(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 3 092 930 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
16.11.2016 Bulletin 2016/46

(51) Int Cl.:
A47L 9/06 *(2006.01)* ***A47L 9/02*** *(2006.01)*

(21) Application number: **16169662.0**

(22) Date of filing: **13.05.2016**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
MA MD

(30) Priority: **15.05.2015 GB 201508330**

(71) Applicant: **Dyson Technology Limited**
Malmesbury,
Wiltshire SN16 0RP (GB)

(72) Inventors:
- **HENDERSON, James**
  Malmesbury, Wiltshire SN16 0RP (GB)
- **WARMAN, Daniel**
  Malmesbury, Wiltshire SN16 0RP (GB)
- **COOPER, Sam**
  Malmesbury, Wiltshire SN16 0RP (GB)

(74) Representative: **Hobday, Duncan Stuart et al**
Dyson Technology Limited
Intellectual Property Department
Tetbury Hill
Malmesbury, Wiltshire SN16 0RP (GB)

(54) FLOOR TOOL FOR A VACUUM CLEANER

(57) A floor tool (1) for a vacuum cleaner, the floor tool (1) comprising a cleaner head (2). The cleaner head (2) has a main body (4), a sole plate (5) with an inlet (15) through which dirt-laden fluid enters the cleaner head (2), an outlet duct (6) fluidly connected to the inlet (15) through which dirt-laden fluid exits the cleaner head (2), two inflatable supports (7,8) housed between and connected to the main body (4) and the sole plate (5), and an actuator assembly (9) for regulating the size of the two inflatable supports (7,8). The sole plate (5) is movable relative to the main body (4) in a vertical direction between a first position and a second position, movement of the sole plate (5) is controlled by the size of the two inflatable supports (7,8). The two inflatable supports (7,8) are arranged either side of the sole plate inlet (15).

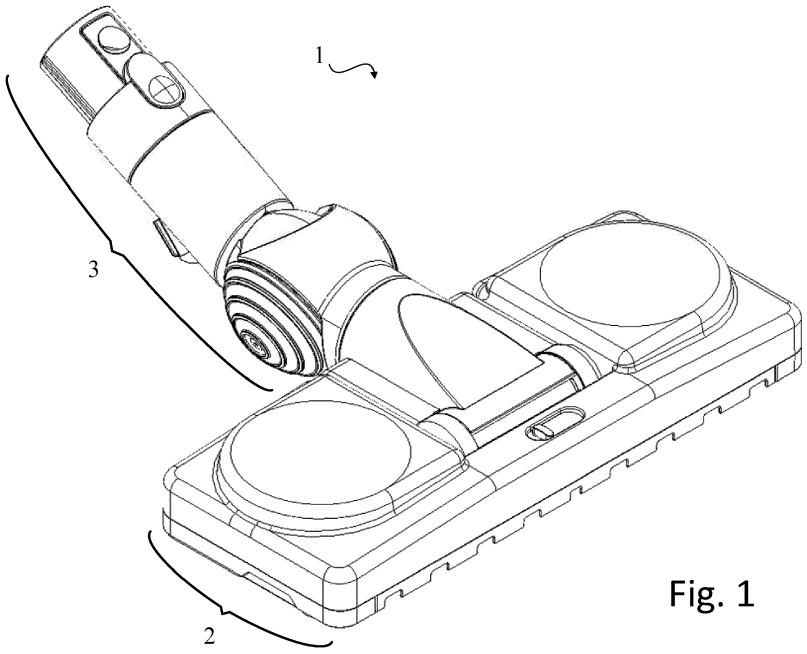

Fig. 1

EP 3 092 930 A1

Description

[0001] The present invention relates to a floor tool for a vacuum cleaner.

[0002] Vacuum cleaners can be supplied with a variety of floor tools and accessories for cleaning different floor surfaces. Some floor tools are intended for use on a particular floor surface i.e. single-mode cleaning. Some floor tools however can include adjustable parts to change cleaning mode when cleaning different surfaces, i.e. multi-mode cleaning. Mode adjustment is usually either triggered purposefully by the user via a physical switch or button or, more conveniently for the user, automatically triggered by the floor tool as it senses and adapts to changes in the floor surface to be cleaned.

[0003] A problem with conventional multi-mode floor tools that adjust automatically is that they often offer a compromise between user convenience and overall cleaning performance across all surfaces. In addition, conventional multi-mode floor tools generally have a large footprint as they need to accommodate the means necessary to automatically adjust the mode of the floor tool rapidly, smoothly and consistently without impeding the contact surface area of the floor tool.

[0004] The present invention provides a floor tool for a vacuum cleaner, the floor tool comprising: a cleaner head having a main body, a sole plate with an inlet through which dirt-laden fluid enters the cleaner head, an outlet duct fluidly connected to the inlet through which dirt-laden fluid exits the cleaner head, two inflatable supports housed between and connected to the main body and the sole plate, and an actuator assembly for regulating the size of the two inflatable supports; wherein the sole plate is movable relative to the main body in a vertical direction between a first position and a second position, movement of the sole plate is controlled by the size of the two inflatable supports, and the two inflatable supports are arranged either side of the sole plate inlet.

[0005] During use, the sole plate of the cleaner head of the present invention is required to move vertically between two positions during a mode change. The floor tool of the present invention comprises two inflatable supports that act to change the mode of the floor tool. By having two inflatable supports positioned either side of the inlet duct of the sole plate, the sole plate is encouraged to wholly and evenly contact the floor surface to be cleaned, thereby increasing cleaning performance of the cleaner head.

[0006] An additional benefit is that the total size and footprint of the floor tool may be reduced by positioning two inflatable supports either side of the suction inlet. The suction inlet and the outlet duct can then be positioned centrally or towards the front edge of the cleaner head. The other components of the cleaner head can be arranged in such a way to further decrease the size of the floor tool.

[0007] A perceived drawback from using two inflatable supports is that movement of the sole plate could become unbalanced i.e. the supports may inflate by different amounts. Furthermore, when moving from a carpeted surface to a hard floor surface the suction inlet may clamp down on the hard floor surface. It was thought that an upward force directly over the suction inlet would be required to lift the sole plate into a different position. It has been found however that the performance of the floor tool is unaffected by having two inflatable supports arranged either side of the suction inlet, even though there is no force applied directly over the suction inlet during a mode change.

[0008] The actuator assembly may comprise a single valve which closes to deflate the inflatable supports. The use of a single valve to deflate the two inflatable supports provides balance to the floor tool during mode change. In particular, the single valve ensures that the two inflatable supports are deflated more evenly. In addition, the suction that is used to draw the dirt-laden fluid through the cleaner head can be exploited to provide an additional airflow that deflates the two inflatable supports. The two inflatable supports can then be re-inflated by opening the single valve.

[0009] The inflatable supports may be symmetrically arranged either side of the inlet. Providing two symmetrically arranged inflatable supports improves the balance of the sole plate and provides smoother movement of the sole plate between the first and second positions. By having two independent inflatable supports, a more even force can be applied across the sole plate on each side of the suction inlet during their deflation to prevent the suction inlet from clamping to a hard floor surface.

[0010] The inflatable supports may be fluidly connected to the actuator assembly, and the actuator assembly may be fluidly connected to the outlet duct. By fluidly connecting the two inflatable supports, the actuator assembly and the outlet duct, the suction applied to the outlet duct by the vacuum cleaner can be employed to deflate the two inflatable supports.

[0011] The actuator assembly may be positioned on the cleaner head between the two inflatable supports. By placing the two inflatable supports either side of the inlet, the inlet can be positioned further towards the leading edge of the cleaner head. This means that the actuator assembly can be positioned further forward on the cleaner head, thereby reducing the overall footprint of the floor tool.

[0012] The sole plate may further comprise a suction channel with two bleed valves, a bleed valve being located towards each side edge of the sole plate. The bleed valves can be manually or automatically operated to release the sole plate from a surface to be cleaned in the event that the suction inlet becomes clamped to flat and or smooth surface. A balanced and responsive floor tool can be achieved by providing bleed valves on each side of the sole plate since the bleed valves can be opened to equalise any force from the two inflatable supports.

[0013] In order that the present invention may be more readily understood, an embodiment of the invention will

now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a perspective view of a floor tool of the present invention;

Figure 2 is an exploded view of a cleaner head of the floor tool;

Figure 3 is an underside view of the cleaner head;

Figure 4 is a plan sectional view of the cleaner head, the section being taken in a horizontal plane;

Figure 5 is a perspective view of the cleaner head without the main body;

Figure 6 is a perspective view of the actuator assembly;

Figure 7 is a sectional view of the actuator assembly in the plane A-A shown in Fig 6 with the valve closed; and

Figure 8 is a sectional view of the actuator assembly in the plane A-A shown in Fig 6 with the valve open

Figure 1 illustrates a floor tool 1 for a vacuum cleaner, the floor tool 1 comprising a cleaner head 2 and a conduit assembly 3.

[0014] The cleaner head 2 is shown in more detail in Figures 2 to 5. The cleaner head 2 comprises a main body 4, a sole plate 5, an outlet duct 6, two inflatable supports 7,8, an actuator assembly 9 and cap 10.

[0015] The main body 4 comprises a carrier assembly 11, a cover 12 and a flexible skirt 13. The carrier assembly 11 and cover 12 are fixed together and form a cavity with two chambers 14. The cavity receives the sole plate 5 and the two chambers 14 accommodate the two inflatable supports 7,8.

[0016] The sole plate 5 comprises a suction inlet 15 and two bleed valves 16 disposed within a channel 17. The sole plate 5 is received within the main body 4 and is moveable in a substantially vertical direction between two positions. The channel 17 spans the width of the sole plate 5 with the suction 15 inlet being positioned in the middle of the channel 17. The two bleed valves 16 are positioned towards each side edge of the sole plate 5.

[0017] The outlet duct 6 comprises a main conduit 18 which is connected at one end to the inlet 15 of the sole plate 5 and at the opposite end to the conduit assembly 3. The main conduit 18 provides a fluid flow path through which dirt-laden fluid is carried from the inlet 15 to the conduit assembly 3. The outlet duct also has a secondary inlet 19 which is best shown in Figure 4. The secondary inlet 19 is fluidly connected to the two inflatable supports 7,8 via the actuator assembly 9. The secondary inlet 19 provides a secondary fluid flow path for an airflow to through the cleaner head 2. The full function of secondary inlet 19 will be described later. The cap 10 is used to cover the outlet duct 6.

[0018] The two inflatable supports 7,8 are secured to the main body 4 and the sole plate 5. The two inflatable supports 7,8 are symmetrically arranged either side of the suction inlet 15 of the sole plate 5. Each inflatable support 7,8 comprises a resilient cushion 20 having an air inlet 21 and an air outlet 22, which are perforations on the ceiling and floor of the cushion 20, respectively. The cushions 20 are inflated by ambient air which enters the cushions 20 through the inlets 21. The cushions 20 are deflated by suction applied to the air outlet 22. The cushions 20 contract to occupy a reduced volume during deflation. The inflatable supports 7,8 are shaped to collapse and fold in a concertina fashion, folding to provide a narrow and uniform profile under suction. Each inflatable support 7,8 has a spring 23 located within the cushion 20 which forces the floor and ceiling of the cushion 20 apart. Consequently, when the suction is removed from the air outlet, the spring 23 causes the cushion 20 to expand as ambient air re-enters the cushion 20 via the air inlet 21. As a result, the inflatable supports 7,8 can be deflated and re-inflated by applying and removing a suction to the air outlet 22. Since the inflatable supports 7,8 are attached to both the main body 4 and the sole plate 5 of the cleaner head 2, their collapse and expansion causes the sole plate 5 to move upwardly and downwardly within the main body 4.

[0019] The actuator assembly 9 comprises a sensor switch 24 and a valve assembly 25. The sensor switch 24 and the valve assembly 25 are shown in more detail in Figures 6 to 8. The sensor switch 24 is a paddle which rotates about an axis B-B. The sensor switch 24 is free to rotate about the axis B-B in either a clockwise and anticlockwise motion. The sensor switch 24 is configured so that the paddle rotates when the floor tool 1 is manoeuvred on a carpeted floor surface, the direction of rotation of the sensor switch 24 being dictated by the direction of travel of the floor tool 1. The sensor switch 24 is also configured so that it does not rotate when the when the floor tool 1 is manoeuvred on a hard floor surface.

[0020] The valve assembly 25 comprises a valve 26, an ambient air inlet 27, a cushion air inlet 28 and a common outlet 29. The valve 26 is configured to control whether the flow of air exiting through the common outlet 29 has entered either through the ambient air inlet 27 or the cushion air inlet 28. The valve 26 is moveable between a closed position (shown in Figure 7) and an open position (shown in Figure 8). Springs (not shown) are used to bias the valve 26 in the closed position against the ambient air inlet 27. Air is allowed to flow through the ambient air inlet 27 to the common outlet 29 when the valve 26 is open. Conversely, air travels only through the cushion air inlet 28 to the common outlet 29 when the valve 26 is closed. Airflow drawn from the ambient air inlet 27 is thus prevented when the valve 25 is closed.

[0021] The cushion air inlet 28 of the valve assembly 25 is fluidly connected to both of the inflatable supports 7,8 via connected tubes (not shown). The common outlet 29 of the valve assembly 25 is fluidly connected to the secondary inlet 19 of the outlet duct 6 via a tube 30. Suction applied in the outlet duct 6 causes the secondary inlet 19 to draw a secondary airflow through either the ambient air inlet 27 or the cushion air inlet 28. The secondary airflow is admitted into the cleaner head 2 either through the air inlet 21 provided on each of the two inflatable supports 7,8, or through the ambient air inlet 29 of the actuator assembly 9 depending on the position of the valve 26.

[0022] When the valve 26 is in the closed position, the secondary airflow is drawn into the cleaner head 2 through the air inlets 21 provided on the two inflatable supports 7,8. The secondary airflow passes through the cushions 20 towards the air outlets 22 which are fluidly connected to the valve assembly 25 by the connected tubes. The secondary airflow enters the valve assembly 25 via the cushion air inlet 28 and exits through the common outlet 29. The tube 30 fluidly connects the common outlet 29 to the secondary inlet 19 of the outlet duct 6, such that the secondary airflow ultimately combines with the dirt-laden airflow as it travels through the outlet duct 6. As the secondary airflow is drawn through the cushions 20, they are caused to deflate due to the suction applied from the secondary inlet 19. The contraction of the cushions 20 causes the substantially vertical upward movement of the sole plate 5 within the main body 4. The outer perimeter and the flexible skirt 13 of the main body 4 are brought into contact with the floor surface to be cleaned.

[0023] When the valve 26 is in the open position, the secondary airflow enters the cleaner head 2 via the ambient air inlet 27 instead of entering through the air inlets 21 provided on the two inflatable supports 7,8. The airflow from the ambient air inlet 27 has a lower resistance path than that provided by the cushion air inlet 28. Since the suction applied to the two inflatable supports 7,8 is reduced, the internal springs 23 cause the cushions 20 to expand as ambient air re-enters via the air inlet 21. The expansion of the internal springs 23 causes the two inflatable supports 7,8 to inflate and push the sole plate 5 downwardly within the main body 4. The expansion of the cushions 20 causes the substantially vertical downward movement of the sole plate 5 within the main body 4. The outer perimeter and the flexible skirt 13 of the main body 4 appear to lift from the surface whilst the sole plate 5 maintains contact with the floor surface to be cleaned.

[0024] The valve 26 is opened and closed by the sensor switch 24 rotating about axis B-B. The sensor switch 24 rotates on axle 31 during rotation. The axle 31 is coupled to the valve 26 such that rotation of the axle 31 is transferred into lateral movement of the valve 26. Rotation of the axle 31 in either a clockwise or anti-clockwise direction causes the valve 26 to move to the open position against the bias of the springs, thereby opening the ambient air inlet 27.

[0025] The conduit assembly 3 is connected at one end to the cleaner head 2 via the outlet duct 6. The other end of the conduit assembly 3 is connectable to a wand or a hose of a vacuum cleaner (not shown). The conduit assembly 3 provides a fluid flow path through which dirt-laden fluid is carried from the cleaner head 2 to the vacuum cleaner via the wand or hose.

[0026] In use, the floor tool 1 is manoeuvred over a floor surface to be cleaned using the wand. The cleaner head 2 maintains a flat profile with the floor surface as the floor tool is manoeuvred backwards and forwards.

[0027] On a hard floor surface, the cleaner head 2 maintains constant contact with the surface to be cleaned via the wheels of the sole plate 5 and main body 4. The sensor switch 24 of the actuator assembly 9 avoids contact with the floor surface and is therefore kept stationary during forward and backward manoeuvring of the floor tool 1. The valve 26 is kept in a closed position to cause or maintain the substantially vertical upward movement of the sole plate 5 within the main body 4. The outer perimeter of the main body 4 and the flexible skirt 13 then contact the hard floor surface. The outer perimeter of the main body 4 may have felt or bristles to prevent the main body 4 from scratching the hard floor surface. Thus, the floor tool 1 is deployed in a hard floor cleaning mode.

[0028] On a carpet surface, the floor tool 1 is drawn down into the carpet fibres. As the floor tool 1 is manoeuvred backwards and forwards, carpet fibres push against the sensor switch 24. The force causes the sensor switch 24 to rotate about its axle 31 and open the valve 26. The sole plate 5 moves downward from the expansion of the two inflatable supports 7,8. The sole plate 5 maintains contacts the carpeted surface to be cleaned and the main body 4 appears to lift away from the carpeted surface. Thus, the floor tool 1 has automatically adjusted into a carpet floor cleaning mode.

[0029] The multi-mode floor tool 1 of the present invention is configured to provide a sole plate 5 which is balanced and efficiently engaged against different types of floor surface. In addition, an even contact across the whole of the sole plate 5 is achieved by positioning the two inflatable supports 7,8 either side of the suction inlet 15. During mode change, it has been surprisingly found that the movement of the sole plate 5 can be achieved without having to provide an inflatable support directly over the suction inlet 15, even if the floor tool 1 is operating on a smooth hard floor surface. By having the two inflatable supports 7,8 either side of the suction inlet 15 the overall footprint of the floor tool can be reduced. The suction inlet 15 and the actuator assembly 9 can all be brought forward on the cleaner head 2 so that they are all incorporated within the leading and trailing edges of the cleaner head 2. The footprint size of the cleaner head 2 is thereby reduced without impacting on the performance or the mode changing ability of the floor tool 1.

Claims

1. A floor tool for a vacuum cleaner, the floor tool comprising:

   a cleaner head having a main body, a sole plate with an inlet through which dirt-laden fluid enters the cleaner head, an outlet duct fluidly connected to the inlet through which dirt-laden fluid exits the cleaner head, two inflatable supports housed between and connected to the main body and the sole plate, and an actuator assembly for regulating the size of the inflatable supports;
   wherein the sole plate is movable relative to the main body in a vertical direction between a first position and a second position, movement of the sole plate is controlled by the size of the inflatable supports, and the inflatable supports are arranged either side of the sole plate inlet.

2. The floor tool according to Claim 1, wherein the actuator assembly comprises a single valve which closes to deflate the inflatable supports.

3. The floor tool according to Claim 1 or Claim 2, wherein the inflatable supports are symmetrically arranged either side of the inlet.

4. The floor tool according to Claim 3, wherein the inflatable supports are fluidly connected to the actuator assembly, and the actuator assembly is fluidly connected to the outlet duct.

5. The floor tool according to any one of the previous claims, wherein the actuator assembly is positioned between the two inflatable supports.

6. The floor tool according to any one of the previous claims, wherein the sole plate further comprises a suction channel with two bleed valves, a bleed valve being located towards each side edge of the sole plate.

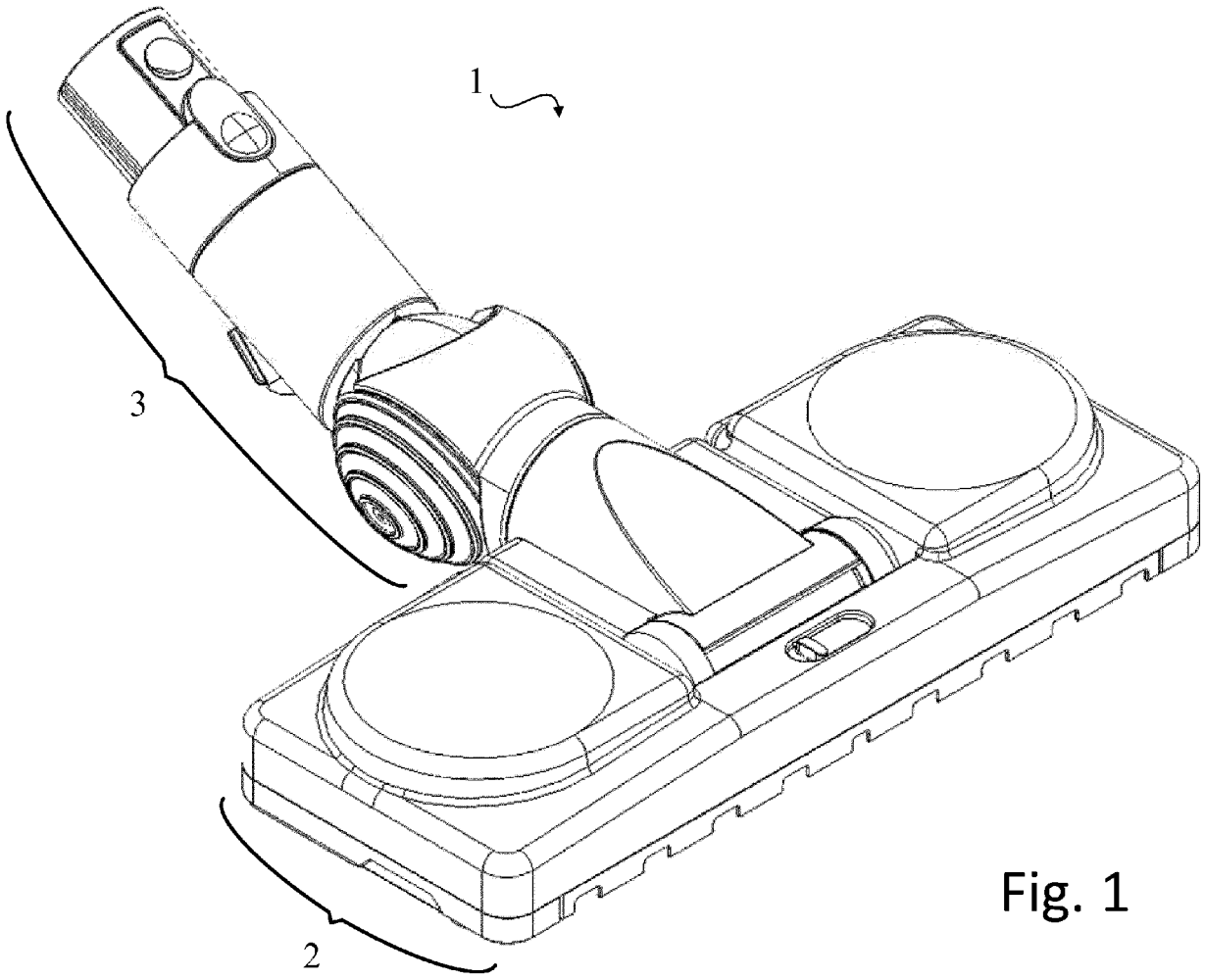

Fig. 1

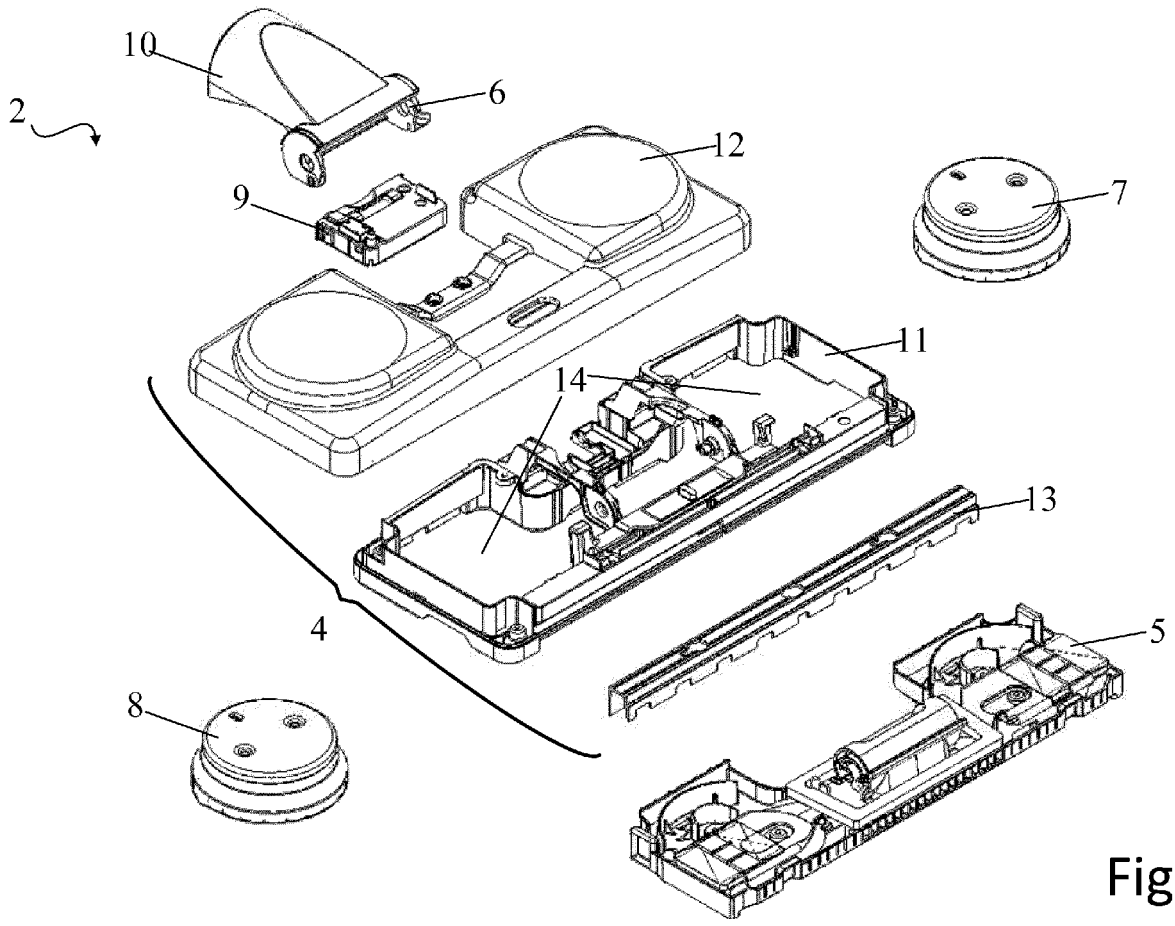

Fig. 2

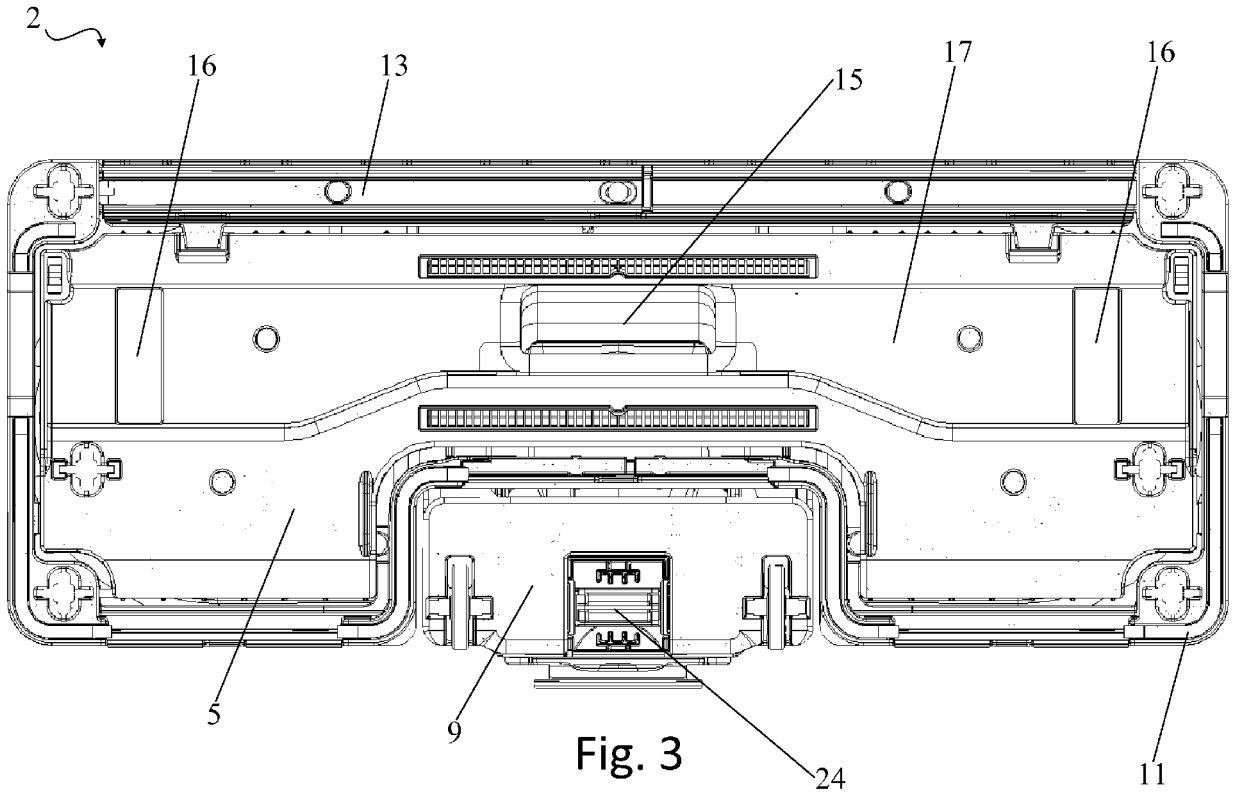

Fig. 3

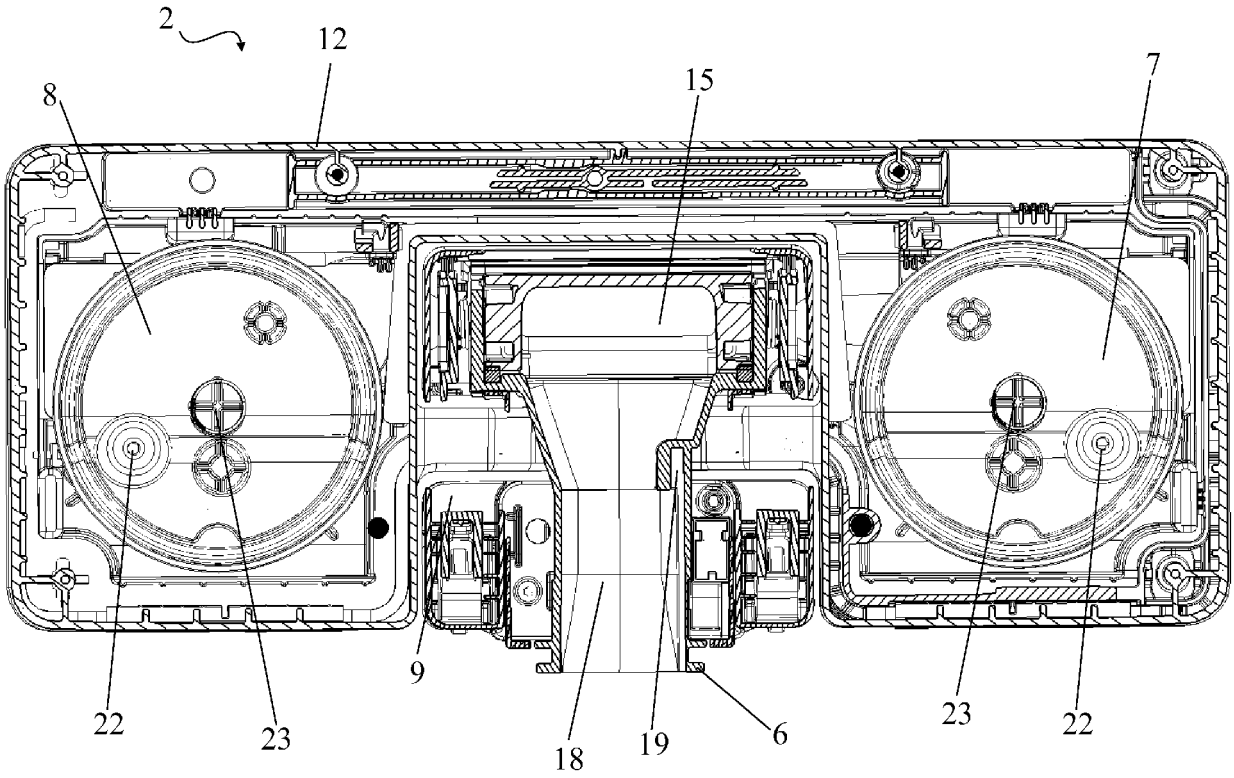

Fig. 4

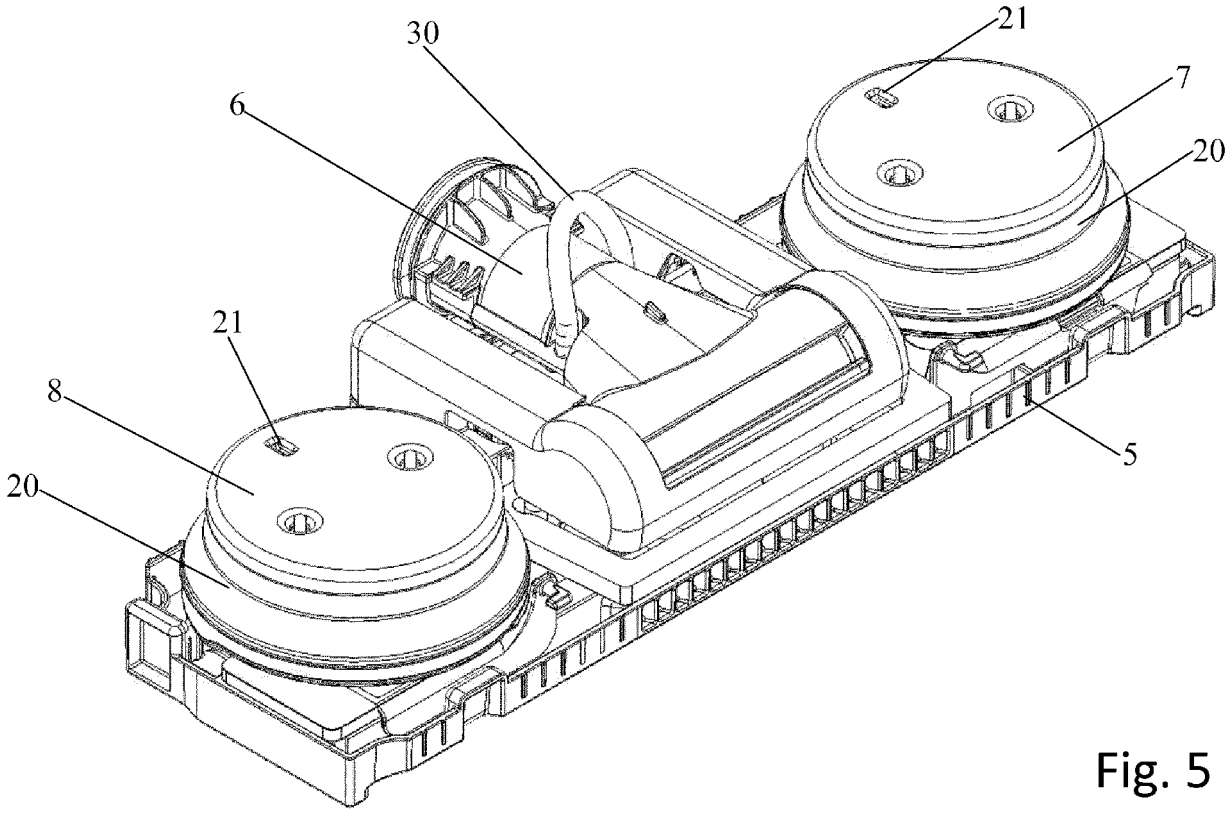

Fig. 5

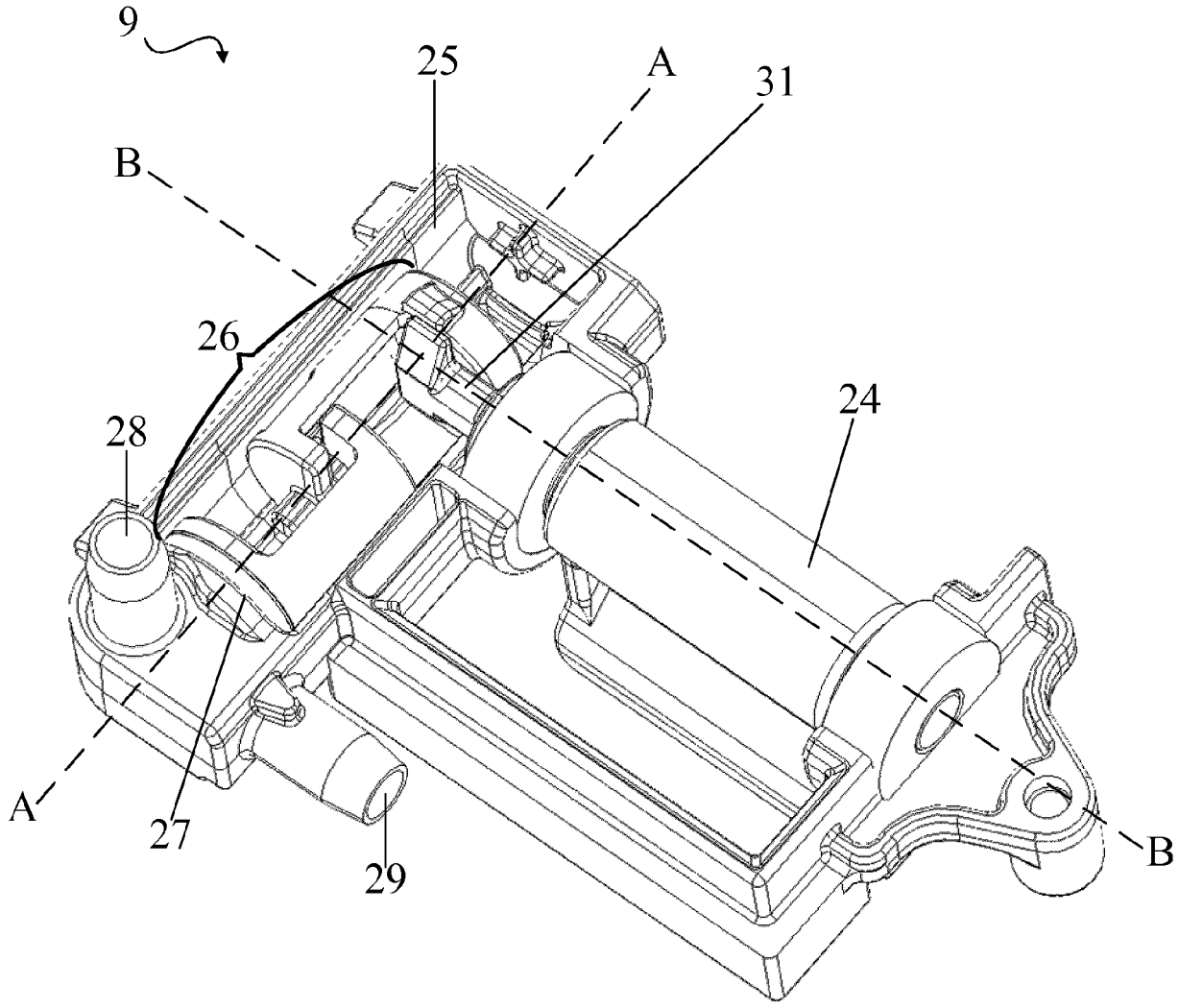

Fig. 6

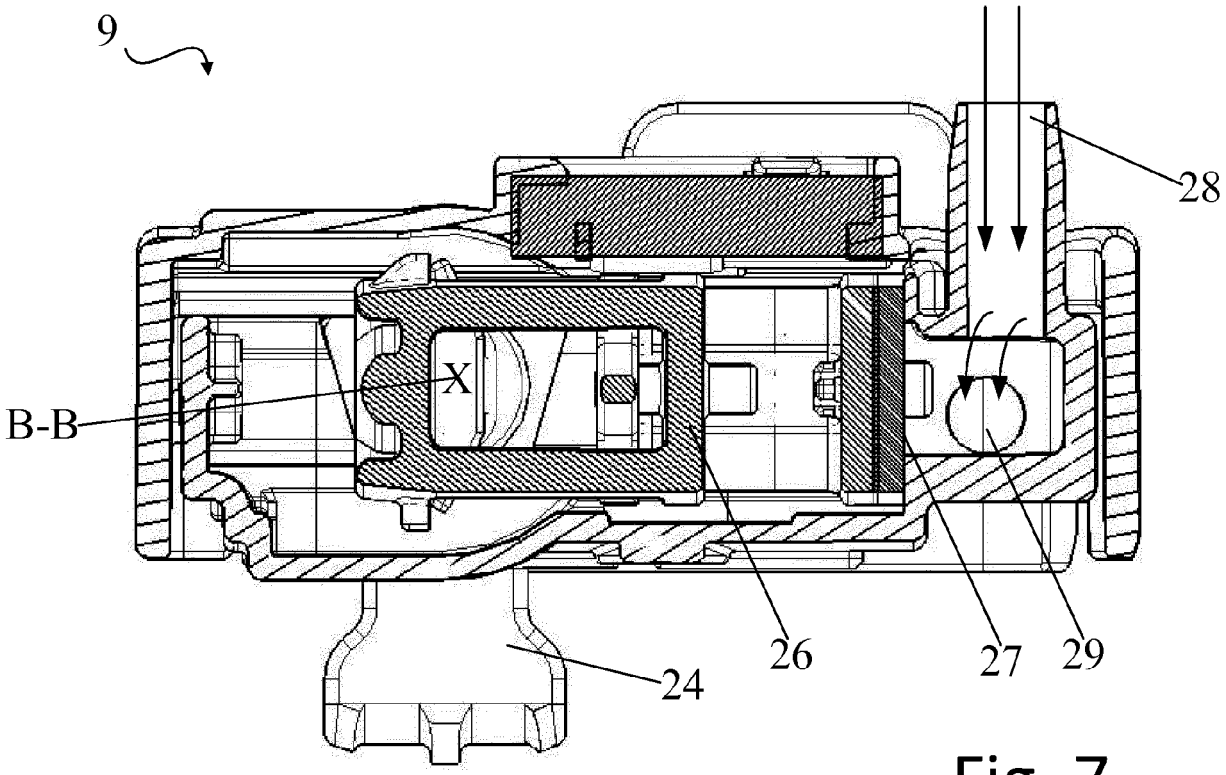

Fig. 7

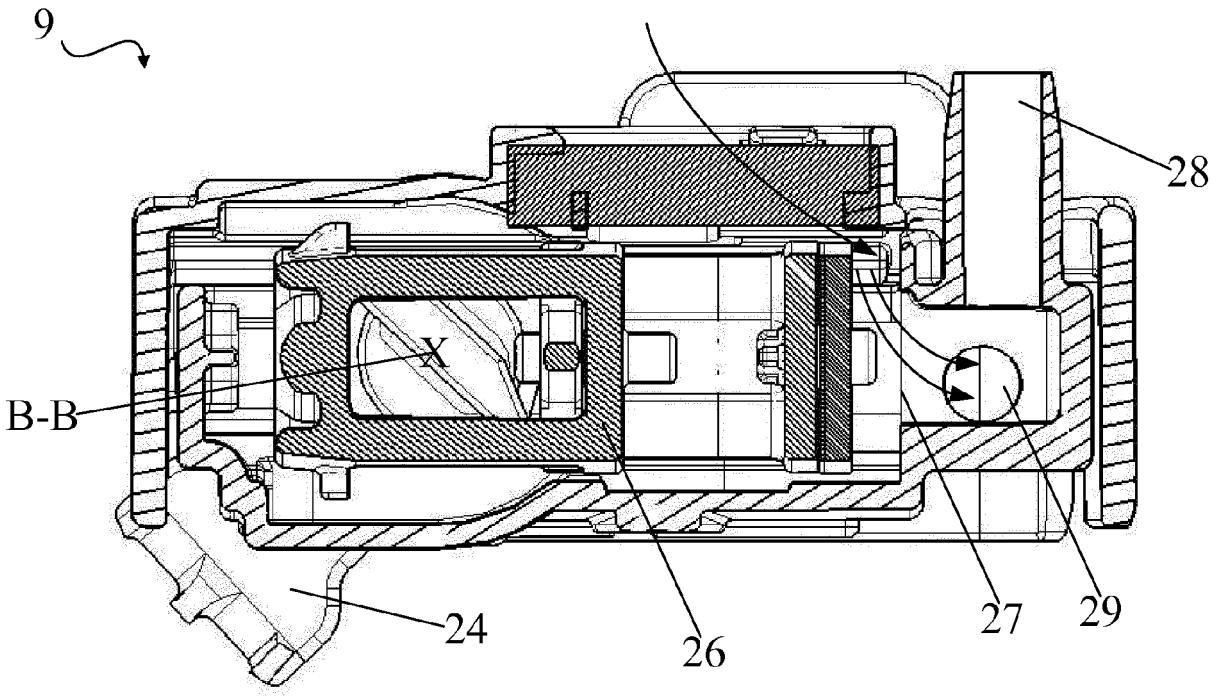

Fig. 8

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 16 16 9662

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	DE 83 35 356 U1 (VORWERK & CO. GMBH [DE]) 15 March 1984 (1984-03-15) * the whole document *	1-6	INV. A47L9/06 A47L9/02
Y	DE 20 04 649 A1 (AKTIEBOLAGET ELECTROLUX, STOCKHOLM [SE]) 6 August 1970 (1970-08-06) * *	1-6	
Y	DE 10 2008 010334 A1 (DUEPRO AG [CH]) 27 August 2009 (2009-08-27) * paragraphs [0035] - [0049] *	1,2,4	
Y	US 2010/257695 A1 (MAGUIRE SCOTT ANDREW [GB] ET AL) 14 October 2010 (2010-10-14) * paragraphs [0008] - [0035] *	1,2,4	
X	FR 1 545 346 A (ELECTROLUX AB) 8 November 1968 (1968-11-08) * the whole document *	1	
A	GB 2 471 918 A (DYSON TECHNOLOGY LTD [GB]) 19 January 2011 (2011-01-19) * page 5, lines 17-20 * * page 19, line 19 - page 25, line 30 *	1-6	TECHNICAL FIELDS SEARCHED (IPC) A47L
A	EP 2 027 807 A2 (SAMSUNG KWANGJU ELECTRONICS CO [KR]) 25 February 2009 (2009-02-25) * paragraphs [0059] - [0063] *	1-6	
A	WO 2005/051154 A1 (ARIETE SPA [IT]; ROSA CARLO [IT]; PICCHI MICHELE [IT]; CARTEI MIRKO [I) 9 June 2005 (2005-06-09) * pages 1,2 *	1-6	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	19 September 2016	Martin Gonzalez, G

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

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 16 16 9662

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
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

19-09-2016

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 8335356 U1	15-03-1984	NONE	
DE 2004649 A1	06-08-1970	DE 2004649 A1	06-08-1970
		FR 2030296 A1	13-11-1970
		GB 1289381 A	20-09-1972
		JP S4822430 B1	05-07-1973
		NL 7001572 A	06-08-1970
		SE 334715 B	03-05-1971
		US 3599271 A	17-08-1971
DE 102008010334 A1	27-08-2009	NONE	
US 2010257695 A1	14-10-2010	AU 2010238376 A1	20-10-2011
		CN 101862159 A	20-10-2010
		EP 2418994 A1	22-02-2012
		JP 5061219 B2	31-10-2012
		JP 5283773 B2	04-09-2013
		JP 5612639 B2	22-10-2014
		JP 2010246936 A	04-11-2010
		JP 2012210498 A	01-11-2012
		JP 2012236059 A	06-12-2012
		KR 20110137360 A	22-12-2011
		US 2010257695 A1	14-10-2010
		WO 2010119279 A1	21-10-2010
FR 1545346 A	08-11-1968	NONE	
GB 2471918 A	19-01-2011	AU 2010272317 A1	19-01-2012
		CN 101953665 A	26-01-2011
		CN 103169427 A	26-06-2013
		EP 2453779 A1	23-05-2012
		GB 2471918 A	19-01-2011
		JP 5118726 B2	16-01-2013
		JP 5433718 B2	05-03-2014
		JP 2011019914 A	03-02-2011
		JP 2012106137 A	07-06-2012
		US 2011010890 A1	20-01-2011
		WO 2011007159 A1	20-01-2011
EP 2027807 A2	25-02-2009	EP 2027807 A2	25-02-2009
		JP 5156500 B2	06-03-2013
		JP 2009045439 A	05-03-2009
		KR 20090019560 A	25-02-2009
		US 2009049643 A1	26-02-2009
WO 2005051154 A1	09-06-2005	IT GE20030024 U1	27-05-2005

EPO FORM P0459

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

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 16 16 9662

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
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

19-09-2016

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
		WO 2005051154 A1	09-06-2005

EPO FORM P0459

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