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(54) Device for balancing the door of a dishwasher appliance

(57) The balancing device (1) is connected to the door (2) of a dishwasher appliance provided with a casing (3), and comprises a single spring (5) for compensating the door weight "G", and two identical tensioning assemblages (7-11) secured symmetrically on the two side walls of the casing (3), having a respective cord (7) connected to each door side hinge (4). The spring (6) occupies the space below the door (2) not supported, and it is kept in a horizontal position extended in a direction parallel to the door swivel pin (5). Transmission of the spring force F_s in a given direction (14) transverse to the swivel pin (5), is achieved by a respective tensioning plate (8), which is formed by a piece (8a) secured to the casing (3) and a movable piece (8b) provided with a sliding surface (9) for tensioning the cord (7), which is guided and kept oriented towards the corresponding end of the spring (6) coaxially.

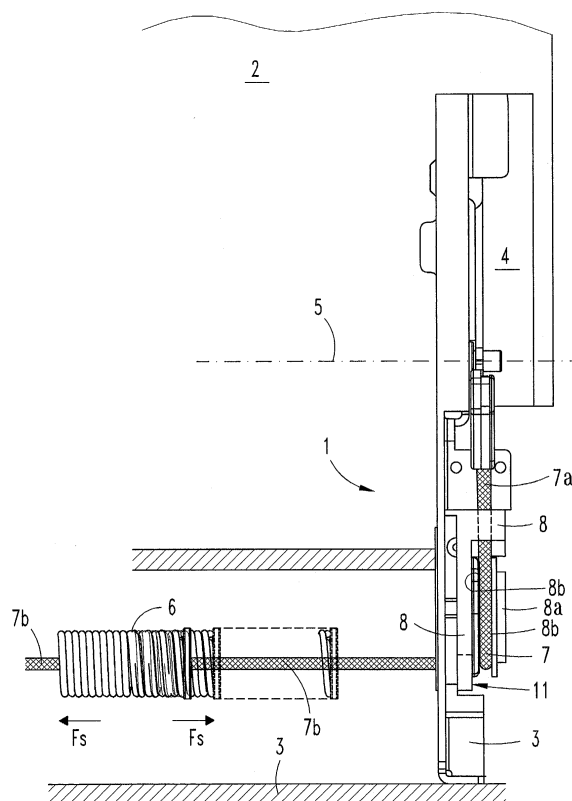


FIG. 2

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Description

[0001] The present invention is related to a spring device connected to the hinge of a fold-down door on a household dishwasher appliance, for balancing the opening of the door.

PRIOR ART

[0002] On a dishwasher appliance with a front fold-down door, the door hinge has a horizontal swivel pin at the bottom of the door and its opening is balanced by means of a device provided with a mechanism of two coil springs anchored to the casing walls. The weight of the door varies from one appliance to another depending on whether it has a cover panel or not and the device for balancing the opening of the door is the same on all appliances of all types, a compensation spring being connected at each of the two side walls from the casing of the appliance to the door hinge, each by means of a respective transmission cord, with the assistance of a means for the initial adjustment of each of the two springs, or prior spring tensioning. The balancing device has to compensate the moment of the weight of the door and of its cover panel in order to keep the door open at any angular opening position.

[0003] The dishwasher appliance described in US-A-5980006 contains the combination of the components described in the preamble of claim 1. The balancing device belonging to the prior art comprises various parts that are complicated to mount for the transmission and adjustment of the pre-tension of the springs mechanism, which is fitted occupying a space on the both side walls of the appliance. The installation of the prior art balancing device including two compensation springs supported by the casing requires the prior fitting of the door and subsequently the fitting of a spring on either opposite side of the casing. This succession of fitting operations is a drawback for manufacture and generates an additional economic cost, since for the installation of both springs, the appliance casing has to be turned over and re-oriented in relation to the position of the working person. Further, for the replacement of the spring when it breaks due to continual use it is necessary to remove the side wall panel from the appliance in order to gain access to the spring housing.

DISCLOSURE OF THE INVENTION

[0004] The object of the invention is a device for balancing the opening of a fold-down door of a household dishwasher appliance, attenuating the door opening movement by means of a single door weight compensating helical spring connected to a horizontal swivel pin hinge, as defined in claim 1.

[0005] The balancing device according to the invention uses flat-shaped moulded parts, thereby facilitating the assembling of the device and its fitting on the casing

of the appliance, and it uses a single compensation spring, which extends inside the casing parallel to the door swivel pin. The single spring installed in this way is held without support, by being pulled from either end in opposite directions by two transmission cords. The balancing device offers an advantage for the assembly of the dishwasher appliance, since, as it consists of a single spring in an internal front location, its installation is done entirely in the same stage as the rest of the internal components from the upper opening in the casing, without movable or turning the appliance over, while the door is fitted at the final stage of assembly. For the subsequent replacement of the spring access is gained easily to the spring housing from the front of the appliance.

DESCRIPTION OF THE DRAWINGS

[0006]

FIG. 1 is a sectional side view of a dishwasher appliance with a fold-down door and with a door balancing device connected by way of the hinge.

FIG. 2 is a sectional view from the rear of the dishwasher appliance of FIG. 1.

FIG. 3 is a diagram showing the nominal characteristic of the balancing device traction spring of FIG. 1 compared with the door weight moment.

DESCRIPTION OF AN EMBODIMENT OF THE INVENTION

[0007] In reference to FIG. 1-3 a balancing device 1 according to the invention is connected to a door 2 of a dishwasher appliance provided with a dishwasher casing 3, the door being fold-down at the front by means of a door hinge 4 fitted with a swivel pin 5. During opening the weight "G" of the door 2 generates a moment M_g shown in FIG. 3 in respect of pin 5, depending on the angle "A" of opening from a vertical plane of angle $A=0^\circ$ to a horizontal plane of angle $A=90^\circ$. The balancing device 1 comprises a single compensation spring 5 for attenuating the door opening movement "A", the moment M_g of the door 2 being compensated by means of the moment M_s of the force F_s of spring 5, in respect of pin 5 too.

[0008] The balancing device 1 comprises a single helical compensation spring 6 and two identical tensioning assemblages 7-11 made of moulded plastic, secured respectively in a symmetrical manner on two opposite side walls of the casing 3. Each of these symmetrical tensioning assemblages 7-11 comprises a cord 7 with an end 7a connected to one of the two side hinges 4 for transmitting a force F_s of spring 6 to door 2 in a given direction 14 (FIG. 1) on a plane transverse to the swivel pin 5, and a flat plate 8 provided with an arched sliding surface 9 wound by said cord 7 for tensioning the spring 6 proportionately the opening angle A, a surface 11 for guiding the opposite end 7b of the cord 7 for its connection

tion to an end of spring 6, oriented coaxially with the latter, and an adjustment component 8-10 for pre-setting the spring 6, which includes an adjusting screw 10 accessible from the outside of the casing 3-

[0009] The helical spring 6 is not supported and it is kept in a horizontal position extended in a direction parallel to the swivel pin 5, occupying the space below the door 2. The tensioning assemblage 7-11 comprises said tensioning plate 8, which is formed by a part piece 8a secured to the casing 3 and a movable part piece 8b provided with said tensioning surface 9 on which it is guided and kept within a plane according to a direction 13 (FIG. 1) transverse to the swivel pin 5 and to the spring 6. The plate's movable piece 8b is guided between two outer walls of the plate's fixed piece 8a. The guiding surface 11 is formed on the fixed piece 8a, and it has a round edge 11a surrounded by the cord 7 to direct the cord end 7b towards the corresponding end of the spring 6 coaxially.

[0010] The tensioning plate's movable piece 8b on which cord 7 slides is guided within the fixed piece 8a and pushed in a direction 13 transverse to the swivel pin 5 by the adjusting screw threaded into a casing wall. In an initial adjusting operation, the spring 6 is set with a pre-tension for each appliance in accordance with weight "G" of the door 2 plus its cover panel, by means of the forward movement of the adjusting screw 10 which displaces the movable part 8b a separation distance "d" in said direction 13. This movement "d" of the tensioning surface 9 is done with the door 2 closed and provides the spring 6 with a pre-tension, which modifies the characteristic curve during travel "A" of the resultant moment M_s of spring 6, between two curves of values M_s (max) and M_s (min), as is shown in FIG.3.

[0011] According to one embodiment of the invention, spring 6 is 180 mm long and the displacement "d" of the tensioning surface 9 in relation to the fixed part 8a for the pre-adjustment is 10 mm. The curve of the resultant pre-setting moment M_s coincides with or intersects the curve of moment M_g in an angular position $A=70^\circ$ of door 2, with a value for instance of 35 N.m (FIG.3), so that it completes its full opening $A=90^\circ$ due to the weight "G" of the door 2 only, without the user's intervention. The mismatch between the values of both moments M_g and M_s is compensated by means of a braking effect produced by the guiding surface 11a when the cord 7 changes from transverse to axial orientation in relation to spring 6, this braking force being added to the force of spring 6 so that it thereby balances the weight G of the door 2.

ing the door weight (G) housed inside the casing 3, wherein the balancing device (1) comprises two tensioning assemblages (7-11) attached symmetrically on each of the side walls of the casing (3), and connected to a respective door side hinge (4) provided with a horizontal swivel pin (5), by means of a respective cord (7) for transmitting a moment (M_s) of the force of the springs mechanism (6) to both door hinges, attenuating the opening movement of the door (2), and with means (8-10) for setting the pre-tension of the spring device (6), including a sliding arched surface (9) for tensioning each cord (7), and means (8,9,11) for guiding the cord (7) at its respective ends (7a, 7b) for connection to the hinge (4) and to the springs mechanism (6), **characterised in that** the balancing device (1) with the springs mechanism (6) for compensation is made up of a single reaction spring (6) housed in an inner space between both side walls of the casing (3), and it is kept extended horizontally in a direction parallel to the swivel pin and tensioned between two ends (7b) of both transmission cords (7), and **in that** said guide means (8,9,11) comprise a guide plate (8) for tensioning the cord (7) provided with a surface (11) for guiding the cord (7), supplying an orientation coaxial with the spring (6) for its connection thereto at one end (7b) of the cord.

2. A device for balancing the opening (A) of a door (2) according to claim 1, **characterised in that** said means (8-10) for setting the pre-tension of the spring (6) comprise said guide plate (8) with a movable piece (8b) provided with a surface (9) for tensioning the cord (7) which is slidable for a separation distance (d) from a fixed piece (8a) belonging to the guide plate (8) in a direction (13) transverse to the swivel pin (5).
3. A device for balancing the opening (A) of a door (2) according to claim 1, **characterised in that** said cord tensioning plate (8) is provided with a guiding surface (11b), supplying at one end (7b) of the cord (12) an orientation in relation to the spring (6) for generating cord braking friction and counteracting the opening (A) of the door (2).

Claims

1. A device for balancing the opening (A) of a fold-down door (2) of a household dishwasher appliance adapted to an appliance casing (3), by means of a mechanism of reaction springs (6) for compensat-

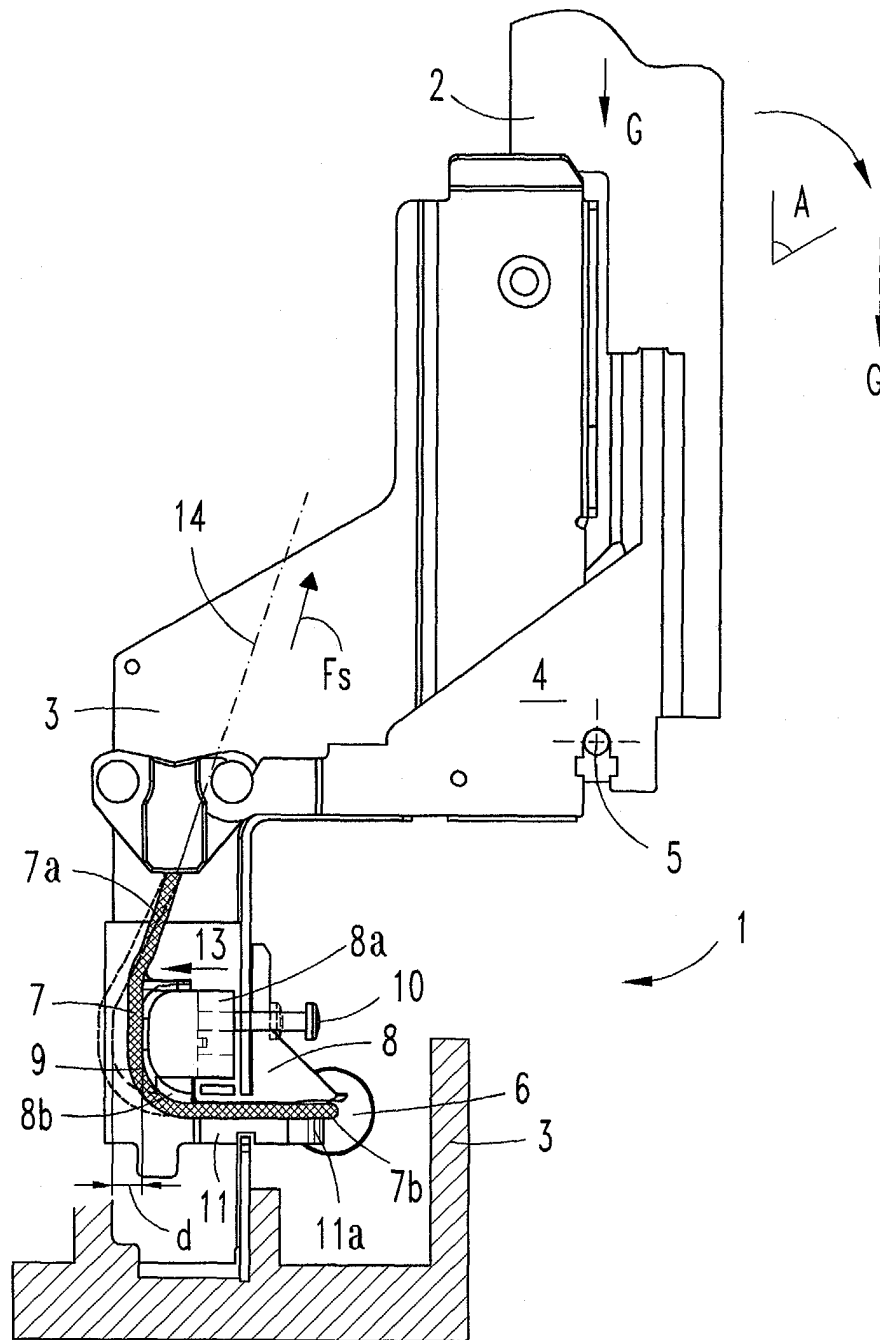


FIG. 1

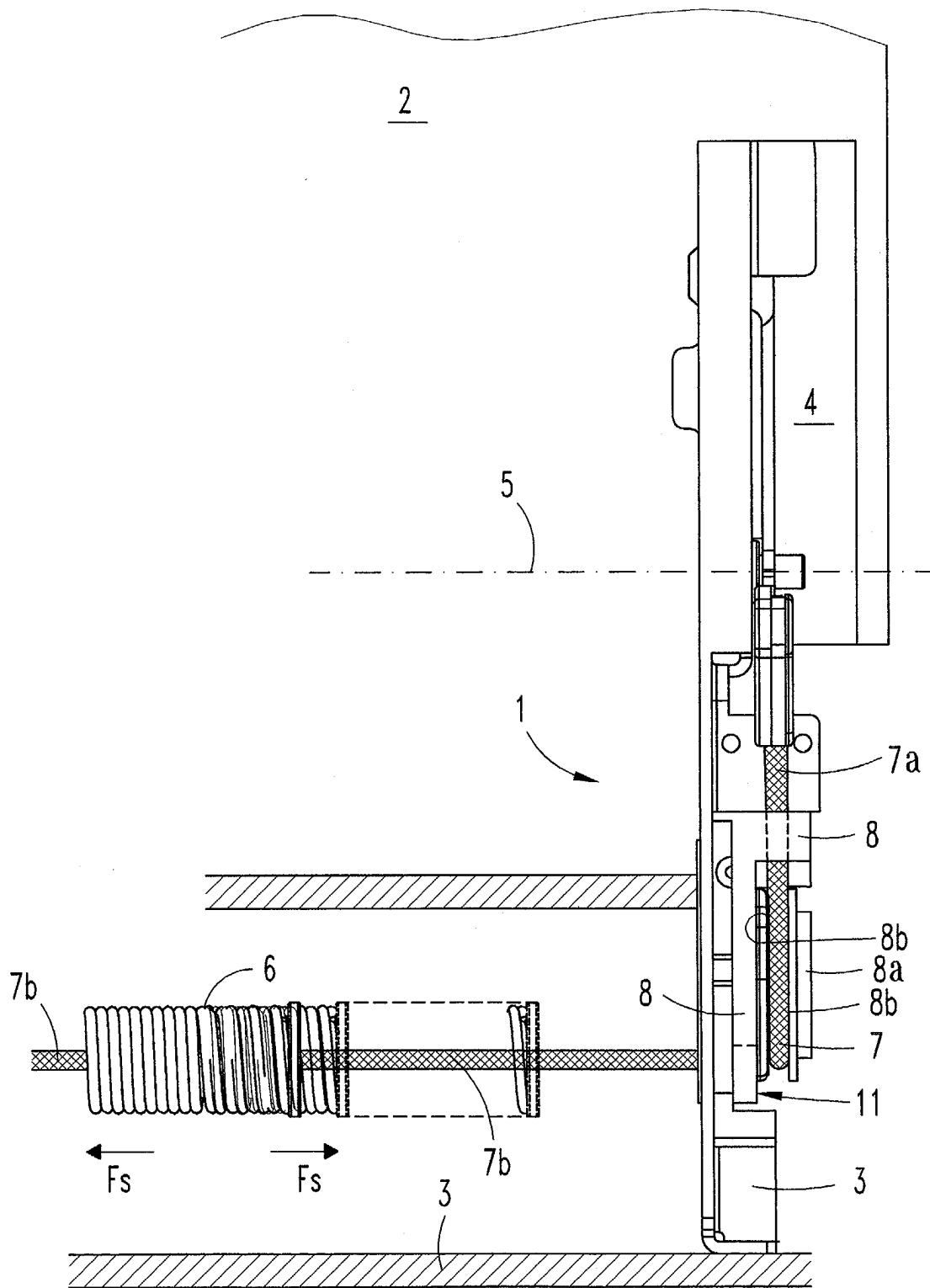


FIG. 2

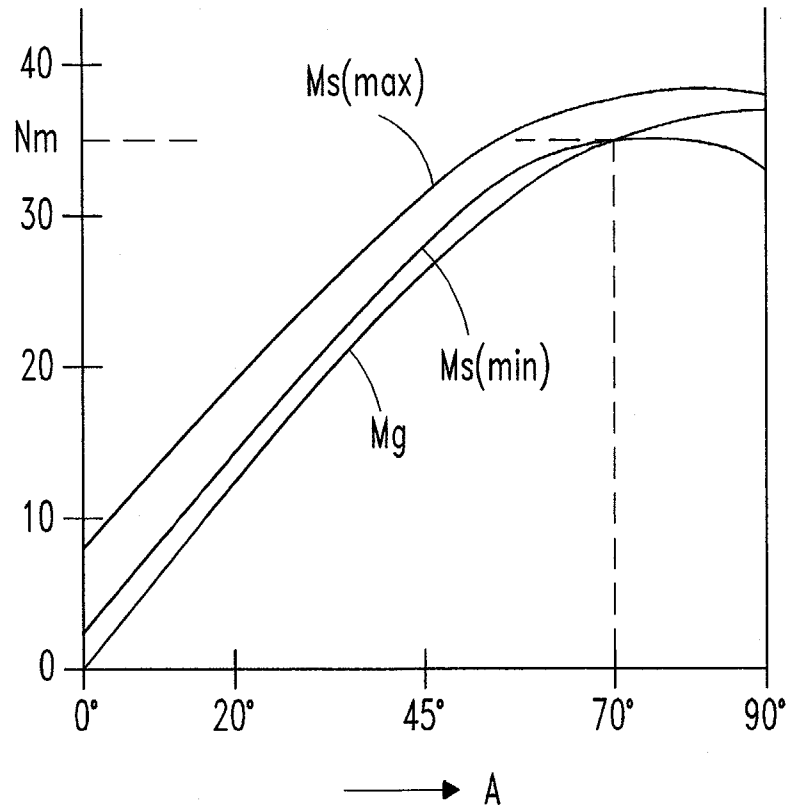


FIG. 3