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

(11) EP 2 336 414 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
22.06.2011 Bulletin 2011/25

(51) Int Cl.:
D06F 37/26 *(2006.01)*

(21) Application number: **09179860.3**

(22) Date of filing: **18.12.2009**

(84) Designated Contracting States:
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 SE SI SK SM TR
Designated Extension States:
AL BA RS

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(54) Counterweight for washing machine

(57) The invention relates to a counterweight unit, a method for forming such a counterweight unit and a washing machine comprising such a counterweight unit, wherein the counterweight unit comprises at least two ballast segments 2a, 2b, a closed-loop connecting element 4 connecting each of the at least two ballast segments 2a, 2b to its neighbouring ballast segment, and additionally or alternatively at least two connecting elements, wherein each of the connecting elements connects at least a portion of each of the at least two ballast segments to its neighbouring ballast segment.

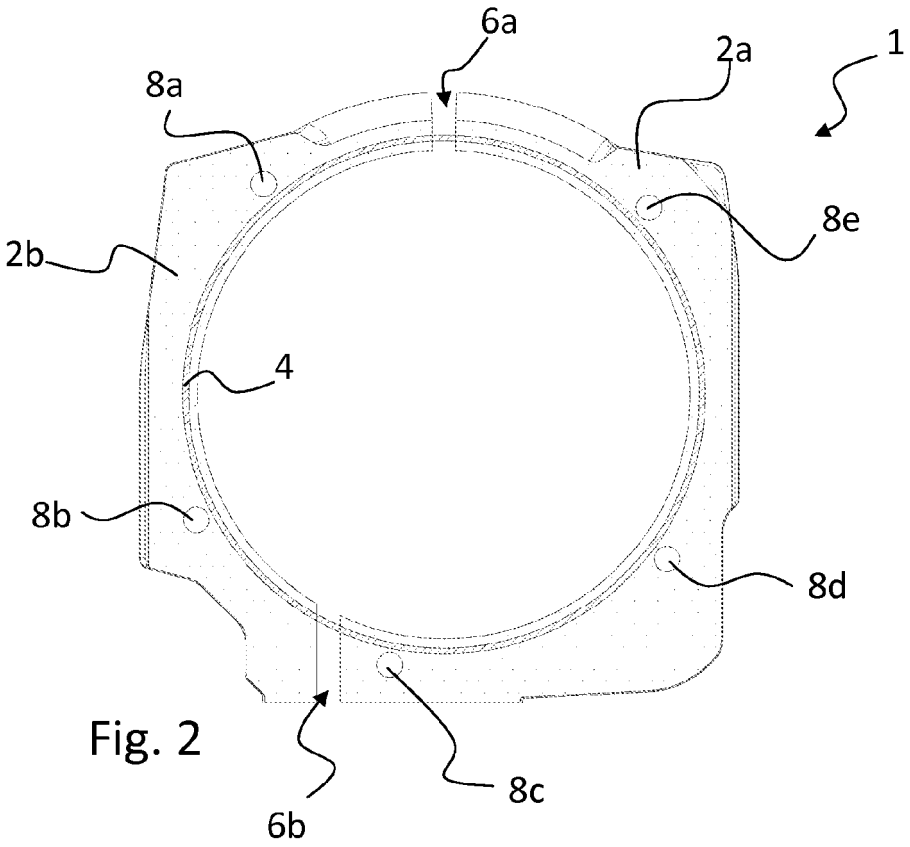

Fig. 2

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Description

[0001] The invention relates to a counterweight unit for a washing machine, a method for forming a counterweight unit and a washing machine comprising such a counterweight.

[0002] EP 1 918 443 B1 discloses a counterweight for a washing machine comprising two separate ballast elements screwed to a front wall of the tub.

[0003] It is an object of the invention to provide a counterweight unit for a washing machine, a method for forming such a counterweight unit and a washing machine comprising such a counterweight unit, which allows an easy handling, forming and mounting of the counterweight unit.

[0004] The invention is defined in claims 1, 13 and 14, respectively. Particular embodiments are set out in the dependent claims.

[0005] The invention is directed to a counterweight unit for a washing machine, wherein the counterweight unit is mountable to a front wall or flange of a tub of a washing machine, e.g. around a loading opening of the tub.

[0006] According to claim 1, a counterweight unit comprises at least two ballast segments, wherein a closed-loop connecting element, e.g. a ring element, connects each of the at least two ballast segments to its neighbouring ballast segment. Thereby each ballast segment is connected to its adjacent segment and a one-piece counterweight unit is achieved. A closed-loop connecting element comprises for example one, two, three or more rings having a circular or substantially circular shape. Alternatively or additionally at least two connecting elements are provided to connect the at least two ballast elements, wherein each of the connecting elements connects at least an end portion or end section of each the at least two ballast segments to its neighbouring ballast segment. I.e. instead of providing one connecting element to connect all ballast elements, i.e. a closed-loop connecting element, a plurality of individual connecting elements are provided to connect neighbouring ballast segments. Both solutions or when the solutions are combined provide a connection between the at least two, three or plurality of ballast segments, whereby an easy-to-handle one-piece counterweight unit is provided. This is particularly advantageous during an assembly process of a washing machine, as only one assembly part, namely the counterweight unit, needs to be handled, transported and positioned during mounting and fixing of the counterweight unit to a washing machine, i.e. to a front shell of a tub.

[0007] Preferably neighbouring ballast segments are spaced apart, i.e. a spacing or gap is provided between adjacent ballast segments. The closed-loop connecting element bridges the spacings between the neighbouring ballast segments. Alternatively or additionally at least one connecting element of the at least two connecting elements bridges a spacing between neighbouring ballast segments. Due to the spacing between the ballast segments and in dependency of the flexibility of the (closed-loop) connecting elements, the ballast segments are not rigidly coupled to each other. I.e. a relative movement of the ballast segments is only restricted by the connecting element(s) bridging the spacings. This is particularly advantageous, when mounting a counterweight unit to a tub shell, taking in consideration that the supporting surface of the tub shell for the counterweight unit, the counterweight unit itself or both are not precisely planar or do not correspond to each other due to manufacturing tolerances thereof. As the ballast segments are separated from each other by spacings, within the tolerance of the (closed-loop) connecting element(s) the ballast segments can be separately adjusted to the front shell or a flange thereof and the connecting element(s) bridging the spacings relieve the stress that would be exerted on a one-piece or rigid counterweight unit. Preferably the connecting element(s) bridging the respective spacings are flexible or elastic to an extend to absorb or compensate stress exerted on the counterweight unit. Thereby the lifetime of the counterweight unit is substantially increased, as for example the risk of stress cracks is reduced.

[0008] Preferably the closed-loop connecting element is fixed in the in the at least two ballast segments, e.g. the connecting element is at least partially embedded or anchored in the at least two ballast elements, for example during casting or moulding of the counterweight unit, i.e. of the ballast segments. By embedding the connecting element in the ballast segments, the counterweight unit is reinforced and therefore the mechanical stability is increased, e.g. when using concrete for the ballast segments and iron for the connecting element. Further, a separate fixing step of the connecting element to the ballast segments is not required, whereby the production time of a counterweight unit is reduced. Alternatively, the closed-loop connecting element is fixed to the at least two ballast segments. For example the closed-loop connecting element circumferentially encloses or envelopes the at least two ballast segments. In particular the closed-loop connecting element is additionally attached or fixed to the ballast segments, e.g. by means of anchoring elements or screws to provide a mechanical stable connection between connecting element and ballast segments.

[0009] According to an alternative embodiment each of the at least two connecting elements is fixed to or fixed in neighbouring ballast segments. In contrast to the closed-loop connecting element, a plurality of individual connecting elements are provided for connecting the ballast segments, whereby the required amount of material for connecting the ballast segments is reduced. For example respective ends of a connecting element are attached to outer surfaces of neighbouring ballast elements. Alternatively each of the connecting elements is embedded or anchored in neighbouring ballast segments. Preferably respective ends of each of the at least two connecting elements comprise an anchor element or portion, which are integrally formed with the connecting element or are separately attached to the connecting element ends. An anchor element or portion has a wider or broader cross section than the remaining part of the connecting

element. For example each of the plurality of connecting elements comprises a rod having broadened end portions, e.g. a double-T form. The connecting elements can be embedded or anchored in the ballast segments during casting or moulding of the ballast segments.

[0010] Preferably the stability of the counterweight unit and the ballast segments is further increased by using fiber reinforced concrete, using for example steel fibers, glass fibers, synthetic fibers or natural fibers.

[0011] Preferably the closed-loop connecting element and/or the at least two connecting elements, in particular the part of the connecting element(s) bridging the spacings, are adapted to allow a deflection or displacement between the at least two ballast segments when stress is exerted on the counterweight unit. For example when a ballast element is displaced with respect to the other or a neighbouring ballast element during fixing or screwing of the counterweight unit to a tub front shell. Thereby the connection between the ballast elements is elastic or flexible, i.e. a flexible counterweight unit is provided. In particular such a connection compensates manufacturing tolerances or non-planarity of a flange of a front tub shell or of the counterweight unit as described above.

[0012] Preferably the closed-loop connecting element comprises at least one wire element, e.g. one ring shaped wire. To further reinforce the counterweight unit, i.e. the connections between the ballast segments as well as the ballast segments, more than one wire ring can be used as a closed-loop connecting element. Alternatively the closed-loop connecting element comprises a strip element, like a metal strip. Wire elements, rod elements and/or strip elements can also be used to form the plurality of connecting elements.

[0013] Preferably at least two connecting elements are provided to connect neighbouring ballast segments, i.e. two connecting elements bridge a spacing between adjacent ballast segments. Thereby the connection between the ballast segments is reinforced. Preferably more than two connecting elements are provided to span or bridge a spacing between adjacent ballast segments to further reinforce the connection and therefore the counterweight unit.

[0014] According to a preferred embodiment each of the at least two ballast segments comprises at least one mounting point, preferably a maximum of three mounting points, in particular mounting holes. Each ballast segment and therefore the counterweight unit is fixed to a tub or front shell thereof by or through the mounting points, for example by means of screws or the like. Three mounting or fixing points span a plane, i.e. as only a maximum of three mounting points or holes per ballast segment are provided, less stress is exerted on each ballast segment, e.g. due to manufacturing tolerances between counterweight unit and a flange of a front tub shell as described above.

[0015] Preferably each of the at least two ballast segments comprises a partial ring shape, like a divided ring shape, adapted to be arranged around a loading opening of a tub. According to a preferred embodiment the ballast segments have not the same circumferential size or dimension, i.e. they are formed asymmetrically. Preferably the shape of one of the at least two ballast segments extends over 180° or less and the shape of the other of the at least two ballast segments extends over 180° or more. More preferably the shape of one of the at least two ballast segments extends over 160° or less and the shape of the other of the at least two ballast segments extends over 200° or more. Alternative dimensions of at least two ballast segments comprise a combination of 150° or less and 210° or more.

[0016] Preferably the ballast segments of the counterweight unit are uniformly positioned, such that the weight of the ballast segments is evenly distributed among the counterweight unit. In use the ballast of the counterweight unit is therefore evenly distributed around a tub opening of a washing machine, i.e. the weight is symmetrically distributed around the rotation axis of a drum. Thereby an oscillating movement of the washing group of a washing machine is effectively dampened, wherein the washing group comprising tub, drum, upper spring and bottom damper.

[0017] According to claim 14, a method for forming a counterweight unit as described above is provided. The method requires a mould which comprises at least two cavities having the form of a partial ballast segment of a counterweight unit, e.g. partial ring cavities to receive concrete therein. Further, at least two narrowed portions or necks are provided to provide a passage between the cavities, wherein the narrowed portions form spacings between the ballast segments of the counterweight unit. The mould also comprises at least one filling hole in each of the partial ring segments for casting or injecting the ballast segment material, e.g. concrete. Preferably a closed-loop connecting element is placed in the mould, such that the closed-loop connecting element bridges the at least two narrowed portions.

[0018] Alternatively or additionally at least two connecting elements are placed in the mould, such that each of the connecting elements bridges a narrowed portion, whereby end portions of the connecting elements are positioned in neighbouring ring segments to provide a connection between them. The transverse cross-section of each of the passages between the cavities corresponds to or essentially corresponds to the cross section of a respective (closed-loop) connecting element. When placing a (closed-loop) connecting element in the narrowed portion(s), the ballast material is securely held within the mould during casting or injecting of ballast material into the mould, i.e. a leakage of ballast material out of the mould or into the passages is prevented. Finally the mould is filled with ballast material, e.g. fiber reinforced concrete. Thereby the closed-loop connecting element as well as the connecting elements are embedded or anchored within the moulded ballast segments. A multi-part and fixedly interconnected counterweight unit is formed in only one moulding step, ready to be fixed to a washing machine or a front tub shell thereof.

[0019] Preferably the mould is composed of at least two shell-parts, e.g. at least one upper and one lower shell-part, wherein each shell-part comprises depressions forming a portion of a respective one of the passages.

[0020] Preferably the mould comprises respective projections reaching through the ring segments, to form mounting holes for the ballast segments of the counterweight unit during the casting thereof.

[0021] Reference is made in detail to a preferred embodiment of the invention, examples of which are illustrated in the accompanying figures, which show:

Fig. 1a a front view of a counterweight unit according to a first embodiment,

Fig. 1b a cross sectional side view of the counterweight unit of Fig. 1a,

Fig. 2 a cross sectional front view of the counterweight unit of Fig. 1a,

Fig. 3a a front view of the counterweight unit of Fig. 1a fixed to a tub of a washing machine,

Fig. 3b a cross sectional side view of the counterweight unit and tub of Fig. 3a,

Fig. 4 a cross sectional side view of a connection region of a counterweight unit according to a second embodiment,

Fig. 5a a schematic top view of a lower shell of a mould, and

Fig. 5b a cross sectional side view of a narrowed portion of a mould.

[0022] Fig. 1a depicts a front view of a counterweight unit 1 comprising two ballast segments 2a, 2b, preferably made of concrete or the like. The ballast segments 2a, 2b are connected by a connecting loop 4 or ring, which is embedded in the ballast segments 2a, 2b, wherein the connecting loop 4 is preferably made of metal. Mounting holes 8a-e are provided in each of the ballast segments 2a, 2b to mount the counterweight unit 1 on a front tub shell 10 of a washing machine (Fig. 3b). The ballast segments 2a, 2b are positioned such that gaps 6a, 6b are provided between them, wherein the gaps 6a, 6b are bridged by the connecting loop 4.

[0023] Fig. 1b shows a cross sectional side view of the counterweight unit 1 along the line A-A of Fig. 1a. The cross section of each mounting hole 8e, 8c - representative for all holes 8a-e - are stepped to provide a seat for receiving a washer 16 and screw 14 therein (Fig. 3a).

[0024] Fig. 2 shows a cross sectional front view of the counterweight unit 1 of Fig. 1a, where the ring-like shape of the closed connecting loop 4 is shown. The connecting loop 4 connects the ballast segments 2a, 2b and also provides reinforcement for the segments 2a, 2b. The portions of the connecting loop 4 bridging the gaps 6a, 6b provide flexibility for the counterweight unit 1. Thereby each ballast segment 2a, 2b, e.g. made of concrete, can independently level out a possible non-planarity or unevenness of a contact plane between the individual segments of the counterweight unit 1 and a front tub shell 10 (Fig. 3b).

[0025] Fig. 3a shows a front view of the counterweight unit 1 of Fig. 1a mounted on a tub 12 of a washing machine. The counterweight unit 1 is positioned around a loading opening 20 of the tub 12 and is fixed to the tub 12 with screws 14a-e through mounting holes 8a-e. The weight or ballast of the counterweight unit 1 is thereby evenly distributed around the rotation axis C of the tub 12, whereby oscillation movements and vibrations during operation of a washing machine are effectively dampened.

[0026] Fig. 3b shows a cross sectional side view of the assembly of Fig. 3a along the line B-B. A front tub shell 10 is attached to the tub 12 of a washing machine, wherein the mounting points at holes 8c, 8e represent all mounting points of holes 8a-e of the counterweight unit. As shown in Fig. 3b, the front tub shell 10 comprises protrusions 18c, 18e which are received in the respective mounting holes 8c, 8e, wherein the protrusions 18c, 18e comprise a screw hole to receive screws 14c, 14e. The protrusions 18c, 18e are preferably casted or formed integrally with the front tub shell 10. The counterweight unit 1 is mounted by screws 14c, 14e and washers 16c, 16e to the front tub shell 10 such that the ballast weight of the counterweight unit 1 is evenly distributed around the rotation axis C.

[0027] Fig. 4 shows a detail of an alternative connecting element 5 between ballast segments 2a', 2b' in a cross sectional side view. The alternative connecting element 5 depicted in Fig. 4 replaces the connecting loop 4 as shown in Fig. 1a, i.e. at least one connecting element 5 is provided for each gap 6a' (corresponding to gaps 6a, 6b). The ballast segments 2a', 2b' correspond to the ballast segments 2a, 2b of Fig. 1a, wherein the ballast segments 2a', 2b' are preferably made of fiber reinforced concrete. The gap 6a' between ballast segments 2a', 2b' is bridged by a connecting element 5 which comprises broadened anchor ends 7a, 7b.

[0028] The anchor ends 7a, 7b are embedded and thereby anchored in the neighbouring ballast segments 2a', 2b'.

[0029] Fig. 5a shows a schematic top view inside a lower shell 26 of a mould for forming a counterweight unit 1. The lower shell 26 comprises cavities 22a', 22b' forming at least a portion of the ballast segments 2a, 2b of a counterweight unit 1 therein. Channels or passages 24a', 24b' connect the cavities 22a', 22b'.

[0030] Fig. 5b shows a cross sectional side view of a in the region of a passage of a mould comprising a lower shell 26 as depicted in Fig. 5a joined to or assembled with an upper shell 28. The passage 24a between cavities 22a, 22b is provided by corresponding depressions of the upper and lower shells 26, 28.

[0031] In a first step of forming a counterweight 1, a connecting loop 4 is placed in the lower shell 26, such that the connecting loop 4 bridges the passages 24a, 24b, i.e. such that the loop 4 lies within the passages 24a, 24b or narrowed portions. Alternatively or additionally connecting elements 5 as depicted in Fig. 4 are placed across the passages 24a, 24b. The transverse cross-section of the passage 24a, 24b corresponds to the cross section of the connecting loop 4, connecting element 5 or the respective total cross section of a combination of (loop) connecting elements, which are used to connect the ballast cavities 22a, 22b. Then the upper shell 28 is joined to or assembled with the lower shell 26 (Fig. 5b) such that the cavities 22a', 22b' and passages 24a', 24b' of the lower shell 26 and corresponding cavities of the upper shell 18 form ballast cavities 22a, 22b and passage 24a. Subsequently ballast material is filled or injected into the assembled mould through at least one filling hole (not shown) in each of the cavities 22a, 22b, e.g. filling holes in the upper shell 28. In a last step the mould is removed when the ballast material inside the mould is hardened or set and the finished counterweight unit 1 is ready-to-use, i.e. ready for mounting to a tub shell of a washing machine.

Reference Numeral List:

[0032]

1	counterweight unit
2a, 2b, 2a', 2b'	ballast segment
4	connecting loop
5	connecting element
6a, 6b, 6a'	spacing
7a, 7b	anchor end
8a-e	mounting hole
10	front tub shell
12	tub
14a-e	screw
16c, 16e	washer
18c, 18e	protrusion
20	loading opening
22a', 22b', 22a, 22b	cavity
24a', 24b', 24a	passage
26	lower shell
28	upper shell
C	rotation axis

Claims

1. Counterweight unit comprising at least two ballast segments (2a, 2b),
characterized by
a closed-loop connecting element (4) connecting each of the at least two ballast segments (2a, 2b) to its neighbouring ballast segment, and/or
at least two connecting elements (5), wherein each of the connecting elements (5) connects at least a portion of each of the at least two ballast segments (2a, 2b) to its neighbouring ballast segment.

2. Counterweight unit according to claim 1, wherein neighbouring ballast segments (2a, 2b) are spaced apart, wherein the closed-loop connecting element (4) bridges the spacings (6a, 6b) between neighbouring ballast segments (2a, 2b) and/or each of the at least two connecting elements (5) bridges the spacing between neighbouring ballast segments, in particular bridges end portions of neighbouring ballast segments.

3. Counterweight unit according to claim 1 or 2, wherein each of the at least two connecting elements (5) is fixed to or fixed in neighbouring ballast segments (2a, 2b) and/or wherein the closed-loop connecting element (4) is fixed to or fixed in the at least two ballast segments (2a, 2b).

4. Counterweight unit according to claim 1, 2 or 3, wherein each of the at least two connecting elements (5) comprises anchoring ends (7a, 7b) embedded in neighbouring ballast segments (2a, 2b).

5. Counterweight unit according to any of the previous claims, comprising at least two connecting elements (5) between neighbouring ballast segments and/or at least two closed-loop connecting elements.

6. Counterweight unit according to any of the previous claims, wherein the number of the connecting elements (5) corresponds to or is larger than the number of the ballast segments (2a, 2b).

7. Counterweight unit according to any of the previous claims, wherein each of the at least two ballast segments (2a, 2b) comprises at least one mounting point (8a-e), preferably a maximum of three mounting points, for fixing the counterweight unit to a washing machine, in particular to a front tub shell (10) thereof.

8. Counterweight unit according to any of the previous claims, wherein each of the at least two ballast segments (2a, 2b) has a partial ring shape, wherein a first of the at least two ballast segments (2b) has a circumferential dimension of about 175° or less and a second of the at least two ballast segments has a circumferential dimension of about 185° or more (2a).

9. Counterweight unit according to any of the previous claims, wherein the closed-loop connecting element (4) or the at least two connecting elements (5) are adapted to provide a deflection between the at least two ballast segments (2a, 2b) of at least one degree, preferably at least 3 degrees and more preferably at least 5 degrees.

10. Counterweight unit according to any of the previous claims, wherein the closed-loop connecting element (4) or each of the at least two connecting elements (5) comprises at least one wire element and/or at least one strip element.

11. Counterweight unit according to any of the previous claims, wherein the material of the closed-loop connecting element (4) or the at least two connecting elements (5) is selected from metal or plastic.

12. Counterweight unit according to any of the previous claims, wherein the material of the at least two ballast segments (2a, 2b) is selected from concrete or fiber reinforced concrete.

13. Washing machine comprising a counterweight unit (1) according to any of the previous claims.

14. Method for forming a counterweight unit, in particular counterweight unit according to any of the previous claims, the method comprising:

providing a mould comprising:

at least two cavities (22a, 22b) each having the outer form of a partial ballast segment (2a, 2b);
at least two narrowed portions providing a passage (24a, 24b) between the at least two cavities (22a, 22b);

and
at least one filling hole in each of the cavities (22a, 22b);

placing a closed-loop connecting element (4) in the mould, such that the closed-loop connecting element (4) bridges the at least two narrowed portions, and/or
placing at least two connecting elements (5) in the mould, such that each of the connecting elements (5) bridges a narrowed portion; and
filling the mould with ballast material,
wherein the transverse cross-section of each of the passages (24a, 24b) between the cavities (22a, 22b) corresponds or essentially corresponds to the outer cross section of a respective closed-loop connecting element (4) and/or connecting element (5).

15. Method according to claim 14, wherein the mould is composed of at least two shell-parts, wherein
a first shell-part (26) has first depressions, each forming at least a portion of a respective one of the passages (24a, 24b), and/or
a second shell-part (28) has second depressions, each forming at least a portion of a respective one of the passages (24a, 24b).

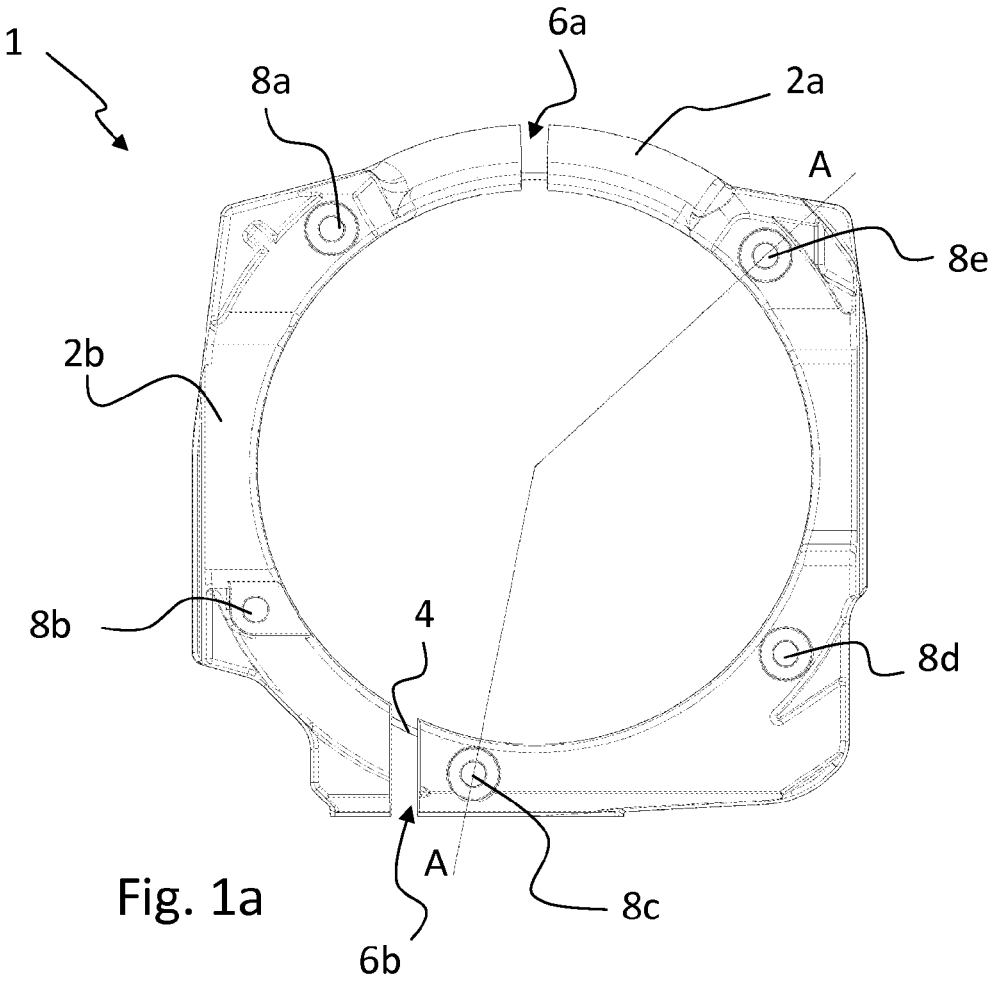

Fig. 1a

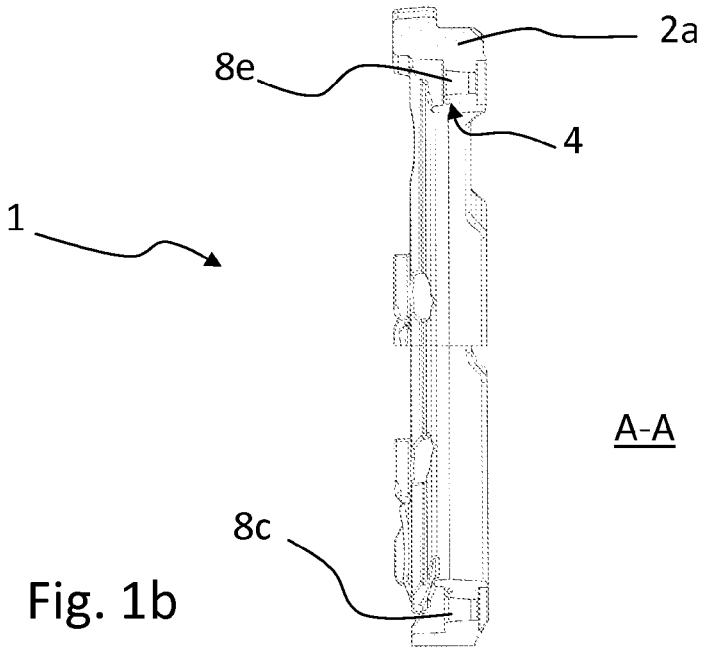

Fig. 1b

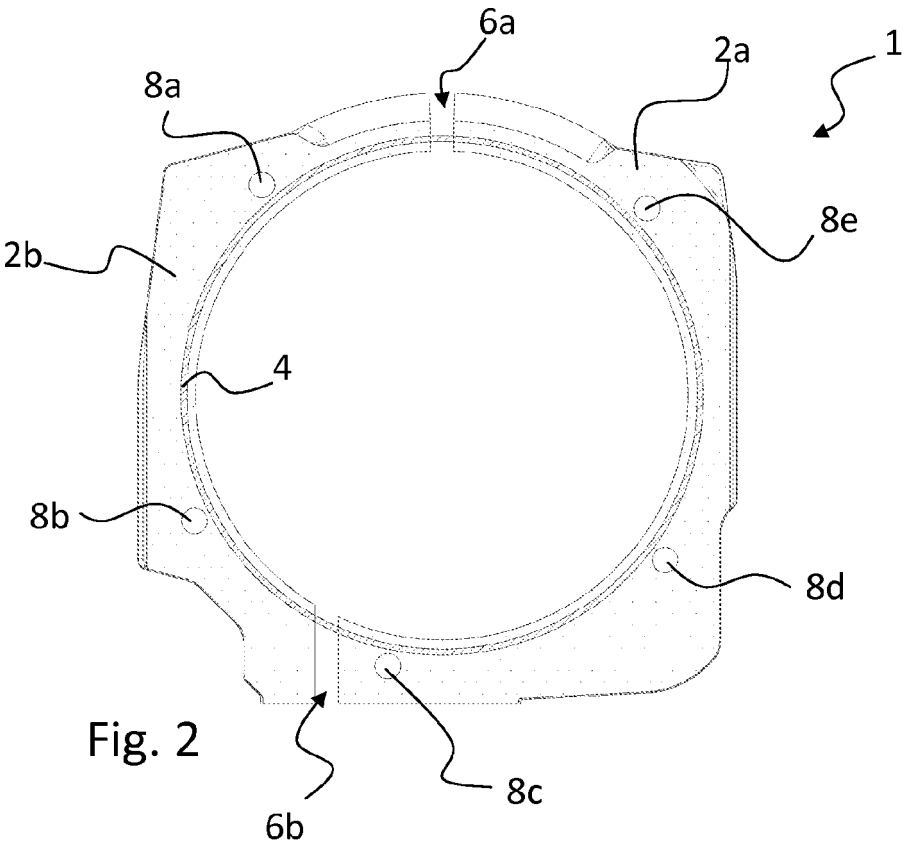

Fig. 2

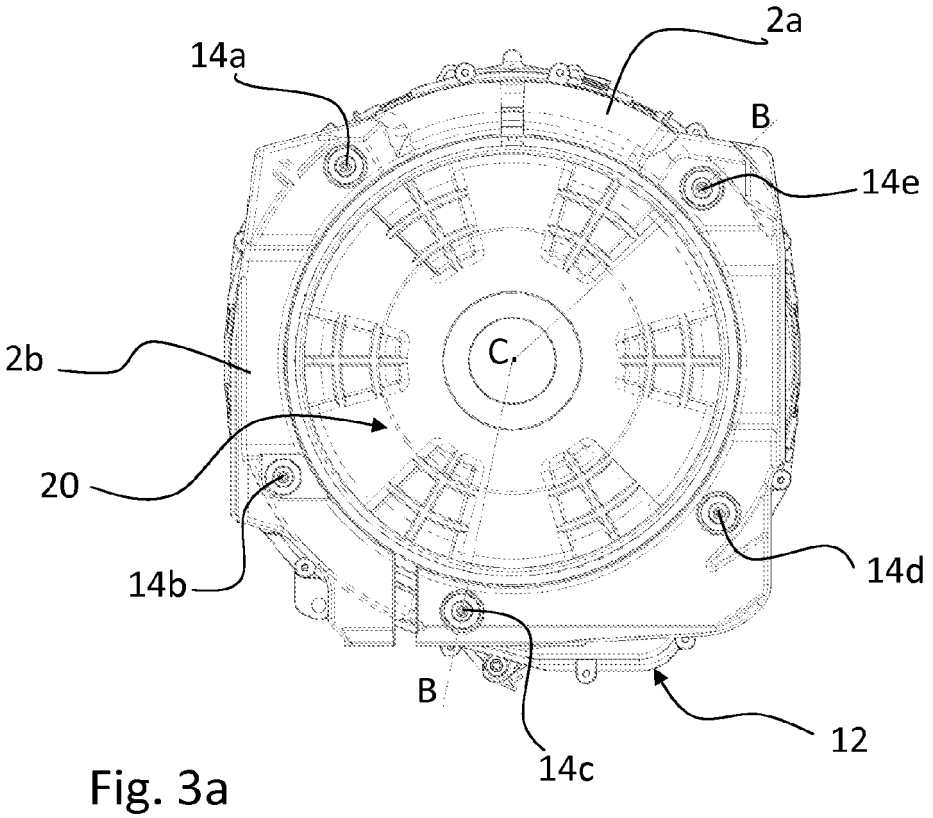

Fig. 3a

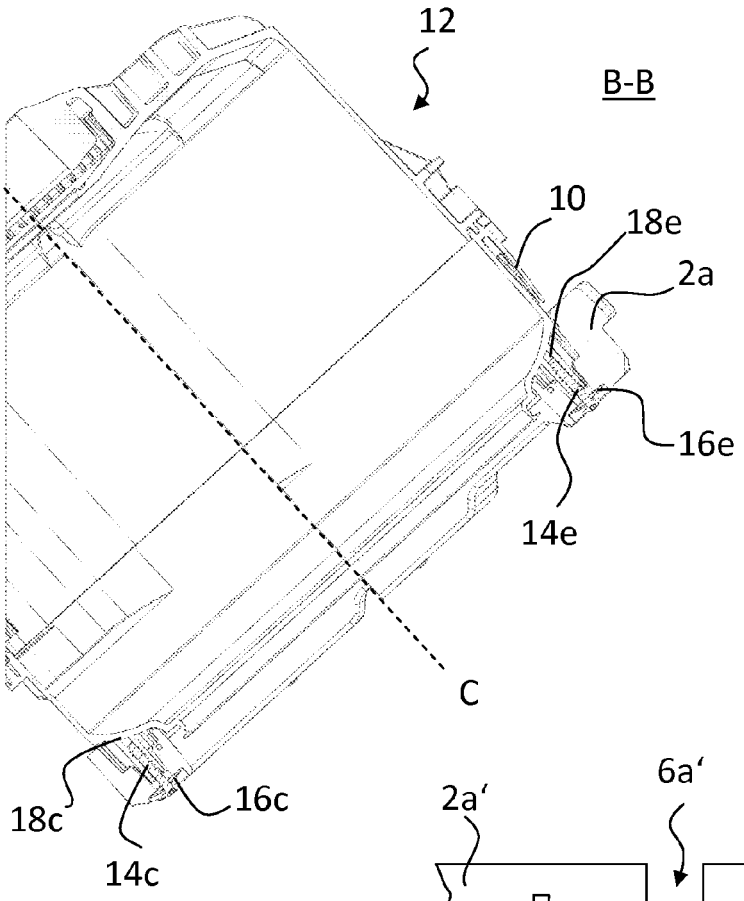

Fig. 3b

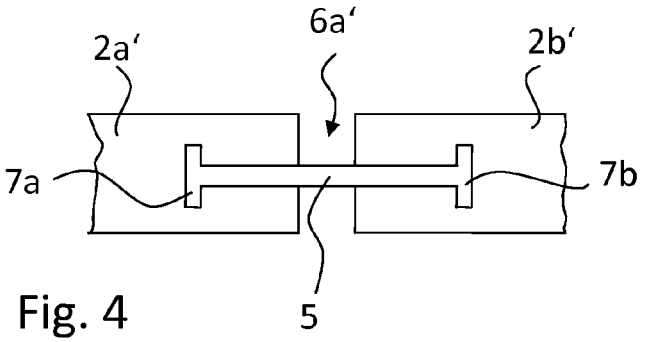

Fig. 4

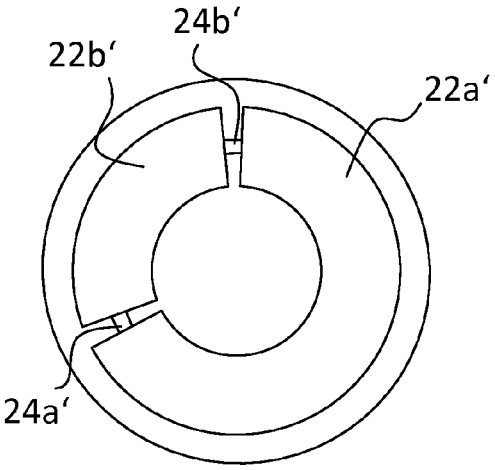

Fig. 5a

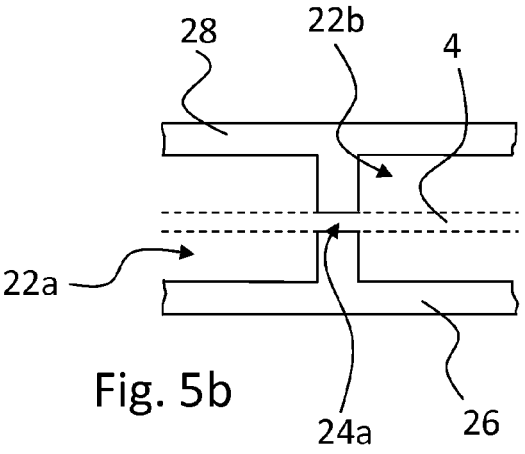

Fig. 5b

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EUROPEAN SEARCH REPORT

Application Number
EP 09 17 9860

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	EP 1 780 326 A1 (PIAZZOLI GIANFRANCO [IT]) 2 May 2007 (2007-05-02) * paragraph [0027]; claim 1; figures 1,7,8 *	1-15	INV. D06F37/26
X	DE 44 44 254 C1 (MIELE & CIE [DE]) 13 June 1996 (1996-06-13) * claim 1; figure 4 *	1-15	

TECHNICAL FIELDS SEARCHED (IPC)

D06F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	20 May 2010	Dupuis, Jean-Luc

CATEGORY OF CITED DOCUMENTS

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1

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 09 17 9860

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