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(54) **Pump impeller**

(57) A pump impeller has two impeller bodies (10, 10A, 20, 20A) attached to each other. Each impeller body (10, 10A, 20, 20A) has an annular base wall (11, 11A, 21, 21A) and multiple partition protrusions (12, 12A, 22, 22A) separately formed on an inner surface of the base wall (11, 11A, 21, 21A). Multiple outlet channels (30, 30A) are respectively defined between the partition protrusions (12, 12A, 22, 22A). Each outlet channel (30, 30A) has a cross-sectional area decreasing from an inner end to an outer open end of the outlet channel (30, 30A). Thus, liquid flowing through the outlet channels (30, 30A) does not become turbulent and a working efficiency of a pump with the pump impeller is certainly improved.

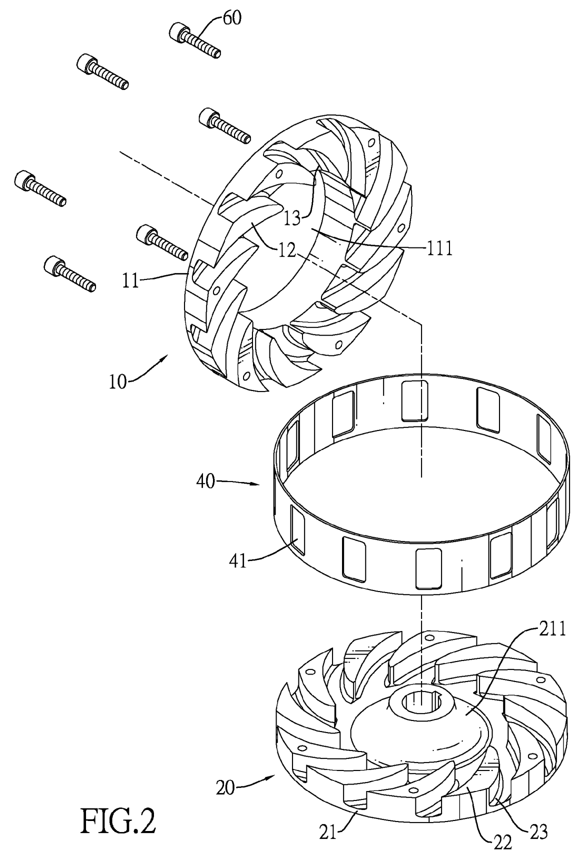

FIG.2

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Description

1. Field of the Invention

[0001] The present invention relates to a pump impeller, especially to a pump impeller for a centrifugal pump.

2. Description of the Prior Art(s)

[0002] With reference to Fig. 8, a general centrifugal pump 90 has a housing 92, a conventional impeller 91 mounted in the housing 92, a motor 93 and a driving shaft 94. The driving shaft 94 protrudes from the motor 93, and is connected to and drives the conventional impeller 91.

[0003] With further reference to Figs. 9 and 10, the conventional impeller 91 has a central channel 911, multiple vanes 913 and multiple outlet channels 912. The central channel 911 is axially formed in the conventional impeller 91. The vanes 913 are separately formed in and arranged around the conventional impeller 91. Each vane 913 has a uniform thickness. Each outlet channel 912 is defined between two adjacent vanes 913, is radially disposed in the conventional impeller 91, communicates with the central channel 911 and an outside of the conventional impeller 91 and has a cross-sectional area. Since circumference of the conventional impeller 91 gradually increases from a center to a periphery of the conventional impeller 91, the cross-sectional area of each outlet channel 912 increases from the center to the periphery of the conventional impeller 91. When the pump 90 operates and drives the conventional impeller 91, liquid is drawn from the central channel 911 and flows outwards through the outlet channels 912 by a centrifugal force. The closer the liquid approaches the periphery of the impeller 91, the faster the liquid flows.

[0004] According to fluid dynamics, at each position in a tube having incompressible fluid flowing inside, the value of a cross-sectional area of the tube multiplied by a velocity of the fluid is a constant value. Thus, since the liquid flows faster when approaching the periphery of the impeller 91, the cross-sectional area of the outlet channel 912 is supposed to be getting smaller. However, actually, the cross-sectional area of the outlet channel 912 of the conventional impeller 91 is increased. Therefore, the liquid does not flow uniformly in the outlet channel 912 and even becomes turbulent and the pump 90 with the conventional impeller 91 is inefficient.

[0005] The main objective of the present invention is to provide a pump impeller. The pump impeller has two impeller bodies attached to each other and multiple outlet channels. Each impeller body has an annular base wall and multiple partition protrusions separately formed on an inner surface of the base wall. The outlet channels are respectively defined between the partition protrusions. Each outlet channel has a cross-sectional area decreasing from an inner end to an outer open end of the outlet channel. Thus, liquid flowing through the outlet channels does not become turbulent and a working efficiency of a pump with the pump impeller is certainly improved.

<u>IN THE DRAWINGS</u>

[0006]

Fig. 1 is a perspective view of a first embodiment of a pump impeller in accordance with the present invention;
Fig. 2 is an exploded perspective view of the pump impeller in Fig. 1;
Fig. 3 is a top view of a first impeller body of the pump impeller in Fig. 1;
Fig. 4 is a perspective view of a second embodiment of a pump impeller in accordance with the present invention;
Fig. 5 is an exploded perspective view of the pump impeller in Fig. 4;
Fig. 6 is a perspective view of a third embodiment of a pump impeller in accordance with the present invention;
Fig. 7 is an exploded perspective view of the pump impeller in Fig. 6;
Fig. 8 is a side view in partial section of a centrifugal pump with a conventional pump impeller in accordance with the prior art;
Fig. 9 is a cross-sectional side view of the conventional pump impeller in Fig 8; and
Fig. 10 is a top view of the conventional pump impeller in Fig. 8.

[0007] With reference to Figs. 2, 5 and 7, a pump impeller in accordance with the present invention comprises a first impeller body 10, 10A, a second impeller body 20, 20A, multiple outlet channels 30, 30A, a collar 40 and multiple bolts 60.

[0008] With further reference to Fig. 3, the first impeller body 10, 10A has a first base wall 11, 11A, multiple first partition protrusions 12, 12A, multiple chamfers 13, 13A and a flange 14. The first base wall 11, 11A is annular and has an inflow hole 111, 111A formed through a center of the first base wall 11, 11A. The first partition protrusions 12, 12A are separately formed on and arranged around an inner surface of the first base wall 11, 11A. Each first partition protrusion 12, 12A is curved and has two opposite side surfaces and a width. The width of the first partition protrusion 12, 12A increases from an inner end to an outer end of the first partition protrusion 12, 12A. The chamfers 13, 13A of the first impeller body 10, 10A are respectively formed between the side surfaces of the first partition protrusions 12, 12A and the inner surface of the first base wall 11, 11A of the first impeller body 10, 10A. The flange 14 is formed on an outer surface of the first base wall 11, 11A and around the inflow hole 111, 111A of the first base wall 11, 11A.

[0009] The second impeller body 20, 20A is securely attached to the first impeller body 10, 10A and has a second base wall 21, 21A, multiple second partition protrusions 22, 22A and multiple chamfers 23, 23A. The second base wall 21, 21A is separated from and parallel to the first base wall 11, 11A of the first impeller body 10, 10A and has an axial portion 211, 211A. The axial portion 211, 211A is formed on a center of the second base wall 21, 21A and is connected to and is driven by a driving shaft of a motor. The second partition protrusions 22, 22A are separately formed on and arranged around an inner surface of the second base wall 21, 21A. Each second partition protrusion 22, 22A is curved and has two opposite side surfaces and a width. The width of the second partition protrusion 12, 12A increases from an inner end to an outer end of the second partition protrusion 12, 12A. The chamfers 23, 23A of the second impeller body 20, 20A are respectively formed between the side surfaces of the second partition protrusions 22, 22A and the inner surface of the second base wall 21, 21A of the second impeller body 20, 20A.

[0010] The outlet channels 30, 30A are respectively defined between the first partition protrusions 12, 12A and the second partition protrusions 22, 22A. Each outlet channel 30, 30A has an outer open end 31, 31A and a cross-sectional area. The cross-sectional area of the outlet channel 30, 30A decreases from an inner end to the outer open end 31, 31A of the outlet channel 30, 30A.

[0011] The collar 40 is mounted around the first impeller body 10, 10A and the second impeller body 20, 20A and has multiple outflow holes 41. The outflow holes 41 are separately formed through the collar 40 and respectively correspond to the outer open ends 31, 31A of the outlet channels 30, 30A. Each outflow hole 41 may be equal to or smaller than the outer open end 31, 31A of a corresponding outlet channel 30, 30A.

[0012] The bolts 60 are securely mounted through the first and second base walls 11, 11A, 21, 21A and the first and second partition protrusions 12, 12A, 22, 22A of the first and second impeller bodies 10, 20 to securely hold the first and second impeller bodies 10, 10A, 20, 20A together. Preferably, the pump impeller has, but not limited to, six bolts 60.

[0013] With further reference to Figs. 1 and 4, in the first and second preferred embodiments, the second partition protrusions 22 of the second impeller body 20 respectively correspond to and stack against the first partition protrusions 12 of the first impeller body 10. Each outlet channel 30 is defined between two adjacent first partition protrusions 12 and two second partition protrusions 22 that correspond to the two adjacent first partition protrusions 12. Preferably, each of the first impeller body 10 has, but not limited to, twelve first partition protrusions 12 and correspondingly, each of the second impeller body 20 has, but not limited to, twelve second partition protrusions 22. Thus, twelve outlet channels 30 are defined in each of the first and second preferred embodiments of the pump impellers.

[0014] With reference to Figs. 4 and 5, in the second preferred embodiment, the pump impeller further comprises a partition panel 50. The partition panel 50 is annular, is mounted between the first partition protrusions 12 of the first impeller body 10 and the second partition protrusions 22 of the second impeller body 20 and divides each of the outlet channels 30 into two sub-channels 32.

[0015] With further reference to Fig. 6, in a third preferred embodiment, each second partition protrusion 22A is mounted between two adjacent first partition protrusions 12A. Each outlet channel 30A is defined between one of the first partition protrusions 12A and one of the second partition protrusions 22A next to each other. Preferably, each of the first impeller body 10A has, but not limited to, six first partition protrusions 12A and correspondingly, each of the second impeller body 20A has, but not limited to, six second partition protrusions 22A. Thus, twelve outlet channels 30A are defined in the third preferred embodiment of the pump impeller.

[0016] When the pump impeller is made into small size, forming the separated first or second partition protrusions 12, 22 that have a same number as the outlet channels 30 would be difficult. Therefore, in the third preferred embodiment of the pump impeller, the number of the outlet channels 30A is double the number of the first or second partition protrusions 12A, 22A. The third preferred embodiment of the pump impeller is more suitable for being made into a small-sized pump impeller than the first and second preferred embodiments of the pump impellers.

[0017] The pump impeller as described has the following advantages. When the pump impeller is mounted in a pump and operates, liquid is drawn from the inflow hole 111, 111A of the first impeller body 11, 11A and then flows outwards through the outlet channels 30, 30A by a centrifugal force. A flow rate of the liquid is constrained by the outflow holes 41 of the collar 40. Since the cross-sectional area of each outlet channel 30, 30A decreases from the inner end to the outer end of the outlet channel 30, 30A, the liquid flows uniformly with increasing velocity and becomes a laminar flow. Thus, the liquid does not become turbulent, no cavitation will occur in the liquid, no vibration will occur on the pump and a working efficiency of the pump with the pump impeller is certainly improved.

[0018] Furthermore, since the liquid becomes turbulent more easily in a medium-sized or a large-sized pump impeller, the partition panel 50 that divides each of the outlet channels 30 into two sub-channels 32 ensures that the liquid flowing in the sub-channels 32 is remains laminar flow. Therefore, the pump impeller with the partition panel 50 is especially suitable for being made into the medium-sized or the large-sized pump impeller.

[0019] As a further matter, since the first base wall 11, 11A of the first impeller body 10, 10A and the second base wall 21, 21A of the second impeller body 20, 20A are disposed parallel to each other, distances between the first and second base walls 11, 11A, 21, 21A are equivalent. Consequently, resistance between the liquid and the pump impeller is low. Moreover, the chamfers 13, 13A, 23, 23A of the first and second impeller bodies

10, 10A, 20, 20A also reduce the resistance between the liquid and the pump impeller. Furthermore, when the first and second impeller bodies 10, 10A, 20, 20A are manufactured by a milling machine with a computer numerical control (CNC) system, sizes of the outlet channels 30, 30 are precise and inner surfaces of the pump impeller defined around the outlet channels 30, 30A are smooth. Thus, the resistance between the liquid and the pump impeller is further reduced.

Claims

1. A pump impeller **characterized in that**:

   the pump impeller comprising
   a first impeller body (10, 10A) having
   a first base wall (11, 11A) being annular and having an inflow hole (111, 111A) formed through a center of the first base wall (11, 11A); and
   multiple first partition protrusions (12, 12A) separately formed on and arranged around an inner surface of the first base wall (11, 11A), and each first partition protrusion (12, 12A) being curved and having a width increasing from an inner end to an outer end of the first partition protrusion (12, 12A);
   a second impeller body (20, 20A) securely attached to the first impeller body (10, 10A) and having
   a second base wall (21, 21A) separated from and being parallel to the first base wall (11, 11A) of the first impeller body (10, 10A) and having an axial portion (211, 211A) formed on a center of the second base wall (21, 21A); and
   multiple second partition protrusions (22, 22A) separately formed on and arranged around an inner surface of the second base wall (21, 21A), and each second partition protrusion (22, 22A) being curved and having a width increasing from an inner end to an outer end of the second partition protrusion (12, 12A); and
   multiple outlet channels (30, 30A) respectively defined between the first partition protrusions (12, 12A) and the second partition protrusions (22, 22A), and each outlet channel (30, 30A) having
   an outer open end (31, 31A); and
   a cross-sectional area decreasing from an inner end to the outer open end of the outlet channel (30, 30A).

2. The pump impeller as claimed in claim 1, wherein the second partition protrusions (22) of the second impeller body (20) respectively correspond to and stack against the first partition protrusions (12) of the first impeller body (10); and each outlet channel (30) is defined between two adjacent first partition protrusions (12) and two second partition protrusions (22) that correspond to the two adjacent first partition protrusions (12).

3. The pump impeller as claimed in claim 1, wherein each second partition protrusion (22A) is mounted between two adjacent first partition protrusions (12A); and each outlet channel (30A) is defined between one of the first partition protrusions (11A) and one of the second partition protrusions (21A) next to each other.

4. The pump impeller as claimed in claim 2 further comprising a partition panel (50) being annular, mounted between the first partition protrusions (12) of the first impeller body (10) and the second partition protrusions (22) of the second impeller body (20).

5. The pump impeller as claimed in claims 1, 2, 3 or 4 further comprising a collar (40) mounted around the first impeller body (10, 10A) and the second impeller body (20, 20A) and having multiple outflow holes (41) separately formed through the collar (40) and respectively corresponding to the outer open ends (31, 31A) of the outlet channel (30, 30A).

6. The pump impeller as claimed in claim 5, wherein each outflow hole (41) of the collar (40) is equal to or smaller than the outer open end (31, 31A) of a corresponding outlet channel (30, 30A).

7. The pump impeller as claimed in claim 6, wherein each first partition protrusion (12, 12A) has two opposite side surfaces; the first impeller body (10, 10A) has multiple chamfers (13, 13A) respectively formed between the side surfaces of the first partition protrusions (12, 12A) and the inner surface of the first base wall (11, 11A) of the first impeller body (10, 10A);
   each second partition protrusion (22, 22A) has two opposite side surfaces; and
   the second impeller body (20, 20A) has multiple chamfers (23, 23A) respectively formed between the side surfaces of the second partition protrusions (22, 22A) and the inner surface of the second base wall (21, 21A) of the second impeller body (20, 20A).

8. The pump impeller as claimed in claim 7 further comprising multiple bolts (60) securely mounted through the first and second base walls (11, 11A, 21, 21A) and the first and second partition protrusions (12, 12A, 22, 22A) of the first and second impeller bodies (10, 10A, 20, 20A).

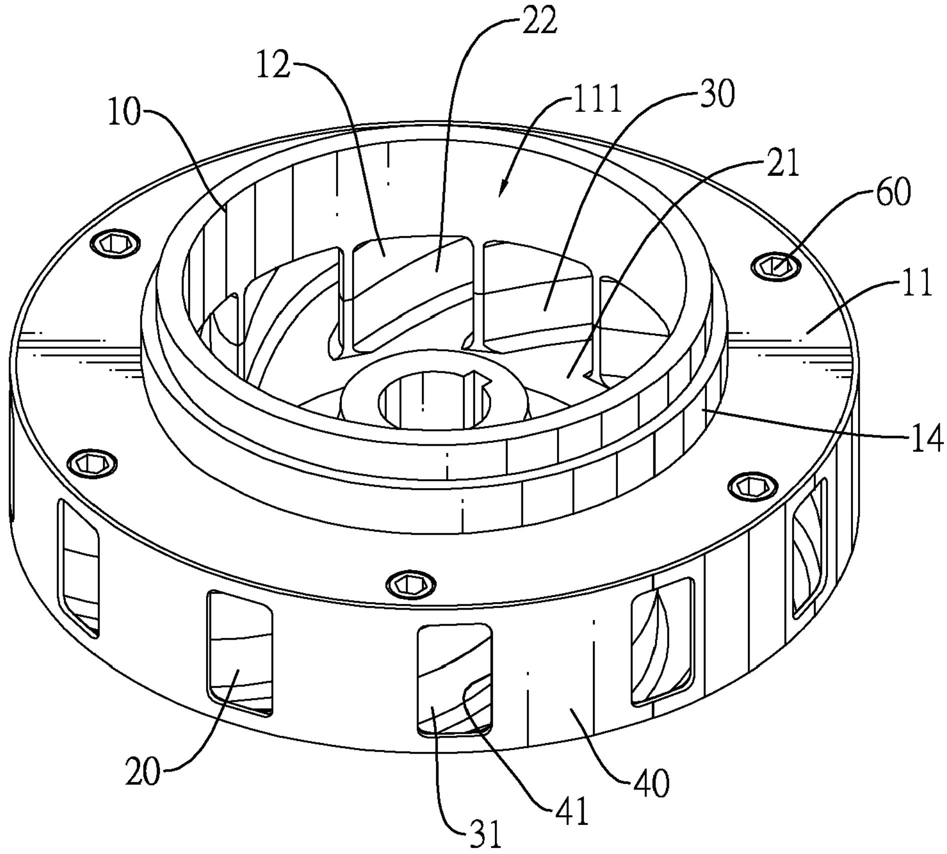

FIG.1

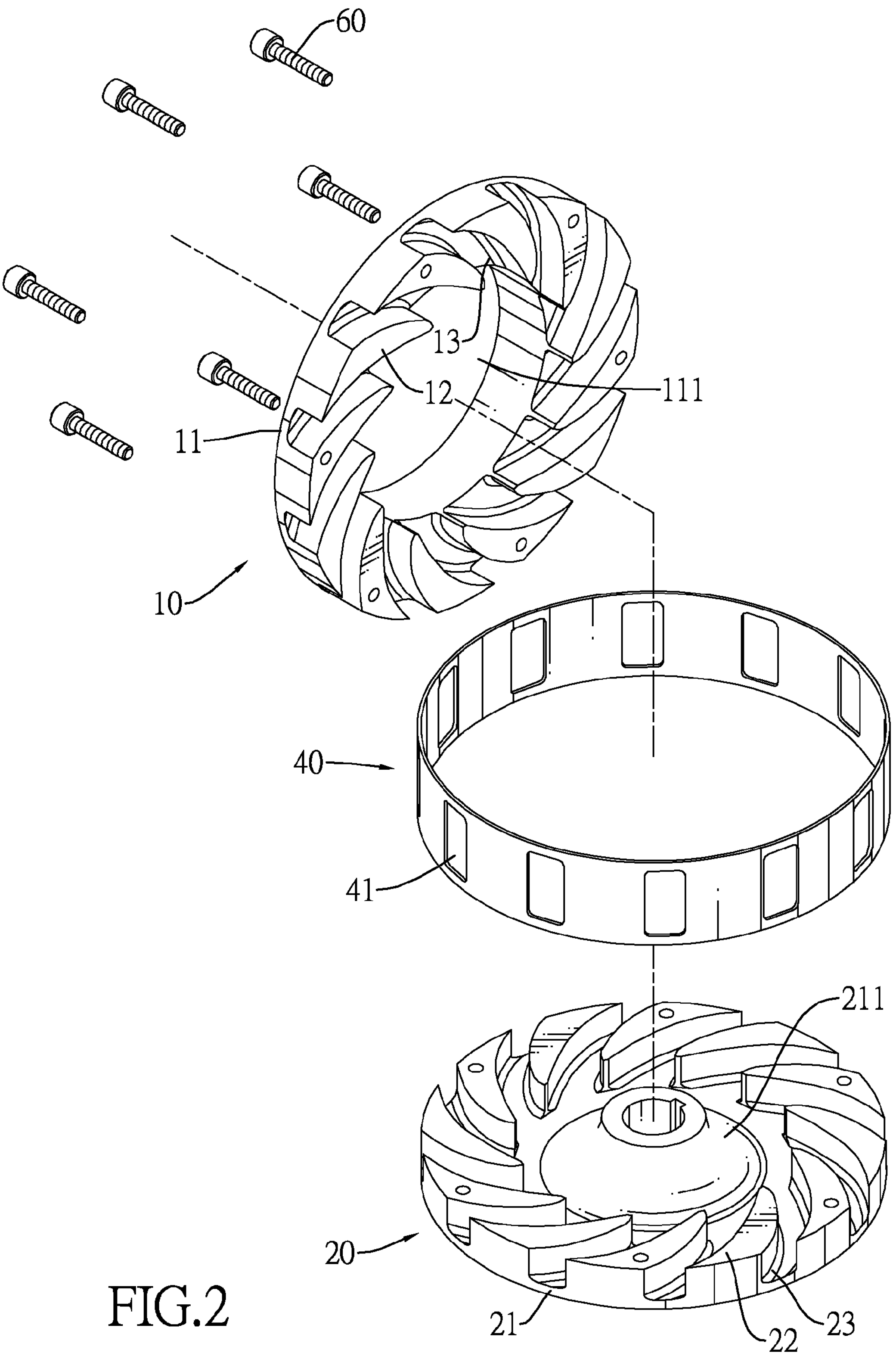

FIG.2

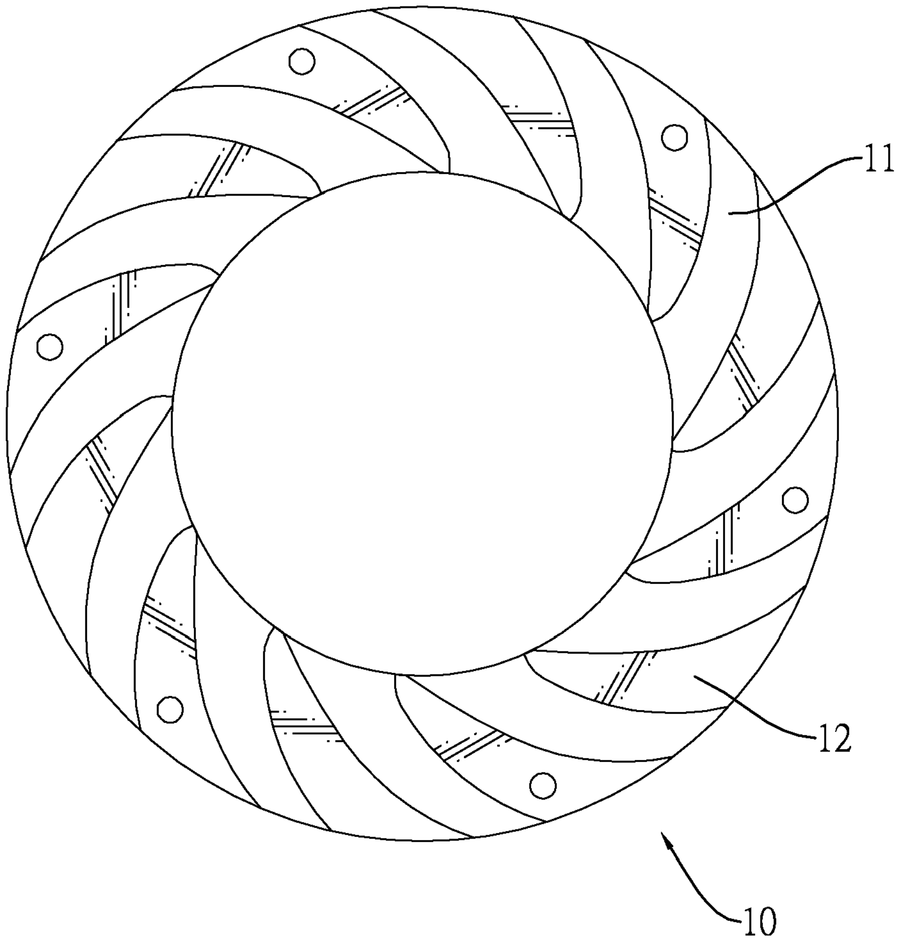

FIG.3

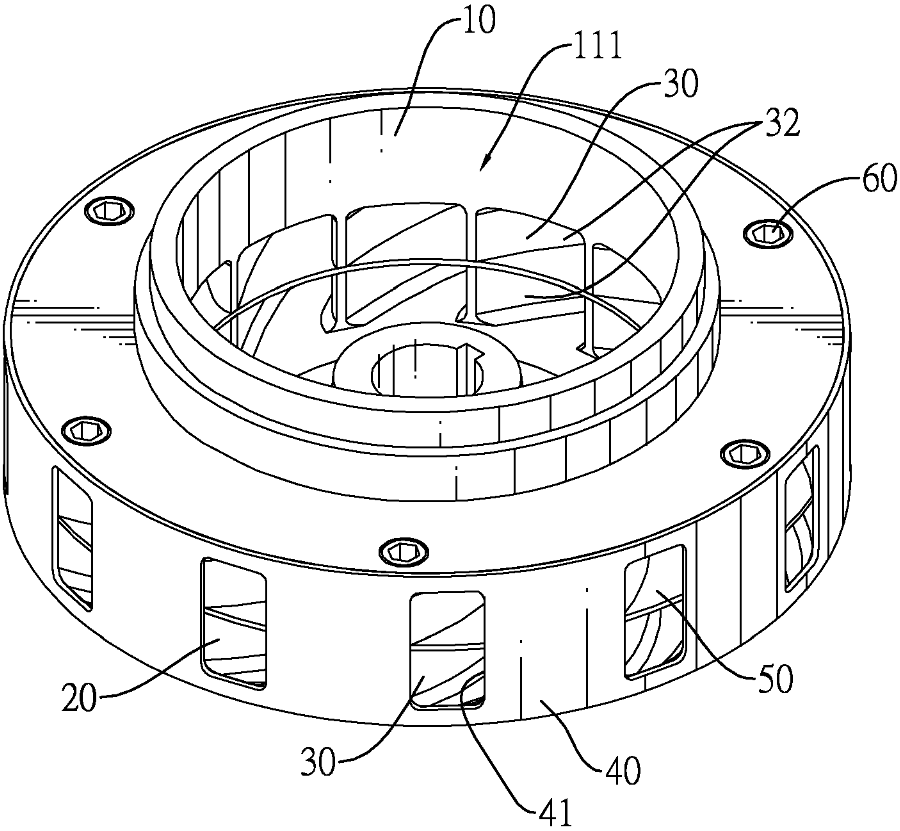

FIG.4

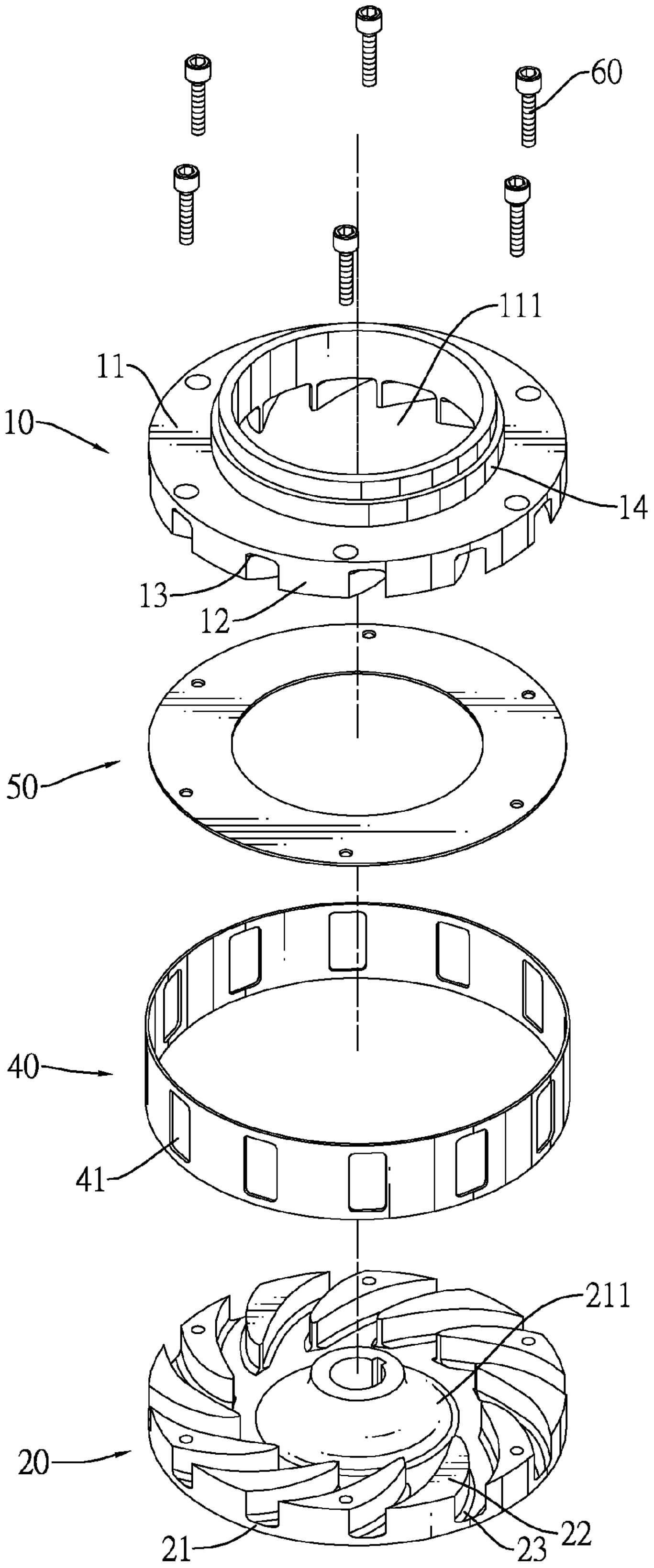

FIG.5

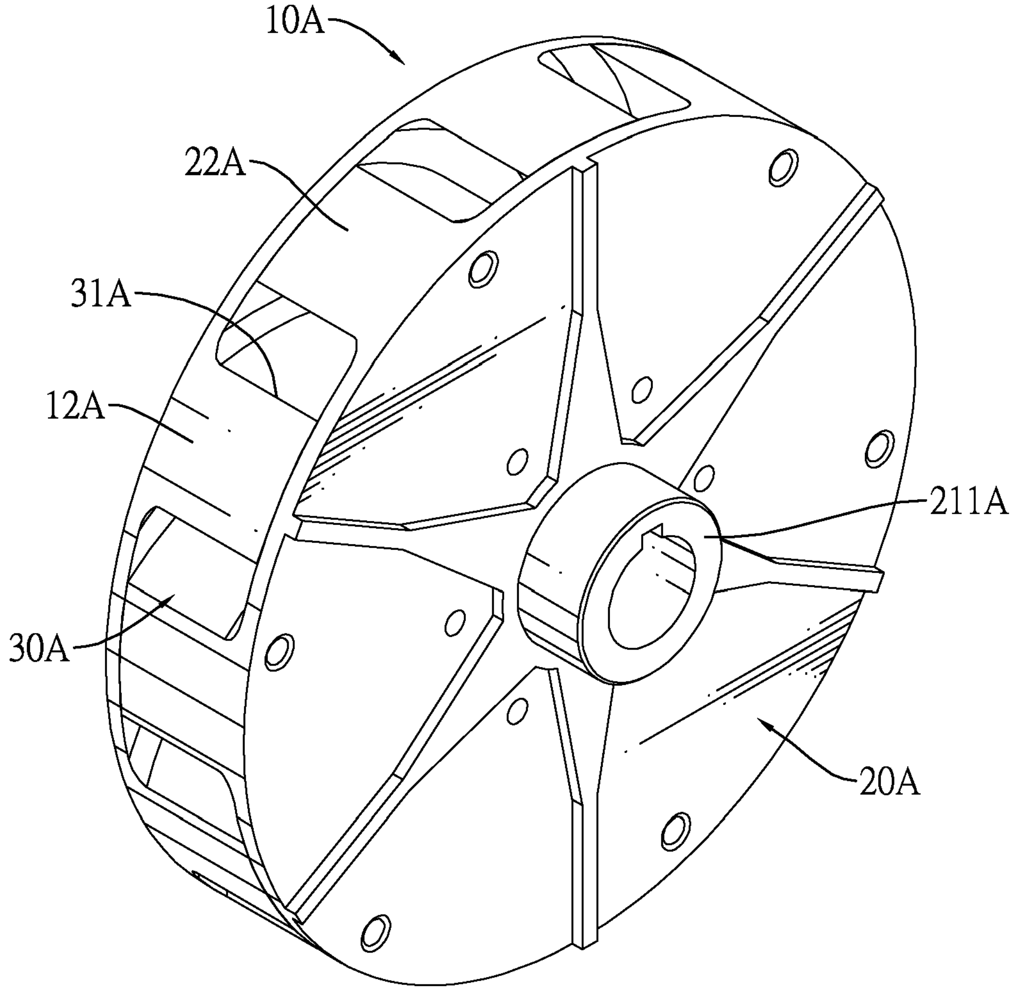

FIG.6

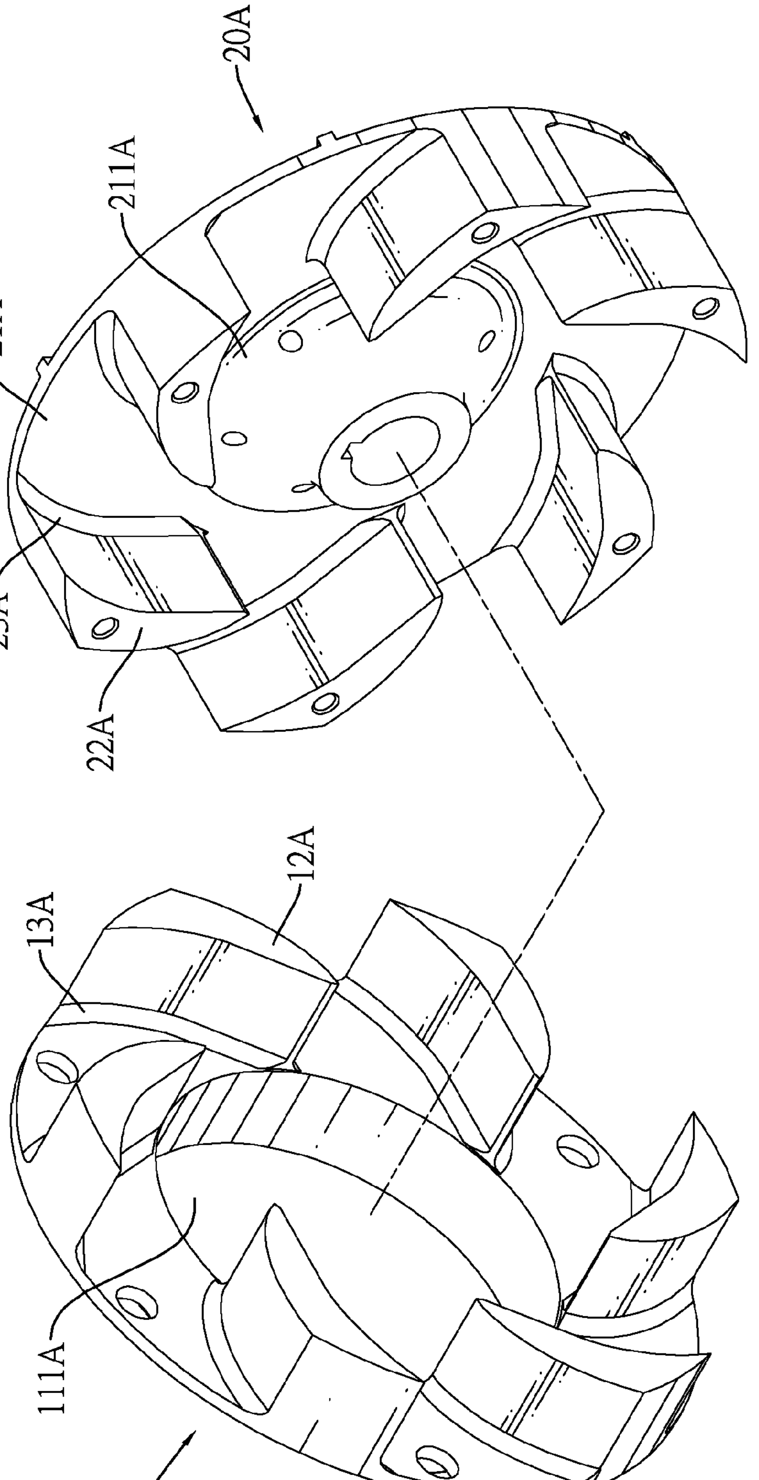

FIG.7

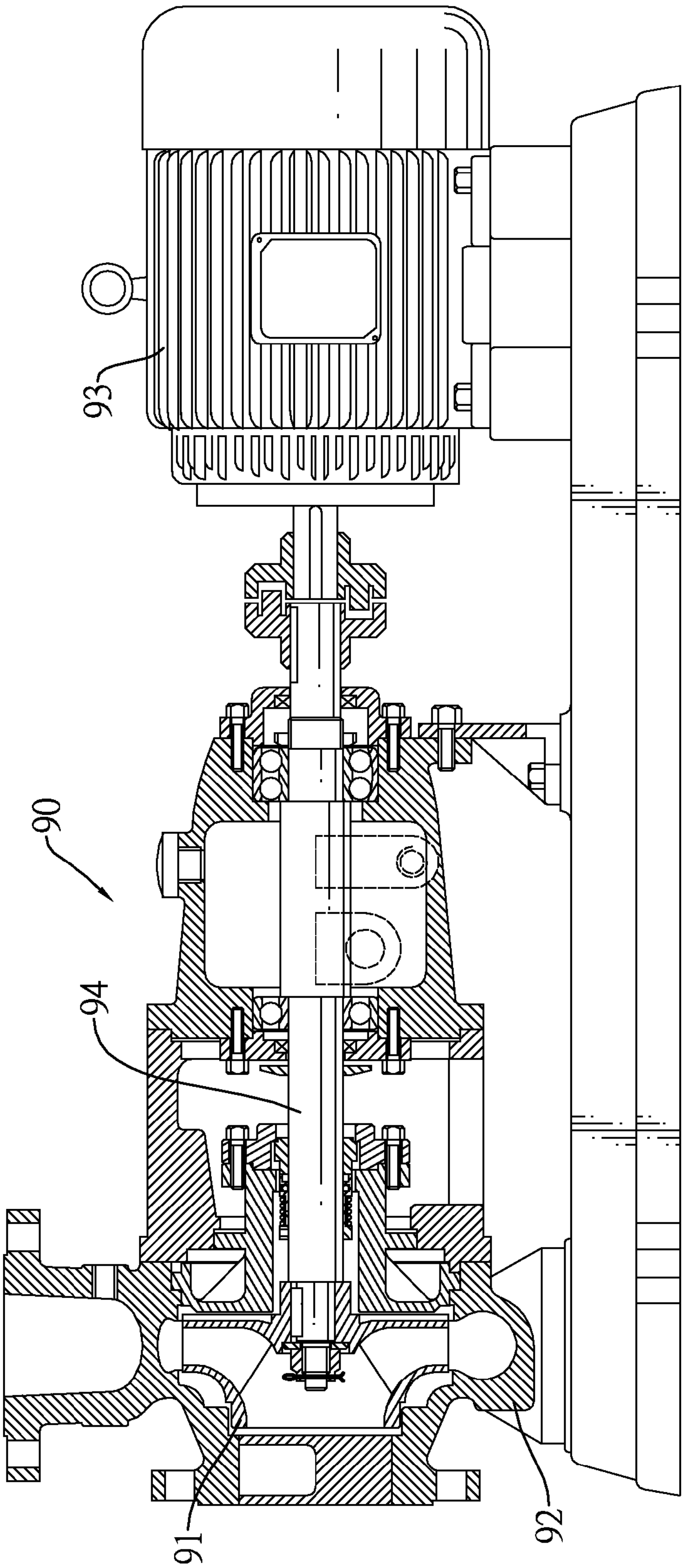

FIG.8
PRIOR ART

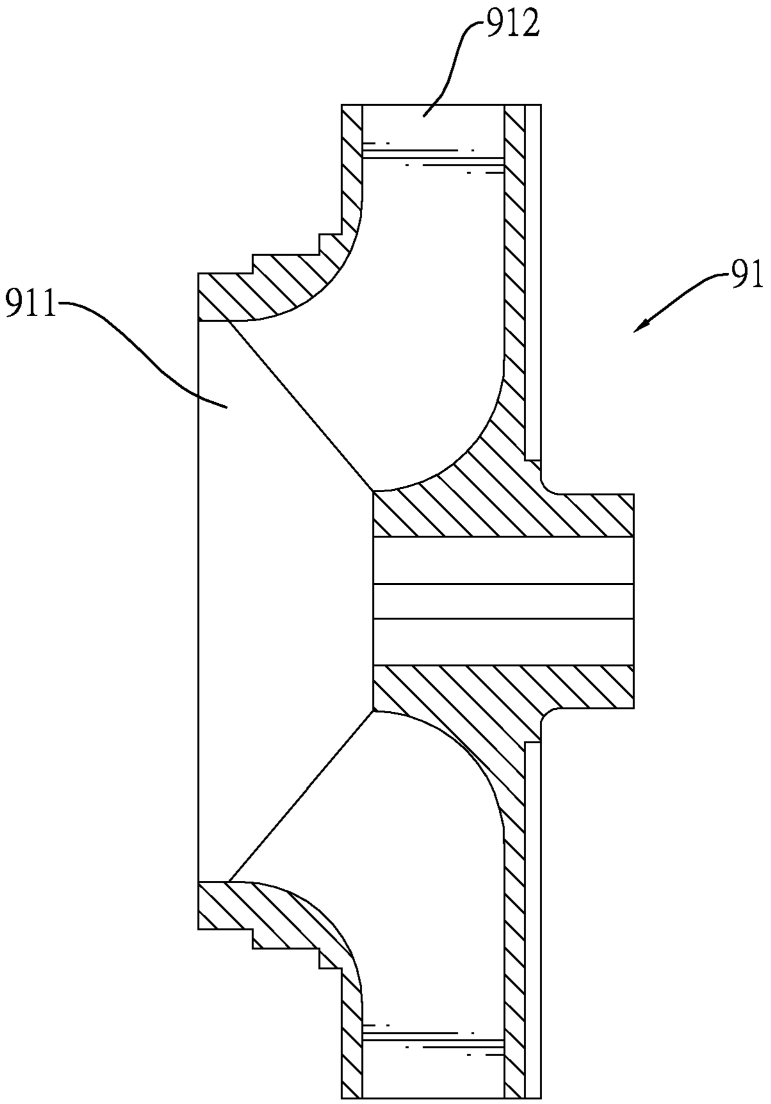

FIG.9
PRIOR ART

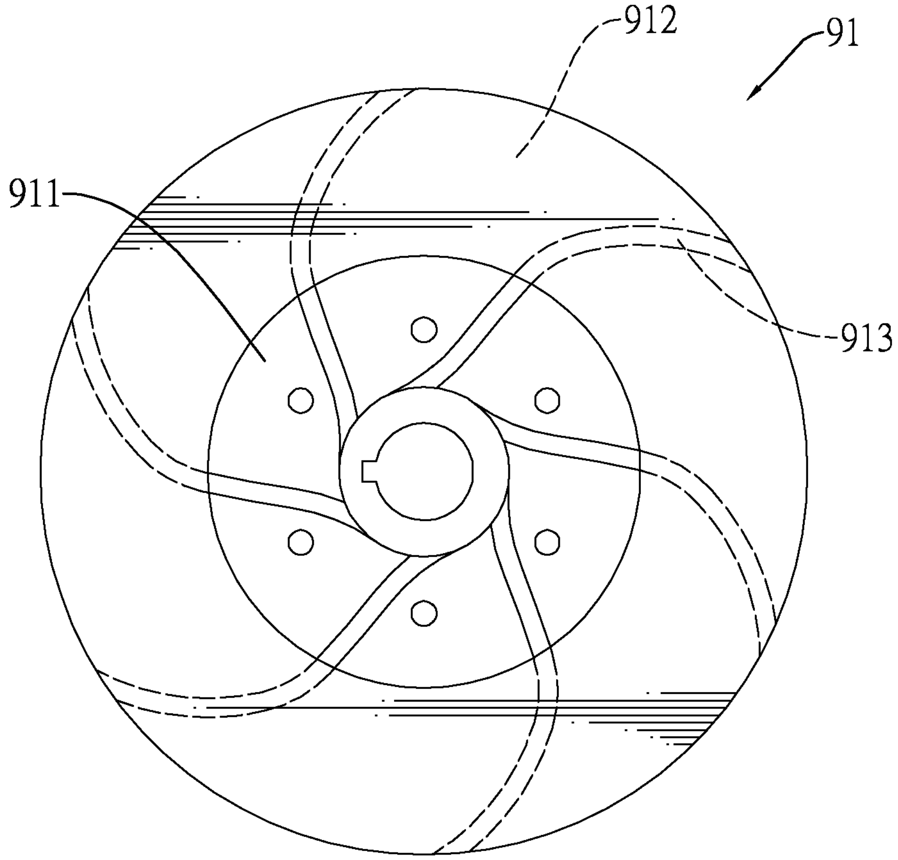

FIG.10
PRIOR ART