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(54) **Diaphragm type vacuum pump**

(57) The present invention relates to a diaphragm type vacuum pump that is compact in size and manufactured at low cost and includes an inclined pin 13 that is radially spaced at a predetermined distance from the rotational center of a motor 1 and turns around the rotational center, a rolling plate 9 that is connected with the inclined pin 13 and eccentrically shakes up and down, and a

three-point diaphragm 10 that is combined with the rolling plate 9 and changes the internal volume by eccentrically shaking up and down, in which vacuum pumping is applied by repeating intake and exhaust of air according to changes in the internal volume of the three-point diaphragm 10.

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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a diaphragm type vacuum pump, and in particular, to the structure of a vacuum pump that is compact in size and can be manufactured at low cost without using lubricant by using a small electric motor and a diaphragm type pump.

2. Description of the Related Art

[0002] Vacuum pumps are widely used to reduce the internal pressure of a container and various types of vacuum pumps, depending on the use, have been known in the art.

[0003] Recently, it has been known that the flavor of rice is considerably improved when the internal pressure of a rice cooker is reduced during cooking. Therefore, vacuum pumps that can reduce the internal pressure of an electric rice cooker have been developed.

[0004] It is required for a vacuum pump that is used to reduce the internal pressure of an electric rice cooker to satisfy various conditions, such as, it should be a dry type without lubricant, manufactured to have a compact and small-sized configuration and disposed in a case of the electric rice cooker, and the manufacturing cost is low.

[0005] Known in the related art as a compact and small-sized dry diaphragm type vacuum pump is a vacuum pump in which a connecting rod is reciprocated by rotation of an eccentric shaft. A diaphragm is actuated by the reciprocation of the connecting rod to repeat intake and exhaust, and a vacuum pump includes a diaphragm that is reciprocated by a vacuum pump to repeat intake and exhaust.

[0006] However, according to the above configurations, noise was generated by the reciprocation of the connecting rod or the operation of the electric motor and they were limited in obtaining a compact configuration or reducing the size, particularly, it was difficult to manufacture the vacuum pump at low cost.

SUMMARY OF THE INVENTION

[0007] Accordingly, it is an object of the present invention to provide a vacuum pump at low cost by reducing the size, simplifying the configuration, and manufacturing the components by injection molding.

[0008] In order to achieve the above object, a diaphragm type vacuum pump according to an aspect of the invention includes: a pin that is radially spaced from the rotational center of a motor and inclined to the rotational center, a rolling plate that is combined with the pin, a three-point diaphragm that is combined with the rolling plate, and intake and exhaust valves. According to the diaphragm type vacuum pump, as the motor operates

and the inclined pin turns around the rotational shaft of the motor, the rolling plate shakes up and down while being inclined by the inclination angle of the pin, the three-point diaphragm is repeatedly moved up and down by the shaking, and intake and exhaust of air are repeated by changes in the internal volume due to the motion of the three-point diaphragm, thereby forming a vacuum.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009]

FIG. 1 is a perspective view of a diaphragm type vacuum pump according to an embodiment of the invention;

FIG. 2 is an exploded perspective view of FIG. 1;

FIG. 3A is a perspective view of an air port with guide rings connected according to an embodiment of the invention;

FIG. 3B is a bottom view of the air port;

FIG. 3C is a perspective view of the guide ring; and FIG. 4 is a conceptional view illustrating an intake process **a** and an exhaust process **b** in the operation according to an embodiment of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0010] Preferred embodiments of the invention will be described hereafter in detail with reference to accompanying drawings.

[0011] FIG. 1 is a perspective view of a diaphragm type vacuum pump according to an embodiment of the invention, FIG. 2 is an exploded perspective view of FIG. 1, FIG. 3A is a perspective view of an air port with guide rings connected according to an embodiment of the invention, FIG. 3B is a bottom view of the air port, FIG. 3C is a perspective view of the guide ring, and FIG. 4 is a conceptional view illustrating an intake process **a** and an exhaust process **b** in the operation according to an embodiment of the invention.

[0012] As shown in the drawings, a vacuum pump is formed by sequentially assembling a motor 1, a housing 2, a diaphragm guide 3, an air port 4, a cover 5, screws 6, and bolts 7, and a fixture 8 that is connected to the shaft of the motor 1 is provided in the housing 2.

[0013] A three-point diaphragm 10 that is combined with a rolling plate 9 is provided in the diaphragm guide 3, and intake valves 11 and guide rings 12 are combined with the air port 4.

[0014] An inclined pin 13 that is inclined to the rotational center is fixed at a predetermined distance from the rotational center in the fixture 8 connected to the shaft of the motor 1.

[0015] The inclined pin 13 is inserted in an insertion hole formed at the center of the rolling plate 9 and makes the rolling plate 9 eccentrically shake up and down by turning around the rotational center by rotation of the fixture 8.

[0016] In detail, when a side of the rolling plate 9 is perpendicular to the rotational center, the other side is inclined from the rotational center, such that the rolling plate 9 compresses or decompresses the three-point diaphragm 10 combined with the rolling plate 9.

[0017] When the rolling plate 9 is perpendicular to the rotational center, the three-point diaphragm 10 is compressed, and when the rolling plate 9 is inclined from the rotational center, the three-point diaphragm 10 is decompressed.

[0018] As the internal volume of the three-point diaphragm 10 decreases, the inside air pushes an exhaust valve 15 through exhaust passages 14 formed at a side of the insertion wall of the guide ring 12 and is then exhausted out of an exhaust port 17 through an exhaust hole 16. In contrast, as the internal volume increases, the air that flows through an intake port 18 formed at the cover 5 flows along grooves 19 formed on the upper surface of the air port 4 into the three-point diaphragm 10 through the intake valves 11.

[0019] The three-point diaphragm 10, the intake valves 11, and the exhaust valve 15 are formed of a flexible material, such that they can be easily deformed by external force, and the three-point diaphragm 10 and exhaust valve 15 are integrally formed.

[0020] The guide ring 12 is fixed in an insert groove 21 formed on the bottom of the air port 4 such that the exhaust passage 14 formed through the insertion wall faces the exhaust hole 16 and contacts the exhaust valve 15 extending from the three-point diaphragm 10 to the outside of the exhaust passage 14. Therefore, the exhaust valve 15 is closed by contacting the exhaust passage 14 in the intake process and pushed by the pressure of air in the exhaust process to exhaust the air.

[0021] Further, the guide ring 12 prevents the outer wall of the three-point diaphragm 10 from deforming inside by negative pressure in the intake process by strongly pressing the outside of the three-point diaphragm 10 against the wall of the diaphragm guide 3.

[0022] Further, a boss 20 that contacts to the center of the rolling plate 9 that eccentrically shakes under the diaphragm guide 3 is provided; therefore, it is possible to prevent the rolling plate from being sucked up in the intake process of the three-point diaphragm 10.

[0023] As described above, according to the embodiment of the invention, three cycles of pumping is possible for every two rotations of the motor 1; therefore, it is possible to effectively form a vacuum from a compact configuration.

[0024] As described above, the present invention provides a vacuum pump equipped with a diaphragm that is manufactured at low cost and effectively operates in a compact size.

an inclined pin 13 that is radially spaced at a predetermined distance from the rotational center of a motor 1 and turns around the rotational center;

a rolling plate 9 that is connected with the inclined pin and eccentrically shakes up and down; and

a three-point diaphragm 10 that is combined with the rolling plate and disposed between a diaphragm guide 3 and an air port 4,

characterized in that vacuum pumping is applied by repeating intake and exhaust processes according to changes in the internal volume of the three-point diaphragm 10.

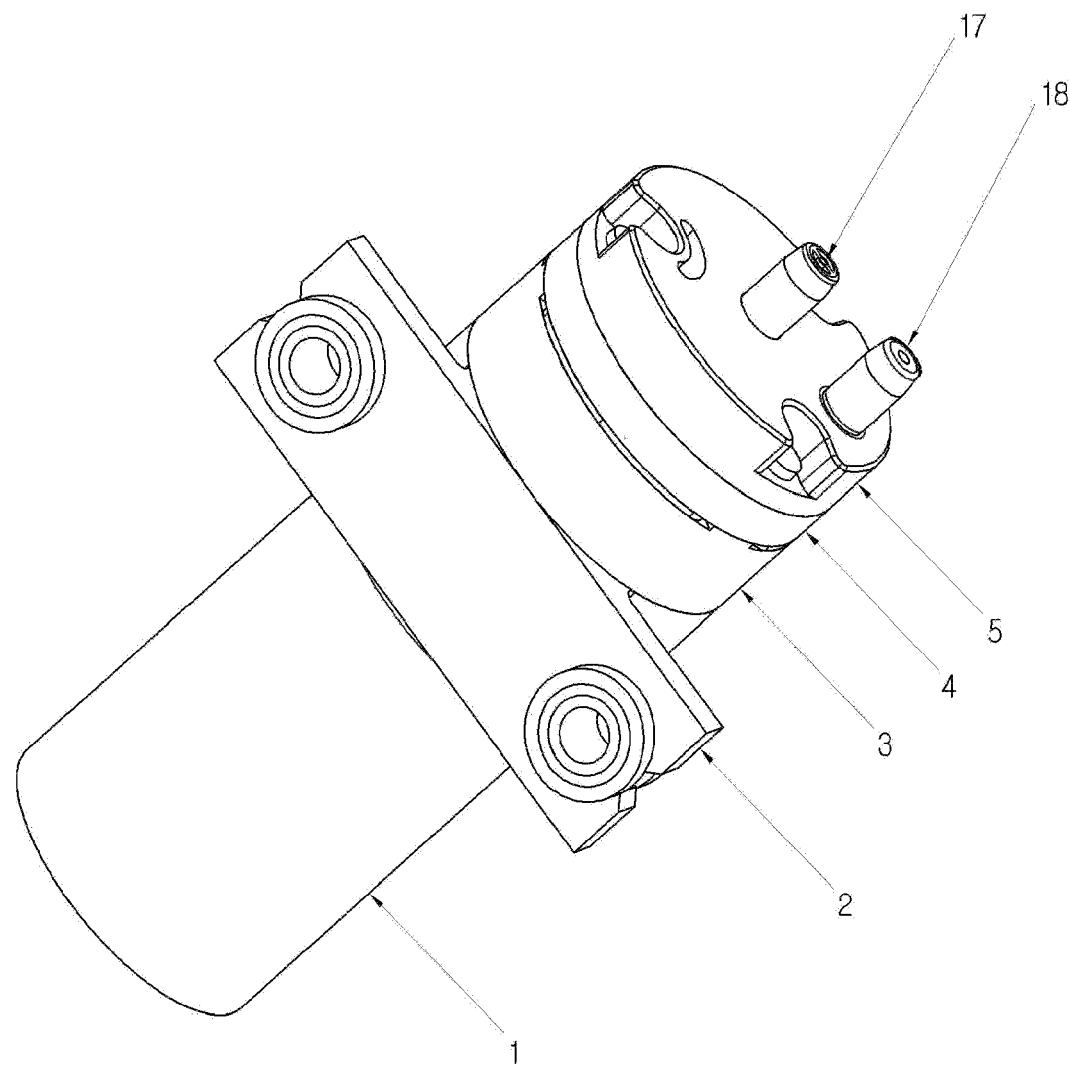
2. The diaphragm type vacuum pump of claim 1, **characterized in that** a boss 20 that protrudes from the center of the diaphragm guide 3 contacts the center of shaking of the rolling plate 9.

3. The diaphragm type vacuum pump of claim 1, **characterized in that** the outside of the three-point diaphragm 10 is in close contact to the wall of the diaphragm guide 3 by guide rings 12 that are inserted in the air port 4.

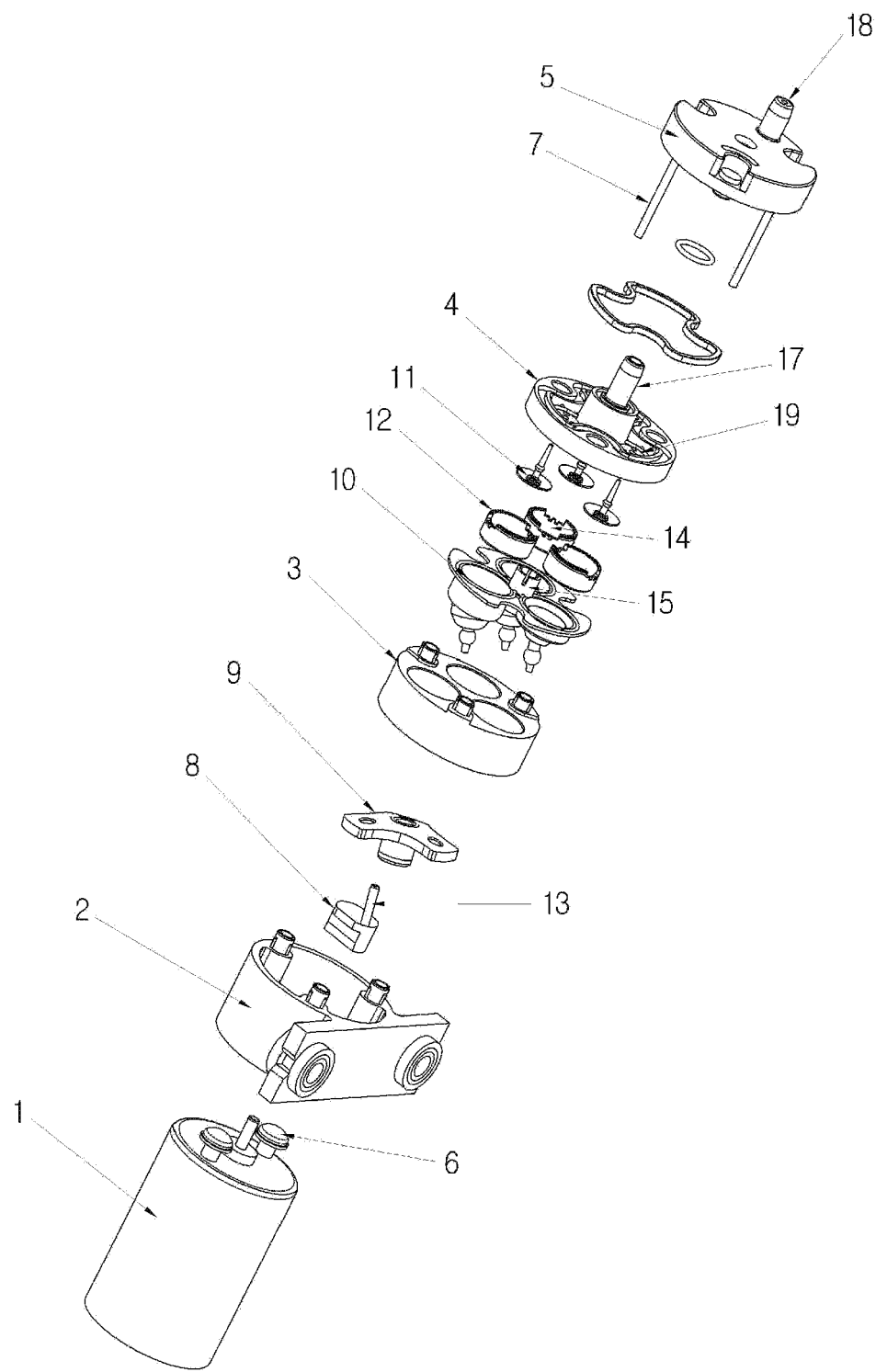
Claims

1. A diaphragm type vacuum pump comprising:

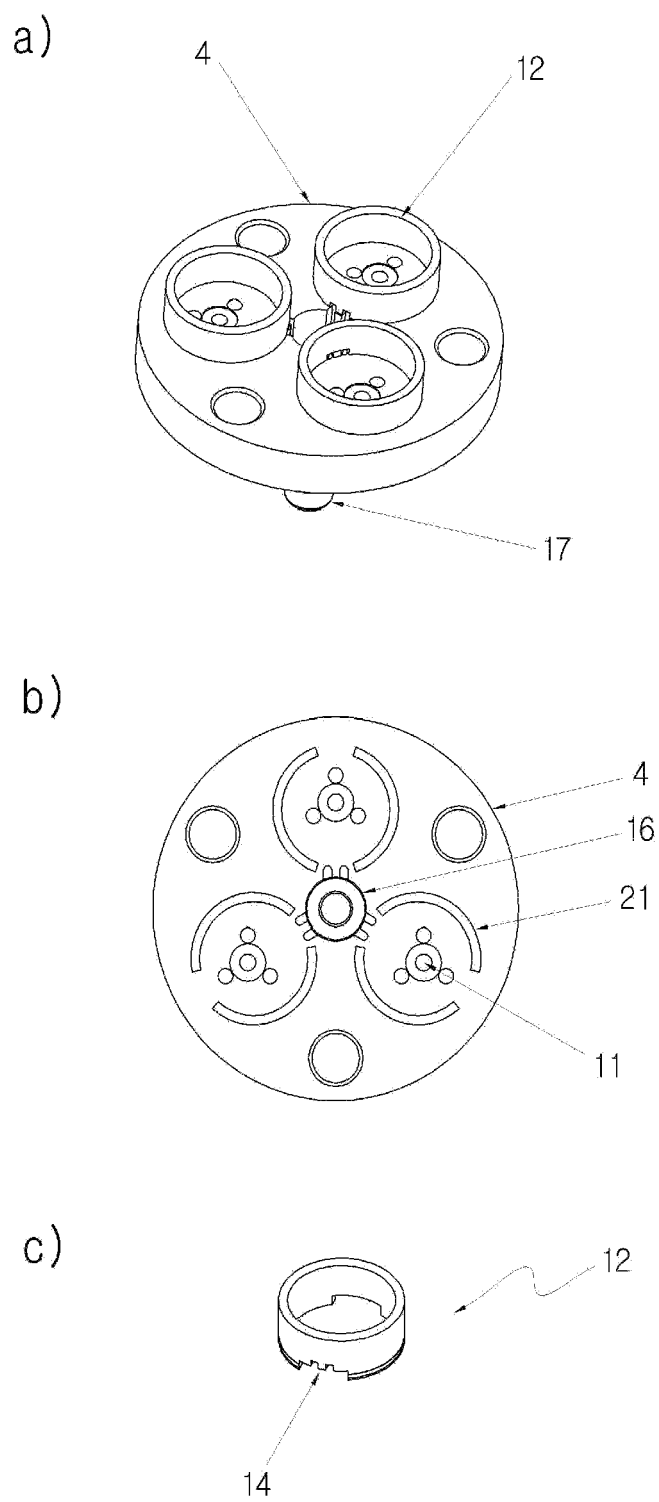
[FIG. 1]



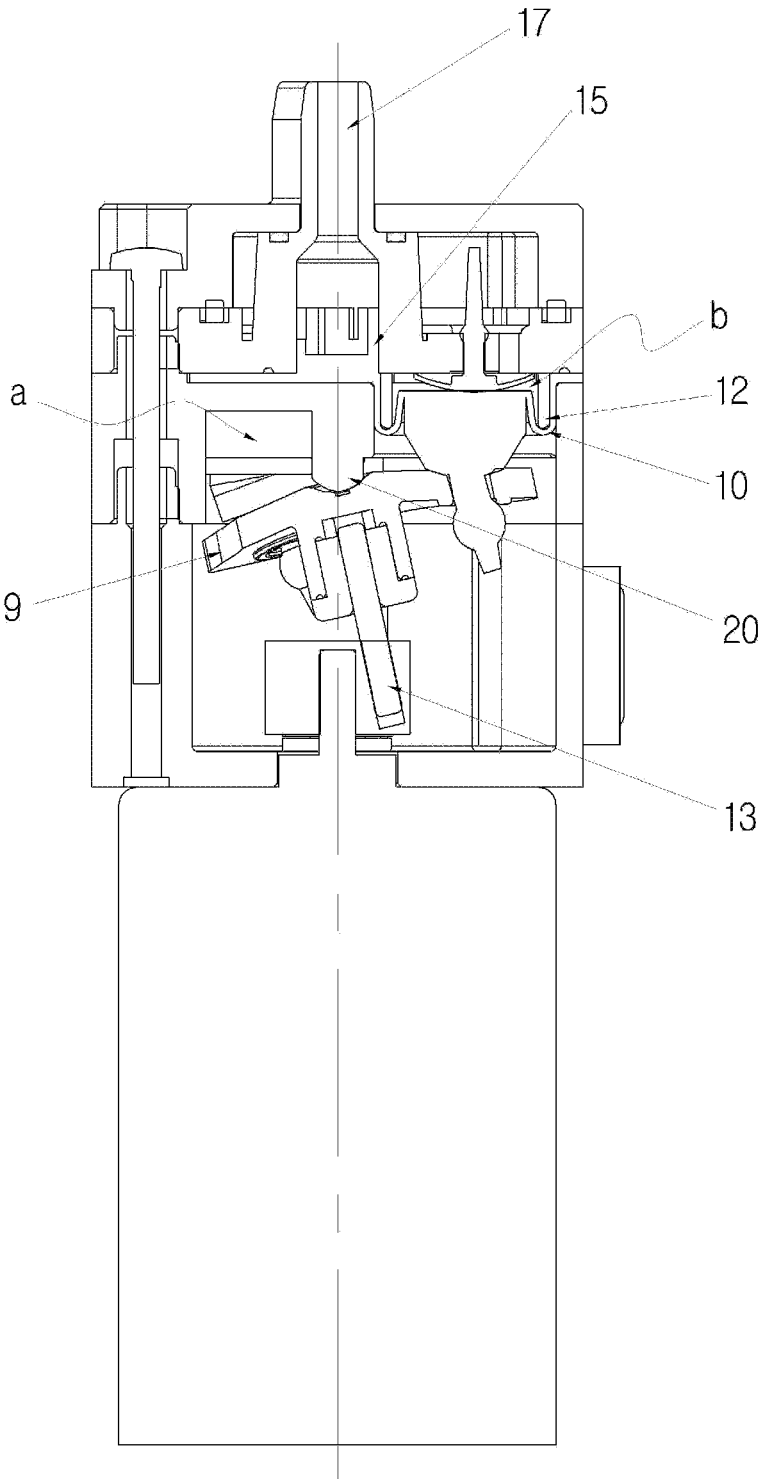
[FIG. 2]



[FIG. 3]



[FIG. 4]





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 07 11 6000

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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 29 November 2007	Examiner Gnächtel, Frank
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			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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