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(54) **Door-lock device for a household appliance door**

(57) The present invention concerns a door lock device (1) for a household appliance door, said door being provided with a locking prong (50), said door lock device (1) comprising a slider (41), provided with an internal compartment (411), and capable to assume a resting position and an operating position, a strut (43), placed in said compartment (411) and slidable in it along said slider (41), a locking hook (42) capable to interact with said locking prong (50), rotatably coupled with an end of said slider (41) and cinematically connected with said strut

(43), pushing means (46), placed within said compartment (411) of said slider (41), arranged to exert a force on said strut (43) so as to keep said strut (43) in contact with said locking hook (42), so that when said prong (50) interacts with said locking hook (42), said locking hook (42) rotates and translates, engaging with said locking prong (50) by the force exerted by said pushing means (46) through said strut (43), so that said slider (41) passes from said resting position to said operating position.

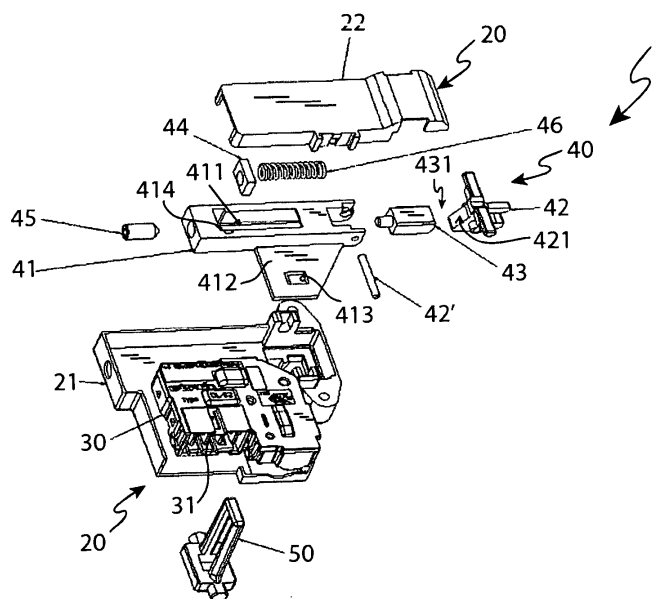


Fig.1

Description

[0001] The present invention relates to a door-lock device for a household appliance door.

[0002] More specifically, the invention concerns a door-lock device for washing machines and household appliances in general, designed and manufactured to minimize the dimensions occupied.

[0003] In the following, the description will be directed to the use in a washing machine, but it is clear that the same should not be considered limited to this specific use.

[0004] As it is well known, at present there are different kinds of door-lock devices, e.g. for washing machines, capable to prevent the opening of the door until the operation cycle of the household appliance is not ended.

[0005] In general, such devices are electromechanical and occupy a significant space, even for the necessary toughness that they must have. However, the trend to the reduction of the size of household appliances in the field moves the household appliances manufacturers to reduce the size of even these devices. However, reducing the size of the devices already known would risk of making them too delicate and not very robust, thus unsafe. Instead, in case of use of more robust materials, such as metallic alloys, it would increase the cost of the final device.

[0006] Moreover, size reduction implies low tolerances between the components, which, therefore, imply a further increase in production cost.

[0007] In light of the above, it is an object of the present invention, therefore, to provide a door-lock device for a household appliance that is robust but has reduced dimensions, in particular that it is thin.

[0008] These and other results are obtained according to the invention with a particular assembly and kinematics of the mechanical unit that holds engaged the door prong of the household appliance, when this is in operation.

[0009] It is therefore a specific object of the present invention door lock device for a household appliance door, said door being provided with a locking prong, said door lock device comprising a slider, provided with an internal compartment, and capable to assume a resting position and an operating position, a strut, placed in said compartment and slidable in it along said slider, a locking hook capable to interact with said locking prong, rotatably coupled with an end of said slider and cinematically connected with said strut, pushing means, placed within said compartment of said slider, arranged to exert a force on said strut so as to keep said strut in contact with said locking hook, so that when said prong interacts with said locking hook, said locking hook rotates and translates, engaging with said locking hook, and remaining engaged with said locking prong by the force exerted by said pushing means through said strut, so that said slider passes from said resting position to said operating position.

[0010] Always according to the invention, said kinematic connection between said strut and said locking

hook could be realized by a suitable shaping of the contact surfaces of said strut and said locking hook respectively.

[0011] Still according to the invention, said door lock device could comprise an electronic unit comprising electrical terminals for the connection to a control unit of said household appliance, and a locking pin, capable to assume: an extracted position, in which said locking pin engages with said slider when it is in said operating position, so as to inhibit the return to said resting position, and wherein said electronic unit enables said household appliance to be activated; and a retracted position in which said locking pin is disengaged from said slider.

[0012] Advantageously according to the invention, said slider could have an opening in which said locking pin is engageable with said opening.

[0013] Further according to the invention, said slider could include a wing whereon said opening is obtained.

[0014] Always according to the invention, said pushing means could comprise a spring, arranged in compression, so as to exert a force on said strut.

[0015] Still according to the invention, said door lock device could comprise adjustment means of the compression of said spring.

[0016] Further according to the invention, said slider could have a seat, and said adjusting means could include a plate, arranged in said seat, said plate having a threaded hole, and a grain, engaged with said threaded hole of said plate, said spring being arranged between said grain and said strut.

[0017] The present invention will be now described, for illustrative but not limitative purposes, according to its preferred embodiments, with particular reference to the figures of the enclosed drawings, wherein:

figure 1 shows an exploded view of the door-lock device for a door of a household appliance according to the present invention;

figure 2 shows a first perspective view of the open device according to figure 1;

figure 3 shows the device according to figure 2 in which it is applied a containment enclosure;

figure 4 shows a second perspective view of the open device according to figure 1;

figure 5 shows a blocking mechanical unit of the device according to figure 1;

figure 6 shows a sectional side view of a device according to the invention when a door is open;

figure 7 shows a sectional side view of a device according to the invention when the door is closed, and

figure 8 shows a sectional side view of a device according to the invention when the door is closed.

[0018] In the various figures, similar parts will be indicated by the same reference numbers.

[0019] Making reference to figures 1 - 5, the structure of a door-lock device 1 according to the present invention can be seen. Said door-lock device 1 comprises a con-

tainment enclosure 20, in which an electronic unit 30 and a blocking mechanical unit 40 of a prong 50, integral with a door of a household appliance, is housed.

[0020] Said containment enclosure 20 comprises a first 21 and a second 22 element. Said first element 21 has a first opening 21', for the introduction of the prong 50, so that it may interact with the blocking mechanical unit 40, and a second opening 21", whose function will be better explained in the following.

[0021] Said electronic unit 30 has the electric terminals 31 for connecting with the control unit of the household appliance (not shown in the figures). Said electronic unit 30 also includes a locking pin 32, capable of assuming a retracted position, in which said electronic unit 30 prevents said household appliance to activate, and an extended position, in which said electronic unit 30 allows said household appliance to operate.

[0022] Said blocking mechanical unit 40 comprises a slider 41, internally hollow, in which an inner compartment 411 is identified. Said slider 41 also has a wing 412 on which an opening 413 is obtained, wherein said locking pin 32 of said electronic unit 30 is insertable. Said slider 41 is capable of assuming a resting position and an operating position, which will be better described below.

[0023] Moreover, said blocking mechanical unit 40 comprises a locking hook 42 rotatably engaged to a first end of said slider 41 by a pin 42'. Said locking hook 42 is arranged in correspondence to said first opening 21'. Said locking hook 42 is engageable with said prong 50.

[0024] Said blocking mechanical unit 40 further comprises a strut 43, slidable within said compartment 411 of said slider 41. Said locking hook 42 and said strut 43 are cinematically connected. In particular, said kinematic connection is realized by a suitable shaping of the contact surfaces 431 and 421 respectively of said strut 43 and of said locking hook 42.

[0025] The blocking mechanical unit also comprises a plate 44, insertable into a corresponding seat 414 of said slider 41, placed substantially near the second end of said slider 41, opposite to said first end. Said plate 44 has a threaded hole, in which a grain 45 is engageable by screwing. Finally, between said grain 45 and said strut, a spring 46, or thrust means in general, is interposed in compression. By the adjustment of the insertion of said grain 45 in said plate 44 the compression of the spring 46 is possible to adjust and therefore the force exerted by it on said strut 43, to keep it in contact with said locking hook 42.

[0026] The operation of the door lock device 1 described above is as follows.

[0027] When the door is opened and, therefore, the prong 50 is disengaged from said blocking mechanical unit 40 (see figure 6), the locking hook 42 is in the initial position shown, in which it is held by the action of the spring 46 on the strut 43. Also, in this initial position, the slider 41 is in said resting position, in which it is arranged in such a way that the opening 413 is not arranged over-

lapped to said locking pin 32, thus holding it in said retracted position, in which, as said above, the household appliance cannot be activated.

[0028] Closing the door, prong 50 moves in the direction of arrow A, fitting into said first opening 21' and intercepting said hook 42 (see figure 7), thus causing, as a consequence of the shaping of said contact surfaces 431 and 421 respectively of said strut 43 and of said locking hook 42, the rotation of the locking hook 42 with respect to said slider 41, according to the arrow B, and the translation always of said hook 42. Being said locking hook 42 rotatably coupled with said slider 41, there is also a translation of said slider 41, which passes from said resting position to said operative position, as effect due to the translation of said locking hook 42. In particular, once the introduction of the prong 50, the locking hook 42 arranges (see figure 8) in such way that the opening 413 is overlapped to said locking pin 32, thus releasing and allowing the passage of the same from said retracted position to said extended position. Moreover, when said locking pin 32 is in said extended position and inserted in said opening 413, said slider 41 cannot slide, therefore the prong cannot be disengaged from said hook 42 and therefore said door is closed, even forcing the opening, when the household appliance is in operation, as it is appropriate for safety reasons. Moreover, said locking hook 42 is kept in the desired position by the action of the strut 43/spring 46 on the locking hook 42, as said locking hook cannot rotate back to its initial position, unless in case of sufficient force on the door to open it, due to the shaping of the contact surfaces 431 and 421 respectively of said strut 43 and of said locking hook 42.

[0029] Even opening 21" of said containment enclosure 20 is arranged overlapped on said locking pin 32 and it is intended to be controlled from the outside or for a possible manual reset.

[0030] Then, when the household appliance has stopped working, locking pin 32 is retracted by a suitable electronic control of the control unit of the household appliance to said electronic unit 30, thus releasing the slider 41. Opening the door, prong 50 is disengaged from said locking hook 42 by means of a sufficient force, suitable to overcome the force of the assembly strut 43/spring 46 on the locking hook 42. The mechanism makes, this time in the opposite way, the same kinematic movement described above, by rotating and translating, thus translating also slider 41, which arranges again in such way that opening 413 does not overlap said locking pin 32, i.e. passes from said operating position to said resting position.

[0031] An advantage of the present invention is that the configuration of the components allows a reduced thickness of the door-lock device and a minimum dispersion of opening and closing forces. This is achieved in particular because the prong of the door causes a rotation-translation movement of the locking hook and the elements that contribute to distribute the opening and clos-

ing forces (the spring and the strut) are integrated and contained within the element that realizes the interlock (the slider).

[0032] A further advantage of the present invention is a reduced impact of mutual positioning tolerances among the components.

[0033] The present invention has been described for illustrative but not limitative purposes, according to its preferred embodiments, but it is to be understood that modifications and/or changes can be introduced by those skilled in the art without departing from the relevant scope as defined in the enclosed claims.

Claims

1. Door lock device (1) for a household appliance door, said door being provided with a locking prong (50), said door lock device (1) comprising a slider (41), provided with an internal compartment (411), and capable to assume a resting position and an operating position, a strut (43), placed in said compartment (411) and slidable in it along said slider (41), a locking hook (42) capable to interact with said locking prong (50), rotatably coupled with an end of said slider (41) and cinematically connected with said strut (43), pushing means (46), placed within said compartment (411) of said slider (41), arranged to exert a force on said strut (43) so as to keep said strut (43) in contact with said locking hook (42), so that when said prong (50) interacts with said locking hook (42), said locking hook (42) rotates and translates, engaging with said locking hook (42), and remaining engaged with said locking prong (42) by the force exerted by said pushing means (46) through said strut (43), so that said slider (41) passes from said resting position to said operating position.
2. Door lock device (1) according to claim 1, characterized that said kinematic connection between said strut (43) and said locking hook (42) is realized by a suitable shaping of the contact surfaces (431, 421) of said strut (43) and said locking hook (42) respectively.
3. Door lock device (1) according to anyone of the preceding claims, **characterized in that** it comprises an electronic unit (30) comprising electrical terminals (31) for the connection to a control unit of said household appliance, and a locking pin (32), capable to assume:
 - an extracted position, in which said locking pin (32) engages with said slider (41) when it is in said operating position, so as to inhibit the return to said resting position, and wherein said elec-
4. Door lock device (1) according to anyone of the preceding claims, **characterized in that** said slider (41) has an opening (413) in which said locking pin (32) is engageable with said opening (413).
5. Door lock device (1) according to claim 4, **characterized in that** said slider (41) includes a wing (412) whereon said opening (413) is obtained.
6. Door lock device (1) according to anyone of the preceding claims, **characterized in that** said pushing means comprise a spring (46), arranged in compression, so as to exert a force on said strut (43).
7. Door lock device (1) according to claim 6, **characterized in that** it comprises adjustment means (44, 45) of the compression of said spring (46).
8. Door lock device (1) according to claim 7, **characterized in that** said slider (41) has a seat (414), and **in that** said adjusting means include a plate (44), arranged in said seat (414), said plate having a threaded hole, and a grain (45), engaged with said threaded hole of said plate (44), said spring (46) being arranged between said grain (45) and said strut (43).

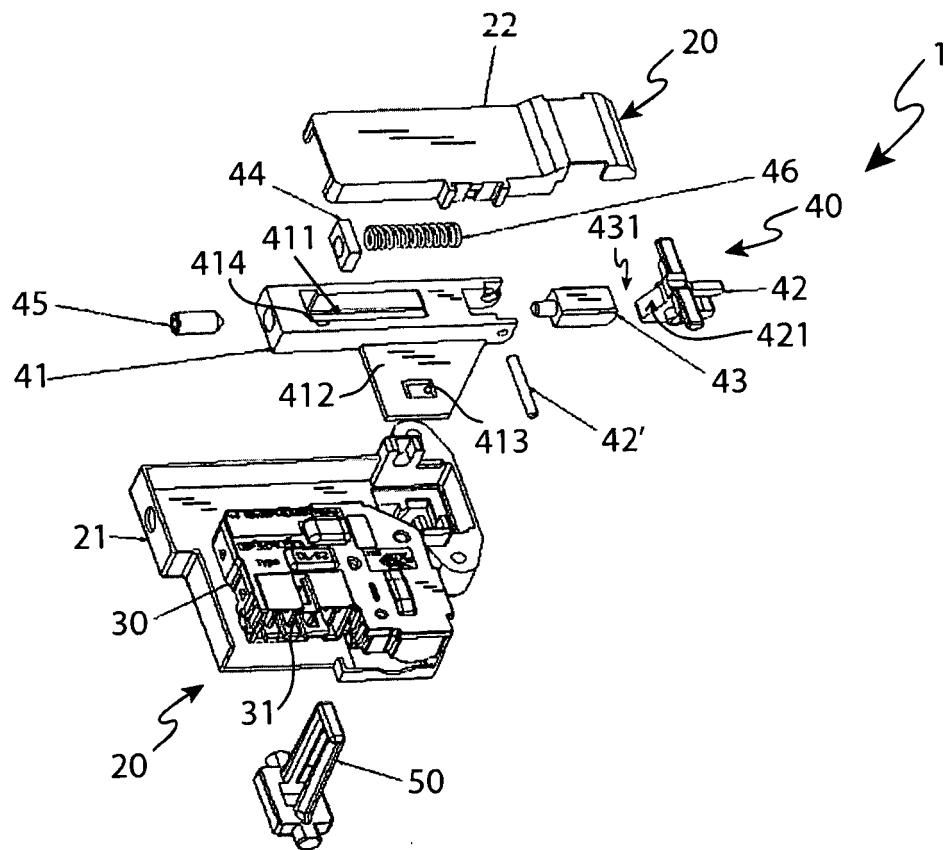


Fig.1

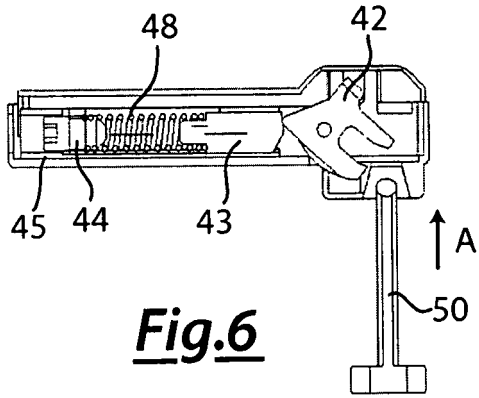


Fig.6

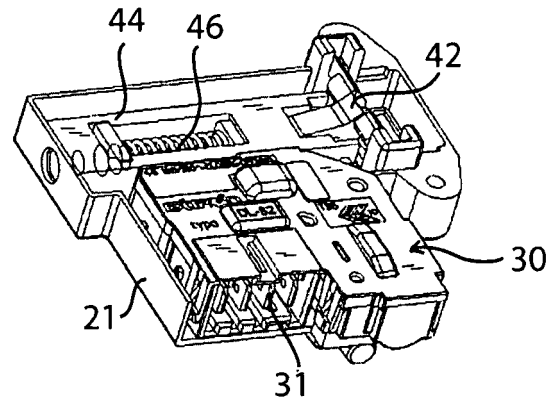


Fig.4

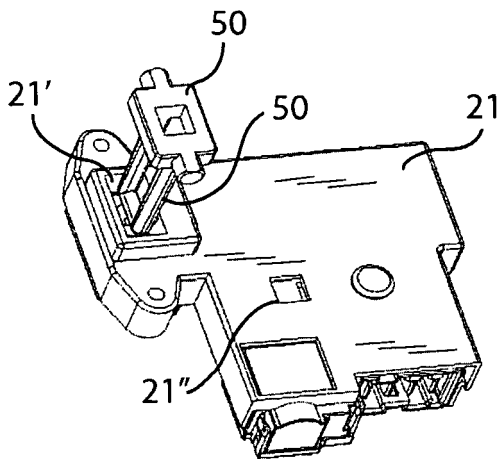


Fig.3

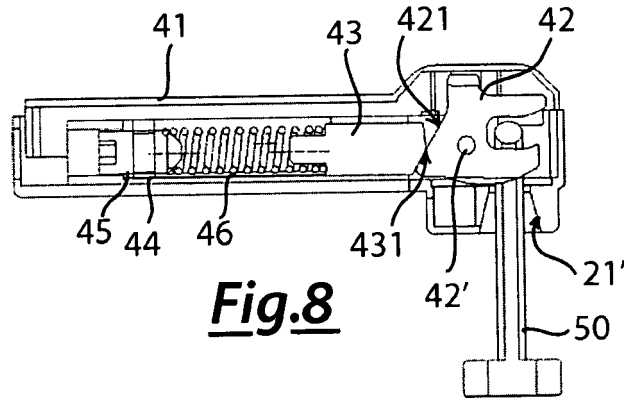


Fig.8

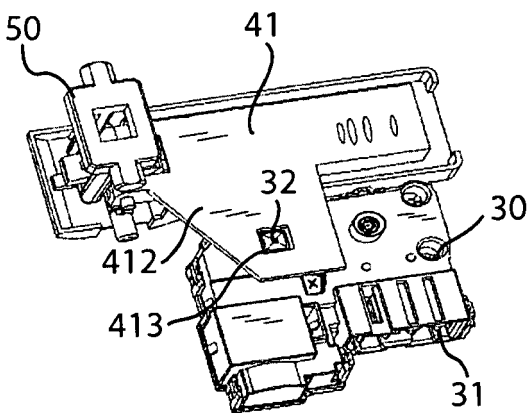


Fig.2

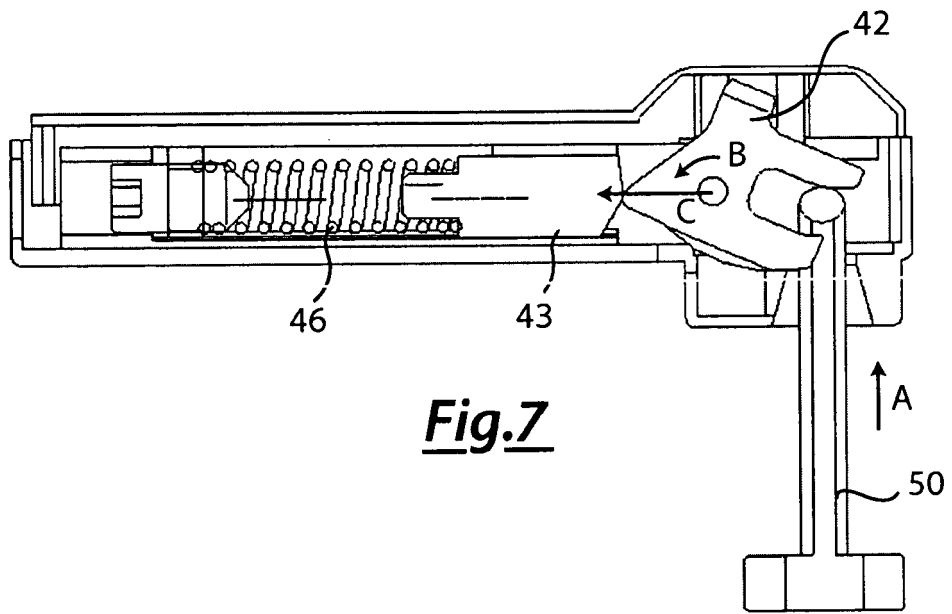


Fig.7

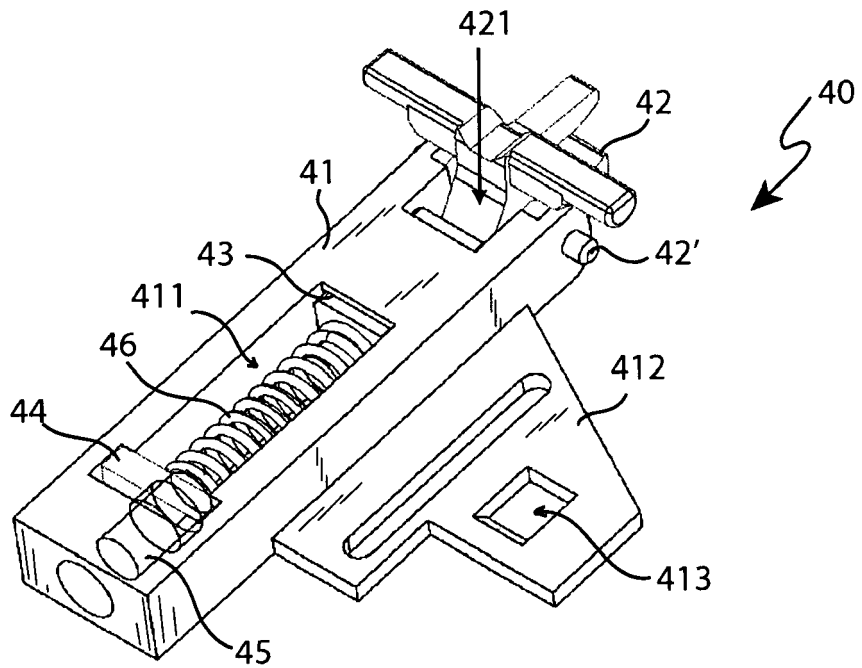


Fig.5



EUROPEAN SEARCH REPORT

Application Number
EP 12 42 5012

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Place of search		Date of completion of the search	Examiner
The Hague		24 April 2012	Pérez Méndez, José F
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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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