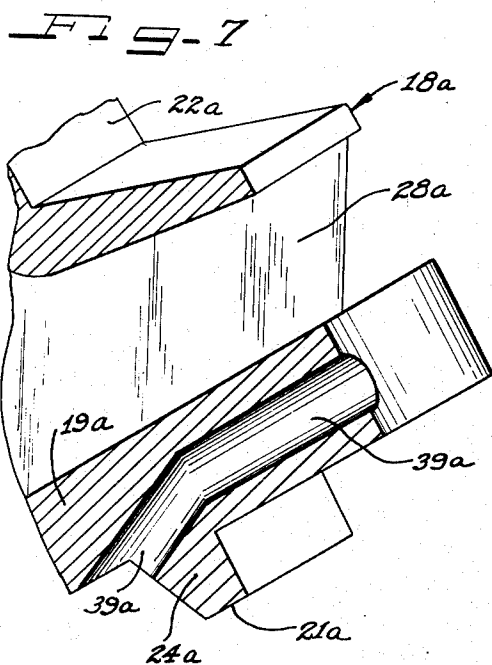
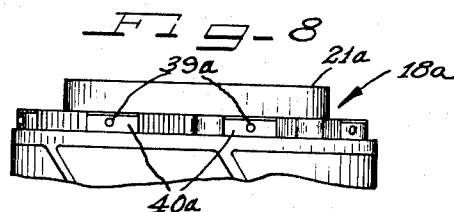
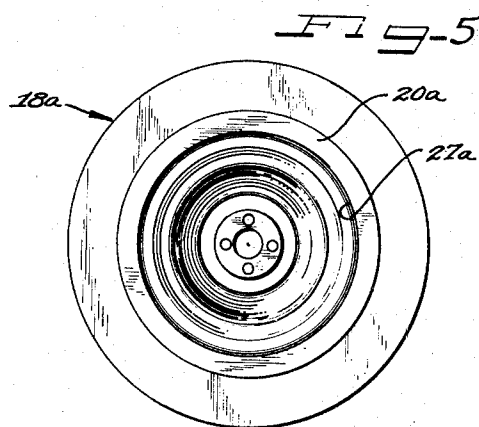
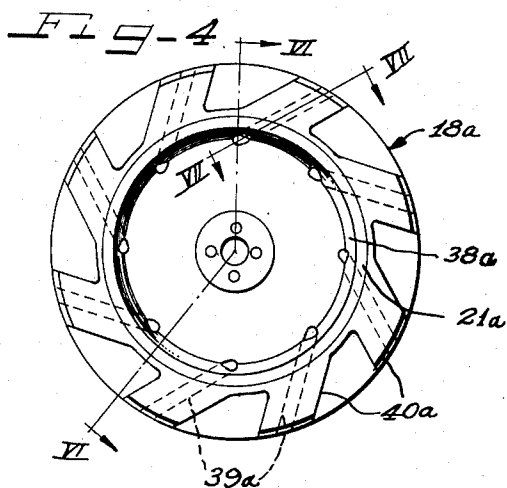
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2 Sheets-Sheet 2



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2,835,203

PUMP IMPELLER

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3 Claims. (Cl. 103—103)

This invention relates generally to fluid pumping apparatus and more particularly to an impeller for a pump wherein a plurality of circumferentially spaced radially extending pumping passages are provided with a center inlet intersecting one face of the impeller, and the opposite face of the impeller communicates with a plurality of circumferentially spaced recesses which extend generally radially outwardly to the periphery of the impeller and operate as pumping passages to evacuate fluid from adjacent the face of the impeller, the other face of the impeller opposite the inlet being further characterized by the provision of an annular row of circumferentially spaced boss portions through which the recesses extend and which are capable of operating as pumping vanes for impelling fluid upon rotation of the impeller.

According to the general principles of the present invention, a pump is provided which includes a casing having a bore therein and an enlarged annular recess is located along the length of the bore to provide a volute pumping chamber. A rotatable impeller having a body portion providing a pair of faces on opposite sides thereof is located in the pumping chamber. A pair of coaxially disposed hub portions extend from the respective faces of the impeller and journal the impeller in the bore. One of the faces of the impeller has an inlet recess formed therein and a plurality of circumferentially spaced pumping passages in the impeller body portion communicate with the inlet recess and extend generally radially outwardly to the outer periphery of the impeller.

A shaft is provided in the bore of the casing and is connected to the impeller so as to rotate same in the pumping chamber. The casing is further provided with a seal chamber around the shaft and adjacent the other of the faces of the impeller, appropriate sealing means being provided in the chamber to effect a seal between the casing and the shaft.

The other face of the impeller is provided with an annular recess forming an axially directed passageway communicating with the seal chamber. The body portion of the impeller may be constructed to provide an annular row of circumferentially spaced boss portions projecting from the other face of the impeller adjacent the periphery thereof. A plurality of circumferentially spaced recesses are formed through the bosses or through the body portion of the impeller so as to communicate with the annular recess and so as to extend generally radially outwardly to the outer periphery of the impeller. The recesses thus provided operate as pumping passages to evacuate the seal chamber and also effect a pressure reduction in the seal chamber upon rotation of the impeller. Furthermore, the annular row of bosses provide pumping vanes which prevent leakage into the seal chamber upon rotation of the impeller.

It is an object of the present invention, therefore, to provide a pump structure wherein it is possible to obtain improved inlet pressure operation.

Another object of the present invention is to provide a pump having a rotatable impeller adjacent a shaft seal-

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ing chamber, which impeller includes means for evacuating the seal chamber and for effecting a marked reduction in pressure within the seal chamber.

A further object of the present invention is to provide a pumping apparatus wherein an impeller is located adjacent a shaft sealing chamber and wherein vanes are provided on the impeller to preclude leakage of fluid into the seal chamber.

Yet another object of the present invention is to provide an impeller for a pump having pumping passages formed therein to effect movement of fluid from opposite generally parallel sides of the impeller radially outwardly of the impeller.

Many other features, advantages and additional objects of the present invention will become manifest to those versed in the art upon making reference to the detailed description which follows and the accompanying sheets of drawings in which preferred structural embodiments incorporating the principles of the present invention are shown by way of illustrative example.

On the drawings:

Figure 1 is a cross-sectional view with parts shown in elevation of the pumping apparatus constructed in accordance with the principles of the present invention.

Figure 2 is an elevational view of one face of the pump impeller provided in the structure of Figure 1.

Figure 3 is an elevational view of the opposite face of the impeller shown in Figure 2.

Figure 4 is an elevational view of an alternative form of impeller provided in accordance with the principles of the present invention.

Figure 5 is an elevational view of the opposite face of the impeller of Figure 4.

Figure 6 is a cross-sectional view taken generally along the line VI—VI of Figure 4.

Figure 7 is an enlarged fragmentary cross-sectional view taken generally on line VII—VII of Figure 4.

Figure 8 is a fragmentary end view of the impeller shown in Figure 4.

As shown on the drawings:

A pump provided in accordance with the principles of the present invention is indicated generally by the reference numeral 10 and includes a casing 11 which may include a casing body portion 12 and a casing cover 13 together providing a complexly shaped bore 14 which extends therethrough. Along the length of the bore 14, the casing 11 is provided with an enlarged annular recess 16 forming a pumping chamber and including a volute portion 17. It will be understood that the volute portion 17 will be under high pressure during the operation of the pump.

A rotatable impeller is provided for the pump 10 and is indicated generally by the reference numeral 18.

The impeller 18 includes a body portion 19 providing a first face 20 and a second face 21, the faces 20 and 21 being located on opposite sides of the impeller 18, respectively.

A hub portion 22 extends axially outwardly of the body portion 19 and is received in a sealing sleeve 23 seated in the casing cover 13.

A hub portion 24 extends axially outwardly of the body portion 19 and is received in a sealing sleeve 26 seated in the casing body portion 12 of the casing 11. Thus, the hub portions 22 and 24 are coaxially disposed and operate to reduce leakage of high pressure fluid around the impeller 18 within the casing 11. The stationary rings or sleeves 23 and 26 together with the hub portions 22 and 24 form labyrinth-type seals to effectively reduce such leakage.

The face 20 of the impeller 18 is provided with an inlet recess 27 thereby forming an inlet for the impeller 18 which communicates with a plurality of circumferen-

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tially spaced pumping passages 28. Each of the pumping passages communicates with the inlet recess 27 and extends generally radially outwardly to the periphery of the impeller 18. That portion of the bore 14 provided by the casing cover 13 is enlarged to form a pump inlet 29 in registry with the inlet recess 27 of the impeller 18 so that fluid will pass through the inlet 29, through the inlet recess 27 of the impeller 18 and will be centrifugally discharged into the pumping chamber 16 and to the volute chamber 17. It will be understood that the pump casing 11 is provided with the usual outlet in communication with the volute chamber 17 so as to carry the pumped fluid to a point of utilization.

A shaft 30 is journaled in the casing 11 by a bearing means generally at 31. The casing body portion 12 of the casing 11 is provided with a seal chamber 31 located generally adjacent the impeller 18 and in surrounding relationship to the shaft 30. A shaft seal is provided in the seal chamber 31 and is indicated generally by the reference numeral 32. The shaft seal 32 is of the type which effects a fluid tight seal between the shaft 30 and the casing 11. Exemplary of one type of sealing arrangement is a cartridge type seal 32 which cooperates with a sealing ring 33 carried for co-rotation with the shaft 30 and engaged by stationary double seal rings 34 on opposite sealing faces thereof.

The impeller 18 is locked for co-rotation with the shaft 30 by appropriate fastening means including the nut shown at 36. For a more detailed disclosure of an exemplary form of a shaft seal and a connecting means between an impeller and a shaft, reference may be had to my copending application, Serial No. 188,424, filed October 4, 1950 now Patent No. 2,662,480.

The face 21 of the impeller 18 is provided with an annular recess 38 which provides an axially directed passageway communicating with the open end of the seal chamber 31.

The body portion 19 of the impeller 18 is provided with a plurality of circumferentially spaced recesses 39 which communicate with the annular recess 38 and which extend generally radially outwardly to the outer periphery of the impeller 18. When the impeller 18 is rotated, the recesses 39 operate as pumping passages to evacuate the seal chamber 31 and also operate to effect a pressure reduction in the annular recess 38 and hence the seal chamber 31.

Referring particularly to Figure 2 in connection with Figure 1, it will be noted that the face 21 of the impeller 18 is characterized by the provision of a plurality of circumferentially spaced boss portions 40. The boss portions 40 have sufficient axial extent to form an annular row of pumping vanes adjacent the outer periphery of the impeller 18. When the impeller 18 is mounted in the pump casing 11, the annular row of vanes provided by the bosses 40 lies proximate the boundary of the pumping chamber 16 provided by the casing body portion 12 of the casing 11 and upon rotation of the impeller 18, the pumping vanes will impel fluid tending to leak past the journaling juncture between the hub portion 24 and the bearing ring 26 from the high pressure area provided by the volute chamber 17 and the outer peripheral portion of the pumping chamber 16 and into the seal chamber 31.

Whatever leakage does occur into the seal chamber 31, however, will be evacuated by the pumping action of the passages 39.

It should be particularly noted that the pumping passages provided by the recesses 39 are independent of the pumping passages 28 and extend in radial direction directly to the peripheral surface of the impeller 18. The arrangement thus provided greatly improves the capacity of the recesses 39 to effect a pumping action so that the seal chamber 31 will be effectively evacuated.

It should also be noted that the embodiment of the applicant's invention shown in Figures 1 and 2 may in-

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clude a plurality of pumping vanes on the face 21 which correspond in number with the plurality of recesses 39. Thus, the recesses 39 can be extended through the boss portion 40. In this form of the invention, the boss portions 40 are aligned radially in circumferentially spaced disposition as are the recesses 39.

In Figures 4-8, a modified embodiment of the applicant's invention is shown. In this embodiment, an impeller 18a is provided which includes a body portion 19a providing a first face 20a and a second face 21a. A hub portion 22a and a hub portion 24a extend from opposite sides of the body portion 19a and form bearing surfaces for journaling the impeller 18a in a casing. An inlet recess 27a is provided in the face 20a and communicates with a plurality of circumferentially spaced pumping passages 28a which extend radially outwardly to the peripheral surface of the impeller 18a.

The face 21a of the impeller 18a is characterized by the provision of an annular recess 38a. A plurality of recesses 39a communicate with the annular recess 38a and extend generally radially outwardly to the peripheral surface of the impeller 18a.

An annular row of bosses 40a are provided on the face 21a of the impeller 18a adjacent the outer peripheral surface and operate as pumping vanes to impel fluid adjacent the face 21a of the impeller 18a.

The embodiment of the present invention as shown in Figures 4-8 differs from the embodiment of Figures 1-3 in utilizing bosses 40a which are angularly disposed relative to any radius arm of the impeller 18a. The angular disposition of the bosses 40a is such as to make all of the bosses 40a lie in general tangential relationship to a circle of smaller diameter than the impeller 18a. By providing the recesses 39a through the bosses 40a, the passageways formed by the recesses 39a will also be angularly disposed with respect to any radius arm of the impeller 18a. The angular arrangement thus provided improves the pumping action of the pumping vanes provided by the bosses 40a as well as the pumping action provided by the recesses 39a.

Although various minor structural modifications might be suggested by those versed in the art in connection with the preferred structural embodiments herein described by way of illustrative example only, it should be understood that I wish to embody within the scope of the patent warranted hereon all such modifications as reasonably and properly come within the scope of my contribution to the art.

I claim as my invention:

1. In a pump, a housing having an inlet, a pumping chamber communicating with the inlet, a seal cavity axially inward of said pumping chamber on the side opposite said inlet, and an outlet communicating with the pumping chamber radially outward of the seal cavity, a centrifugal impeller in said housing having oppositely extending axially disposed hub portions on said opposite sides thereof, said housing having axially spaced bearing means on opposite sides of said pumping chamber each engaging a corresponding hub portion of said impeller, one of said bearing means being disposed between said pumping chamber and said seal cavity, said impeller having a center inlet extending through one of said hub portions and registering with the housing inlet and an annular row of pumping passages communicating with said center inlet and extending outwardly therefrom to said outlet, said impeller having an annular row of circumferentially spaced bosses extending inwardly from its outer periphery and terminating at the other of said hub portions, each of said bosses having a pumping passage therein adjacent and independent of said annular row of pumping passages, said pumping passages in said bosses communicating with said outlet and extending radially inward from the periphery of the impeller and terminating in an annular axial recess formed in the impeller and extending through said other hub portion for communi-

cation with said seal cavity radially inward of said one bearing to evacuate the seal cavity, and said bosses having external surface portions coacting with adjoining portions of the housing to provide additional pumping means extending from adjacent said one bearing to prevent fluid from said outlet or pumping chamber entering said seal cavity.

2. The structure of claim 1 wherein said bosses extend radially inwardly from said periphery of the impeller to the hub portion.

3. The structure of claim 1 wherein said bosses extend tangentially outward from said hub portion to said periphery of the impeller and said passages through said bosses also extend tangentially in the same direction.

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705,347
786,384
977,101
1,756,324
2,017,026
2,571,802
2,612,844

565,019
643,247
684,405
720,243

References Cited in the file of this patent

UNITED STATES PATENTS

Harris ----- July 22, 1902
Richards ----- Apr. 4, 1905
Krough ----- Nov. 29, 1910
Wilfley ----- Apr. 29, 1930
Forrest et al. ----- Oct. 8, 1935
Wilfley et al. ----- Oct. 16, 1951
Grise ----- Oct. 7, 1952

FOREIGN PATENTS

Germany ----- Dec. 2, 1932
Great Britain ----- Sept. 15, 1950
Germany ----- Nov. 27, 1939
Germany ----- Apr. 29, 1942