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(54) **Water switch**

(57) A water switch of a water-bearing appliance, in particular a domestic appliance, including at least one water supply path, several water discharge paths and an adjustable water distribution element, the water distribution element having at least one passage opening and being rotatable around an axis from a first angular position to a second angular position, in the first angular position the at least one passage opening connecting the at least one water supply path to a first water discharge path, and in the second angular position the at least one passage opening connecting the at least one water supply path to a second water discharge path, is characterized in that a guiding mechanism is provided for guiding an axial movement along the axis of the water distribution element when the water distribution element rotates from the first angular position to the second angular position.

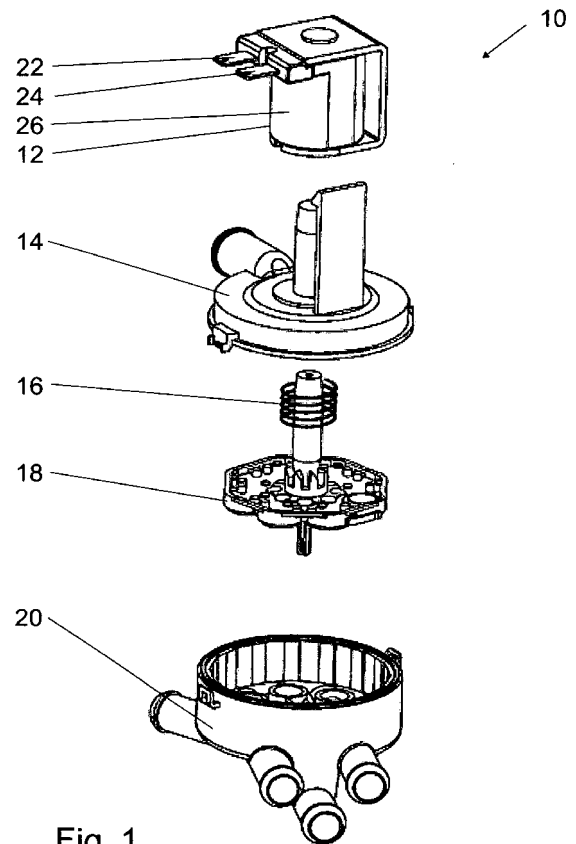


Fig. 1

Description

Technical Field

[0001] The present invention relates generally to a water switch of a water-bearing appliance, in particular a domestic appliance, including at least one water supply path, several water discharge paths and an adjustable water distribution element, the water distribution element having at least one passage opening and being rotatable around an axis from a first angular position to a second angular position, in the first angular position the at least one passage opening connecting the at least one water supply path to a first water discharge path, and in the second angular position the at least one passage opening connecting the at least one water supply path to a second water discharge path.

Background of the Invention

[0002] Water switches, also called fluid switches or water diverters, are used in water-bearing appliances, in particular domestic water-bearing appliances, such as washing machines or dishwashers, to control flows of liquid in the water-bearing appliance. When used in washing machines water switches serve to dispense washing or rinsing water for example to a first or second detergent compartment of two detergent compartments. When used in dishwashers water switches serve to dispense washing water, also referred to as washing liquor, for example alternately to a spray arm for an upper rack or to a spray arm for a lower rack of the respective dishwasher or simultaneously to both spray arms.

[0003] From DE-A-1610146 a water switch is known to include a rotatable control slider which is provided in a cylindrical housing, connecting a supply channel to one of a number of discharge channels by means of a swivel tube. The swivel tube has a rotating pin disposed in a socket of the supply channel in the likeness of a ball and socket joint. A sealing element in the likeness of a hollow cylinder is secured to the mouth of the swivel tube opposite the discharge channels and slides in a cylindrical guide running concentrically to the outer surface of the housing.

[0004] Another water switch known from DE-A-10133130 includes a rotating slider disposed in a pressure chamber of a circulating pump before branching pressure connections. The water switch blocks and releases the pressure connections for washing liquid. A gear drive for the rotating slider is arranged outside and inside the pressure chamber. The rotating slider in question is formed by a cylindrical component, in the cylindrical wall of which one or more apertures are located between one and a number of movable closing elements with a valve function. The apertures and the closing elements are configured in their relative position to the pressure connections, which form the water supply and/or water discharge connections, such that depend-

ing on the rotation of the rotating slider, the pressure connections opposite its cylinder wall are released or blocked in a sealing manner.

[0005] Accordingly, a need exists for a water switch of a water-bearing appliance, for blocking or releasing at least one water supply path to one of several water discharge paths, the water switch being cost efficient in production, being easy to switch, and providing an effective water flow control for the water-bearing appliance associated therewith.

Summary of the Invention

[0006] In accordance with one aspect of the invention a water switch of a water-bearing appliance, in particular a domestic appliance, is provided, the water switch including at least one water supply path, several water discharge paths and an adjustable water distribution element, the water distribution element having at least one passage opening and being rotatable around an axis from a first angular position to a second angular position, in the first angular position the at least one passage opening connecting the at least one water supply path to a first water discharge path, and in the second angular position the at least one passage opening connecting the at least one water supply path to a second water discharge path. Further, a guiding mechanism is provided for guiding an axial movement along the axis of the water distribution element when the water distribution element rotates from the first angular position to the second angular position. The axial movement of the water distribution element, in particular, takes place while the water switch is unpressurized. In order to prevent the water distribution element from moving back after its rotation from one angular position to the next angular position, in particular, a reverse-lock is provided. The water distribution element may serve to connect one or several water supply paths to one or several different water discharge paths and/or to interconnect several water discharge paths.

[0007] Preferably the guiding mechanism includes at least one cylindrical portion being guided in a respective tubular portion surrounding the at least one cylindrical portion, and/or wherein further, in particular, the at least one cylindrical portion is connected to an armature of an associated magnetic coil.

[0008] In a preferred embodiment, the water distribution element is disk shaped and extends perpendicular to the axis, and/or wherein further, in particular, the cylindrical portion and/or the armature extend along the axis.

[0009] In another preferred embodiment, the guiding mechanism includes at least one first ramp portion sliding along a respective second ramp portion during the axial movement of the water distribution element, the pair of a first ramp portion and a respective second ramp portion thereby generating a torque for rotating the water distribution element from the first angular position in the di-

rejection to the second angular position.

[0010] Further preferred, several pairs of a first ramp portion and a respective second ramp portion, in particular, 8 pairs of a first ramp portion and a respective second ramp portion, are circumferentially distributed, and in particular, evenly circumferentially distributed, around a cylindrical portion of the guiding mechanism.

[0011] In a further preferred embodiment, the number of pairs of a first ramp portion and a respective second ramp portion equals the number of water discharge paths.

[0012] In accordance with a preferred aspect of the invention the number of pairs of a first ramp portion and a respective second ramp portion is larger than the number of water discharge paths, whereby at least at one angular position of the water distribution element the respective water discharge is closed.

[0013] In accordance with yet another preferred aspect of the invention at least one first pair of a first ramp portion and a respective second ramp portion and at least one second pair of a first ramp portion and a respective second ramp portion are located on two opposite faces of the water distribution element. Each of the two pairs of a first ramp portion and a respective second ramp portion generates a part of the necessary torque for moving the water distribution element along its travel from the first angular position to the second angular position.

[0014] In accordance with still another preferred aspect of the invention the at least one first pair of a first ramp portion and a respective second ramp portion at one face of the water distribution element generates about one half of the rotary movement of the water distributing element, and the at least one second pair of a first ramp portion and a respective second ramp portion at the opposite face of the water distribution element generates about the second half of the rotary movement of the water distributing element.

[0015] Finally, in a further preferred embodiment of the solution according to the invention, the guiding mechanism includes a spring, in particular a helical spring, biasing the water distribution element in the direction of the several water discharge paths, and/or wherein further, in particular, the spring surrounds a cylindrical portion of the guiding mechanism.

[0016] The water switch apparatus according to the invention can be switched with very low expenditure of energy, because the water distribution element associated therewith does not only rotate from a first angular position to at least one second angular position but also does an axial movement during this rotational movement. With this axial movement the water distribution element can be lifted off a sealing element located at the passage opening of the water distribution element.

[0017] The sealing element helps providing a water tight passageway through the water switch. Further, the sealing element is suitable for sealing a water passage opening which extends through a flat rotating disk in respect to water discharge lines opposite said flat rotating

disk. This water switch according to the invention is even suitable for sealing openings provided in a cylinder wall.

[0018] According to another advantage with this solution, the water switch does not produce an unwanted high pressure loss in the water flow to be distributed in each instance due to only very low deflection within the water distribution element and the flow paths connected therewith.

[0019] Finally, on one hand, the water switch provides the possibility to connect a very large number of water discharge paths. On the other hand, a water tight seal is easily provided against all of the water discharge paths not being connected to the water supply path.

15 Brief Description of the Invention

[0020] Hereinafter an embodiment of the solution according to the invention is described referring to the schematic drawings in which

- 20 Fig. 1 is a perspective explosion view of an embodiment of a water switch according to the invention,
- 25 Fig. 2 is a perspective view of the water switch of Fig. 1,
- Fig. 3 is the sectional view indicated in Fig. 2 showing a position of the re-spective water distribution member during distributing water to a wa-ter discharge path,
- 30 Fig. 4 is the sectional view indicated in Fig. showing a position of the re-spective water distribution element during the movement of switching from one water discharge path to another wa-ter discharge path,
- 35 Fig. 5 is the sectional view indicated in Fig. 6,
- 40 Fig. 6 is a top view of the respective lower housing portion of the water switch of Fig. 1,
- Fig. 7 is a perspective top view of the lower housing portion as shown in Fig. 5 and 6,
- 45 Fig. 8 is the sectional view indicated in Fig. 9,
- Fig. 9 is a top view of the respective upper housing portion of the water switch of Fig. 1,
- 50 Fig. 10 is a perspective bottom view of the upper housing portion as shown in Fig. 8 and 9,
- 55 Fig. 11 is a first perspective view of the respective wa-ter distribution element of the water switch of Fig. 1,

- Fig. 12 is a second respective view of the water distribution element as shown in Fig. 11,
- Fig. 13 is the sectional view indicated in Fig. 14,
- Fig. 14 is a top view of the water distribution element as shown in Fig. 11 to 13 and
- Fig. 15 is a bottom view of the water distribution element as shown in Fig. 11 to 14.

Detailed Description of the Invention

[0021] A water switch 10 for a water-bearing appliance, in particular a domestic appliance, includes the main structural members of a magnetic coil 12, an upper housing portion 14, a spring 16, a water distribution element 18 and a lower housing portion 20. The magnetic coil 12 is fitted on top of the upper housing portion 14, while the spring 16 and the water distribution element 18 are mounted in the hollow space provided by the upper housing portion 14 and the lower housing portion 20. The spring 16 is formed as a helical spring, is located between the upper housing portion 14 and the water distribution element 18 and thereby biases the water distribution element 18 against the lower housing portion 20.

[0022] The magnetic coil 12 has a first connector pin 22 and a second connector pin 24 both protruding in a lateral direction at the upper rim of the magnetic coil 12. The first and second connector pins 22 and 24 are for connecting an electrical plug (not shown) and for supplying current to the magnetic coil 12. The current supplied flows through a wire-wound coil (not shown) which is located within a cylindrical hollow body 26 of the magnetic coil 12. The magnetic coil 12 is a standardized structural element which is produced in large scale manufacture. Thus, the magnetic coil 12 can be produced very cost-effective.

[0023] The upper housing portion 14, which is shown in detail in Fig. 8 to 10, is made of plastic or another synthetic material by an injection molding process. It has the shape of a round, in particular circular disc from which a water supply path 28 in the form of a supply connection tube is projecting radially at the outer range thereof. The water supply path 28 leads to an approximately circular channel 30 which is located at the inner side of this disc-shaped housing shell of the upper housing portion 14. At the center of this disc shape a cylindrical housing portion 32 protrudes to the outside along a central axis of the disc (not figured). The cylindrical housing portion 32 forms a tubular portion for pinning up the cylindrical hollow body 26 thereon and for accommodating a portion of the water distribution element 18 therein, as will be explained in further detail hereinafter.

[0024] Parallel with the cylindrical housing portion 32 a snap-in pin 34 protrudes from the disk. The snap-in pin 34 is adapted to embrace the cylindrical hollow body 26 in order to hold the magnetic coil 12 on the cylindrical

housing portion 32.

[0025] Two notches 36 project radially at one of two diametrical positions of the outer range of the disk-shape housing shell. These notches 36 are provided for a watertight connection of the lower housing portion 20 to the upper housing portion 14 as it is shown in Fig. 2.

[0026] Eight first ramp portions 38 and adjacent first recess portions 40 are surrounding the cylindrical housing portion 32 at the inner center of the housing shell of the upper housing portion 14. Each ramp portion 40 is made of a ramp surface 42 which is skewed relative to said axis. The ramp surface 42 is positioned in an angel relative to the axis of about 40 degrees to 60 degrees, preferably 50 degrees. The ramp surface 42 terminates at a ramp edge 44, which is formed by a smaller and steeper counter ramp 46. The ramp edge 44 is rather dull. The first recess portions 40 are limited by parallel sidewalls forming a type of slot into which a second ramp portion facing the first ramp portion can be inserted, as will be explained later.

[0027] The water distribution element 18 is shown in detail in Fig. 11 to 15. It is made of plastic or synthetic materials, too. The water distribution element 18 is formed like a circular disc, which has eight water distribution positions 48 on its disk-face. The water distribution positions 48 are located with equal distances along a circle on the face. One of the water distribution positions 48 is open, including a passage opening 50 which permeates the disk. The seven remaining water distribution positions 48 are closed.

[0028] At each water distribution position 48 a sealing ring 52 is provided at the lower side of the disk of the water distribution element 18. One of these sealing rings 52 is located at a margin 54 of the passage opening 50. The other sealing rings 52 are fixed to the disk by means of pins 56 protruding through respective openings in the disk.

[0029] A first cylindrical portion 58 protrudes at the central area of the disk-shape and carries a rod-shaped armature 60 made from iron or ferro-magnetic material. The armature 60 elongates the first cylindrical portion 58 along the axis. When mounting the water distribution element 18 into the upper housing portion 14, the armature 60 dives into the cylindrical housing portion 32 and into the cylindrical hollow body 26 of the magnetic coil 12.

[0030] Eight second ramp portions 62 and adjacent recess portions 64 are surrounding the first cylindrical portion 58. These second ramp portions 62 are also formed by ramp surfaces sloping relative to the axis with an angel of between 40 degrees and 60 degrees, preferably of 50 degrees, a respective ramp edge and an associated smaller counter ramp. The ramp surfaces of the second ramp portions 62 are positioned in a manner for sliding along the ramp surfaces 42 of the first ramp portions 38 when the water distribution element 18 moves in an axial direction, and further for diving into the respective first recess portions 40 after the ramp surfaces have left the phase of sliding contact.

[0031] Around these second ramp portions 62 eight through holes 66 are located in the disk of the water distribution element 18 serving as hydraulic flow compensation during movement of the water distribution element 18 in axial direction.

[0032] Two latches 68 are located in a tangential manner at two diametrical positions of an outer margin 70 of the disk-shape of the water distribution element 18. These latches 68 help to ensure that the water distribution element 18 can only rotate on one direction.

[0033] On the lower face of the disk-shape of the water distribution element 18 a guiding pin 72 projects axially and forms a second cylindrical portion. The guiding pin 72 has longitudinal slots 74 on this lateral surface which also leads into the first cylindrical portion 58 and into the armature 60 providing further water compensation.

[0034] The second cylindrical portion formed by the guiding pin 72 is surrounded by eight first ramp portions 76 and adjacent first recess portions 78. These ramp portions 76 and recess portions 78 correspond to those first ramp portions 38 and first recess portions 40 mentioned above, but they are offset in the circumferential direction by nearly the angular width of the first ramp portions 38.

[0035] The cupular lower housing portion 20 is depicted in further detail in Fig. 5 to 7. It is also made of plastic or another synthetic material by injection molding and includes a sealing edge or sealing ring 80 at its upper circular edge. Two notch catchers 82, each for clamping one of the notches 36, project radially at two diametrical positions of the outer sidewall of the lower housing portion 20.

[0036] The bottom of the lower housing portion 20 provides eight water discharge positions 84 located with equal distances along a circle on the inner face of the bottom. One position 86 of these water discharge positions 84 is closed; the remaining seven positions are open. They have respective water discharge paths 88 in the form of a discharge connection tube connected therewith.

[0037] Further, at the inner surface of the sidewall of the cup-shaped or cupular lower housing portion 20 sixteen latch ramps 90 are formed. These latch ramps 90 are designed so that the latches 68 of the water distribution element 18 can slide along.

[0038] A guiding cylinder 92 accommodates the guiding pin 72 and projects in the center of the bottom to the outside of the lower housing portion 20. At the center of the inside of the bottom eight second ramp portions 94 and adjacent second recess portions 96 surround the opening leading into the guiding cylinder 92.

[0039] During operation of the water switch 10, the magnetic coil 12 pulls the armature 60 and the water distribution element 18 connected therewith in the direction of the upper housing portion 14 and biases the spring 16. While moving axially, the first ramp portions 38 and the second ramp portions 62 contact each other and start to work as a guiding mechanism by sliding along each

other. The sliding process provides a torque which starts to rotate the water distribution element 18 from its starting first angular position to the direction of a next second angular position. These positions are those of the water distribution positions 48 mentioned above. The sliding of the ramp portions 38 and second ramp portions 62 provide half of the travel from the first angular position to the second angular position.

[0040] The second half of the travel is provided, when the magnetic coil 12 stops pulling the armature 60 and the spring 16 pushes the water distribution element 18 back along the axis in its previous axial position. While moving back axially, the first ramp portions 76 now come into contact with the second ramp portions 94 in order to slide along each other and in order to turn the water distribution element 18 further along the second half of the travel.

[0041] At the end of the travel, the sealing rings 52 come into contact with respective water discharge paths 88 again. While seven of the discharge paths are closed by means of the water distribution element 18 in this manner, one path through the passage opening 50 is open.

Reference Numerals

[0042]

- | | |
|----|--|
| 10 | water switch for a water-bearing appliance |
| 12 | magnetic coil |
| 14 | upper housing portion |
| 16 | spring |
| 18 | water distribution element |
| 20 | lower housing portion |
| 22 | first connector pin |
| 24 | second connector pin |
| 26 | cylindrical hollow body |
| 28 | water supply path |
| 30 | circular channel |
| 32 | cylindrical housing portion |
| 34 | snap-in pin |
| 36 | notch |
| 38 | first ramp portions |
| 40 | first recess portions |

42	ramp surface		Claims
44	ramp edge		
46	counter ramp	5	1. A water switch (10) of a water-bearing appliance, in particular a domestic appliance, including at least one water supply path (28), several water discharge paths (88) and an adjustable water distribution element (18), the water distribution element (18) having at least one passage opening (50) and being rotatable around an axis from a first angular position to a second angular position, in the first angular position the at least one passage opening (50) connecting the at least one water supply path to a first water discharge path, and in the second angular position the at least one passage opening (50) connecting the at least one water supply path to a second water discharge path,
48	water distribution positions		
50	passage opening	10	characterized in a guiding mechanism (38, 62, 76, 94) for guiding an axial movement along the axis of the water distribution element (18) when the water distribution element (18) rotates from the first angular position to the second angular position.
52	sealing ring		
54	margin of the passage opening		
56	pin of the sealing ring	15	
58	first cylindrical portion		
60	armature	20	
62	second ramp portions		
64	second recess portions		2. The water switch of claim 1,
66	through holes	25	wherein the guiding mechanism includes at least one cylindrical portion (58) being guided in a respective tubular portion (32) which surrounds the at least one cylindrical portion (58), and/or wherein further, in particular, the at least one cylindrical portion (58) is connected to an armature (60) of an associated magnetic coil (12).
68	latch		
70	outer margin	30	
72	guiding pin		
74	longitudinal slot		3. The water switch of claim 1 or 2,
76	first ramp portions	35	wherein the water distribution element (18) is disk shaped and extends perpendicular to the axis, and/or wherein further, in particular, the cylindrical portion (58) and/or the armature (60) extends along the axis.
78	first recess portions		
80	sealing ring		4. The water switch of one of claims 1 or 3,
82	notch catcher	40	wherein the guiding mechanism includes at least one first ramp portion (38, 76) sliding along a respective second ramp portion (62, 94) during the axial movement of the water distribution element (18), the pair of a first ramp portion and a respective second ramp portion (38, 62, 76, 94) thereby generating a torque for rotating the water distribution element (18) from the first angular position in the direction to the second angular position.
84	water discharge positions		
86	closed position	45	
88	water discharge paths		
90	latch ramp		
92	guiding cylinder	50	5. The water switch of claim 4,
94	second ramp portion		wherein several pairs of a first ramp portion and a respective second ramp portion (38, 62, 76, 94), in particular eight pairs of a first ramp portion and a respective second ramp portion (38, 62, 76, 94), are circumferentially distributed, in particular, evenly circumferentially distributed, around a cylindrical portion (58) of the guiding mechanism.
96	second recess portion	55	

6. The water switch of claim 5,
wherein the number of pairs of a first ramp portion
and a respective second ramp portion (38, 62, 76,
94) equals the number of water discharge paths (88). 5
7. The water switch of claim 5,
wherein the number of pairs of a first ramp portion
and a respective second ramp portion (38, 62, 76,
94) is larger than the number of water discharge
paths (88), whereby at least at one angular position 10
of the water distribution element (18) the respective
water discharge is closed.
8. The water switch of one of claims 4 to 7,
wherein at least one first pair of a first ramp portion 15
and a respective second ramp portion (38, 62) and
at least one second pair of a first ramp portion and
a respective second ramp portion (76, 94) are locat-
ed on two opposite faces of the water distribution 20
element (18).
9. The water switch of claim 8,
wherein the at least one first pair of a first ramp por-
tion and a respective second ramp portion (38, 62)
at one face of the water distribution element (18) 25
generates approximately one half of the rotary move-
ment of the water distributing element (18), and the
at least one second pair of a first ramp portion and
a respective second ramp portion (76, 94) at the op-
posite face of the water distribution element (18) gen- 30
erates approximately the second half of the rotary
movement of the water distributing element (18).
10. The water switch of one of claims 1 to 9,
wherein the guiding mechanism includes a spring 35
(16), in particular a helical spring, biasing the water
distribution element (18) in the direction of the sev-
eral water discharge paths (88), and/or wherein fur-
ther, in particular, the spring (16) surrounds a cylin-
drical portion (58) of the guiding mechanism. 40

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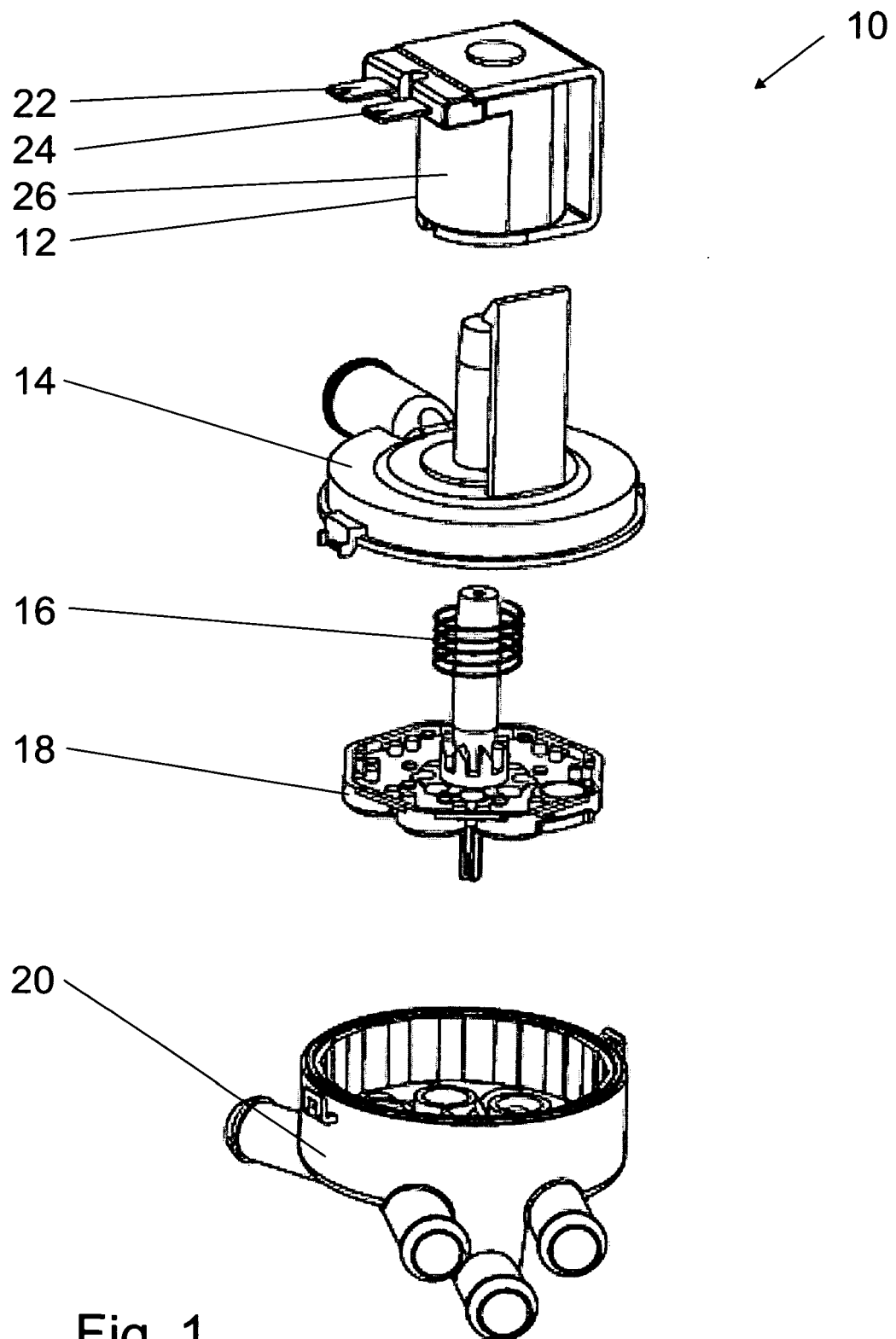


Fig. 1

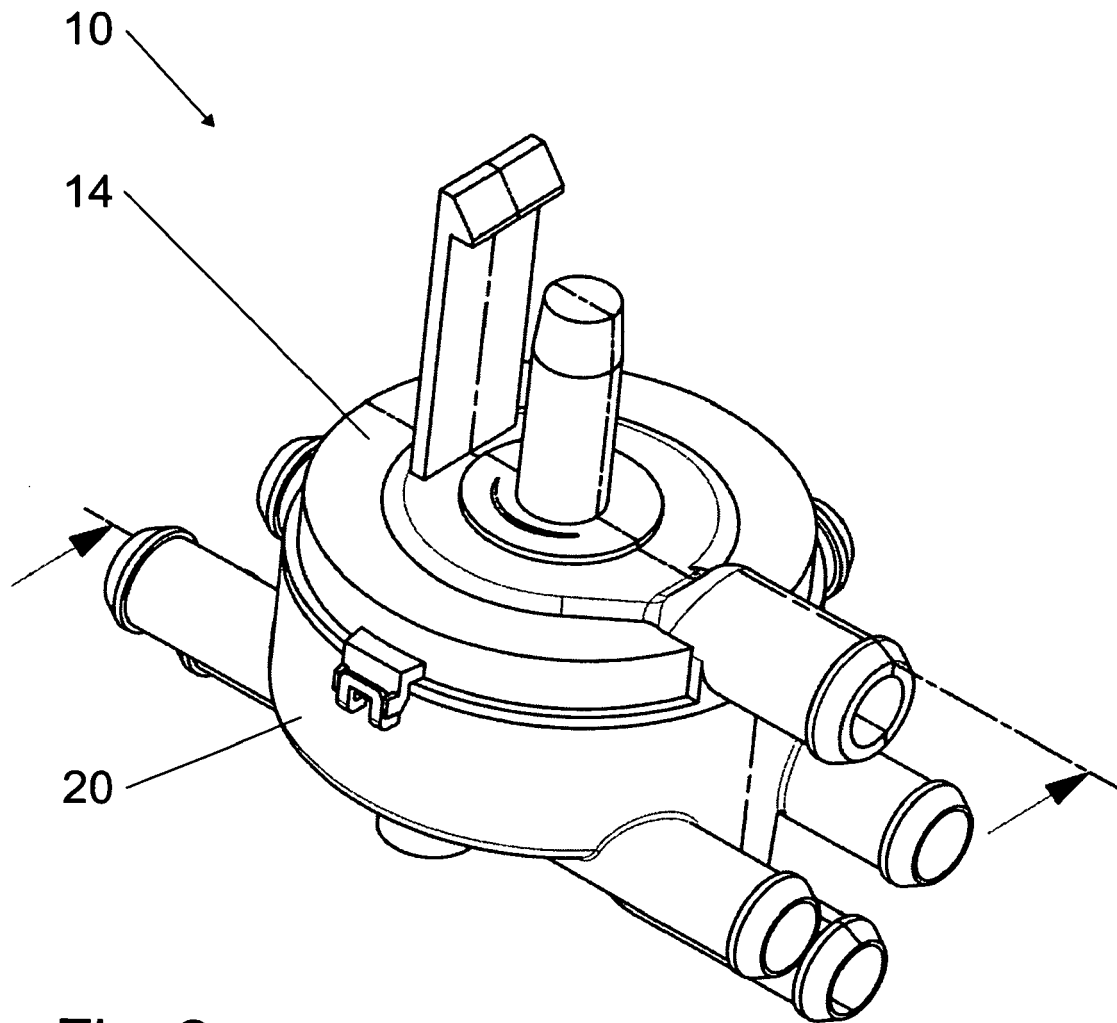


Fig. 2

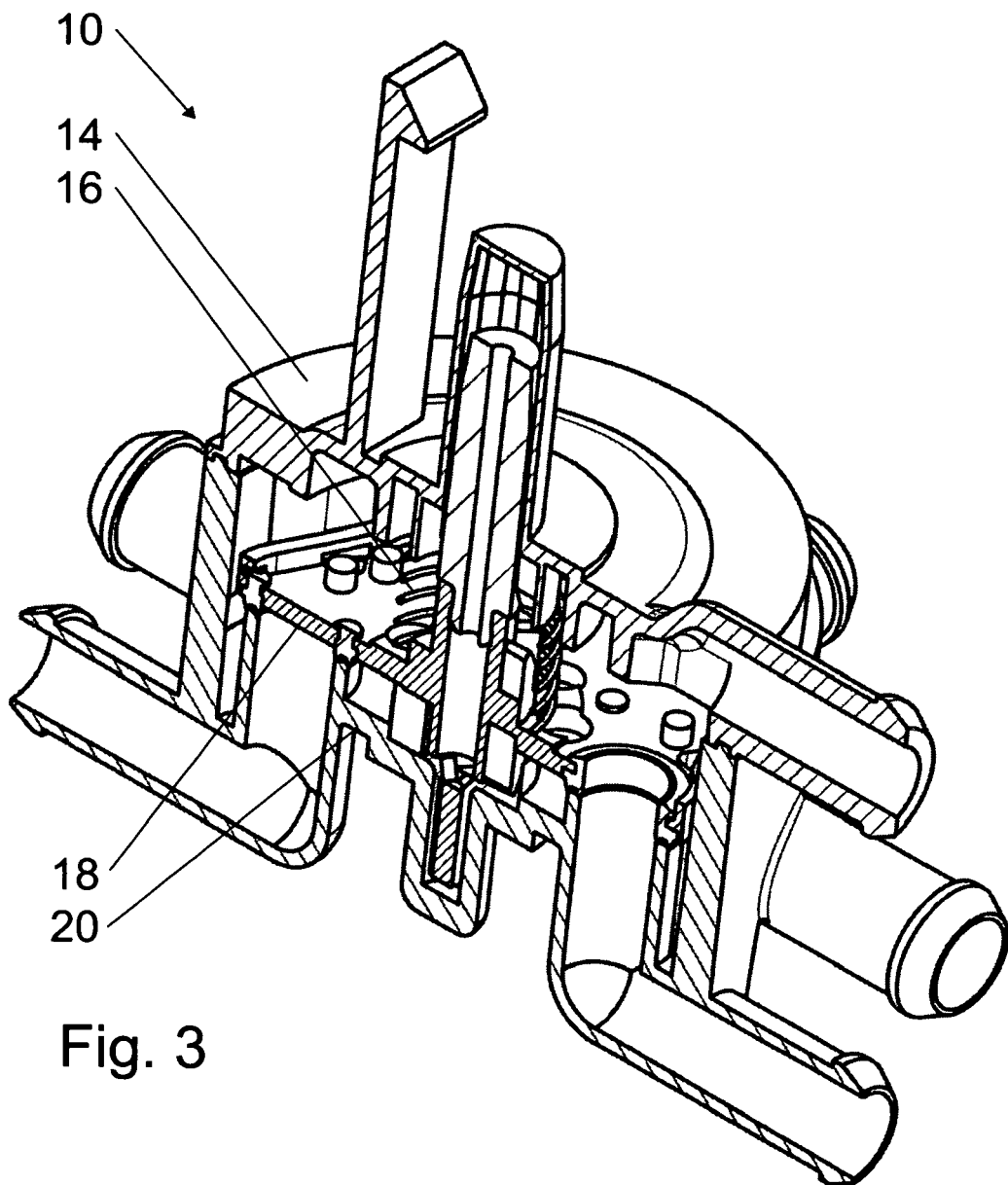


Fig. 3

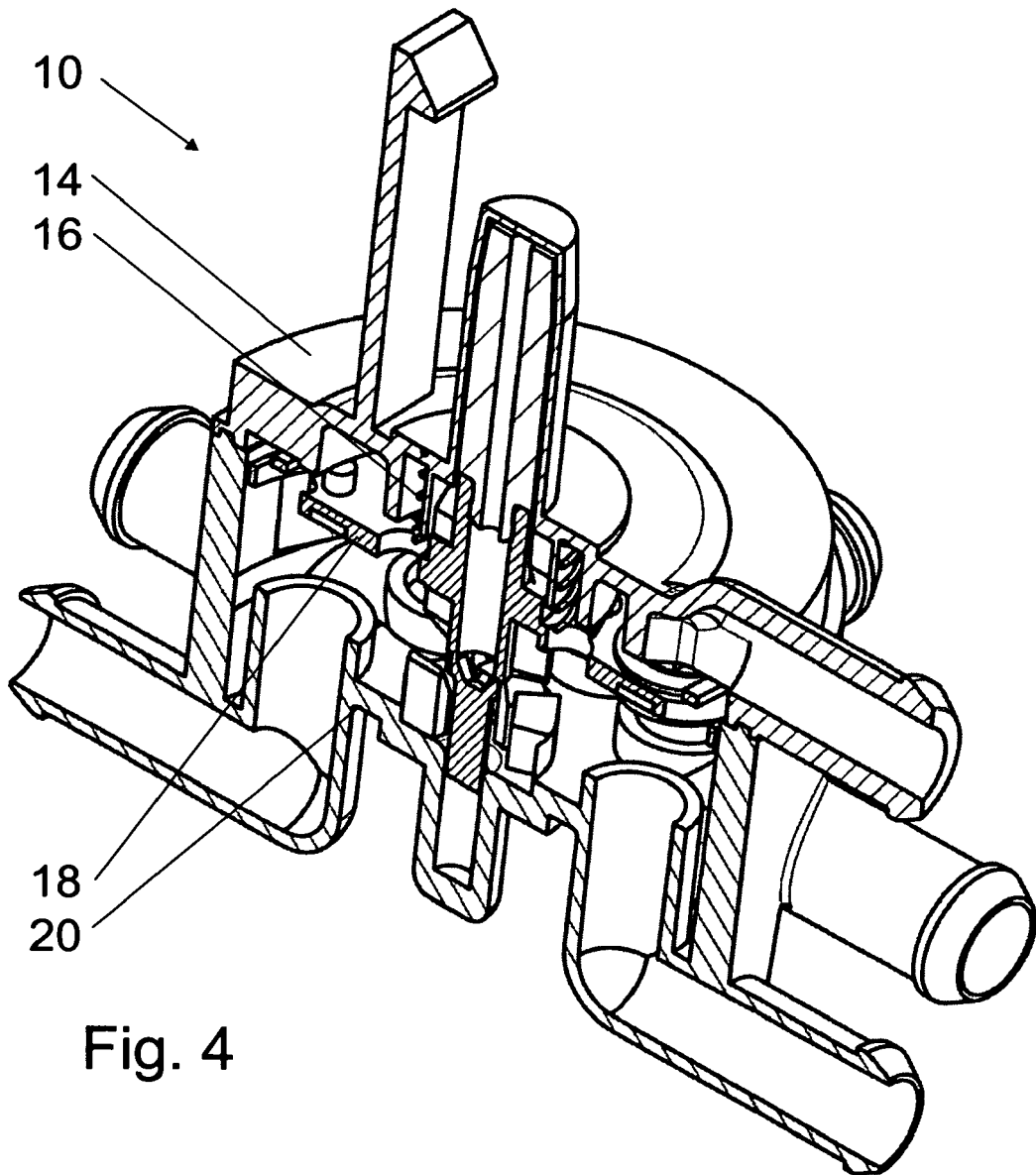


Fig. 4

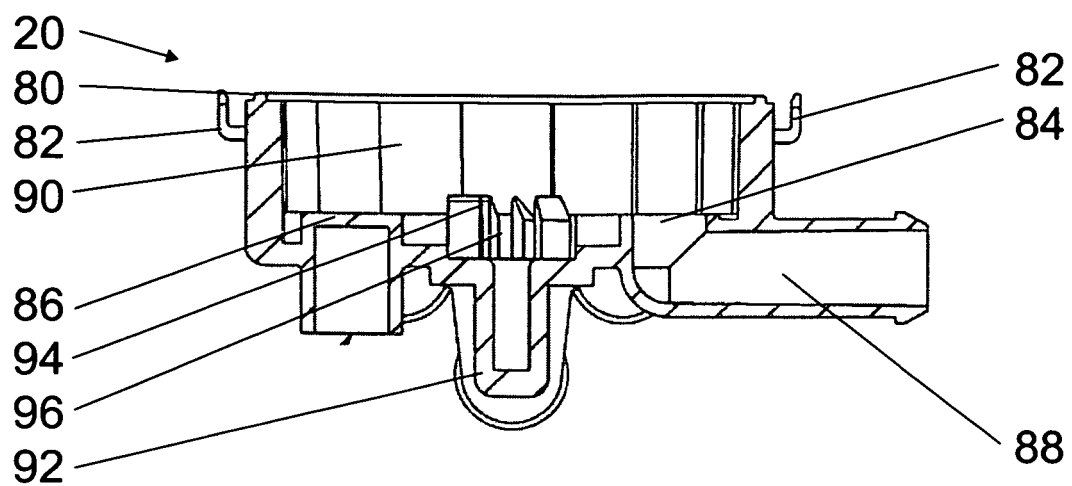


Fig. 5

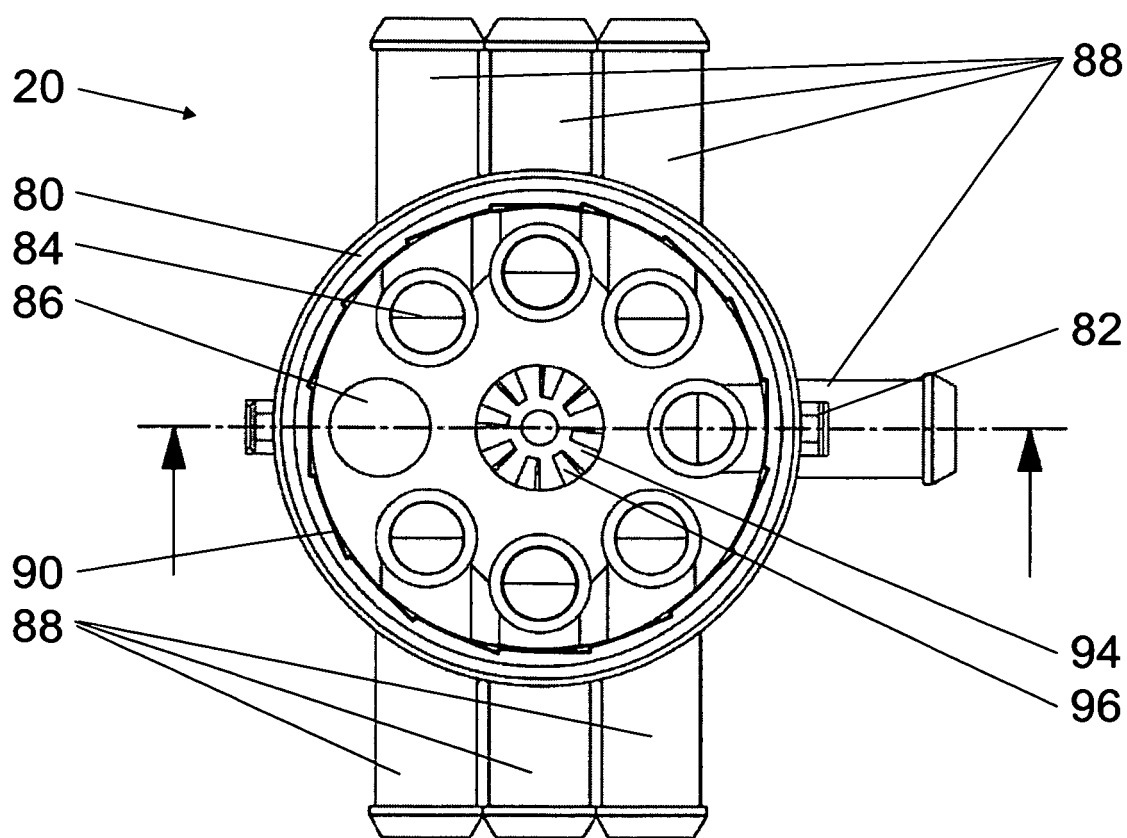


Fig. 6

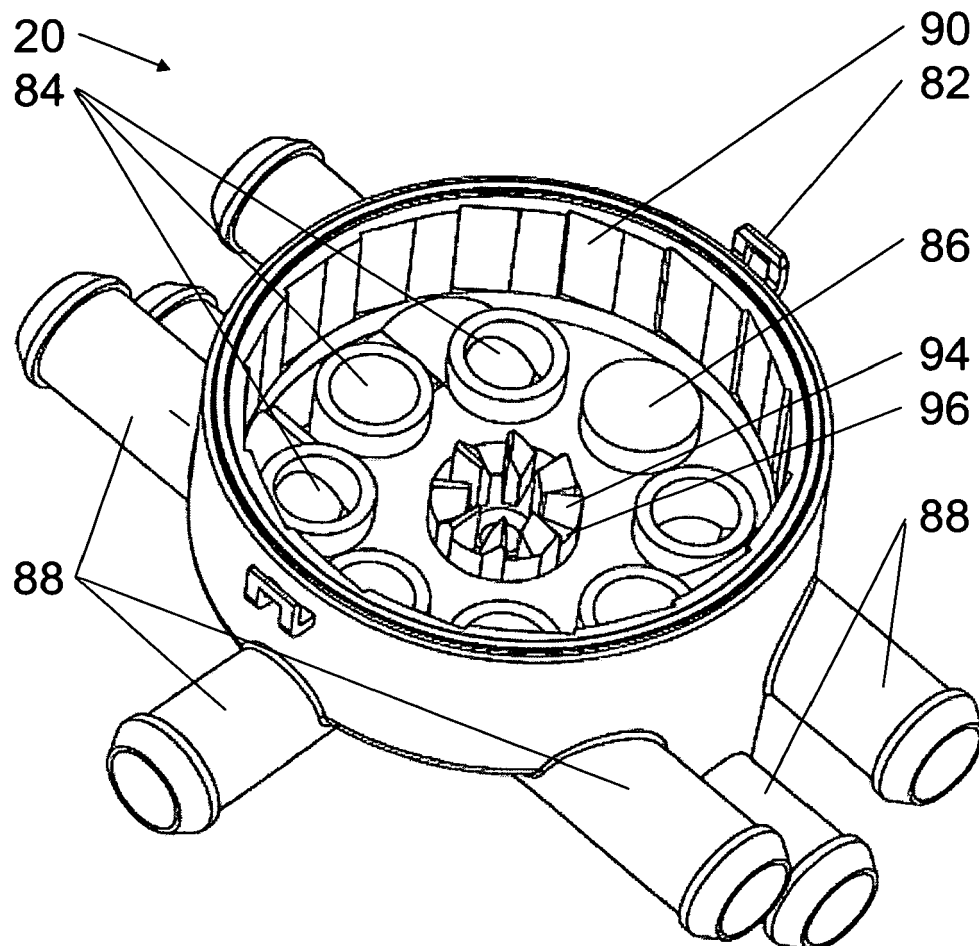


Fig. 7

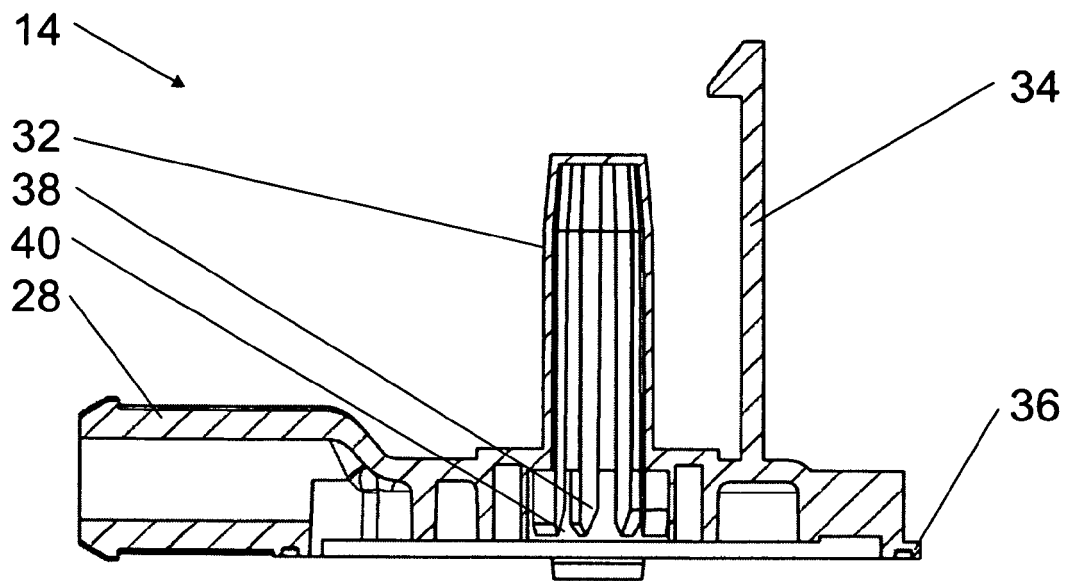


Fig. 8

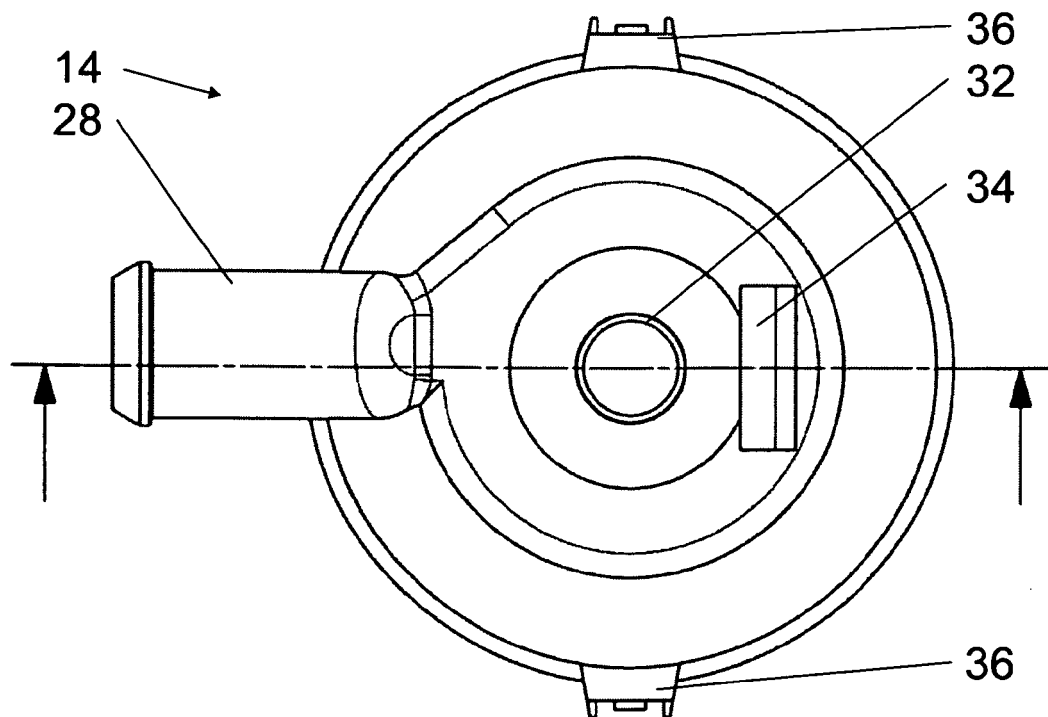


Fig. 9

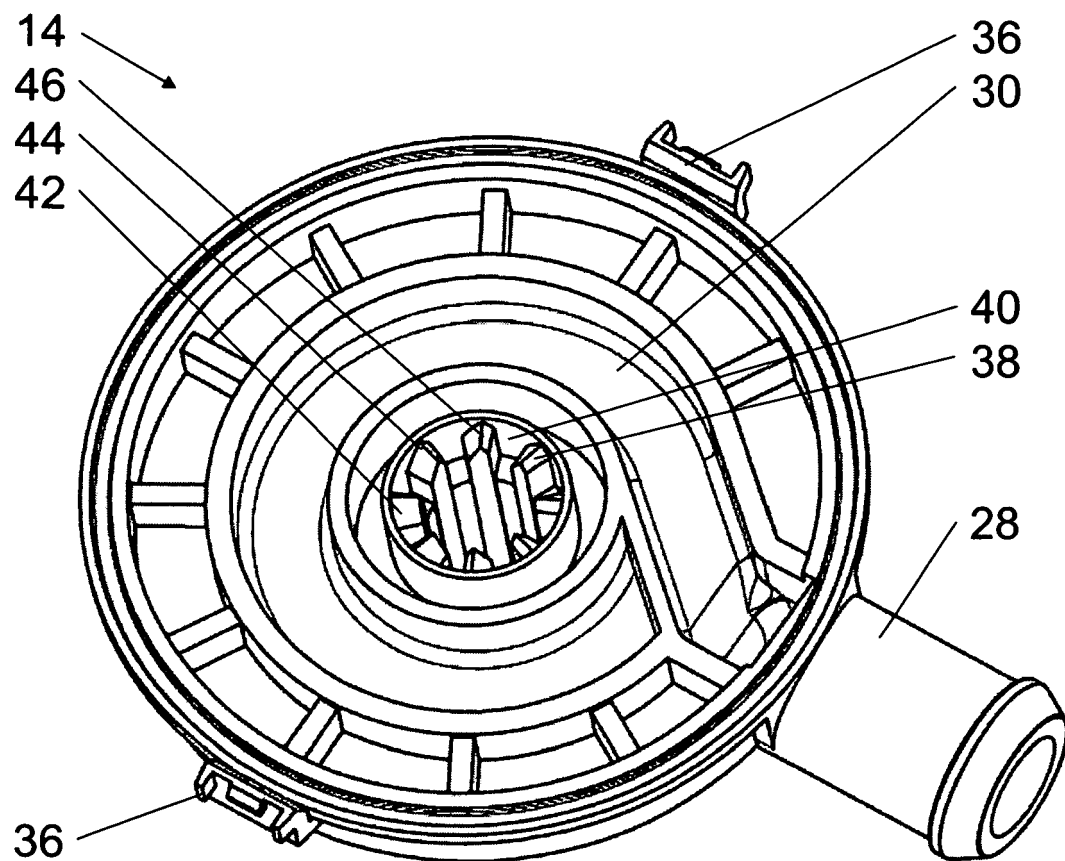


Fig. 10

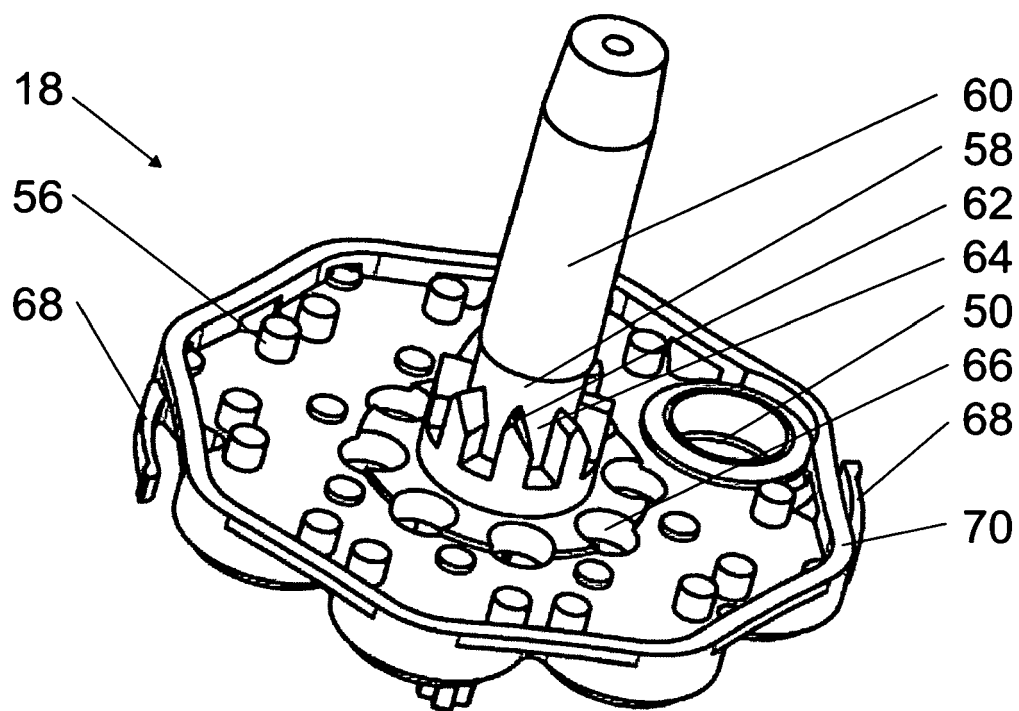


Fig. 11

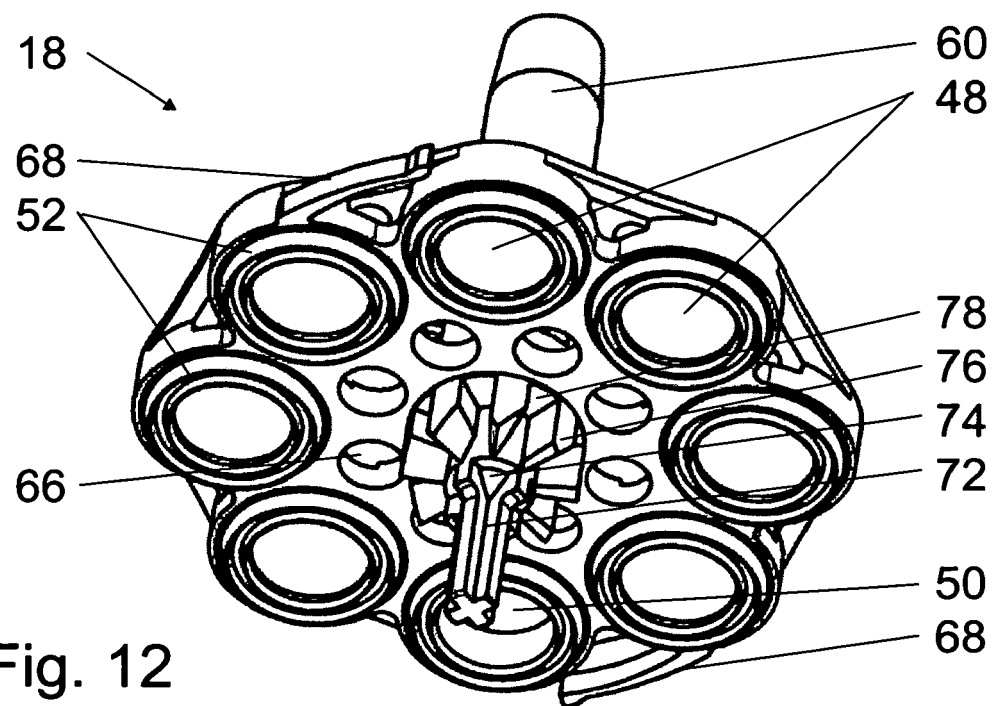


Fig. 12

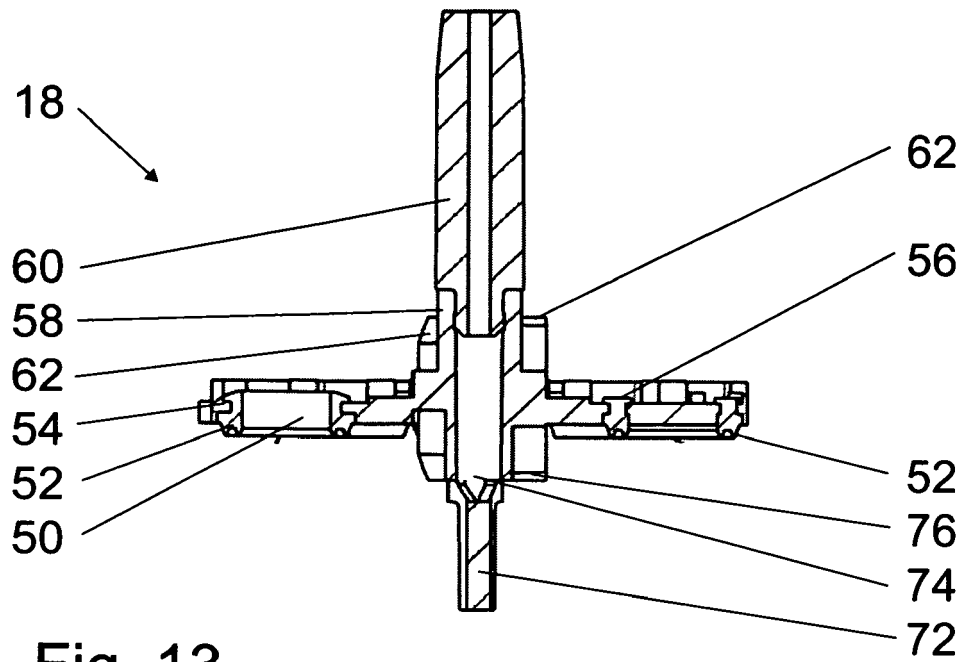


Fig. 13

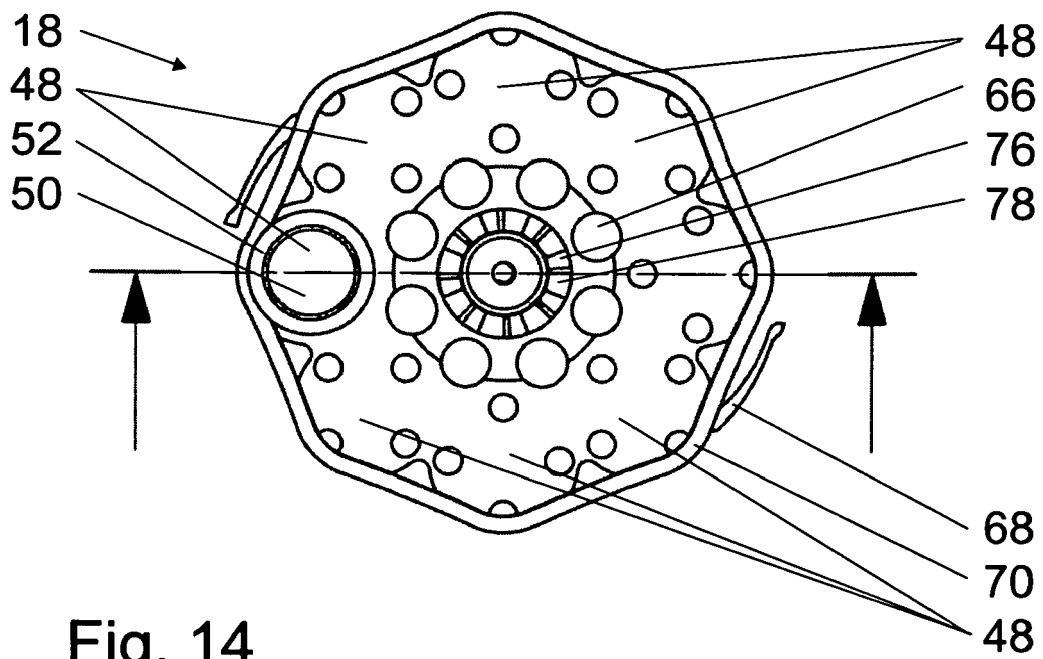


Fig. 14

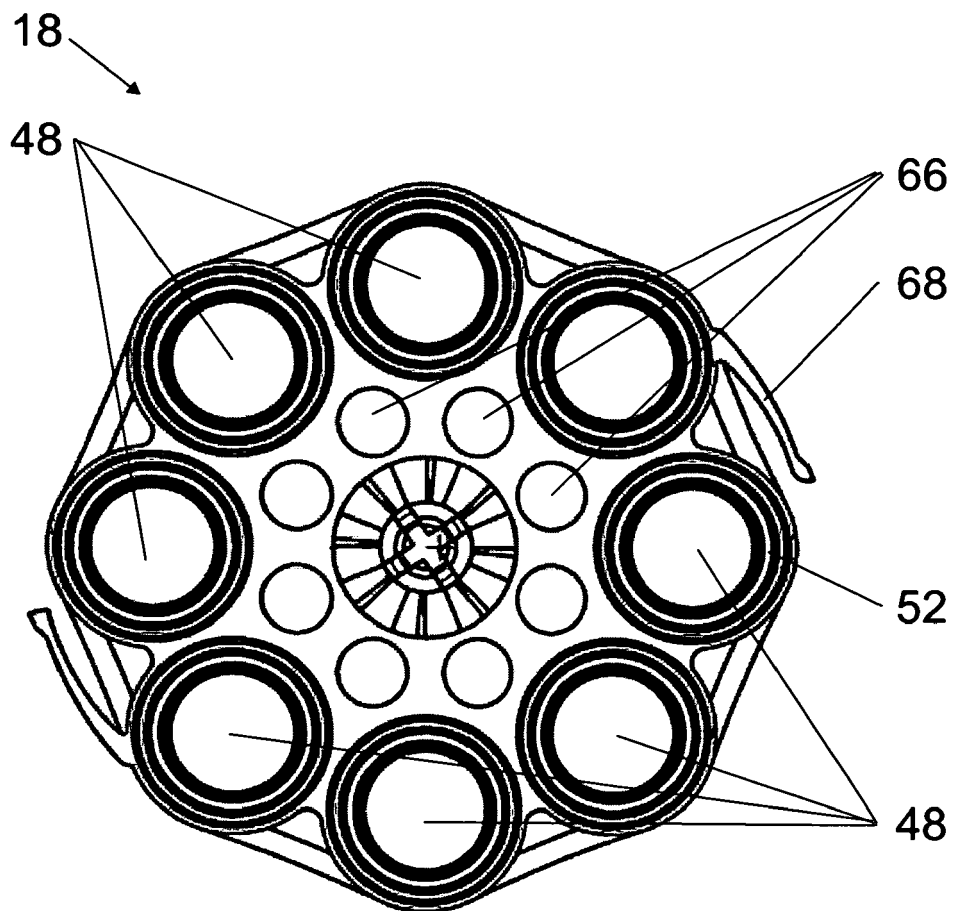


Fig. 15



EUROPEAN SEARCH REPORT

Application Number
EP 11 00 4954

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	DE 10 2007 057336 A1 (BSH BOSCH SIEMENS HAUSGERAETE [DE]) 4 June 2009 (2009-06-04) * claim 1; figures 4, 5, 8 *	1-10	INV. A47L15/42 F16K15/18 D06F39/08
X	DE 10 2007 056922 A1 (BSH BOSCH SIEMENS HAUSGERAETE [DE]) 28 May 2009 (2009-05-28) * claim 1; figures 4, 5, 8 *	1-10	
X	DE 10 2007 056921 A1 (BSH BOSCH SIEMENS HAUSGERAETE [DE]) 28 May 2009 (2009-05-28) * claim 1; figures 1,5, 8 *	1-10	
X	EP 1 469 118 A2 (FAGOR S COOP [ES] COPRECITEC SL [ES]) 20 October 2004 (2004-10-20) * claim 1; figures 1,4a *	1-10	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
			A47L F16K D06F
Place of search		Date of completion of the search	Examiner
Munich		18 January 2012	Dupuis, Jean-Luc
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 03.82 (P04C01)

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

EP 11 00 4954

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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18-01-2012

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