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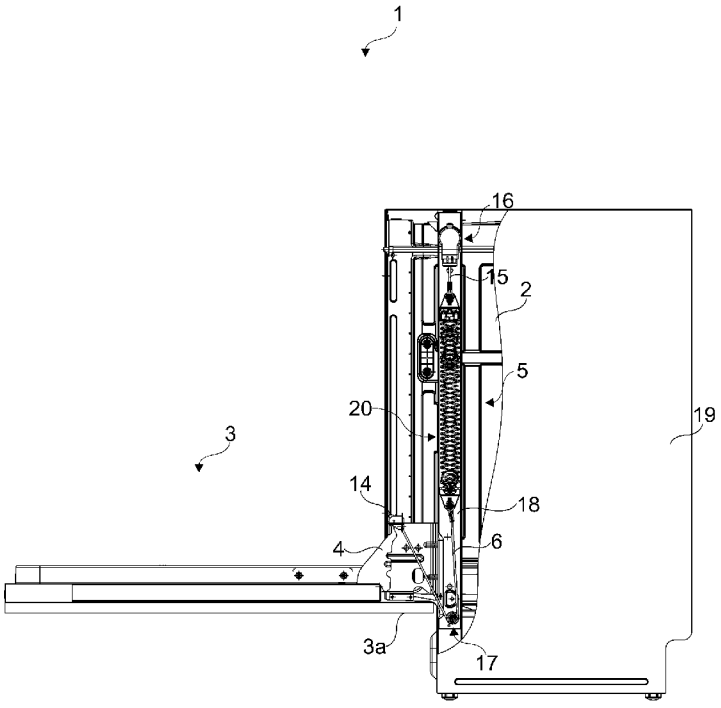
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[Continued on next page]

(54) Title: DISHWASHER HAVING DOOR-WEIGHT COMPENSATING APPARATUS

Fig. 6



(57) Abstract: The present invention relates to a dishwasher (1) comprising a tub (2), a door (3) for opening/closing the tub (2), a hinge (4) for pivotably supporting the door (3), a door-weight compensating apparatus (5) for at least partly compensating for the weight of the door (3) and a tension transmission cable (6) for transmitting the tension force from the door-weight compensating apparatus (5) to the hinge (4). In the dishwasher (1) of the present invention the door-weight compensating apparatus (5) comprises two or more than two tension springs (7) and a coupling (8) which couples the tension springs (7) in a parallel manner with the tension transmission cable (6).

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Description

DISHWASHER HAVING DOOR-WEIGHT COMPENSATING APPARATUS

[0001] The present invention relates to a household appliance, in particular a domestic dishwasher which has a door-weight compensating apparatus.

[0002] Domestic dishwashers are commonly known. A domestic dishwasher generally comprises a tub, an upper pull-out rack, a lower pull-out rack, a door for accessing the tub and a hinge for pivotably supporting the door about a horizontal axis. For loading or unloading the pull-out racks with the dishes, the user must completely open the door. In general, the door of a domestic dishwasher is comparatively heavy. To assist the user when opening/closing the door and to prevent the door from falling, the domestic dishwashers are generally provided with a door-weight compensating apparatus which maintains the door substantially in a balanced state. The door-weight compensating apparatuses which are used in the domestic dishwashers are commonly. The door-weight compensating apparatus generally comprises a tension spring and a tension transmission cable for transmitting the tension force from the tension spring to the hinge of the door. One end of the tension spring is fixed to the frame of the dishwasher. The other end of the tension spring is fixed to the tension transmission cable. It is customary to install a built-in type domestic dishwasher underneath the kitchen counter, particularly between the cabinets and to integrate it with the kitchen furniture. The built-in type domestic dishwasher is usually concealed with a decorative panel which matches the design of the kitchen furniture. The decorative panel increases the overall weight of the door. Therefore, the door-weight compensating apparatus must exert an accordingly higher tension force for compensating for the increased weight of the door. It is customary practice to achieve a higher tension force by utilizing a stiffer tension spring. However, there is generally a risk that the stiff tension spring is permanently deformed at an earlier stage. In the event of a permanent deformation, the spring must be replaced with a new one. The replacement incurs additional material costs and labor costs. Thus, the customer satisfaction may easily decrease.

[0003] The aforementioned difficulties generally put strict limitations on the weight

of the door and the decorative panel. These limitations further restrict the design of the dishwasher door and the choice of the decorative door panels for the customers.

[0004] An objective of the present invention is to provide a dishwasher which overcomes the aforementioned drawbacks of the prior art in a cost effective way and which enables a smooth opening/closing of the door even when the door is comparatively heavy and/or furnished with a comparatively heavy decorative panel.

[0005] This objective has been achieved by the dishwasher as defined in claim 1. Further achievements have been attained by the subject-matters respectively defined in the dependent claims.

[0006] In the dishwasher of the present invention, the door-weight compensating apparatus comprises two or more than two tension springs and a coupling which parallely couples the tension springs with the tension transmission cable which transmits the resultant tension force to the hinge of the door.

[0007] With the present invention, the resultant tension force which is exerted by the door-weight compensating apparatus on the door is obtained by a plurality of parallely coupled tension springs. Thereby, a comparatively high resultant tension force can be obtained by a plurality of parallely coupled tensions springs which have comparatively low stiffness values respectively. With the door-weight compensating apparatus of the present invention, the need for increasing the stiffness values of the tension springs has been obviated. Thus, the stiffness values of the tension springs as well as their sizes, in particular their diameters can be kept comparatively low. Thereby, the risk of a permanent deformation can be eliminated or reduced as much as possible without compromising the operation of the door-weight compensating apparatus. In addition, with the present invention, the utilizable volume for the tub has been prevented from decreasing by obviating the need for large diameter tension springs. With the present invention, the dishwashers can be equipped with comparatively heavier doors and furnished with comparatively heavier decorative panels. Thereby, the customer satisfaction can be further increased.

[0008] In an embodiment, the coupling has one or two retainers for parallely holding the tension springs side by side. The forward retainer is coupled to the rearward end of the tension transmission cable. The rearward retainer can be provided as a separate piece which is identical with the forward retainer or integrally formed onto the frame of the dishwasher. The forward end of the tension transmission cable is coupled to the hinge. The rearward retainer can be fixed to the frame of the dishwasher or alternatively coupled to an adjusting device for pre-tensioning the tension springs and the tension transmission cable. The rearward retainer can be directly coupled to the adjusting device or alternatively through a pre-tension transmission cable. Thereby, the door-weight compensating apparatus can be adjusted to compensate for a desired specific weight of the door, including the weight of the decorative panel as the case may be.

[0009] In another embodiment, the retainers have saddles for securing the hooks of the tension springs. Alternatively, the retainers can be provided with recesses for receiving the hooks of the tension springs.

[0010] In another embodiment, the transmission cables have lugs on both ends. The retainers have claws for holding the lugs of the transmission cables respectively. The hinge and the adjusting device have holders for holding the lugs of the transmission cables respectively.

[0011] In another embodiment, the tension transmission cable is deflected by a roller towards the hinge.

[0012] In another embodiment, the coupling together with the tension springs is movably accommodated in a duct which protects the door-weight compensating apparatus.

[0013] In another embodiment, the duct is provided as a separate piece or integrally formed by the frame of the dishwasher. The duct is disposed between the tub and one of the side walls of the dishwasher. Thereby, the installation of the door-weight apparatus is facilitated. The tension springs are aligned substantially downwards and arrayed along the depth direction so as to save space for the tub.

[0014] In another embodiment, the dishwasher has two door-weight compensating apparatuses which are disposed on the opposing sides of

the dishwasher.

[0015] Additional advantages of the diswasher according to the present invention will become apparent with the detailed description of the embodiments with reference to the accompanying drawings in which:

[0016] Figure 1 – is a schematic side view of a dishwasher according to an embodiment of the present invention, wherein the door is in the closed state;

[0017] Figure 2 – is a schematic side view of the dishwasher according to an embodiment of the present invention, wherein the door is about 15° open;

[0018] Figure 3 – is a schematic side view of the dishwasher according to an embodiment of the present invention, wherein the door is about 45° open;

[0019] Figure 4 – is a schematic side view of the dishwasher according to an embodiment of the present invention, wherein the door is fully opened;

[0020] Figure 5 – is a schematic cutaway side view of the dishwasher according to an embodiment of the present invention, wherein the door is in the closed state and the door-weight compensating apparatus is in the retracted state;

[0021] Figure 6 – is a schematic cutaway side view of the dishwasher according to an embodiment of the present invention, wherein the door is in the fully opened state and the door-weight compensating apparatus is in the fully extended state;

[0022] Figure 7 – is a schematic partial enlarged view of the detail A of Fig. 5;

[0023] Figure 8 – is a schematic perspective view of the door-weight compensating apparatus according to an embodiment of the present invention prior to assembling with the dishwasher of the present invention;

[0024] Figure 9 – is a schematic enlarged view of the detail B of Fig. 8;

[0025] Figure 10 – is a schematic enlarged side view of the detail B of Fig. 8;

[0026] Figure 11 – is a schematic partial enlarged perspective view of the door-weight compensating apparatus according to an embodiment of the present invention prior to assembling the tension springs with the rearward retainer.

[0027] The reference signs appearing on the drawings relate to the following technical features.

1. Dishwasher
2. Tub
3. Door

[0028] 3a. Panel

4. Hinge
5. Apparatus
6. Cable
7. Spring
8. Coupling

[0029] 9a. Retainer

[0030] 9b. Retainer

10. Hook
11. Saddle
12. Lug
13. Claw
14. Holder
15. Cable
16. Device
17. Roller
18. Duct
19. Wall
20. Frame

[0031] The dishwasher (1) comprises a tub (2), a door (3) for opening/closing the tub (2), a hinge (4) for pivotably supporting the door (3), a door-weight compensating apparatus (5) for at least partly compensating for the weight of the door (3) and a tension transmission cable (6) for transmitting the tension force from the door-weight compensating apparatus (5) to the hinge (4).

[0032] In the dishwasher (1) of the present invention the door-weight compensating apparatus (5) comprises two or more than two tension springs (7) and a coupling (8) for coupling the tension springs (7) in a parallel manner with the tension transmission cable (6) (Fig. 1 to 11).

[0033] In an embodiment, the coupling (8) comprises a pair of retainers (9a, 9b)

for holding the tension springs (7) in a parallel manner side by side from both ends respectively. The forward retainer (9a) which is adapted to commonly hold the forward ends of the tension springs (7). The rearward retainer (9b) which is adapted to commonly hold the rearward ends of the tension springs (7).

[0034] In another embodiment, the forward ends of the tension springs (7) and the rearward ends of the tension springs (7) have round hooks (10) respectively. The forward retainer (9a) and the rearward retainer (9b) have round saddles (11) which are adapted to secure the round hooks (10) respectively.

[0035] In another embodiment, the forward retainer (9a) and the rearward retainer (9b) are identical.

[0036] In another embodiment, the tension transmission cable (6) has two lugs (12) which are fixed to its opposing ends respectively. The forward retainer (9a) has a claw (13) which is adapted to engage with the lug (12) which is fixed to the rearward end of the tension transmission cable (6). The free end of the hinge (4) has a holder (14) which is adapted to engage with the lug (12) which is fixed to the forward end of the tension transmission cable (6).

[0037] In another embodiment, the dishwasher (1) further comprises a pre-tension transmission cable (15) and a lug (12) which is fixed to the forward end of the pre-tension transmission cable (15). The rearward retainer (9b) comprises a claw (13) which is adapted to engage with the lug (13) which is fixed to the forward end of the pre-tension transmission cable (15). In this embodiment, the dishwasher (1) further comprises an adjusting device (16) for presetting the tension of the springs (7). The rearward end of the pre-tension transmission cable (15) is fixed to the adjusting device (16).

[0038] In another embodiment, the dishwasher (1) comprises a roller (17) for deflecting the tension transmission cable (6).

[0039] In another embodiment, the dishwasher (1) comprises a duct (18) for slidably accommodating the tension springs (7).

[0040] In another embodiment, the duct (18) extends in the vertical direction.

[0041] In another embodiment, the dishwasher (1) comprises side walls (19) and a frame (20) which supports the tub (2) and the side walls (19). The duct (18) is defined by the frame (20). The duct (18) is disposed between one of the side walls (19) and the tub (2).

[0042] In another embodiment, the door-weight compensating apparatus (5) comprises two coupled coil type tension springs (7) in a parallel manner which are substantially identical.

[0043] With the present invention, particularly by virtue of the door-weight compensating apparatus (5), the dishwasher (1) can be reliably equipped with a comparatively heavier door (3) and furnished with a comparatively heavier decorative panel (3a). With the present invention, the customer satisfaction can be further increased.

Claims

1. A dishwasher (1) comprising a tub (2), a door (3) for opening/closing the tub (2), a hinge (4) for pivotably supporting the door (3), a door-weight compensating apparatus (5) for at least partly compensating for the weight of the door (3) and a tension transmission cable (6) for transmitting the tension force from the door-weight compensating apparatus (5) to the hinge (4), **characterized in that** the door-weight compensating apparatus (5) comprising two or more than two tension springs (7) and a coupling (8) for coupling the tension springs (7) in a parallel manner with the tension transmission cable (6).
2. The dishwasher (1) according to claim 1, **characterized in that** the coupling (8) comprises a pair of retainers (9a, 9b) for holding the tension springs (7) in a parallel manner side by side from both ends respectively, wherein the forward retainer (9a) is adapted to commonly hold the forward ends of the tension springs (7) and wherein the rearward retainer (9b) is adapted to commonly hold the rearward ends of the tension springs (7).
3. The dishwasher (1) according to claim 2, **characterized in that** the forward ends of the tension springs (7) and the rearward ends of the tension springs (7) have round hooks (10) respectively and the forward retainer (9a) and the rearward retainer (9b) have round saddles (11) which are adapted to secure the round hooks (10) respectively.
4. The dishwasher (1) according to claim 2 or 3, **characterized in that** the forward retainer (9a) and the rearward retainer (9b) are identical.
5. The dishwasher (1) according to any one of claims 2 to 4, **characterized in that** the tension transmission cable (6) has two lugs (12) which are fixed to its opposing ends respectively, the forward retainer (9a) has a claw (13) which is adapted to engage with the lug (12) which is fixed to the rearward end of the tension transmission cable (6) and the free end of the hinge (4) has a holder (14) which is adapted to engage with the lug (12) which is fixed the forward end of the tension transmission cable (6).
6. The dishwasher (1) according to claim 5, **characterized in that** a pre-tension transmission cable (15), a lug (12) which is fixed to the forward end of the pre-tension transmission cable (15), wherein the rearward retainer (9b) comprises a claw (13) which engages with the lug (12) which is fixed to the

forward end of the pre-tension transmission cable (15) and an adjusting device (16) for presetting the tension of the springs (7), wherein the rearward end of the pre-tension transmission cable (15) is fixed to the adjusting device (16).

7. The dishwasher (1) according to any one of claims 1 to 6, **characterized in that** a roller (17) for deflecting the tension transmission cable (6).
8. The dishwasher (1) according to any one of claims 1 to 7, **characterized in that** a duct (18) for slidably accommodating the coupling (8) together with the tension springs (7).
9. The dishwasher (1) according to claim 8, **characterized in that** the duct (18) extends in the vertical direction.
10. The dishwasher (1) according to claim 8 or 9, **characterized in that** side walls (19) and a frame (20) which supports the tub (2) and the side walls (19), wherein the duct (18) is defined by the frame (20), wherein the duct (18) is disposed between one of the side walls (19) and the tub (2).
11. The dishwasher (1) according to any one of claims 1 to 10, **characterized in that** the door-weight compensating apparatus (5) comprises two coupled coil type tension springs (7) in a parallel manner which are identical.

Fig. 1

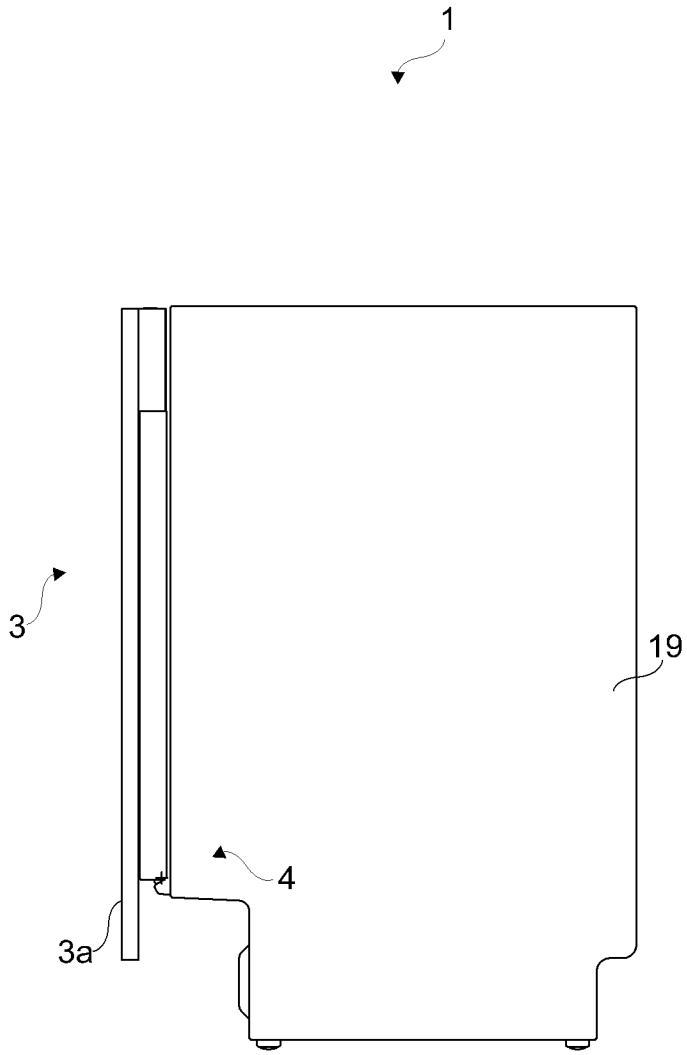


Fig. 2

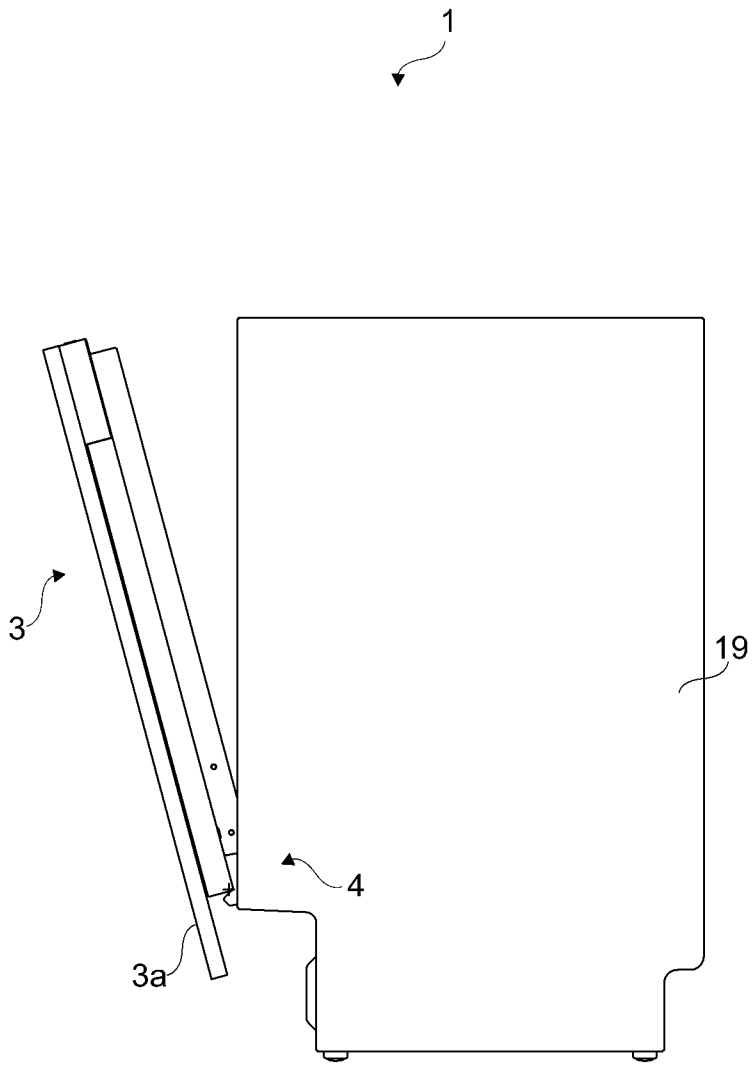


Fig. 3

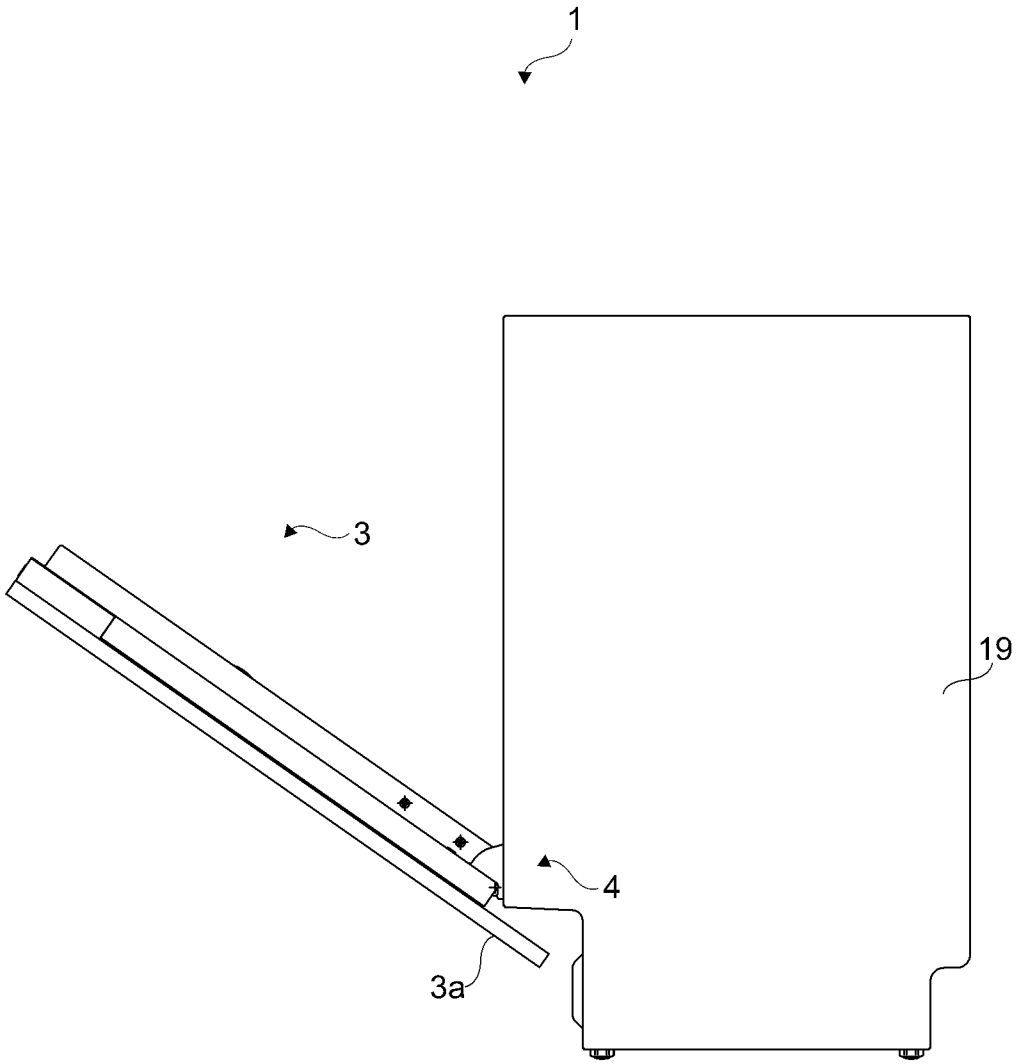


Fig. 4

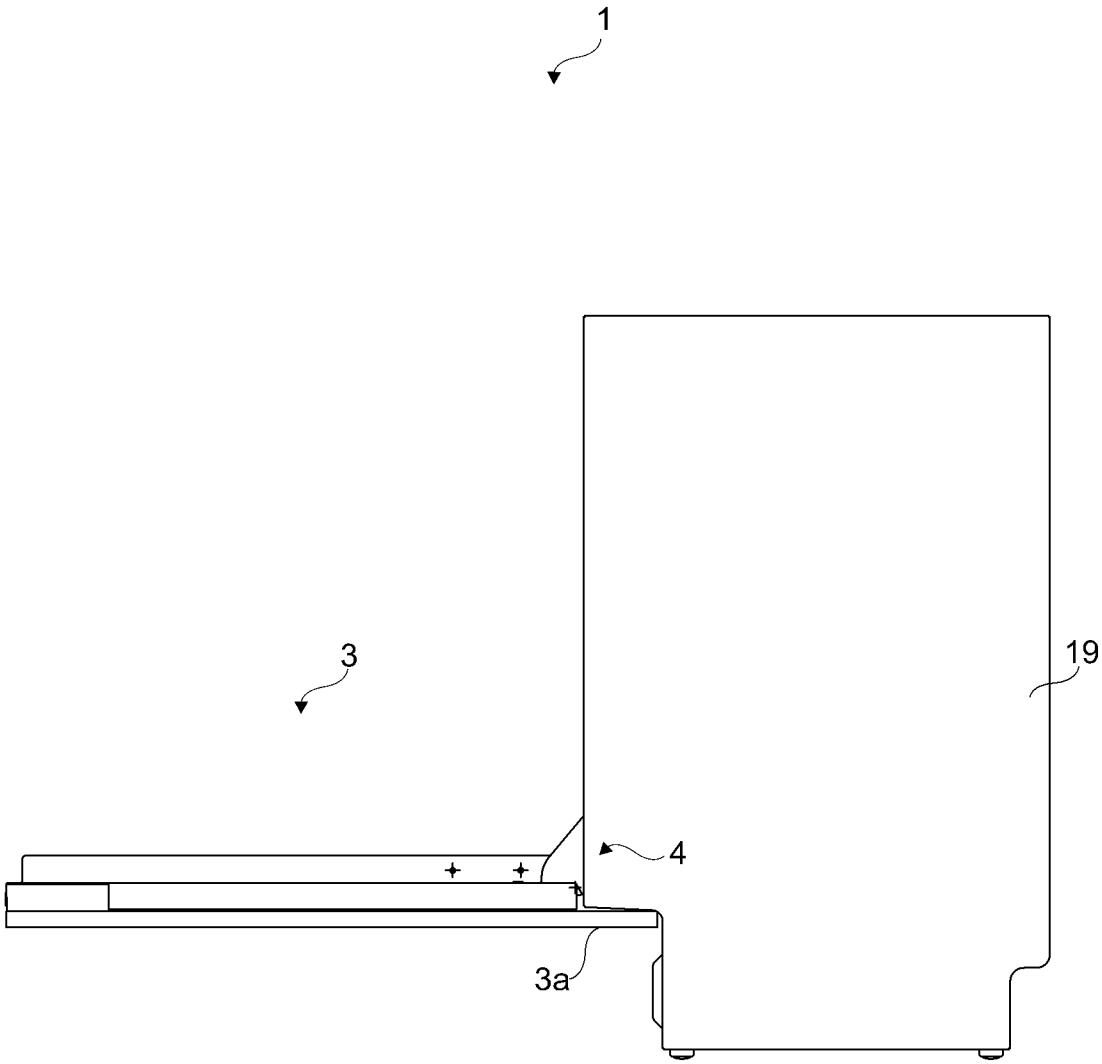


Fig. 5

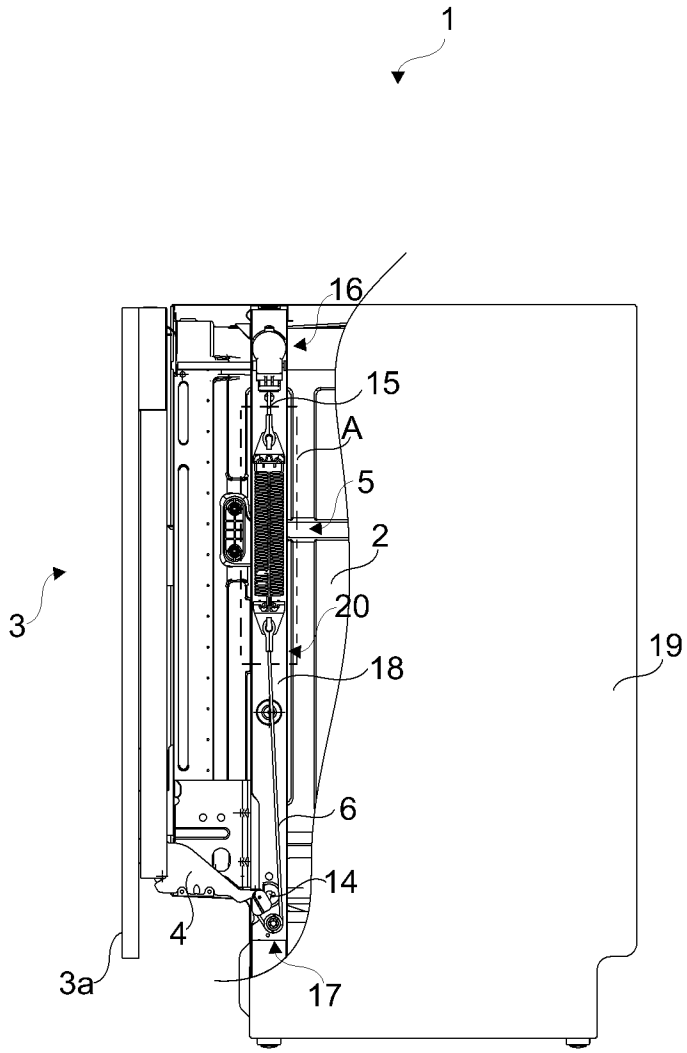


Fig. 6

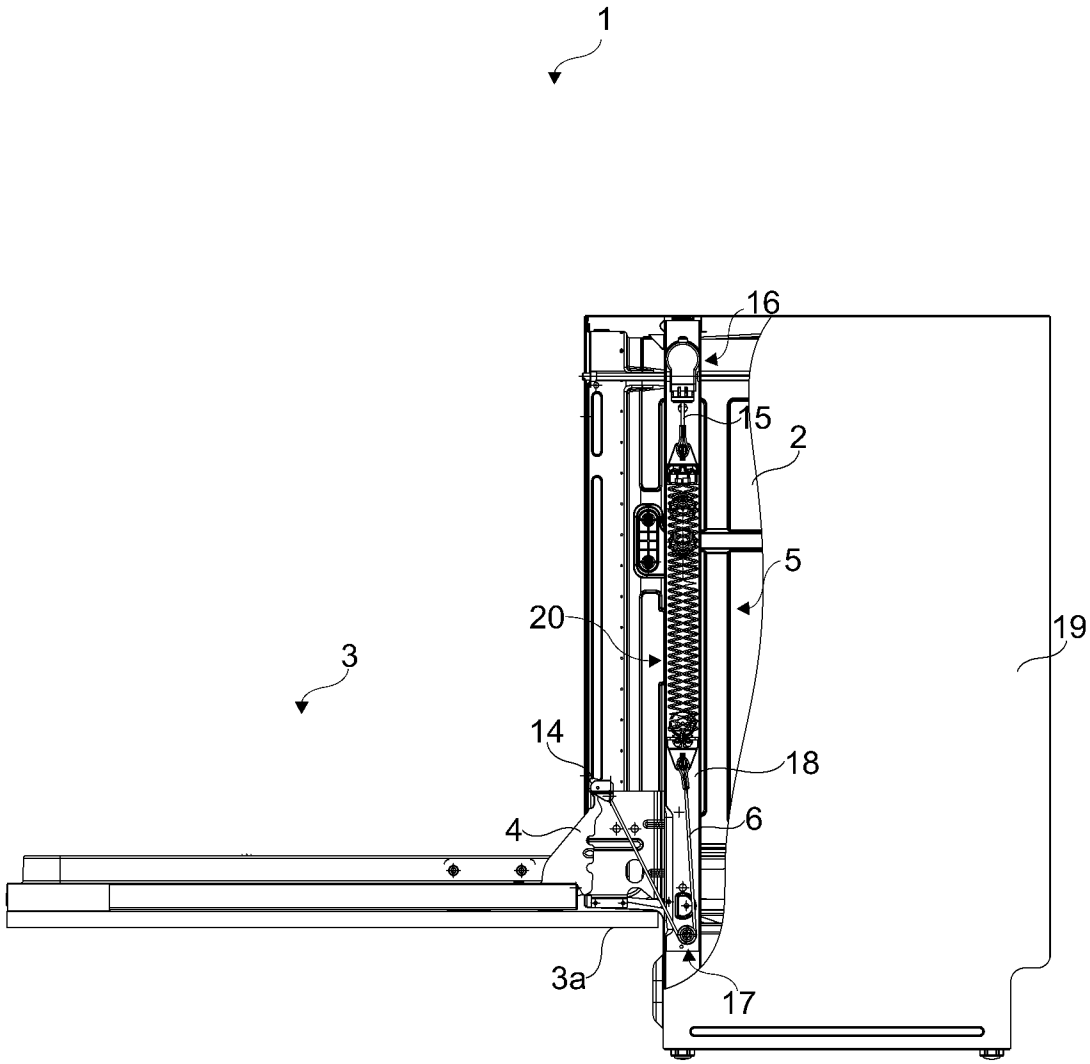


Fig. 7

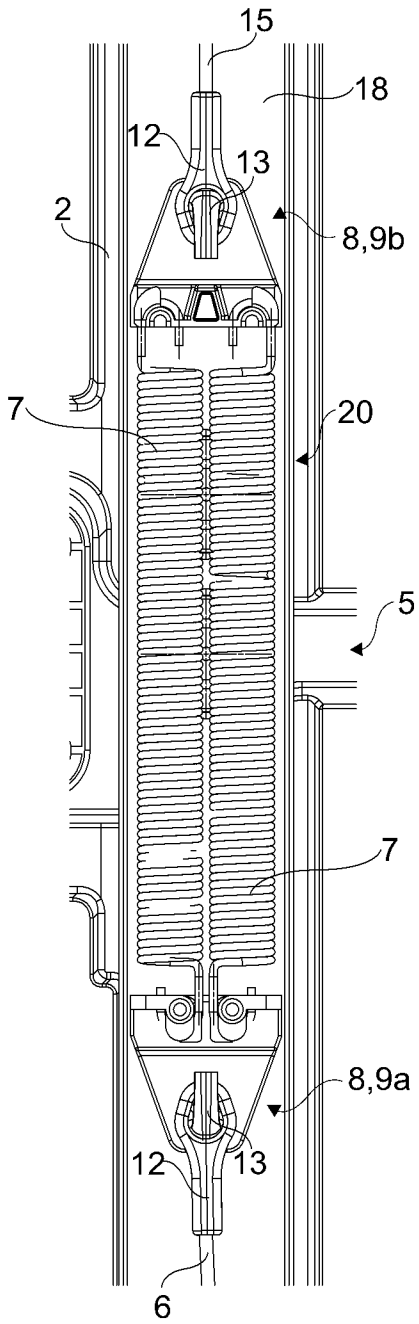


Fig. 8

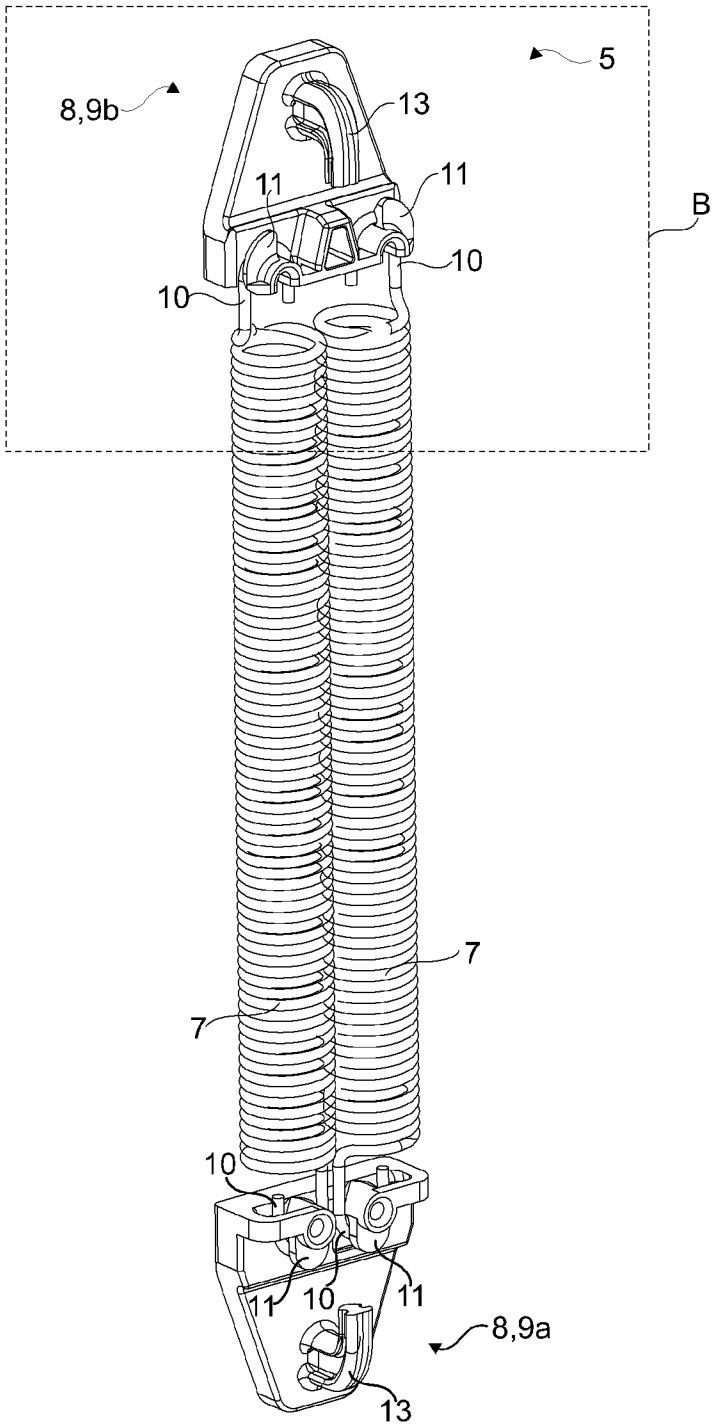


Fig. 9

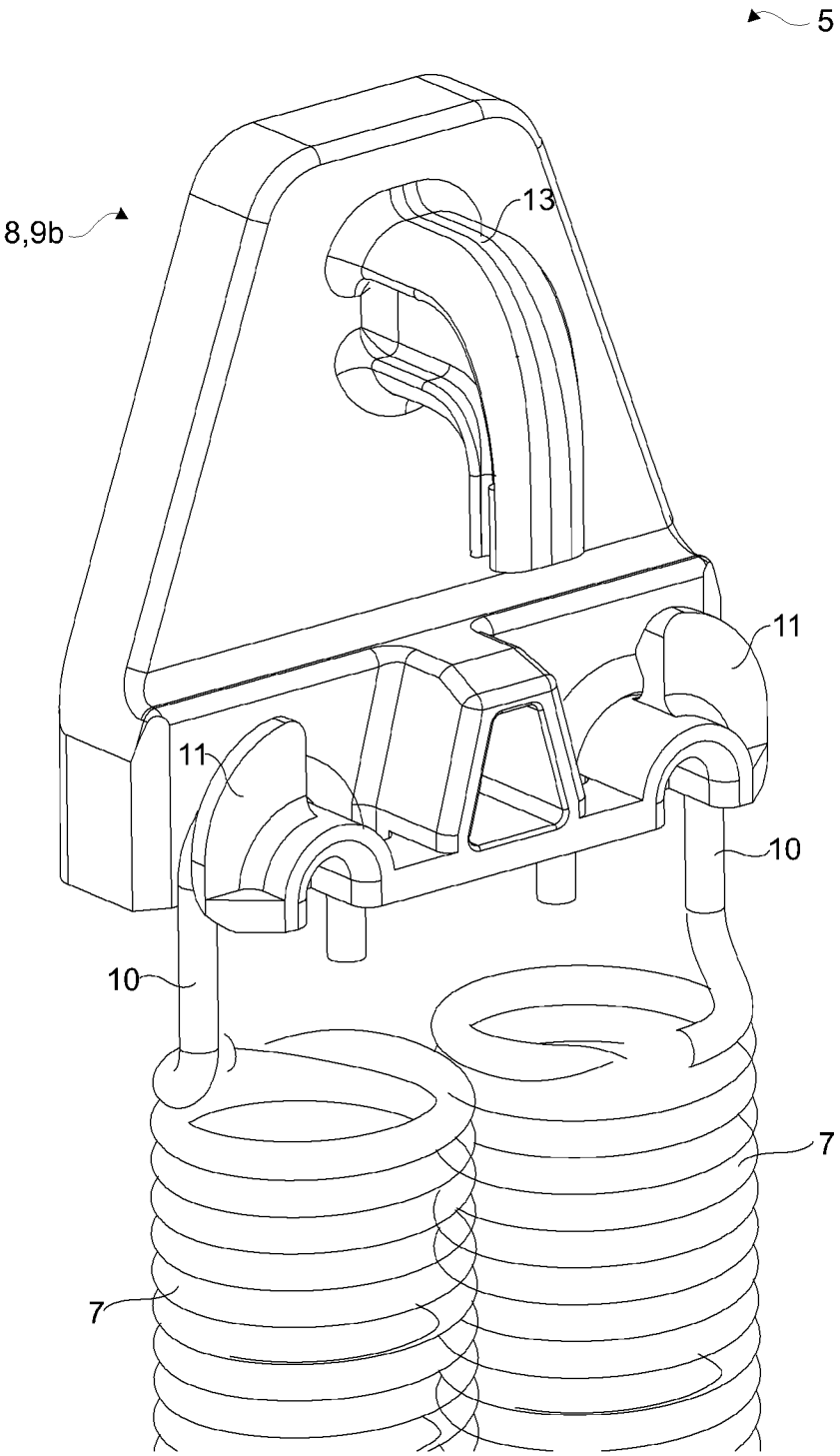


Fig. 10

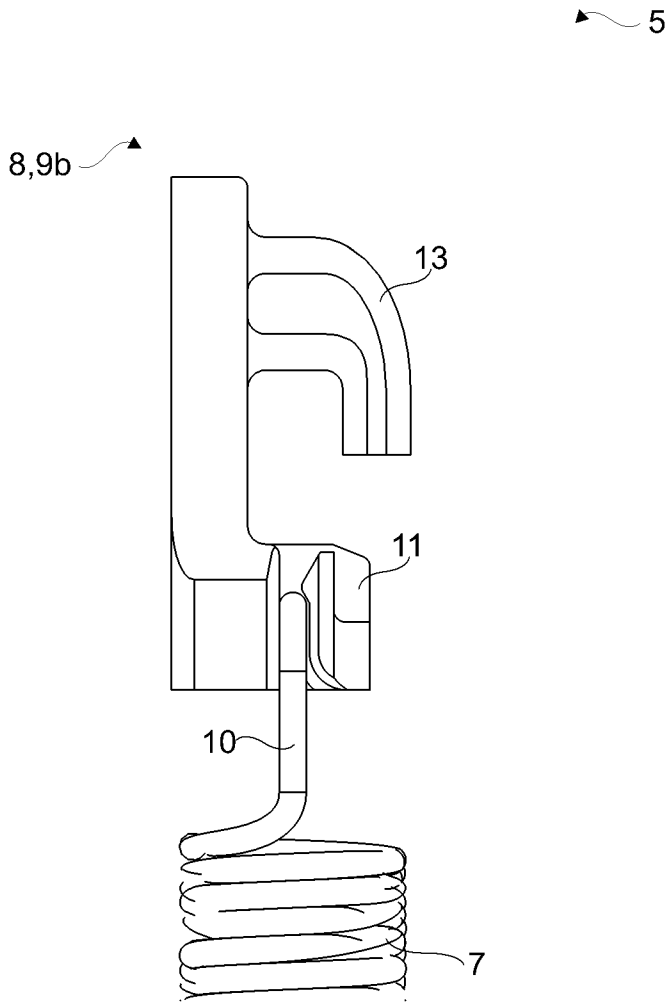
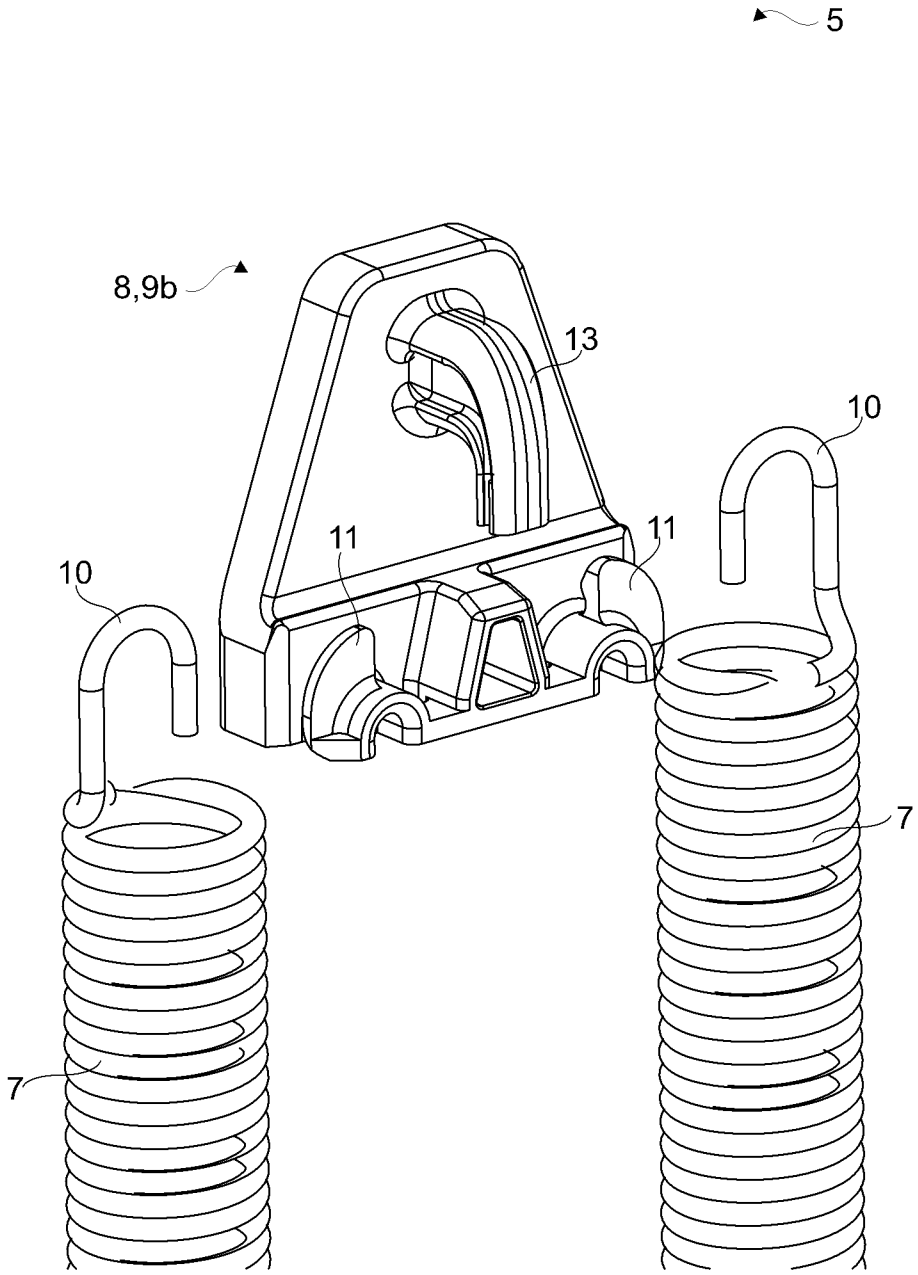


Fig. 11



INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2014/076212

A. CLASSIFICATION OF SUBJECT MATTER
INV. A47L15/42
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)
A47L E05F

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, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2009/072686 A1 (VOOREN GREGORY VAN [US] ET AL) 19 March 2009 (2009-03-19) page 1, left-hand column, paragraph 3 - paragraph 5 page 2, right-hand column, paragraph 29 - page 5, left-hand column, paragraph 45 figures 1-14	1-11

X	EP 2 524 643 A1 (BSH BOSCH SIEMENS HAUSGERAETE [DE]) 21 November 2012 (2012-11-21)	1
A	abstract column 12, paragraph 40 figures 1-13	2-11

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

X 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
25 August 2015	01/09/2015

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Redelsperger, C

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Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2014/076212

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
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