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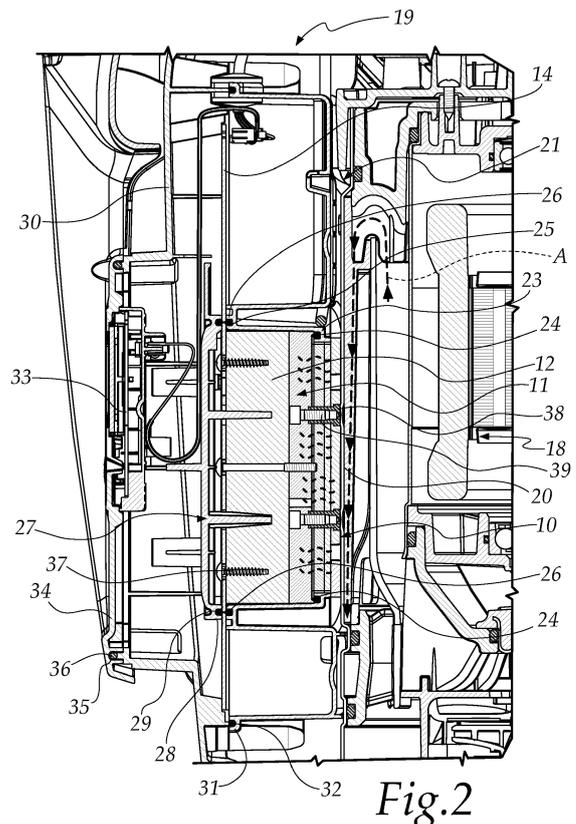
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(54) **ELECTRIC PUMP WITH INSULATION OF THE ELECTRONIC PART AND HEAT SINK ELEMENT FOR THE ELECTRONIC PART**

(57) An electric pump with insulation of the electronic part and a heat sink element for the electronic part. The electric pump comprises an electromechanical section in which there are at least one electric motor and at least one electronic part (19) which in turn comprises at least one electronic board (14) for the control at least of the electric motor. The electric pump comprises, in the electronic part (19), a heat sink element (10), installed between the electronic board (14) and the external wall of a box-like body (20) of the electric pump. The heat sink element (10) comprises a heat sink portion (11) made of metallic material in contact with the box-like body (20) and with the electronic components (13) of the electronic board (14) from which heat is to be removed, and a thermally insulating portion (12).



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Description

[0001] The present invention relates to an electric pump with insulation of the electronic part and to a heat sink element for said electronic part.

[0002] As is known, the feeding of a hydraulic system, such as for example an apartment block system, needs typically at least one electric pump to be connected with the intake and delivery to sections of said system.

[0003] The electric pump is a device which comprises:

- a mechanical section, which comprises an intake port and a delivery port and contains one or more impellers, interleaved by diffusers and keyed on a driving shaft adapted to rotate them to move the liquid,
- an electromechanical section, comprising an electronic part and an electric motor, for moving the driving shaft.

[0004] In turn, in many cases, the electronic part comprises an electronic board assembly, for the control of the pump, and a user interface board assembly.

[0005] Typically, during the design of the pump, forced paths are provided for the liquid being processed, so as to skim containment walls of components to be cooled, or proximate thereto, such as the motor and the electronic part.

[0006] The water is often forced to skim a part of the electronic board assembly.

[0007] In order to improve heat exchange, a heat sink element is installed, and the water is forced to skim the very region of the heat sink element.

[0008] Generally, these elements are double brass/aluminum heat sinks: the heat sink made of brass, due to the well-known heat conduction property of the material, is in contact on one side with the water and on the other side with the heat sink made of aluminum, which in turn is positioned on the electronic board assembly.

[0009] In electric pumps known to date, the thermal gradient detectable between the internal region and the external region of the compartment in which the electronic part is present, and the presence of air circulating in the compartment of said electronic part, cause the forming of condensation on the electronic board, compromising its operation over time.

[0010] Moreover, pumping devices are typically installed in environments such as the technical room, where, for example, the accidental rupture of a pipe can compromise its operation due to the passage of water to the electronic part.

[0011] Currently, therefore, the need is felt to limit the forming of condensation on the electronic board and at the same time to prevent the passage of water to the electronic part.

[0012] The aim of the present invention is to provide an electric pump with insulation of the electronic part and a heat sink element for such electronic part which are

capable of improving the background art in one or more of the aspects mentioned above.

[0013] Within this aim, an object of the invention is to provide an electric pump with improved insulation of the electronic part.

[0014] Another object of the invention is to provide an electric pump with contained space occupation in the arrangement of the electronic board assembly, while making it easy for the user to use the control panel, therefore facilitating access to the user interface part.

[0015] A further object of the present invention is to provide an electric pump that overcomes the drawbacks of the background art in a manner that is alternative to any existing solutions.

[0016] Another object of the invention is to provide an electric pump that is highly reliable, relatively easy to provide and has competitive costs.

[0017] This aim and these and other objects which will become more apparent hereinafter are achieved by an

electric pump with insulation of the electronic part, comprising an electromechanical section in which there is at least one electric motor and at least one electronic part which in turn comprises at least one electronic board for the control at least of said electric motor, said electric pump comprising, in said electronic part, a heat sink element, installed between said electronic board and the external wall of a box-like body of said electric pump, said box-like body being skimmed, on its internal part, by liquid being processed,

said electric pump being characterized in that said heat sink element comprises a heat sink portion made of metallic material in contact with said box-like body and with the electronic components of said electronic board from which heat is to be removed, and a thermally insulating portion.

[0018] This aim and these and other objects which will become more apparent hereinafter are also achieved by a heat sink element for the electronic part of an electric pump, characterized in that it comprises a heat sink portion made of metallic material and a thermally insulating portion.

[0019] Further characteristics and advantages of the invention will become more apparent from the description of a preferred but not exclusive embodiment of the electric pump according to the invention and of the heat sink element according to the invention, illustrated by way of non-limiting example in the accompanying drawings, wherein:

- Figure 1 is a perspective view of the heat sink element according to the invention;
- Figure 2 is a sectional view of the electronic part of the electric pump according to the invention;
- Figure 3 is a view of a portion of the electronic part of the electric pump according to the invention.

[0020] With reference to the figures, the heat sink element according to the invention is generally designated

by the reference numeral 10. It can be installed at an electronic part of an electric pump, in order to dissipate at least part of its heat.

[0021] The heat sink element 10 comprises a heat sink portion 11, made of metallic material to be placed in contact with electronic components 13 of an electronic board 14 from which heat is to be removed, and a thermally insulating portion 12.

[0022] In particular, the heat sink portion 11 is made preferably of aluminum, while the thermally insulating portion 12 is made of plastic material, preferably nylon.

[0023] The electronic board 14 and the electronic components 13 to be cooled are visible and indicated in Figure 3.

[0024] The heat sink element 10 has a substantially block-like shape, in which the heat sink portion 11 is provided with a groove 15 in which the insulating portion 12 is present and from which said portion protrudes. In particular, the groove 15 is formed by two walls 16 with grip protrusions 17 for the insulating portion 12.

[0025] The electric pump comprises an electromechanical section in which at least one electric motor 18 and an electronic part 19 are present.

[0026] As shown in Figures 2 and 3, the electronic part 19 of the electric pump comprises an electronic board 14 for the control at least of the electric motor 18.

[0027] The electric pump comprises, again in the electronic part 19, the heat sink element 10, installed between the electronic board 14 and the external wall of a box-like body 20 of the electric pump. The box-like body 20 is skimmed, on its inside, by liquid being processed, the path of which is designated by A in Figure 2.

[0028] As mentioned, the heat sink element 10 comprises a heat sink portion 11 made of metallic material in contact with the box-like body 20 and with the electronic components 13 of the electronic board 14 from which heat is to be removed, and a thermally insulating portion 12.

[0029] A heat-conducting pad (not visible in the accompanying figures) is interposed between the heat sink portion 11 and the box-like body 20 and substantially acts as a heat-conducting paste, filling in any air gaps between the two surfaces that have to exchange heat.

[0030] The heat sink element 10 has a substantially block-like shape, in which the heat sink portion 11 is provided with a groove 15 in which the insulating portion 12 is present and from which the latter protrudes. The groove 15 is formed by two walls 16 with grip protrusions 17 for the insulating portion 12.

[0031] The heat sink element 10 is installed with at least one of the walls 16 in contact with electronic components 13 to be cooled, as shown in the view of Figure 3.

[0032] Figure 2 shows that the heat sink element 10 is arranged in contact, by means of the insulating portion 12, with the electronic board 14 and is fixed thereto by means of screws 37.

[0033] The electronic board 14 is arranged in a receptacle which comprises a first box-like portion 21 for fixing

to the box-like body 20 and is provided with an opening 22 from which at least one part of the heat sink portion 11 faces outward to rest against the box-like body 20. The opening 22 has a contoured edge 23 (shown in Figure 2) on which the heat sink portion 11 is adapted to rest; a first insulating gasket 24 is present between the contoured edge 23 and the heat sink portion 11.

[0034] The heat sink portion 11 is arranged in contact with the surface of the box-like body 20, where it is skimmed, on its inside, by liquid being processed, typically water.

[0035] In particular, as shown in Figure 2, the heat sink element 10 is fixed to the box-like body 20 by means of bushings 38 welded on the external surface of the box-like body 20. Screws 39 mate with the bushings 38 in order to provide fixing.

[0036] The first box-like portion 21 is provided with a channel 25 which is open toward the electronic board 14 and is substantially perimetric to the heat sink element 10, and in which there is a second insulating gasket 26.

[0037] The first of the two gaskets 24 and 26 is arranged at the heat sink portion 11 and the other one is arranged at the insulating portion 12 and in contact with the electronic board 14.

[0038] These gaskets are co-molded with the first box-like portion 21.

[0039] The electric pump also comprises an element 27 for closing a volume defined with the electronic board 14 on the face thereof that is opposite to the face for fixing the heat sink element 10. The closure element 27 is shown in the sectional view of Figure 2. It is preferably made of plastic material.

[0040] The closure element has a contoured raised portion 28 with a channel which supports a third gasket 29, co-molded with the closure element 27, in contact with the electronic board 14 and in a position that is substantially symmetrical to the second gasket 26.

[0041] These three gaskets 24, 26, 29 isolate the compartment of the heat sink element, limiting the quantity of air to that which is naturally present.

[0042] The receptacle of the electronic part also comprises a second box-like portion 30. The first box-like portion 21 has a perimetric edge 31 for mating with the second box-like portion 30, with a channel which supports a fourth gasket 32.

[0043] The second box-like portion 30 also has an opening at an electronic user interface board 33 and a cover 34, also with an opening for the board 33. A sticker with such graphics as to show display and keys for operating the mechanical keys below is fixed at said opening. Said cover 34 has a perimetric edge 35 for mating with a channel which supports a fifth gasket 36.

[0044] In the electric pump according to the invention, the electronic part 19 is installed on the side of said electric pump, at the electric motor 13 and with the electronic board 14 substantially parallel to the axis of said electric motor. In this manner, the heat sink element 10 is arranged directly in contact with the box-like body 20, in

the part containing the motor and skimmed by the liquid.

[0045] The operation of the electric pump and of the heat sink element, according to the invention, is evident from what has been described and illustrated.

[0046] In particular, it is evident that the heat sink element 10, due to its particular composition and structure, is capable of cooling specific electronic components 13 adjacent thereto on the lateral faces without cooling instead the printed circuit of the electronic board 14.

[0047] Furthermore, the combined presence of the heat sink element 10 and of the described gaskets makes it possible to isolate compartments of the electronic part 19.

[0048] In particular, the first three gaskets 24, 26, 29, as anticipated, isolate the compartment of the heat sink element, limiting the quantity of air to that which is already present. By preventing further air from entering the compartment in which the heat sink element is present and by fixing said element on the electronic board 14 with the insulating portion 12, the thermal gradient at the surface of the board, and therefore the forming of condensation thereon, are limited.

[0049] With the fourth and fifth gaskets 32 and 36, and with the adhesive in front of the electronic board, an insulation with hermetic chambers of the electronic part 19 is achieved, with an IP X5 degree of protection, as per IEC EN 60529 standard.

[0050] Furthermore, as shown in Figure 2, the box-like body 20 is substantially the external jacket of the pump, in which the electric motor 18 is accommodated. The described constructive solution allows the arrangement of the electronic part 19 with the heat sink element 10 resting directly on the external jacket, on the side of the electric pump, with contained overall space occupations with respect to other constructive solutions.

[0051] In practice it has been found that the invention achieves the intended aim and objects, providing a constructive solution capable of limiting the forming of condensation on the electronic board and at the same time of preventing the passage of water to the electronic part.

[0052] Furthermore, this constructive solution makes it possible to contain the space occupation of the pump, leaving the interface easily accessible to the user.

[0053] The invention thus conceived is susceptible of numerous modifications and variations, all of which are within the appended claims; all the details may furthermore be replaced with other technically equivalent elements.

[0054] In practice, the materials used, as long as they are compatible with the specific use, as well as the contingent shapes and dimensions, may be any according to the requirements and the state of the art.

[0055] The disclosures in Italian Patent Application No. 102020000004870 from which this application claims priority are incorporated herein by reference.

[0056] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increas-

ing the intelligibility of the claims and accordingly such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

Claims

1. An electric pump with improved insulation of the electronic part, comprising an electromechanical section in which there are at least one electric motor (18) and at least one electronic part (19) which in turn comprises at least one electronic board (14) for the control at least of said electric motor, said electric pump comprising, in said electronic part (19), a heat sink element (10), installed between said electronic board (14) and the external wall of a box-like body (20) of said electric pump, said box-like body (20) being skimmed, on its inside, by liquid being processed, said electric pump being **characterized in that** said heat sink element (10) comprises a heat sink portion (11) made of metallic material in contact with said box-like body (20) and with the electronic components (13) of said electronic board (14) from which heat is to be removed, and a thermally insulating portion (12).
2. The electric pump according to claim 1, **characterized in that** said heat sink element (10) is substantially shaped like a block in which said heat sink portion (11) has a groove (15) in which there is said insulating portion (12) and from which the latter protrudes, said groove (15) being formed by two walls (16) with grip protrusions (17) for said insulating portion (12).
3. The electric pump according to one or more of the preceding claims, **characterized in that** said heat sink element (10) is installed with at least one of said walls (16) in contact with electronic components (13) to be cooled.
4. The electric pump according to one or more of the preceding claims, **characterized in that** said heat sink element (10) is arranged in contact, by means of said insulating portion (12), with said electronic board (14).
5. The electric pump according to one or more of the preceding claims, **characterized in that** said electronic board (14) is arranged in a receptacle which comprises a first box-like portion (21) for fixing to said box-like body (20) and provided with an opening (22) from which at least one part of said heat sink portion (11) faces outward to rest against said box-like body (20), said opening (22) having a contoured edge (23) on which said heat sink portion (11) is

adapted to rest, a first insulating gasket (24) being present between said contoured edge (23) and said heat sink portion (11).

6. The electric pump according to one or more of the preceding claims, **characterized in that** said first box-like portion (21) is provided with a channel (25) that is open toward said electronic board (14) and is substantially perimetric to said heat sink element (10), in which there is a second insulating gasket (26). 5
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7. The electric pump according to one or more of the preceding claims, **characterized in that** it comprises an element (27) for closing a volume defined with said electronic board (14) on the face thereof that is opposite the face for fixing said heat sink element (10), said closure element (27) having a contoured raised portion (28) with a channel which supports a third gasket (29) in contact with said electronic board (14) and in a position that is substantially symmetrical to said second gasket (26). 15
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8. The electric pump according to one or more of the preceding claims, **characterized in that** said first box-like portion (21) has a perimetric edge (31) for mating with a second box-like portion (30) of said receptacle, with a channel which supports a fourth gasket (32). 25
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9. The electric pump according to one or more of the preceding claims, **characterized in that** said second box-like portion (30) has an opening at an electronic user interface board (33) and a cover (34), also with an opening for said board (33), said cover (34) having a perimetric edge (35) for mating with a channel which supports a fifth gasket (36). 35
10. The electric pump according to one or more of the preceding claims, **characterized in that** said electronic part (19) is installed on the side of said electric pump (10) at said electric motor and with said electronic board (14) substantially parallel to the axis of said electric motor. 40
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11. A heat sink element for an electronic part of an electric pump, **characterized in that** it comprises a heat sink portion (11) made of metallic material and a thermally insulating portion (12). 50
12. The heat sink element according to claim 11, **characterized in that** it comprises a substantially block-like shape, in which said heat sink portion (11) is provided with a groove (15) in which said insulating portion (12) is present and from which the latter protrudes, said groove (15) being formed by two walls (16) with grip protrusions (17) for said insulating portion (12). 55

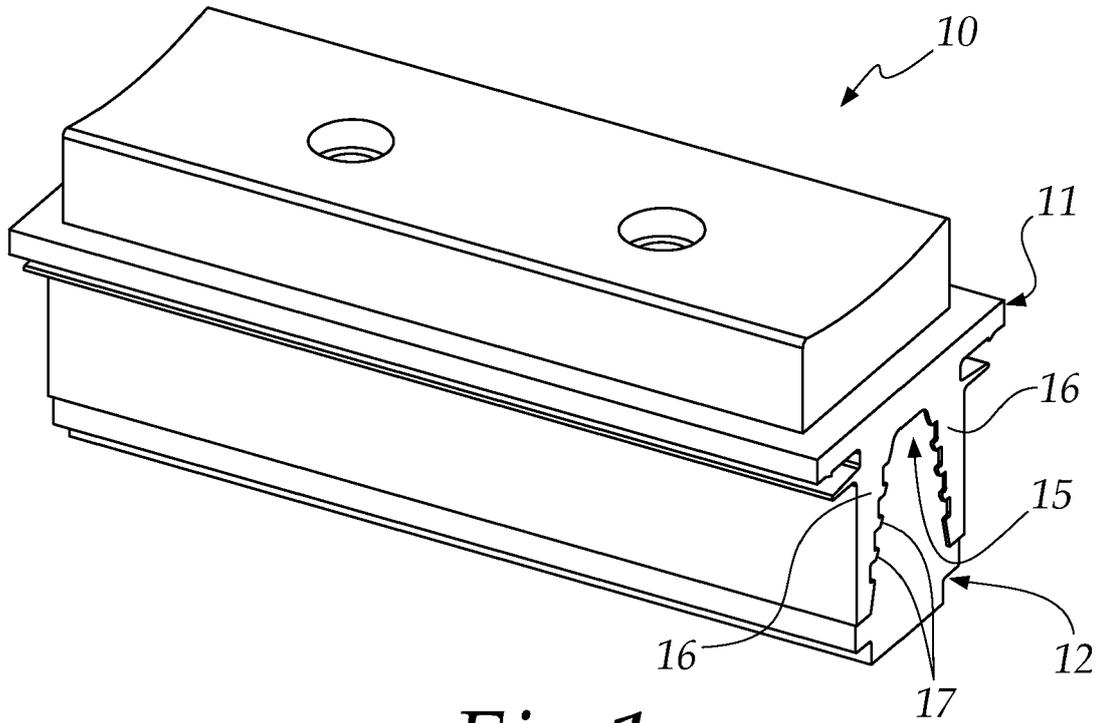


Fig.1

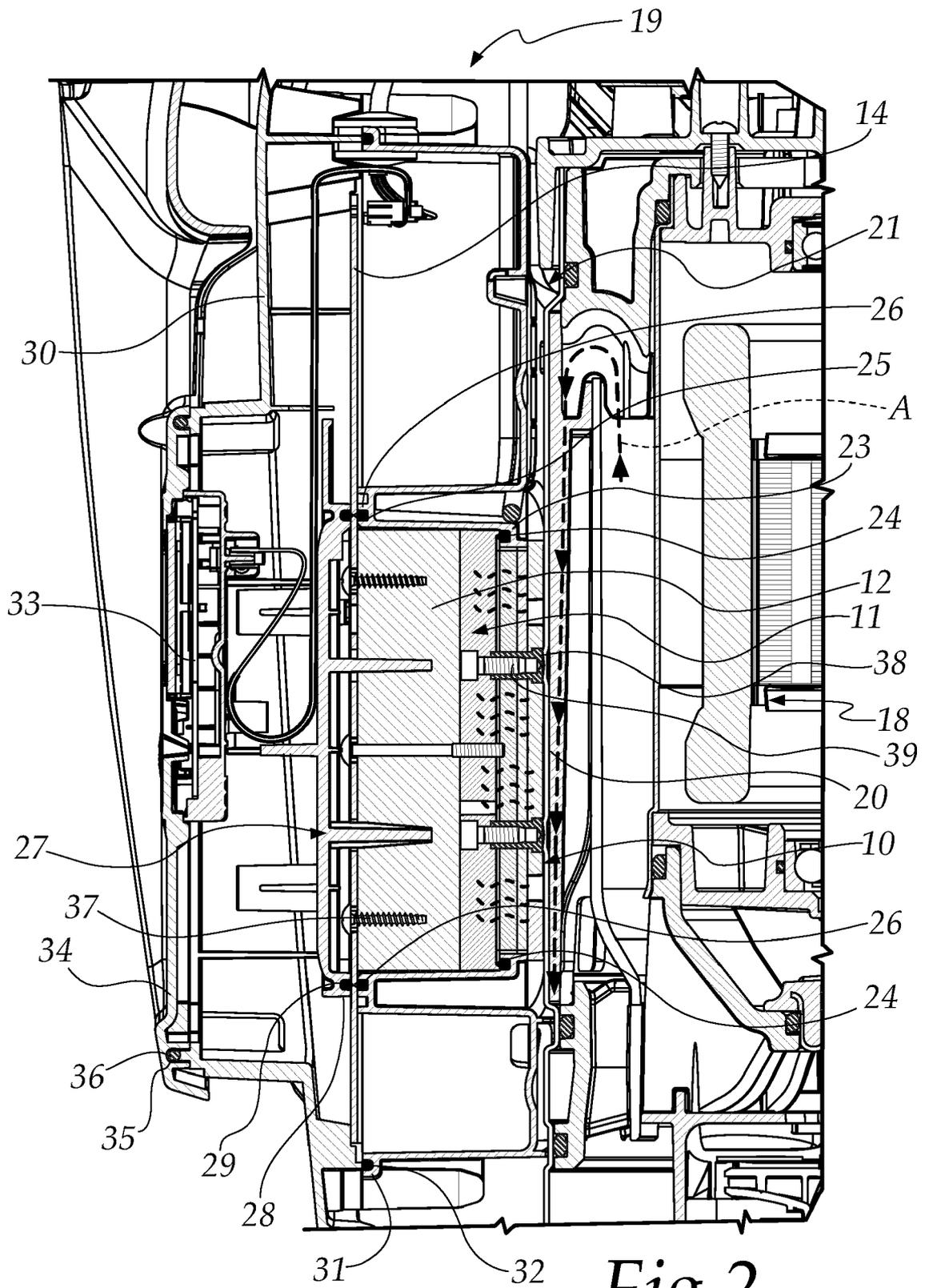


Fig. 2

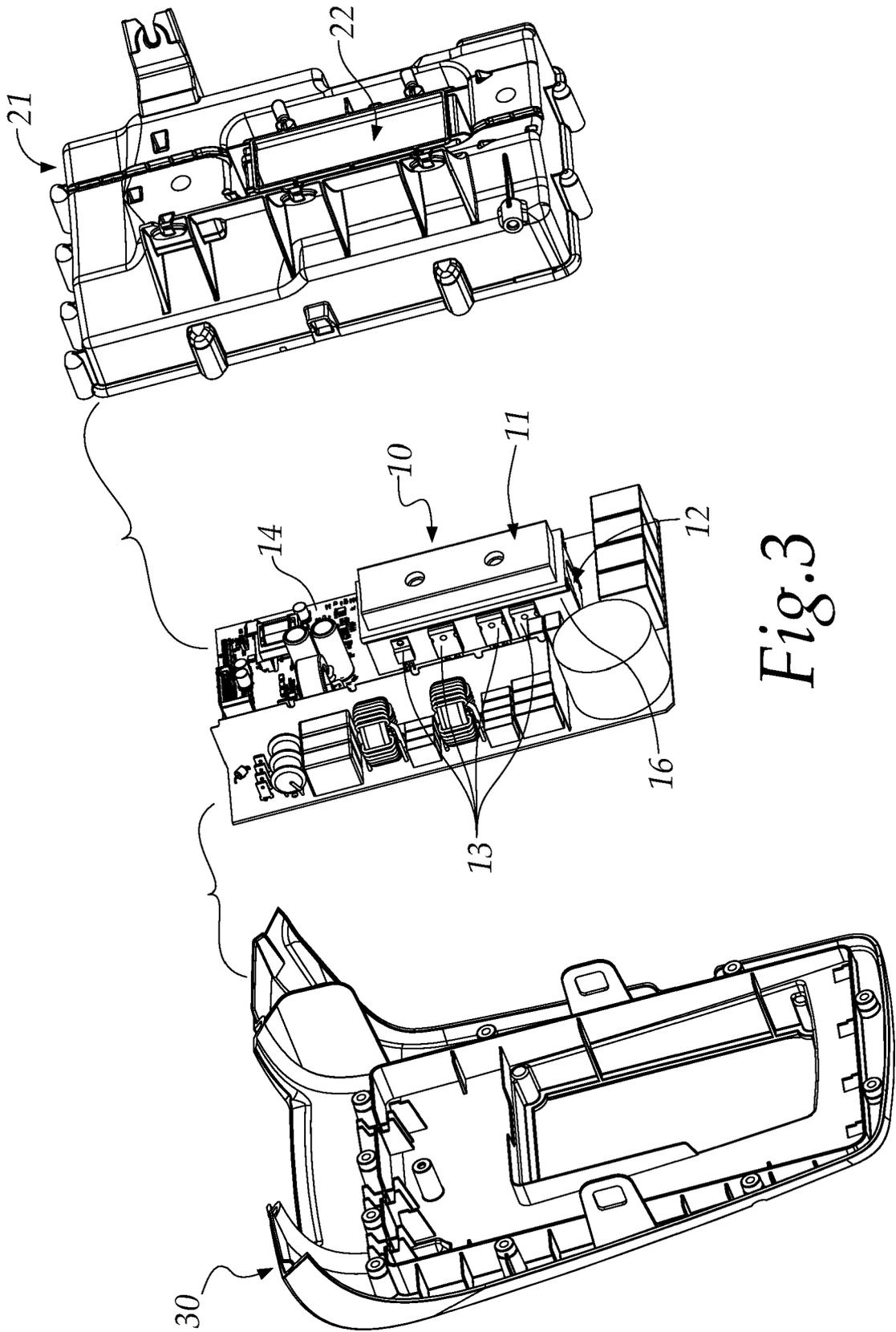


Fig.3



EUROPEAN SEARCH REPORT

Application Number
EP 21 15 3812

5

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	JP 2004 183595 A (CALSONIC KANSEI CORP) 2 July 2004 (2004-07-02)	11	INV. F04D29/58 F04D13/06	
Y	* paragraph [0022] - paragraph [0040] *	1,4,10		
A	* figures 1-5 *	2,3,5-9, 12		

X	JP 2011 226342 A (YAMADA SEISAKUSHO KK) 10 November 2011 (2011-11-10)	11		
Y	* paragraph [0009] - paragraph [0022] *	1,10		
A	* figures *	2-9,12		

X	JP 2006 090251 A (BOC EDWARDS KK) 6 April 2006 (2006-04-06)	11	TECHNICAL FIELDS SEARCHED (IPC) F04D	
Y	* paragraph [0013] - paragraph [0033] *	1,10		
A	* figures *	2-9,12		

X	US 9 198 328 B1 (KOKAS JAY W [US] ET AL) 24 November 2015 (2015-11-24)	11		
Y	* abstract *	1,4,10		
A	* column 1, line 13 - column 3, line 51 *	2,3,5-9, 12		

X	JP 2007 234753 A (DENSO CORP) 13 September 2007 (2007-09-13)	11		
Y	* paragraph [0001] - paragraph [0036] *	1,4,10		
A	* figures *	2,3,5-9, 12		

X	US 6 625 025 B1 (DUXBURY GUY A [CA] ET AL) 23 September 2003 (2003-09-23)	11		
Y	* abstract *	1,4,10		
A	* column 3, line 50 - column 7, line 10 *	2,3,5-9, 12		

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The present search report has been drawn up for all claims				
Place of search		Date of completion of the search	Examiner	
The Hague		2 July 2021	Kolby, Lars	
CATEGORY OF CITED DOCUMENTS		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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EUROPEAN SEARCH REPORT

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EP 21 15 3812

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y A	US 7 407 371 B2 (LEONE MICHELE [IT] ET AL) 5 August 2008 (2008-08-05) * abstract * * column 2, line 35 - column 5, line 56 * * figures *	1,4 2,3,5-12	
Y A	----- US 5 332 369 A (JENSEN NIELS D [DK]) 26 July 1994 (1994-07-26) * abstract * * column 4, line 5 - column 5, line 27 * * figures * -----	1,4,10 2,3,5-9, 11,12	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
Place of search The Hague		Date of completion of the search 2 July 2021	Examiner Kolby, Lars
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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EPO FORM 1503 03.02 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.

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5

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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02-07-2021

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 2004183595 A	02-07-2004	JP 4275393 B2 JP 2004183595 A	10-06-2009 02-07-2004
JP 2011226342 A	10-11-2011	JP 5584513 B2 JP 2011226342 A	03-09-2014 10-11-2011
JP 2006090251 A	06-04-2006	JP 4594689 B2 JP 2006090251 A	08-12-2010 06-04-2006
US 9198328 B1	24-11-2015	EP 2658359 A2 EP 3410831 A1 US 9198328 B1	30-10-2013 05-12-2018 24-11-2015
JP 2007234753 A	13-09-2007	NONE	
US 6625025 B1	23-09-2003	NONE	
US 7407371 B2	05-08-2008	NONE	
US 5332369 A	26-07-1994	DE 4121430 C1 EP 0520333 A1 US 5332369 A	05-11-1992 30-12-1992 26-07-1994

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EPO FORM P0459

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

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- IT 10202000004870 [0055]