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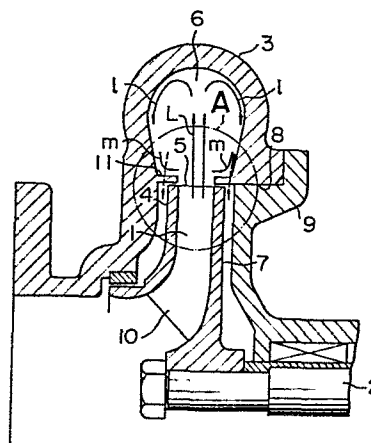
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54 Centrifugal pump.

57 In a centrifugal pump including a pump runner, (1), and a casing (3) enclosing an outlet port (5) of the pump runner and forming a volute chamber (6) around the pump runner, at least one deflecting wall (11, 13, 14, 15) is provided for causing a fluid flux returning along an inner wall surface of the volute chamber toward the outlet port of the pump runner to be deflected so as to avoid production therein of a velocity component flowing in counter current to a fluid flux discharged through the outlet port of the pump runner. The provision of at least one deflecting wall enables a smooth flow of fluid to be obtained in the vicinity of the outlet port of the pump runner.

FIG. 1



CENTRIFUGAL PUMP

1 BACKGROUND OF THE INVENTION

FIELD OF THE INVENTION

This invention relates to a centrifugal pump of improved construction having improved pump performance.

5 DESCRIPTION OF THE PRIOR ART

In a centrifugal pump equipped with a volute chamber covering an outlet port of a pump runner, it has hitherto been necessary to improve the shape and configuration of the pump runner and a casing to obtain improved
10 pump performance.

When the width of the volute chamber near its inlet is greater than the width of the outlet of the pump runner, it has generally been believed that a portion of the water discharged through the outlet port of
15 the pump runner tends to return to the inlet port side of the pump runner by flowing along an inner wall surface of the volute chamber to thereby reduce pump performance. To prevent this return flow of water, proposals have been made to reduce the width of the volute chamber in the
20 vicinity of its inlet to be approximate to the width of the outlet port of the pump runner to thereby increase the resistance offered to the flow of fluid by this part of the pump. However, no marked improvement in pump performance has ever been achieved by reducing the width
25 of the volute chamber near its inlet, probably because

1 a reduction in width causes a large amount of high
velocity component flowing in counter current to a fluid
flux discharged through the pump runner to be produced
in a fluid flux returning to the outlet port of the pump
5 runner along the inner wall surface of the volute chamber,
to thereby interfere with smooth outflow of the fluid
flux discharged through the pump runner.

To obviate the aforesaid problem, proposals
have been made to reduce the gap between a front shroud
10 or rear shroud of the pump runner and an inner wall
surface of a casing or a casing cover in spaced juxtaposed
relation thereto, to thereby reduce a return flow of fluid
from the outlet port of the pump runner toward the inlet
port thereof. This solution, although it is possible to
15 reduce the return flow, increases the friction of a disc
of the pump runner, making it relatively impossible to
provide improvements in pump performance. Also, since
the pump runner moves in sliding movement in an axial
direction as the pump operates, difficulties are
20 encountered in regulating the clearance between the
front shroud or rear shroud of the pump runner and the
inner wall surface of the casing or casing cover in
spaced juxtaposed relation thereto, resulting in colli-
sion between the pump runner and the inner wall surface
25 of the casing or casing cover.

Various proposals have thus been made in the
past to provide an improved pump construction, but none
of them has proved to have effect in obtaining improved

1 pump performance by avoiding a return flow of fluid from
the outlet port of the pump runner toward the inlet port
thereof, without causing some other trouble or rendering
machining of parts or assembling thereof difficult to
5 perform.

SUMMARY OF THE INVENTION

This invention has been developed for the
purpose of obviating the aforesaid problem of the prior
art. Accordingly the invention has as its object the
10 provision of a centrifugal pump of improved construction
capable of obtaining increased pump performance.

The outstanding characteristic of the invention
enabling the aforesaid object to be accomplished is that
at least one deflecting wall is mounted in the vicinity
15 of an inlet of the volute chamber to cause a return flow
of a fluid flux flowing toward an outlet port of the pump
runner along an inner wall surface of the volute chamber
to be deflected to avoid production therein of a velocity
component flowing in counter current to a flow of a fluid
20 flux discharged from the pump runner, to thereby prevent
the returning fluid flux from interfering with the fluid
flow discharged from the outlet port of the pump runner.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a sectional view of the centrifugal
25 pump comprising one embodiment of the invention;

Fig. 2 is a sectional view, on an enlarged

1 scale, of the essential portions of the centrifugal pump shown in Fig. 1;

Fig. 3 is a sectional view of the centrifugal pump comprising another embodiment;

5 Figs. 4 and 5 are sectional views of the centrifugal pump comprising still another embodiment;

Fig. 6 is a view in explanation of the details of the deflecting wall;

Fig. 7 is a view in explanation of the distribution of speeds of a flow flux discharged from the pump runner;

Fig. 8 is a view in explanation of one example of fluid flow in the volute chamber;

Fig. 9 is a sectional view of the centrifugal pump comprising still another embodiment;

Figs. 10-14 are sectional views of centrifugal pumps each comprising still another embodiment;

Fig. 15 is a fragmentary sectional view of the centrifugal pump comprising a further embodiment, showing the construction in greater detail;

Fig. 16 is a view in explanation of the essential portions of the centrifugal pump shown in Fig. 15;

Fig. 17 is a fragmentary sectional view of the volute chamber and the pump runner in explanation of the relation therebetween; and

Fig. 18 is a view showing the casing.

1 DESCRIPTION OF THE PREFERRED EMBODIMENTS

A preferred embodiment of the centrifugal pump in conformity with the invention will be described by referring to Fig. 1. Fig. 2 shows, on an enlarged scale, the essential portions of the pump shown in Fig. 1. A pump runner 1 is mounted on a rotary shaft 2, and a pump casing 3 of cast iron encloses a front shroud 4 and an outlet port 5 of the pump runner 1, to provide a volute chamber 6 around the pump runner 1. To assemble the pump runner 1, the pump casing 3 has an opening 8 on the side of a rear shroud 7 of the pump runner 1 which is closed by a casing cover 9 of cast iron.

Deflecting walls 11 extending from an inner wall surface of the casing in the vicinity of the inlet of the volute chamber 6 toward the outlet port 5. The deflecting walls extend annularly to the vicinity of end faces 12 of the front shroud 5 and rear shroud 7 of the pump runner 1. More specifically, a surface 11a of the deflecting walls 11 on the pump runner 1 extends toward the outlet port 5 of the pump runner 1 with a small clearance between it and the end faces 12 of the front shroud 4 and rear shroud 5, and a surface 11b of the deflecting walls 11 on the side of the volute chamber 6 extends toward the outlet port 5 of the pump runner 1 in a manner to be substantially perpendicular to the direction of flow of a fluid flux L discharged through the outlet port 5 of the pump runner 1. Thus the direction of flow of the fluid flux L discharged through the

1 outlet port 5 of the pump runner 1 is substantially
perpendicular to the rotary shaft 2 of the pump runner 1,
so that the surface 11b of the deflecting walls 11 on the
side of the volute chamber 6 will constitute a cylindri-
5 cal surface centered at the rotary shaft 2 and substan-
tially parallel thereto.

As the pump of this construction starts operat-
ing, fluid drawn by suction through an inlet port 10 of
the pump runner 1 is discharged into the volute chamber
10 6 through the outlet port 5 of the pump runner 1. The
fluid discharged into the volute chamber 6 has the direc-
tion of its flow changed therein, so that a portion of
the fluid becomes a fluid flux ℓ flowing along the inner
wall surface of the volute chamber 6 toward the vicinity
15 of the inlet of the volute chamber 6. The fluid flux ℓ
flowing along the inner wall surface of the volute
chamber 6 has its direction of flow altered along the
surface 11b of the deflecting walls 11 contiguous with
the inner wall surface of the volute chamber 6, so that
20 it becomes a fluid flux $\underline{m}$ directed toward the outlet
port 5 of the pump runner 1. After intersecting the
fluid flux L from the outlet port 5 of the pump runner 1
along the surface 11b of the deflecting walls 11 sub-
stantially perpendicularly thereto, the fluid flux $\underline{m}$ is
25 fed into the volute chamber 6 along with the fluid flux
 L because the fluid flux L is absolutely greater in
volume than the fluid flux $\underline{m}$. At this time, the fluid
flux $\underline{m}$ has no velocity component (oriented in the

1 direction n in Fig. 2) in counter current to the direc-
tion of the fluid flux L, so that the flow of the fluid
flux L is not interfered with. In this way, direct
confrontation of the fluid flux m flowing in return flow
5 along the inner wall surface of the volute chamber 6
with the fluid flux L discharged through the outlet port
5 of the pump runner 1 is avoided to eliminate the risk
of development of an eddy current.

In the centrifugal pump of the aforesaid con-
10 struction, the fluid flux l flowing in return flow along
the inner wall surface of the volute chamber 6 is pre-
vented from interfering with the outflow of the fluid
flux L discharged through the outlet port 5 of the pump
runner 1. By reducing the clearance between the surface
15 11a of the deflecting walls 11 and the end faces 12 of
the pump runner at its discharge side to increase the
resistance offered to the flow of fluid by this portion
of the pump and restrict the flow of a circulating
current o returning toward the inlet port 10 of the pump
20 runner 1, it is possible to minimize a loss of friction
of the disc of the pump runner 1. The deflecting walls
11 extend substantially parallel to the rotary shaft 2
on the outside of the end faces 12 of the pump runner 1
on its discharge side. By virtue of this arrangement,
25 the pump performs in the same manner as if there were
no axial movement of the pump runner 1, even if the pump
runner 1 moves axially during operation. More speciali-
cally, a reduction in eddy loss and disc friction loss

1 causes a rise in the discharge pressure of the centrifugal pump and an increase in the flow rate of fluid delivered by the pump while reducing an axial drive force, to thereby increase the efficiency of the pump.

5 Another embodiment shown in Fig. 3 will now be described in detail. In this embodiment, a deflecting wall extends from the casing cover toward the outlet port of the pump runner to cause a fluid flux returning toward the outlet port of the pump runner along the
10 inner wall surface of the volute chamber to be deflected, so as to avoid the production therein of a velocity component counter current to the fluid flux discharged from the pump runner.

More specifically, 13 is a deflecting wall
15 extending from the casing cover 9 toward the outlet port 5 of the pump runner 1 and arranged, like the deflecting walls 11 described by referring to Figs. 1 and 2, annularly with a small clearance between it and the end face of the rear shroud 7 of the pump runner 1 on the outlet side.
20 The surface of the deflecting wall 11 on the side of the volute chamber 6 is contiguous with the inner surface of the casing 3 and constructed such that its extended surface is substantially perpendicular to the direction of flow of the fluid flux L discharged from the pump
25 runner 1, to prevent a velocity component counter current to the fluid flux L from being produced in the fluid flux m returning along the inner wall surface of the volute chamber 6 toward the outlet port 5 of the pump runner 1.

1 The provision of the one deflecting wall 13 on the side
of the casing cover 9 as aforesaid enables the width W
of the casing 3 in the vicinity of the inlet of the
colute chamber 6 to be increased as the casing 3 is
5 viewed singly. Since the casing 3 is formed of casting,
this construction is conducive to increased operability
because the width W thereof in the vicinity of the inlet
of the colute chamber 6 is preferably increased in view
of facilitating removal of casting sand after casting
10 is performed. By facilitating casting sand removal
following casting of the casing 3, folding of casting
surface in the volute chamber 6 can be prevented, there-
by contributing to improvement of pump performance. In
this type of centrifugal pump, the positional relation
15 between the outlet port 5 of the pump runner 1 and the
deflecting walls 11 and 13 raises an important problem.
This problem can be obviated by working on and assembl-
ing the parts as presently to be described. After an
end face 11c of the deflecting wall 11 of the casing 3
20 formed of casting, a spigot joint surface 3a of the
casing 3 is worked. Then a spigot joint surface 9a of
the casing cover 9 and an end face 13c of the deflecting
wall 13 are worked. By performing working in this way,
the parts concerned can be finished in a predetermined
25 dimensional relation. When the parts are assembled, the
pump runner 1 is assembled with the casing cover 9, and
the casing 3 is assembled with the casing cover 9 after
making sure that the pump runner 1 and the deflecting

1 wall 11 is in correct positional relation. This enables
quality control of a centrifugal pump to be carried out
by a simple process. Moreover, the use of this construc-
tion enables assembling of the pump runner 1 having an
5 outlet port 5 of a different width to be effected with
the casing cover 9 by merely altering the dimensions of
the casing cover 9 to be machined, allowing realization
of benefits from common use of parts to be achieved.

Another embodiment shown in Figs. 4 and 5 will
10 be described. In this embodiment, the deflecting walls
for deflecting a fluid flux returning along the inner
wall surface of the volute chamber toward the outlet
port of the pump runner to avoid production therein of
a velocity component flowing in counter current to a
15 fluid flux discharged through the outlet port of the pump
runner are in the form of tubes and mounted in the
vicinity of the inlet of the volute chamber. In Fig. 4,
the pump runner 1 is enclosed by a casing 3 defining a
volute chamber 4, a casing cover 16 located on the side
20 of a front shroud 4 and a casing cover 9 located on the
side of a rear shroud 7. 14 and 15 are deflecting walls
in the form of tubes including large thickness portions
14a and 15a. The deflecting wall 14 is held in position
while its large thickness portion 14a is held between
25 the casing 3 and casing cover 16, and the deflecting wall
15 is likewise held in position while its large thickness
portion 15a is held between the casing 3 and casing cover
9. A suitable dimension may be selected for small

1 thickness portions 14b and 15b of the deflecting walls 14
and 15 in such a manner that they will be arranged on
the side of the end face of the pump runner 1 on its
discharge side when the centrifugal pump is assembled.

5 The small thickness portions 14b and 15b are contiguous
at their surfaces facing the volute chamber 6 with the
inner wall surface of the casing 3 and located substan-
tially perpendicular to a fluid flux discharged from the
pump runner 1. In ordinary centrifugal pumps, the

10 direction in which fluid is discharged therefrom is
substantially perpendicular to the rotary shaft 2, so
that the surfaces of the small thickness portions 14b
and 15b of the deflecting walls 14 and 15 on the side
of the volute chamber 6 should be substantially parallel

15 to the rotary shaft 2. When the deflecting walls are
formed of other material than the materials forming the
casing 3 and casing cover 9, replacements of the old
deflecting walls 14 and 15 by new ones can be readily
effected when wear is caused thereon.

20 The centrifugal pump shown in Fig. 5 is distinct
from that shown in Fig. 4 in that the casing 3 and the
casing cover 16 are not separate entities but are formed
as a unit in the latter. The deflecting walls 14 and 15
shown in Figs. 4 and 5 may be produced by cutting tubular

25 material crosswise and machining same. In this case, an
annular member may be cut out in part and arranged in
compressed condition in a groove 3d formed in the casing
3 (Fig. 5) or in grooves 9d and 16d formed between the

1 casing 3 and casing covers 9 and 16 respectively (Fig. 4),
so that spring-back of the compressed annular member may
be utilized to place the deflecting walls 14 and 15
securedly in the groove 3d or grooves 9d and 16d.

5 Fig. 7 shows the velocity distribution of the
fluid flux L discharged from the pump runner 1. In the
figure, it will be seen that the velocity tends to be
higher on the side of the rear shroud 7. When a centri-
fugal pump provided with this type of pump runner 1 is
10 driven, a strong flow L_1 discharged and located on the
side of the rear shroud 7 might, when it changes its
direction within the volute chamber 6 as shown in Fig. 8,
produce a secondary flow which might interfere with a
weak flow L_2 discharged and located on the side of the
15 front shroud 4, thereby bringing about a loss of mixing.

In the embodiment shown in Fig. 9, means is
provided for minimizing the production of a secondary
flow in the volute chamber 6 to reduce a loss of mixing.
More specifically, the volute chamber 6 in the casing 3
20 is extended toward the side of the front shroud 4 in
which the flow of fluid discharged from the pump runner
1 has a lower velocity. This embodiment has, of course,
the deflecting walls 11 located in the vicinity of the
inlet of the volute chamber 6 to deflect the fluid flux
25 m returning along the inner wall surface of the volute
chamber 6 toward the outlet port 5 of the pump runner
1 so as to avoid production therein of a velocity com-
ponent flowing in counter current to the fluid flux L

1 discharged from the pump runner, as is the case with the
embodiments shown and described hereinabove. When the
centrifugal pump of this construction is driven for
operation, the flow L_1 of high velocity discharged from
5 the runner 1 and located on the side of the rear shroud
7 is led toward the interior of the volute chamber 6
extended to the side of the front shroud 4. The flow L_1
regains pressure and has its velocity reduced within
the volute chamber 6, so that it does not interfere with
10 the flow L_2 of lower velocity discharged and located on
the side of the front shroud 4. Thus this construction
can eliminate head-on collision between the flow L_1 of
higher velocity and the flow L_2 of lower velocity,
thereby reducing a loss of mixing in the volute chamber
15 6 and improving pump performance. The deflecting walls
11 achieve the same effects as described by referring to
the embodiments shown in Figs. 1-5, so that the descrip-
tion thereof shall be omitted.

In the embodiments shown and described herein-
20 above, two deflecting walls are provided in the vicinity
of the inlet of the volute chamber in positions
corresponding to the end faces of the front shroud and
the rear shroud. The invention is not limited to this
specific number of deflecting walls and one of the
25 deflecting walls may be provided on one side of the
vicinity of the inlet of the volute chamber in a position
facing the end face of the front shroud or the rear shroud.
In the embodiments shown and described hereinabove, the

1 forward end of each deflecting wall (the end face on the
side of the outlet port of the pump runner) is extended
to a point immediately before it faces the outlet port.
However, the deflecting walls may be shaped such that
5 the spacing between the end faces of the deflecting
walls is greater than the diameter of the outlet port
of the pump runner. Also, in the embodiments shown and
described hereinabove, the surfaces of the deflecting
walls facing the volute chamber are cylindrical in shape
10 and substantially parallel to the rotary shaft. However,
the deflecting walls may be constructed such that their
forward ends are slightly inclined toward the center of
the volute chamber.

Figs. 10-14 show other embodiments. In the
15 embodiment shown in Figs. 10 and 11, the spacing W
between the deflecting walls 11 is greater than the inner
diameter of the outlet port 5 of the pump runner 1 and
smaller than the outer diameter thereof. In the embodi-
ment shown in Fig. 12, the deflecting wall 11 formed on
20 the side of the casing 3 is located substantially flush
with the end face 12 of the outlet port 5 on the side of
the front shroud 4. In the embodiment shown in Fig. 13,
the deflecting wall 11 is formed on the casing 3 only
on the side of the front shroud 4. In the embodiment
25 shown in Fig. 14, the deflecting walls 11 extend along
the vicinity of extensions of the end faces 12 of the
outlet port 5 near the front and rear shrouds 4 and 7
and are juxtaposed against the front and rear shrouds 4

1 and 7 respectively.

An embodiment of the invention shown in concrete form is shown in Figs. 15-18, wherein parts similar to those shown in Figs. 1-14 are designated by like reference characters and their description is omitted. 3b, 3c and 3d are a base, a suction flange and a discharge flange respectively which are integrally formed with the casing 3 by casting. The two flanges 3c and 3d have mounting ducts 17 and 18 for a gauge and a priming water funnel respectively formed at the back of Fig. 15. As shown in Fig. 18, a duct 19 is formed starting at the vicinity of the lowermost portion of the volute chamber 6 in the casing 3 and extending toward the convolution starting side (back of Fig. 15) of the volute chamber 6. 20 is a duct for mounting a gauge extending axially of the discharge flange 3d. 21 is a liner ring secured to the casing 3, and 22 is an O-ring held between the spigot joint surface 3a of the casing 3 and the spigot joint surface 9a of the casing cover 9 for the casing 3. 23 is a bearing box having one end positioned against the casing cover 9, a central portion supporting a main bearing 24 and another end having attached thereto a bracket 26 supporting an auxiliary bearing 25. The bearing box 23 is bolted at 27 to the casing 3 in a manner to hold the casing cover 9 between it and the casing 3. A partition wall 28 is located on the side of the casing 3 with respect to the main bearing 24 in the central portion of the bearing box 23. A ventilating

1 passageway 30 is defined partly between an outer race of
the main bearing 24 and an inner wall surface of the bear-
ing box 23. 29 is a slinger mounted on the rotary shaft
2 outside of the partition wall 28. 31 designates bolts
5 for affixing to an end portion of the bearing box 23 the
bracket 26 supporting the outer race of the auxiliary
bearing 25. As can be clearly seen in the figure, the
main bearing 24 has a larger diameter and a greater
capacity than the auxiliary bearing 25. A spigot joint
10 surface 26a for mounting the bracket 26 or the inner wall
surface of the bearing box 23 are larger than the outer
diameter of the main bearing 24. 23a is an opening
formed in the bearing box 23. 32 is a square packing for
effecting shaft sealing. 33 is a cylindrical cavity
15 formed in the central portion of the casing cover 9 for
housing the square packing 32. 34 is a packing gland for
arranging the square packing 32 inside the cavity 33.
35 is a bolt for threadable engagement with the casing
cover 9 for biasing the packing gland 34 toward the
20 casing cover 9 to affix same thereto. 37 is a nut for
mounting the pump runner 1 on the end of the rotary shaft
2 which is brought into threadable engagement with a
screw thread, not shown, formed at the end of the rotary
shaft 2 with a washer 36 interposed therebetween. 38 is
25 an ancillary leg secured to a lower portion of the bear-
ing box 23. 39 is a pressurized water introducing pipe
to supply pressurized water in the casing 3 to the square
packing 32 in the cavity 33, to thereby provide a seal

1 to the portion of the casing cover 9 through which the shaft extends and to lubricate the square packing 32.

The centrifugal pump of the aforesaid construction is assembled as follows. The main bearing 24 and
5 auxiliary bearing 25 are force fitted in the rotary shaft 2. Then the bearing box 23 is fitted over the rotary shaft 2 in such a manner that the main bearing 24 and auxiliary bearing 25 are inserted therein in the indicated order, and thereafter the bracket 26 is affixed
10 by the bolt 31 to the bearing box 23. After the slinger 29, packing gland 34 and square packing 32 are inserted in the rotary shaft 2, the casing cover 9 is attached on the rotary shaft 2, and the pump runner 1 is connected to the end of the shaft and clamped by the nut 37 there-
15 against. The casing 3 is arranged in position against the casing cover 9, and the casing 3 is secured to the bearing box 23 by the bolts 27 in such a manner that the casing cover 9 is held by the casing 3 and the bearing box 23. Finally the bolts 27 and nuts are tightened to
20 provide a completed centrifugal pump.

In the centrifugal pump of this construction, machining of the mounting ducts 17 and 18 and the duct 19 for providing a drain is facilitated because these ducts are oriented in the same direction. Machining of
25 the mounting opening 20 is also facilitated because it opens in the same direction as the suction flange 3c. The arrangement whereby the main bearing 24 and auxiliary bearing 25 have a difference in diameter and the auxiliary

1 bearing 25 of smaller bearing is supported through the
bracket 26 facilitates assembling of the bearing box 23.
If the centrifugal pump is connected to a motor, not
shown, through a shaft joint, not shown, attached to an
5 end 2a of the rotary shaft 2 and the motor is actuated
to drive the pump, then air is drawn by suction through
the ventilating passageway 30 on the side of the outer
race of the main bearing 24 and flows through a shaft
penetrating portion of the partition wall 28 to be dis-
10 charged along the wall surface. Thus cooling of the
main bearing 24 can be effected. The duct 19 for pro-
viding a drain opens toward the convolution starting
side of the volute chamber 6, so that pressurized water
discharged through the outlet port 5 of the pump runner
15 1 directly enters the duct 19 without interfering with
the flow of the fluid flux within the volute chamber 6,
thereby minimizing a loss during pump operation.

Operation of the centrifugal pump will be
described more in detail by referring to Fig. 17. In
20 this embodiment, the inlet of the volute chamber 6 has
a width W smaller than the thickness W_2 of the runner 1
and greater than the width W_1 of the outlet part 5.
That is, an extended surface of the inlet of the volute
chamber 6 is positioned against the end faces 12 of the
25 front and rear shrouds 4 and 7 of the pump runner 1 on
the outlet side thereof. In this embodiment, the outlet
side end faces 12 of the front and rear shroud 4 and 7
have the same function as the deflecting walls described

1 by referring to Figs. 1-14. In this construction, a
fluid flux ℓ flowing along the wall surface of the volute
chamber 6 is led to the end faces 12 on the outlet side
of the pump runner 1 as indicated by $\underline{m}$, where it is
5 deflected and discharged into the volute chamber 6 along
with the fluid flux L.

In this embodiment, the pump runner 1 moves
axially during operation of the centrifugal pump, so
that an extension of the inner wall surface of the volute
10 chamber 6 is desired to be positioned against the outlet
side end faces 12 at all times. In this embodiment, the
gap G between the outlet side end faces 12 of the pump
runner 1 and the casing is selected to be in the range
between 0.5 and 40 mm when the pump runner 1 has a dia-
15 meter of 40-50 mm. In this embodiment, the casing cover
9 is affixed between the casing 3 and bearing box 23.
Alternatively, the casing cover 9 may be affixed to the
bearing box 23 and then the casing 3 may be affixed to
the casing cover 9.

WHAT IS CLAIMED IS:

1. A centrifugal pump comprising:
 a pump runner (1); and
 a casing (3) enclosing an outlet port (5) of
5 said pump runner and forming a volute chamber (6) around
 said pump runner;
 wherein the improvement comprises:
 at least one deflecting wall (11, 13, 14, 15)
 for causing a fluid flux returning along an inner wall
10 surface of said volute chamber toward said outlet port
 of said pump runner to be deflected so as to avoid
 production therein of a velocity component flowing in
 counter current to a fluid flux discharged through said
 outlet port of said pump runner.
- 15 2. A centrifugal pump as claimed in claim 1,
 wherein said at least one deflecting wall extends in a
 direction substantially perpendicular to the direction
 of flow of said fluid flux discharged through the outlet
 port of said pump runner.
- 20 3. A centrifugal pump comprising:
 a pump runner (1);
 a pump casing (3) enclosing a front surface
 and an outlet port (5) of said pump runner and forming
 a volute chamber (6) around said pump runner; and
25 a casing cover (9) closing an opening of said
 pump casing; wherein the improvement comprises:
 a deflecting wall for causing a fluid flux
 returning along an inner wall surface of said volute

chamber toward said outlet port of said pump runner to be deflected so as to avoid production therein of a velocity component flowing in counter current to a fluid flux discharged through said outlet port of said
5 pump runner, said deflecting wall being located on said casing cover side and extended toward the outlet port of said pump runner.

4. A centrifugal pump as claimed in claim 3, further comprising a deflecting wall located on said
10 casing side and extended toward the outlet port of said pump runner.

5. A centrifugal pump as claimed in claim 4, wherein said volute chamber includes an inlet of a width (W) smaller than the thickness (W_2) of said pump
15 runner and greater than the width (W_1) of the outlet port thereof.

6. A centrifugal pump as claimed in claim 3, wherein said deflecting wall is extended along the vicinity of an extension of an end face (12) of each
20 shroud of said pump runner at the outlet end thereof.

7. A centrifugal pump comprising:
a pump runner (1); and
a casing (3) enclosing an outlet port (5) of
said pump runner and forming a volute chamber (6)
25 around said pump runner; wherein the improvement comprises:

at least one deflecting wall (11, 13, 14, 15)
for causing a fluid flux returning along an inner wall

surface of said volute chamber toward said outlet port of said pump runner to be deflected so as to avoid production therein of a velocity component flowing in counter current to a fluid flux discharged through said outlet port of said pump runner, said deflecting wall being in the form of a tube (14, 15) and located on a front shroud (4) or a rear shroud (7) in the vicinity of an end face (12) thereof on the outlet port side.

8. A centrifugal pump comprising:
10 a pump runner (1); and
a casing (3) enclosing an outlet port (5) of said pump runner and forming a volute chamber (6) around said pump runner; wherein the improvement comprises:
at least one deflecting wall comprising an end
15 face (12) of a front shroud (4) or a rear shroud (7) of said pump runner, said deflecting wall being operative to lead a fluid flux returning along an inner wall surface of said volute chamber toward said outlet port of said pump runner to the end face of one of the front
20 and rear shrouds of said pump runner on the outlet port side thereof and deflect said fluid flux returning toward the outlet port in such a manner that no velocity current flowing in counter current to a fluid flux discharged through the outlet port of the pump runner is
25 produced.

9. A centrifugal pump as claimed in claim 8, wherein said volute chamber has an inlet of a width (W) smaller than the thickness (W_2) of said pump runner and greater than the width (W_1) of the outlet port thereof.

FIG. 1

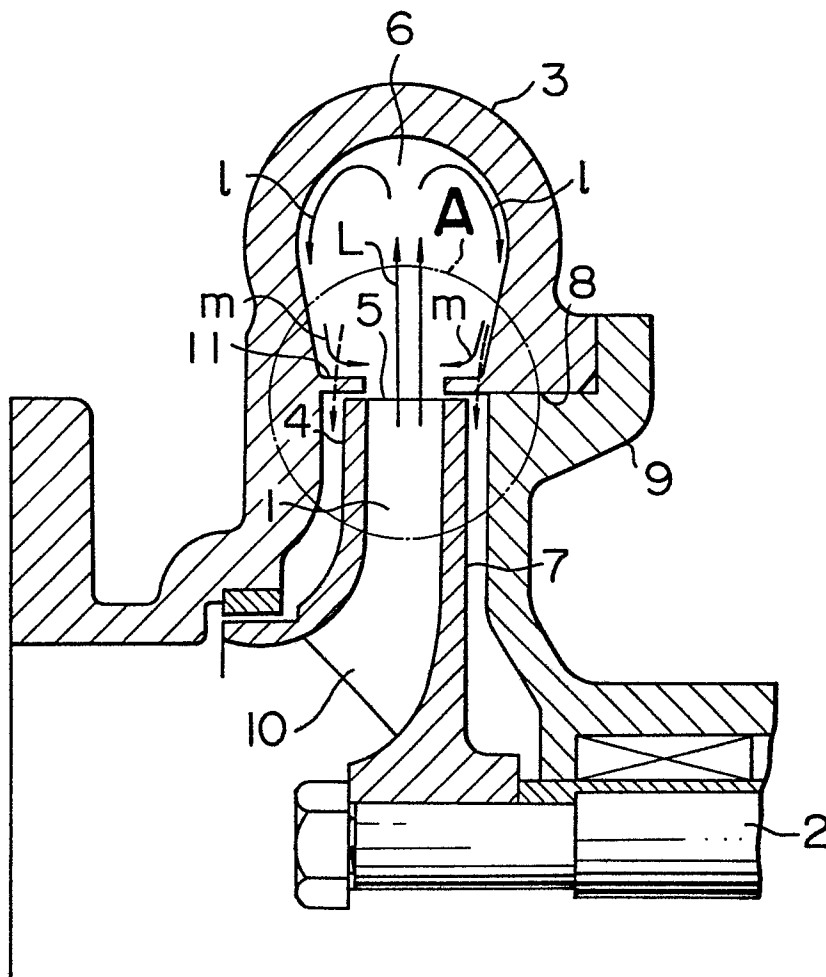


FIG. 2

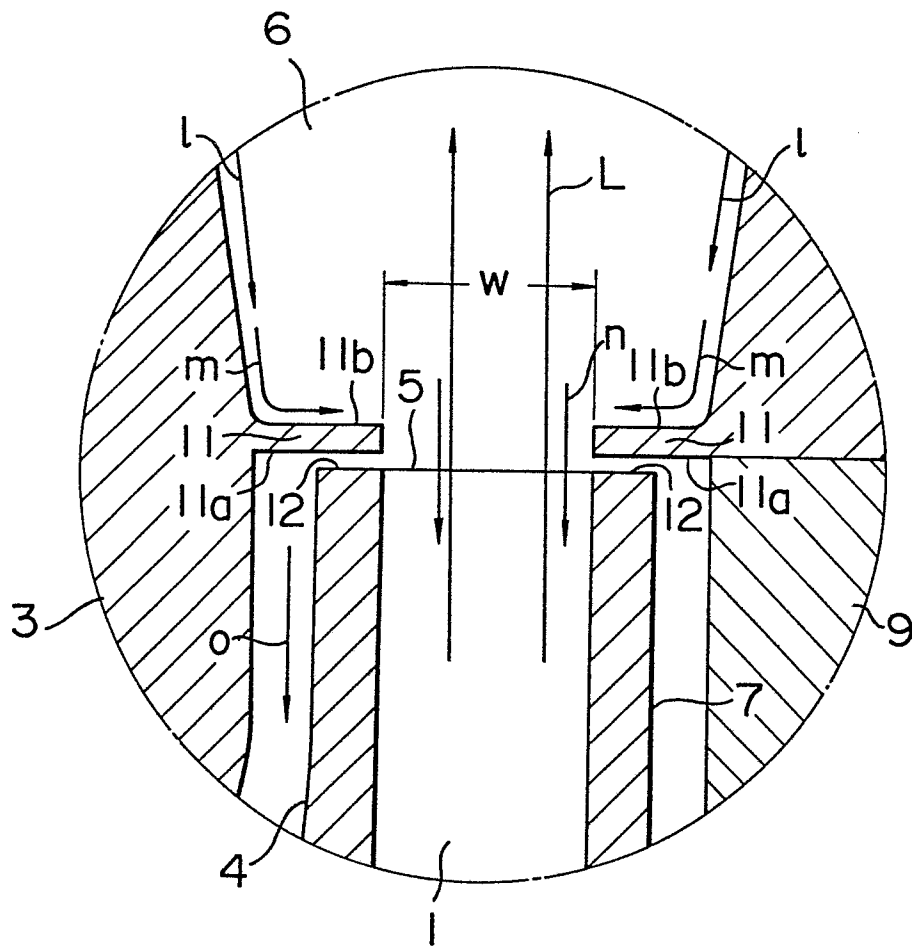


FIG.3

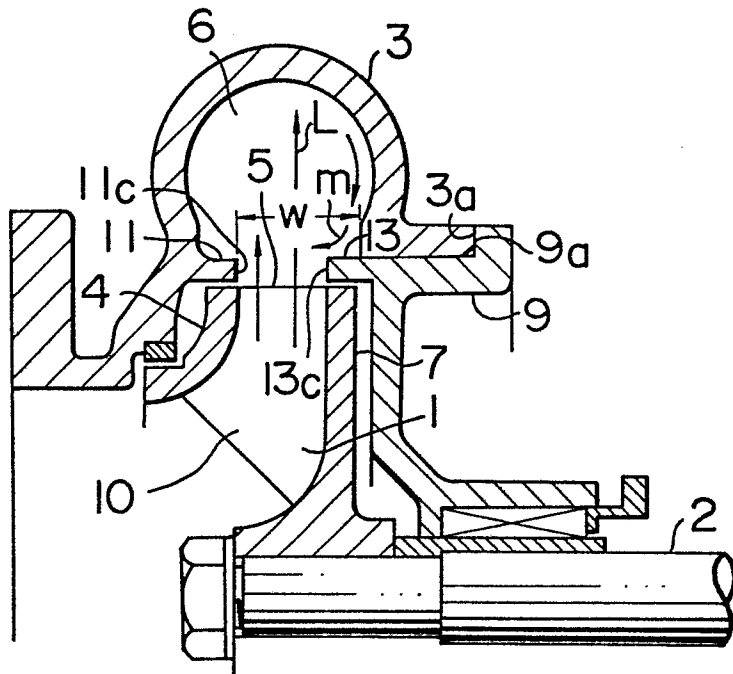


FIG. 4

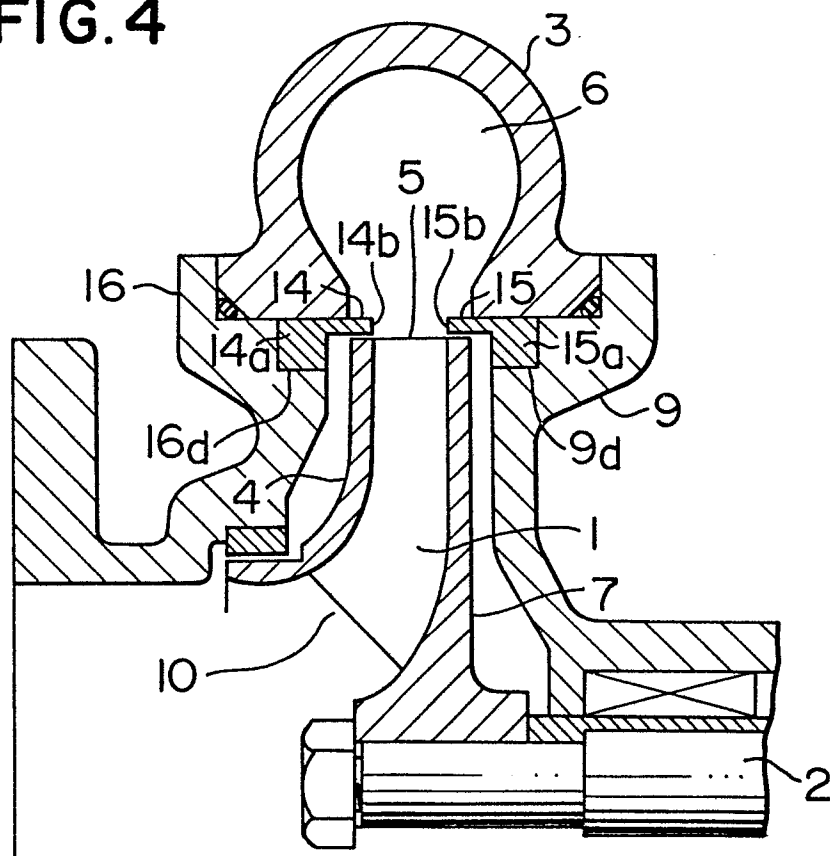


FIG. 5

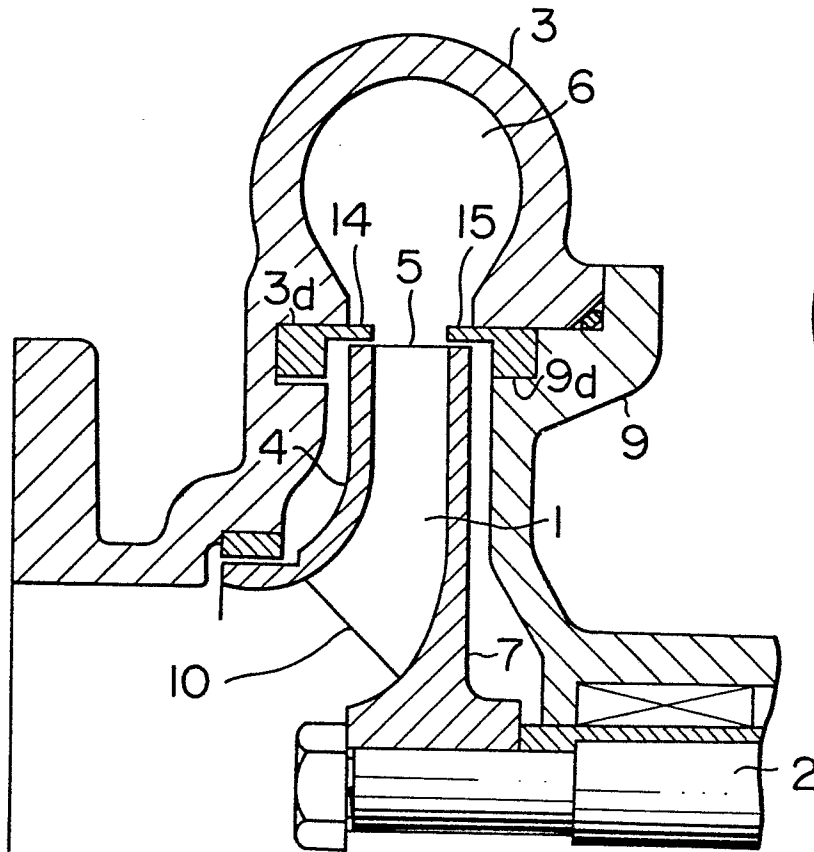


FIG. 6

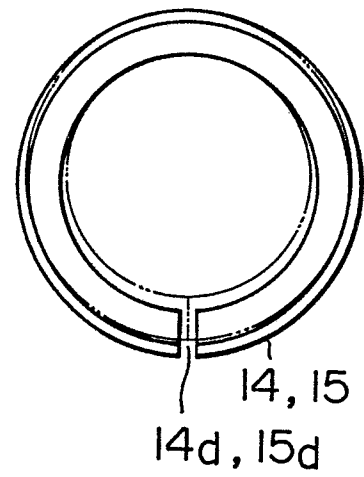


FIG. 7

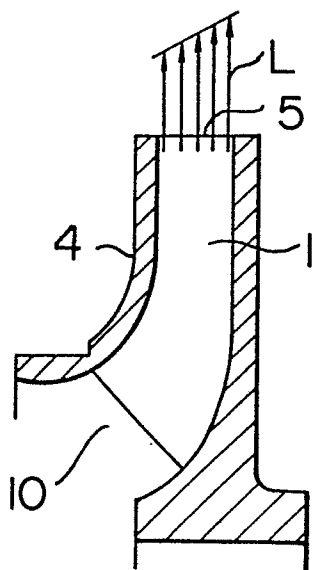


FIG. 8

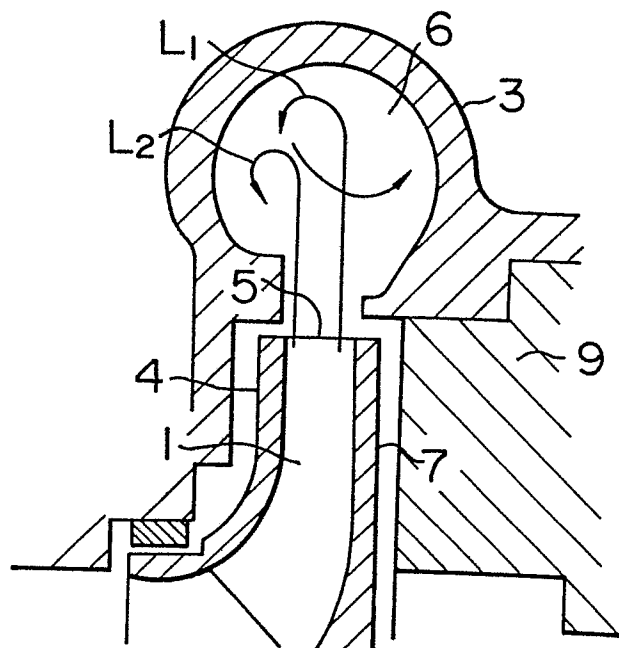


FIG. 9

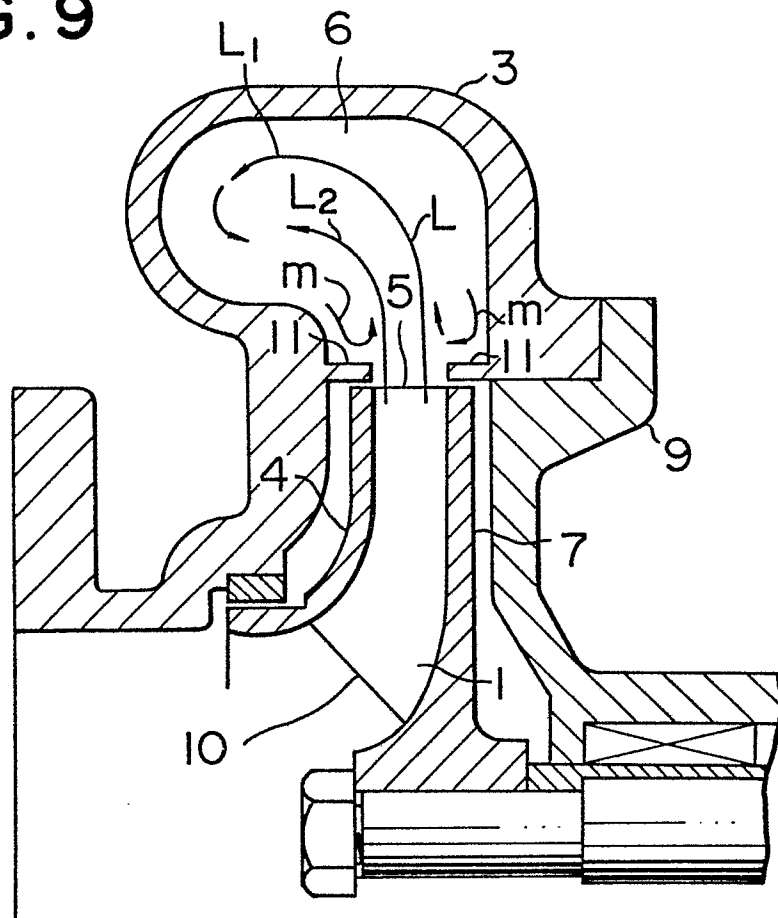


FIG. 10

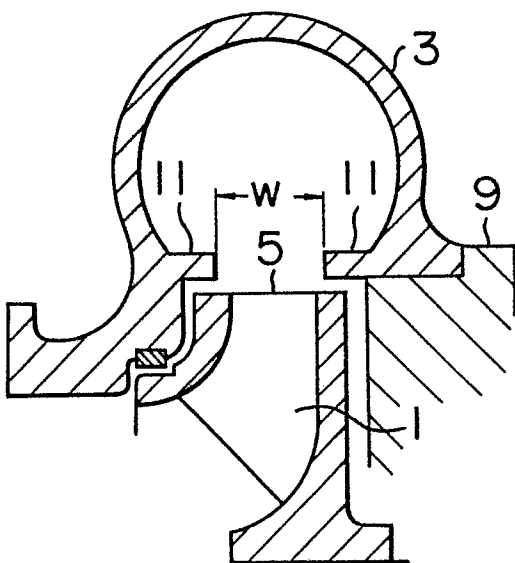


FIG. 12

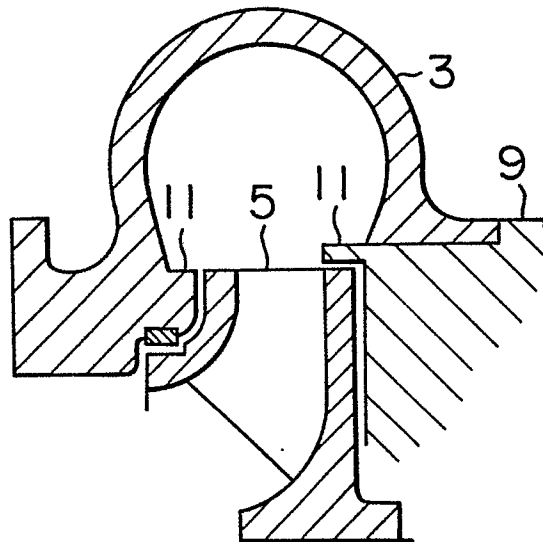


FIG. 11

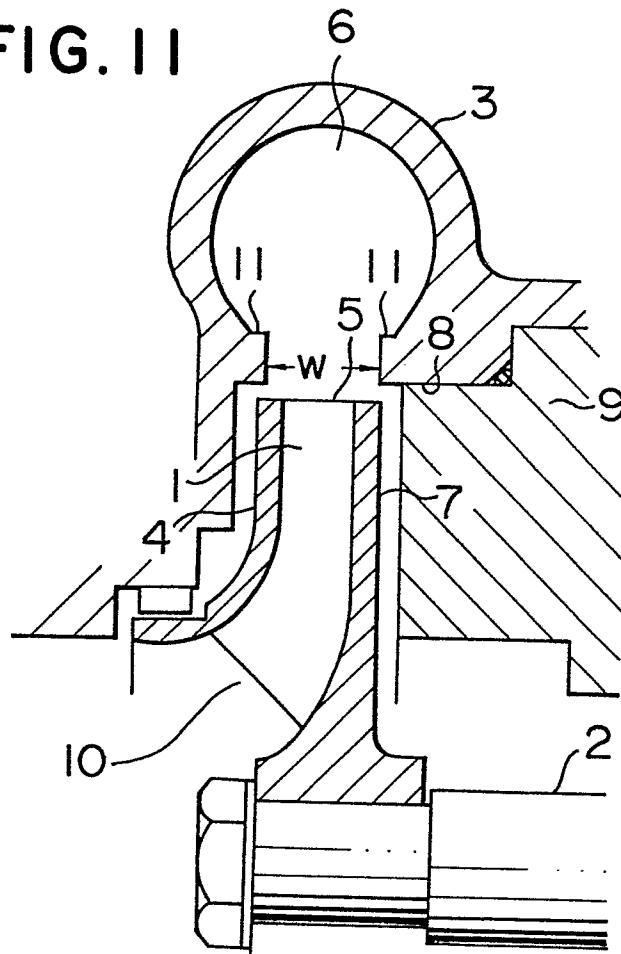


FIG. 13

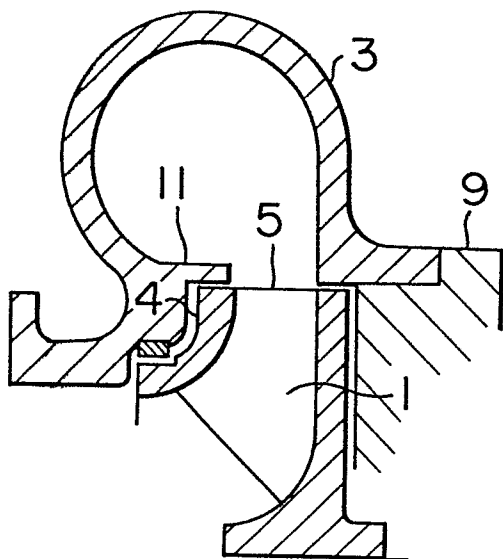


FIG. 14

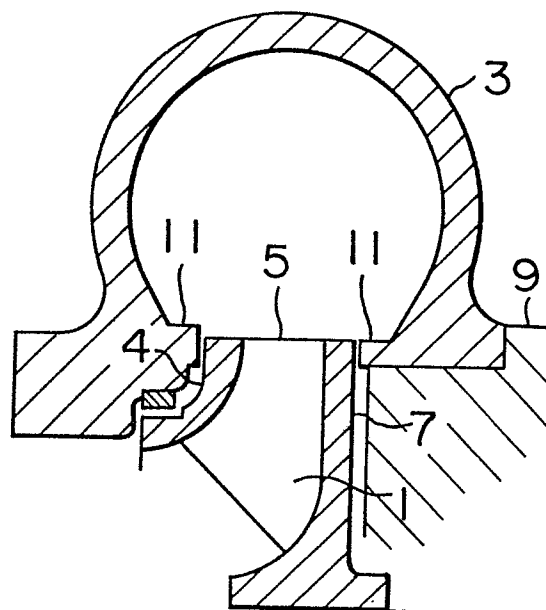


FIG. 15

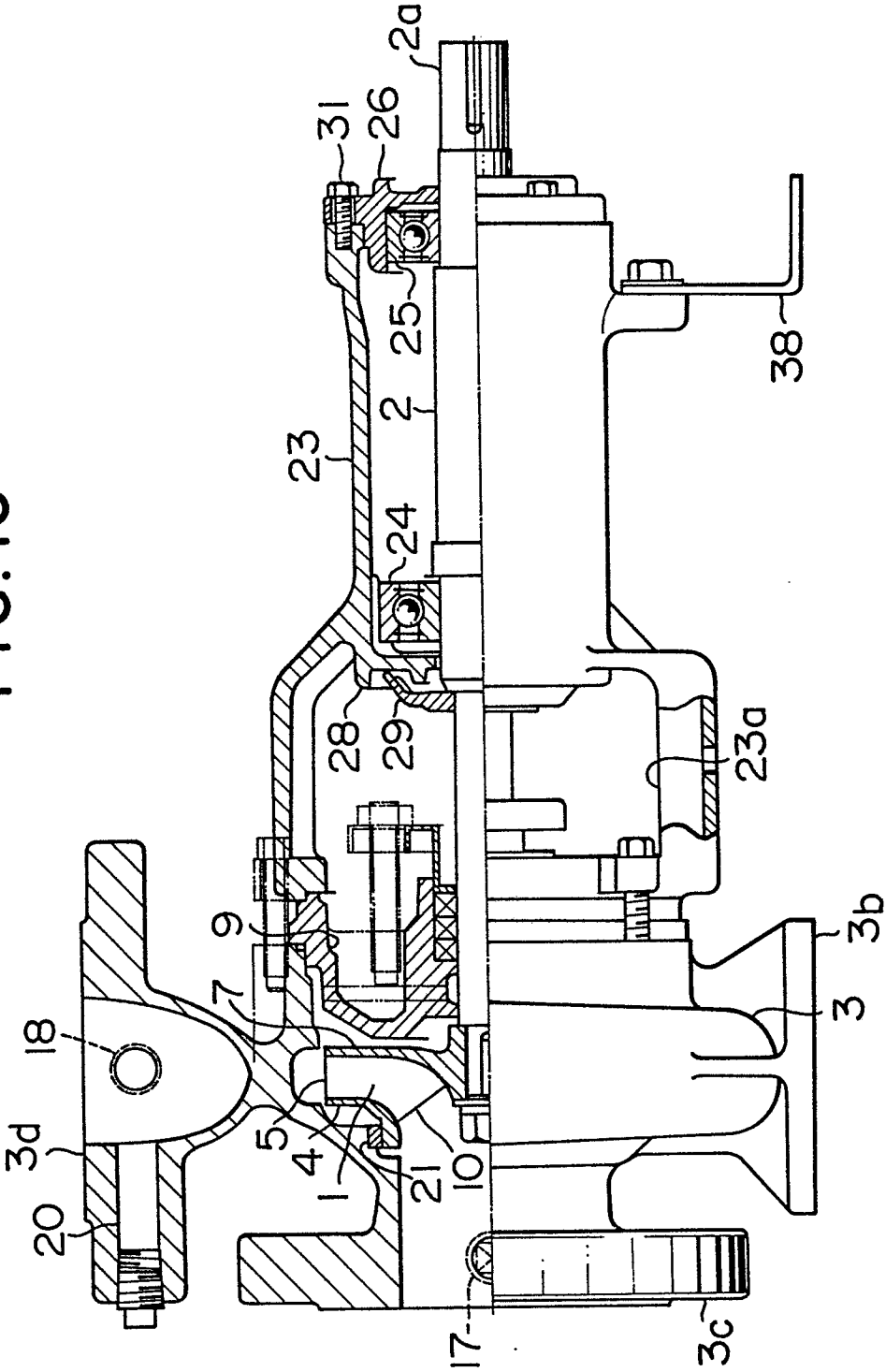


FIG.16

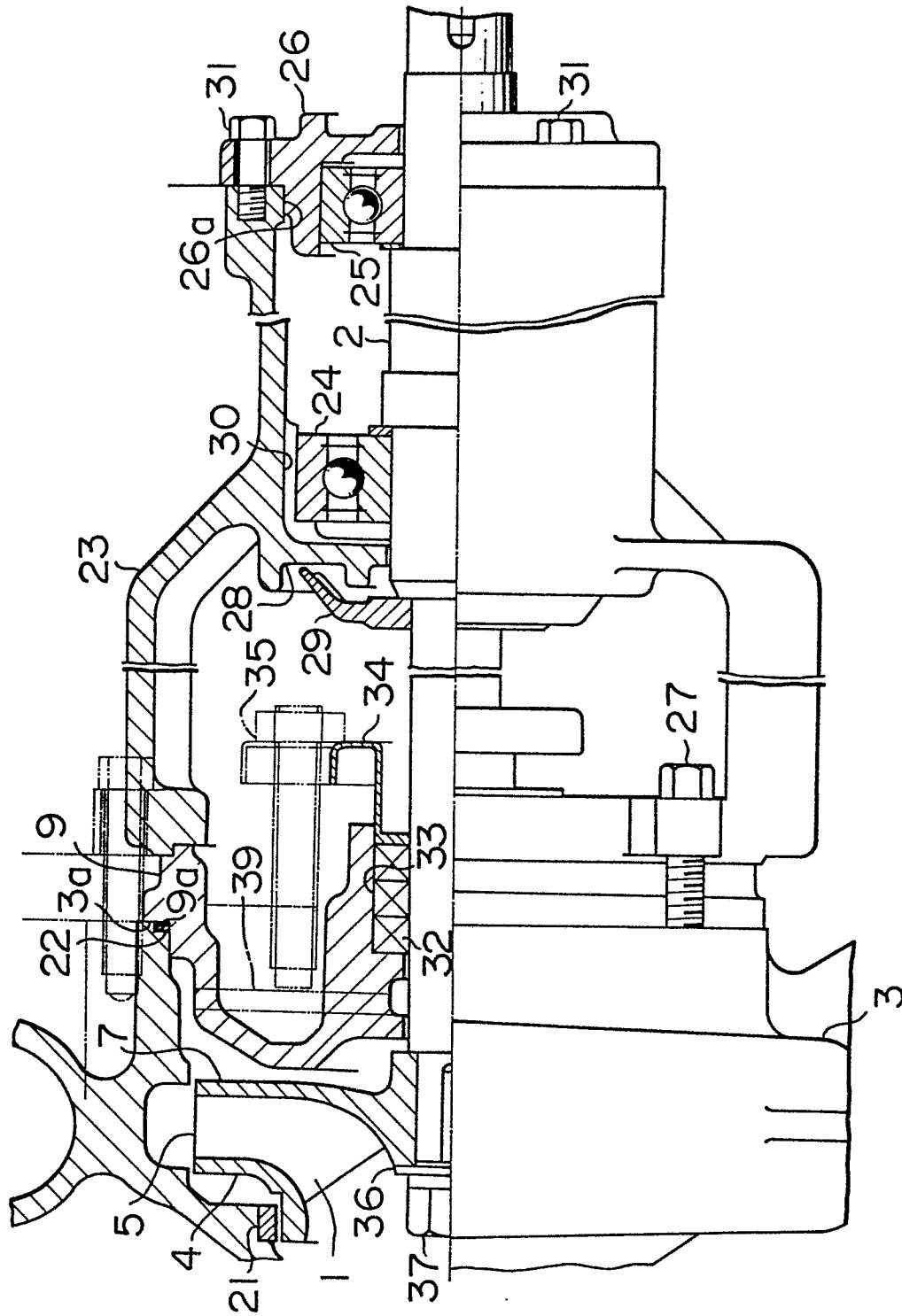


FIG. 17

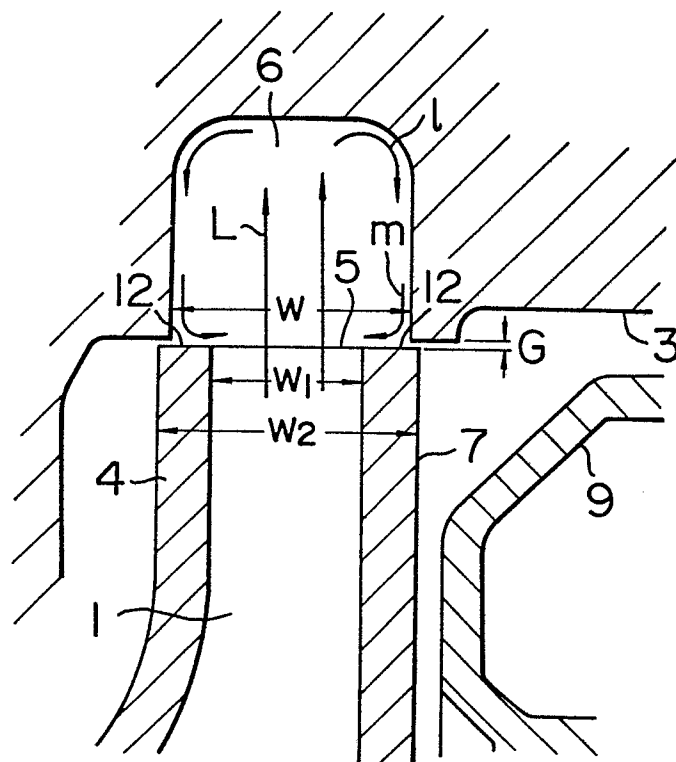
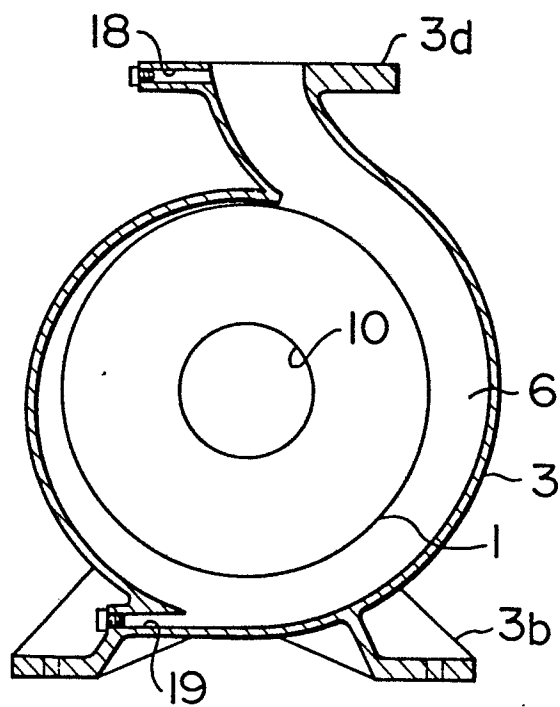


FIG. 18





DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. *)
X	--- CH-A- 428 444 (VOLLAND) *Column 2, lines 45-52; column 4, lines 5-15; figures 1,3* -----	1-5, 7, 8	F 04 D 29/42 F 04 D 29/44
			TECHNICAL FIELDS SEARCHED (Int. Cl. *)
			F 04 D
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 28-01-1983	Examiner WOOD R.S.
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	