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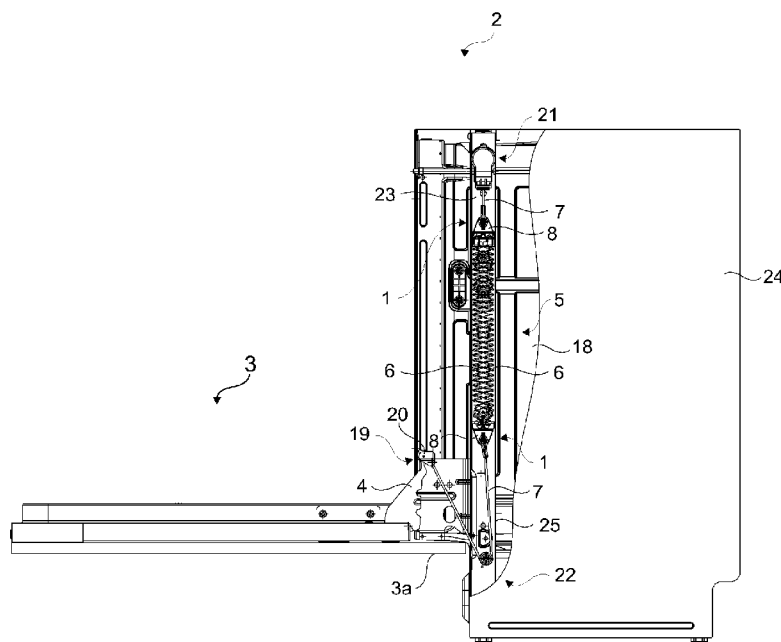
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(54) **Title:** COUPLING APPARATUS FOR USE IN A DOOR-WEIGHT COMPENSATING APPARATUS OF A HOUSEHOLD
APPLIANCE

Fig. 2



(57) **Abstract:** The present invention provides a coupling apparatus (1) for use in a household appliance (2) comprising a pivotally supported door (3), a hinge (4) for supporting the door (3) and a door-weight compensating apparatus (5) for at least partially compensating for the weight of the door (3). The coupling apparatus (1) of the present invention comprises two retainers (8) for parallelly stretching one or more than one tension spring (6) between two cables (7) that tension said one or more than one tension spring (6) respectively from both ends and transmit the tension force to the hinge (4).

Description**COUPLING APPARATUS FOR USE IN A DOOR-WEIGHT COMPENSATING APPARATUS OF A HOUSEHOLD APPLIANCE**

[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 pivotally 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 known. The door-weight compensating apparatus generally comprises a tension spring for acting a tension force on the hinge 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 generally fixed to the frame of the dishwasher. The other end of the tension spring is fixed to the tension transmission cable. Domestic dishwashers are generally designed either as a free-standing type or a built-in type. A built-in type domestic dishwasher is generally installed underneath the kitchen counter, particularly between the cabinets and integrated 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 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 of the deformed spring incurs additional material costs and labor costs. Thus, the customer satisfaction may easily decrease. The aforementioned difficulties generally put limitations on the weight of the door and the decorative panel. These limitations further restrict the design of the appliance door and the choice of the decorative panels for the customers. Another difficulty is that the assembly of the prior art door-weight compensating apparatus with the household appliance is a time consuming and complicated process.

- [0003] An objective of the present invention is to provide a coupling apparatus for use in a door-weight compensating apparatus of a household appliance which overcomes the aforementioned drawbacks of the prior art in a cost effective way and which enables an improved assembly of the door-weight compensating apparatus and a permanently reliable opening/closing of the door even when the door is comparatively heavy and/or furnished with a comparatively heavy decorative panel.
- [0004] This objective has been achieved by the coupling apparatus as defined in claim 1 and the household appliance as defined in claim 1. Further achievements have been attained by the subject-matters respectively defined in the dependent claims.
- [0005] The coupling apparatus of the present invention comprises a couple of retainers for parallelly stretching one or more than one tension spring between two cables which tension said one or more than one tension spring respectively from both ends and transmit the tension force to the hinge. Each retainer comprises a first attachment means for holding the end of the corresponding cable and a second attachment means for holding the end of each corresponding tension spring.
- [0006] With the present invention, particularly by virtue of the coupling apparatus, the necessary amount of tension springs can be parallelly stretched between the two cables in a few steps. For instance, the necessary amount of tension springs can be attached to the retainers in a preassembly step. And subsequently the retainers can be attached to the two cables. The preassembly step can be separately performed in order to

expedite and simplify the final assembly process. Thereby, the assembly of the door-weight compensating apparatus has been improved. With the present invention, the tension force which is exerted by the door-weight compensating apparatus onto the door is obtained by a single tension spring or a plurality of parallelly coupled tension springs. Particularly in the latter case, a comparatively high resultant tension force can be obtained by a plurality of parallelly coupled tension 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.

- [0007] In an embodiment, the retainers have hooks which respectively engage with the eyes of the cables. Thereby, the retainers which are preassembled with the tension springs can be easily attached to end of the cables respectively.
- [0008] In another embodiment, the retainers have saddle-shaped notches which respectively engage with the round hooks of the tension spring. Thereby, the tension springs can be easily attached to the retainers.
- [0009] In another embodiment, the retainers have claws which lock the hooks of the tension spring in place.
- [0010] In another embodiment, the retainers have holes which respectively receive the ends of the tension spring.
- [0011] In another embodiment, the retainers hold two identical tension springs side by side. In alternative versions of this embodiment, the hooks of the

tension springs bend towards each other or away from each other.

Thereby, a stable attachment can be attained.

- [0012] In another embodiment, the door-weight compensating apparatus has an adjusting device for presetting the tension force via the cable.
- [0013] In another embodiment, the coupling apparatus together with each tension spring is movably accommodated in a duct of the household appliance which protects the door-weight compensating apparatus from dislodging.
- [0014] In another embodiment, the household appliance has two door-weight compensating apparatuses which are disposed on opposing side relative to the door.
- [0015] In another embodiment, the household appliance is provided as a domestic dishwasher.
- [0016] In another embodiment, the duct is provided as a separate member 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 further facilitated. The tension springs are aligned substantially downwards and arrayed along the depth direction so as to save space for the tub.
- [0017] Additional advantages of the coupling apparatus and the household appliance according to the present invention will become apparent with the detailed description of the embodiments with reference to the accompanying drawings in which:
- [0018] Figure 1 – is a schematic cutaway side view of the dishwasher which has the coupling apparatus 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;
- [0019] Figure 2 – is a schematic cutaway side view of the dishwasher which has the coupling apparatus 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;
- [0020] Figure 3 – is a schematic perspective view of the door-weight compensating apparatus which has the coupling apparatus according to an embodiment of the present invention;

- [0021] Figure 4 – is a schematic perspective view of the door-weight compensating apparatus which has the coupling apparatus according to an alternative embodiment of the present invention;
- [0022] Figure 5 – shows schematic front views of the door-weight compensating apparatus of Fig. 3 in three different states;
- [0023] Figure 6 – shows schematic front views of the door-weight compensating apparatus of Fig. 4 in three different states;
- [0024] Figure 7 – is a schematic perspective view of the coupling apparatus and the tension springs of Fig. 5, prior to the assembly;
- [0025] Figure 8 – is a schematic perspective view of the coupling apparatus and the tension springs of Fig. 6, prior to assembly;
- [0026] Figure 9 – is a schematic enlarged front view of the coupling apparatus and the tension springs of Fig. 7 during the assembly;
- [0027] Figure 10 – is a schematic enlarged front view of the coupling apparatus and the tension springs of Fig. 7, during the assembly;
- [0028] Figure 11 – is a schematic enlarged front view of the coupling apparatus and the tension springs of Fig. 7, after the assembly;
- [0029] Figure 12 – is a schematic enlarged perspective view of the coupling apparatus and the tension springs of Fig. 9 during the assembly;
- [0030] Figure 13 – is a schematic enlarged perspective view of the coupling apparatus and the tension springs of Fig. 10, during the assembly;
- [0031] Figure 14 – is a schematic enlarged perspective view of the coupling apparatus and the tension springs of Fig. 11, after the assembly;
- [0032] Figure 15 – is a schematic enlarged perspective view of the coupling apparatus and the tension springs of Fig. 8, during the assembly;
- [0033] Figure 16 – is a schematic enlarged perspective view of the coupling apparatus and the tension springs of Fig. 8, during the assembly;
- [0034] Figure 17 – is a schematic enlarged perspective view of the coupling apparatus and the tension springs of Fig. 8, after the assembly;
- [0035] Figure 18 – is a schematic sectional view of the coupling apparatus and the tension springs of Fig. 11, taken along the line A-A;
- [0036] Figure 19 – is a schematic side view of the coupling apparatus and the tension springs of Fig. 11, when viewed from the direction B;

[0037] Figure 20 – is a schematic sectional view of the coupling apparatus and the tension springs of Fig. 17, taken along the line C-C.

[0038] The reference signs appearing on the drawings relate to the following technical features.

1. Coupling apparatus
2. Household appliance
3. Door

[0039] 3a. Decorative panel

4. Hinge
5. Compensating apparatus
6. Tension spring
7. Cable
8. Retainer
9. 1st attachment means
10. 2nd attachment means
11. Eye
12. Hook
13. Hook
14. Notch
15. Claw
16. Rib
17. Hole
18. Tub
19. Holder
20. Mounting lug
21. Adjusting device
22. Roller
23. Duct
24. Side wall
25. Frame

[0040] The coupling apparatus (1) is suitable for use in a household appliance (2), in particular a dishwasher.

[0041] The household appliance (2) comprises a door (3), a hinge (4) for pivotally

supporting the door (3) about a horizontal axis and a door-weight compensating apparatus (5) for at least partly compensating for the weight of the door (3).

[0042]

In the household appliance (2) of the present invention, the door-weight compensating apparatus (5) comprises one or more than one tension spring (6) for acting a tension force on the hinge (4) and two cables (7) for tensioning said one or more than one tension spring (6) respectively from both ends and for transmitting the tension force to the hinge (4). In the household appliance (2) of the present invention, each tension spring (6) is stretched between the two cables (7) (Fig. 1 to 20).

[0043] The coupling apparatus (1) of the present invention comprises two retainers (8) for parallelly stretching said one or more than one tension spring (6) between the two cables (7). Each retainer (8) comprises a first attachment means (9) which is adapted to hold the end of the corresponding cable (7) and a second attachment means (10) which is adapted to hold the end of each corresponding tension spring (6).

[0044] In the household appliance (2) of the present invention, said one or more than one tension spring (6) are parallelly stretched between the two cables (7) through the coupling apparatus (1).

[0045] In an embodiment, the ends of the cables (7) have eyes (11). In this embodiment, each first attachment means (9) comprises a hook (12) which is adapted to engage with the eye (11) of the corresponding cable (7).

[0046] In another embodiment, the end of the tension springs (6) have hooks (13). In this embodiment, each second attachment means (10) comprises one or more than one saddle-shaped notch (14) which is adapted to respectively engage with the corresponding hook (13) of the tension spring (6).

[0047] In another embodiment, each second attachment means (10) also comprises one or more than one claw (15) which is respectively disposed adjacent to the corresponding saddle-shaped notch (14) for locking the hook (13) of the corresponding tension spring (6) in place.

- [0048] In another embodiment, each retainer (8) comprises one or more than one reinforcement rib (16).
- [0049] In another embodiment, each second attachment means (10) comprises one or more than one hole (17) for respectively receiving the end of the corresponding tension spring (6).
- [0050] In another embodiment, each retainer (8) is adapted to stretch a single tension spring (6) between the two cables (7).
- [0051] In another embodiment, each retainer (8) is adapted to parallelly stretch two tension springs (6) between the two cables (7).
- [0052] In another embodiment, the two tensions springs (6) are identical. Each second attachment means (10) is adapted to hold the tension springs (6) side by side in an attachment position where the hooks (13) of the tension springs (6) bend towards each other (Fig. 3).
- [0053] In an alternative embodiment, each second attachment means (10) is adapted to hold the tension springs (6) side by side in an attachment position where the hooks (13) of the tension springs (13) bend away from each other (Fig. 4).
- [0054] In another embodiment, the two retainers (8) of the coupling apparatus (1) are identical.
- [0055] In another embodiment, the free end of the hinge (4) has a holder (19) which is adapted to engage with a mounting lug (20) which is fixed to the forward end of the cable (7) (Fig. 1 and 2).
- [0056] In another embodiment, the door-weight compensating apparatus (5) comprises an adjusting device (21) for presetting the tension force. The rearward end of the cable (7) is fixed to the adjusting device (21).
- [0057] In another embodiment, the door-weight compensating apparatus (5) comprises a roller (22) for deflecting the cable (7).
- [0058] In another embodiment, the household appliance (2) comprises a duct (23) for slidably accommodating the door-weight compensating apparatus (5).
- [0059] In another embodiment, the duct (23) extends in the vertical direction.
- [0060] In another embodiment, the household appliance (2) is provided as a dishwasher (2). The dishwasher (2) has a tub (18). The door (3) is pivotally hinged about the horizontal axis for opening/closing the tub (18).

- [0061] In another embodiment, the dishwasher (2) comprises side walls (24) and a frame (25) which supports the tub (18) and the side walls (24). In this embodiment, the duct (23) is defined by the frame (25). The duct (23) is disposed between one of the side walls (24) and the tub (18).
- [0062] With the present invention, particularly by virtue of the coupling apparatus (1), the household appliance (2) can be easily and 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 coupling apparatus (1) for use in a household appliance (2), in particular a dishwasher comprising a door (3), a hinge (4) for pivotally supporting the door (3) about a horizontal axis and a door-weight compensating apparatus (5) for at least partially compensating for the weight of the door (3), wherein the door-weight compensating apparatus (5) comprising one or more than one tension spring (6) for acting a tension force on the hinge (4) and two cables (7) for tensioning said one or more than one tension spring (6) respectively from both ends and for transmitting the tension force to the hinge (4), **characterized in that** two retainers (8) for parallelly stretching said one or more than one tension spring (6) between the two cables (7), wherein each retainer (8) comprising a first attachment means (9) which is adapted to hold the end of the corresponding cable (7) and a second attachment means (10) which is adapted to hold the end of each corresponding tension spring (6).
2. The coupling apparatus (1) according to claim 1, wherein the ends of the cables (7) have eyes (11), **characterized in that** each first attachment means (9) comprising a hook (12) which is adapted to engage with the eye (11) of the corresponding cable (7).
3. The coupling apparatus (1) according to claim 1 or 2, wherein the ends of the tension springs (6) have hooks (13), **characterized in that** each second attachment means (10) comprising one or more than one saddle-shaped notch (14) which is adapted to respectively engage with the corresponding hook (13) of the tension spring (6).
4. The coupling apparatus (1) according to claim 3, **characterized in that** each second attachment means (10) further comprising one or more than one claw (15) which is respectively disposed adjacent to the corresponding saddle-shaped notch (14) for locking the hook (13) of the corresponding tension spring (6) in place.
5. The coupling apparatus (1) according to any one of claims 1 to 5, **characterized in that** each retainer (8) comprising one or more than one reinforcement rib (16).
6. The coupling apparatus (1) according to any one of claims 1 to 6, **characterized in that** each second attachment means (10) comprising one or

more than one hole (17) for respectively receiving the end of the corresponding tension spring (6).

7. The coupling apparatus (1) according to any one of claims 1 to 6, **characterized in that** each retainer (8) is adapted to stretch a single tension spring (6) between the two cables (7).
8. The coupling apparatus (1) according to any one of claims 1 to 6, **characterized in that** each retainer (8) is adapted to parallelly stretch two tension springs (6) between the two cables (7).
9. The coupling apparatus (1) according to claim 8, **characterized in that** the two tensions springs (6) are identical and each second attachment means (10) is further adapted to hold the tension springs (6) side by side in an attachment position where the hooks (13) of the tension springs (6) bend towards each other.
10. The coupling apparatus (1) according to claim 8, **characterized in that** the two tensions springs (6) are identical and each second attachment means (10) is further adapted to hold the tension springs (6) side by side in an attachment position where the hooks (13) of the tension springs (6) bend away from each other.
11. The household appliance (2), in particular a dishwasher (2) comprising a door (3), a hinge (4) for pivotally supporting the door (3) about a horizontal axis, a door-weight compensating apparatus (5) for at least partly compensating for the weight of the door (3), **characterized in that** the door-weight compensating apparatus (5) comprising one or more than one tension spring (6) for acting a tension force on the hinge (4), two cables (7) for tensioning said one or more than one tension spring (6) from both ends and for transmitting the tension force to the hinge (4) and a coupling apparatus (1) as defined in any one of claims 1 to 10.

Fig. 1

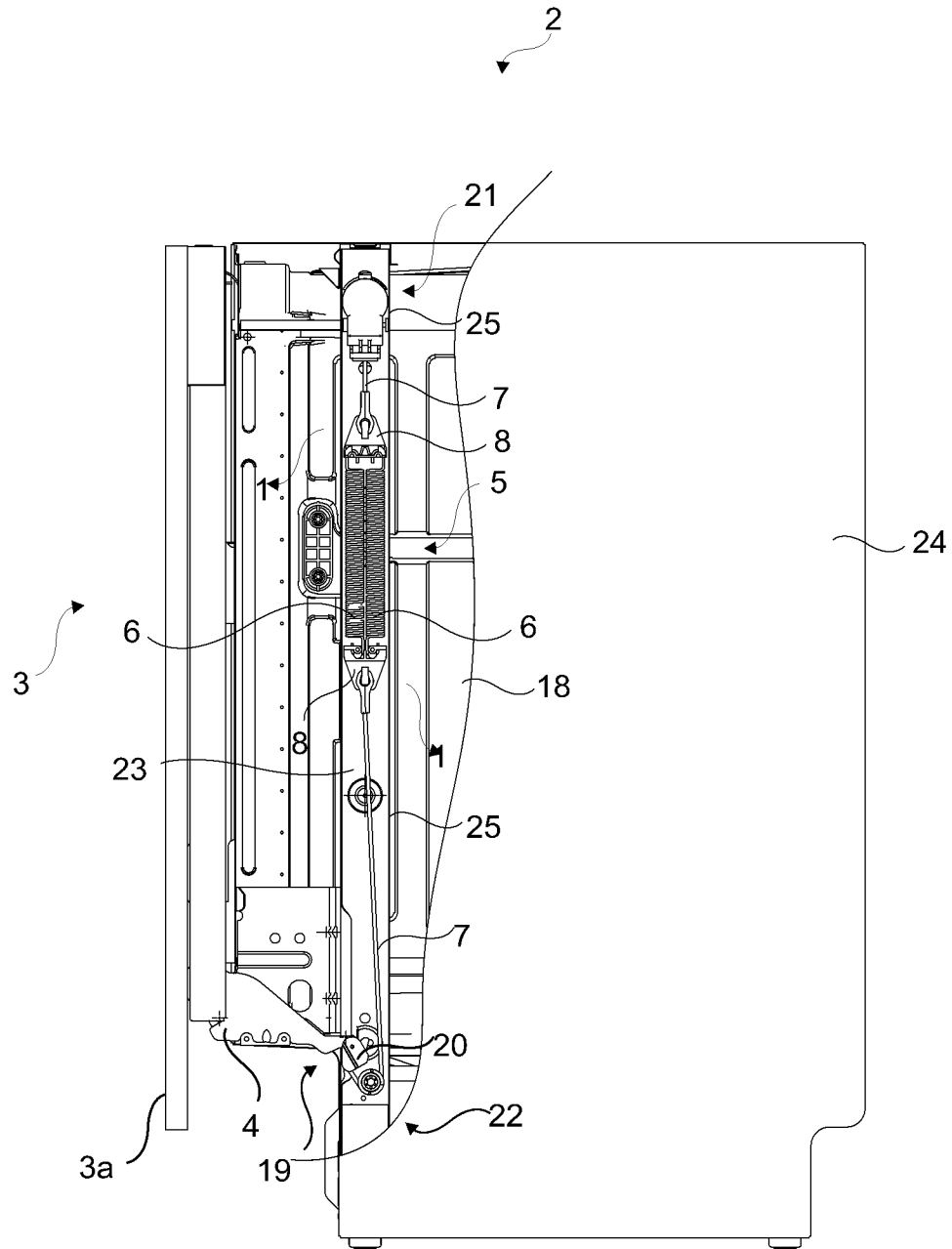


Fig. 2

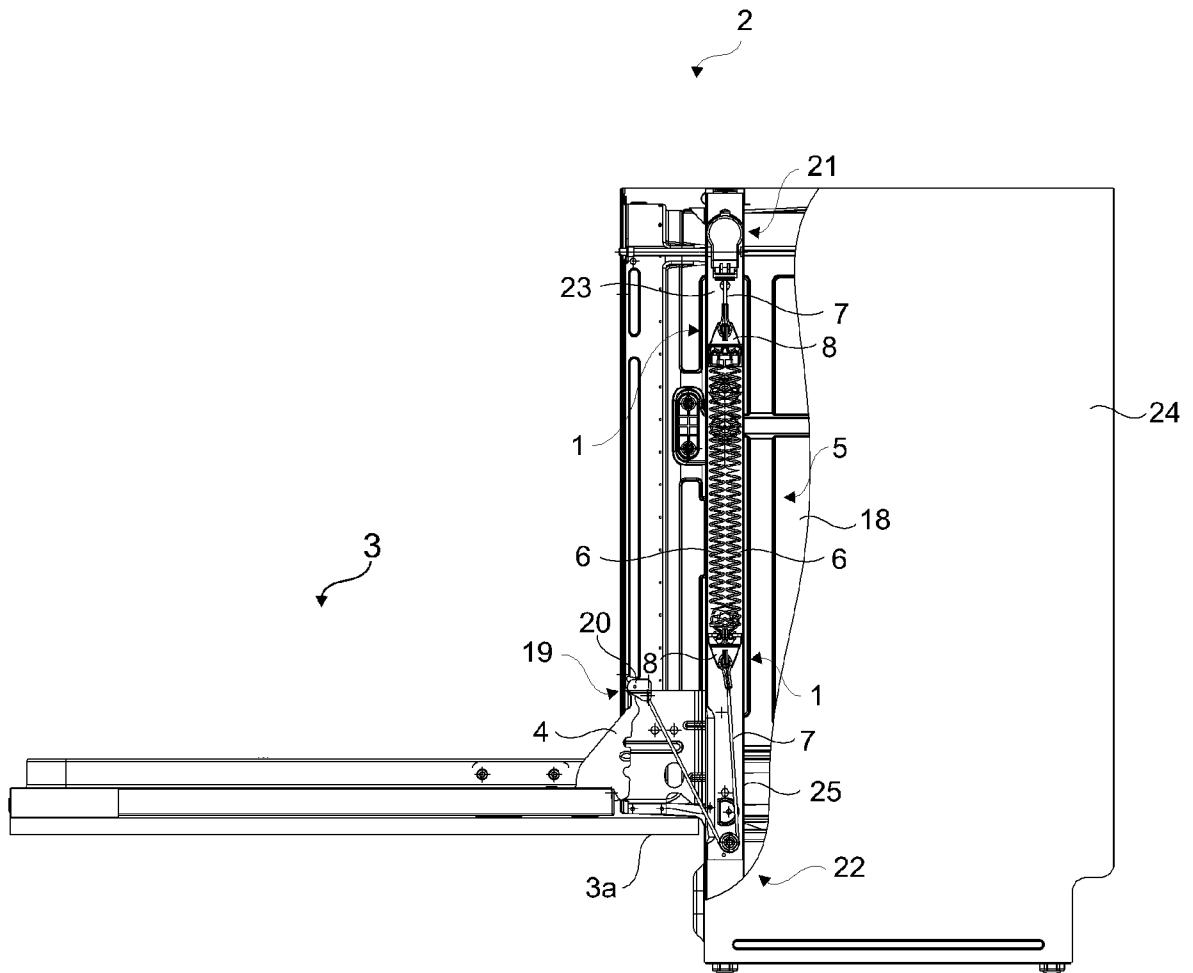


Fig. 3

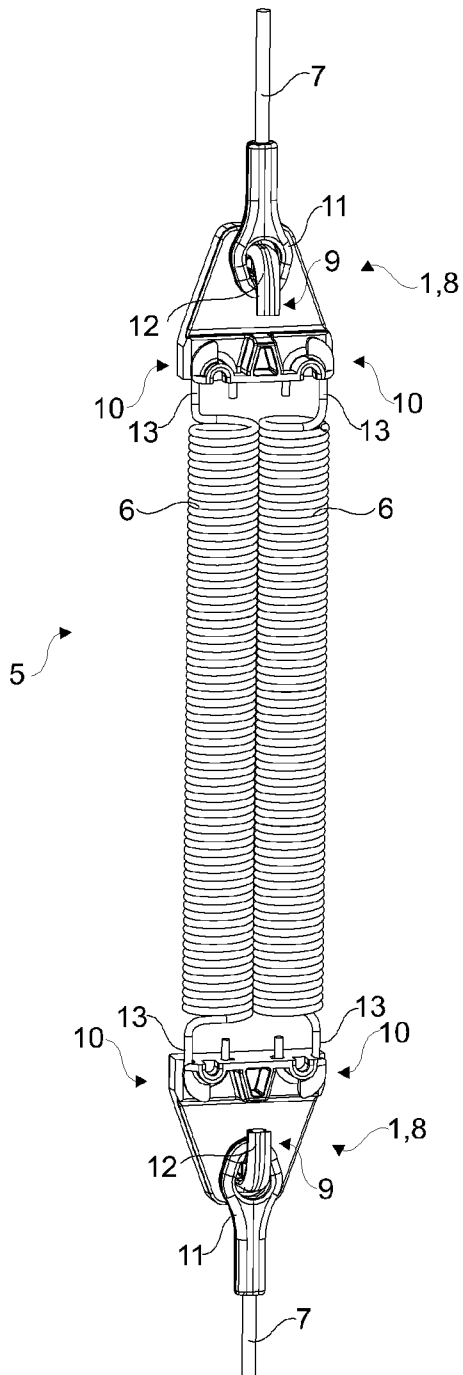


Fig. 4

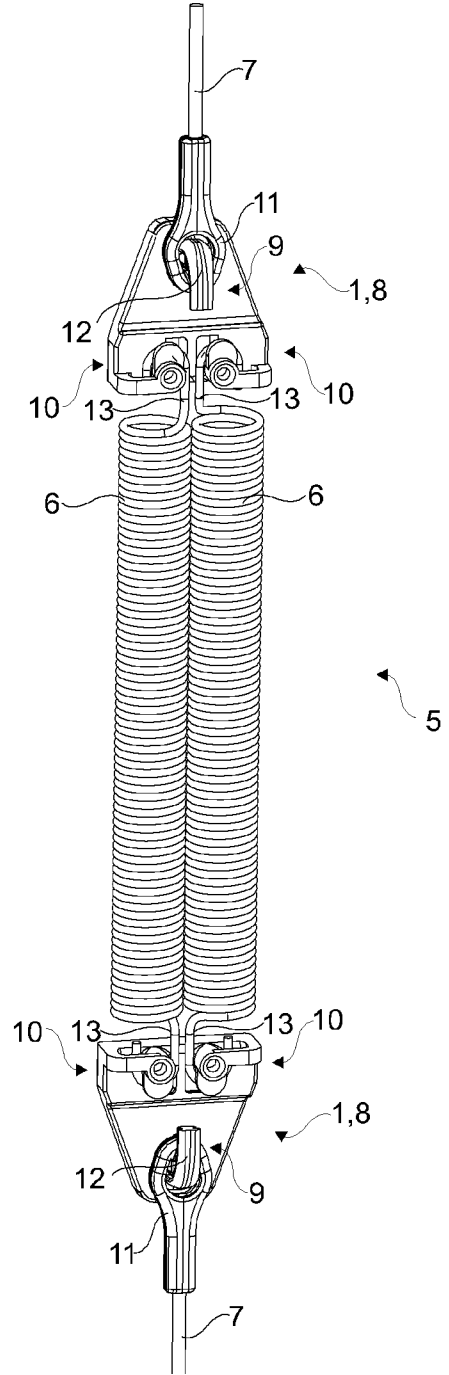


Fig. 5

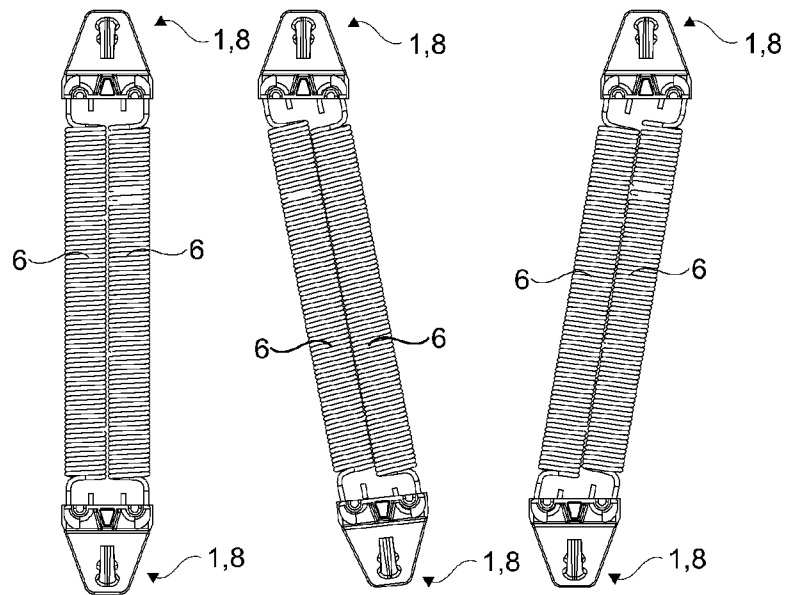


Fig. 6

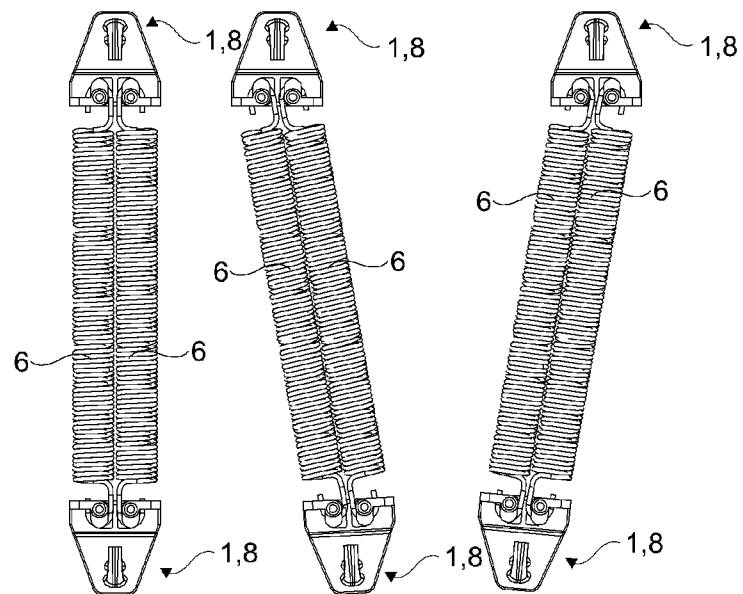


Fig. 7

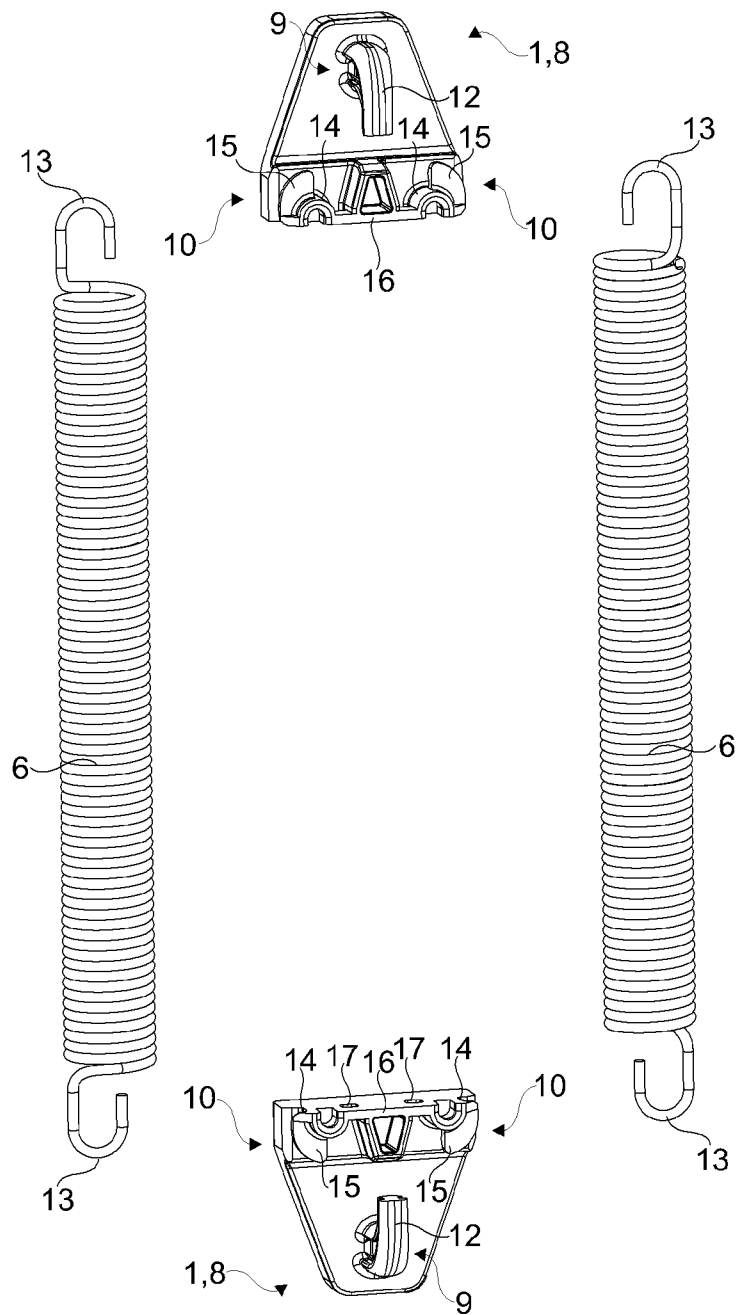


Fig. 8

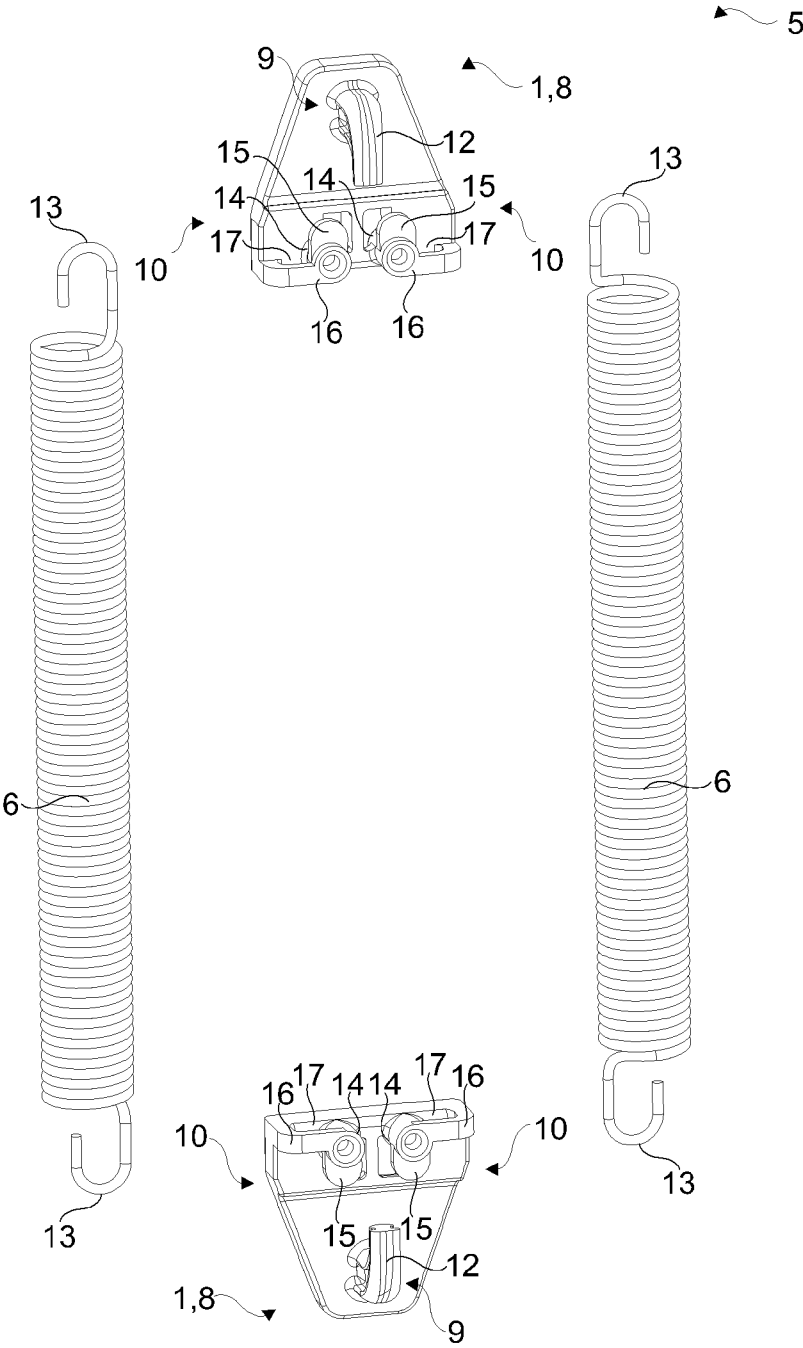


Fig. 9

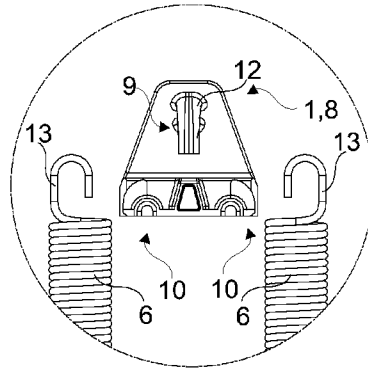


Fig. 10

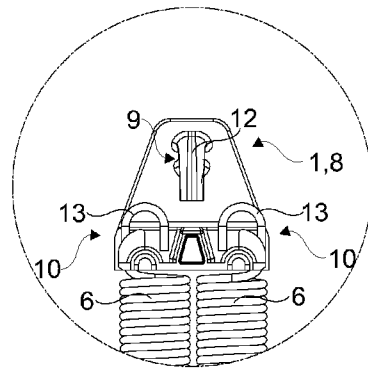


Fig. 11

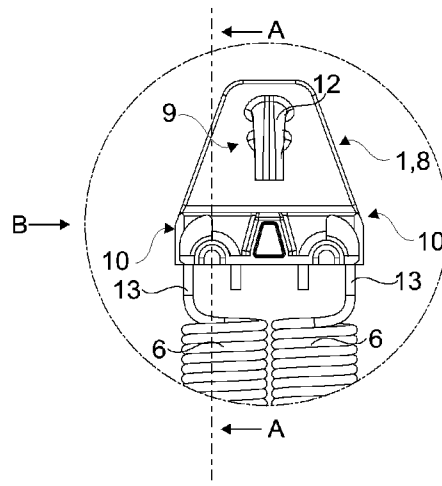


Fig. 12

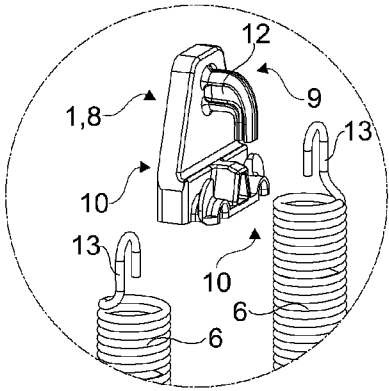


Fig. 13

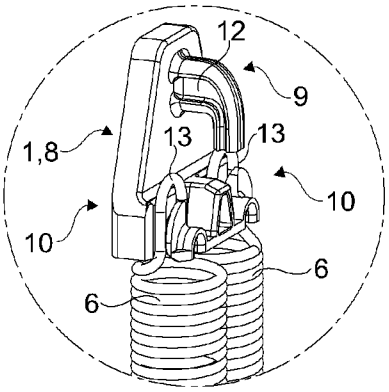


Fig. 14

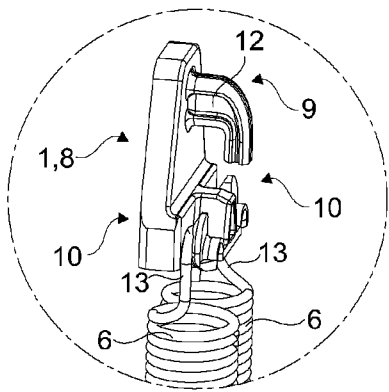


Fig. 15

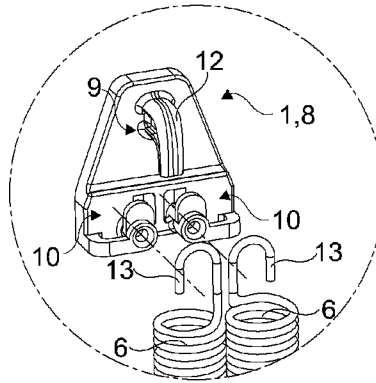


Fig. 16

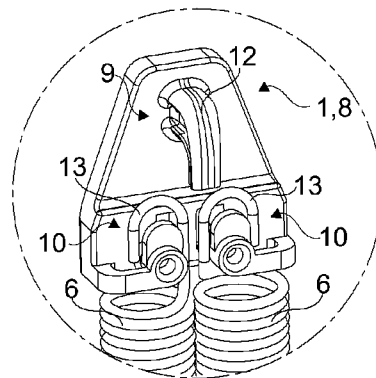


Fig. 17

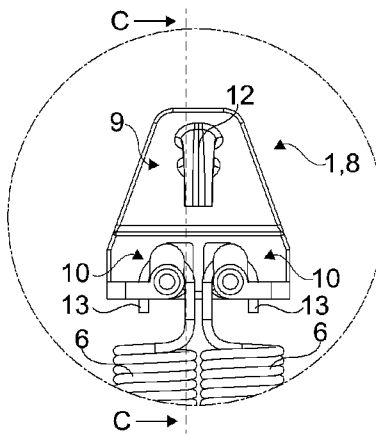


Fig. 18

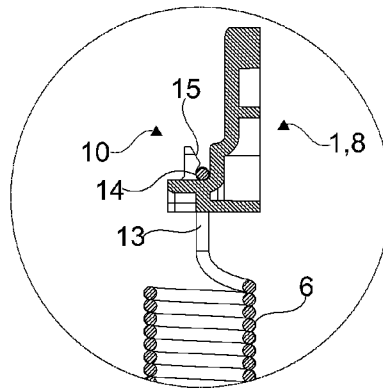


Fig. 19

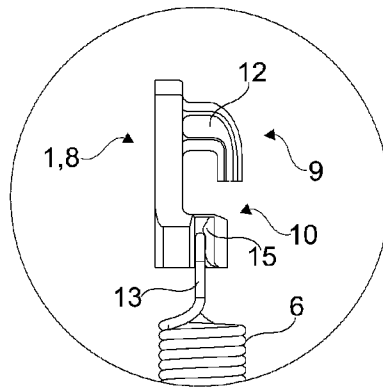
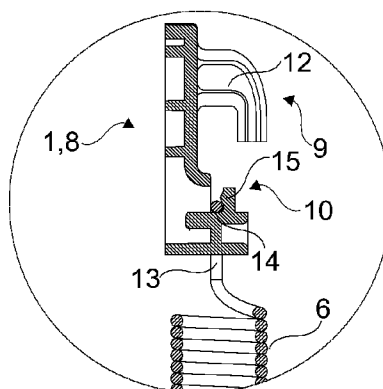


Fig. 20



INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2014/078258

A. CLASSIFICATION OF SUBJECT MATTER
INV. A47L15/42 E05F1/10
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	WO 2006/137039 A2 (ARCELIK AS [TR]; KESKIN OGUZCAN [TR]; SARI PELIN [TR]) 28 December 2006 (2006-12-28)	1,3,6,7, 11
Y	paragraph [0024]; figures 1,4	2,4,5, 8-10
X	----- DE 24 24 288 A1 (PHILIPS NV) 19 December 1974 (1974-12-19)	1,7,11
Y	page 3 - page 4; figures	3,6
Y	----- DE 10 2011 076205 A1 (BSH BOSCH SIEMENS HAUSGERAETE [DE]) 22 November 2012 (2012-11-22) paragraph [0044] paragraph [0051] - paragraph [0056]; figures 2,4	4,5,8-10
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Date of the actual completion of the international search

28 August 2015

Date of mailing of the international search report

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INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2014/078258

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