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(54) **Vacuum cleaner**

Staubsauger

Aspirateur

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Description

[0001] This invention relates to a vacuum cleaner having an increased suction power.

[0002] Typically vacuum cleaners incorporate a clean air fan system in which air is drawn through a separation unit comprising a filter bag and/or a cyclonic separator by a fan mounted downstream thereof. The separation unit removes substantially all of the dust entrained in the airflow and thus the air passing through the fan is substantially clean.

[0003] Typically the fan comprises a centrifugal radial flow impeller driven by an electric motor. The fan is arranged to draw air axially, out of a first chamber mounted in front of the impeller. The air is then driven radially by the impeller into a second chamber which is connected to the exhaust of the cleaner. A duct leads from the separation unit to the first chamber.

[0004] GB341743 discloses a vacuum cleaner having an electric motor, a fan driven by the motor and a dust filter mounted in a common housing. EP0970651 discloses a vacuum cleaner having a suction unit at the front side of the main body and a dust collector and blower at the rear side. Another known vacuum cleaner is described in DE 196 16 156 C1.

[0005] Vacuum cleaners of the above mentioned type function extremely well. However, there is increasing demand to improve the suction power of vacuum cleaners without increasing the wattage of the motor.

[0006] Thus, we have now devised a vacuum cleaner having an increased suction power compared with known vacuum cleaners having the same motor power.

[0007] In accordance with this invention, there is provided a vacuum cleaner as set out in claim 1. ,

[0008] In conventional vacuum cleaners, the fan chamber actually forms a part of the duct leading to the impeller. We have realised that the increased cross-sectional area of the chamber causes the airflow entering the chamber to expand and drop in velocity. This expansion and drop in velocity causes the kinetic energy of the air molecules to drop as they enter the fan chamber. Accordingly, more power is required to move the air from the chamber. The chamber also causes a turbulent flow which further inhibits the airflow and causes noise.

[0009] The present invention overcomes the above-mentioned problems by omitting the chamber and by communicating the air directly to the impeller through a duct having a substantially uniform cross-sectional area along a substantial part of its length.

[0010] Preferably the area of said outlet end of the duct of the airflow path is substantially equal to the cross-sectional area of the inlet end of the central duct of the impeller.

[0011] Preferably said outlet end of the duct of the airflow path extends axially of the rotational axis of the impeller.

[0012] Preferably said outlet end of the duct of the airflow path is circular in cross-section.

[0013] Conventional vacuum cleaners having a fan chamber can be modified in accordance with the present invention by providing an insert member in the chamber having a passageway therethrough forming a part of the duct of the airflow path.

[0014] Claim 9 relates to a method of modifying a vacuum cleaner.

[0015] Preferably the member comprises a solid body of material which fills the chamber apart from the passageway.

[0016] Preferably the material comprises expanded polystyrene or polypropylene.

[0017] In vacuum cleaners of the clean air type, the separation unit is preferably mounted in the airflow path upstream of the fan unit, the duct having an inlet end connected to the outlet of the separation unit.

[0018] An embodiment of this invention will now be described by way of an example only and with reference to the accompanying drawings, in which:

Figure 1 is a sectional view through the fan assembly of an embodiment of vacuum cleaner in accordance with this invention; and

Figure 2 is a sectional view along the line II - II of Figure 1.

[0019] Referring to the drawings, there is shown the fan assembly of an upright vacuum cleaner, which assembly is arranged to draw air along an inlet duct 10 leading from a dust separation unit, such as a cyclonic separator and/or filter bag (not shown).

[0020] The output shaft 14 of the motor 13 is connected to an impeller 15 comprising a plurality of blades 16 extending radially with respect to the rotational axis of the motor shaft 14, between circular front and rear plates 18,28 of the impeller which lie normal to the rotational axis. The radially outer ends of the blades 16 terminate adjacent the inner surface of the cylindrical housing 11. The blades 16 extend outwardly from a central hollow region 17 which extends axially of the impeller 15. A circular aperture 29 is formed in the front plate of the impeller 15 to communicate with the central hollow region 17.

[0021] A large cavity 19 is formed at one end of the housing 11 between the front plate 18 of the impeller 15 and an end wall of the housing 11. The inlet duct 10 from the separation unit leads tangentially into the cavity 19.

[0022] The fan unit as hereinbefore described corresponds with that of a conventional vacuum cleaner. When the motor 13 is energised, the impeller 15 is rotated about its axis to cause air to flow radially outwardly from its central region 17 through the blades 16 and then axially over the motor 13, whereupon the air leaves the housing 11 through an exhaust duct 21.

[0023] The impeller 15 draws air axially into the central region 17 through the aperture 29 from the cavity 19, disposed on the opposite side of the impeller 15 to the motor 13: This creates a drop in pressure in the cavity 19 which causes air to flow from the atmosphere through

the dust separation unit (not shown) and into the cavity 19, whereupon it is discharged to atmosphere through the impeller 15 and exhaust 21 as hereinbefore described.

[0024] Conventional cleaners of this type function extremely well. However, we have realised that by making a relatively straightforward modification to the fan unit, the suction power of the cleaner can surprisingly be increased by approximately 15%.

[0025] Thus in accordance with the present invention, the cavity 19 is filled by a cylindrical insert 20 of expanded polypropylene material.

[0026] An involuted through passage 22 extends through the insert 20, with one end of the passage 22 extending axially to communicate directly with the tangential inlet duct 10 from the outlet of the separation unit and the other end extending axially to communicate directly with the aperture 29 in the front plate 18 of the impeller 15: preferably this end of the passage 22 is circular in cross-section and has a diameter which is substantially equal to the diameter of the aperture 29 in the front plate 18 of the impeller 15.

[0027] The insert 20 effectively fills the cavity 19, so as to maintain a substantially uniform cross-sectional area to the airflow path leading from the dust separation unit. We have found that this surprisingly increases the suction power.

[0028] We have found that in conventional vacuum cleaners any increase in the cross-sectional area of the airflow path causes a corresponding drop in velocity. Thus, the kinetic energy of the air molecules drops as the velocity falls and the airflow expands in the chamber 19. This drop in energy means that more power has to be exerted by the motor 13 to move the same volume of air.

[0029] Accordingly, the present invention solves the above-mentioned problem by effectively replacing the chamber 19 with a passageway 22 having a cross-sectional area which is substantially equal to the cross-sectional area of the duct 10 and the area of the aperture 29 in the front plate 18 of the impeller 15.

[0030] We have also found that the vacuum cleaner is quieter in operation than conventional vacuum cleaners, since a less turbulent flow is created.

Claims

1. A vacuum cleaner having an inlet for dirty air, an outlet for cleaned air, an airflow path extending between the inlet and outlet, a fan unit mounted in the airflow path for causing an airflow between the inlet and outlet through a dust separation unit arranged to separate a substantial amount of the dust and other matter from the air flowing along said airflow path, the fan unit comprising a motor (13), wherein the fan unit comprises a radial flow impeller (15), the impeller being rotatable by the motor about a rotational axis, the impeller comprising a plurality of blades (16) extending radially from an axially extending central hollow region (17) having an air inlet (29) at one axial end thereof, the airflow path comprising a duct (10) having an outlet end directly aligned with the inlet (29) of the impeller, said duct (10) having a substantially uniform cross-sectional area along a substantial part of its length **characterised in that** the vacuum cleaner further comprises a fan chamber directly upstream of the impeller and an insert member (20) mounted within the chamber and having a passageway (22) therethrough forming a part of the duct of the airflow path.

2. A vacuum cleaner as claimed in claim 1, in which the area of said outlet end of the duct (10) of the airflow path is substantially equal to the cross-sectional area of the inlet end (29) of the central hollow region (17) of the impeller (15).

3. A vacuum cleaner as claimed in claims 1 or 2, in which said outlet end of the duct of the airflow path extends axially of the rotational axis of the impeller.

4. A vacuum cleaner as claimed in any preceding claim, in which said outlet end of the duct of the airflow path is circular in cross-section.

5. A vacuum cleaner as claimed in any preceding claim, in which the insert member comprises a solid body of material which fills the chamber apart from the passageway.

6. A vacuum cleaner as claimed in any preceding claim, in which the material of the insert comprises expanded polystyrene or polypropylene.

7. A vacuum cleaner as claimed in any preceding claim, in which the passageway through the insert member forms said outlet end of the duct.

8. A vacuum cleaner as claimed in any preceding claim, in which the separation unit is mounted in the airflow path upstream of the fan unit, the duct having an inlet end connected to the outlet of the separation unit.

9. A method of modifying a vacuum cleaner, the vacuum cleaner having an inlet for dirty air, an outlet for cleaned air, an airflow path extending between the inlet and the outlet, a fan unit mounted in the airflow path for causing an airflow between the inlet and the outlet through a dust separation unit arranged to separate a substantial amount of the dust and other matter from the air flowing along said airflow path, the fan unit comprising a radial flow impeller (15) and a motor (13) for rotating the impeller about a rotational axis, the impeller comprising a plurality of blades (16) extending radially from an axially extending central

hollow region (17) having an air inlet (29) at one axial end thereof, and a fan chamber (19) directly upstream of the impeller,
comprising the step of mounting an insert member (20), having a passageway (22) therethrough, in the fan chamber (19) such that the insert member effectively fills the fan chamber and the passageway maintains a substantially uniform cross-sectional area in the part of the airflow path leading from the dust separation unit to the air inlet (29) of the impeller.

Patentansprüche

1. Staubsauger, der einen Einlass für Schmutzluft, einen Auslass für gesäuberte Luft, einen sich zwischen dem Einlass und dem Auslass erstreckenden Luftströmungsweg, eine im Luftströmungsweg montierte Gebläseeinheit zur Veranlassung einer Luftströmung zwischen dem Einlass und dem Auslass durch eine Staubabscheideeinheit hat, die zum Abscheiden einer wesentlichen Menge des Staubs und anderer Materialien aus der den Luftströmungsweg entlang strömenden Luft angeordnet ist, wobei die Gebläseeinheit einen Motor (13) umfasst, wobei die Gebläseeinheit ein Radiallaufrad (15) umfasst, das durch den Motor um eine Rotationsachse gedreht werden kann, wobei das Laufrad mehrere Schaufeln (16) umfasst, die sich radial von einem sich axial erstreckenden mittleren Hohlbereich (17) erstrekken, der einen Lufteinlass (29) an einem axialen Ende davon hat, wobei der Luftströmungsweg einen Kanal (10) umfasst, dessen Auslassende direkt auf den Einlass (29) des Laufrads ausgerichtet ist und der eine im Wesentlichen einheitliche Querschnittsfläche entlang einem wesentlichen Teil seiner Länge hat, **dadurch gekennzeichnet, dass** der Staubsauger ferner eine Gebläsekammer direkt stromaufwärts vom Laufrad und ein in der Kammer montiertes Einlageelement (20) mit einem dort hindurchgehenden Durchgang (22) umfasst, der einen Teil des Kanals des Luftströmungswegs bildet.

2. Staubsauger nach Anspruch 1, wobei die Fläche des Auslassendes des Kanals (10) des Luftströmungswegs der Querschnittsfläche des Einlassendes (29) des mittleren Hohlbereichs (17) des Laufrads (15) im Wesentlichen entspricht.

3. Staubsauger nach Anspruch 1 oder 2, wobei sich das Auslassende des Kanals des Luftströmungswegs axial zur Rotationsachse des Laufrads erstreckt.

4. Staubsauger nach einem der vorhergehenden Ansprüche, wobei das Auslassende des Kanals des Luftströmungswegs einen kreisförmigen Querschnitt hat.

5. Staubsauger nach einem der vorhergehenden Ansprüche, wobei das Einlageelement einen festen Materialkörper umfasst, der die Kammer außer dem Durchgang füllt.

6. Staubsauger nach einem der vorhergehenden Ansprüche, wobei das Material der Einlage expandiertes Polystyrol oder Polypropylen umfasst.

7. Staubsauger nach einem der vorhergehenden Ansprüche, wobei der Durchgang durch das Einlageelement das Auslassende des Kanals bildet.

8. Staubsauger nach einem der vorhergehenden Ansprüche, wobei die Abscheideeinheit im Luftströmungsweg stromaufwärts von der Gebläseeinheit montiert ist, wobei der Kanal ein mit dem Auslass der Abscheideeinheit verbundenes Einlassende hat.

9. Verfahren zur Modifizierung eines Staubsaugers, der einen Einlass für Schmutzluft, einen Auslass für gesäuberte Luft, einen sich zwischen dem Einlass und dem Auslass erstreckenden Luftströmungsweg, eine im Luftströmungsweg montierte Gebläseeinheit zur Veranlassung einer Luftströmung zwischen dem Einlass und dem Auslass durch eine Staubabscheideeinheit hat, die zum Abscheiden einer wesentlichen Menge des Staubs und anderer Materialien aus der den Luftströmungsweg entlang strömenden Luft angeordnet ist, wobei die Gebläseeinheit ein Radiallaufrad (15) und einen Motor (13) zum Drehen des Laufrads um eine Rotationsachse umfasst, wobei das Laufrad mehrere Schaufeln (16) umfasst, die sich radial von einem sich axial erstreckenden mittleren Hohlbereich (17) erstrecken, der einen Lufteinlass (29) an einem axialen Ende davon hat, sowie eine Gebläsekammer (19) direkt stromaufwärts vom Laufrad,
mit dem Schritt des Montierens eines Einlageelements (20) mit einem dort hindurchgehenden Durchgang (22) in der Gebläsekammer (19), so dass das Einlageelement die Gebläsekammer effektiv füllt und der Durchgang eine im Wesentlichen einheitliche Querschnittsfläche in dem Teil des Luftströmungswegs behält, der von der Staubabscheideeinheit zum Lufteinlass (29) des Laufrads führt.

Revendications

1. Aspirateur comportant une entrée pour l'air poussiéreux, une sortie pour l'air dépoussiéré, un cheminement de l'air s'étendant entre l'entrée et la sortie, une unité de ventilateur montée dans le cheminement de l'air pour provoquer un écoulement d'air entre l'entrée et la sortie qui traverse une unité de séparation de poussières disposée pour séparer une quantité importante de poussières et autres matières

de l'air s'écoulant le long dudit cheminement de l'air, l'unité de ventilateur comprenant un moteur électrique (13), dans lequel l'unité de ventilateur comprend une turbine à flux radial (15), la turbine pouvant être mise en rotation par le moteur autour d'un axe de rotation, la turbine comprenant une pluralité d'aubes (16) s'étendant radialement à partir d'une zone centrale creuse (17) s'étendant axialement et comportant une entrée d'air (29) à une de ses extrémités axiales, le cheminement de l'air comprenant un conduit (10) comportant une extrémité de sortie exactement alignée avec l'entrée (29) de la turbine, ledit conduit (10) ayant une section sensiblement uniforme sur une partie importante de sa longueur, **caractérisé en ce que** ledit aspirateur comprend une chambre de ventilateur exactement en amont de la turbine et un élément d'insert (20) monté à l'intérieur de la chambre et comportant une voie de passage (22) qui le traverse et constitue une partie du conduit du cheminement de l'air.

2. Aspirateur selon la revendication 1, dans lequel la superficie de ladite extrémité de sortie du conduit (10) du cheminement de l'air est sensiblement égale à la section de l'extrémité d'entrée (29) de la zone centrale creuse (17) de la turbine (15).

3. Aspirateur selon la revendication 1 ou 2, dans lequel ladite extrémité de sortie du conduit du cheminement de l'air s'étend axialement suivant l'axe de rotation de la turbine.

4. Aspirateur selon l'une quelconque des revendications précédentes, dans lequel ladite extrémité de sortie du conduit du cheminement de l'air a une section transversale circulaire.

5. Aspirateur selon l'une quelconque des revendications précédentes, dans lequel l'élément d'insert comprend un corps de matière solide qui remplit la chambre en dehors de la voie de passage.

6. Aspirateur selon l'une quelconque des revendications précédentes, dans lequel la matière de l'insert comprend du polystyrène ou du polypropylène expansé.

7. Aspirateur selon l'une quelconque des revendications précédentes, dans lequel la voie de passage traversant l'élément d'insert constitue ladite extrémité de sortie du conduit.

8. Aspirateur selon l'une quelconque des revendications précédentes, dans lequel l'unité de séparation est montée dans le cheminement de l'air en amont de l'unité de ventilateur, le conduit ayant une extrémité d'entrée raccordée à la sortie de l'unité de séparation.

9. Procédé de modification d'un aspirateur, l'aspirateur comportant une entrée pour l'air poussiéreux, une sortie pour l'air dépoussiéré, un cheminement de l'air s'étendant entre l'entrée et la sortie, une unité de ventilateur montée dans le cheminement de l'air pour provoquer un écoulement d'air entre l'entrée et la sortie qui traverse une unité de séparation de poussières disposée pour séparer une quantité importante de poussières et autres matières de l'air s'écoulant le long dudit cheminement de l'air, l'unité de ventilateur comprenant une turbine à flux radial (15) et un moteur électrique (13) pour faire tourner la turbine autour d'un axe de rotation, la turbine comprenant une pluralité d'aubes (16), s'étendant radialement à partir d'une zone centrale creuse (17) s'étendant axialement et comportant une entrée d'air (29) à une de ses extrémités axiales, et une chambre (19) de ventilateur exactement en amont de la turbine,
comprenant l'étape consistant à monter un élément d'insert (20), comportant une voie de passage (22) qui le traverse, dans la chambre (19) de ventilateur de telle sorte que l'élément d'insert remplisse effectivement la chambre de ventilateur et que la voie de passage garde une section sensiblement uniforme dans la partie du cheminement de l'air allant de l'unité de séparation de poussières à l'entrée d'air (29) de la turbine.

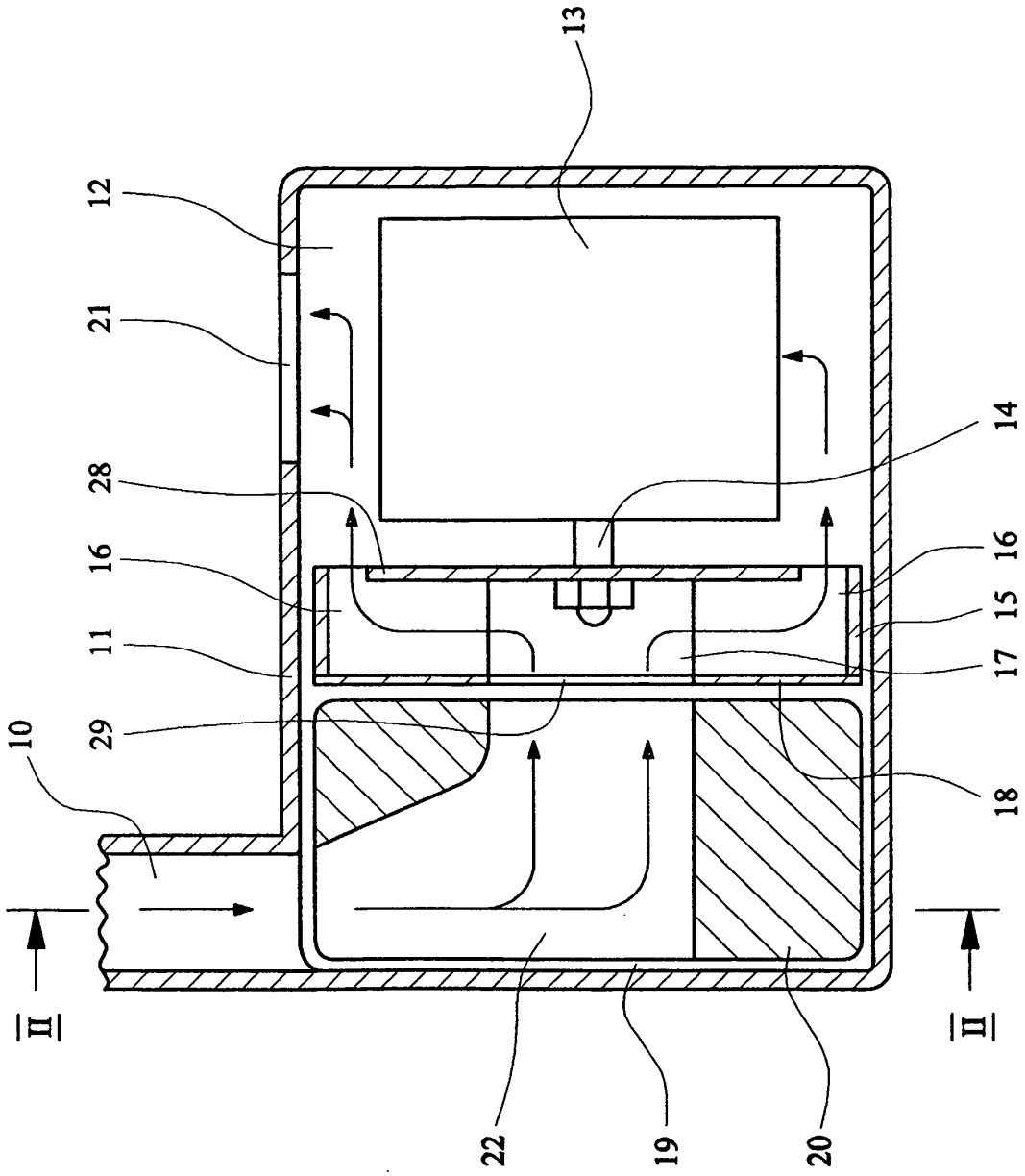

FIG. 1

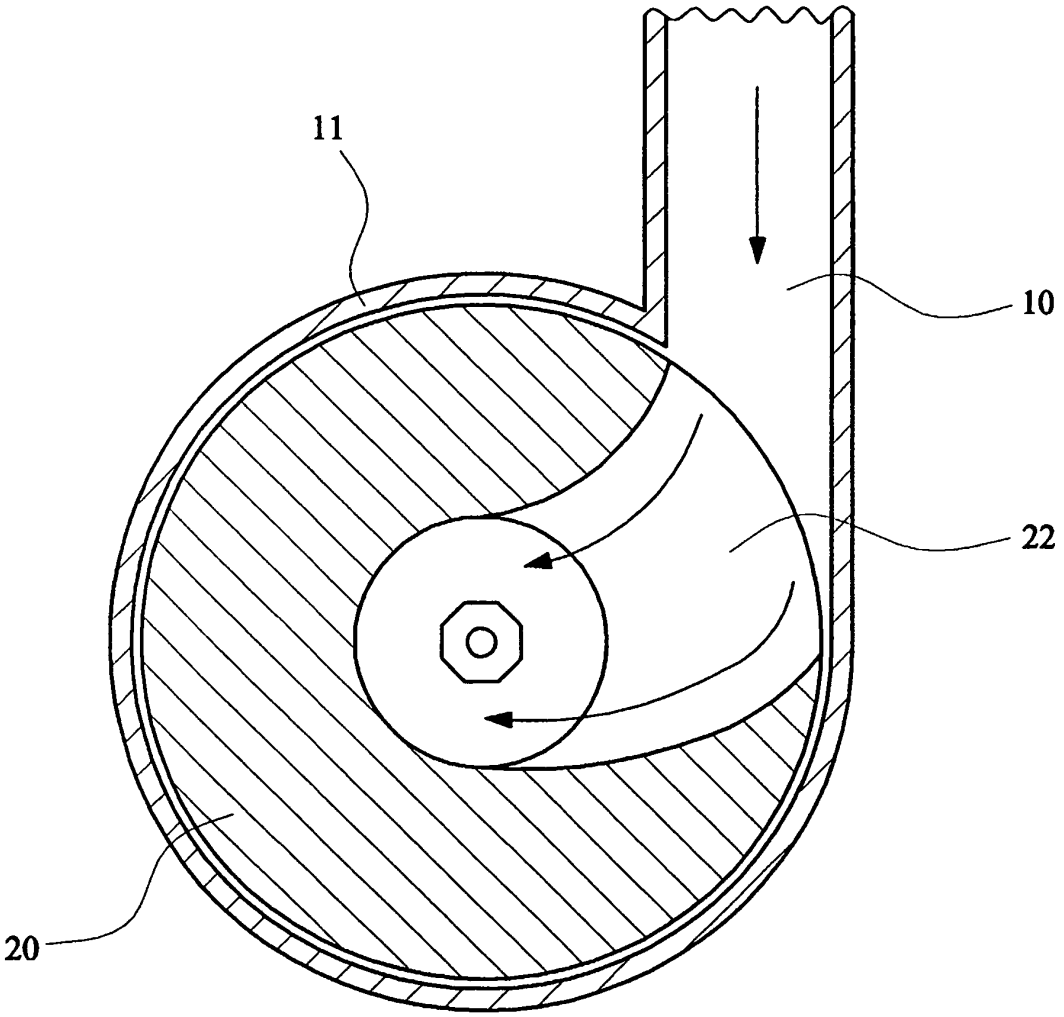

FIG. 2

REFERENCES CITED IN THE DESCRIPTION

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