(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
30 June 2016 (30.06.2016)

WIPO | PCT

(10) International Publication Number
WO 2016/103096 A1

(51) International Patent Classification:
D06F 39/00 (2006.01) *D06F 37/28* (2006.01)
A47L 15/42 (2006.01) *F25D 27/00* (2006.01)
D06F 39/12 (2006.01) *H01H 19/02* (2006.01)

(21) International Application Number:
PCT/IB2015/059543

(22) International Filing Date:
11 December 2015 (11.12.2015)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
201410830353.4 26 December 2014 (26.12.2014) CN

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(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

(54) Title: HOUSEHOLD APPLIANCE HAVING LIGHT GUIDE APPARATUS

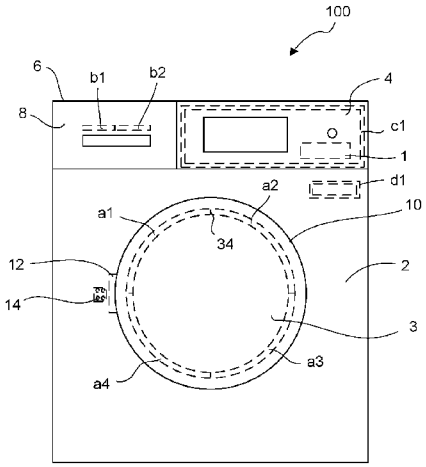


FIG. 1

(57) Abstract: The present invention discloses a household appliance (100), including an enclosure assembly (2, 4, 8, 10) that forms appearance of the household appliance, a light source (14, 140, 1400) controlled by a control apparatus (1), and a light guide apparatus (16, 16a, 16b, 1610) that fits with the light source (14, 140, 1400) and is located on the enclosure assembly (2, 4, 8, 10), where the light source (14, 140, 1400) includes a first light guide element (16a) and a second light guide element (16b), and the first light guide element (16a) and second light guide element (16b) form a light-emitting pattern on an outer surface of the enclosure assembly (2, 4, 8, 10), where a first light-emitting segment (a1) and a second light-emitting segment (a2) are connected to each other to form the light-emitting pattern. The light guide apparatus (16, 16a, 16b, 1610) spreads a point light source to obtain a segmental light, and the first light-emitting segment (a1) and the second light-emitting segment (a2) are connected to each other; thus, various continuous light-emitting patterns can be formed on the enclosure assembly (2, 4, 8, 10) of the household appliance (100) as needed.

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HOUSEHOLD APPLIANCE HAVING LIGHT GUIDE APPARATUS

The present invention relates to components of a household appliance, and in particular, to a light-emitting apparatus of the household appliance.

To achieve some decorative or functional indication effects, light-emitting apparatuses are disposed on enclosures of some household appliances. The light-emitting apparatus includes a light source such as an LED lamp, and a light guide element that guides the light source to a target position or coverts the light source to a target shape.

A Chinese invention patent No. CN 131 86 79 C discloses a light-emitting bar formed by compactly arranging a relatively large quantity of light-emitting elements sequentially. The forming of the light-emitting bar by directly arranging point light emitted from a light-emitting element not only needs a large quantity of light-emitting elements, but also forms discontinuous light; therefore, a visual effect is unsatisfactory, and a complicated light-emitting pattern is also difficult to be formed.

An objective of the present invention is to implement a continuous and connected light-emitting pattern on an outer surface of the household appliance.

For the above objective, the technical solutions used in the present invention are: A household appliance, including an enclosure assembly that forms appearance of the household appliance, a light source controlled by a control apparatus, and a light guide apparatus that fits with the light source and is located on the enclosure assembly, where the light source includes a first light guide element and a second light guide element, and the first light guide element and second light guide element form a light-emitting pattern on an outer surface of the enclosure assembly, where a first light-emitting segment and a second light-emitting segment are connected to each other to form the light-emitting pattern.

The household appliance may be embodied as, but is not limited to, a washing machine, a refrigerator, a range hood, an air conditioner, a dishwasher, a microwave oven, a vacuum cleaner, and the like. The enclosure assembly may include an enclosure body and external mechanical parts installed on the enclosure body, such as a door, windows, a drawer panel, and the like.

The light guide apparatus spreads a point light source to obtain a segmental light, and the first light-emitting segment and the second light-emitting segment are connected to each other; thus, various continuous light-emitting patterns can be formed on the enclosure assembly of the household appliance as needed. Because the light-emitting pattern consists of light guided by at least two light guide elements, there are more light variations.

As an optional implementation manner, the first light guide element and the second light guide element are flexible light guide bars with light transmittable side surfaces. This light guide bar may adapt to requirements for various patterns, and have uniform light, simple structures, and low costs. As an optional implementation manner, the first light guide element and the second light guide element are partially overlapped in a projection direction on the outer surface of the enclosure assembly. Therefore, the first light-emitting segment and the second light-emitting segment are more compactly connected, thereby avoiding occurrence of a gap.

As an optional implementation manner, an overlapping area of the first light guide element and the second light guide element corresponds to a connection area of the first light-emitting segment and the second light-emitting segment.

As an optional implementation manner, after the first light guide bar and the second light guide bar are overlapped, each of the first light guide bar and the second light guide bar deviates from an axial direction to deflect at a specific angle. Such disposing prevents a highlight point at the end of the light guide element from causing non-uniform light on the light-emitting segment.

As an optional implementation manner, the first light guide element and the second light guide element have different deflecting directions, which helps to fix the first light guide element and the second light guide element.

As an optional implementation manner, end surfaces of the first light guide element and the second light guide element after deflection deviate from a direction of the outer surface of the enclosure assembly. Such disposing better prevents a highlight point at the end of the light guide element from causing non-uniform light on the light-emitting segment.

As an optional implementation manner, at least one part of the outer surface of the enclosure assembly is covered by a light transmittable plate.

As an optional implementation manner, the control apparatus controls the light-emitting elements to be turned on or turned off at the same time or at different times.

As an optional implementation manner, the first light-emitting segment and the second light-emitting segment are separately long-strip-shaped.

The following further describes the present invention by means of an application of the present invention in a washing machine with reference to the figures of the accompanying drawing. In the drawing,

FIG. 1 is a front schematic diagram of a washing machine;

FIG. 2 is a schematic partial diagram, obtained after a door body and a case body are cut at a hinge, of a light guide bar and a light-emitting module in a first assembling mode;

FIG. 3 is an enlarged front diagram of a cut part in FIG. 2;

FIG. 4 is a schematic partial diagram, obtained after the door body and the case body are cut at the hinge, of the light guide bar and the light-emitting module in a second assembling mode;

FIG. 5 is a schematic diagram of a light-emitting module close to the hinge, and a receiving end of a light guide bar on the door;

FIG. 6 is a schematic diagram of an emitting surface of the light-emitting module around the hinge;

FIG. 7 is a rear schematic diagram of the receiving end of the light guide bar on the door;

FIG. 8 is a schematic diagram of a receiving surface of the receiving end of the light guide bar on the door;

FIG. 9 is a schematic diagram of an installation structure of the light guide bar;

FIG. 10 is a schematic diagram of an internal structure of the door body, where to clearly display a key portion, the middle of the schematic diagram is omitted, and two ends are close to each other; and

FIG. 11 is a schematic diagram of an overlapping part of light guide bars.

As shown in FIG. 1, a washing machine 100 has a housing 2, a control panel 4 installed on the housing 2, a drawer 6 disposed on the housing 2, and a door 10 that is installed on the housing 2 to close a laundry delivery and fetch opening 3 on the housing 2. The door 10 is connected to the housing 2 by using a hinge 12. The drawer 6 has a drawer panel 8 that fits with the housing 2. The washing machine 100 further has a control apparatus 1 that controls various circuit modules within the washing machine 100, thereby controlling running of the washing machine 100.

The door 10 has an enclosed circular light-emitting ring, where an elongated first light-emitting segment a1, a second light-emitting segment of a2, a third light-emitting segment a3, and a fourth light-emitting segment a4 are continuously connected to form the enclosed circular light-emitting ring. Four light sources 14 are provided at a position close to the hinge 12 on the housing 2. Each light source 14 corresponds to one of light-emitting segments of a1 to a4. The control apparatus 1 controls the light source 14 to be turned on or turned off.

Moreover or alternatively, there is a fifth light-emitting segment b1 and a sixth light-emitting segment b2 on the drawer panel 8, to separately indicate different laundry processing solvents stored in the drawer 6.

Moreover or alternatively, there is a seventh light-emitting segment c1 on the control panel 4.

Moreover or alternatively, there is an eighth light-emitting segment d1 on the housing 2.

The seventh light-emitting segment c1 and the eighth light-emitting segment dl may also be formed by connecting multiple light-emitting segments.

Light-emitting statuses of the forgoing light-emitting segments of a1 to a4, b1, b2, c1, and d1 are controlled by the control apparatus 1, so that the light-emitting segments are turned on or turned off at the same time or at different times, or gradually become brighter or gradually fade away at the same time or at different times, or emit light in different colors, so as to produce a decorative effect, and/or indicate different running statuses of the washing machine 100 to a user that or send warning information. For example, the first light-emitting segment a1, the second light-emitting segment a2, the third light-emitting segment a3, and the fourth light-emitting segment a4 on the door 10 are sequentially turned on and turned off to indicate running of a program, or the first light-emitting segment a1, the second light-emitting segment a2, the third light-emitting segment a3, and the fourth light-emitting segment a4 are turned on at the same time and turned off at the same time at a preset frequency to prompt ending of a program.

The following describes forming principles and structure features of the light-emitting segments of a1 to a4 by using the door 10 as an example. Principles and structures of other light-emitting segments can be easily understood according to the following description.

As shown in FIG. 2 and FIG. 3, a light-emitting module 140 is fixed on the housing 2, and the light-emitting module 140 is connected to the control apparatus 1 (not shown in the accompanying drawings) by using a wire (not shown in the accompanying drawings). A light guide bar 16 is fixed on door 10, and a light receiving end 161 thereof passes

through a hole or gap 18 on the hinge 12 to approach the light-emitting module 140, and is opposite to the light-emitting module 140, so as to receive light emitted from the light-emitting module 140. The light guide bar 16 is fixed relative to the hinge 12, for example, the light guide bar 16 is clamped in the hole or gap 18 on the hinge 12, and the light receiving end 161 of the light guide bar 16 is not directly connected to the light-emitting module 140. The light receiving end 161 of the light guide bar 16 leaves or approaches the light-emitting module 140 as the door 10 is opened or closed. When the door 10 is closed, a gap is reserved between the light receiving end 161 of the light guide bar 16 and the light-emitting module 140.

As shown in FIG. 4, a light receiving end 1610 of the light guide bar and a light-emitting module 1400 may have another assembling mode: the light-emitting module 1400 is fixed on the door 10, and a wire 20 connected to the light-emitting module 1400 passes through the hinge 12 and then is connected to the control apparatus 1 disposed in the housing 2.

As shown in FIG. 5 to FIG. 8, the light-emitting module 140 around the hinge 12 includes a light-emitting base 141, and four light sources 14 are fixed in the light-emitting base 141. A light transmittable plate or light transmittable film 142 is provided in a light emitting direction of the light source 14. The light receiving end 161 of the light guide bar 16 is disposed opposite to the light-emitting module 140. Light receiving ends 161 of the four light guide bars 16 are also integrated on one light guide base 162, and a light transmittable plate or light transmittable film 163 is also provided in a light receiving direction thereof. When the light-emitting module 140 and the light receiving end 161 of the light guide bar 16 approach each other, the light receiving end 161 of each light guide bar 16 is separately opposite to one of the light sources 14, so as to receive light from the light source 14.

Under control of the control apparatus 1, when a relative distance D between the light source 14 and the light guide element 16 is greater than or equal to a preset value D0, the light source 14 is to be closed. Thus, it can be imaged that when the light source 14 is in an on state, if the door 10 is opened, the relative distance D between the light guide element 16 and the light source 14 increases, so that the light source 14 is turned off.

In addition, when the door 10 is gradually closed, and the relative distance D between the light source 14 and the light guide element 16 gradually reduces to become less than or equal to the preset value D0, the light source 14 is turned on. It may be understood that, a prerequisite is that the control apparatus is powered on.

The relative distance D between the light source 14 and the light guide element 16 may be measured by using a sensor (not shown in the accompanying drawings), or a micro switch (not shown in the accompanying drawings) electrically connected to the light source 14 is disposed at a suitable position. When the relative distance D between the light source 14 and the light guide element 16 reaches a critical value, the micro switch is trigged, so that the light source 14 is turned off.

As shown in FIG. 2 to FIG. 4 and in FIG. 9 to FIG. 11, the light guide bar 16 is preferably a flexible fiber whose side surface is light transmittable, and is in an elongated and cylindrical structure. Light is uniformly emitted from the side surface after entering the light guide bar 16 from the receiving end 161, so that the side surface of the entire light guide bar 16 is luminous. A light guide fiber with this feature may be purchased from the market.

To define an extension path of the light guide bar 16 and make the extension path form a particular preset shape, for example, to obtain a circular light ring on the door 10 shown in FIG. 1, a guide slot 22 whose entirety extends in an arc is provided in the door 10. In addition, a cross sectional shape of the guide slot 22 is an arc that matches a cross sectional shape of the light guide bar 16. A light transmittable plate 24 covers an outer side of the light guide bar 16, so that light that passes through the light guide bar 16 can be emitted from the light transmittable plate 24. The light transmittable plate 24 forms at least one part of an outer surface of the door 10.

To obtain light with a clearer edge, light shading plates 26 may be disposed at two sides of the light transmittable plate 24. The shape of the light transmittable plate 26 may adapt to the shape of the light guide bar 16.

Because the light receiving ends 161 of the four light guide bars 16 on the door 10 are centralized together, to obtain the light-emitting segments of a1 to a4 that are connected to each other but independent of each other, the light guide bars 16 needs to be specially arranged. As an example, FIG. 10 shows arrangement structures of two light guide bars of 16a and 16b, which is described in detail below.

The door 10 has a light transmittable outer surface 101. The most part of the first light guide bar 16a is directly located below the light transmittable plate 24, and light emitted from the most part may pass through the outer surface 101 of the door, and form, on the outer surface 101 of the door 10, the first light-emitting segment a1. An axial first part 16b1 of the second light guide bar 16b extends within an opaque mechanical part 30, and light emitted from the first part 16b1 cannot pass through the outer surface 101 of the door. The second light guide bar 16b further has an axial second part 16b2, where the part is not shaded by the opaque mechanical element 30, and is directly located below the light transmittable plate 24, and light emitted from the second part 16b2 can pass through the outer surface 101 of the door, and form, on the outer surface 101 of the door 10, the second light-emitting segment a2. The second part 16b2 of the second light guide bar 16b is way from a light receiving end 161b of the second light guide bar 16b.

An end 162a, away from a light receiving end 161a thereof, of the first light guide bar 16a overlaps a connection 160b of the first part 16b1 and the second part 16b2 on the second light guide bar 16b, so that projections of the light transmittable part of the first light guide bar 16a, and the second part 16b2 of the second light guide bar 16b onto the outer surface 101 of the door 10 are connected to each other. Thus, the first light-emitting segment a1 and the second light-emitting segment a2 are connected to each other. An overlapping area 32 of the first light guide bar 16a and the second light guide bar 16b corresponds to a connection area 34 of the first light-emitting segment a1 and the second light-emitting segment a2.

As shown in FIG. 11, after the first light guide bar 16a and the second light guide bar 16b are overlapped, each of the first light guide bar 16a and the second light guide bar 16b deviates from an axial direction to deflect at a specific angle, where a deflection direction for example, is shown in the embodiment shown in the figure: the first light guide bar 16a laterally deflects at a specific angle and then deflects downward, so that an end surface

1600a thereof deviates from a direction of the outer surface 101 of the door 1; and the second light guide bar 16b directly deflects downward, so that an end surface 1600b thereof also deviates from the direction of the outer surface 101 of the door 1.

Various specific implementation manners described in the foregoing and shown in the accompanying drawings are only used to illustrate the present invention, and are not considered as the entirety of the present invention. Within the scope of the basic technical thought of the present invention, any type of modifications for the present invention made by persons of ordinarily skills in the related technical field shall fall within the protection scope of the present invention.

CLAIMS

1. A household appliance, comprising an enclosure assembly (2, 4, 8, 10) that forms appearance of the household appliance, a light source (14, 140, 1400) controlled by a control apparatus (1), and a light guide apparatus (16, 16a, 16b, 1610) that fits with the light source and is located on the enclosure assembly, wherein the light guide apparatus comprises a first light guide element (16a) and a second light guide element (16b), and the first light guide element (16a) and second light guide element (16b) form a light-emitting pattern on an outer surface (101) of the enclosure assembly (2,4,8,10), wherein a first light-emitting segment (a1) and a second light-emitting segment (a2) are connected to each other to form the light-emitting pattern.

2. The household appliance according to claim 1, wherein the first light guide element (16a) and the second light guide element (16b) are flexible light guide bars with light transmittable side surfaces.

3. The household appliance according to claim 2, wherein the first light guide element (16a) and the second light guide element (16b) are partially overlapped in a projection direction on the outer surface (101) of the enclosure assembly.

4. The household appliance according to claim 3, wherein an overlapping area (32) of the first light guide element (16a) and the second light guide element (16b) corresponds to a connection area (34) of the first light-emitting segment (a1) and the second light-emitting segment (a2).

5. The household appliance according to claim 3, wherein after the first light guide bar (16a) and the second light guide bar (16b) are overlapped, each of the first light guide bar (16a) and the second light guide bar (16b) deviates from an axial direction to deflect at a specific angle.

6. The household appliance according to claim 5, wherein the first light guide element (16a) and the second light guide element (16b) have different deflecting directions.

7. The household appliance according to claim 5, wherein end surfaces of the first light guide element (16a) and the second light guide element (16b) after deflection deviate from a direction of the outer surface (101) of the enclosure assembly.

8. The household appliance according to claim 1, wherein at least one part of the outer surface (101) of the enclosure assembly is covered by a light transmittable plate (24).

9. The household appliance according to claim 1, wherein the control apparatus (1) controls a light-emitting element (14) to be turned on or turned off at the same time or at different times.

10. The household appliance according to claim 1, wherein the first light-emitting segment (a1) and the second light-emitting segment (a2) are separately long-strip-shaped.

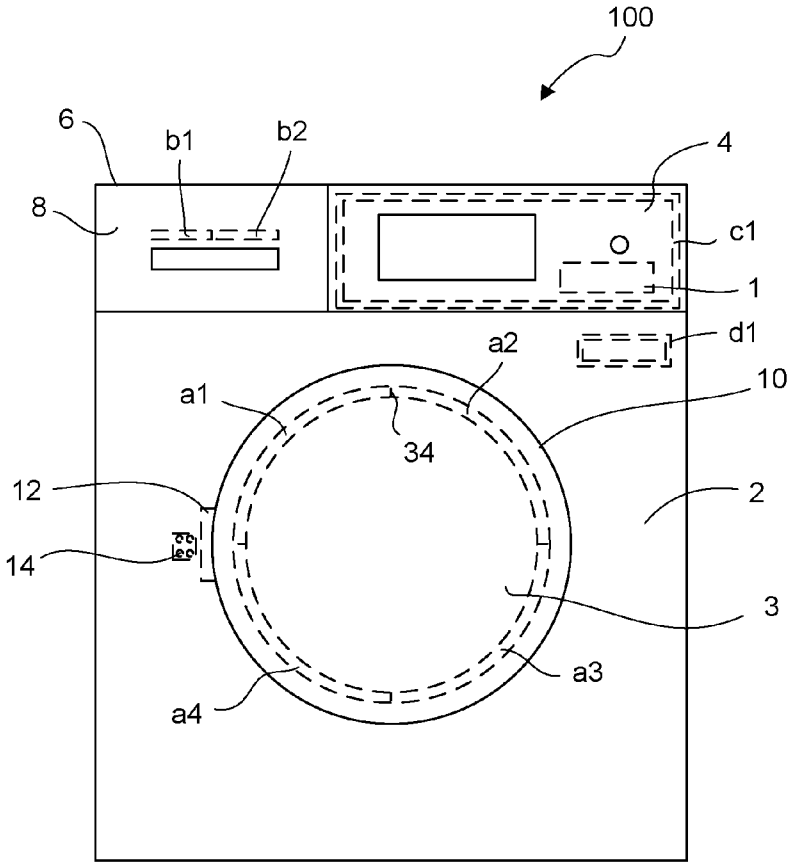


FIG. 1

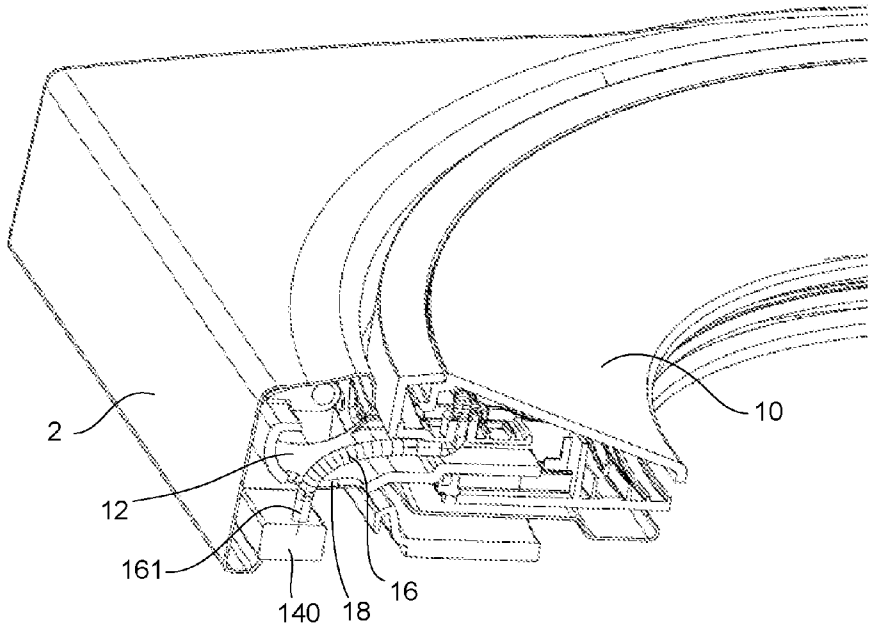


FIG. 2

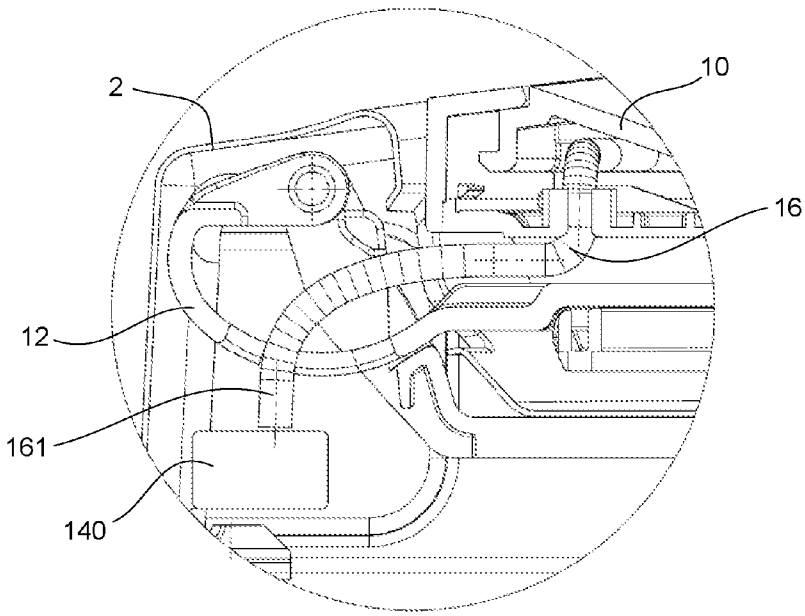


FIG. 3

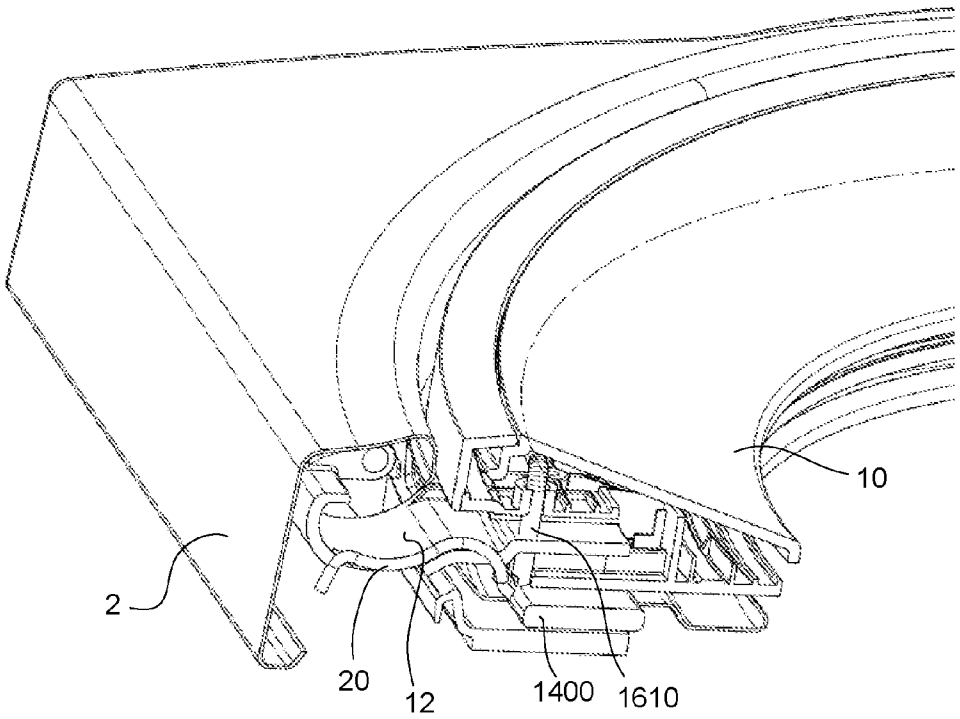


FIG. 4

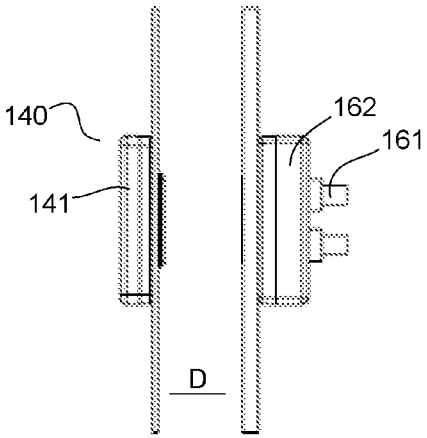


FIG. 5

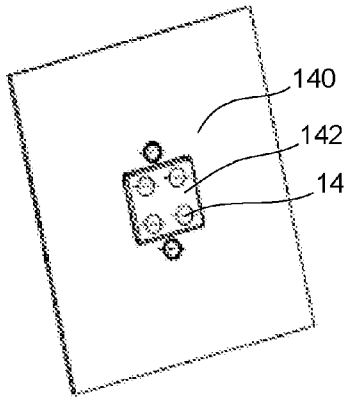


FIG. 6

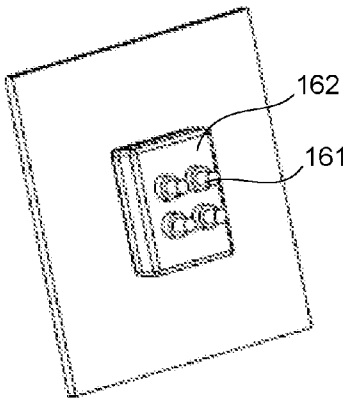


FIG. 7

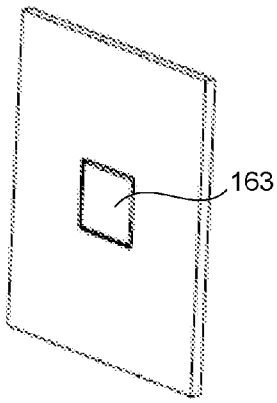


FIG. 8

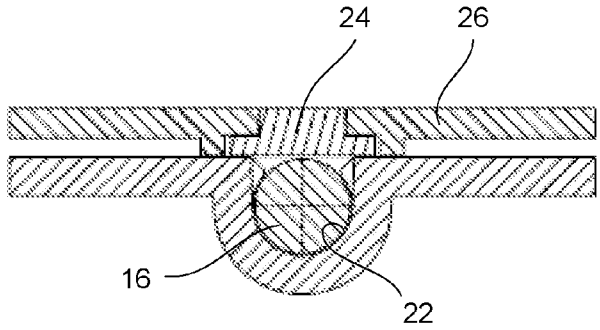


FIG. 9

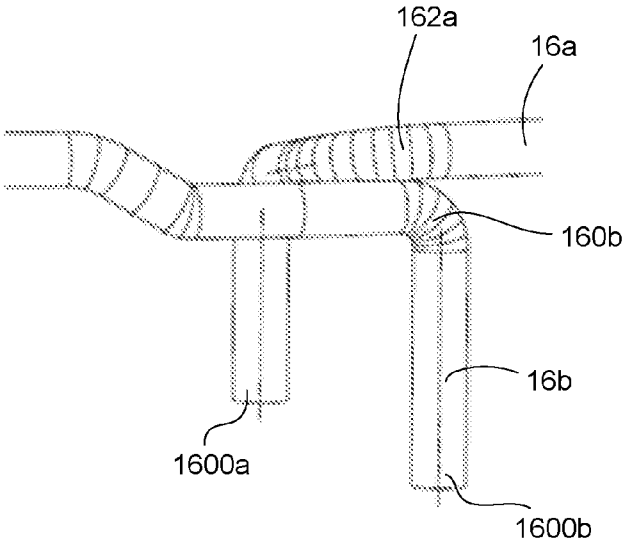


FIG. 11

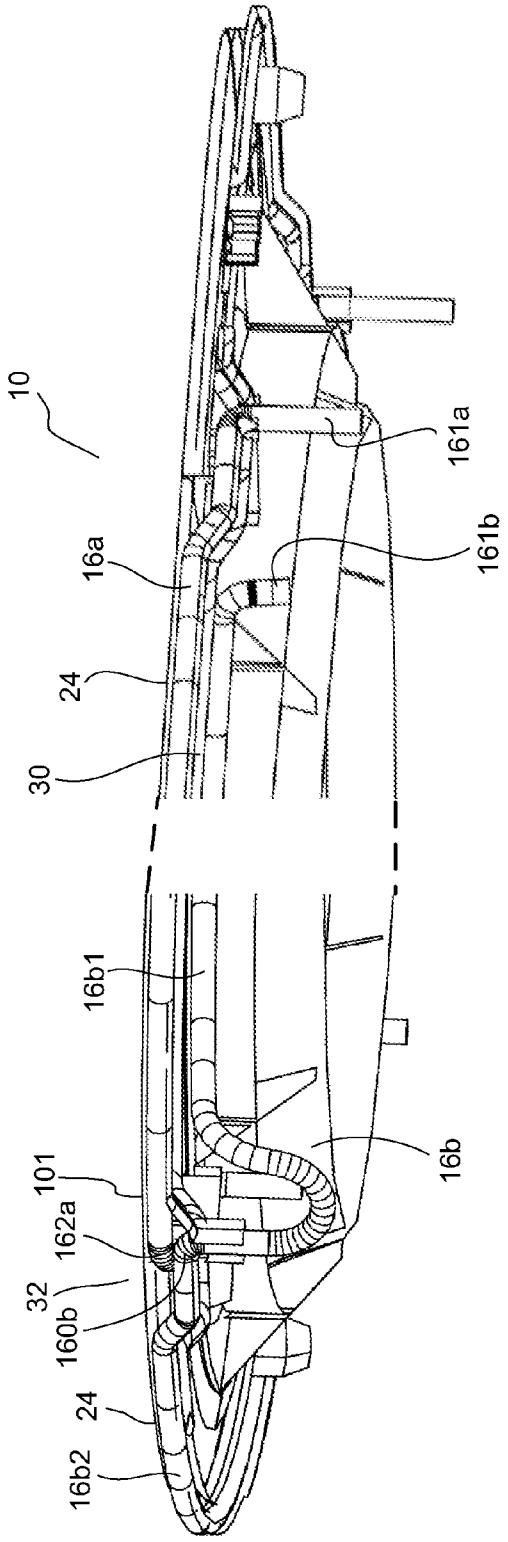


FIG. 10

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2015/059543

A. CLASSIFICATION OF SUBJECT MATTER
INV. D06F39/00 A47L15/42 D06F39/12 D06F37/28 F25D27/00
H01H19/02
ADD.
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
D06F A47L F25D H01H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	EP 1 582 619 A1 (WHIRLPOOL CO [US]) 5 October 2005 (2005-10-05) paragraph [0031] - paragraph [0043]; figures 1-4 -----	1,3-10 2
X Y	EP 2 363 056 A1 (INDESIT CO SPA [IT]) 7 September 2011 (2011-09-07) paragraph [0019] - paragraph [0040] -----	1-10 2
A	DE 101 44 668 A1 (BSH BOSCH SIEMENS HAUSGERAETE [DE]) 27 March 2003 (2003-03-27) cited in the application the whole document -----	1-10

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
19 February 2016	02/03/2016

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/IB2015/059543

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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