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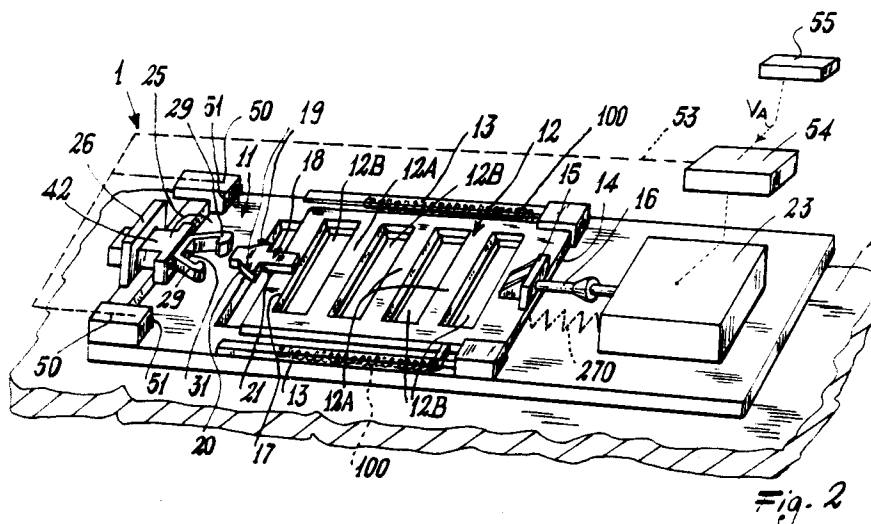
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I- 21025 Comerio (VA) (IT)(54) **Actuator device for operating a shut-off member for an air duct in a refrigerator of forced air circulation type.**

(57) An actuator device (1) for operating a shut-off member (12) for an air duct (8) in a refrigerator (5) of forced air circulation type, said duct (8) opening via an aperture (7) into a freezer compartment or refrigeration compartment (3), at said aperture (7) there being provided preferably a grille able to be closed by a shutter member (12) which is movable relative to the grille (11) along usual guides (13). The

shutter member (12) cooperates with a drive means (16) for moving said shutter (12) along said guides (13), and with retention means (25) for retaining said shutter (12) at least in the position in which it completely closes said aperture (7), said retention means (25) releasing said shutter (12) to enable it to move when said aperture (7) is to be opened.

*Fig. 2***EP 0 540 873 A2**

This invention relates to an actuator device for operating a shut-off member for an air duct in a refrigerator of forced air circulation type, said duct opening via an aperture into a freezer or refrigeration compartment provided in the refrigerator casing, at said aperture there being provided preferably a grille able to be closed by a shutter member movable relative to the grille along usual guides.

A shutter member or shutter is used to close a corresponding duct when the temperature within the compartment, for example the refrigeration compartment, has reached a preset value. In this situation a usual thermostat provided in the compartment senses when the preset value has been reached and closes said duct by means of said shutter. After this, the cold air normally fed into the refrigeration compartment can no longer enter it, so that the temperature within this latter is not further reduced.

The shutter is usually operated by two drive members (for example formed by usual resistors of positive or negative temperature coefficient fixed to opposing ends of the shutter and controlled in their operation by a usual electrical or electronic control circuit to which the thermostat is also connected.

These drive members operate alternately, one closing the shutter and the other opening it.

This method has however various drawbacks.

In particular, the use of two drive members associated with the shutter negatively affects the refrigerator construction cost and its maintenance time.

In addition, the control circuit which operates on these drive members is of complicated construction.

An object of the present invention is to provide a device of the aforesaid type which is of simple construction, short assembly and maintenance time and low cost.

A further object is to provide a device of the aforesaid type which is much less liable to develop faults or problems than analogous known devices.

These and further objects which will be apparent to the expert of the art are attained by a device of the aforesaid type, characterised in that the shutter member cooperates with a single drive means able to move it from at least one first to at least one second working position, return means being provided to return the shutter from said second to said first working position, said return means being elastically loadable, to then unload in order to move said shutter from said second into said first working position.

In particular, the device of the invention is characterised in that the shutter member cooperates with a single drive means able to induce its opening and closure movement along corresponding guides, retention means being provided

to retain said shutter at least in the position in which it completely closes the aperture on which it is located, said retention means releasing said shutter to enable it to move when said aperture is to be opened. The present invention will be more apparent from the accompanying drawing, which is provided by way of non-limiting example and in which:

Figure 1 is a schematic representation of the device according to the invention in one example of its application;

Figure 2 is a perspective view of the device of Figure 1;

Figure 3 is a cross-section through a part of the device of Figure 1; and

Figure 4 is a modification of the device of Figure 1.

With reference to Figures 1 to 3, the device of the invention is indicated overall by 1 and is positioned at a wall 2 of a compartment 3, for example the refrigeration compartment, of the cabinet 4 of a refrigerator 5 of forced air circulation type, a usual air circulation duct 8 opening at this wall via an aperture 7.

On the aperture 7 of the duct 8 there is provided a grille 11 along which there can be positioned a shutter 12 movable along guides 13 fixed for example to said grille.

At one end 14 the shutter 12 comprises a projection 15 which cooperates with a pusher member or pusher 16 which is separate from this projection and is operated in any known manner, for example by a resistor of positive or negative temperature coefficient (PTC or NTC), not shown, enclosed in a block 23 associated with the grille 12.

At the end 17 distant from said end 14 an arm 18 is provided projecting from the shutter 12. This arm comprises opposing projections or fins 19 having a rounded first side 20 and a straight second side 21 angularly connected to the first side 20 to hence define a substantially triangular fin.

The shutter 12 is also preferably of grille formation with alternating full portions 12A and empty portions 12B reproducing the form of the grille 11.

The projecting arm 18 cooperates with a retention member 25 associated with a fixed support 26 fixed for example to the grille 11.

The retention member 25 comprises a box casing 27 within which a gripper element 28 comprising elastically movable arms 29 and extending from a body 30 moves inwardly and outwardly, one end 31 (projecting with said arms from the casing 27) of which cooperates with one end 18A of the projecting arm 18.

The gripper element 28 moves within a cavity 33 in the casing 27 against a spring 34 the opposing ends of which are fixed to the casing 27

and to the element 28 respectively.

The body 30 of this latter comprises a channel 37, formed about a pad 40, and within which (relatively speaking) there moves a pin 41 associated with an upper part 42 of the box casing 27 and able to move transversely in known manner relative to said part 42.

The channel 37 and pad 40 are of such a shape that the pin, during its movement within said channel, can become locked at a recessed end 40A of the pad 40 to hence retain the gripper element 28 within the casing 27 when this element is pressed into this latter. On again pressing the element 28 into the casing 27 the pin 41 is released from said end 40A. The pin is then guided within the channel 37 until it reaches an end-of-travel seat 48 in which the pin stops. When in this seat the gripper element 28 projects from the box casing 27.

As stated, the shutter 12 slides along guides 13.

At the end of this movement, namely when the shutter is close to the retention member 25, the shutter comes into contact with the shoulders 50 provided on the grille 11.

Proximity sensors 51, such as microswitches, are associated with these shoulders, against which the shutter 12 rests when in its end-of-travel position.

The sensors 51 are connected by an electrical connection to a control unit 54, advantageously of microprocessor type. To this latter there are also connected a usual thermostat 55 and the drive member for the pusher 16 housed in the block 23. The thermostat and the unit 54 are indicated only by way of example. During the use of the refrigerator 5 it will be assumed that the temperature within the compartment 3 reaches a set minimum value but that the shutter 12 has yet to close the aperture 7.

In this situation the thermostat 55 senses that the set temperature has been reached and feeds a signal V_A to the unit 54.

On the basis of this signal this latter enables the drive member associated with the pusher 16 (for example a known PTC) to act on this latter to move it towards the shutter 12.

The pusher 16 makes contact with the projection 15 to then act on it and move the shutter 12 along the guides 13. The end 17 of the shutter therefore approaches the member 25, with the shutter simultaneously closing the aperture 7 of the duct 8.

During this movement, the projecting arm 18 penetrates with its end 18A between the elastic arms 29 of the gripper element 28.

When said end 18A comes into contact with the end 31 of the body 30 of said element 28, it

causes this latter to retract into the box casing 27.

Until the shutter 12 reaches its end-of-travel position, ie in contact with the sensors 51, the drive member presses against the shutter, which in its turn urges the body 30 into the casing 27.

When the shutter has reached its travel limit, the sensors 51 sense this and feed a relative signal to the unit 54, which on the basis of this interrupts the action of the drive member on the pusher 16, hence halting the movement of the shutter.

As the body 30 withdraws into the box casing 27, the pin 41 undergoes the described movement relative to said body 30. The pin moves into the recessed end 40A of the said pad 40 and halts said body in its inserted position in the box casing 27. In this position the arms 29 are closed about the fins 19 of the projecting arm 18 by virtue of the cooperation between said arms and the walls of the cavity 33.

As the drive member of the pusher 16 is no longer powered, this retracts (at least partly) into the block 23. The shutter however remains in the position in which it has closed the aperture 7, retained by the element 28 acting on the projecting arm 18, and slightly separated from the shoulders 50.

In contrast, to open the shutter 12 the drive member of the pusher 16 is again powered so that this latter again makes contact with the projection 15, to press (a second time) the shutter 12 towards the member 28 until the shutter again makes contact with the shoulders 50.

In this manner, the arm 18 urges the body 30 into the cavity 33 of the box casing 27, to release the pin 41 from the end 40A of the pad 40 in the described manner.

Then, on interrupting power to the drive member of the pusher 16 when the shutter makes contact with the shoulders 50, the element 28 emerges from the box casing 27 to enable the arms 29 to diverge and release the fins 19 from the arm 18. In urging the body 30 of the element 28 out of the cavity 33, the spring 34 also pushes the shutter 12 into a position such as to open the duct 8, ie to move the empty portions 12B of the shutter 12 into positions corresponding with those of the grille 11.

Advantageously, further springs 100 (fixed to the grille 11 and acting on the shutter 12) positioned along the guides 13 complement the action of the spring 34 and contribute to returning the shutter into the position in which it does not close the aperture 7.

Figure 4 shows a modified embodiment of the invention as an alternative to that described. In this figure (in which parts corresponding to those already described are indicated by the same reference numerals), there is no longer the element 28

associated with the box casing 27, but instead there are provided at least two parts 200 movable towards and away from each other by the action of small electromagnets 201 powered in known manner and arranged to cooperate with the fins 19 of the arm 18. At least one pair of such parts 200 is provided to retain the shutter 12 associated with the member 25 and maintain the duct 8 closed.

Advantageously, a plurality of such pairs can be provided to retain the arm 18 of the shutter 12 inserted to a greater or lesser extent in the box casing 27. In this manner said shutter can be halted in different positions along the aperture 7, which can then be variously restricted.

The springs 100 return the shutter 12 into the position in which it does not restrict the grille 11 when such restriction is no longer required.

This embodiment operates in the following manner.

The shutter is driven in the described manner against elastic elements provided along the guides 13. When the fins 19 of the arm 18 are within the box casing 27, the electromagnets 201 act on metal projections 202 associated with the parts 200, to cause these latter to approach each other and close the arm 18 between them in the manner of jaws.

On reversing the polarity of the electromagnetic field generated by the electromagnets 201 to allow the elastic elements acting on the shutter 12 to operate, the parts 200 open and the shutter 12 returns to its rest position.

By operating suitably in cascade on a plurality of elements 200 (if present), the shutter 12 can be moved from a position in which it completely closes the aperture 7 to a position in which it partly closes it.

Particular embodiments of the invention have been described.

However further embodiments are therefore possible, to be considered as falling within the scope of the present document.

In particular, the member 25 does not necessarily have to comprise the arms 29. In this case, said member does not retain the shutter 12 in a particular first working position (for example grille closed); however, the loading of the spring 34 enables this latter to return the shutter to a second working position (for example grille open) when the pusher acts on it the second time (in the manner already described). In this case, advantageously a second spring 270 (see Figure 2) acts on the end 14 of the shutter 12 to maintain it in contact with the member 25 when the shutter is in its first working position. This second spring, generating a force less than that of the spring 34, prevents undesirable grille movement due for example to vibration arising within the refrigerator during its

use.

Claims

1. An actuator device for operating a shut-off member for an air duct in a refrigerator of forced air circulation type, said duct opening via an aperture into a freezer or refrigeration compartment, at said aperture there being provided preferably a grille able to be closed by a shutter member movable relative to the grille along usual guides, characterised in that the shutter member (12) cooperates with a single drive means (16) able to move it from at least one first to at least one second working position, return means (25, 100) being provided to return the shutter (12) from said second to said first working position, said return means (25, 100) being elastically loadable, to then unload in order to move said shutter (12) from said second into said first working position.
2. A device as claimed in claim 1, characterised in that the drive means is a pusher (16) associated with any known movement-generating member and acting on a part (15) associated with one end (14) of the shutter member (12).
3. A device as claimed in claim 1, characterised in that the return means comprise a body (30) movable within a fixed box casing (27) against elastic means (34), said body being able to assume at least two stationary positions relative to the box casing (27), with respect to which it moves.
4. A device as claimed in claim 1, characterised in that the return means comprise at least one compression spring (100) acting on the shutter (12) and fixed to the grille (11).
5. A device as claimed in claim 3, characterised in that the box casing (27) is associated with the grille (11).
6. A device as claimed in claim 1, characterised in that the movable body comprises retention means (28, 29) able to retain said shutter (12) at least in one working position, said retention means (28, 29) releasing said shutter (12) to enable it to move when it is to be shifted into a second working position.
7. A device as claimed in claim 6, characterised in that the retention means comprise a gripper element (28) having elastically movable arms (29) and extending from the body (30) of the

return means movable within a cavity (33) in the box casing (27) against elastic means (34), said arms (29) projecting from said box casing (27) and cooperating with a projecting part (18) of the shutter member comprising engagement means (19) for engaging said elastic arms. (8).

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8. A device as claimed in claim 7, characterised in that the engagement means of the projecting part (18) of the shutter member (12) are opposing fins (19) of substantially triangular shape. 10

9. A device as claimed in claim 1, characterised by comprising sensor means (51) for sensing at least when the shutter member attains the position in which it closes the aperture (7) of the air duct (8), ie when it attains one of its two working positions. 15 20

10. A device as claimed in claim 9, characterised in that the proximity sensor means are micro-switches (50) arranged on shoulders provided in a position corresponding with the retention means (25). 25

11. A device as claimed in claim 9, characterised in that the proximity sensor means are micro-switches (50) are connected to a control unit connected to a usual thermostat (55) situated in the compartment (3) into which the duct (8) opens, said unit powering the movement-generating means for the drive means (16) for the shutter member (12). 30 35

12. A device as claimed in claim 11, characterised in that the control unit is a microprocessor circuit. 40

13. A device as claimed in claim 6, characterised in that the retention means are at least one pair of parts (200) mutually movable towards and away from each other and arranged to move orthogonally to a projecting part (18) of the shutter member (12), said movable parts being moved by electromagnets (201). 45

14. A device as claimed in claim 13, characterised in that the mutually movable parts (200) are associated with metal elements arranged to cooperate with the electromagnets (201). 50

15. A device as claimed in claim 15, characterised by comprising a plurality of pairs of mutually movable parts (200) operating sequentially with and/or independently of each other, to obtain different degrees of closure of the air duct 55

