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(54) **Dishwasher with automatic door-opening device**

(57) A dishwasher is provided with a bottom-hinged door that is kept closed by a pull lock (1) and with an automatic door-opening device comprising a pair of pushers (2) that act under the push of springs (3) having a force that is insufficient to overcome the resistance of

the pull lock (1). Said resistance is overcome by a pair of thermoactuators (6) that push the pushers (2) through rear rods (5) to unlock the pull lock (1), while the springs (3) only have to exert the much smaller effort of completing the opening travel by overcoming the rotational resistance of the door hinge.

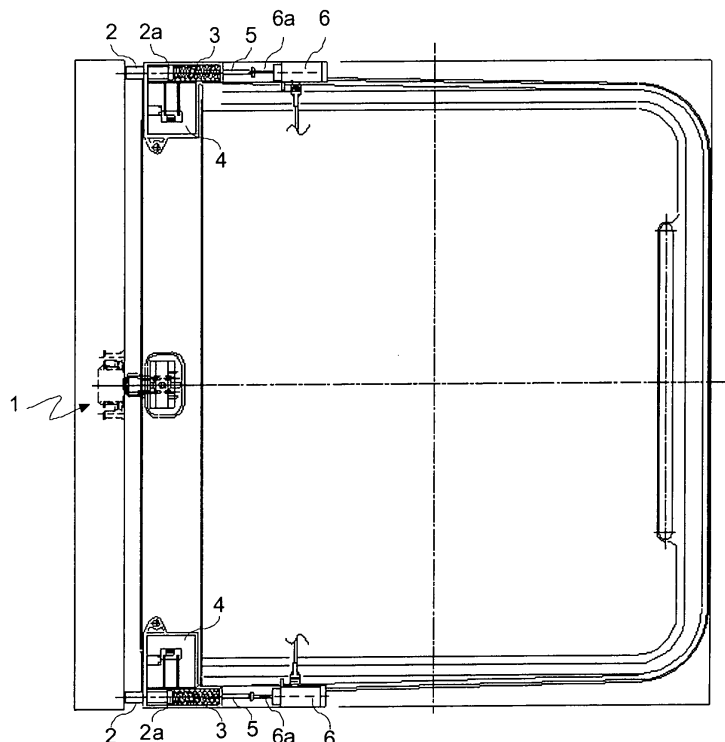


Fig.2

Description

[0001] The present invention relates to dishwashers, and in particular to a dishwasher provided with a device for the automatic opening of the door closed by a pull lock.

[0002] It is known that the opening of a dishwasher door can take place by means of different types of mechanism such as a lever lock, which requires the unlocking of a lever prior to opening the door, or a pull lock that only requires to pull the door with an adequate force in order to open it by overcoming the resistance of the pull lock. Furthermore, there are also dishwashers provided with devices for automatically opening the door that can be made in different ways, for example an unlocking coil that acts on a lever system like in EP 1935313, a motor driving a bracket connected to the lock like in DE 9421812U1, a spring that causes the extension of a telescopic pusher through a hydraulic piston like in DE 2405143 or a rack and pinion system that acts as a linear actuator like in EP 1733675.

[0003] The automatic door opening may be useful at the end of the wash cycle to show the user that the cycle is over, in particular in built-in dishwashers where the control/display panel is not visible when the door is closed, and also in some steps of the wash cycle to enhance the dishwasher performance, in particular in the drying step as disclosed in the above-mentioned application EP 1733675.

[0004] However, the above-mentioned prior art automatic opening devices are quite complicated and consequently rather expensive, bulky and unreliable.

[0005] The applicant has already devised and disclosed in EP 2210547 a simpler device consisting of a pair of pushers driven by relevant resilient members having a force sufficient to open the door by overcoming the resistance of the pull lock, as well as a pushers control mechanism mobile between a retention position and a release position according to the commands received from the dishwasher control unit

[0006] Although such a device is an improvement over the more complicated devices previously cited, it still has some drawbacks both in manufacturing and in operation. These drawbacks stem from the fact that the device must employ resilient members having a force sufficient to overcome the resistance of the pull lock by exerting on the pushers a push equivalent to the pull exerted by the user to manually open the door.

[0007] As a consequence, also the pushers control mechanism must exert a greater force that is sufficient to pull back the resilient members so as to allow the closure of the door and this implies the use of a motor of suitable power which therefore has a certain degree of bulkiness and cost. Moreover, when the device is in the pushers retention position and the resilient members are compressed, their strength is discharged on the device structure that must therefore be sufficiently robust in all its components and is in any case subjected to a continuous high stress that affects its reliability.

[0008] Therefore the object of the present invention is to provide a dishwasher provided with an automatic door-opening device which overcomes the above-mentioned drawbacks. This object is achieved by means of a dishwasher whose automatic door-opening device comprises one or more pushers driven in the first length of the opening travel by thermoactuators having a force sufficient to overcome the resistance of the pull lock and in the rest of the opening travel by resilient members. In this way, the thermoactuators exert the greater effort of overcoming the resistance of the pull lock whereas the resilient members only have to exert the much smaller effort of completing the opening travel by overcoming the rotational resistance of the door hinge.

[0009] The main advantage of the dishwasher according to the present invention is therefore that of having an automatic door-opening device in which the unlocking of the door is achieved through small and inexpensive means, while the resilient members even when compressed do not stress the device structure too much since they are much weaker with respect to those used in the device disclosed in EP 2210547.

[0010] A further significant advantage of this dishwasher is that the automatic door-opening device is extremely simple and consequently reliable and inexpensive, and its operation is very simple to be controlled by the control unit.

[0011] These and other advantages and characteristics of the dishwasher according to the present invention will be clear to those skilled in the art from the following detailed description of an embodiment thereof, with reference to the annexed drawings wherein:

Fig.1 is a diagrammatic top plan view, with some parts removed, of a dishwasher provided with an automatic door-opening device according to the present invention, in the condition of closed door;

Fig.2 is a view similar to the preceding one with the open door at the end of the opening travel of the thermoactuators; and

Fig.3 is a view similar to the preceding one with the open door at the end of the opening travel of the pushers and the thermoactuators returned to their rest position in order to allow to close the door.

[0012] Referring to said figures, there is seen that a dishwasher according to the present invention conventionally includes a bottom-hinged door that is kept closed by means of a pull lock 1, as well as an automatic door-opening device comprising a pair of pushers 2 located at the top corners of the door, perpendicularly thereto, and driven by a pair of coil springs 3 respectively arranged behind pushers 2 and compressed within suitable housings 4 secured on the dishwasher body.

[0013] Pushers 2 are slidably arranged in said housings 4 so as to project through the front side of the latter, and they are provided with rear flanges 2a preventing them from sliding out of housings 4. The movements of

pushers 2 are preferably guided also by a pair of rods 5 that extend backwards from pushers 2 and are slidably arranged in housings 4 so as to project through the rear side of the latter (springs 3 are slidably introduced on rods 5).

[0014] The novel aspect of the present invention resides in the presence of a pair of thermoactuators 6 arranged so as to act on the rear end of rods 5 to push forward pushers 2. It should be noted that in the closed door condition of Fig.1, where thermoactuators 6 are in the rest position, springs 3 are compressed but they are too weak to overcome the resistance of the pull lock 1 whereby the door remains closed, yet it is possible to open and close it manually.

[0015] The simple and effective operation of the automatic opening device of the dishwasher according to the present invention will be readily understood from the description given above.

[0016] As shown in Fig.2, when the dishwasher control unit activates thermoactuators 6, that exert a force greater than that required to unlock the pull lock 1, the extension of their stems 6a results in a push on rods 5 of pushers 2 which in turn causes the opening of the door. As soon as lock 1 is unlocked and thermoactuators 6 have reached the end of their opening travel, i.e. stems 6a are completely extended, the control unit that has detected the opening of the door (through a sensor that is not illustrated) deactivates thermoactuators 6.

[0017] The rest of the opening travel of pushers 2 until the position illustrated in Fig.3 is reached, with flanges 2a abutting on housings 4, is due to the push of springs 3 that make up for the short travel of thermoactuators 6. The latter, once deactivated, retract their stems 6a to the rest position so as to allow the manual closure of the door that, by pushing on pushers 2, causes the compression of springs 3 and returns rods 5 close to stems 6a.

[0018] It should be noted that thermoactuators 6 could act on pushers 2 even through means different from rods 5, which therefore could serve only as guiding members or be absent altogether. For example, thermoactuators 6 could be arranged parallel to pushers 2, rather than aligned behind them, such that stems 6a could act on lateral pins of pushers 2 projecting from housings 4 through suitable slots.

[0019] It is therefore clear that the above-described and illustrated embodiment of the dishwasher according to the invention is just an example susceptible of various modifications. In particular, the exact shape and arrangement of the members could be changed according to specific manufacturing needs, e.g. by using a different number of pushers arranged at different positions (starting from a single pusher at a central position), or by using mechanical equivalents of the above-described members such as a different type of resilient members with respect to springs 3, which could be arranged even outside housings 4, as long as the general structure of the automatic opening device is retained with the thermoactuators for unlocking the pull lock and the resilient mem-

bers for completing the travel of the pushers.

Claims

1. Dishwasher provided with a bottom-hinged door that is kept closed by a pull lock (1) and with an automatic door-opening device comprising one or more pushers (2) that act on said door under the push of resilient members, said automatic door-opening device being controlled by a control unit of the dishwasher, **characterized in that** said resilient members have a force that is insufficient to overcome the resistance of said pull lock (1) that is overcome by corresponding one or more thermoactuators (6) that act on said pushers (2) according to the commands received from said dishwasher control unit.
2. Dishwasher according to the preceding claim, **characterized in that** it includes a pair of pushers (2) located at the top corners of the door, perpendicularly thereto, and driven by a pair of coil springs (3) respectively arranged behind said pushers (2) and compressed within housings (4) secured on the dishwasher body, the pushers (2) being slidably arranged in said housings (4) so as to project through the front side of the latter and being provided with rear flanges (2a) preventing them from sliding out of the housings (4).
3. Dishwasher according to the preceding claim, **characterized in that** a pair of rods (5) extend backwards from the pushers (2) and are slidably arranged in the housings (4) so as to project through the rear side of the latter, the coil springs (3) being slidably introduced on said rods (5).
4. Dishwasher according to the preceding claim, **characterized in that** the thermoactuators (6) are aligned behind the pushers (2) and the rods (5) extend up to the proximity of the stems (6a) of the thermoactuators (6) when said stems (6a) are retracted.

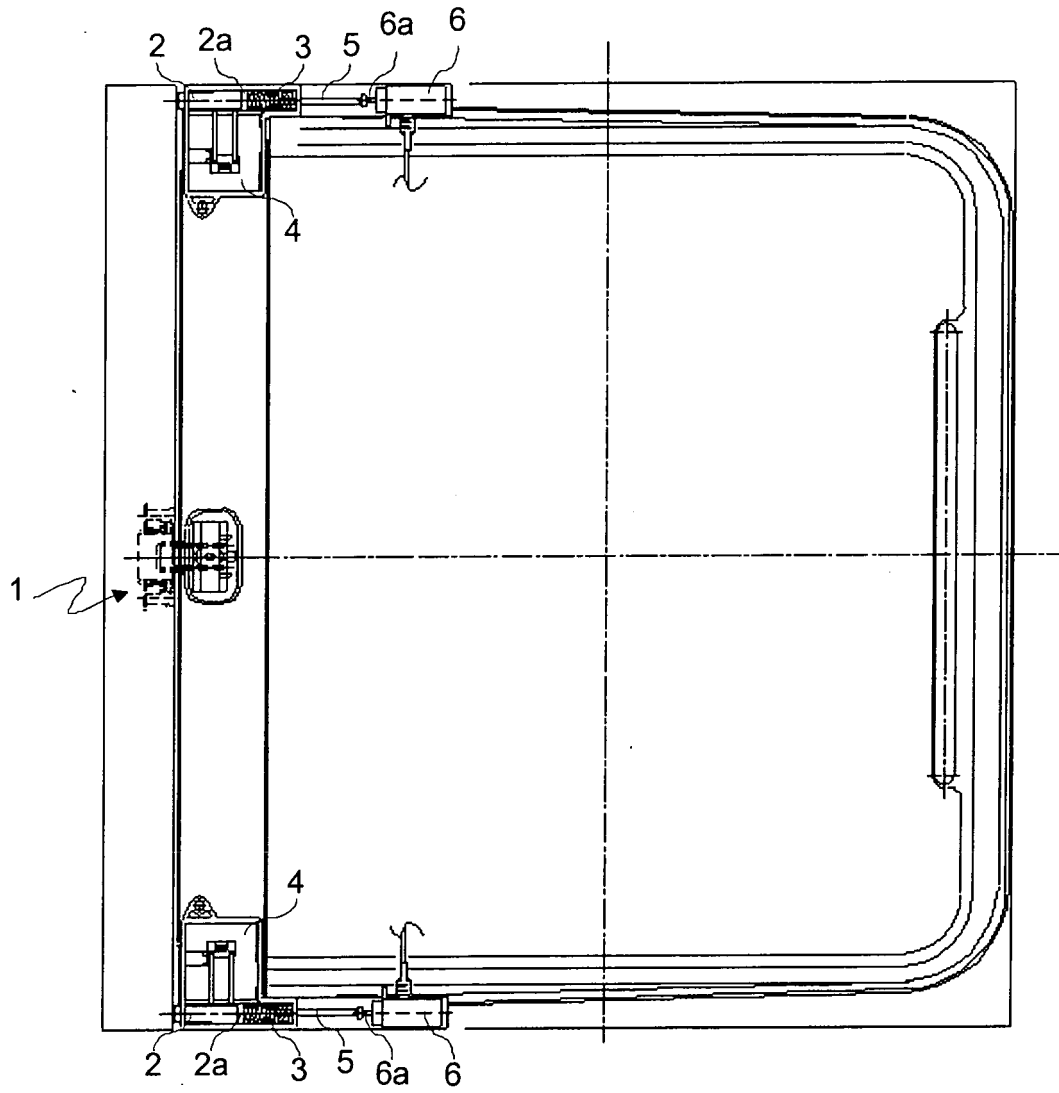


Fig.1

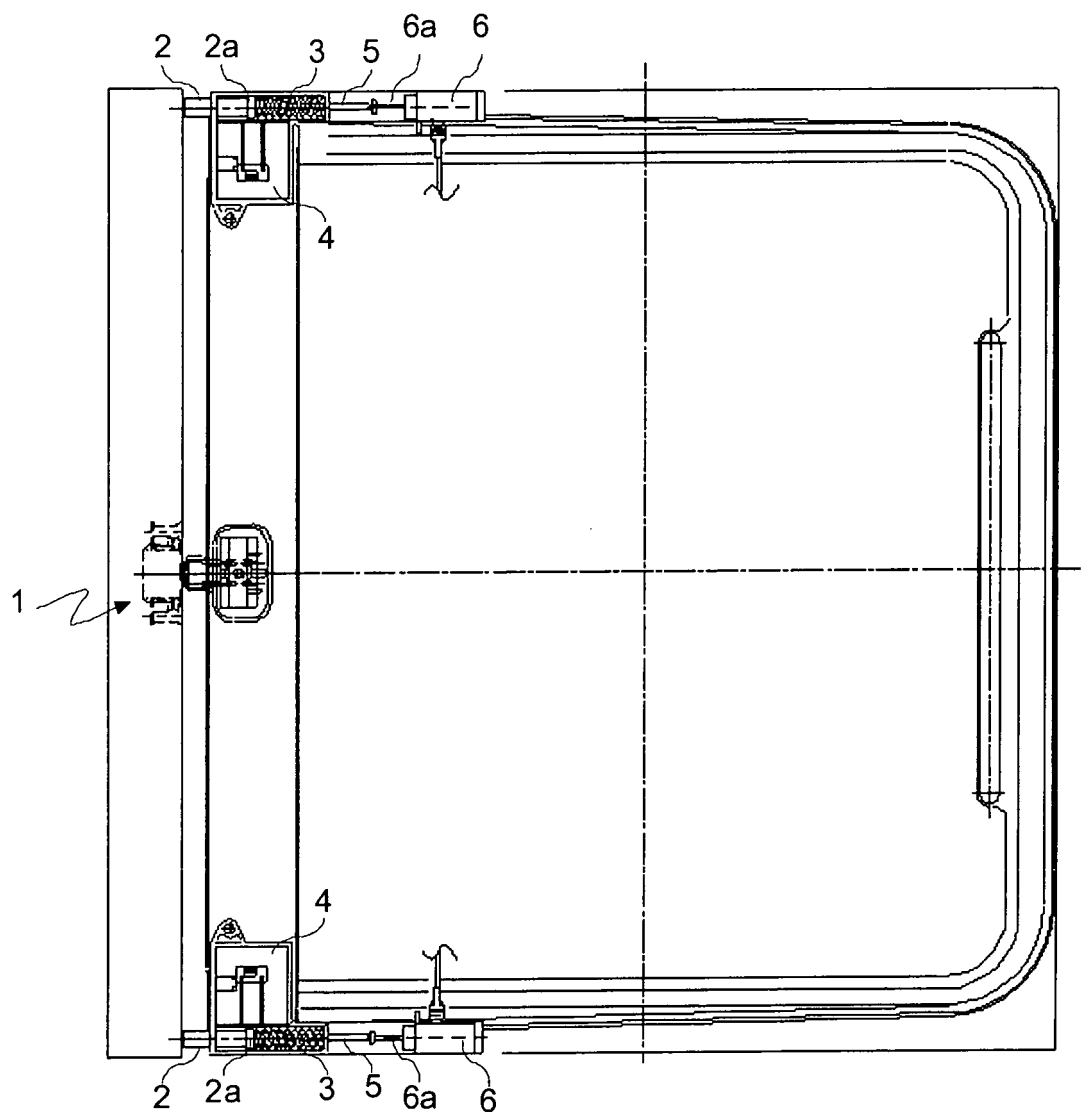


Fig.2

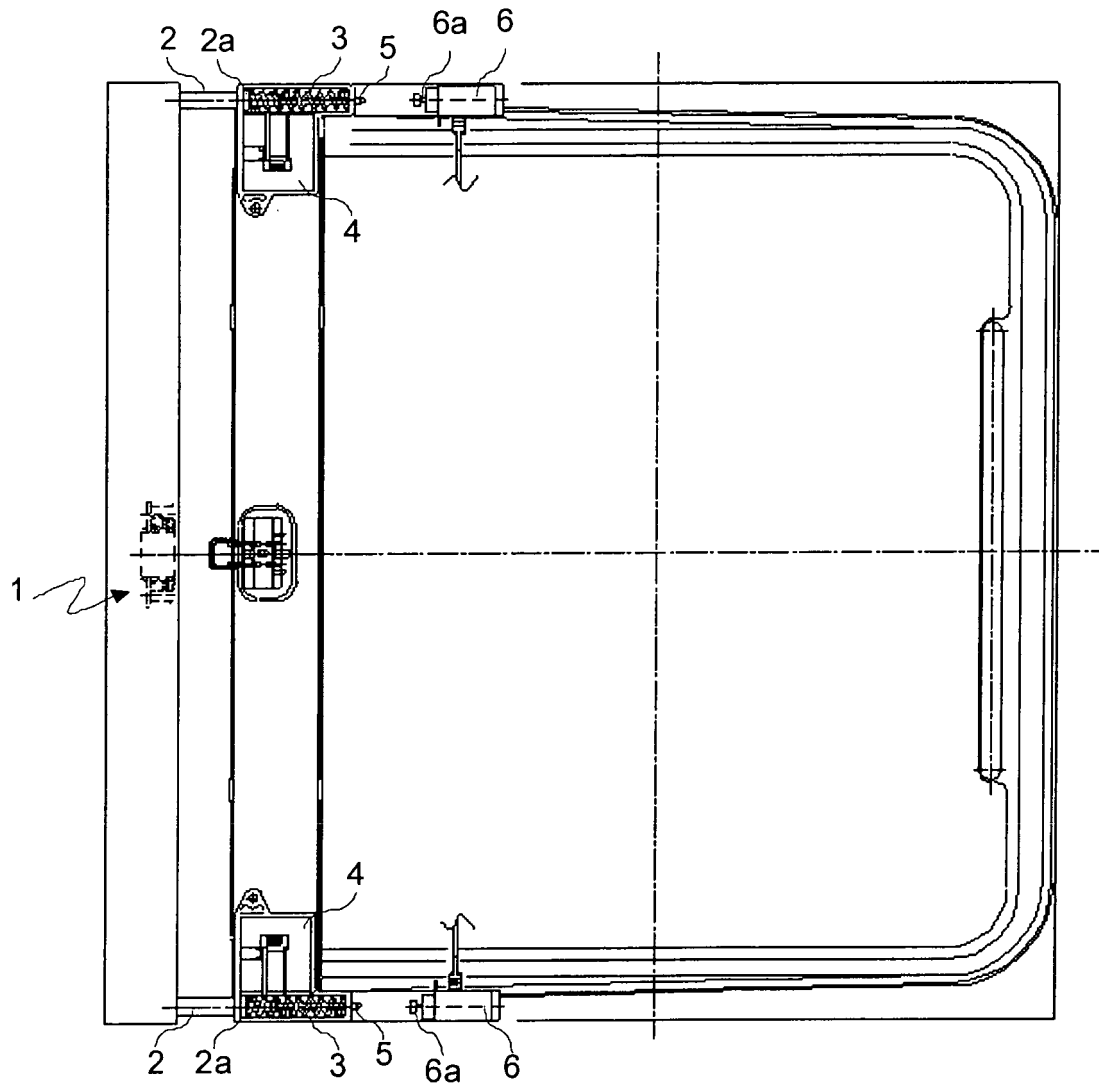


Fig.3



EUROPEAN SEARCH REPORT

Application Number
EP 11 42 5273

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			TECHNICAL FIELDS SEARCHED (IPC)
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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 28 March 2012	Examiner Richmond, Sarah
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 11 42 5273

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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28-03-2012

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