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(54) Elastic insulation system for an electric motor for reducing vibration transmission

(57) Fan assembly (10) for air treatment systems for vehicles, comprising a support case (11) having a seat (14) in which an electric motor (32) bearing a fan (38) is housed. The support case (11) comprises a support base (12) and a cover (13) secured to the support base and provided with an opening (13a) through which a shaft (34) of the electric motor protrudes, wherein opposite ends of the electric motor bear against the bottom (20) of the seat within the support base (12) and against the cover (13), respectively, through first and second elastic insulation means (52, 54) arranged on the bottom (20) of said seat and on the cover (13), respectively, which are adapted to bias the electric motor axially, and to cause the electric motor to be radially centred with respect to the seat (14).

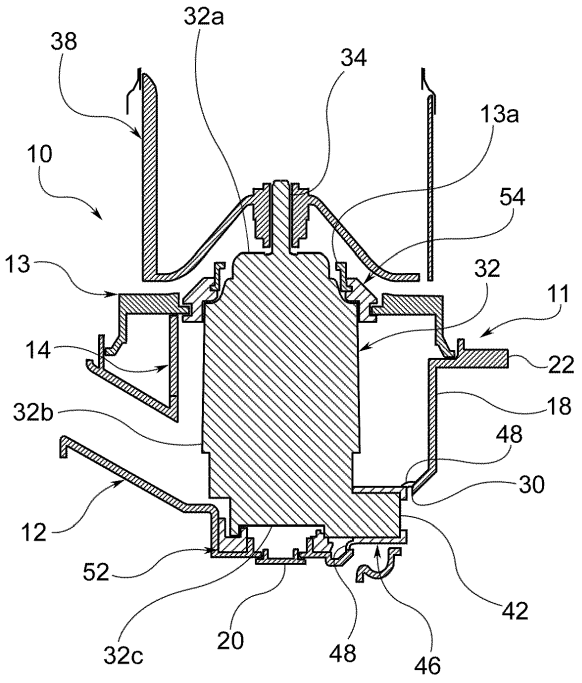

FIG. 5

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Description

[0001] The present invention relates to a fan assembly for air treatment systems for vehicles, comprising a support case having a seat in which an electric motor bearing a fan is housed.

[0002] An air treatment system for vehicles normally includes a variable-speed centrifugal fan generating a flow of air which is directed, after any necessary heating and/or cooling/dehumidifying, into the passenger compartment of the vehicle. The fan assembly of an air treatment system for vehicles is normally formed by a case of injection-moulded plastic material having a seat in which an electric motor bearing a centrifugal fan is mounted. The electric motor is connected to an electrical power source by a connector extending through an opening in the case.

[0003] A fan assembly of the type defined above is described in EP 1 516 756. This fan assembly comprises radial support elements of elastic material, overmoulded on the inner surface of the seat, together with securing elements which are also of elastic material, overmoulded on the bottom of the seat.

[0004] Although this solution has proved optimal in many respects, it has been found to be unable to filter certain specific vibration frequency bands, particularly when the motor rotates at low speed.

[0005] Additionally, the securing screws used to fasten the motor to the support case crush the securing elements on the bottom of the seat, thus introducing a degree of rigidity into the system.

[0006] Furthermore, in the course of assembly the radial support elements may be damaged by the sharp edges of the electric motor frame, which may cause some parts to be lost.

[0007] One object of the present invention is therefore to provide an improved fan assembly which can at least partially overcome the aforesaid drawbacks, and which can be assembled more simply and rapidly than the aforesaid prior art fan assembly.

[0008] This object is achieved according to the invention with a fan assembly of the type defined above, wherein the support case comprises a support base and a cover secured to the support base and provided with an opening through which a shaft of the electric motor protrudes, wherein opposite ends of the electric motor bear against the bottom of the seat within the support base and against the cover, respectively, through first and second elastic insulation means arranged on the bottom of the seat and on the cover, respectively, which are adapted to bias the electric motor axially, and to cause the electric motor to be radially centred with respect to the seat.

[0009] Preferred embodiments of the invention are defined in the dependent claims, which are to be considered as an integral part of the present description.

[0010] Further characteristics and advantages of the fan assembly according to the invention will be made clearer by the following detailed description of an embodiment of the invention, given with reference to the attached drawings which are provided purely as non-limiting illustrations, in which:

- Figures 1 and 2 are perspective views, from above and below respectively, of a fan assembly according to the invention;
- Figure 3 is an exploded view of the fan assembly of Figure 1;
- Figure 4 is a simplified perspective view of an electric motor of the assembly of Figure 1;
- Figures 5 and 6 are sectional views of the fan assembly, illustrating two different embodiments of the invention; and
- Figures 7 and 8 are simplified views in lateral elevation of the electric motor, illustrating two different embodiments of the invention.

[0011] With reference to the drawings, the number 10 indicates a fan assembly for air treatment systems for vehicles. The fan assembly 10 comprises a support case 11 made of injection-moulded plastic material. By way of example, the plastic material used for moulding the support case 11 can be polypropylene or a similar thermoplastic material. The plastic material forming the support case 11 can be mixed with fillers such as talc.

[0012] The support case 11 comprises a support base 12 and a cover 13 secured to this support base 12 and provided with an opening 13a. The cover 13 can be secured to the support base 11, for example by means of sprung snap-fitting elements (as in the example of Figures 1 to 3), or by means of screws.

[0013] The cover 13 can be provided with appendages and/or formations (not shown) for supporting and/or fastening it on an external structure (not shown), to ensure that any fracture of the means of securing to the base 12 does not compromise the operation of the system.

[0014] The support base 12 comprises a seat 14 having a cavity delimited by a lateral wall 18 and a bottom wall 20. The lateral wall 18 of the seat 14 is formed in one piece with a radial flange 22 having a securing portion 24, provided for fastening the case 11 to an external structure (not shown).

[0015] The seat 14 is provided with a through-opening 30 which preferably extends partially along the lateral wall 18 and partially along the bottom wall 20.

[0016] With reference to Figures 3 and 4, the fan assembly 10 comprises an electric motor 32 housed in the cavity 14 of the case 12. The electric motor 32 has a shaft 34 which is integral with the rotor (not shown) of the motor, and which protrudes through the opening 13a of the cover 13 and bears a centrifugal fan 38 at one of its ends.

[0017] In structural terms, the casing of the electric motor 32 comprises a coupling end section 32a, through which the shaft 34 protrudes, an intermediate frame section 32b, and a section 32c located opposite the coupling end. On the section 32c opposite the coupling end, there is arranged an electrical connector 42, adapted to interact

with a complementary connector (not shown) connected to an electrical power supply cable.

[0018] With reference to Figures 3 and 5, the electrical connector 42 extends with clearance through the through-opening of the seat 14. Around the outer surface of the connector 42 there is applied a sealing sheath 46 having a flange portion 48 which bears along the edge of the through-opening 30, on the inner side thereof, thus forming a seal to prevent the outflow of air through the space between the outer surface of the connector 42 and the edge of the opening 30.

[0019] With reference to Figures 5 and 6, when the cover 13 is closed onto the support base 12, the ends of the electric motor 32 bear against the bottom 20 of the seat 14 inside the support base 12 and against the cover 13, respectively, through first and second elastic insulation means 52, 54, arranged on the bottom 20 of the seat 14 and on the cover 13, respectively, which are adapted to bias the electric motor 32 axially, while interacting with each other to lock the motor axially, and to cause the electric motor to be centred radially with respect to the seat 14.

[0020] For this purpose, the first and second elastic insulation means 52, 54 engage with corresponding bearing or shoulder surfaces which are normally present on the casing of an electric motor. These surfaces can be located on the coupling end section 32a, on the intermediate frame section 32b, and/or on the section 32c opposite the coupling end. For example, Figures 7 and 8 show an electric motor 32 in which possible areas of engagement for the elastic insulation means 52, 54 are indicated by horizontal and vertical arrows. The dark vertical arrows represent the axial locking action, while the light horizontal arrows represent the radial centring action.

[0021] Figure 7 shows an area of engagement on the section 32c opposite the coupling end and on the corresponding electrical connector 42, and, on the opposite end, an area of engagement on the coupling end section 32a. Figure 8 shows areas of engagement on the opposite ends of the intermediate frame portion 32b.

[0022] Clearly, the actual areas of engagement may be formed by a combination of the locations illustrated above, or other locations which may be present on the electric motor casing, depending on constructional requirements.

[0023] Figure 5 shows an exemplary embodiment in which the first elastic insulation means 52 are interposed between the bottom 20 of the seat 14 and the section 32c opposite the coupling end of the electric motor 32, while the second elastic insulation means 54 are interposed between the cover 13 and the coupling end section of the intermediate frame section 32b of the electric motor.

[0024] Figure 6, in which elements corresponding to those of Figure 5 are indicated by the same reference numerals, shows another exemplary embodiment in which the first elastic insulation means 52 are interposed between the bottom 20 of the seat 14 and the end of the intermediate frame section 32b of the electric motor 32 opposite the coupling end, while the second elastic insulation means 54 are interposed between the cover 13, on the one hand, and the coupling end section 32a and the coupling end of the intermediate frame section 32b of the electric motor, on the other hand.

[0025] The first and second elastic insulation means 52, 54 are made of elastic material, such as thermoplastic rubber, in order to prevent the displacement of the electric motor and keep it in its correct position, while also preventing the transmission of vibrations to the case 11. In this way the acoustic and vibration performance of the fan assembly are improved.

[0026] Each of the first and second elastic insulation means 52, 54 can be formed by a single element, for example a ring- or cap-shaped element. If present, the sealing sheath 46 of the electrical connector 42 can be made in one piece with the first elastic insulation means 52, as in the example shown in Figure 5. Alternatively, each of the first and second elastic insulation means 52, 54 can be formed by a plurality of separate elements arranged circumferentially in corresponding seats on the bottom of the seat 14 and on the cover 13.

[0027] The first and second elastic insulation means 52, 54 can be formed by elements which are produced separately and are subsequently mounted on the bottom of the seat 14 and on the cover 13. Alternatively, the first and second elastic insulation means 52, 54 can be formed by overmoulding an elastomeric material on the plastic material forming the support base 12 and the cover 13.

[0028] The first and second elastic insulation means 52, 54 can also be shaped, or provided with reference formations, so as to allow them to be correctly angularly positioned with respect to the bottom of the seat 14 and the cover 13 during assembly, and/or to allow the electric motor to be correctly angularly positioned with respect to them.

[0029] The first and second elastic insulation means 52, 54 enable the separation between the motor and fan assembly and the casing 11 to be maintained in order to prevent the transmission of vibrations originating from the motor and fan assembly to the case and to the parts connected thereto, with the aim of reducing the noise generated by the fan assembly. These elements can also be used to secure the motor axially to the case without using additional securing elements, while maintaining an elastic connection which does not transmit vibrations. Additionally, the sealing sheath 46 allows mechanical decoupling to be provided between the case and the connector, in such a way that the connector is free to move together with the motor to which it is secured, without interfering with the case and without transmitting vibrations to the case.

[0030] Other positive results achieved with the invention are the improved cooling of the electric motor, due to the establishment of an air flow through the cover, and

the reduction of the direct noise from the motor, due to the enclosed configuration of the latter.

Claims

1. A fan assembly (10) for air treatment systems for vehicles, comprising a support case (11) having a seat (14) in which an electric motor (32) bearing a fan (38) is housed, **characterized in that** said support case (11) comprises a support base (12) and a cover (13) secured to said support base and provided with an opening (13a) through which a shaft (34) of the electric motor protrudes, wherein opposite ends of said electric motor bear against the bottom (20) of said seat within the support base (12) and against the cover (13), respectively, through first and second elastic insulation means (52, 54) arranged on the bottom (20) of said seat and on the cover (13), respectively, which are adapted to bias axially said electric motor, and to cause the electric motor to be radially centered with respect to the seat (14).

2. An assembly according to claim 1, wherein at least one of said first and second elastic insulation means (52, 54) is constituted by a single ring- or cap-shaped element of elastomeric material.

3. An assembly according to claim 1 or 2, wherein at least one of said first and second elastic insulation means (52, 54) is constituted by a plurality of separate elements of elastomeric material circumferentially arranged on the bottom (20) of the seat (14) or on the cover (13).

4. An assembly according to any of the preceding claims, wherein said first and second elastic insulation means (52, 54) are formed by overmolding an elastomeric material on said support base (12) and on said cover (13).

5. An assembly according to any of the preceding claims, wherein at least one of said first and second elastic insulation means (52, 54) is shaped for allowing it to be correctly placed in angular position with respect to the bottom of the seat (14) and to the cover (13) during assembly, and/or for allowing the electric motor (32) to be correctly placed in angular position with respect thereto.

6. An assembly according to any of the preceding claims, wherein said seat (14) is provided with a through-opening (30), and wherein an electric connector (42) is arranged on the electric motor (32) and extends with clearance through the through-opening (30) of the seat (14), a sealing sheath (46) being applied around the outer surface of the electric connector (42) and having a flange portion (48) bearing along the edge of the through-opening (30), on the inner side thereof.

7. An assembly according to claim 6, wherein said sealing sheath (46) is formed integrally with said first elastic insulation means (52).

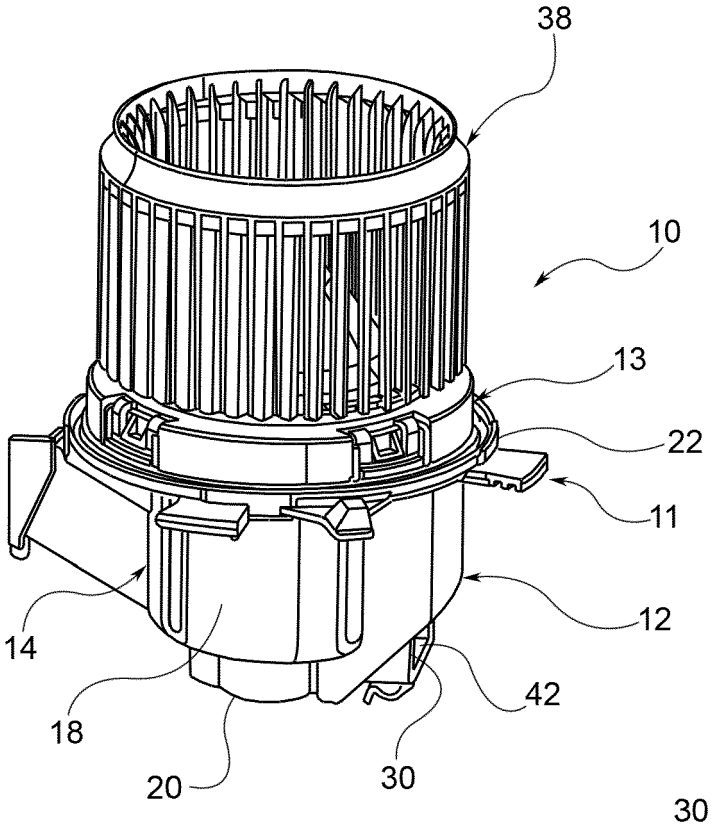


FIG. 1

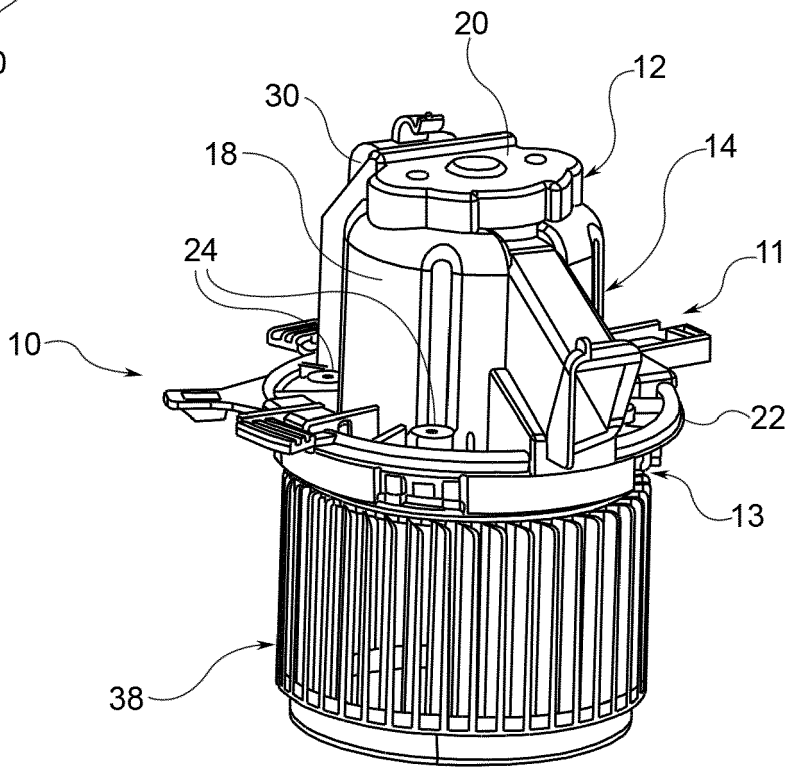


FIG. 2

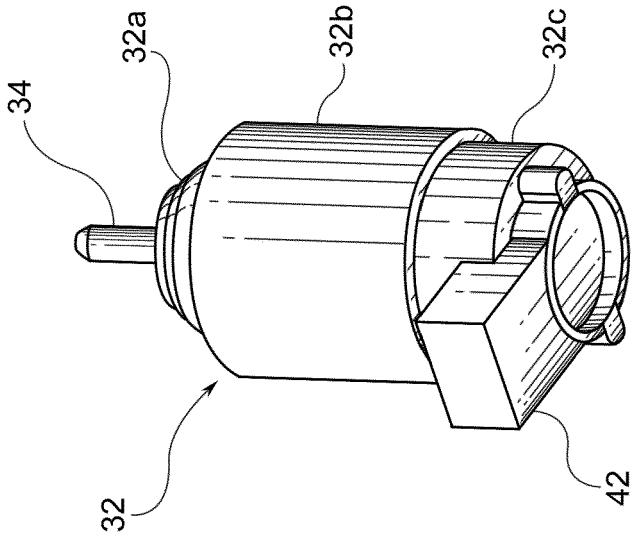

34
32a
32b
32c
32
42

FIG. 4

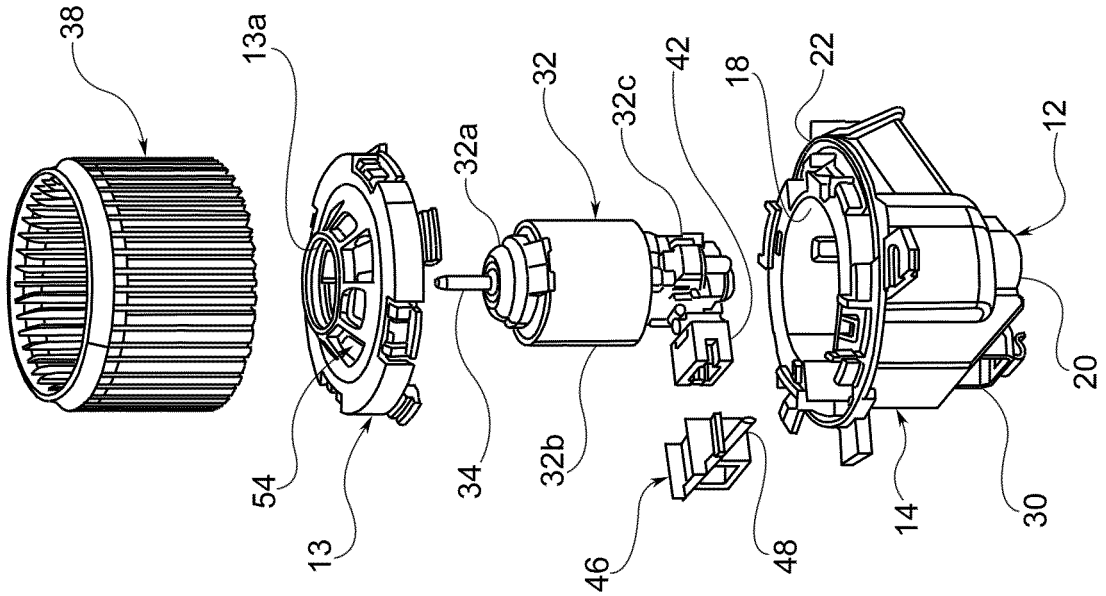

38
13a
54
13
32a
34
32
32b
32c
42
46
18
48
22
12
14
30
20

FIG. 3

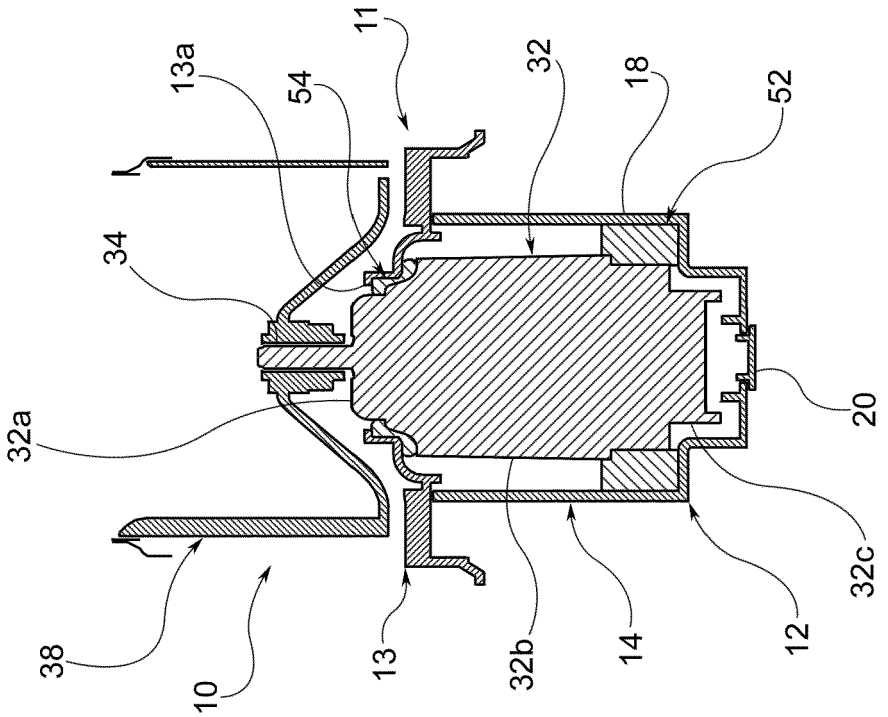
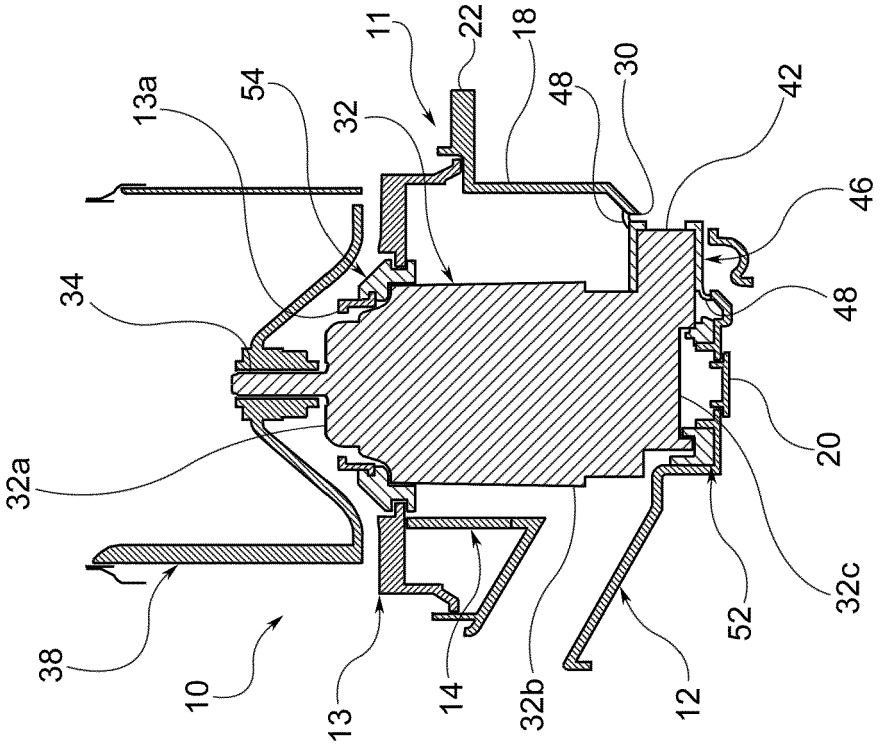

11
13a
54
32
18
52
34
32a
20
38
10
13
32b
14
12
32c

FIG. 6


11
22
18
13a
54
32
48
30
42
46
34
48
32a
20
38
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13
14
32b
12
52
32c

FIG. 5

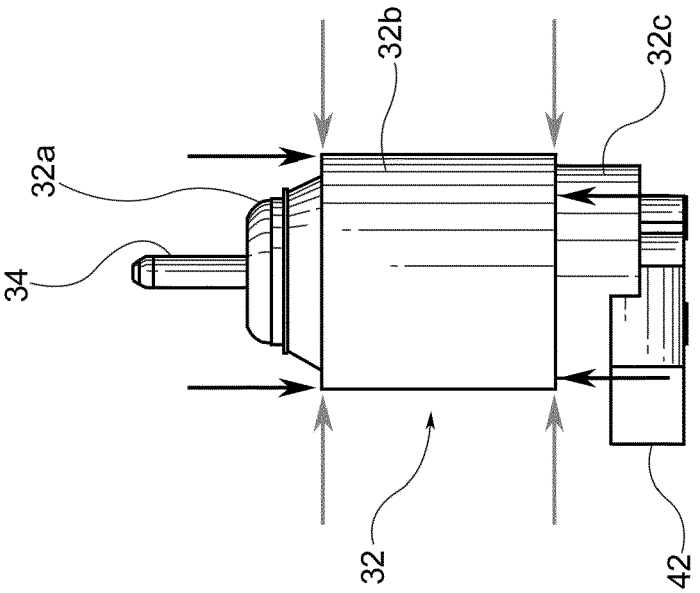

FIG. 8

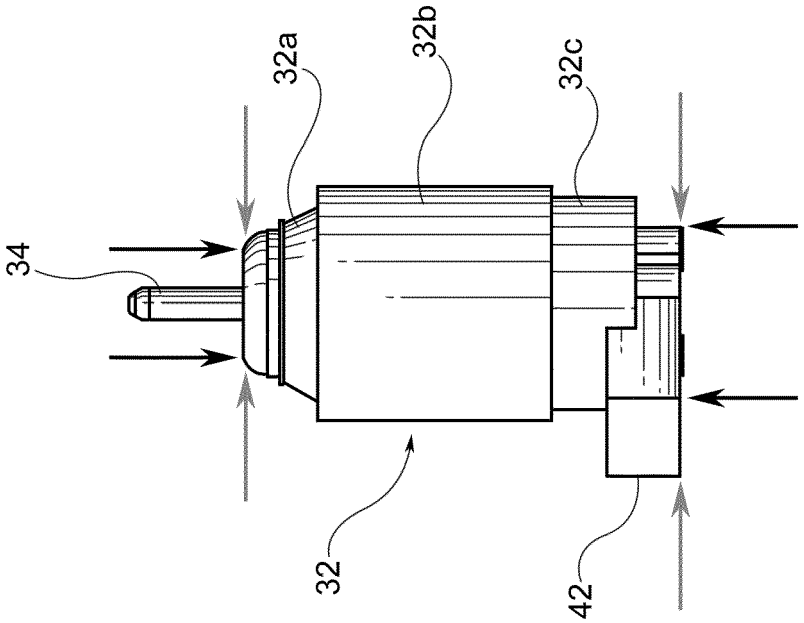

FIG. 7

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EUROPEAN SEARCH REPORT

Application Number
EP 12 15 7664

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 5 786 647 A (VOLLMER THOMAS [DE] ET AL) 28 July 1998 (1998-07-28) * column 1, lines 4-10 * * column 1, line 66 - column 4, line 44; figures 3,4,10-12,17,18 * -----	1-7	INV. F04D25/06 F04D29/42 F04D29/66 B60H1/00
X	DE 44 38 751 A1 (PIERBURG GMBH [DE]) 2 May 1996 (1996-05-02) * column 1, line 3 - column 2, line 46; figure 1 * -----	1-7	
X	EP 0 909 006 A2 (SIEMENS CANADA LTD [CA]) 14 April 1999 (1999-04-14) * paragraphs [0001], [0015] - [0017], [0022], [0032] - [0033]; figure 1 * -----	1-7	
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TECHNICAL FIELDS SEARCHED (IPC)

F04D
B60H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	4 April 2012	Homan, Peter

CATEGORY OF CITED DOCUMENTS

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REFERENCES CITED IN THE DESCRIPTION

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