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(54) **A clothes dryer comprising a container for collecting the condensed water and container thereof**

(57) The present invention relates to a clothes dryer, in particular of the condensation type, which comprises:

- a frame (2) housing a drum (3) adapted to contain laundry to be dried;
- first means (5, 6) for delivering heated air into said drum (3);
- second means (7) for exchanging heat, said second means (7) being crossed by the air coming from the drum (3);
- at least one container (10) for collecting the condensed water produced by said second means (7) for exchanging heat,

wherein said at least one container (10) comprises a cover (20) for closing an aperture (11) for supplying condensed water into the container (10).
The invention is characterized in that said cover (20) is of the self-closing type and comprises:

- a first portion (21) which comprises a hole (210) acting as a passage for the condensed water;
- a shutter element (22; 220) adapted to enter at least partially into the hole (210) of said first portion (21);
- a second portion (23) adapted to house at least partially said shutter element (22; 220), said second portion (23) comprising elastic means (230) for pushing the shutter element (22; 220) into the position wherein it closes said hole (210).

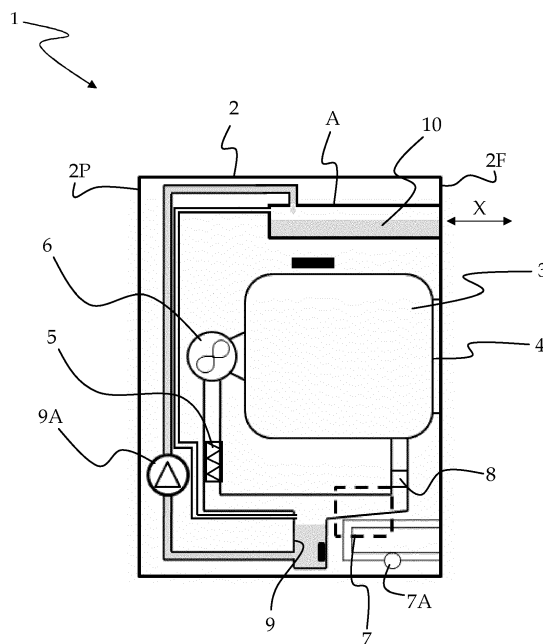


Fig. 1

Description

[0001] The present invention relates to a clothes dryer according to the preamble of claim 1. The present invention further relates to a container for collecting condensed water in said clothes dryer. In particular, the invention is applicable to the field of condensation-type clothes dryers.

[0002] Clothes dryers, in particular of the condensation type, are per se known and typically comprise a drum containing laundry to be dried by an air jet generated by a fan and heated by an electric resistor or by a condenser device in a machine fitted with a heat pump.

[0003] The hot air jet flows through the laundry in the drum, thereby subtracting moisture therefrom, and then flows through a filter that removes any lint and other impurities from the air jet.

[0004] Said air jet also flows through a heat exchanger, where it cools down through the effect of thermal exchange with colder environmental air, thus condensing and yielding water, which flows into a collection tank usually located in the lower part of the machine; from the collection tank, the water is conveyed by a pump into a removable container typically arranged in the upper part of the machine, in a position easily accessible to a user, who can then periodically remove and empty said container.

[0005] It is clear that the clothes dryers known in the art may not include a collection tank; in such cases, they are only equipped with the container for collecting condensed water, said container being usually positioned in the lower part of the machine.

[0006] As a consequence, the clothes dryers, in particular of the condensation type, known in the art comprise:

- a frame that houses a drum for containing laundry to be dried,
- first means for delivering heated air into said drum,
- heat exchanger means crossed by the air coming from the drum,
- at least one container for collecting the condensed water produced by said heat exchanger means.

[0007] However, the above-described clothes dryers suffer from some drawbacks, in that it frequently happens that the condensed water container includes closing means being so designed that they allow neither an easy supply of said condensed water into the container nor an adequate closure of the condensed water supply aperture; in particular, said inadequate closure may cause an undesired overflow of condensed water onto components of the clothes dryer, especially while extracting the container from the respective housing in said clothes dryer.

[0008] Moreover, the condensed water containers of the clothes dryers known in the art have a condensed water supply aperture which is also used for emptying

the container; said supply aperture is usually rather large, thus not allowing for a precise drainage of the condensed water present in the container.

[0009] A further drawback of the condensed water containers of the clothes dryers known in the art is that they are difficult to carry after having been extracted from the respective housing in said clothes dryers. In particular, this problem is especially felt by the user when the containers are full of condensed water and are therefore quite heavy.

[0010] In this frame, it is the main object of the present invention to overcome the above-mentioned drawback by providing a clothes dryer and a container thereof for collecting condensed water, which are so designed as to comprise closing means adapted to allow the condensed water to be easily supplied into the container and to ensure an adequate and safe containment of the condensed water.

[0011] It is another object of the present invention to provide a clothes dryer and a container thereof for collecting condensed water, which are so designed that said container comprises closing means adapted to avoid any undesired overflow of condensed water from the container onto components of the clothes dryer, especially while extracting the container from the respective housing in the clothes dryer.

[0012] It is a further object of the present invention to provide a clothes dryer and a container thereof for collecting condensed water, which are so designed that said container allows, whenever necessary, for a precise drainage of the condensed water present therein.

[0013] It is yet another object of the present invention to provide a clothes dryer and a container thereof for collecting condensed water, which are so designed as to facilitate the transportation of said container after the latter has been extracted from the respective housing in said clothes dryer, in particular when the container is full of condensed water and is therefore quite heavy.

[0014] Said objects are achieved by the present invention through a clothes dryer and a container thereof for collecting condensed water incorporating the features set out in the appended claims, which are intended as an integral part of the present description. Further objects, features and advantages of the present invention will become apparent from the following detailed description and from the annexed drawings, which are supplied by way of non-limiting example, wherein:

- Fig. 1 schematically shows a clothes dryer according to the present invention;
- Figs. 2a and 2b are a perspective view and a top view, respectively, of a container for collecting condensed water of the clothes dryer of Fig. 1;
- Figs. 3a and 3b are an exploded view and a sectional view, respectively, of a detail of the container of Fig. 2;
- Fig. 4 is a sectional view of a variant of the detail shown in Figs. 3a and 3b. Referring now to the an-

nexed drawings, in Fig. 1 reference numeral 1 designates as a whole a clothes dryer, in particular of the condensation type, according to the present invention.

[0015] The clothes dryer 1 comprises a frame 2 that houses a drum 3 adapted to contain laundry (not shown) to be dried, said drum 3 being accessible from the outside through a door 4 usually fitted with sealing gaskets (not shown).

[0016] The clothes dryer 1 also comprises first means 5,6, for delivering heated air into said drum 3. In particular, said first means may comprise an electric resistor 5 and a fan 6 (as shown in Fig. 1) or, in the case of a clothes dryer equipped with a heat pump (not shown in the drawings), a condenser and a fan.

[0017] The clothes dryer 1 further comprises second means 7 for exchanging heat, said second means 7 being crossed by the air coming from the drum 3; preferably, said second means comprise an exchanger 7, where the humid air coming from the drum 3 condenses.

[0018] The clothes dryer 1 also comprises at least one container 10 for collecting the condensed water produced by said second means 7 for exchanging heat.

[0019] In particular, the humid air exiting the drum 3 flows through a filter 8 for removing any lint and/or other impurities from the air jet; in said second means 7 the hot humid air is then cooled through thermal exchange with fresh air (normally at ambient temperature) conveyed by a second fan 7A.

[0020] The condensed water contained in a collection tank 9 is pushed by a pump 9A towards the container 10, where it is collected; the container 10 is removable, and can therefore be removed and emptied.

[0021] The one described above is a basic scheme of a clothes dryer, in particular of the condensation type, which is useful for understanding the operation thereof; in practice, however, the machine 1 may include additional components which have been omitted in the present description for simplicity.

[0022] Preferably, the container 10 extends substantially horizontally from a front portion 2F of the frame 2 towards a rear portion 2P of said frame 2; in particular, said container 10 is of the drawer type and can be extracted from and/or inserted into a housing A in the frame 2 with a substantially horizontal movement (see arrow "X" in Fig. 1). Furthermore, the container 10 of the machine 1 shown in Fig. 1 is arranged in an upper part of the frame 2; this improves the ergonomics of the machine 1, in that said container 10 can be easily reached by a user. It is however clear that the container 10 may also be arranged in a lower part of the machine 1 according to the present invention; in such a case, said machine 1 may even lack the collection tank 9 and/or the pump 9A.

[0023] Figs. 2a and 2b are a perspective view and a top view, respectively, of the container 10; as can be seen in particular in these drawings, the container 10 comprises a cover 20 for closing an aperture 11 for sup-

plying condensed water into the container 10.

[0024] Figs. 3a and 3b show an exploded view (Fig. 3a) and a sectional view (Fig. 3b) of said cover 20; in particular, in Fig. 3b the cover 20 is associated with the aperture 11 of the container 10, in a condition wherein the container 10 is inserted in the housing A in the frame 2.

[0025] According to the present invention, said cover 20 is of the self-closing type and comprises:

- a first portion 21 which comprises a hole 210 acting as a passage for the condensed water;
- a shutter element 22 adapted to enter at least partially into the hole 210 of said first portion 21;
- a second portion 23 adapted to house at least partially said shutter element 22, said second portion 23 comprising elastic means 230 for pushing the shutter element 22 into the position wherein it closes said hole 210.

[0026] In a preferred embodiment, said cover 20 is made of plastic material; in particular:

- said first portion 21 is made of polypropylene (PP);
- said shutter element 22 is made of polypropylene (PP) or a thermoplastic elastomer (TPE);
- said second portion 23 is made of acetalic resin (POM).

[0027] As can be observed especially in Figs. 3a and 3b, said first portion 21 comprises coupling means 211 for securing the cover 20 to the aperture 11 of the container 10, in particular said coupling means comprising a thread 211.

[0028] Preferably, said first portion 21 comprises gripping means 212 that make it easier for a user to couple the cover 20 to the aperture 11 of the container 10. In particular, said gripping means comprise a plurality of reliefs 212 obtained on said first portion 21 of the cover 20.

[0029] As can be observed in particular in Figs. 3a and 3b, the shutter element 22 has a shape complementary to that of the aperture 11 of the container 10, in particular that part of the shutter element 22 which comes in contact with the aperture 11, so as to ensure an optimal closure of said aperture 11.

[0030] In fact, in the representation shown in Figs. 3a and 3b the aperture 11 has a substantially circular shape and the shutter element 22 has a substantially spherical shape, in particular that part of the shutter element 22 that comes in contact with the aperture 11.

[0031] It is however clear that the aperture 11 and/or the shutter element 22 may also have different shapes; for example, the shutter element 22 may be shaped like a truncated cone, with a major base associated with said elastic means 230 and a minor base inserted in the aperture 11, thus causing contact between the aperture 11 and the side surface of the truncated conical shutter el-

ement 22.

[0032] As a further example, it is worth mentioning the case wherein the aperture 11 has a polygonal shape; in such a case, the shutter element 22 may be shaped like a truncated pyramid, with a number of sides corresponding to that of the aperture 11. In this solution (not shown in the drawings), the major base of the truncated pyramidal shutter element 22 is preferably associated with said elastic means 230, whereas the minor base is inserted in the aperture 11.

[0033] In Figs. 3a and 3b one can also see that the elastic means of the second portion 23 comprise a strip 230 associated with the walls 231 of said second portion 23, said strip 230 being arched towards the first portion 21 of the cover 20. The particular shape of the elastic means 230 according to the present invention allows exerting an optimal thrust against the shutter element 22 in order to move it into the position wherein it closes said hole 210; however, it is clear that the elastic means 230 of the second portion 23 may also be made otherwise.

[0034] In addition, the second portion 23 comprises at least one access 232 to allow the condensed water to flow through and reach the container 10.

[0035] The second portion 23 is adapted to house at least partly said shutter element 22, in that preferably said second portion 23 is shaped substantially like a cup; in fact, the walls 231 make up the side surface of said cup, and the elastic means 230 make up the cup base.

[0036] In the representation shown in the annexed drawings, the first portion 21, the shutter element 22 and the second portion 23 of the cover 20 are made as separate and associable parts; it is however clear that said components may be made otherwise; in particular, at least two of them may be manufactured as one piece. For example, the cover 20 may be conceived in a manner such that the shutter element 22 and the second portion 23 are first formed as one piece (e.g. by connecting the shutter element 22 to the elastic means 230), the first portion 21 being subsequently associated with said one piece.

[0037] Though immediately apparent, the operation of the cover 20 of a container 10 for collecting condensed water in a clothes dryer 1 according to the present invention will now be described.

[0038] When the container 10 is extracted from the housing A in the frame 2, the elastic means 230 of the second portion 23 exert a thrust against the shutter element 22 towards the hole 210, so that said shutter element 22 can enter at least partially into the hole 210 to close it. A self-closing cover 20 is thus obtained.

[0039] On the contrary, when the container 10 is inserted in the housing A in the frame 2, a protuberance 10P (visible in Fig. 3b) present in said housing A exerts a pressure against the shutter element 22 that allows to overcome the thrust of the elastic means 230, thus causing said shutter element 22 to move in order to open at least partially the hole 210 of the first portion 21. In short, the opening of the hole 210 due to the pressure exerted

against the shutter element 22 by the protuberance 10P allows supplying condensed water of the clothes dryer 1 into the container 10.

[0040] As a result, the special design of the cover 20 according to the present invention allows to obtain:

- a facilitated supply of condensed water into the container 10 when said container 10 is positioned inside the housing A,
- an adequate and safe containment of the condensed water when the container 10 is extracted from the housing A in the frame 2.

[0041] As a matter of fact, such a self-closing cover 20 also allows preventing the condensed water from overflowing onto components of the clothes dryer 1 as the container 10 is being extracted from the housing A, such extraction operations being usually more difficult because of the quantity of condensed water in the container 10 and of the increased weight of the latter.

[0042] Referring back to Figs. 2a and 2b, it can be observed that the container 10 is shaped substantially like a parallelepipedon; it must be pointed out that the following references to the surfaces of the container 10 (i.e. the terms "top surface" and "side surface") are to be intended as referring to a container 10 inserted in the housing A in the frame 2. The aperture 11 for supplying condensed water into the container 10 is positioned on a top surface 10S of said container 10; it is clear that said aperture 11 can also be used for quickly draining the container 10, in particular after having removed the cover 20. In fact, said cover 20 is of the removable type and can be removed from the first aperture 11 in order to drain the condensed water quickly from the container 10.

[0043] The container 10 according to the present invention further comprises a second aperture 12 for a fine and precision drainage of the container 10, said second aperture 12 having a smaller surface or area than the aperture 11 for supplying condensed water into the container 10; it is clear that the smaller surface or area of the second aperture 12 determines a lower flow rate of said second aperture 12 compared with the flow rate of the first aperture 11 when emptying the container 10, thus ensuring a more precise drainage.

[0044] Preferably, said second aperture 12 is positioned on a side surface 10A, 10B, 10C, 10D of the container 10. Preferably, said second aperture 12 is positioned on a face 10F obtained between a first side surface 10A and a second side surface 10B of the container 10; in particular, said face 10F is obtained by bevelling a corner comprised between said first side surface 10A and said second side surface 10B.

[0045] Preferably, the first side surface 10A corresponds to that surface of the container 10 which is closest to the rear portion 2P of the frame 2 when the container 10 is inserted in the housing A; also, when the container 10 is inserted in the housing A, the first side surface 10A is substantially parallel to the rear portion 2P of said frame

2.

[0046] As can be seen in particular in Fig. 2b, said face 10F substantially lies in a plane P (indicated by a dashed-dotted line in Fig. 2b) that forms an angle $\square$ of 30° to 60° with the first side surface 10A and an angle $\square$ of 30° to 60° with the second side surface 10B. Preferably, said second aperture 12 is closed by a cap 12A.

[0047] The special provision of said second aperture 12 allows the container 10 to be drained with precision, so that the condensed water collected in said container 10 can be easily reused, e.g. for filling the boiler of a steam iron, said filling operation being facilitated by the presence of the second aperture 12, as well as by the particular position and size thereof

[0048] Still in Figs. 2a and 2b, it can be observed that the container 10 comprises a first handle 13 for extracting said container 10 from the housing A in the frame 2; in particular, said first handle 13 is associated with a third side surface 10C, opposite to the first side surface 10A.

[0049] Said first handle 13 allows the container 10 to be carried upright, i.e. with the third side surface 10C facing upwards; this allows the container 10 to be carried easily, and without taking up much space, even when it is full of condensed water (in which situation the container 10 is particularly heavy, if we consider that the container 10 may have a capacity of up to approx. six litres of condensed water).

[0050] Advantageously, the container 10 comprises a second handle 14 associated with a fourth side surface 10D, opposite to the second side surface 10B; said second handle 14 facilitates the task of fine-draining the condensed water through the second aperture 12 of the container 10, as well as the steps of extracting the container 10 from the housing A in the frame 2 and inserting it into said housing A.

[0051] Preferably, the second handle 14 is substantially associated with an intermediate portion of the fourth side surface 10D of the container 10, so that the weight of the container 10 can be better balanced while draining the condensed water through the second aperture 12; moreover, said second handle 14 is obtained in a recess 15 of the container 10, so that it does not protrude from the outer profile of said container 10 and therefore it does not hinder the operations of extracting and inserting the container 10; in particular, the recess 15 is obtained in said fourth side surface 10D, preferably in said intermediate portion of the fourth side surface 10D.

[0052] The advantages of a clothes dryer 1, in particular of the condensation type, and of a container 10 thereof for collecting condensed water according to the present invention are apparent from the above description.

[0053] In particular, said advantages consists in the fact that the particular realization of the cover 20 according to the present invention facilitates the supply of condensed water into the container 10 when said container 10 is positioned inside the housing A in the frame 2 of the clothes dryer 1, while ensuring an adequate and safe

containment of the condensed water when the container 10 is extracted from said housing A.

[0054] In fact, the specially designed self-closing cover 20 avoids any undesired overflow of condensed water onto the components of the clothes dryer 1 even while the container 10 is being extracted from the housing A.

[0055] A further advantage of the clothes dryer 1 according to the present invention is that the special provision of said second aperture 12 on the container 10 allows for a fine and precision drainage of said container 10 and makes it easier to reuse the condensed water collected inside the container 10.

[0056] Yet another advantage of the clothes dryer 1 according to the present invention is that the second handle 14 obtained in said container 10 facilitates the task of fine-draining the condensed water through the second aperture 12 of the container 10, as well as the steps of extracting the container 10 from the housing A in the frame 2 and inserting it into said housing A.

[0057] The clothes dryer described herein by way of example may be subject to many possible variations without departing from the novelty spirit of the inventive idea; it is also clear that in the practical implementation of the invention the illustrated details may have different shapes or be replaced with other technically equivalent elements.

[0058] Among the many possible variations, it is worth mentioning the one shown in Fig. 4, which is a sectional view of a variant of the cover 20 according to the present invention.

[0059] According to this variant, the cover 20 comprises a shutter element 220 so designed as to comprise a shank 221 associated with the elastic means 230 and a cap 222 for closing the hole 210; in fact, as can be seen in the sectional view of Fig. 4, the shutter element 220 is shaped substantially like a mushroom or an open umbrella, since the cap 222 has a substantially semispherical surface.

[0060] In addition to requiring much less material in comparison with the shutter element 22 shown in Figs. 1 to 3b, the particular configuration of the shutter element 220 of Fig. 4 makes it easier to direct the condensed water towards said at least one access 232 of the second portion 23 of the cover 20; as a consequence, the shutter element 220 of Fig. 4 facilitates the supply of condensed water into the container 10.

[0061] It can therefore be easily understood that the present invention is not limited to the above-described clothes dryer, in particular of the condensation type, and to the container thereof for collecting condensed water, but may be subject to many modifications, improvements or replacements of equivalent parts and elements without departing from the inventive idea, as clearly specified in the following claims.

Claims

1. A clothes dryer (1), in particular of the condensation

type, comprising:

- a frame (2) housing a drum (3) adapted to contain laundry to be dried;
 - first means (5, 6) for delivering heated air into said drum (3);
 - second means (7) for exchanging heat, said second means (7) being crossed by the air coming from the drum (3);
 - at least one container (10) for collecting the condensed water produced by said second means (7) for exchanging heat, wherein said at least one container (10) comprises a cover (20) for closing an aperture (11) for supplying condensed water into the container (10),
characterized in that
 said cover (20) is of the self-closing type and comprises:
 - a first portion (21) which comprises a hole (210) acting as a passage for the condensed water;
 - a shutter element (22; 220) adapted to enter at least partially into the hole (210) of said first portion (21);
 - a second portion (23) adapted to house at least partially said shutter element (22; 220), said second portion (23) comprising elastic means (230) for pushing the shutter element (22; 220) into the position wherein it closes said hole (210).
2. A clothes dryer (1) according to claim 1, **characterized in that** said shutter element (22; 220) has a shape which is complementary to that of the aperture (11) of the container (10), in particular that part of the shutter element (22; 220) which comes in contact with the aperture (11), so as to ensure an optimal closure of said aperture (11).
 3. A clothes dryer (1) according to claim 2, **characterized in that** said aperture (11) has a substantially circular shape and the shutter element (22) has a substantially spherical shape, in particular that part of the shutter element (22) which comes in contact with the aperture (11).
 4. A clothes dryer (1) according to one or more of claims 2 and 3, **characterized in that** said cover (20) comprises a shutter element (220) so designed as to comprise a shank (221) associated with the elastic means (230) and a cap (222) for closing the hole (210), in particular said cap (222) having a substantially semispherical surface.
 5. A clothes dryer (1) according to claim 1, **characterized in that** the elastic means of the second portion (23) comprise a strip (230) associated with the walls (231) of said second portion (23), said strip (230) being arched towards the first portion (21) of the cov-

er (20).

6. A clothes dryer (1) according to claim 1, **characterized in that** said second portion (23) comprises at least one access (232) allowing the condensed water to flow through and reach the container (10).
7. A clothes dryer (1) according to claim 1, **characterized in that** the first portion (21), the shutter element (22) and the second portion (23) of the cover (20) are made as separate and associable parts.
8. A clothes dryer (1) according to claim 1, **characterized in that** said cover (20) is of the removable type and can be removed from the first aperture (11) in order to quickly drain the condensed water from the container (10).
9. A clothes dryer (1) according to claim 1, **characterized in that** said container (10) is of the drawer type and can be extracted from and/or inserted into a housing (A) in the frame (2) with a substantially horizontal movement (X).
10. A clothes dryer (1) according to one or more of claims 1 and 9, **characterized in that** said container (10) substantially has a parallelepipedon shape and the aperture (11) for supplying condensed water into the container (10) is positioned on a top surface (10S) of said container (10).
11. A clothes dryer (1) according to claim 10, **characterized in that** said container (10) comprises a second aperture (12) for a precision drainage of the container (10), said second aperture (12) having a smaller area than the aperture (11) for supplying condensed water into the container (10).
12. A clothes dryer (1) according to claim 11, **characterized in that** said second aperture (12) is positioned on a side surface (10A, 10B, 10C, 10D) of the container (10), in particular said second aperture (12) being positioned on a face (10F) obtained between a first side surface (10A) and a second side surface (10B) of the container (10).
13. A clothes dryer (1) according to one or more of the preceding claims, **characterized in that** said container (10) comprises a first handle (13) for extracting said container (10) from the housing (A) in the frame (2), in particular said first handle (13) being associated with a third side surface (10C) opposite to the first side surface (10A), and **characterized in that** said container (10) comprises a second handle (14) associated with a fourth side surface (10D) opposite to the second side surface (10B), in particular said second handle (14) being substantially associated with an intermediate portion of the fourth side surface

(10D) of the container (10).

14. A clothes dryer (1) according to claim 13, **characterized in that** said second handle (14) is obtained in a recess (15) of the container (10).

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15. A container (10) for collecting condensed water in a clothes dryer (1) according to one or more of the preceding claims 1 to 14.

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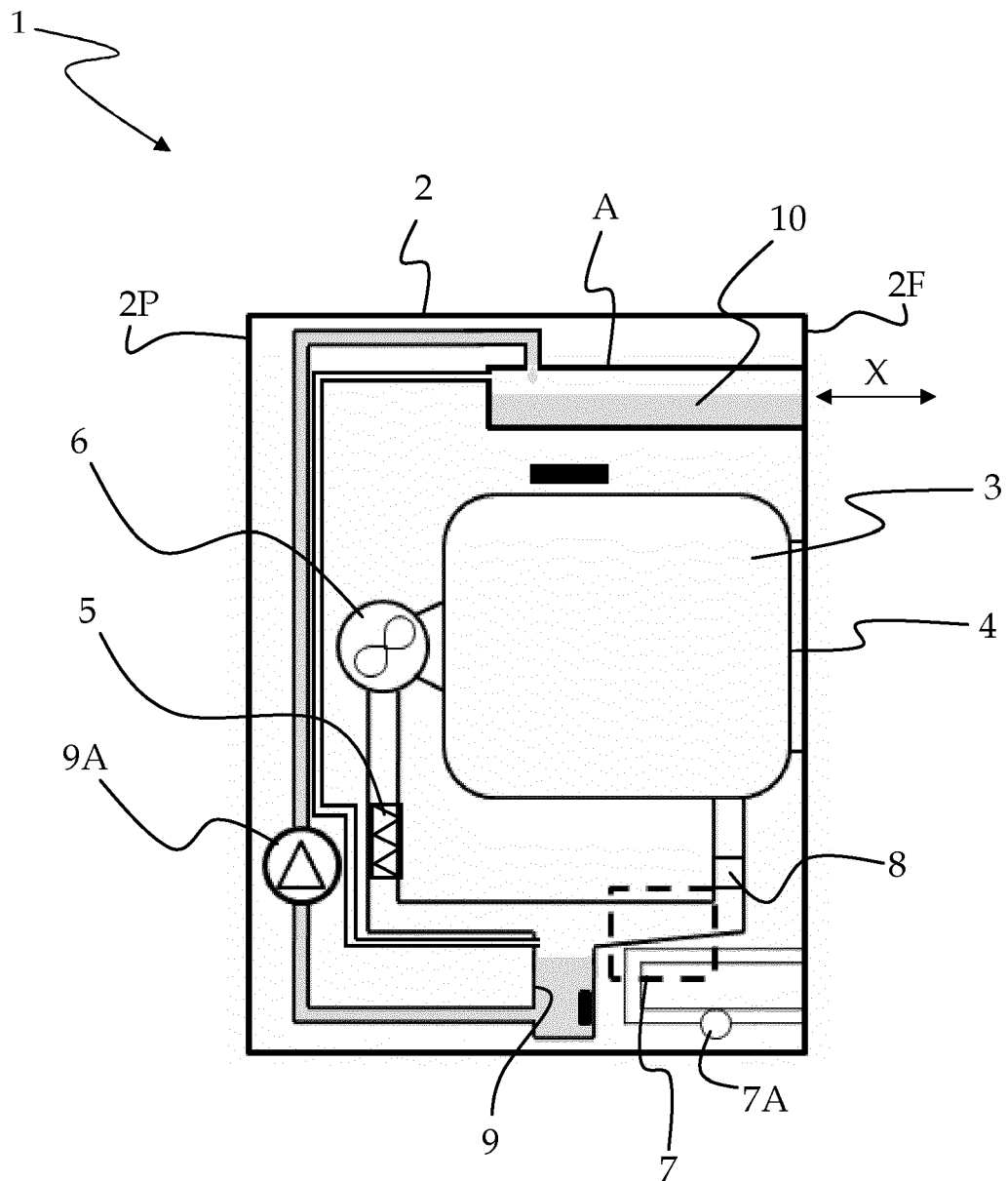


Fig. 1

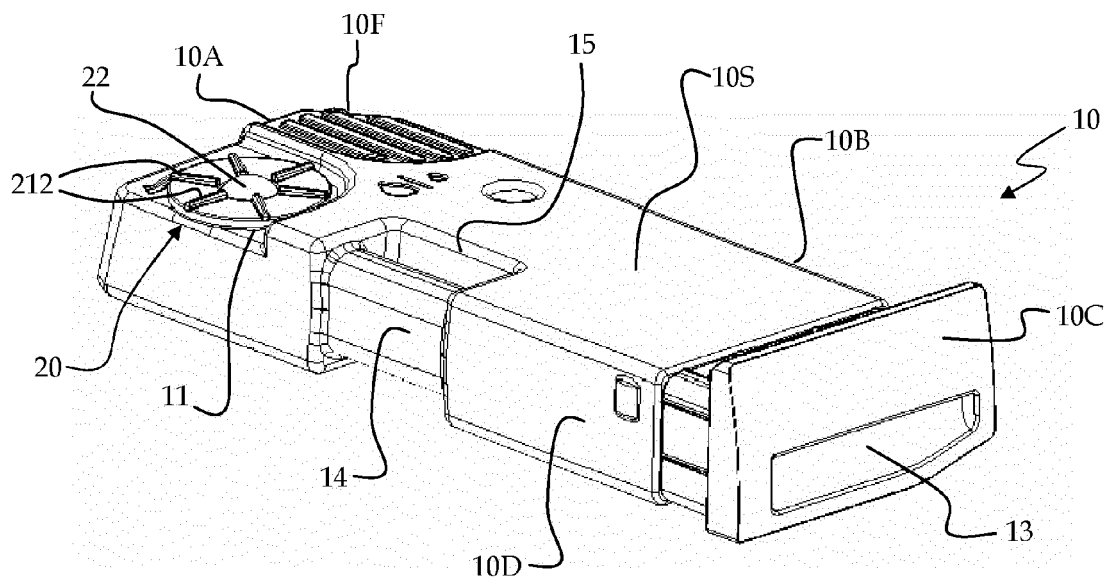


Fig. 2a

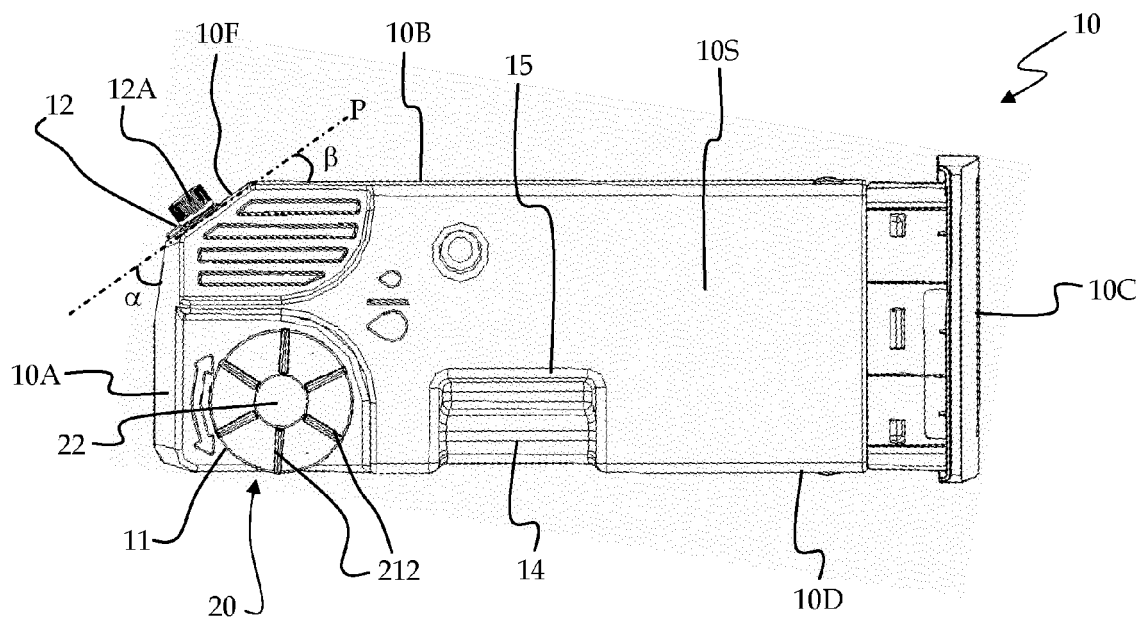


Fig. 2b

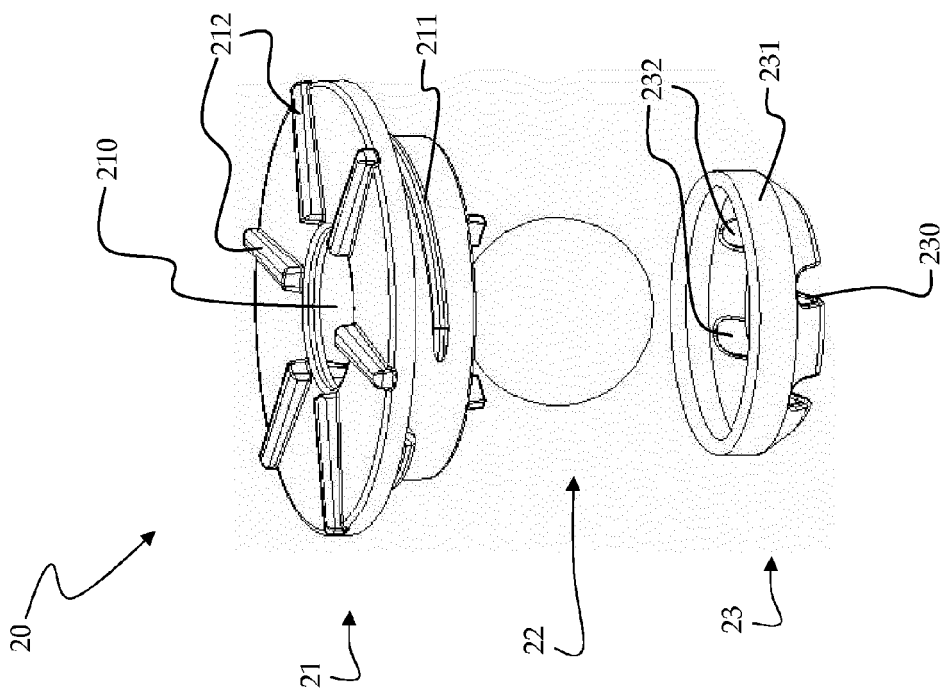


Fig. 3a

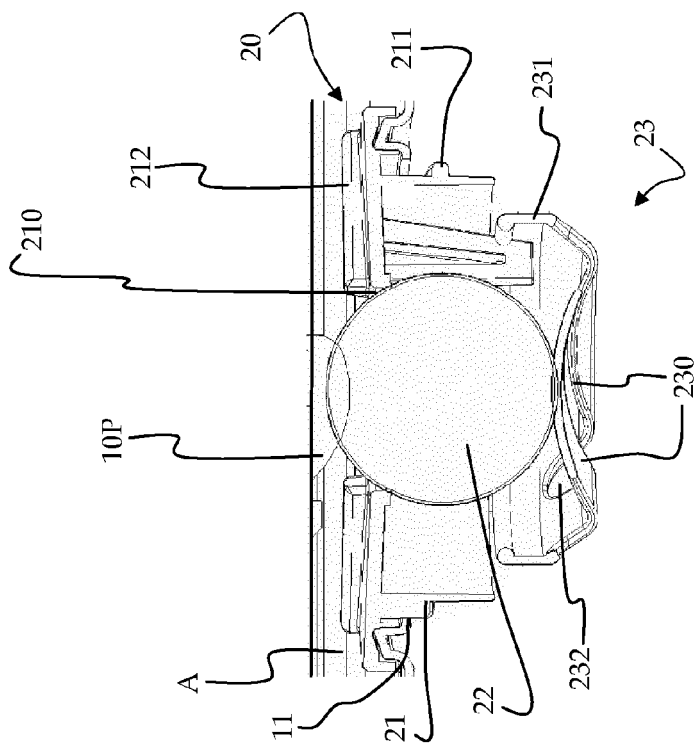


Fig. 3b

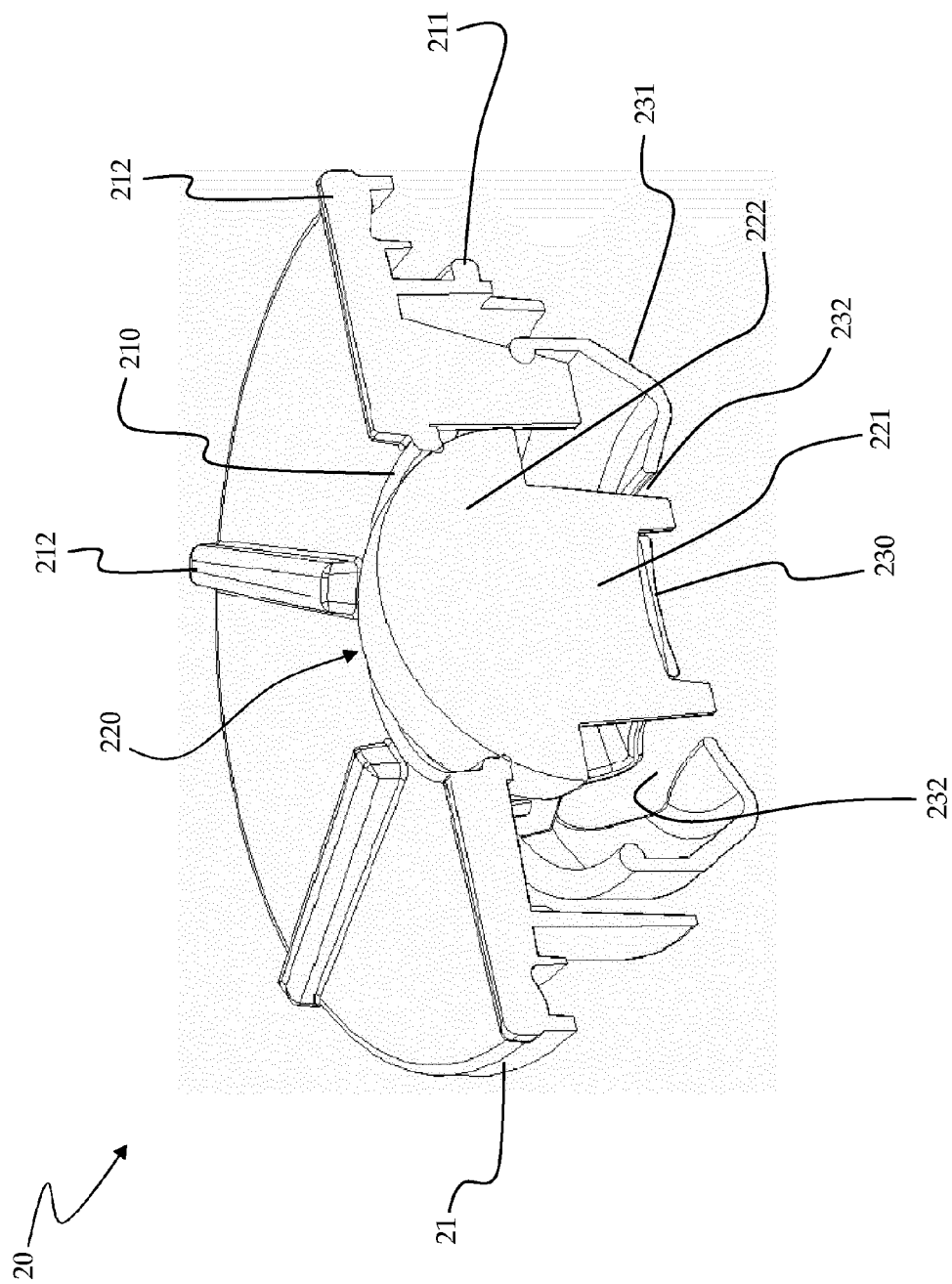


Fig. 4



EUROPEAN SEARCH REPORT

Application Number
EP 11 18 9698

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 0 484 225 A1 (CIAPEM [FR]) 6 May 1992 (1992-05-06) * column 5, line 12 - line 24 * * column 5, line 48 - line 57; figure 6 * -----	1,2,4,6, 7,10,15	INV. D06F58/24
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			TECHNICAL FIELDS SEARCHED (IPC)
			D06F
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 17 February 2012	Examiner Westermayer, Wilhelm
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 18 9698

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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17-02-2012

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