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- (71) Applicant: ARCELIK ANONIM SIRKETI [TR/TR]; E5
Ankara Asfalti Uzeri, Tuzla, 34950 Istanbul (TR).
- (72) Inventors: YAGCI, Alper; E5 Ankara Asfalti Uzeri,
Tuzla, 34950 Istanbul (TR). GULSEN, Deha; E5 Ankara
Asfalti Uzeri, Tuzla, 34950 Istanbul (TR). AYDINTUG,
Cetin; E5 Ankara Asfalti Uzeri, Tuzla, 34950 Istanbul
(TR).
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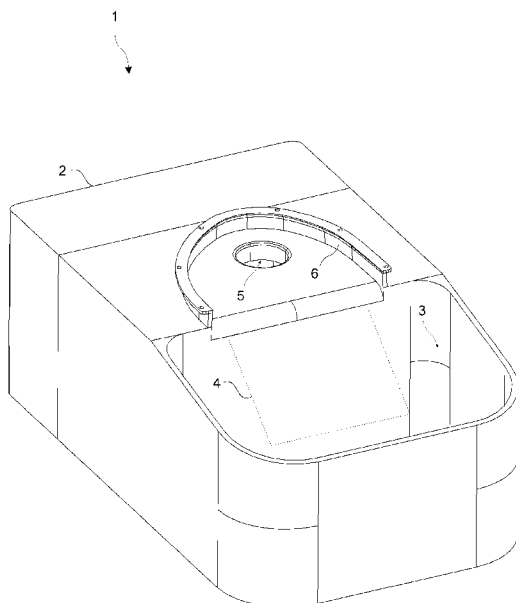
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- (54) Title: A VACUUM CLEANER WITH IMPROVED OPERATIONAL PERFORMANCE

Figure 1



- (57) Abstract: The present invention relates to a vacuum cleaner (1) comprising a body (2), a dirt collecting chamber (3) that is disposed in the body (2), a motor (4) that is disposed in the body (2) and that has a suction inlet (5), and an air channel (6) that is arranged on the suction inlet (5), with one end of the air channel (6) opening to the suction inlet (5) and the other end thereof opening to the dirt collecting chamber (3).

Description

A VACUUM CLEANER WITH IMPROVED OPERATIONAL PERFORMANCE

- [0001] The present invention relates to a vacuum cleaner wherein the air flow or the vacuum effect created by the motor is delivered to the dirt collecting chamber by means of an air channel opening to the motor suction inlet.
- [0002] Especially in vacuum cleaners with dust bag, the circuit board, where on the power electronics and the control unit are disposed, heats up due to the operation of the motor. On the circuit board heat exchangers providing the cooling of the circuit board are provided. For an efficient cooling operation, the heat exchanger should be disposed at a position subjected to an air flow. However, disposing the heat exchanger at a position on the air flow provided by the motor may adversely affect the operational performance of the vacuum cleaner and moreover may cause the vacuum cleaner to operate in a noisier manner. It is a desired feature that the circuit board is cooled without adversely affecting the operation of the vacuum cleaner and increasing the noise level.
- [0003] In the state of the art European Patent Application No. EP2077089, a vacuum cleaner is disposed, that comprises a heat exchanger disposed at the exhaust outlet and providing the cooling of the circuit board.
- [0004] In the state of the art United States Patent Application No. US2008047091, a vacuum cleaner is disclosed, that comprises a vortex stabilizer stabilizing the vortexes generated at the motor suction port.
- [0005] In the state of the art Japanese Patent Application No. JP2000316766, a vacuum cleaner is disposed, that comprises a wall arranged at the inlet of the air channel and eliminating the vortexes generated in the air flow.
- [0006] The aim of the present invention is the realization of a vacuum cleaner wherein the circuit board controlling the same is efficiently cooled.
- [0007] The vacuum cleaner realized in order to attain the aim of the present invention, explicated in the first claim and the respective claims thereof, comprises at least one opening that is arranged at the upper wall of the air channel, whereon the motor suction inlet is arranged, and a heat exchanger that passes through the opening as connected to the circuit board and that provides the cooling of the circuit board.

- [0008] In an embodiment of the present invention, the heat exchanger extends up to the motor suction inlet and eliminates the vortexes generated at the suction inlet. Thus, a linear air flow is obtained in the air channel.
- [0009] In another embodiment of the present invention, the heat exchanger has at least one plate extending into the air channel. More than one plate can be used in order to increase the surface area of the heat exchanger, in contact with the cool air inside the air channel.
- [0010] In another embodiment of the present invention, the heat exchanger is produced from metal material. For an efficient heat transfer, the heat exchanger is preferably produced from aluminum as the state of the heat exchangers.
- [0011] In another embodiment of the present invention, by means of a gasket that is disposed on the edges of the opening and that fills the gap between the opening and the plates of the heat exchanger, the air flow rate in the air channel is prevented from decreasing.
- [0012] By means of the present invention, the circuit board is efficiently cooled by means of the heat exchanger that is disposed on the air channel through which cool air is taken into the vacuum cleaner. Thus, in cases of long usages or in case the circuit board is subjected to excessive load, the performance of the vacuum cleaner is prevented from decreasing.
- [0013] The vacuum cleaner realized in order to attain the aim of the present invention is illustrated in the attached figures where
- [0014] Figure 1 – is the cross-sectional view of a vacuum cleaner.
- [0015] Figure 2 – is the cross-sectional view of a vacuum cleaner in an embodiment of the present invention.
- [0016] Figure 3 – is the cross-sectional view of a vacuum cleaner in a different embodiment of the present invention.
- [0017] Figure 4 – is the perspective view of the circuit board in another embodiment of the present invention.
- [0018] The elements illustrated in the figures are numbered as follows:
1. Vacuum cleaner
 2. Body
 3. Dirt collecting chamber

4. Motor
5. Suction inlet
6. Air channel
7. Circuit board
8. Opening
9. Heat exchanger
10. Plate
11. Gasket

[0019] The vacuum cleaner (1) comprises a body (2), a dirt collecting chamber (3) that is disposed in the body (2), a motor (4) that is disposed in the body (2) and that has a suction inlet (5), and an air channel (6) that is preferably arranged on the suction inlet (5), with one end of the air channel (6) opening to the suction inlet (5) and the other end thereof opening to the dirt collecting chamber (3) (Figure 1).

[0020] In the vacuum cleaner (1), the air inside the air channel (6) is sucked into the suction inlet (5) as the motor (4) is operated. As one end of the air channel (6) opens into the dirt collecting chamber (3), a vacuum effect is generated in the dirt collecting chamber (3). The user carries out the cleaning process by means of the hose (not shown in the figures) connected to the dirt collecting chamber (3).

[0021] The vacuum cleaner (1) of the present invention comprises a circuit board (7) that is disposed on the air channel (6), at least one opening (8) that is arranged on the upper wall of the air channel (6), and a heat exchanger (9) that extends through the opening (8) into the air channel (6) as connected to the circuit board (7) and that provides the cooling of the circuit board (7) (Figure 2).

[0022] In the vacuum cleaner (1) of the present invention, the circuit board (7) is positioned over the air channel (6) where the motor (4) suction inlet (5) is arranged. By means of the opening (8) opening to the upper wall of the air channel (6), the heat exchanger (9) used for cooling the circuit board (7) extends into the air channel (6). The motor (4) rotates at high speeds and sucks in the air in the air channel (6) through the suction inlet (5). Thus, a high-speed air flow is created in the air channel (6). Moreover, the air

sucked from the air channel (6) is relatively cooler since it does not pass through the motor (4) yet. The heat generated on the circuit board (7) is transferred onto the heat exchanger (9). As the motor (4) is operated, a cool air flow is obtained in the air channel (6) and heat transfer is realized between the surfaces of the heat exchanger (9) and the air flow. Thus, the heat exchanger (9) with the surface thereof being cooled draws more heat from the circuit board (7), thereby providing the cooling of the circuit board (7).

[0023] In an embodiment of the present invention, the heat exchanger (9) extends up to the suction inlet (5) through the air channel (6) and prevents the formation of turbulence at the suction inlet (5). As the motor (4) is operated, a vortex-like air flow is generated at the suction inlet (5) due to the rotor rotating at high speeds around itself in the motor (4). By means of the heat exchanger (9) extending up to the suction inlet (5), the vortexes at the suction inlet (5) are eliminated or reduced into smaller vortexes. Thus, a linear air flow is created inside the air channel (6) from the dirt collecting chamber (3) towards the suction inlet (5). This both improves the operational performance of the vacuum cleaner (1) and reduces the noise level of the vortexes.

[0024] In another embodiment of the present invention, the heat exchanger (9) comprises at least one plate (10) extending into the air channel (6). The heat exchanger (9) is fixed onto the electronic components heating up on the circuit board (7). Preferably a paste increasing the heat transfer is used between the electronic components and the heat exchanger (9). In order to increase the heat transfer with the cool air inside the air channel (6), the area of the surface of the heat exchanger (9) in contact with the cool air should be increased. On the upper wall of the air channel (6) there are openings (8) as much as the plates (10) on the heat exchanger (9) and the plates (10) pass through the openings (8) and extend into the air channel (6).

[0025] In another embodiment of the present invention, the heat exchanger (9) is produced from metal material. The heat transfer is maximized by using a metal with high thermal conductivity coefficient as the heat exchanger (9).

- [0026] In another embodiment of the present invention, the vacuum cleaner (1) comprises a gasket (11) that is disposed at the edge of the opening (8) and that provides leak-proofing of the air channel (6). By means of the gasket (11), the air flow rate inside the air channel (6) is prevented from decreasing.
- [0027] In the vacuum cleaner (1) of the present invention, by means of the opening (8) arranged on the upper wall of the air channel (6), the heat exchanger (9) providing the cooling of the circuit board (7) can be positioned so as to be inside the air channel (6) and to be in contact with the cool air. Moreover, as the plates (10) of the heat exchanger (9) extend up to the motor (4) suction inlet (5), a relatively linear air flow is provided in the air channel (6) and moreover the noise level is decreased.

Claims

1. A vacuum cleaner (1) **comprising** a body (2), a dirt collecting chamber (3) that is disposed in the body (2), a motor (4) that is disposed in the body (2) and that has a suction inlet (5), and an air channel (6) that is preferably arranged on the suction inlet (5), with one end of the air channel (6) opening to the suction inlet (5) and the other end thereof opening to the dirt collecting chamber (3),
characterized by
 - a circuit board (7) that is disposed on the air channel (6),
 - at least one opening (8) that is arranged on the upper wall of the air channel (6), and
 - a heat exchanger (9) that extends through the opening (8) into the air channel (6) as connected to the circuit board (7) and that provides the cooling of the circuit board (7).
2. A vacuum cleaner (1) as in Claim 1, **characterized by** the heat exchanger (9) that extends up to the suction inlet (5) through the air channel (6) and prevents the formation of turbulence at the suction inlet (5).
3. A vacuum cleaner (1) as in Claim 1 or 2, **characterized by** the heat exchanger (9) that has at least one plate (10) extending into the air channel (6).
4. A vacuum cleaner (1) as in Claim 1 or 2, **characterized by** the heat exchanger (9) that is produced from metal material.
5. A vacuum cleaner (1) as in any one of the above claims, **characterized by** a gasket (11) that is disposed at the edge of the opening (8) and that provides leak-proofing of the air channel (6).

Figure 1

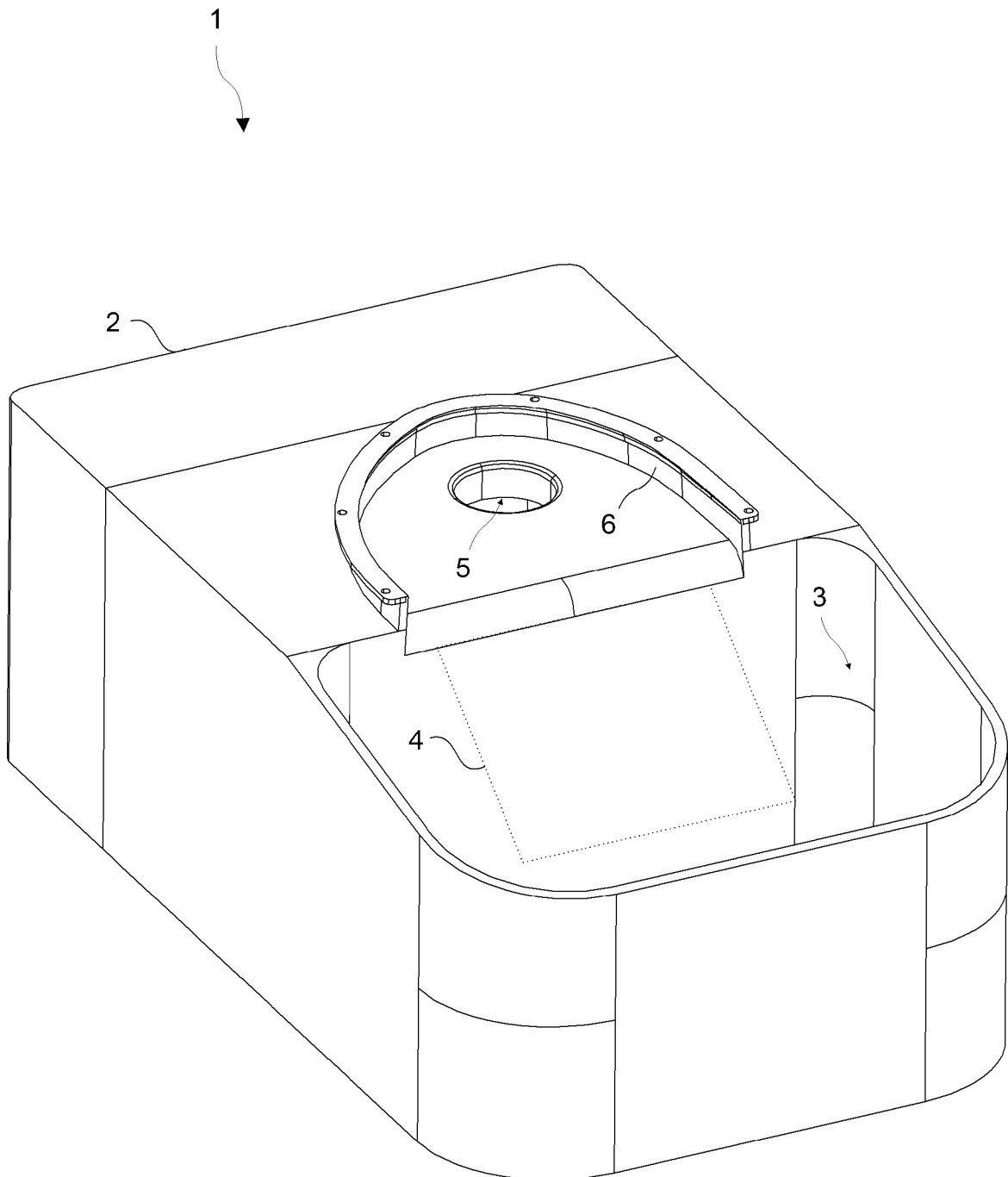


Figure 2

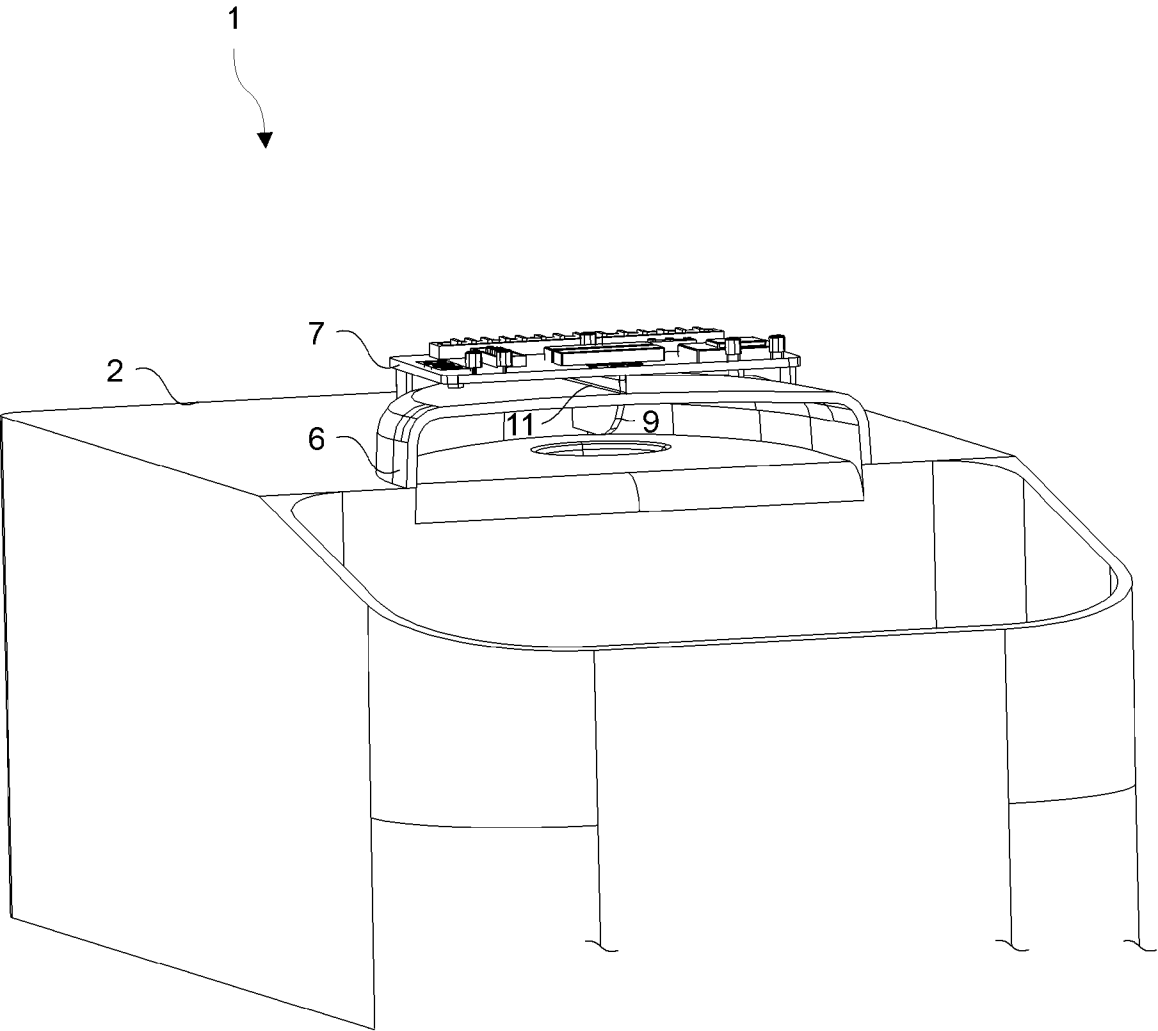


Figure 3

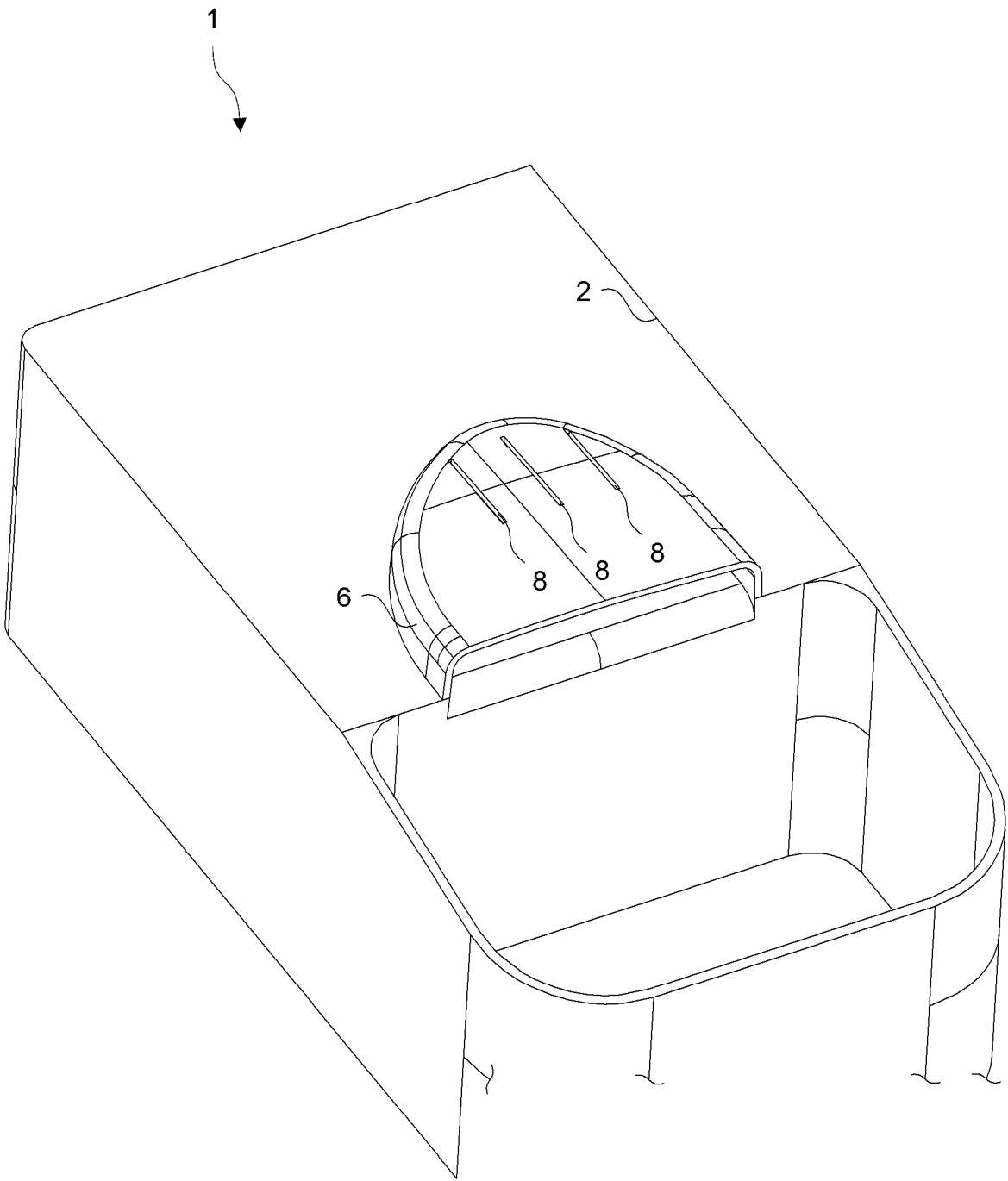
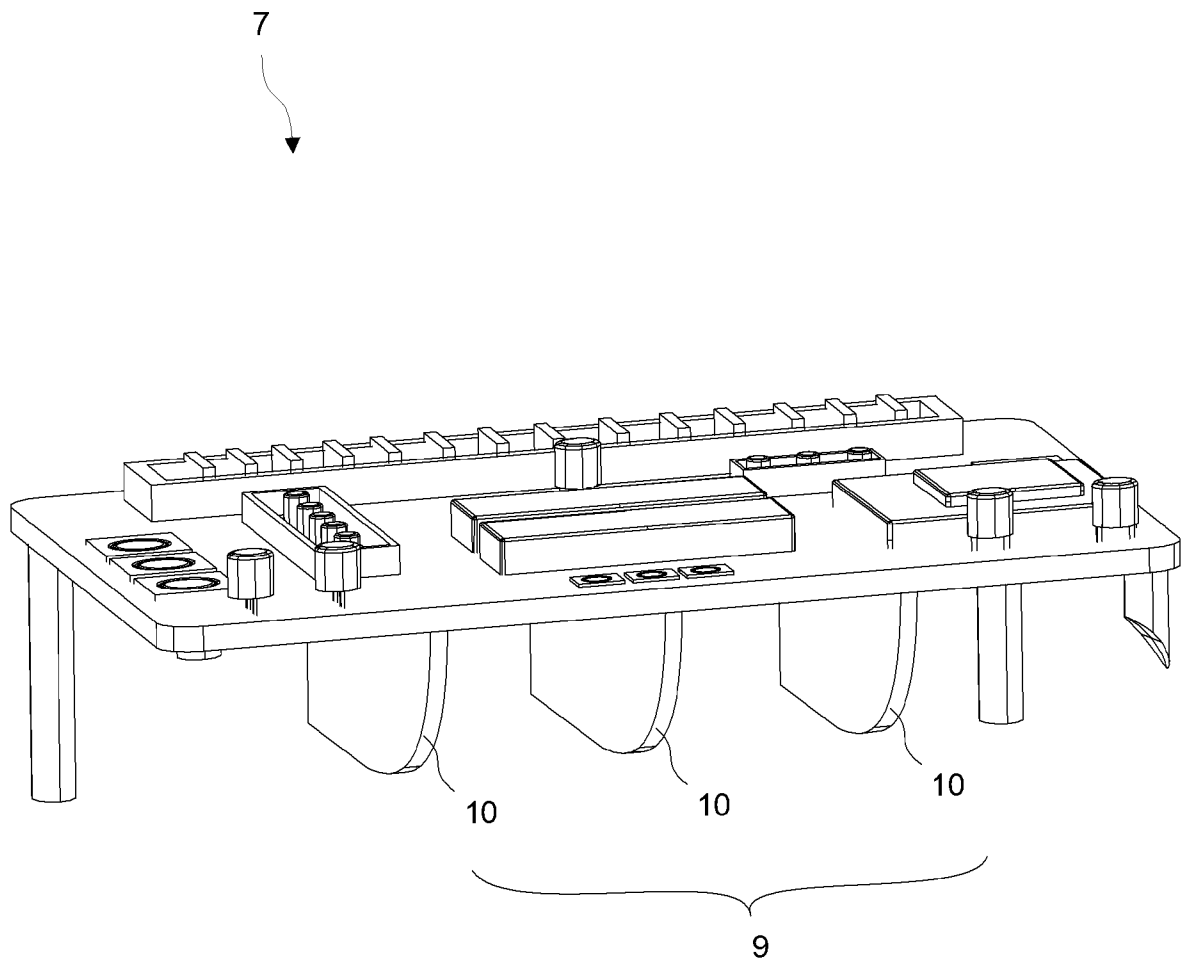


Figure 4



INTERNATIONAL SEARCH REPORT

International application No
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A. CLASSIFICATION OF SUBJECT MATTER
INV. A47L9/00 A47L9/28
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A47L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 2000 217751 A (SHARP KK) 8 August 2000 (2000-08-08)	1-4
A	page 3, paragraph 17 page 3, paragraph 25 - page 4, paragraph 31 figures 1,3-6	5
X	JP H08 38398 A (TEC CORP) 13 February 1996 (1996-02-13) abstract figures 1-3,5	1,3,5
X	JP H07 136083 A (SANYO ELECTRIC CO) 30 May 1995 (1995-05-30) abstract figures 4,5	1-3
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Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Authorized officer

Redelsperger, C

INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2017/052418

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 2006 288801 A (TOSHIBA TEC KK) 26 October 2006 (2006-10-26) abstract figures 1,2,9-15 -----	1
A	EP 0 415 076 A2 (WAP REINIGUNGSSYSTEME [DE]) 6 March 1991 (1991-03-06) abstract figures 1-5 -----	1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2017/052418

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 2000217751 A	08-08-2000	JP 3515405 B2 JP 2000217751 A	05-04-2004 08-08-2000
JP H0838398 A	13-02-1996	JP 3186009 B2 JP H0838398 A	11-07-2001 13-02-1996
JP H07136083 A	30-05-1995	NONE	
JP 2006288801 A	26-10-2006	NONE	
EP 0415076 A2	06-03-1991	AT 116825 T BR 9004193 A DE 3928313 A1 EP 0415076 A2 JP H0724644 B2 JP H03139319 A US 5068555 A	15-01-1995 03-09-1991 28-02-1991 06-03-1991 22-03-1995 13-06-1991 26-11-1991