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### (54) Washing machine

(57) The invention relates to a washing machine (1) comprising a tub (2) comprising at least two shells (4, 6) connected to one another, wherein the bottom of the tub (2) comprises a sump (14), a draining circuit (16) connected to the sump (14), wherein a first shell (4) of the tub comprises the sump (14) and a second shell (6) of the tub comprises at least a portion of the draining circuit (16), and a filter element (8) for retaining foreign bodies in the sump (14), wherein the filter element (8) is placed between the sump (14) and the draining circuit (16) and wherein the filter element (8) is fixed in its position by the connection of the first shell (4) and the second shell (6).

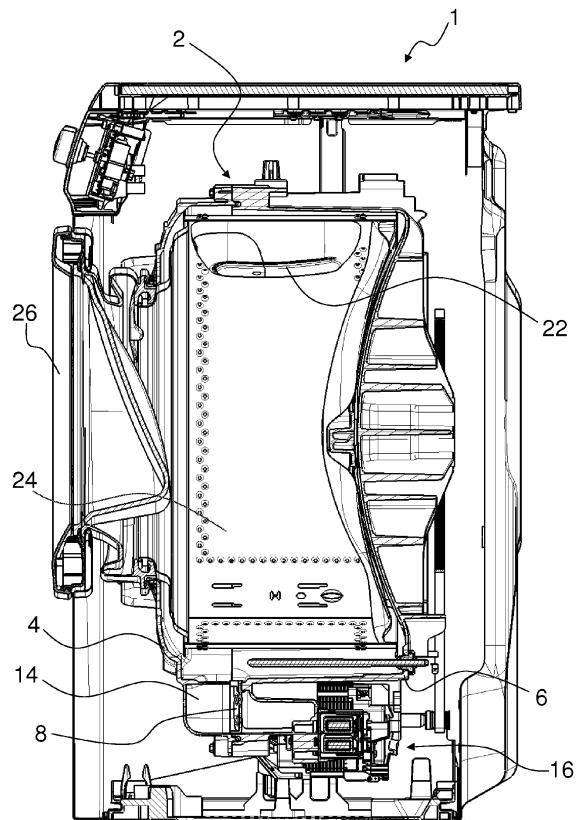


Fig. 1

**Description**

**[0001]** The present invention relates to a washing machine comprising a filter element.

**[0002]** EP 0 534 381 B1 discloses a discharge device for washing machines, wherein a filter is formed in one piece at the bottom of a tub of the washing machine.

**[0003]** EP 0 110 482 A1 discloses a washing machine. A tub of the washing machine comprises at its bottom a cavity which communicates with a compartment, which in turn communicates with a conduit connected to a draining pump. The cavity communicates with the compartment via an orifice in form of a slit, whereby it is prevented that solid bodies enter a draining circuit.

**[0004]** GB 1,197,919 B discloses a washing machine, wherein a glass filter element is placed in a sump at the bottom of a tub of the washing machine.

**[0005]** Each of EP 1 849 910 B1, EP 1 849 904 A1, EP 1 849 910 A1 discloses a top-loading washing machine, wherein a sump is located at a bottom of a tub of the washing machine. A basket containing a filter is placed in the sump.

**[0006]** It is an object of the present invention to provide a washing machine comprising a filter element which is simple and robust in use.

**[0007]** The invention is defined in claim 1. Particular embodiments are set out in the dependent claims.

**[0008]** According to claim 1, a washing machine comprises a tub, which in turn comprises (e.g. is composed of) at least two shells which are connected to one another. In particular the shells are connected such that the connection is watertight. The bottom of the tub comprises a sump for collecting foreign objects like coins etc. contained in the drain water during/after a washing operation of the machine. Preferably the sump is formed by a well or trough extending downward at the bottom of the tub (and forming part thereof) and is designed to hold and collect washing water. The washing machine further comprises a draining circuit which is connected to the sump, wherein a first shell of the tub comprises the sump and a second shell of the tub comprises at least a portion of the draining circuit. Further, the washing machine comprises a filter element for retaining (with holding) foreign bodies in the sump, i.e. the filter element is placed between the sump and the draining circuit. Thereby the filter element prevents that foreign objects reach the draining circuit, in particular a draining pump thereof, when water is drained from the washing machine, i.e. the tub. The filter element is fixed in its position by the connection of the first shell and the second shell. In other words, the filter element itself hasn't to be separately fixed to the tub. With a single assembling step the connection between the two shells is provided as well as the filter element is mounted on or fastened of or in the tub. As no additional fastening step for the filter element is needed, the steps during assembly of the tub i.e. the washing machine are reduced and therefore assembling simplified and the assembling time reduced.

**[0009]** Preferably the filter is designed such that smaller particles like fluff may pass the filter while foreign objects (bigger particles) are retained from passing the filter. According to a preferred embodiment the filter element

5 forms at least a portion of the sump, e.g. a side wall and/or bottom wall of the sump or only a part thereof. I.e. no pipe or tube which might be obstructed or clogged by foreign objects is arranged between sump and filter element. Drain water is directly filtered from the sump, i.e. 10 foreign objects are held back within the sump.

**[0010]** Preferably the filter element comprises a filter wall which forms at least a portion of a lateral or side surface of the sump. Thereby the filter element can be formed as a simple and robust wall, which is easy to form 15 and to assemble with the tub.

**[0011]** Advantageously a lower portion of the filter element, in particular of the filter wall, is closed, i.e. comprises no openings. A lower portion means in the proximity of the bottom or lower side of the sump. For example 20 the height of the closed lower portion of the filter element is one fifth, one quarter or one third of the height of the filter element from the bottom of the sump. Thereby it is prevented that foreign objects that are retained in the sump and having a mean density above the one of water, 25 in particular at the bottom of the sump, obstruct or clog the filter element or filter wall.

**[0012]** Preferably the filter element comprises at least one opening or aperture which comprises smooth borders, advantageously openings/apertures that have 30 smooth border surfaces in direction of the water flow. Smooth or smoothed borders, in particular smooth edges or rims, improve the water flow and it is avoided that fluff gets caught in the at least one opening.

**[0013]** According to a preferred embodiment the at 35 least one opening comprises a shape selected from circular, substantially circular, oval, square or rectangular having rounded inside or flow passage corners. As the at least one opening of the filter element comprises no corners or at least rounded corners, fluff is not caught in 40 or by the at least one opening.

**[0014]** Preferably the filter element comprises at least 45 in one plane an arched or bent cross-section and/or is concave seen from the side of the sump. Advantageously the filter element may have a semicircular or substantially semicircular cross-section. The filter element, in particular the filter wall, comprises for example a partial-cylindrical shape or concave shape. The filter element is preferably arched in direction of the water flow, i.e. downstream in direction from the sump to the draining circuit. 50 Due to this feature a foreign object, like e.g. a coin, which abuts against the filter element or the filter wall, cannot completely obstruct an opening of the filter element, as the planar coin cannot seal the arched surface of the filter element.

**[0015]** In a preferred embodiment a surface of the filter element comprises at least one recessed or notched portion which extends across the at least one opening of the filter element. Preferably the recessed or notched portion

is facing the sump side. A recess or notch extending across an opening provides that in case a foreign object like a coin lies atop an opening, water can still flow past the foreign object via the channel formed by the recessed part of the filter element.

**[0016]** Preferably a surface between at least two openings of the filter element comprises at least one recessed or notched portion. A recessed portion e.g. a rounded or concave shape, between at least two openings connects the openings in form of a channel and provides that water is still able to flow through the filter element, i.e. openings, when a foreign object lies atop an opening.

**[0017]** According to a preferred embodiment the filter element comprises a structured surface, in particular a plurality of recessed areas and additionally or alternatively elevated areas. For example a corrugated surface which provides a plurality of channels via which water can still pass the filter element when a foreign object blocks one or more of the openings.

**[0018]** Preferably the filter element is not removable from the tub, i.e. a user does not have to remove the filter element for cleaning. This is possible due to the particular design of the filter element as described above, which provides a filter element with which a clogging of the filter is avoided, i.e. a cleaning of the filter element, in particular of its openings, is not necessary.

**[0019]** In a preferred embodiment the sump can be cleaned or emptied by a user from foreign objects. The sump is reachable via an aperture in a rotatable drum of the washing machine, which is closed during operation of the washing machine by an openable drum lifter. i.e. the access to the sump is integrated in a lifter for lifting or agitating the laundry in the washing machine. Preferably a lifter cover element can be opened or removed for providing the access from the drum interior to the sump. Alternatively and for low-priced washing machines the sump is not accessible.

**[0020]** Preferably a chamber of a draining pump of the washing machine is obtained in a single piece construction with one of the shells of the tub. i.e. the chamber does not have to be separately attached to the tub or washing machine, i.e. the assembling steps are reduced, whereby in turn the assembling time is reduced and assembling is simplified.

**[0021]** In a preferred embodiment the filter is made of a polymer, e.g. polypropylene, polyamide or polystyrol, and is formed by injection or compression moulding. Thereby a low-priced and robust filter element is provided. In particular by moulding the design of the filter element can be easily adapted to be kept in position by the tub shells, i.e. the form or shape of the filter element is adapted to engage with the correspondingly formed portions of the tub shells, such that the filter element is fixed by the tub shells and no separate fixing elements for the filter element are necessary.

**[0022]** Preferably, but not necessarily, a seal is provided between the at least two shells to provide a watertight connection between them. The seal can be formed by a

sealant or sealing compound as well as a gasket.

**[0023]** According to a preferred embodiment a recirculation circuit is provided downstream the filter element. i.e. the filtered water can be used again in the washing cycle of the washing machine, such that the amount of fresh water required during a washing cycle is reduced.

**[0024]** Preferably, but not necessarily, a dimension of a cross-section of the at least one opening is in the range between 4 to 12 mm, more preferably between 6 and 10 mm.

**[0025]** The above described embodiments of the washing machine can be implemented in a front-loading washing machine as well as a top-loading washing machine.

**[0026]** Reference is made in detail to a preferred embodiment of the invention, an example of which is illustrated in the accompanying figures, which show:

**Fig. 1** a cross-sectional side view of a washing machine according to an embodiment of the invention,

**Fig. 2** an exploded view of a tub and filter of the washing machine of Fig. 1,

**Fig. 3** a partial cross-sectional perspective view of a detail of the washing machine of Fig. 1, and

**Fig. 4** a cross-sectional side view of a detail of the washing machine of Fig. 1.

**[0027]** Fig. 1 shows a cross-sectional side view of a washing machine 1 according to an embodiment of the invention. The washing machine 1 is a front loader having a door 26 and a drum 24 with a preferably horizontal rotation axis. Alternatively a top-loading washing machine having a drum with horizontal axis can be provided. A first shell 4 of the tub 2 comprises a sump 14, wherein a lateral or side wall of the sump 14 is provided by a filter element or filter 8. The filter element or filter 8 separates the volume of the tub 2 from the draining circuit 16 of the washing machine 1, such that no bigger foreign parts reach the draining circuit 16, in particular the draining pump. During operation of the washing machine foreign parts like coins, screws etc. which may be contained in

the laundry and which may be dragged by the washing water from the drum 24 into the tub 2, are collected in the sump 14, in particular when water is drained from the tub 2. After a washing operation, the foreign objects can be removed from the sump 14 by opening an openable lifter 22 which is mounted on the drum 24 of the washing machine 1. Alternatively, for example for low-priced washing machines, the sump 14 may be not accessible.

**[0028]** Fig. 2 shows an exploded view of the tub 2 and filter 8 of Fig. 1. The filter 8 is held in its position by the connection of the two shells 4, 6 of the tub 2.

**[0029]** Preferably, but not necessarily, a seal, not illustrated, is provided between the abutting surfaces of the shells 4, 6 to provide a watertight connection between

them. Advantageously, but not necessarily, the shells 4 and 6 may be connected one another by welding; in this case the seal is preferably not provided.

**[0030]** Preferably the border of the filter 8 is substantially counter-shaped to the border of the inlet of the draining circuit 16 present in the second shell 6, so that the filter 8 totally obstructs the draining circuit 16, allowing the passage of water, but preventing the passage of foreign bodies (like coins, screws, buttons, etc.) from the sump 14 to the draining circuit 16.

**[0031]** Advantageously, the border of the filter 8 is clamped between the first and second shells 4, 6, so that the filter 8 is held in its position when the first and second shells 4 and 6 are fastened one another.

**[0032]** Preferably, but not necessarily, in the border of the first and/or of the second shell a seat is provided, not illustrated, adapted for lodging the border of the filter 8, so as to facilitate the positioning of the filter 8 between the first and second shells 4, 6, in particular before the fastening of the latter.

**[0033]** The filter 8 comprises a plurality of holes 18 to allow water to flow past the filter 8, in particular during the draining of the water from the tub 2.

**[0034]** Advantageously the filter 8 comprises a partial semi-cylindrical shape, which is arched in direction of the draining circuit 16, i.e. in water flow direction. Thereby an obstruction or blocking of the holes 18 by flat and plane foreign objects is avoided, as due to the curved or bent surface of the filter 8 inflexible or hard foreign objects like coins cannot lie tightly against a hole 18, i.e. against the arched surface of the filter 8. That means there is always a passage for water through the holes 18 maintained.

**[0035]** Fig. 3 shows a partial cross-sectional perspective view of a detail of the washing machine of Fig. 1. An inner surface 10 of the filter 8 comprises recessed portions 20a, 20b which extend across the holes 18 of the filter 8. Thereby an additional channel or passage is provided for water, when e.g. a coin abuts against one or several of the holes 18.

**[0036]** Fig. 4 shows a cross-sectional side view of a detail of the washing machine 1 of Fig. 1. The sump 14 is integrally formed with the first shell 4 of the tub 2 and the draining circuit 16 or at least a part thereof is integrally formed with the second shell 6 of the tub 2. The filter 8 forms one side wall of the sump 14, wherein the inner surface 10 of the filter 8 faces the sump 14 and an outer surface 12 of the filter 8 faces the draining circuit 16.

**[0037]** A lower portion of the filter 8 preferably does not comprise holes 18 (Fig. 1). In other words, only an upper part of the filter 8 comprises holes 18 to let pass the water containing small dimensioned foreign objects like fluff from the sump 14 to the draining circuit 16. The lower portion of the filter 8 is closed to provide a barrier and to trap and collect bigger objects like coins or screws etc.

**[0038]** Further, the holes 18 preferably comprise smooth borders or rounded inner edges, such that the

water flow through the holes 18 is improved and the deposit of fluff in the holes 18 is avoided. A cleaning of the filter, in particular of the holes 18, is not necessary as the specific shape of the holes 18 provides that no foreign objects like fluff clogs the filter 8, i.e. a self-cleaning filter 8 is preferably provided.

## Claims

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1. Washing machine (1) comprising:

- a tub (2) comprising at least two shells (4, 6) connected to one another, wherein the bottom of the tub (2) comprises a sump (14),
- a draining circuit (16) connected to the sump (14), wherein a first shell (4) of the tub comprises the sump (14) and a second shell (6) of the tub comprises at least a portion of the draining circuit (16), and
- a filter element (8) for retaining foreign bodies in the sump (14), wherein the filter element (8) is placed between the sump (14) and the draining circuit (16),

### **characterized in that**

the filter element (8) is fixed in its position by the connection of the first shell (4) and the second shell (6).

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2. Washing machine according to claim 1, wherein the filter element (8) forms at least a portion of the sump (14).

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3. Washing machine according to claim 1 or 2, wherein the filter element (8) comprises a filter wall forming at least a portion of a lateral surface of the sump (14).

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4. Washing machine according to claim 1, 2 or 3, wherein a lower portion of the filter element (8), in particular of the filter wall, is closed.

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5. Washing machine according to any of the previous claims, wherein the filter element (8) comprises at least one opening (18), wherein the at least one opening (18) comprises smooth borders.

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6. Washing machine according to any of the previous claims, wherein the at least one opening (18) comprises a shape selected from circular, substantially circular, oval, square or rectangular having rounded inside corners.

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7. Washing machine according to any of the previous claims, wherein the filter element (8) comprises at least in one cross-section plane an arched or bent cross-section and/or is concave seen from the sump side

8. Washing machine according to claim 7, wherein the filter element (8) comprises at least in one cross-section plane a semicircular or substantially semicircular cross-section.

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9. Washing machine according to any of the previous claims, wherein a surface of the filter element (8) comprises at least one recessed or notched portion (20a, 20b) extending across the at least one opening (18) of the filter element (8).

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10. Washing machine according to any of the previous claims, wherein a surface between at least two openings (18) of the filter element (8) comprises at least one recessed or notched portion (20a, 20b).

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11. Washing machine according to any of the previous claims, wherein the filter element (8) comprises a structured surface, in particular a plurality of recessed portions and/or elevated portions.

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12. Washing machine according to any of the previous claims, wherein the border of said filter element (8) is substantially counter-shaped to the border of the inlet of the draining circuit (16) present in said second shell (6).

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13. Washing machine according to any of the previous claims, wherein the border of said filter element (8) is clamped between said first and second shells (4, 6).

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14. Washing machine according to any of the previous claims, wherein in the border of said first and/or second shell a seat is provided, adapted for lodging the border of said filter element (8).

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15. Washing machine according to any of the previous claims, wherein the filter element (8) is not removable from the tub (2).

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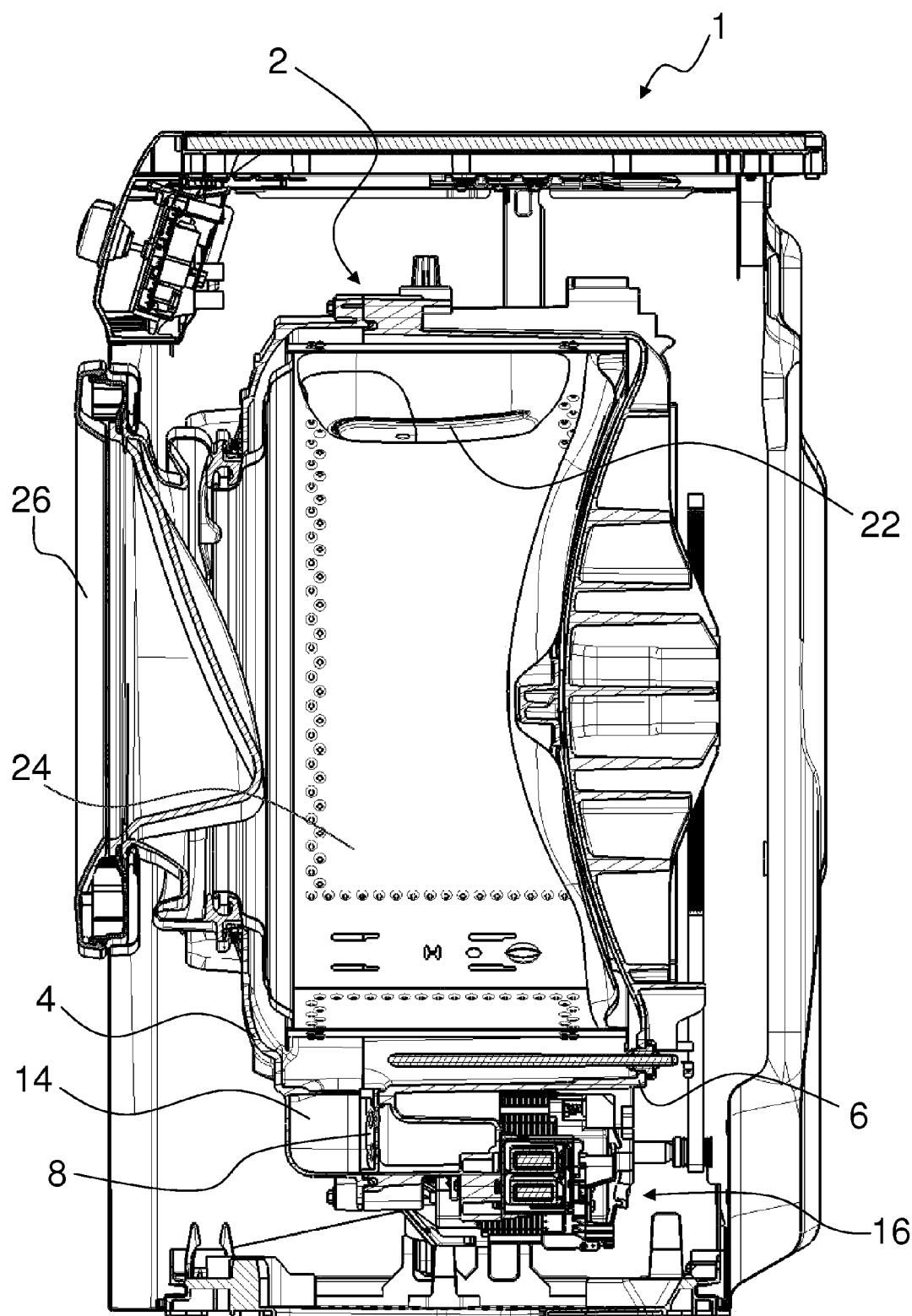


Fig. 1

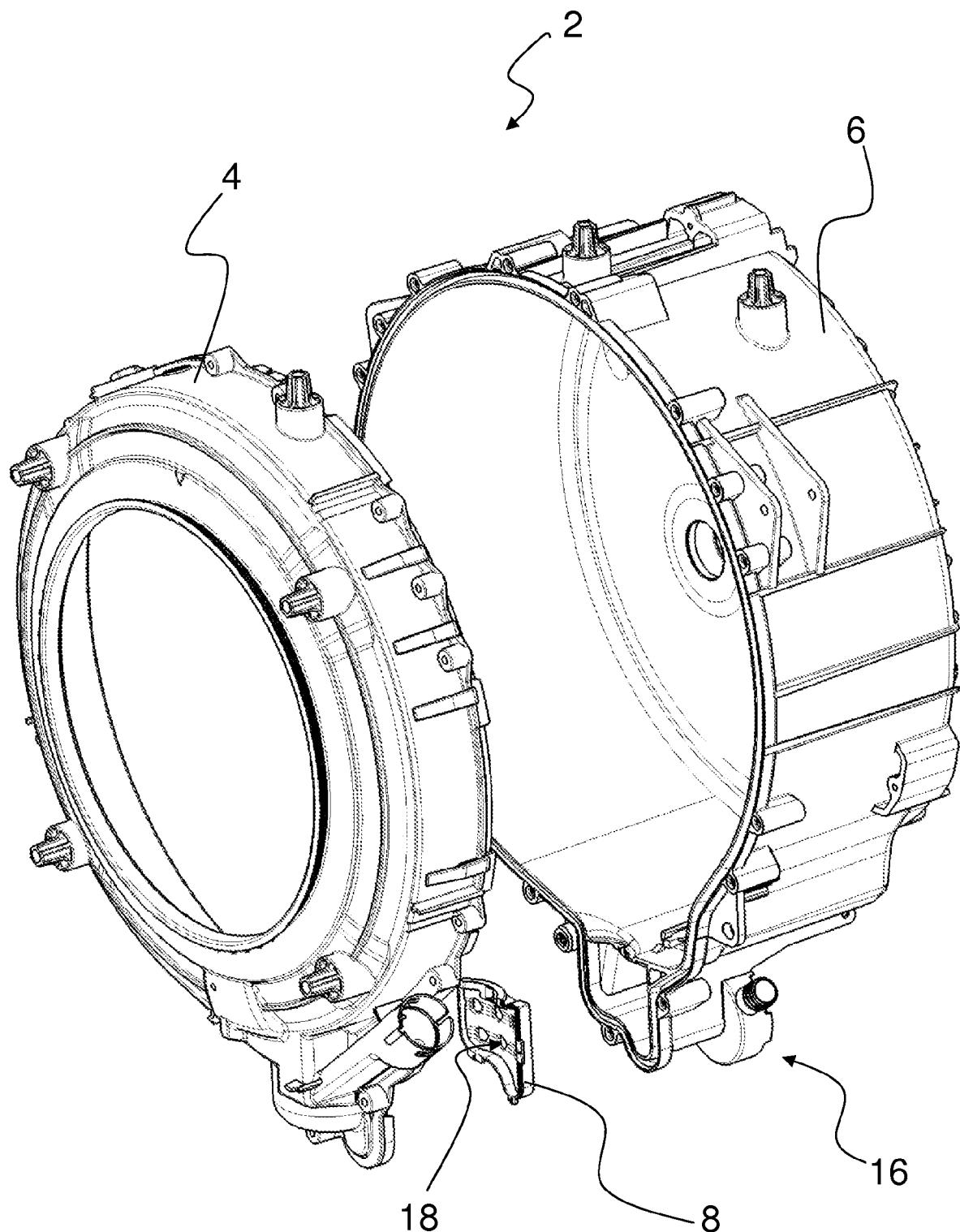


Fig. 2

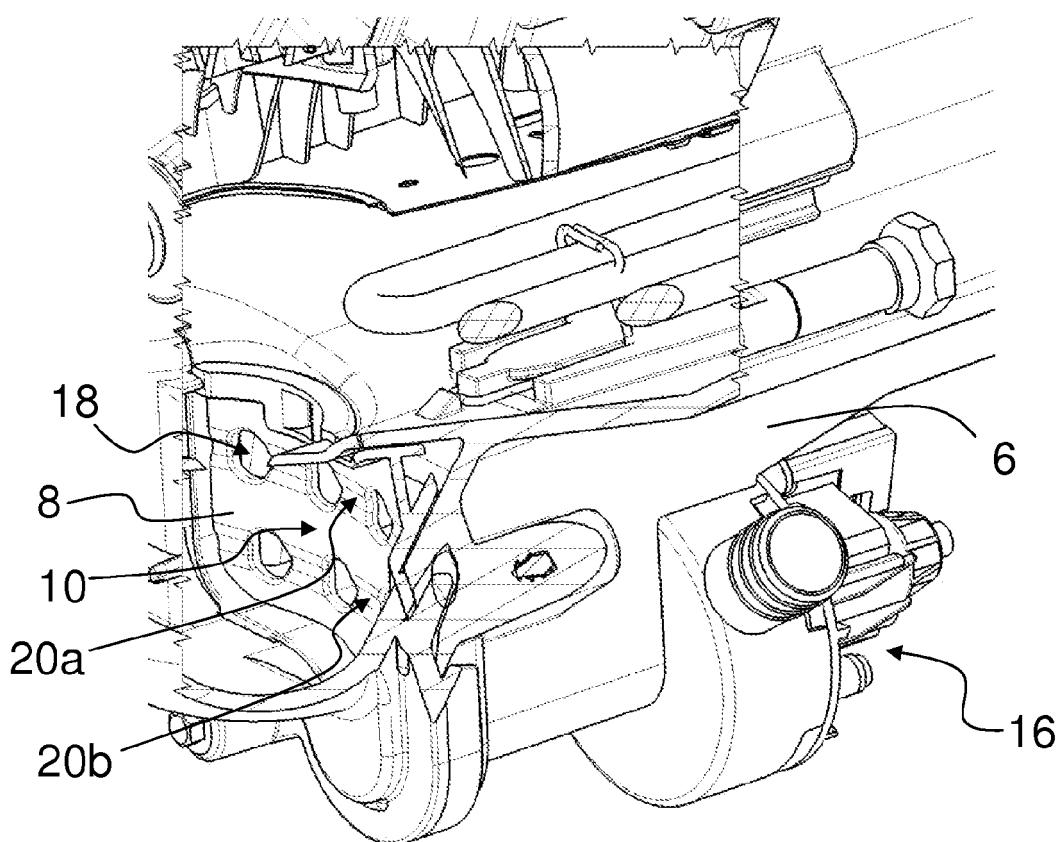


Fig. 3

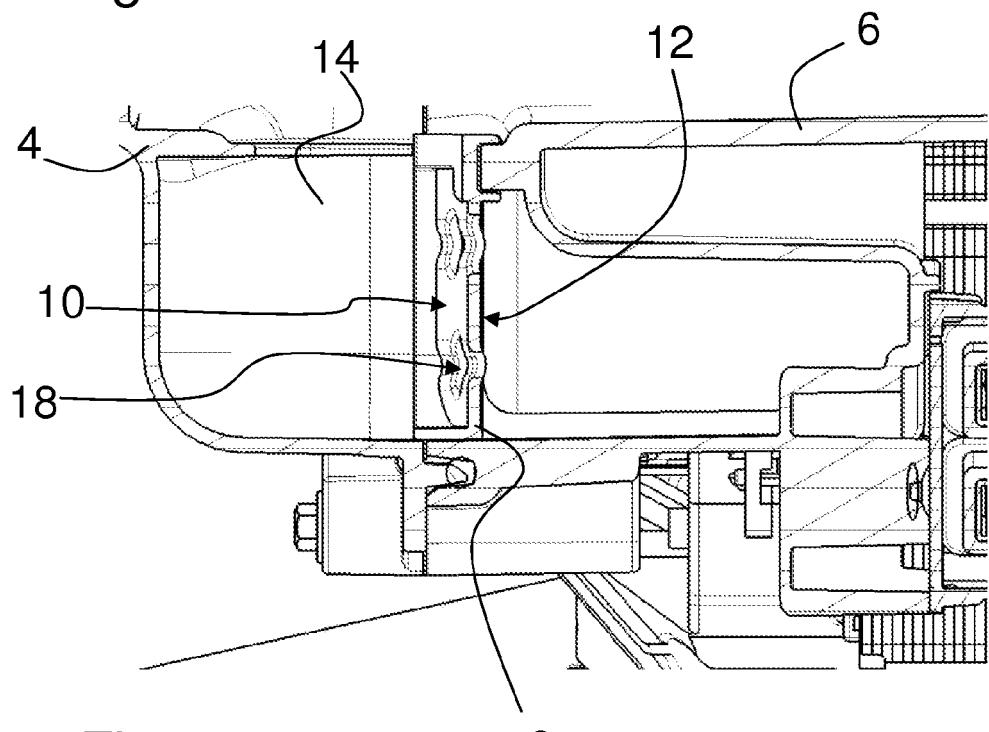


Fig. 4



## EUROPEAN SEARCH REPORT

Application Number  
EP 10 16 8811

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (IPC)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
A	EP 1 990 462 A2 (SAMSUNG ELECTRONICS CO LTD [KR]) 12 November 2008 (2008-11-12) * figure 3 *	1-15	INV. D06F37/26 D06F39/10
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	-----		TECHNICAL FIELDS SEARCHED (IPC)
			D06F
The present search report has been drawn up for all claims			
1	Place of search	Date of completion of the search	Examiner
	Munich	26 November 2010	Stroppa, Giovanni
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ANNEX TO THE EUROPEAN SEARCH REPORT  
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**REFERENCES CITED IN THE DESCRIPTION**

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- EP 0110482 A1 [0003]
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