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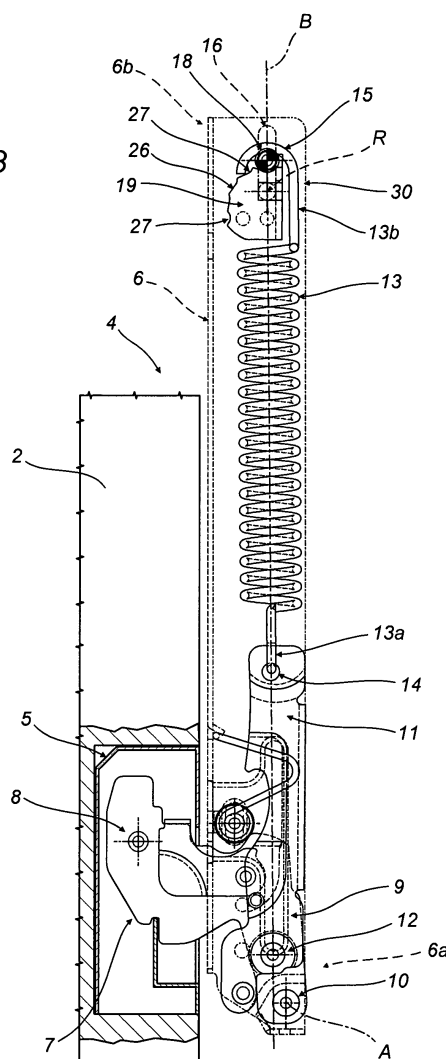
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(54) **Door hinge**

(57) A hinge (4) for doors (3), in particular the doors of domestic appliances (1) such as ovens, dishwashers or the like, comprises: a first box-shaped structure (5) attachable to a frame (2); a second box-shaped structure (6) attachable to the door (3) and extending principally in a direction (B); a lever (7) connecting the first and second structures (5, 6) to each other, the second structure (6) being pivoted on a pin (10) connected to the lever (7) and being able to be tilted about said pin (10) at least between a closed position and an open position of the door 3; a spring (13) connected to the second box-shaped structure (6) and designed to be elastically deformed in such way as to produce an elastic reaction that opposes the opening of the door (3); and means (30) for adjusting the elastic reaction.

FIG. 3



Description

[0001] The present invention relates to a door hinge, in particular a hinge used for connecting the doors of domestic appliances, such as ovens, to the respective supporting structures.

[0002] This specification describes the present invention with reference to an oven purely by way of example and without restricting the scope of the inventive concept.

[0003] Hinges of this type normally consist of two parts, both having a box-shaped structure and being kinematically linked to each other.

[0004] More specifically, the first part is fixed to one side of the oven opening, whilst the second part is fixed to an edge of the oven door which can thus be tilt opened with respect to the opening.

[0005] Between the box-shaped structures there is an operatively interposed lever with one end rigidly linked to the first box-shaped structure and a second end pivoted to the second box-shaped structure by means of a pin.

[0006] When the door is turned in either direction in order to open or close it, the second box-shaped structure rotates about the pin, which thus defines a pivot axis for the door itself.

[0007] The lever is operated upon by elastic elements positioned between it and the box-shaped structure connected to the door.

[0008] More specifically, the elastic elements operate between this box-shaped structure and a rod located inside it. The rod is pivoted to the lever by its free end, that is to say, the end that does not interact with the elastic elements.

[0009] During the rotation of the door about its pivot axis, the aforementioned elastic elements oppose first the movement of the door away from the oven structure and then the rotation of the door and its consequent lowering to the position in which the oven door is fully open. Hinges of this type therefore continuously exert on the door a force that tends to keep it in the position in which the oven opening is closed.

[0010] The downward turning of the door, under the combined action of its weight, which tends to pull it downwards, and of the elastic elements, which oppose this downward pulling action, is thus slowed and the door opens gradually.

[0011] In the configuration in which the door is fully open, the torque exerted by the weight of the door is balanced by the torque exerted by the elastic elements, thus creating a condition of equilibrium which makes the configuration stable.

[0012] Prior art hinges of the type described above had one drawback and this was that, in order to adapt the hinges to doors of different sizes and weights, the elastic elements had to be substituted to enable a hinge on a door of a given size and weight to reach the condition of equilibrium.

[0013] To overcome the above mentioned drawback, this applicant proposed a hinge in which the elastic elements, consisting of a helical spring, had built-in screw adjustment means designed to vary its pre-loading condition by changing the axial extension of the spring.

[0014] These adjustment means, however, are not free of disadvantages.

[0015] One of these disadvantages is the fact that the adjustment screw has to be turned a large number of times to make even the smallest change to the axial extension of the spring. This is because, for stability the adjustment screw has to have a very fine thread, which means that each turn of the screw results in a minimal forward movement of the screw in an axial direction.

[0016] Moreover, the adjustment made using a screw tends to be unsteady, which means that, after some time, the initial adjustment is lost and the hinge has to be readjusted.

[0017] Another disadvantage connected with the use of a screw to adjust the hinge is that the adjustment is a highly time-consuming task and is difficult to repeat from one hinge to the next. This constitutes a particularly serious drawback since doors usually have two hinges and a system of forces that is not perfectly balanced eventually and inevitably leads to problems opening and closing the doors.

[0018] The present invention has for an aim to overcome the above mentioned disadvantages by providing a door hinge that has a simple structure and that is practical and easy to adjust.

[0019] The technical characteristics of the invention according to the aforementioned aim may be easily inferred from the contents of the appended claims, especially claim 1, and preferably any of the claims that depend, either directly or indirectly, on claim 1.

[0020] Further, the advantages of the invention are apparent from the detailed description which follows, with reference to the accompanying drawings which illustrate preferred embodiments of the invention provided merely by way of example without restricting the scope of the inventive concept, and in which:

- Figure 1 is a schematic perspective view from above of an oven with a door connected to it by two hinges made in accordance with the present invention;
- Figure 2 is a schematic perspective view, with some parts cut away and others transparent in order to better illustrate others, of a preferred embodiment of a hinge according to the present invention;
- Figure 3 is a schematic side elevation view, with some parts transparent in order to better illustrate others, of a hinge according to the present invention;
- Figures 4 to 6 are perspective views, with some parts cut away, of three different configurations in which the hinge shown in the illustrations listed above is used.

[0021] The numeral 1 in Figure 1 denotes in its entirety an oven comprising a frame 2 to which a door 3 is connected by two hinges 4 which enable it to be rotated downwards about a first horizontal axis A.

[0022] With reference to Figures 2 and 3, each of the two hinges 4 comprises a first box-shaped structure 5 connected to the frame 2 of the oven 1 and a second box-shaped structure 6 connected to the door 3. The first and the second box-shaped structure 5 and 6 are kinematically connected by a connecting lever 7.

[0023] The second box-shaped structure 6 has a substantially C-shaped cross section and extends lengthways along an axis B which hereinafter also denotes the principal axis along which the second structure 6 extends.

[0024] The connecting lever 7 comprises a first arm 8, designed to be rigidly connected to the first box-shaped structure 5, and a second arm 9 connected to the second box-shaped structure 6.

[0025] For connecting the second arm 9 and the second box-shaped structure 6 to each other, the hinge 4 comprises a first pin 10 passing through a respective hole made in the end of the second arm 9 itself and being coaxial with the axis A.

[0026] The hinge 4 also comprises a rod 11 positioned lengthways within the second structure 6 and connected to a lower end of it 6a by a second pin 12 parallel to the pin 10 and passing through a respective hole made in an intermediate section of the second arm 9 of the lever 7.

[0027] Inside the second box-shaped structure 6 there is a helical spring 13 extending lengthways in line with the rod 11, parallel to the axis B and operating by traction, as described in more detail below.

[0028] The helical spring 13 is connected by a first, lower end of it 13a to a hole 14 made in the rod 11, and by a second, upper end of it 13b, longitudinally opposite the first, lower end 13a, to a hooking element 15 located at the upper end 6b of the second box-shaped structure 6.

[0029] As illustrated in detail in Figure 4, the hooking element 15 of the spring 13 has two longitudinally opposite ends 15a, 15b which slidably engage with two respective slots 16 made in two opposite side walls 17a, 17b of the second box-shaped structure 6, said side walls defining the C shape of the structure 6 itself.

[0030] The slots 16 extend lengthways in a direction parallel to the axis B of the second box-shaped structure 6.

[0031] At the ends 15a, 15b, the hooking element 15 has two respective portions 18 that are larger than the central body of the element 15, these larger portions being designed to keep it stably engaged with the slots 16.

[0032] Between the helical body and the upper end 13b of the spring 13, the hinge 4 comprises a cam-like member 19.

[0033] The cam-like member 19 comprises a central body 20 and two wings 21a, 21b extending in a direction

parallel to the side walls 17a, 17b of the second box-shaped structure 6.

[0034] The central body 20 has fixed to it a third pin 22 positioned transversely of the aforementioned axis B and having two longitudinally opposite cylindrical ends 22a, 22b, each designed to rotatably engage a lower, rounded area of a respective slot 16.

[0035] The central axis R of the third pin 22 defines an axis of rotation for the cam-like member 19. The cam-like member 19 is thus pivoted to the second box-shaped structure 6.

[0036] At each of the ends 22a, 22b of the third pin 22, there is a respective polygonal control head 23 designed to be engaged by a respective tool 24 shaped to match it.

[0037] Each control head 23 is positioned outside the respective side wall 17a, 17b of the second box-shaped structure 6 so that it can be easily accessed by the tool 24.

[0038] Each of the control heads 23 constitutes a respective actuating element 25 for rotationally driving the cam-like member 19 about the axis B.

[0039] Each of the wings 21a, 21b of the cam-like member 19 has an eccentric profile 26. The eccentric profile 26 of each wing 21a, 21b presents a plurality of recesses 27 for accommodating one of the opposite longitudinal ends 15a, 15b of the hooking element 15.

[0040] As illustrated in Figures 4, 5 and 6, the recesses 27 on the eccentric profile 26 are arranged in succession at increasing radial distances from the axis of rotation R of the cam-like member 19. In other words, the recesses 27 are made one after the other and, on account of the eccentricity of the profile 26, are located at different distances from the axis R. Thus, if we consider the first recess to be the one located nearest the axis R, the other recesses are located further and further from the axis R.

[0041] As shown in Figures 5 and 6, the central body 20 of the cam-like member 19 has an opening 28 made in it to enable the cam-like member 19 to rotate without interfering with the upper end 13b of the spring 13.

[0042] The slots 16 constitute respective guide means 29 enabling the hooking element 15 to vary its position relative to the second box-shaped structure 6 in a direction parallel to the axis R.

[0043] The cam-like member 19 constitutes, for the hinge 4, together with the slidable hooking element 15, means 30 for adjusting the elastic reaction of the spring 13.

[0044] The spring 13 constitutes, for the hinge 4, an elastic element 31 designed to produce a reactive force opposing the opening of the door 3.

[0045] During use, with reference to European patent No.02425779.2 granted to this Applicant and totally incorporated herein by reference, when the door 3 is pulled by a user, starting from a condition in which the door 3 itself is closed, not illustrated in the accompanying drawings, the hinges 4 cause the door 3 to turn rel-

atively rapidly in the opening direction through a predetermined angle and then to gradually slow down the rotational movement until the door 3 reaches the fully open position illustrated in Figure 1.

[0046] The door 3, under the action of its weight, which tends to tilt it downwards, combined with the opposing braking action due to the moment M1 of force applied by the helical spring 13 completes its rotational opening motion gradually to reach the position illustrated in Figure 1.

[0047] The moment M1 is generated by the elastic reaction applied by the spring 13 as a result of the deformation of the spring 13 during the opening motion of the door 3.

[0048] For adjusting the intensity of the moment M1 and, hence, of its braking action on the door 3, as a function of the properties of the spring 13 and as a function of the weight and size of the door, the invention contemplates the provision of the aforementioned means 30 for adjusting the intensity of the elastic reaction of the spring 13.

[0049] More specifically, the means 30 comprise the cam-like member 19 which, by rotating about its axis R, makes it possible to vary the relative position between the hooking element 15 and the second box-shaped structure 6.

[0050] Considering the lower end 13a of the spring 13 to be substantially fixed since it is attached to the rod 11, while, on the contrary, the upper end 13b is hooked to the element 15, the variation in the position of the hooking element 15 changes the longitudinal extension of the spring 13 along its axis B.

[0051] As is known, the intensity of the elastic reaction of a spring is a function of the elastic constant of the spring itself, as well as of the deformation to which the spring is subjected. In the embodiment illustrated, the helical spring 13 extends lengthways and the deformation to which it is subjected results in its elongation along the axis B.

[0052] More specifically, by using the tool 24 to engage one of the two control heads 23 of each hinge 4, it is possible to turn the cam-like member 19 about its axis R causing it to adopt a plurality of possible different positions.

[0053] The eccentric profile 26 of the cam-like member 19 engages the hooking element 15 and produces the positive movement of the element 15 itself in a direction V along the axis B.

[0054] At each of the aforementioned possible positions, the ends 15a and 15b of the hooking element 15 are securely accommodated in two respective recesses 27 of the eccentric profiles of the two wings 21a, 21b of the cam-like member 19.

[0055] The force of the spring 13 holds the hooking element 15 securely in contact with recesses 27.

[0056] In conclusion, by simply adjusting the cam-like member 19, it is advantageously possible to adjust, effectively and rapidly, the elastic reaction of the spring 13

and, consequently, the intensity of the moment M1 and of its braking action on the door 3.

[0057] Figures 4, 5 and 6 show three different adjustments of the spring 13.

[0058] Furthermore, the adjustment is advantageously extremely stable and not subject to unwanted changes.

[0059] Another advantage achieved by the present invention is that by simply providing the side walls 17a, 17b with a reference scale T, the hinge adjustment can be repeated exactly on a plurality of hinges. Thus, for example, the scale T can be used to quickly and easily adjust both the hinges 4 of the oven 1 by aligning the respective hooking elements 15 with the same mark on each of the reference scales T.

[0060] Furthermore, the ease with which they can be adjusted makes the hinges according to the invention, advantageously, especially suitable for use on the doors of dishwashers, particularly fitted dishwashers, which are often covered with panels made of any of a wide range of materials and which thus vary greatly in weight.

[0061] The invention described has evident industrial applications and can be subject to modifications and variations without thereby departing from the scope of the inventive concept. All the details of the invention may be substituted by technically equivalent elements.

Claims

1. A hinge for doors (3), in particular for domestic appliances (1) such as ovens, dishwashers or the like, of the type comprising:
 - a first box-shaped structure (5) attachable to a frame (2);
 - a second box-shaped structure (6) attachable to the door (3) and extending principally along an axis (B);
 - a lever (7) connecting the first and second structures (5, 6) to each other, the second structure (6) being pivoted on a pin (10) connected to the lever (7) and being able to be tilted about said pin (10) at least between a closed position and an open position of the door (3);
 - at least one elastic element (31) operatively connected to the second box-shaped structure (6) and designed to be elastically deformed in such way as to produce an elastic reaction that opposes the opening of the door (3); and
 - means (30) for adjusting the intensity of the elastic reaction, the hinge being **characterised in that** the adjustment means (30) comprise a cam-like member (19) designed to adopt a plurality of different positions each corresponding to a different deformed configuration of the elastic element (31).

2. The hinge according to claim 1, where the elastic element (31) is a helical spring (13) extending lengthways in a direction parallel to the principal axis (B) along which the second box-shaped structure (6) extends, the hinge being **characterised in that** the cam-like member (19) operatively engages the helical spring (13) and is designed to modify the latter's longitudinal extension. 5
3. The hinge according to claim 2, **characterised in that** the cam-like member (19) is pivoted on the second box-shaped structure (6) and is rotatable about a respective axis of rotation (R) that is substantially perpendicular to the axis (B) along which the second structure (6) itself extends. 10 15
4. The hinge according to claim 2 or 3, **characterised in that** it comprises an element (15) for hooking the spring (13), said hooking element (15) being slidably engaged with respective guide means (29) made on the second box-shaped structure (6) so as to vary its position along the principal axis (B) of extension. 20
5. The hinge according to claim 4, **characterised in that** the cam-like member (19) comprises at least one eccentric profile (26) designed to engage the hooking element (15) to produce the positive movement of the element (15) itself in a direction (V) along the principal axis (B) of extension. 25 30
6. The hinge according to claim 5, **characterised in that** the eccentric profile (26) of the cam-like member (19) comprises a plurality of recesses (27) for accommodating a portion (15a, 15b) of the hooking element (15), which are held securely in said recesses by the elastic reaction applied by the spring (13). 35
7. The hinge according to claim 6, **characterised in that** the recesses (27) are made in the profile (26) and are arranged in succession at increasing radial distances from the axis of rotation (R). 40
8. The hinge according to any of the foregoing claims from 1 to 7, **characterised in that** the adjustment means (30) comprise an actuating element (25) for rotationally driving the cam-like member (19). 45
9. The hinge according to claim 8, **characterised in that** the actuating element (25) comprises a control head (23) positioned at least partially outside the second box-shaped structure (6) and designed to engage with a respective tool (24). 50 55
10. A door, in particular for domestic appliances such as ovens, dishwashers or the like, **characterised in that** it comprises at least one hinge (4) made according to any of the foregoing claims from 1 to 9.

FIG. 1

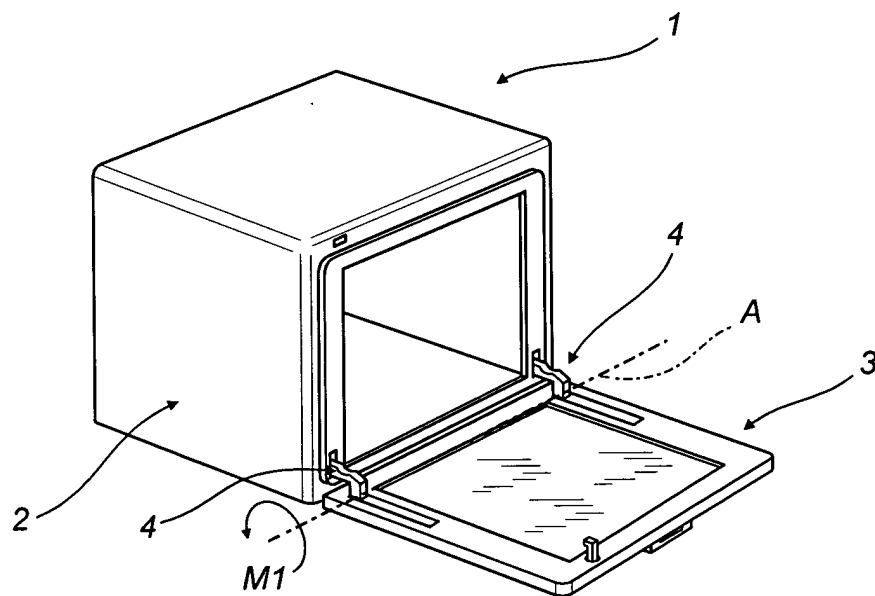


FIG. 2

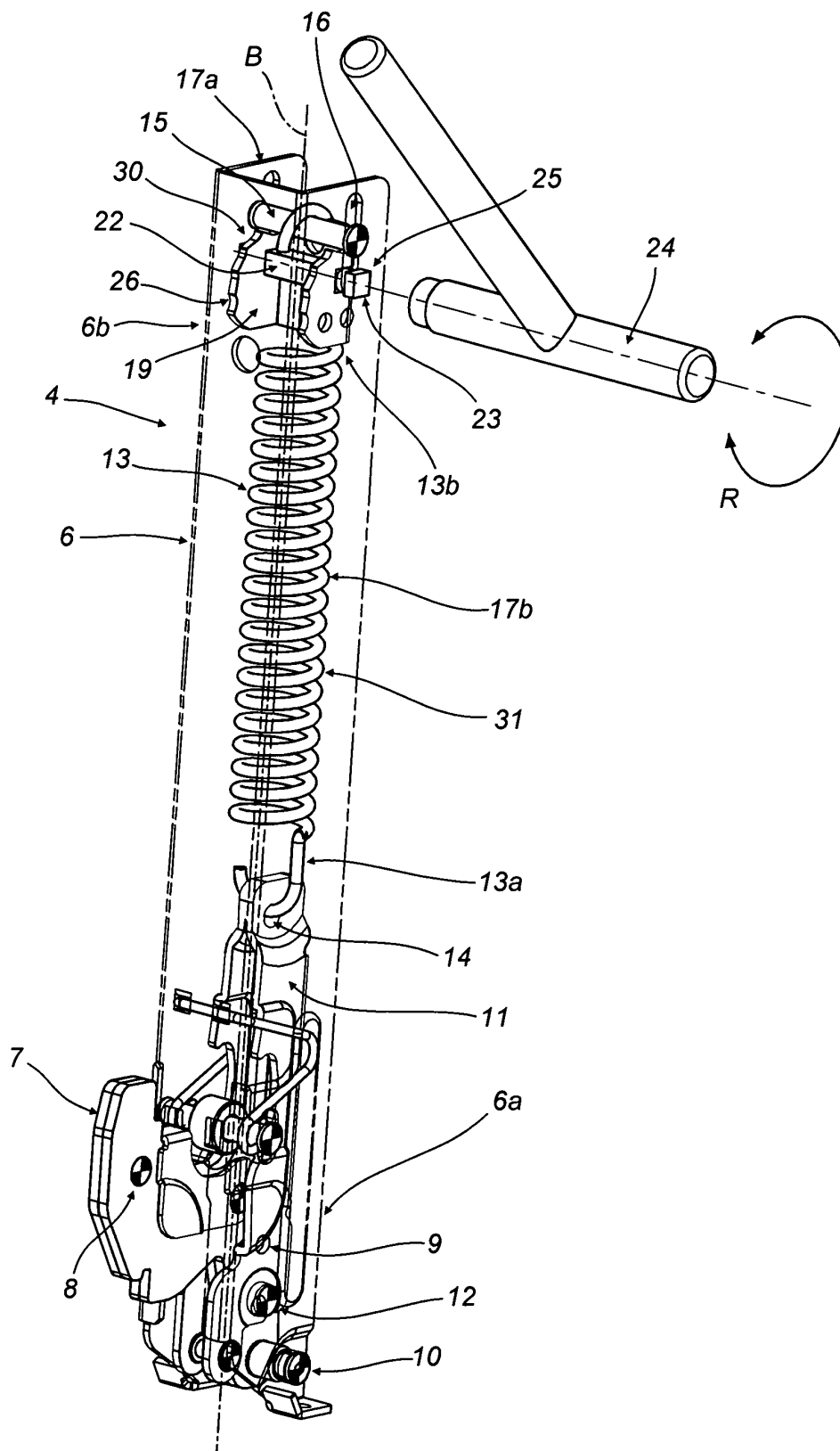


FIG. 3

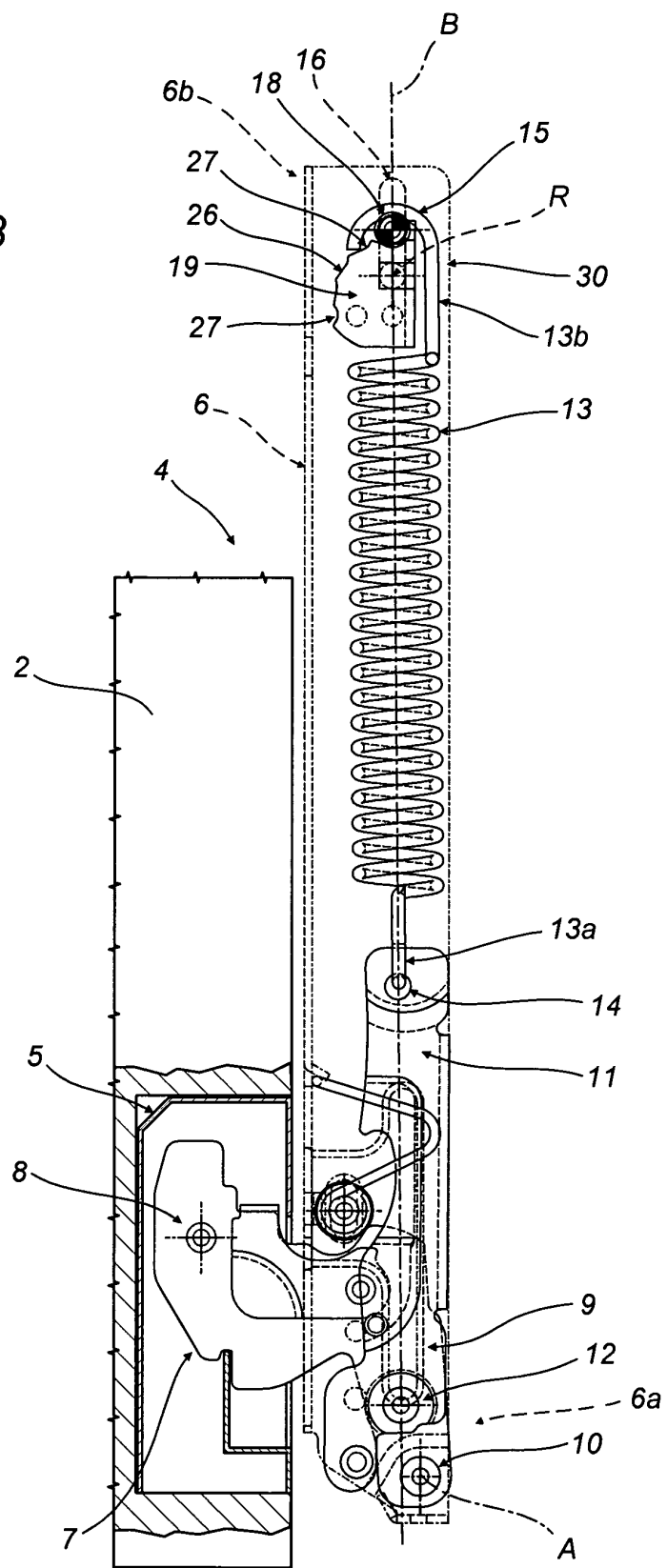


FIG. 4

