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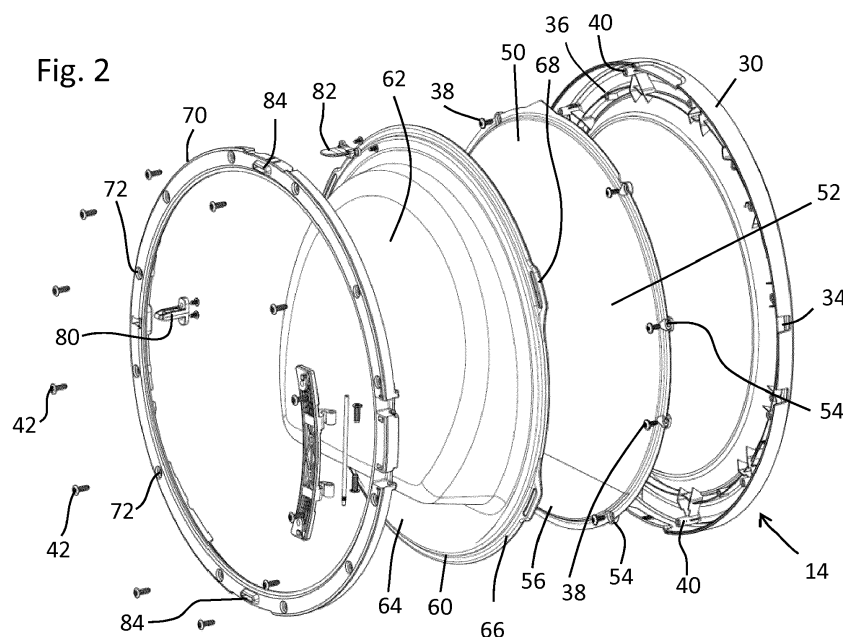
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(54) **Door assembly for laundry treatment apparatus**

(57) The invention relates to a door (14) for a laundry treatment apparatus, in particular for a dryer, washing machine or washer-dryer. The door comprises: a front frame (30) having a central opening; an inner window (60); a cover (50) adapted to prevent the inner window front side to be touched by a user; and a rear frame (70) having a central opening. The arrangement sequence is: front frame (30), cover (50), inner window (60) and rear frame (70). The cover (50) and either the front frame (30)

or the rear frame form a door subassembly (100) by being mechanically connected to each other using at least one first connecting device (38/30) that engages the cover and either the front frame or the rear frame. The inner window (60) is arranged between the front frame (30) and the rear frame (70), and the front frame (30) and the rear frame (70) are mechanically connected to each other using at least one second connecting device (42/40) that engages the rear frame and front frame.



Description

[0001] The invention relates to a door for a laundry treatment apparatus, in particular for a dryer, a washing machine or washer-dryer. Further the invention relates to a method for assembling a door.

[0002] US 7,559,156 B2 discloses a door assembly for a dryer. The door assembly comprises in a sandwich-structure a series of individual door components that are fixedly connected to each other using screws. Coming from the front side direction the door assembly comprises as essential components an outer (or front) frame, an outer window having a flange, a collar, an inner window and an inner (or rear) door frame which are stacked over each other. For assembling, screws are inserted through screw holes of the inner door frame and of some of the components and are screwed into receiving studs formed on the rear side of the outer frame.

[0003] It is an object to provide a door having improved mechanical characteristic and a method for assembling a door that result in a door with such improved mechanical characteristic.

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

[0005] According to claim 1 a door for a laundry treatment apparatus is provided, wherein the door is adapted to cover a loading opening of the apparatus. The laundry treatment apparatus may be a dryer, a washing machine or a washer-dryer. Preferably the apparatus is a front-loading laundry treatment apparatus. The door comprises a front frame having a central opening, an inner window, a cover adapted to prevent the inner window front side to be touched by a user, an inner window, and a rear frame having a central opening. In a closed state of the door at the apparatus, the cover may be or may be denoted as a protection cover, which prevents a user to contact the inner window that may be hot during a hot water washing process or during a drying process. Preferably the cover extends over the complete and/or exposed front surface of the inner window, wherein the 'exposed window front surface' is the surface portion that is on the front side when the door is closed at the apparatus and which is not covered by the front frame.

[0006] The inner window can also be denoted as or preferably is a 'glass window' and/or is a transparent window, e. g. is made of a transparent material and/or is transparent. However and although denoted as 'window' the inner window is not necessarily transparent, e.g. it can be non-transparent or can be formed of a non-transparent material, for example may be formed of colored plastics.

[0007] Preferably the sequence of arrangement of the door elements is from the front side to the rear side or from the outer side to the inner side (when the door is closed at the apparatus): front frame, cover, inner window and rear frame. Here the 'arrangement sequence' relates to the assembled state of the door. The cover and either the front frame or the rear frame form a door sub-assembly by being mechanically connected to each other using at least one first connecting device that engages the cover and either the front frame or the rear frame. Thus the sub-assembly is formed by the front frame and cover engaged or fixed to each other, or by the cover and the rear frame with preferably the inner window clamped therebetween and where the cover and rear frame are engaged or fixed to each other. Preferably the door sub-assembly is formed by the front frame and the cover, wherein the front frame and cover are in mutual engagement by the at least one first connecting device

[0008] In the assembled door the inner window is arranged between the front frame and the rear frame, and the front frame and the rear frame are mechanically connected to each other using at least one second connecting device that engages the rear frame and front frame.

[0009] The engagement of the cover to either the front or rear frame provides a sub-assembly of the door which provides self-supporting mechanical stability. This not only facilitates assembling together the further components of the door with the 'single' unit of the sub-assembly, it also increases the mechanical end stability of the door. The relative position of cover and front or rear frame are rigidly fixed and the sub-assembly has increased stability as compared to its individual elements, if mounted in a final step without mechanically engaging the cover to the rear or front frame. Preferably, when either the front frame or the rear frame and the cover are connected to each other via the at least one first connection device, the mechanical rigidity of either the front frame or the rear frame is increased as compared to the mechanical rigidity of the front frame alone. For example the cover increases the mechanical stability of the front and/or rear frame in respect to torsions relative to the main plane of the front or rear frame, respectively.

[0010] As used herein the term 'transparent' is used in the meaning of visually transparent for the user. Further, as used herein, relative terms like 'front', 'rear', 'inner', 'outer' relate to the position of the assembled door relative to each other and relative to a normal use where the door is mounted at the laundry treatment apparatus and the door is closed to cover a loading opening of the apparatus for loading/unloading laundry to an apparatus inner space. E.g. when door is closed, 'inner' relates to close to the inner space, 'front' relates to the outer side of the apparatus, 'rear' relates to the 'rear side' of the door when 'front' is at the outer side of the apparatus. Preferably, in case of a front-loading apparatus and when the door is closed, 'front' is linked to the front side and 'rear' to oriented to the rear side of the apparatus. Further, as used herein, the term 'engaged' can be replaced by 'fixedly connected' and/or means that the connecting device(s) is directly fixed on the cover and/or the front/rear frame. As used herein, the meaning of 'element A engages element B' is that elements A and B are brought into mechanical engagement by the at least one (first and/or second

and/or third) connecting device.

[0011] In an embodiment, for engaging the cover with either the front frame or with the rear frame, the at least one first connecting device provides a self-maintaining connection fixedly connecting the cover and either the front frame or the rear frame. Thereby a direct connection between these two elements of this door-subassembly is provided without requiring support by the other elements of the door. The engaging connection of the cover to the front or rear frame may be in the form of force-closure and/or form-fit and/or adhesive bond between the two elements. Most preferably screw-connections are used for the at least one first and/or second connecting devices. The screws preferably extend in a direction perpendicular to the main extension plane of the frames and the cover. The screws at least partially extend through the material thickness of the cover and/or front or rear frame and enhance thus the mechanical stability of the connection between the two elements of the sub-assembly.

[0012] What has been said above or will be said below to the engagement between the cover and the front or rear frame using the at least one first connecting device alternatively or additionally applies to the mechanical engagement between the front frame and the rear frame by the at least one second connecting device.

[0013] In an embodiment the front frame comprises a base frame and a decorative frame or decorative ring and is thus formed of the two elements. However, in a preferred embodiment the front frame is a single piece that additionally may have a decorative element like a deco ring or a paint on its front surface and/or inner edge surface and/or outer edge surface. Preferably all first elements (e.g. sockets and/or connecting element) of the first connection device are provided at the decorative frame (ring) or at the base frame or as well on the decorative frame (ring) and on the base frame. Additionally or alternatively the base frame and the decorative ring are engaged or fixedly connected to each other. As an example, the fixed connection may be one or more connections formed by the following: overmolding, bi-injection molding, snap-fitting, adhesion, gluing, and using at least one third connection device.

[0014] For the elements of the door one or more of the following applies: the basic form of the front frame is ring-shaped, the basic form of the rear frame is ring-shaped, and the basic form of the cover is plate-shaped.

[0015] The inner window preferably is mechanically clamped between the front frame and the rear frame, or between the cover and the rear frame, or between the rear frame and simultaneously between the front frame and cover. Here 'clamping' means that the two (or three) components are in physical contact with each other and mutually exert a force for clamping the inner window.

[0016] In an embodiment the at least one first connecting device comprises: a plurality of mounting sockets arranged spaced from each other at either the front frame or the rear frame and a plurality of connecting element arranged at the cover or a plurality of connecting elements releasably provided at the cover; a plurality of mounting sockets arranged spaced from each other at the cover and a plurality of connecting elements arranged at either the front frame or the rear frame or a plurality of connecting elements releasably provided at either the front frame or the rear frame; or both of the above, wherein a first group of mounting sockets is arranged at the front frame and a first group of connecting elements is releasably provided or arranged at the cover, while a second group of mounting sockets is arranged at the cover and a second group of connecting elements is releasably provided or arranged at the front frame. The position of connecting elements corresponds/mates with position of associated mounting socket. For example the screws and associated screw holes are provided at the cover at positions that are over the screw thread receiving bores of screw sockets formed at the front or rear frame, when the cover is positioned over the front or rear frame for assembling the sub-assembly.

[0017] Preferably the sockets are formed or positioned at the rear side of the front frame or at the front side of the rear frame. The 'releasably provided at' includes for example screws inserted in screw holes of the respective element, which can be un-screwed for disassembling the rear and front frame or the cover from the front or rear frame (the latter for disassembling the sub-assembly). In an embodiment the first and/or second connecting elements may be fixedly connected at the cover (e.g. at the front side) for example in a plug-and ready mounting. For example the first and/or second connecting device may be latching connection like snap-fit connection, - in case of latching or snap-fit connection the mounting socket is more rigid part that receives a hook or engages with more flexible element of the connection element. However, the first and/or second connecting elements preferably are or comprise removable connecting elements like screws which enable disassembling: In the latter case the mounting socket may comprise screw holes for receiving the screws. In case of removable elements provided 'at' the cover (or front or rear frame), the cover (or front or rear frame) preferably provides receptacles for the removable connecting elements, e.g. screw holes or screw-head receptacles.

[0018] During the assembling, the engaging connection is established by the first and/or second connecting device in a way that the connection may be permanent (i.e. the connection would be destroyed or damaged when releasing connection). Preferably the engagement by first and/or second connections is releasable (screw, snap-fit in specific releasable design).

[0019] In an embodiment the at least one second connecting device comprises: a plurality of mounting sockets arranged spaced from each other at the front frame and a plurality of connecting element arranged at the rear frame or a plurality of connecting elements releasably provided at the rear frame; a plurality of mounting sockets arranged spaced from each other at the rear frame and a plurality of connecting element arranged at the front frame or a plurality of connecting elements releasably provided at the front frame; or both of the above, wherein a first group of mounting sockets is

arranged at the front frame and a first group of connecting elements is arranged or releasably provided at the rear frame, while a second group of mounting sockets is arranged at the rear frame and a second group of connecting elements is arranged or releasably provided at the front frame. As already indicated above, for the second connection elements the same may apply as above mentioned in respect of the first connection elements.

[0020] In the preferred design, an inner portion of the inner window extends from the front side through the central opening of the rear frame such that the inner portion protrudes beyond a rear surface of the rear frame at the rear side of the door. In this way, when the door is closed at a loading opening of the horizontal rotating drum apparatus, laundry is deflected by the inner window rear surface towards the drum interior.

[0021] The door may further comprise a door lock and/or a door hinge and/or a door handle. Preferably the door lock and/or door hinge are mechanically fixed at the rear frame. The door lock may be a static or fixed position door lock (e.g. non-moveable and/or non-pivoting relative to the other elements of the door), or the door lock may be pivotably arranged at the door. Further preferable the door lock is connected to a or the pivotable handle or a pivoting mechanism actuated by the handle for opening the door when arranged at the apparatus. Preferably the door handle is arranged at the front frame and/or cover.

[0022] In an embodiment the cover and/or the inner window are adapted to be mounted on either the front or the rear frame in at least two different orientations between the cover and/or the inner window relative to the front or rear frame. Thus in the assembled door the cover and/or window may have the one or the other of the at least two positions relative to the other elements (front and rear frame). This allows to modify a door opening/closing pivoting orientation. By additionally changing the position of mounting the door hinge and/or door handle at the door (preferably at the rear frame as mentioned above), the movement of the door swing can be changed with respect to a cabinet of a drying apparatus. Preferably the cover and/or the inner window are adapted to be mounted at or to be positioned in at least two different angular orientations relative to the front frame and the rear frame. One can also say to the reverse that the front frame and the rear frame are adapted to be mounted at or to be positioned in at least two different angular orientations relative to the cover and/or the inner window. This symmetry of positioning is required in case the window (e.g. due to the asymmetric design of the rearward extending part) and/or cover (e.g. due the coloring and/or non-transparent part covering a step in the window) itself are not formed symmetrical. E.g. cover and/or window can not be mounted in an orientation rotated by 180° at the loading opening of the apparatus, while the front and/or rear frame allow a 180° turn mounting (possibly except minor details - see interlock of the detailed embodiment).

[0023] According to a design embodiment the cover is at least partially transparent. The 'at least partially transparent', if applicable, is applicable to all 'transparent cover' mentioned in the claims. In another embodiment the cover may be completely (over full surface) non-transparent.

[0024] According to the invention, a method of assembling a door for a laundry treatment apparatus is provided, in particular for a dryer, washing machine or washer-dryer. The method comprises: forming a door sub-assembly by fixing a cover to one of a front frame having a central opening or a rear frame having a central opening, wherein the one of the front and rear frame and the cover are mechanically connected to each other using at least one first connecting device that engages the cover and the one of the front frame or the rear frame of the sub-assembly; arranging an inner window between the one of the front frame or the rear frame of the sub-assembly and the other of the front frame or the rear frame; and fixing the other of the rear frame or the rear frame and not forming part of the sub-assembly to the frame being part of the sub-assembly. The rear frame and the front frame are mechanically connected to each other using at least one second connecting device that engages the rear frame and front frame. The method steps are not necessarily in the temporal or sequence order for assembling the door as mentioned in their sequence in the method, but in an embodiment the method sequence may also be considered as being the actual temporal sequence of assembling the door.

[0025] Preferably the door to be assembled is a door as described above and/or below or may comprise any feature or sub-combination of features for a door as described above and/or below.

[0026] The 'mechanical connection' or mechanical engagement preferably is a 'mechanically fixture to each other' as mentioned above. In case the sub-assembly is formed by the cover and rear frame, preferably the inner window is part of the sub-assembly and preferably is clamped between cover and rear frame.

[0027] In an embodiment of the method the step of forming a door sub-assembly comprises positioning the inner window between the cover and the frame forming part of the sub-assembly, wherein preferably the frame forming the sub-assembly is the rear frame.

[0028] The above door and/or method are to be understood in connection with the embodiments presented in the detailed embodiments. All features, functions, steps and elements described below are individually or in any sub-combination applicable to the door and/or method and vice versa without restriction.

[0029] Embodiments are described in more detail under reference to the figures, which show:

Fig. 1 a perspective front view of a laundry dryer,

Fig. 2 an exploded rear perspective view of a door of the laundry dryer,

- Fig. 3 an exploded front perspective view of the door shown in Fig. 2,
- Fig. 4 an exploded perspective rear view of the door of Fig. 2 from the left side,
- 5 Fig. 5 an exploded perspective front view of the door of Fig. 2 seen from the right side,
- Fig. 6 the door of Fig. 2 in the finally assembled state shown from the rear side,
- Fig. 7 the door of Fig. 2 in the assembled state shown from the front left side,
- 10 Fig. 8 a perspective exploded rear view of a protection cover and a front frame forming a sub-assembly of the door shown in Fig. 2,
- Fig. 9 a rear view to the sub-assembly formed by the protection cover and the front frame which are shown in the pre-assembled state in Fig. 8,
- 15 Fig. 10 the sub-assembly of Fig. 9 shown in cross-section at an outer area, where the cross-section is indicated by the line A-A in Fig. 9, and
- 20 Fig. 11 a cross-sectional view of a door according to a second embodiment.

[0030] The drawings are not drawn in scale, however, mechanical details are appropriately depicted such that conclusion to a support for technical elements is well provided to the skilled person. Herein, relative terms like "top", "bottom", "front", "rear", "inner" and "outer" relate to a positional orientation as conventional in dryers, where the front side is the front side at which the user operates the dryer, the "sides" are the sides of the dryer (compare side wall 8), the "top" or "upper side" is at the top of the dryer (compare top plate 6) and the "rear side" is the rear side of the dryer, not shown in Fig. 1. The "outer" side is the exterior of the dryer and the "inner" side is the side which is directing towards the inner space of the dryer relative to the outer side. Such relative orientation is transferred to the doors 14, 14', when the door is mounted at the dryer body or outer case 4 and when the door is in its closing position for closing the loading opening 12. The relative terms in respective of the dryer 2 are passed to the door 14, 14' in its closed state.

[0031] Fig. 1 shows a front perspective view of a tumble dryer 2 having mounted thereto a door 14 according to a first embodiment. The dryer 2 may be a vented dryer, a condensate dryer or any other type of dryer. The condensate dryer may be a heat pump tumble dryer or may have a drying air/ambient cooling air heat exchanger for cooling the drying air. Preferably the dryer is a tumble dryer having a drum that is rotating around a horizontal axis or around an axis inclined relative to the horizontal axis (e. g. by less than 50°).

[0032] Mounting the door according to the embodiment to the outer case 4 of the tumble dryer 2 is only an example and such kind of door may also be mounted on the case of a washing machine or a washer-dryer or any other laundry treatment apparatus having a laundry storing compartment to be closed by the door. The laundry storing compartment is for example a drum that is rotatably mounted.

[0033] The dryer 2 shown in Fig. 1 has an outer case 4 formed by a top plate 6, side walls 8 (only one shown), the front wall 10, a rear wall (not shown) and a bottom part (not shown). The front wall 10 has a loading opening 12 for loading and unloading laundry into and out of an interior of a drum (not illustrated). The loading opening 12 is closed by door 14, which - in the closed state - partially extends from the front side of the dryer through a front frame 18 which surrounds the loading opening 12. At a lower portion of the front frame 18, between the front wall 10 and a front edge of the drum, a fluff filter 20 is inserted into an inlet of an air channel. The door 14 is mounted by a hinge flange 76 (see Fig. 4 and not shown in Fig. 1) to a corresponding receptacle at the front frame 18 or front side of the dryer. Program selection and program start/stop are input by a user via a control panel 16 of the dryer.

[0034] Fig. 2 shows a rear exploded perspective view from the rear-right side, in which the elements forming the door 14 are shown. Fig. 3 shows the door 14 in an exploded perspective view from the left-front side. When the door is closed and the user has a look to the front side of the dryer 2, the outer front appearance of the door is provided by a front frame 30 which basically has a ring shape with a large opening in its center. A door handle 32 is formed on or at the front frame 30 for opening and closing the door. At the outer edge of the front frame 30, opposite to the position of the door handle 32, hinge slots 34 are provided which allow cantilever beams 77 of a hinge flange 76 to pass through the outer edge of the front frame 30 while the door 14, mounted to the outer case 4 of the tumble dryer 2, is pivoted from open and close position and back. On the rear side of the front frame 30, a plurality of first sockets 36 is arranged spaced apart from each other. The sockets 36 are arranged distributed over the complete angular range at the rear side along an imaginary circle line having a first inner radius. The first sockets 36 provide mounting or screwing receptacles for first screws 38, which are used for fixing a protection cover 50 to the rear side of the front frame 30.

[0035] On the rear side of the front frame 30 a second set of second sockets 40 is arranged. The second sockets 40 are spaced from each other and are arranged distributed on an imaginary circle line around the full angular range of the rear side. The circle line has a second radius, which is larger than the first radius at which the first sockets 36 are arranged. The second sockets form screw receptacles for a set of second screws 42 which are used to fix a rear frame 70 to the door assembly 100 (described below).

[0036] At the rear side of the front frame 30 the protection cover 50 is arranged, which has a transparent plate 52 in its inner area. Preferably the transparent plate 52 has a diameter which is larger than the inner diameter of the front frame 30 at the opening of the front frame and/or the transparent plate or the cover 50 as such has a smaller outer diameter than the outer diameter of the front frame 30 and/or the outer diameter of the cover 50 is smaller than the imaginary circle line for the second sockets 40.

[0037] The transparent plate 52 is surrounded by a rim having a positioning or alignment structure for aligning the cover relative to the front frame 30 by cooperating with a counter-alignment structure provided at the rear side of the front frame 30. Along the rim and at angularly distributed positions eyelets 54 are provided on an imaginary circle line having the first radius mentioned above. The eyelets each have a hole and rear side abutment surface such that the first screws 38 can be inserted through the eyelet hole and can be screwed into the first sockets 36 of the front frame 30. As can be seen from the cross section in Fig. 10, if the first screws 38 are fully screwed into the first sockets 36, the screw head abuts against the rear abutment surface at the eyelet 54.

[0038] Preferably the transparent plate 52 is visually transparent. However in other embodiments the transparent plate (the protection cover) may be non-transparent. In the case where the transparent plate 52 is transparent, a paint section 56 (compare Fig. 9) may be provided, which is non-transparent. In the assembled state and when seen from the front side, the paint section 56 serves to visually cover areas of the otherwise transparent protection cover 50. Through the transparent portion of the cover 50 the interior of the laundry storing compartment and thus the laundry therein can be seen. The paint section 56 is provided to visually hide mechanical elements like the step of the glass 60 and the top side of the filter 20 that should not be visible due to aesthetic reasons.

[0039] The rim of the protection cover 50 further has one or more alignment elements 58 (see for example Fig. 9) which serve(s) for aligning the protection cover 50 relative to the front frame 30 in respect of the angular position. At the rear side of the protection cover 50 a glass 60 is provided, which in this embodiment is completely transparent. However in other embodiments the glass may be partially transparent only or may even be non-transparent. In the embodiment shown, the glass 60 is transparent. When the door 14 is closed, the glass deflects laundry from falling onto the top surface of the fluff filter 20. For this purpose the glass 60 has a protruding deflection portion 62 which, when the door 14 closes the loading opening 12, extends into the loading opening 12 within the front frame 18. When the laundry receiving compartment is a drum and rotates, the laundry falling from above downwards at the front side of the drum slides along the protruding deflection portion 62 and is guided towards the interior of the drum. Thereby the laundry is kept away from the air inlet openings of filter 20.

[0040] Further the glass 60 has a stepped-back pack portion 64 which leaves the space free where the filter 20 is arranged in door closed position. Between the bottom side of the back step portion at the protruding deflection portion and the upper side of filter 20, a small air gap is kept clear which enables the drying air to reach the inlet openings of the filter 20 to be passed through the filter into the air channel.

[0041] The glass 60 has a rim 66 at its outer circumference, which is clamped between a front edge of the rear frame 70 and the rear rim(s) of the protection cover 50 and/or the front frame 30. The rim 66 preferably has alignment elements 68 distributed around the periphery of the glass 60 such that the glass 60 can be angularly aligned relative to the rear frame 70. For this purpose alignment ribs are provided on the front side of rear frame 70 for cooperating or engaging with the elements 68. Alternatively or additionally one or more or all of the alignment elements 68 may cooperate or engage with ribs provided at the rear side of the cover 50 and/or front frame 30.

[0042] The rear frame 70 is formed by a radially small ring which centrally has a large opening. Angularly distributed along the rear frame eyelets 72 are provided on an imaginary circle line of the second radius mentioned above. The eyelets provide a hole and an abutment surface on the rear side for the set of second screws 42 by which the rear frame 70 is mechanically fixed to the second screw sockets 40 at the rear side of the front frame 30.

[0043] The rear frame 70 has at its outer edges hinge recesses 74 which receive the front ends of the cantilever beams 77 of the hinge flange 76. As indicated in Fig. 3, the front ends of cantilever beams 77 are inserted into the hinge recesses 74 and a hinge shaft 78 is moved into respective holes of the cantilever beams 77. The hinge shaft is blocked within the rear frame 70 by bushings such that the hinge shaft 78 serves as the pivoting point of the flange 76 at the rear frame 70.

[0044] On the opposite side of the rear frame 70 relative to the hinge recesses 74, an opening is provided in the rear frame for inserting therethrough a locking latch 80 which is screwed at a base plate to the front side of the rear frame 70. The locking latch 80 has a stud which extends through the opening in the frame 70 and protrudes from the rear side of frame 70. When closing the door, the protruding stud is pressed into a case lock 81 (Fig. 1) provided at the front side of the front frame 18 of the dryer 2. The stud has an outer structure such that it can be clamped by clamping elements provided in the case lock 81 to hold the door in its closed position. Only when pulling with some force on the handle 32

of door 14 the stud of case lock 81 is released against a resistance and the door can be opened.

[0045] At the upper side of the rear frame 70 an interlock and alignment pin 82 is inserted from the front side through slots 84 in the frame. A base plate of the interlock pin 82 is screwed onto the front side of the rear frame 70. The pin 82 protrudes from the rear side of frame 70 and serves to align the door relative to the opening 12 by engagement with a case slot 86 (Fig. 1) and/or to actuate a security switch within the case slot 86 and which disables dryer operation as soon as the interlock pin 82 is withdrawn from the case slot 86.

[0046] For completeness, cross-references and better understanding the positions of the elements of the door 14: Fig. 5 shows an exploded perspective front view of the door of Fig. 2 seen from the right side, Fig. 6 shows the door of Fig. 2 in the finally assembled state shown from the rear side, and Fig. 7 shows the door of Fig. 2 in the assembled state shown from the front left side.

[0047] Fig. 8 shows a rear perspective view of the sub-assembly 100 of door 14, wherein the sub-assembly is formed by the protection cover 50 screwed by the first screws 38 to the back side of the front frame 30 as mentioned above.

[0048] Fig. 9 shows the sub-assembly 100 from the rear side in a state where the protection cover 50 is screwed to the back side of the front frame 30. As can be seen, the imaginary inner or first circle line, where the first sockets 36 are aligned, is occupied by screwing-in the first screws 38. In this intermediate step of assembling, the outer or imaginary second circle line, where the second sockets 40 are arranged spaced apart of each other, is not occupied by the set of second screws 42, which are used to screw the rear frame 70 against the front frame 30 in a next mounting step.

[0049] Fig. 10 shows a cross-section through the sub-assembly 100 at a section taken along the line A-A shown in Fig. 9. It can be seen that the first screw 38 is inserted in the eyelet 54 and the screw head abuts against the rear side of eyelet 54 such that the protection cover 50 is fixed to the rear side of the front frame 30 via the screw 38 being fixed within the first socket 36.

[0050] The cross section further shows that in this embodiment the front frame 30 is formed by bi-injection molding using molds of two different colors and/or different material. A first colored mold 44 forms the inner portion and rear portion of frame 30 from which the mechanical structures of the frame are formed. A second mold 46 is formed at the outer edge and front side of frame 30, wherein the second mold provides improved surface aesthetics as compared to the first mold 44. Molds 44, 46 form a single-piece or monolithic block and are formed in one synchronized injection step.

[0051] In other embodiments the front frame can be formed as a unitary piece from a single mold material and/or single-injection molding or it may be formed of two parts that are fixed together, for example a decorative ring that is clued or clamped to the front or outer side of a basic structure forming the ring of the front frame.

[0052] An exemplary embodiment for assembling the door 14 according to the first embodiment is explained now. The protection cover 50 is already provided with the paint section 56. The protection cover 50 is positioned at the rear side of the front frame 30. The set of first screws 38 are inserted through the eyelets 54 and are screwed into the first sockets 36 (one screw 38 per socket 36). The glass 60 is positioned at the rear side of the sub-assembly 100 formed by having screwed the protection cover 50 to the front frame 30. In an arbitrary order of assembling steps:

- the hinge flange 76 is connected to the rear frame 70 by the hinge shafts 78 (see above) using the bushings,
- the locking latch 80 is screwed to the rear frame (see above), and
- the interlock pin 82 is screwed to the rear frame at the upper slot 84.

[0053] Then this pre-assembled rear frame is positioned over the glass 60, the set of second screws 42 is inserted through the holes of eyelets 72 and the screws are screwed into the set of second sockets 40 at the rear side of the front frame 30 (one screw 42 per socket 40). Thereby the door 14 is finally assembled and can be mounted at the front side of the dryer by screwing the hinge flange 76 to the respective position at the front frame 18 of the dryer.

[0054] During assembling it can be decided whether the door 14 is provided as right-swing door or left-swing door. In Figs. 1 to 10 the door 14 is shown for left swing mounting, i.e. when seen from the front side of the dryer 2 and when the door is closed, the hinge with the hinge flange 76 and hinge shaft 78 are arranged at the left side of the closed door. With the same elements the door can be assembled to be a right-swing door. For this, and referring to Fig. 2, the front frame 30 is rotated by 180°. The protection cover 50 can keep its position or may also be rotated by 180° without a change otherwise at the protection cover. The glass 60 keeps its position without any change. The rear frame is rotated by 180° where nothing changes at the mounting of the hinge flange 76 and the locking latch 80, as they are mirror-symmetric relative to the horizontal plane. Only the position of the interlock pin 82 has to be changed such that it again is at the upper one of the slots 84 and such that it can come into engagement with the case slot 86 which is provided on the upper side of the loading opening 12 at the front frame shown in Fig. 1.

[0055] When the user decides to change the pivoting side of the door, the user or a service person:

- can unscrew the rear frame,
- can change the position of the interlock pin 82 at the rear frame,
- can rotate the door by 180°, and

- can rotate the glass by 180° (possibly additionally the cover 50)
- can unscrew the hinge flange 76 from the front frame 18, and
- can mount the hinge flange 76 at the other side where the case lock 81 is provided (by unscrewing the hinge flange 76 from the original side, another identical case lock 81 is exposed on the side where the door originally was hinged at).

[0056] The series or order of steps of modifying the door from a left hinge to a right hinge door and vice versa can be permuted in arbitrary order as compared to the one described above.

[0057] In embodiments one or more of the following is applicable to the door assembly or parts thereof of the door 14 according to the first embodiment or the door 14' according to the second embodiment: Preferably the hinge flange 76 and/or the hinge shaft 78 and/or the locking latch 80 and/or the interlock pin 82 are formed from a metal. For example a diecast metal or a metal part formed by pressing. Preferably the front frame 30 and/or the protection cover 50 and/or the rear frame 70 are formed by single-material injection molding or by bi-material or be-layer injection molding such that these pieces are preferably monolithic or single-piece elements.

[0058] Fig. 11 shows a non-to-scale simplified schematic of a door 14' according to a second embodiment. For the second embodiment all the above described details apply in any arbitrary combination and sub-combination unless the difference between the first and second embodiment is described below. Unless otherwise mentioned, the above described features, elements and functions of the door 14 according to the first embodiment correspond to the features, elements and functions of the door 14' of the alternative embodiment as described below. Like reference signs are used for like elements.

[0059] In the second embodiment, the protection cover 50' is not screwed to the front frame 30' but it is screwed by the first screws 38' to the rear frame 70'. For this purpose the set of first sockets 36, which are provided in the first embodiment at the front frame 30, are now provided at the front side of the rear frame 70' (such sockets not shown but indicated by screwing screws 38' into the rear frame 70'). As before, the glass 60' is arranged between the rear side of the protection cover 50' and the front side of the rear frame 70'. As here the rim 66 of the glass 60' lies between the protection cover 50' and the rear frame 70', the glass 60' is clamped between these two elements when screws 38' are screwed into the rear frame 30'. Thus, here, the sub-assembly is formed by the protection cover 50', the glass 70' and the rear frame 70'. In a next assembling step, the sub-assembly is fixed to the front frame 30'. For that purpose the same set of second sockets 40 formed at the rear side of the front frame 30 of the first embodiment and the set of second screws 42' can be used. Thereby the difference between the first and second embodiment is that in the second embodiment the protection cover 50' is fixed at the rear frame 70' instead of fixing it to the front frame 30' as in the first embodiment.

[0060] In the first embodiment the sub-assembly 100 forms a mechanically stable arrangement which due to its self-maintaining mutual connection provides higher mechanical stability to the door 14. In the second embodiment the sub-assembly of protection cover 50 screwed to the rear frame 70' with the glass 60' clamped therebetween provides a mechanical, self-stabilizing sub-assembly also providing additional stability to the finally assembled door 14'.

Reference Numeral List:

2	tumble dryer	54	eyelet
4	outer case	56	paint section
6	top plate	58	alignment element
8	side wall	60, 60'	glass
10	front wall	62	protruding deflection portion
12	loading opening	64	back step portion
14, 14'	door	66	rim
16	control panel	68	alignment element
18	front frame	70, 70'	rear frame
20	fluff filter	72	eyelet
30, 30'	front frame	74	hinge recess
32	door handle	76	hinge flange
34	hinge slot	77	cantilever beam
36	first socket	78	hinge shaft
38, 38'	first screw	80	locking latch
40	second socket	81	case lock
42, 42'	second screw	82	interlock pin
44	first mold	84	slot
46	second mold	86	case slot

(continued)

50, 50' protection cover 100 sub-assembly
 52 transparent plate

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Claims

- 10 1. Door (14, 14') for a laundry treatment apparatus, in particular for a dryer (2), washing machine or washer-dryer, the door comprising:
- 15 a front frame (30, 30') having a central opening,
 an inner window (60, 60'),
 a cover (50, 50') adapted to prevent the inner window front side to be touched by a user, and
 a rear frame (70, 70') having a central opening,
 wherein the arrangement sequence is: front frame (30, 30'), cover (50, 50'), inner window (60, 60') and rear
 frame (70, 70'),
 wherein the cover (50, 50') and either the front frame (30) or the rear frame (70') form a door sub-assembly
 (100) by being mechanically connected to each other using at least one first connecting device (38/38', 30) that
 20 engages the cover and either the front frame or the rear frame,
 wherein the inner window (60, 60') is arranged between the front frame (30, 30') and the rear frame (70, 70'), and
 wherein the front frame (30, 30') and the rear frame (70, 70') are mechanically connected to each other using
 at least one second connecting device (42/42', 40) that engages the rear frame and front frame.
- 25 2. The door of claim 1, wherein, for engaging the cover (50, 50') with either the front frame (30) or with the rear frame
 (70'), the at least one first connecting device (38/38', 30) provides a self-maintaining connection fixedly connecting
 the cover and either the front frame or the rear frame.
- 30 3. The door of claim 1 or 2, wherein, when either the front frame (30) or the rear frame (70') and the cover (50, 50')
 are connected to each other via the at least one first connection device (38/38', 30), the mechanical rigidity of either
 the front frame or the rear frame is increased as compared to the mechanical rigidity of either the front frame or the
 rear frame alone.
- 35 4. The door of claim 1, 2 or 3, wherein the front frame (30, 30') comprises a base frame (44) and a decorative frame
 (46) or decorative ring.
5. The door of claim 4, wherein the base frame (44) and the decorative frame (46) or ring are engaged or fixedly
 connected to each other.
- 40 6. The door of any of the preceding claims, wherein one or more of the following applies:
- the basic form of the front frame (30, 30') is ring-shaped,
 the basic form of the rear frame (70, 70') is ring-shaped, and
 the basic form (52) of the cover (50, 50') is plate-shaped.
- 45 7. The door of any of the preceding claims, wherein the inner window (60, 60') is mechanically clamped between the
 front frame (30) and the rear frame (70), or between the cover (50') and the rear frame (70'), or between the rear
 frame and simultaneously between the front frame and cover.
- 50 8. The door of any of the preceding claims, wherein the at least one first connecting device (38/38', 30) comprises:
- a plurality of mounting sockets (30) arranged spaced from each other at either the front frame (30) or the rear
 frame (70') and a plurality of connecting element arranged at the cover or a plurality of connecting elements
 (38/38') releasably provided at the cover (50, 50'),
 55 a plurality of mounting sockets arranged spaced from each other at the cover and a plurality of connecting
 elements arranged at either the front frame or the rear frame or a plurality of connecting elements releasably
 provided at either the front frame or the rear frame, or
 both of the above, wherein a first group of mounting sockets is arranged at the front frame and a first group of

connecting elements is releasably provided or arranged at the cover, while a second group of mounting sockets is arranged at the cover and a second group of connecting elements is releasably provided or arranged at the front frame.

9. The door of any of the preceding claims, wherein the at least one second connecting device (42/42', 40) comprises:

a plurality of mounting sockets (40) arranged spaced from each other at the front frame (30, 30') and a plurality of connecting element arranged at the rear frame or a plurality of connecting elements (42/42') releasably provided at the rear frame (70, 70'),

a plurality of mounting sockets arranged spaced from each other at the rear frame and a plurality of connecting element arranged at the front frame or a plurality of connecting elements releasably provided at the front frame, or both of the above, wherein a first group of mounting sockets is arranged at the front frame and a first group of connecting elements is arranged or releasably provided at the rear frame, while a second group of mounting sockets is arranged at the rear frame and a second group of connecting elements is arranged or releasably provided at the front frame.

10. The door of any of the preceding claims, wherein an inner portion (62) of the inner window (60, 60') extends from the front side through the central opening of the rear frame (70, 70') such that the inner portion protrudes beyond a rear surface of the rear frame at the rear side of the door (14, 14').

11. The door of any of the preceding claims, further comprising a door lock (80) or a door hinge (76, 78).

12. The door of any of the preceding claims, wherein

the cover (50, 50') and/or the inner window (60, 60') is adapted to be mounted at or to be positioned in at least two different angular orientations relative to the front frame and the rear frame, or the front frame and the rear frame are adapted to be mounted at or to be positioned in at least two different angular orientations relative to the cover (50, 50') and/or the inner window (60, 60'), such that a door opening a closing movement can be changed with respect to a cabinet of a drying apparatus.

13. The door of any of the preceding claims, wherein the cover (50, 50') is at least partially transparent.

14. Method of assembling a door (14, 14') for a laundry treatment apparatus, in particular for a dryer (2), washing machine, washer-dryer or a door (14, 14') according to any of the previous claims, the method comprising:

forming a door sub-assembly (100) by

a1) fixing a cover (50) to a front frame (30) having a central opening, wherein the front frame and the cover are mechanically connected to each other using at least one first connecting device (38, 30) that engages the cover and the front frame of the sub-assembly, and

b1) arranging an inner window (60) at the rear side of the sub-assembly (100),

or

a2) arranging an inner window (60') between a rear frame (70') having a central opening and a cover (50'), and b2) fixing the cover (50') to the rear frame (70') to form a sub-assembly having the inner window between the cover and rear frame, wherein the rear frame and the cover are mechanically connected to each other using at least one first connecting device (38', 30) that engages the cover and the rear frame of the sub-assembly,

and

c) fixing the rear frame (70, 70') to the front frame (30, 30'), wherein the rear frame (70, 70') and the front frame (30, 30') are mechanically connected to each other using at least one second connecting device (42/42', 40) that engages the rear frame and front frame.

15. The method of claim 14, wherein the inner window (60, 60') is part of the sub-assembly (50', 60', 70') or is arranged between the sub-assembly (100) and the rear frame (70).

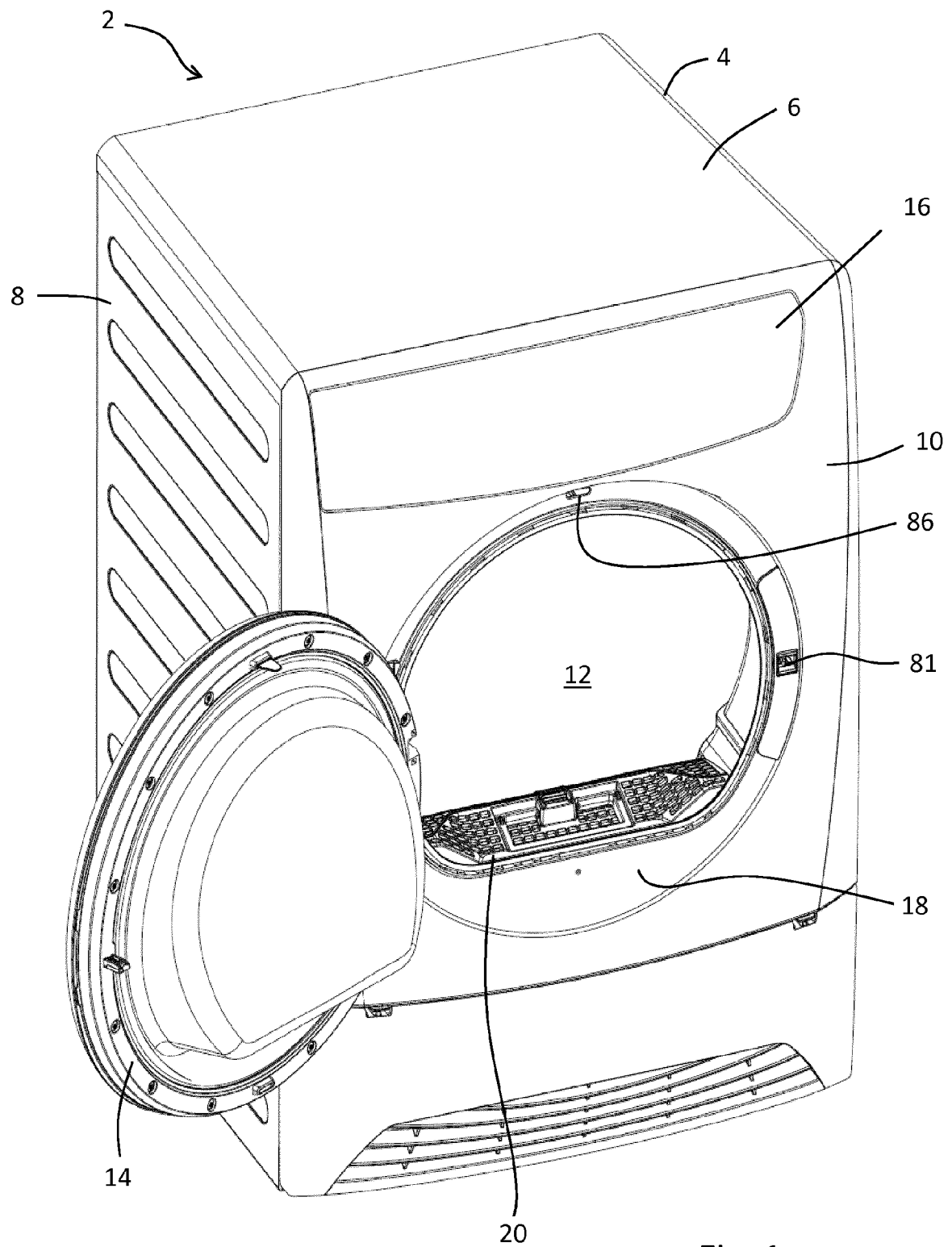


Fig. 1

Fig. 2

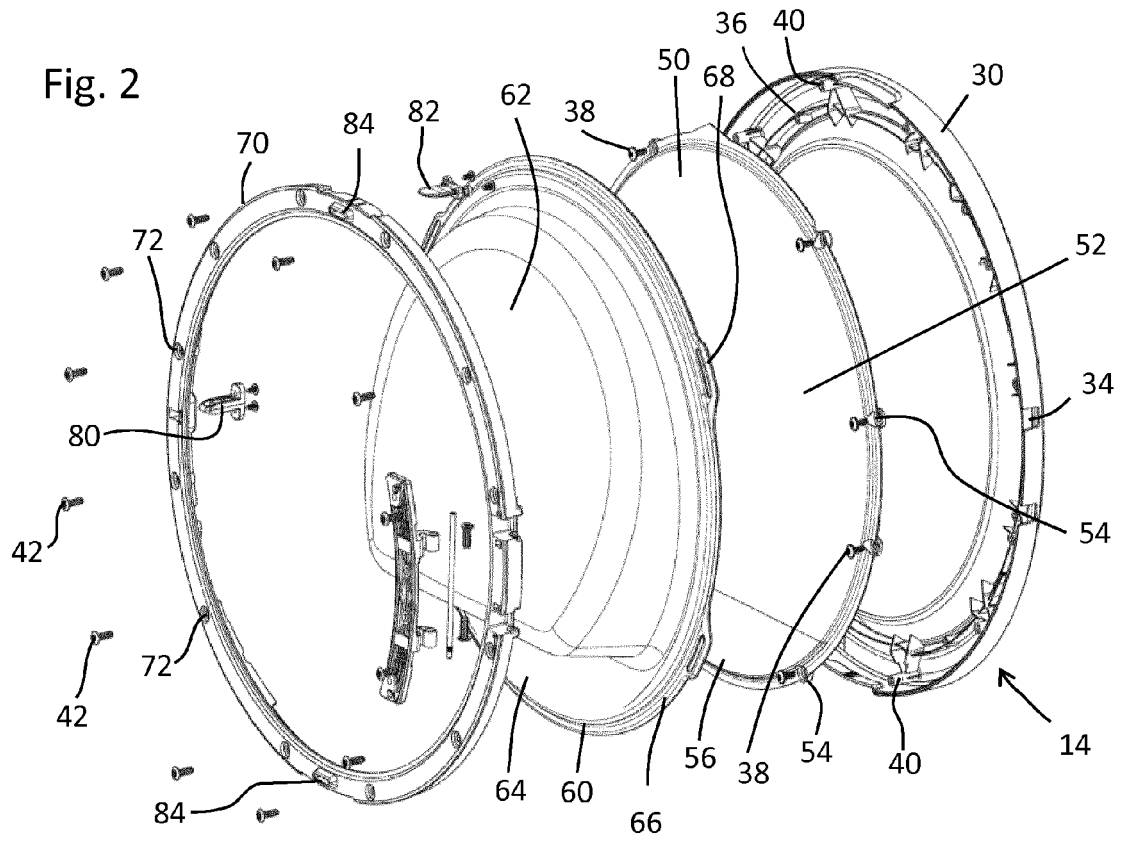
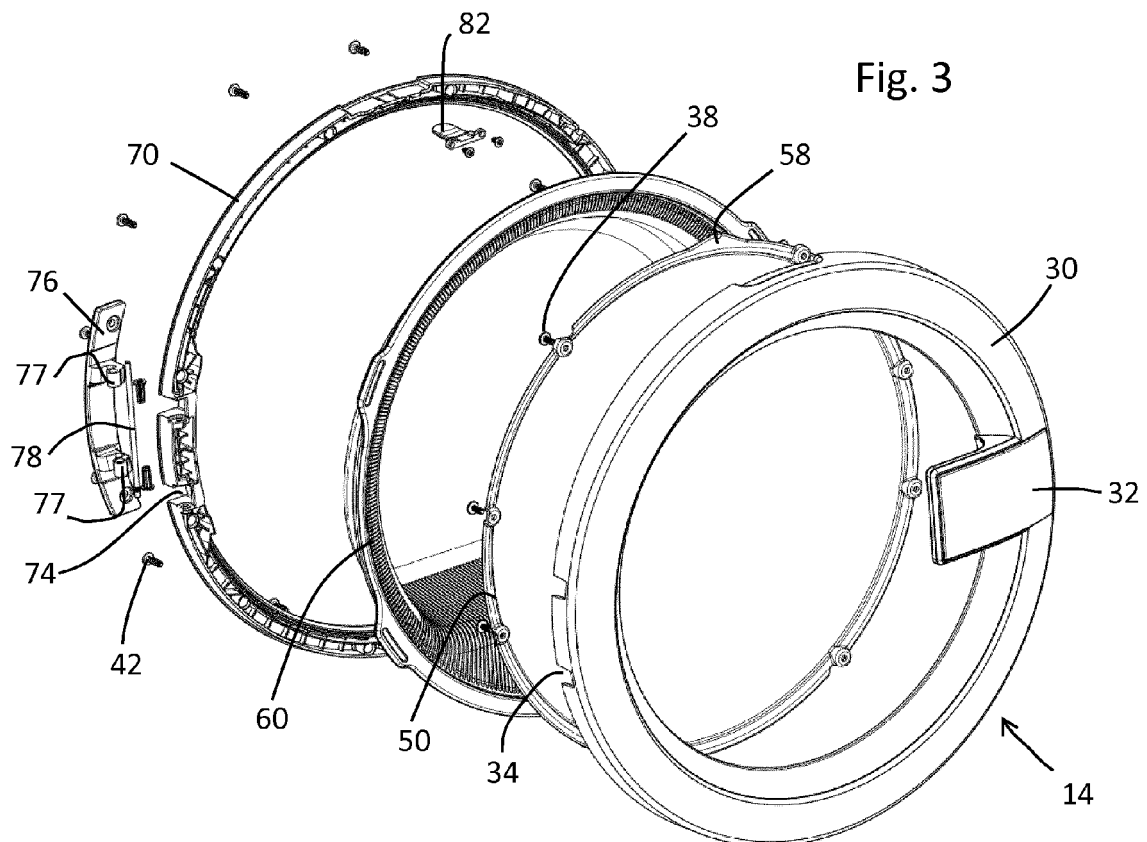
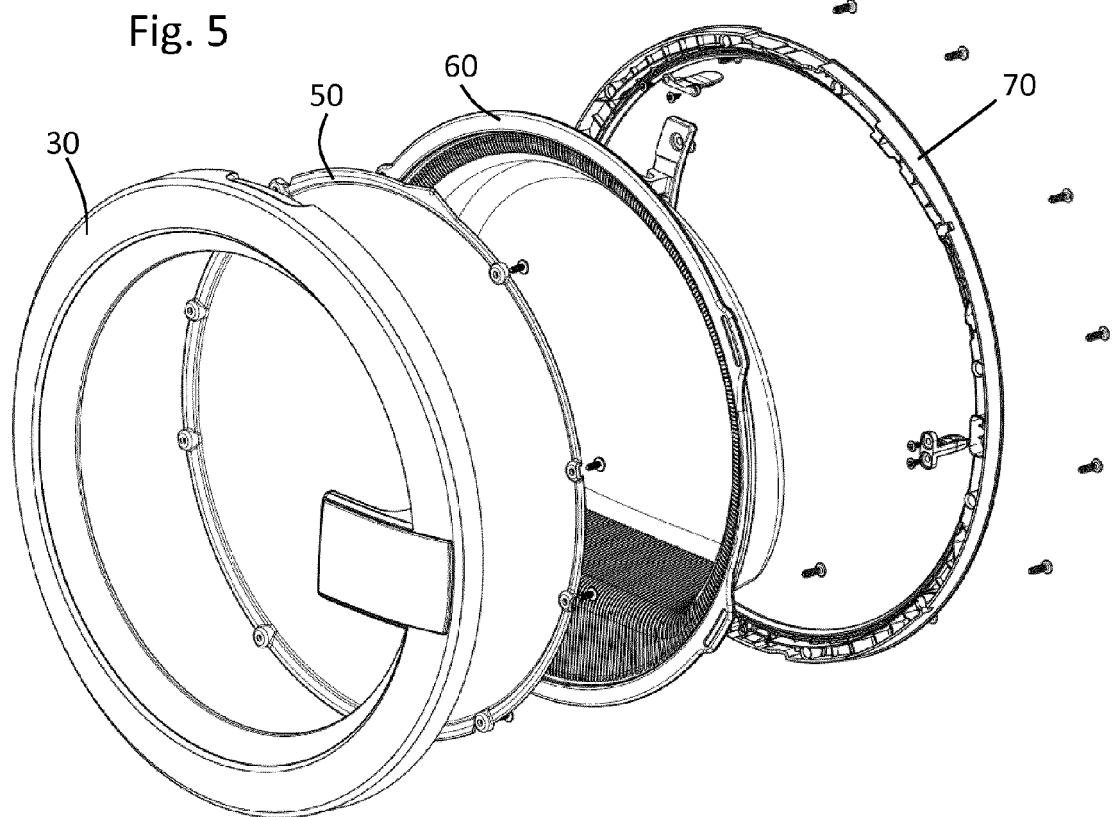
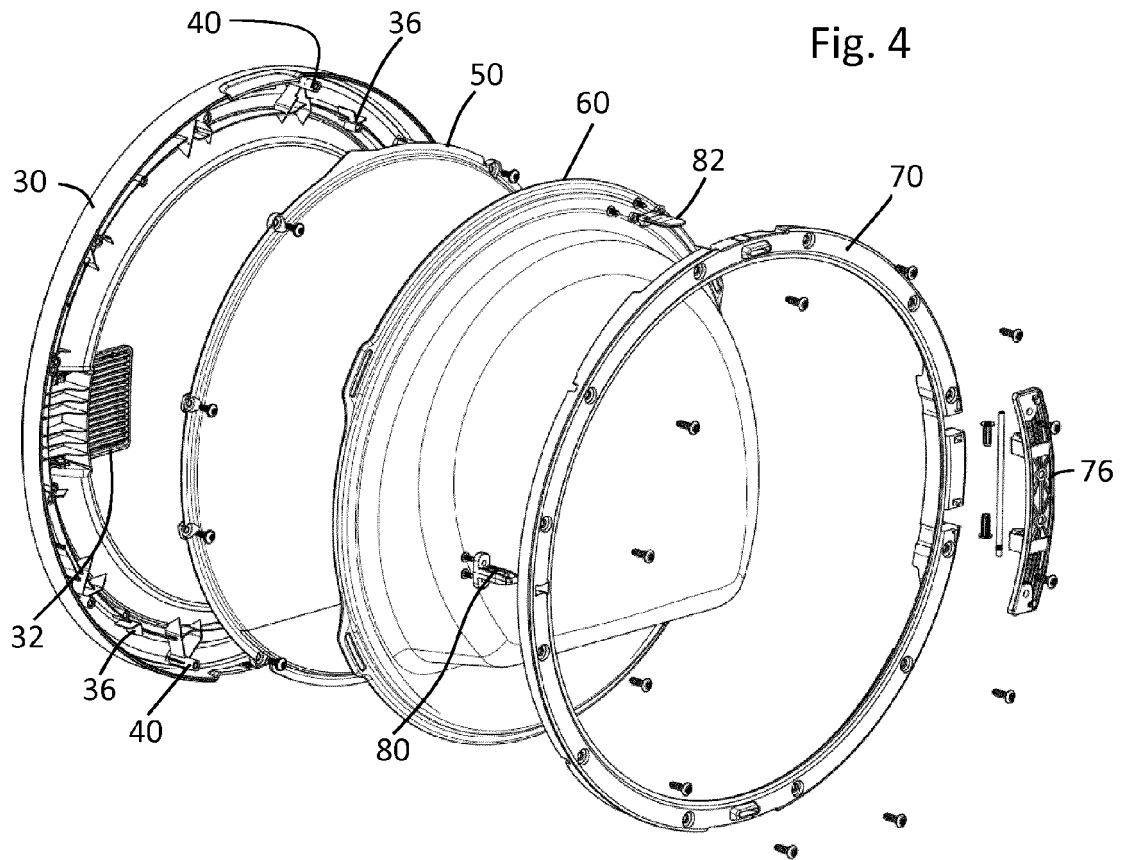


Fig. 3





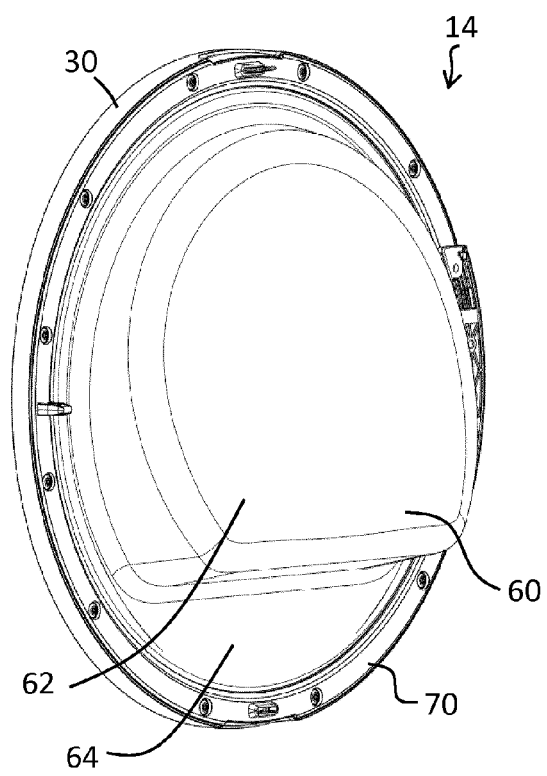


Fig. 6

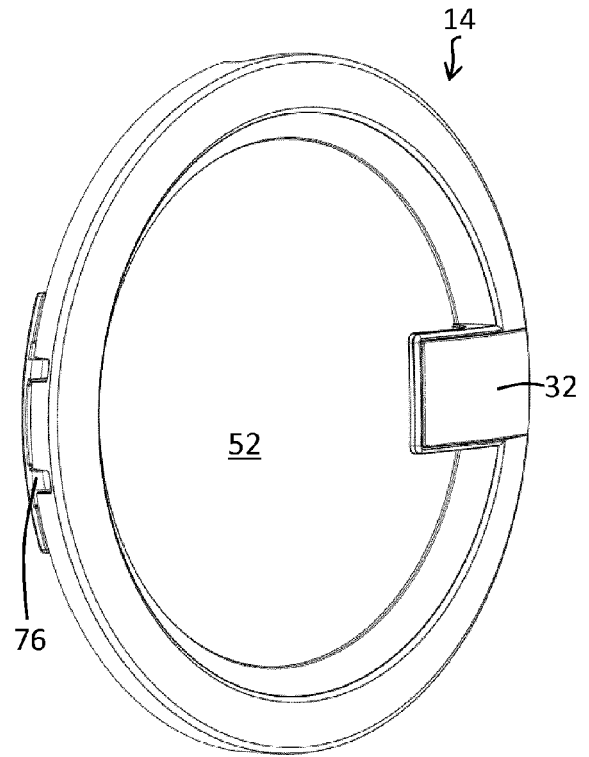


Fig. 7

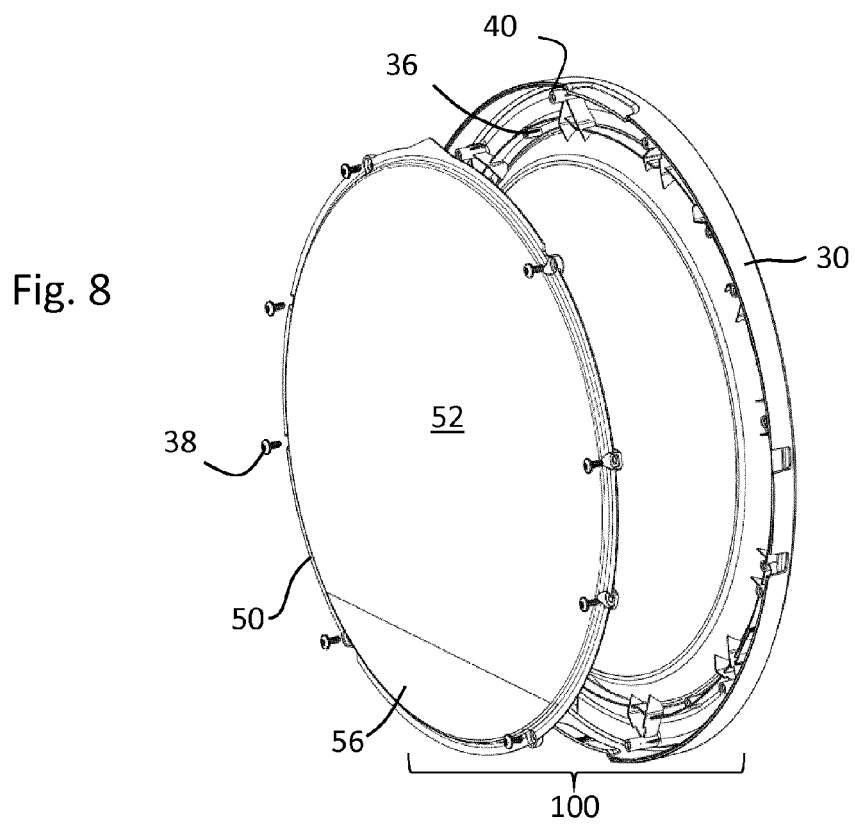


Fig. 8

Fig. 10

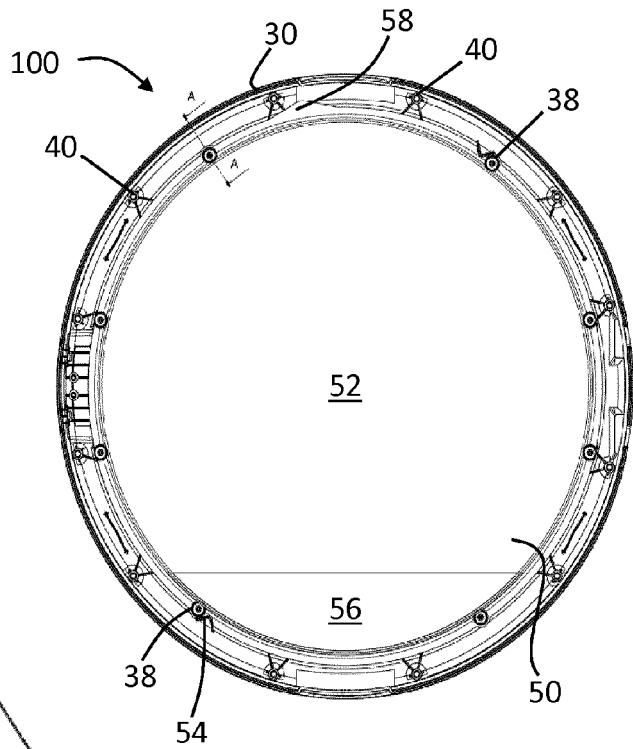
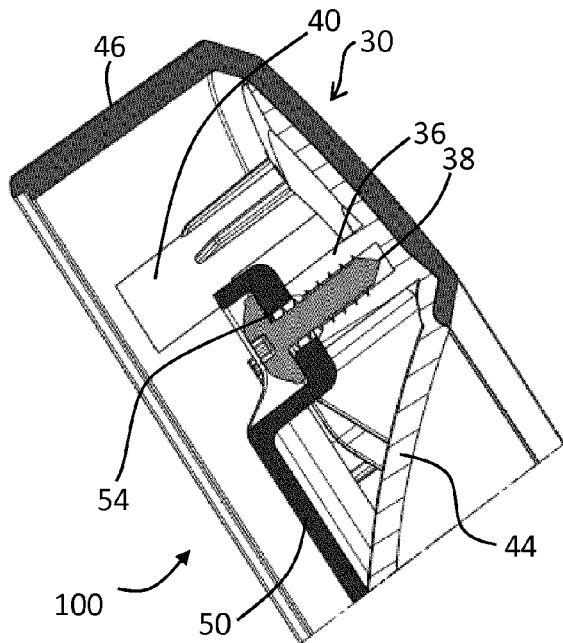
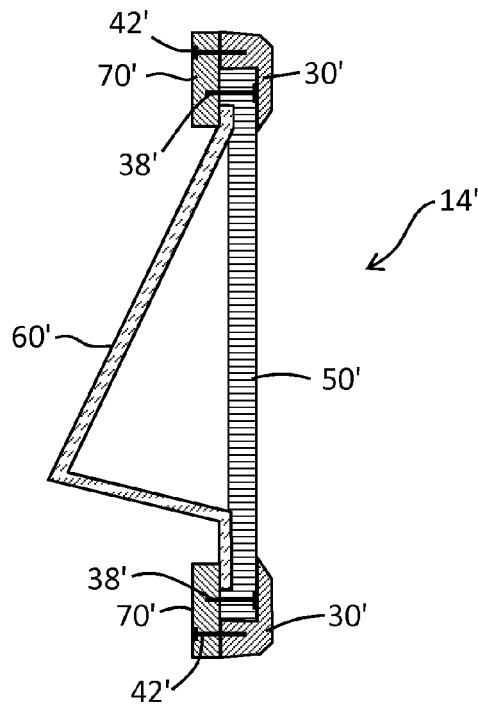


Fig. 9

Fig. 11





EUROPEAN SEARCH REPORT

Application Number
EP 14 19 9125

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			D06F
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 12 June 2015	Examiner Westermayer, Wilhelm
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12-06-2015

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