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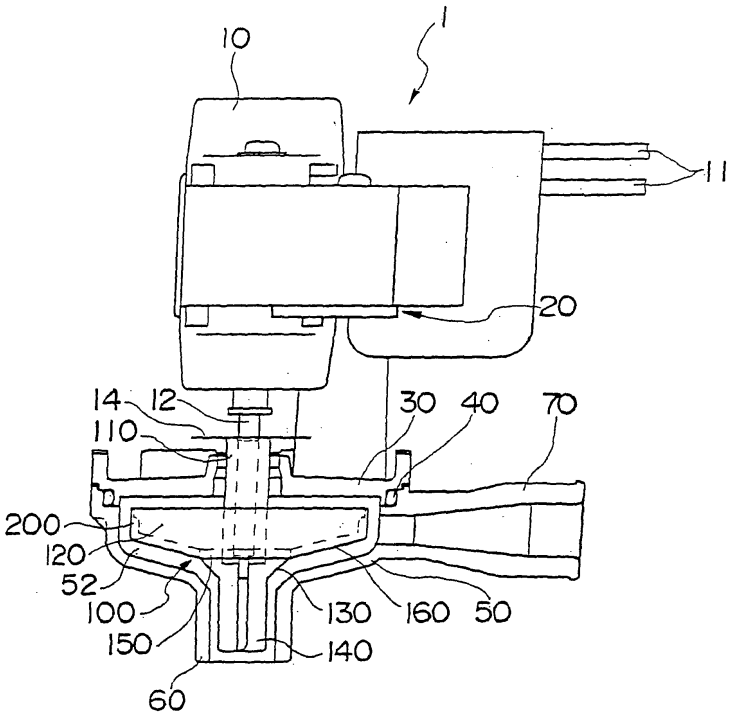
(54) Drainage pump

(57) The invention aims at reducing the paddling noise of a drainage pump provided in an air conditioner. A rotary vane 100 has a shaft portion 110 with a hole having a bottom portion, and in the hole is inserted an output shaft 12 of the electric motor 10. A plate-shaped large-diameter vane 120 that extends in the radial direction from the shaft portion 110 has an outer circumference end connected to a cylindrical ring member 200. According to a preferred embodiment of the rotary vane 100, an upper end of the ring member is formed as a thin wall portion which is connected via a connecting portion to a dish-like member 160.

FIG. 1



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Description

BACKGROUND OF THE INVENTION

Field of the invention

[0001] The present invention relates to a drainage pump, especially a drainage pump provided in an air conditioner.

Description of the related art

[0002] During cooling operation of an indoor unit of an air conditioner, the moisture in the air is condensed on a heat exchanger and drops down into a drain pan disposed under the heat exchanger. A drainage pump is used to discharge the drain water collected in the drain pan. The drainage pump comprises a pump main body or housing having a suction inlet at the bottom, an opened upper portion and a discharge outlet at the side, which houses a vane disposed rotatably therein, and the vane is rotated by a motor fixed to the upper portion of the housing opening via a cover. The drive shaft of the motor passes rotatably through a through hole formed to the cover and connected to a shaft portion of the vane, so that when the motor is driven to rotate the vane, the drain water collected in the drain pan is sucked in through the lower end of the vane in the suction inlet, pumped up by centrifugal force along the inner surface of the housing and discharged to the exterior through the discharge outlet of the casing.

[0003] This type of drainage pump is disclosed for example in Japanese Patent Application Laid-Open No. 2000-213770 (patent document 1) filed by the present applicant.

[0004] The operation noise of the indoor unit is required to be as small as possible.

SUMMARY OF THE INVENTION

[0005] The present invention aims at providing a drainage pump having a reduced operation sound.

[0006] The drainage pump according to the present invention comprises, as basic means, a motor; a rotary vane connected to an output shaft of the motor; a housing for the rotary vane, the housing having a suction inlet to which a small-diameter vane of the rotary vane is inserted, and a discharge outlet disposed on a side of the pump chamber; wherein the rotary vane comprises a shaft portion connected to the output shaft of the motor, a plate-shaped large-diameter vane extending in the radial direction from the shaft portion, a plate-shaped small-diameter vane connected to the large-diameter vane via a tapered connecting portion, a ring member connected to an outer circumference portion of the large-diameter vane, andadish-like member connected to the lower end of the ring member; and the ring member has a thin wall portion formed to an upper end portion thereof.

[0007] The present invention having the above arrangement is capable of reducing the water paddling noise of the drainage pump.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008]

FIG. 1 is an explanatory view of a drainage pump according to the present invention;
FIG. 2 is an explanatory view of a rotary vane;
FIG. 3 is an explanatory view illustrating examples of cross-sectional shapes taken at line A-A of FIG. 2;
FIG. 4 is an explanatory view illustrating examples of cross-sectional shapes taken at line A-A of FIG. 2;
FIG. 5 is an explanatory view illustrating examples of cross-sectional shapes taken at line A-A of FIG. 2; and
FIG. 6 is an explanatory view illustrating examples of cross-sectional shapes taken at line A-A of FIG. 2.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0009] FIG. 1 is an explanatory view of a drainage pump to which the present invention is applied.

[0010] A drainage pump, the whole of which being denoted by reference number 1, comprises an electric motor 10, and power to the electric motor 10 is fed via a lead wire 11. The electric motor 10 is supported by a bracket 20, and the lower end of the bracket 20 is connected to a lid member 30 mounted on an upper portion of a pump housing (pump main body) 50.

[0011] The housing 50 is formed of plastic, and inside the housing is defined a pump chamber 52. A suction inlet 60 and a discharge outlet 70 communicated with the pump chamber 52 are formed integrally with the housing 50.

[0012] A rotary vane 100 is disposed inside the pump chamber 52, and the opening of the pump chamber 52 is covered with the lid member 30. A seal member 40 is inserted between the housing 50 and the lid member 30, preventing leakage of drain water from the pump chamber.

[0013] FIG. 2 is an explanatory view showing the details of the rotary vane 100.

[0014] The rotary vane 100 has a shaft portion 110 with a hole having a bottom portion, and in the hole is inserted an output shaft 12 of the electricmotor 10. Aplate-shaped large-diameter vane 120 extending in the radial direction from the shaft portion 110 has its outer circumference end connected to a cylindrical ring member 200.

[0015] As shown in FIG. 1, the large-diameter vane 120 is connected via a tapered connecting portion 130 to a small-diameter vane 140.

[0016] According to the present embodiment, the drainage pump is equipped with four large-diameter

vanes 120 and small-diameter vanes 140.

[0017] The lower end of the large-diameter vane 120 is connected to a dish-like member 160. An opening 150 is formed to the center area of the dish-like member 160, and the drainage water entering from the suction inlet is sent via the small-diameter vane 140 and the connecting portion 130 toward the large-diameter vane 120.

[0018] Four auxiliary large-diameter vanes 122 are provided inside the ringmember 200. The inner circumference end of the auxiliary large-diameter vane 122 extends close to the outer edge of the opening 150 of the dish-like member 160.

[0019] FIGS. 3 through 6 illustrate various examples of the shape of the ring member 200 of the rotary vane according to the present invention, which are shown by cross-sectional views taken at line A-A of FIG. 2.

FIG. 3(a) illustrates an example in which the upper end of the ring member 200 is formed as a thin wall portion 201, which is connected via a protruded curved wall 201a to the dish-like member 160. By adopting a ring member having such cross-sectional shape, water paddling noise can be reduced.

FIG. 3(b) illustrates an example in which the upper end of the ring member 200 is formed as a thin wall portion 202, which is connected via a step portion 202a to the dish-like member 160.

FIG. 3(c) illustrates an example in which the upper end portion of the ring member 200 is formed as a thin wall portion 203, which is connected via a chamfered portion 203a to the dish-like member 160.

FIG. 3(d) illustrates an example in which the upper end portion of the ring member 200 is formed as a thin wall portion 204, which is connected via a tapered portion 204a to the dish-like member 160.

FIG. 3(e) illustrates an example in which the outer circumference of the upper end portion of the ring member 200 is cut away to form a thin wall portion 205, which is connected via a protruded curved wall 205a to the dish-like member 160.

[0020] Cutting away the wall thickness of the outer circumference of the upper end portion to form the thin wall portion can be applied to all other examples described above.

FIG. 4(a) illustrates an example in which the upper end portion of the ring member 200 is formed as a thin wall portion 211, which is connected via a tapered portion 211a to the dish-like member 160. By adopting a ring member having such cross-sectional shape, water paddling noise can be reduced.

FIG. 4(b) illustrates an example in which the upper end portion of the ring member 200 is formed as a thin wall portion 212 having a height lower than the height of the large-diameter vane, which is connected via a protruded curved wall 212a to the dish-like member 160.

FIG. 4(c) illustrates an example in which the upper end portion of the ring member 200 is formed as a thin wall portion 213, which is connected via a stepped and tapered portion 213a to the dish-like member 160.

FIG. 4(d) illustrates an example in which the upper end portion of the ring member 200 is formed as a thin wall portion 214, which is connected via a protruded curved wall 214a to the dish-like member 160.

FIG. 4(e) illustrates an example in which the outer circumference wall of the upper end portion of the ring member
200 is cut away to form a thin wall portion 215, which is connected via a tapered portion 215a to the dish-like member 160.

[0021] Cutting away the wall thickness of the outer circumference of the upper end portion to form the thin wall portion can be applied to all other examples described above.

FIG. 5(a) illustrates an example in which the upper end portion of the ring member 200 is formed as a thin wall portion 221, which is connected via a tapered portion 221a to the dish-like member 160. By adopting a ring member having such cross-sectional shape, water paddling noise can be reduced.

FIG. 5(b) illustrates an example in which the upper end portion of the ring member 200 is formed as a thin wall portion 222, which is connected via a recessed curved wall 222a to the dish-like member 160.

FIG. 5(c) illustrates an example in which the upper end portion of the ring member 200 is formed as a thin wall portion 223, which is connected via a tapered portion 223a to the dish-like member 160.

FIG. 5(d) illustrates an example in which the upper end portion of the ring member 200 is formed as an upward tapered thin wall portion 224, which is connected via a protruded curved wall 224a to the dish-like member 160.

FIG. 5(e) illustrates an example in which the outer circumference wall of the upper end portion of the ring member 200 is cut away to form a thin wall portion 225, which is connected via a tapered portion 225a to the dish-like member 160.

[0022] Cutting away the wall thickness of the outer circumference of the upper end portion to form the thin wall portion can be applied to all other examples described above.

FIG. 6(a) illustrates an example in which the upper end portion of the ring member 200 is formed as an upward tapered thin wall portion 231, which is connected via a protruded curved wall 231a to the dish-like member 160. By adopting a ring member having such cross-sectional shape, water paddling

noise can be reduced.

FIG. 6(b) illustrates an example in which the upper end portion of the ring member 200 is formed as an upward tapered thin wall portion 232, which is connected via a protruded curved wall 232a to the dish-like member 160.

FIG. 6(c) illustrates an example in which the upper end portion of the ring member 200 is formed as a thin wall portion 233 with an inner curved surface, which is connected via a protruded curved wall 233a to the dish-like member 160.

FIG. 6(d) illustrates an example in which the upper end portion of the ring member 200 is formed as a thin wall portion 234 with an outer curved surface, which is connected via a protruded curved wall 234a to the dish-like member 160.

FIG. 6(e) illustrates an example in which the outer circumference wall of the upper end portion of the ring member 200 is cut away to form a thin wall portion 235, which is connected via a protruded curved wall 235a to the dish-like member 160.

[0023] Cutting away the wall thickness of the outer circumference of the upper end portion to form the thin wall portion can be applied to all other examples described above.

[0024] By adopting the above-illustrated design to the ring member of the rotary vane, the water paddling noise of the drainage pump can be reduced.

Claims

1. A drainage pump comprising:

a motor;
a rotary vane connected to an output shaft of the motor;
a housing for the rotary vane, the housing having a suction inlet to which a small-diameter vane of the rotary vane is inserted, and a discharge outlet disposed on a side of the pump chamber; wherein
the rotary vane comprises a shaft portion connected to the output shaft of the motor, a plate-shaped large-diameter vane extending in the radial direction from the shaft portion, a plate-shaped small-diameter vane connected to the large-diameter vane via a tapered connecting portion, a ring member connected to an outer circumference portion of the large-diameter vane, and a dish-like member connected to the lower end of the ring member; and
the ring member has a thin wall portion formed to an upper end portion thereof.

2. The drainage pump according to claim 1, further comprising a tapered portion connecting the thin wall portion and the dish-like member.

3. The drainage pump according to claim 1, further comprising a stepped portion connecting the thin wall portion and the dish-like member.

4. The drainage pump according to claim 1, further comprising a chamfered portion connecting the thin wall portion and the dish-like member.

5. The drainage pump according to claim 1, further comprising a protruded curved wall connecting the thin wall portion and the dish-like member.

6. The drainage pump according to claim 1, further comprising a recessed curved wall connecting the thin wall portion and the dish-like member.

FIG. 1

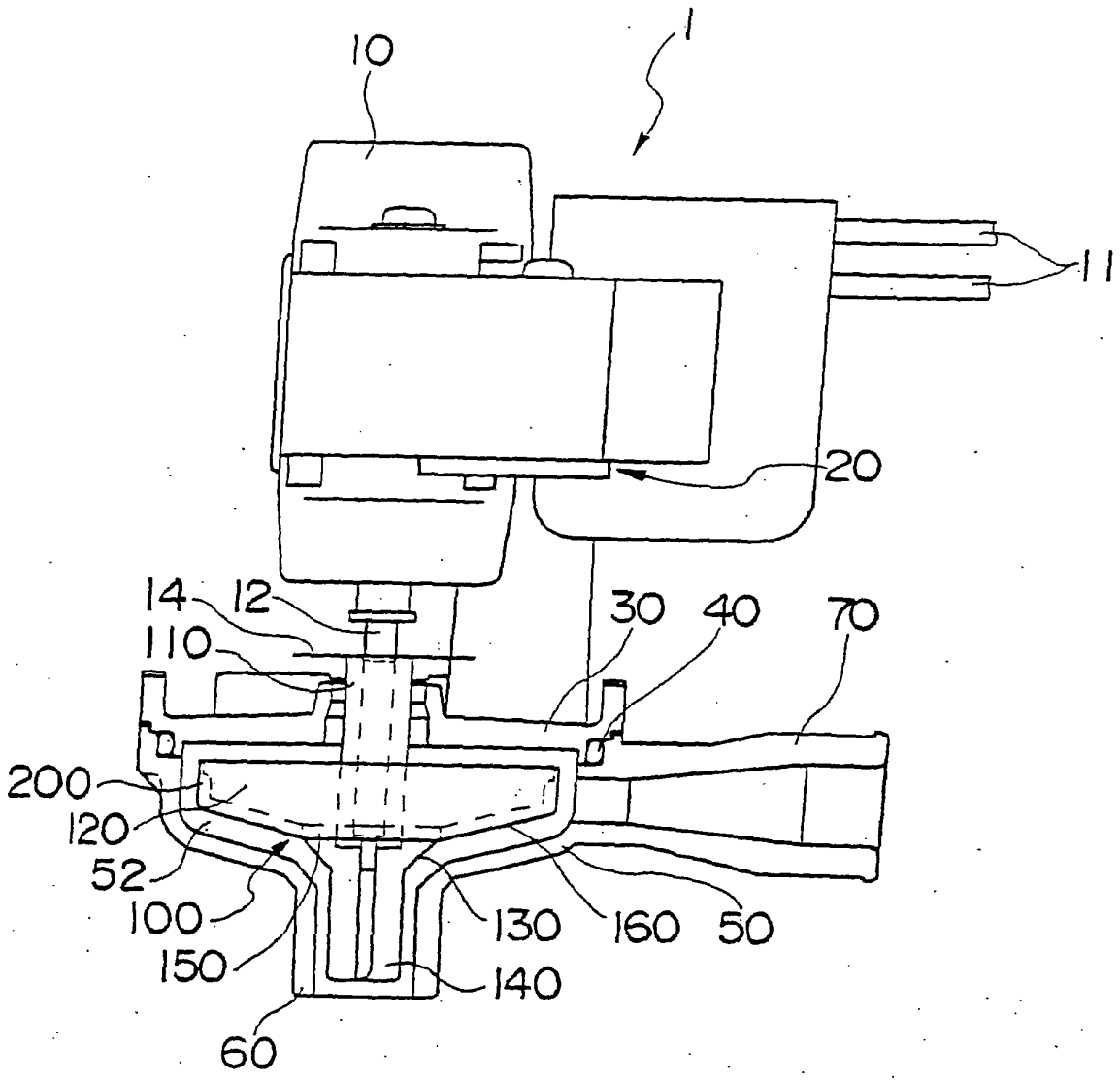


FIG. 2A

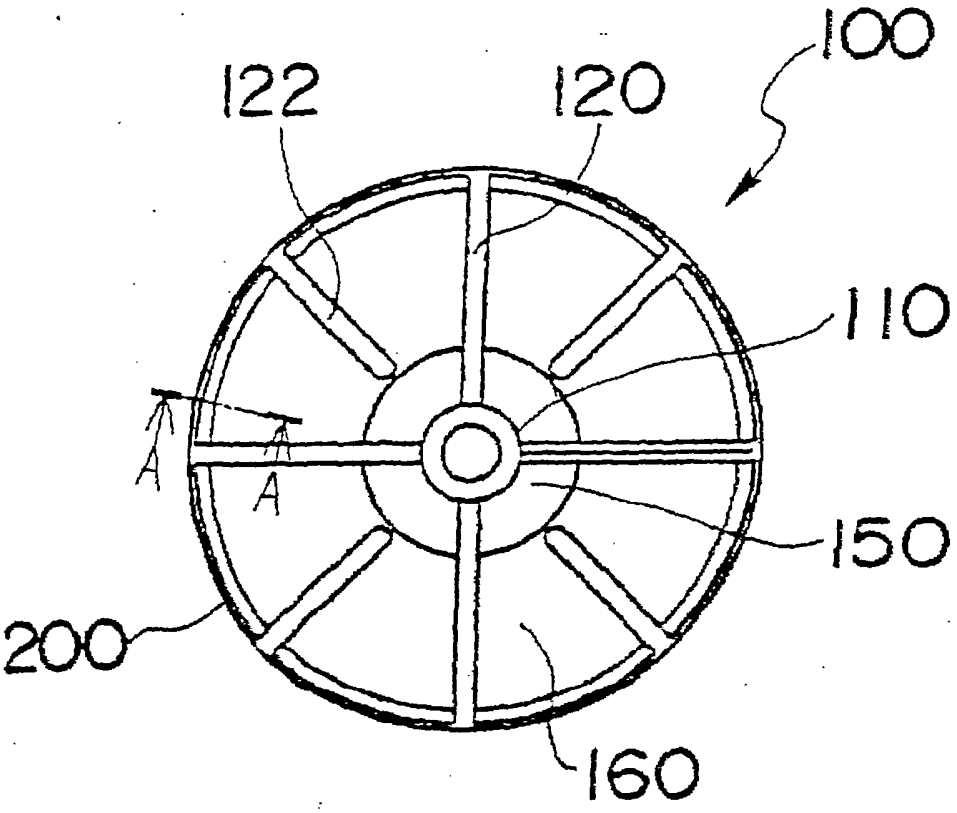
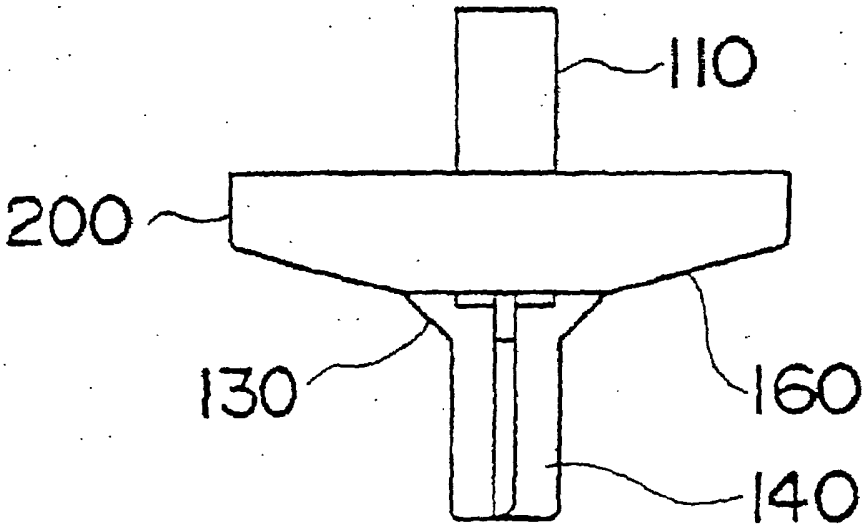


FIG. 2B



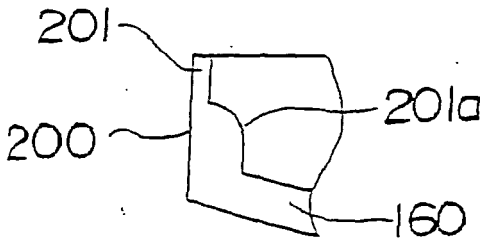


FIG. 3A

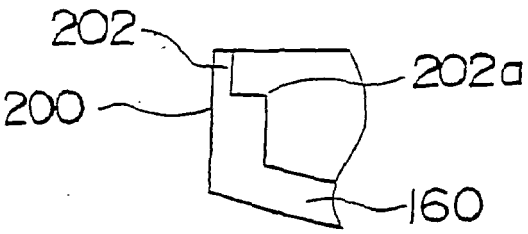


FIG. 3B

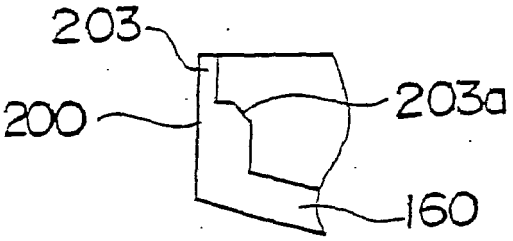


FIG. 3C

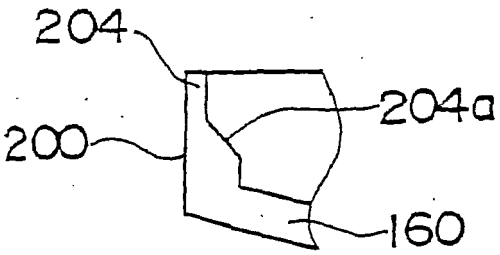


FIG. 3D

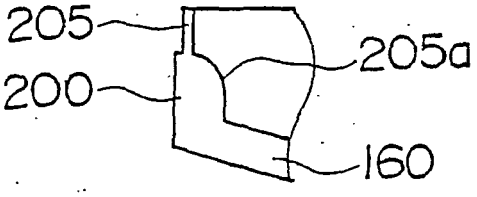


FIG. 3E

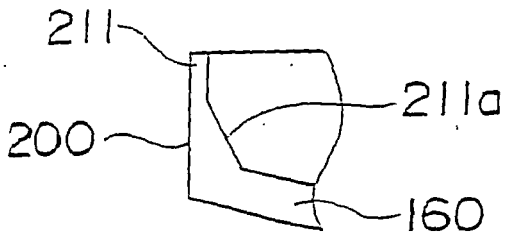


FIG. 4A

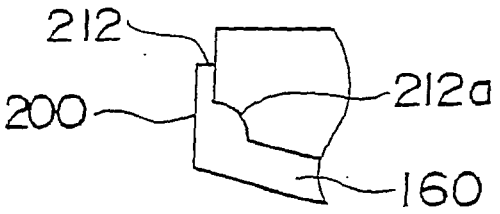


FIG. 4B

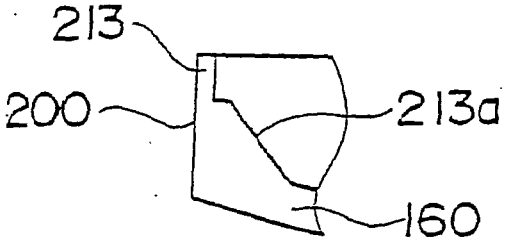


FIG. 4C

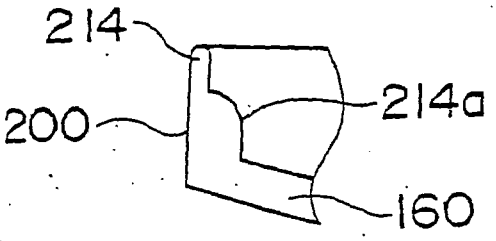


FIG. 4D

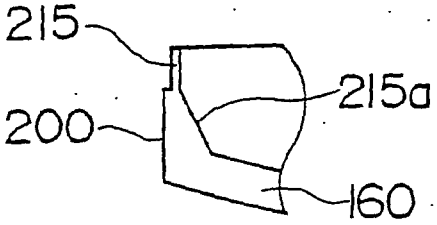


FIG. 4E

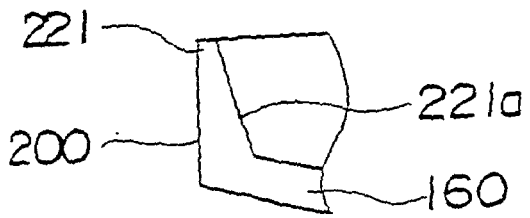


FIG. 5A

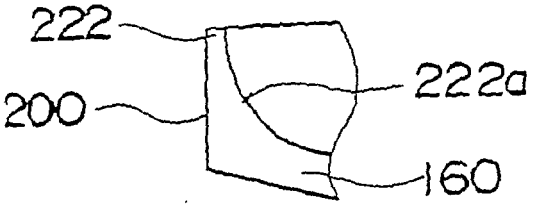


FIG. 5B

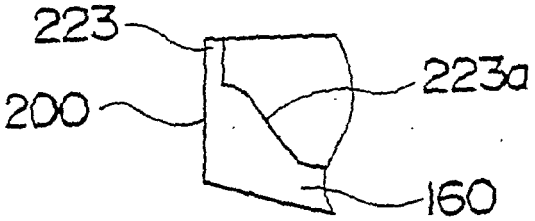


FIG. 5C

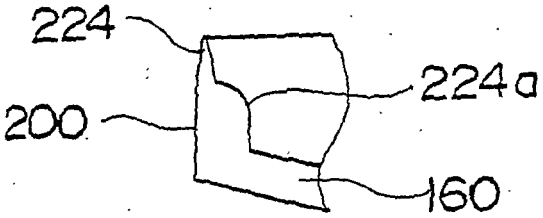


FIG. 5D

FIG.5E

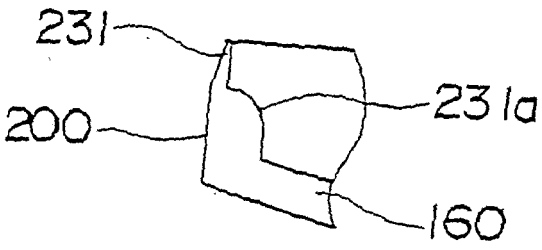


FIG. 6A

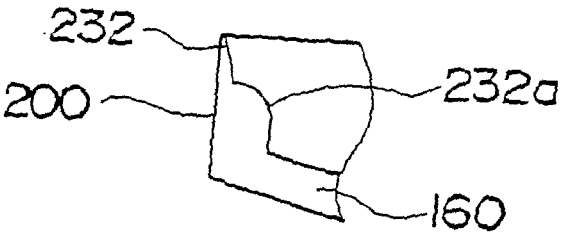


FIG. 6B

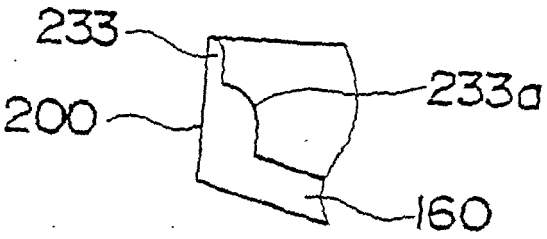


FIG. 6C

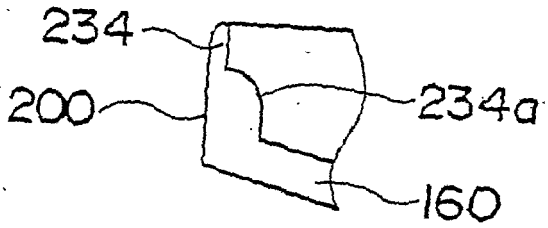


FIG. 6D

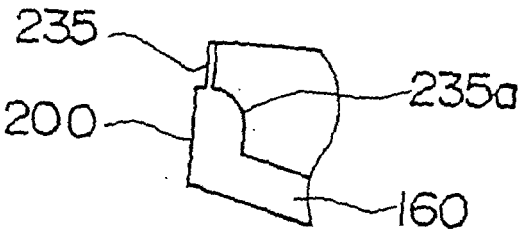


FIG. 6E

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 05 01 3455

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X	EP 0 760 428 A (FUJIKOKI CORPORATION) 5 March 1997 (1997-03-05) * column 2, lines 33-40 * * column 3, lines 19-46 * * figures 1,3-5 *	1,2,6	F04D29/24 F04D29/22 F04D29/66
X	EP 1 024 297 A (FUJIKOKI CORPORATION) 2 August 2000 (2000-08-02) * paragraph [0004] * * paragraph [0007] * * figures 1-3 *	1	
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A	WO 95/09984 A (SPIN CORPORATION) 13 April 1995 (1995-04-13) * the whole document *	1	
A	US 4 218 018 A (SEIBICKE, HORST ET AL) 19 August 1980 (1980-08-19) * the whole document *	1	TECHNICAL FIELDS SEARCHED (Int.Cl.7) F04D
A	US 4 836 748 A (CHURCH ET AL) 6 June 1989 (1989-06-06) * the whole document *	1	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	20 July 2005	Giorgini, G

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 05 01 3455

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EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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