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(54) **Counterbalanced hinge device with vertical and frontal movement of a door particularly for dishwashing machine**

(57) A counterbalanced hinge device with vertical and frontal movement for a door particularly for dishwashing machine, includes a connection mean (1) to fixing means (10) of the dishwashing machine and a support mean (2) to which it is connected the door.

The hinge device includes a crank (4) pivoted on the connection mean (1) and rotatably connected to the support mean (2), a first arm (6) pivoted on the connection mean (1) and rotatably connected to the support mean (2) and balancing means (11) connected to the fixing means (10) and to the support mean (2).

The hinge device also includes cam means (15) rotatably connected to the balancing means (11) and articulated members (8), these latter being linked to the support mean (2). The hinge further includes friction means (14) connected to the cam means (15) and fit for friction mating the connection mean (1) for the door counterbalancing in correspondence of its change from a closing condition (C) to an opening condition (A) and vice versa.

The cam means (15) are subject at least to a couple of opposed and misaligned forces, respectively of the balancing means (11) and the articulated members (8), in such a way to produce friction forces of the friction means (14) on said support mean (2) for contributing in counterbalancing the door.

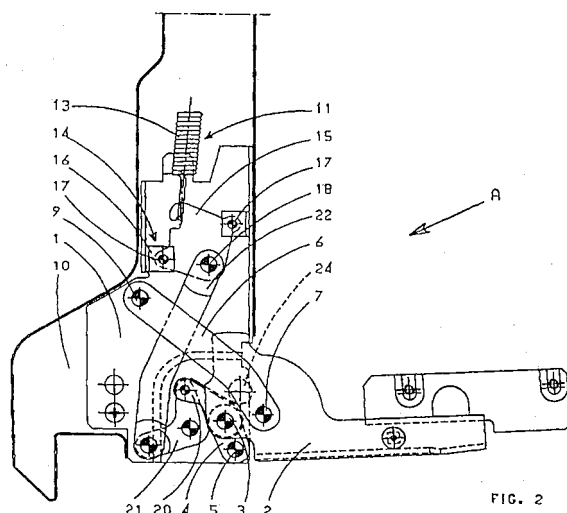


FIG. 2

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Description

[0001] The present invention relates to elements for household electrical appliances and the like.

[0002] Particularly the present invention refers to a counterbalanced hinge device with vertical and frontal movement of a door particularly for dishwashing machine or household electrical appliances and the like in order to counter the door weight and to block this latter in any position and to allow its opening and closing without interfering with elements such as baseboards or similar.

[0003] The known doors of electrical household appliances such as dishwashing machine, ovens and similar are fixed to the apparatus frame by means of hinges allowing the rotation of said doors between a closing position and an opening position, by rotating on a horizontal axis positioned in the lower portion of the door.

[0004] Below said doors, there is often a baseboard covering the unaesthetic empty space between the apparatus bottom and the floor.

[0005] There are known hinges fit for translating their revolving axis in order to avoid interferences between the door and baseboards or similar elements. These known hinges include quite complex and therefore expensive articulated joints.

[0006] In addition such hinges have the drawback of having a large encumbrance that reduces the useful volumes of the apparatuses to which the hinges are assembled.

[0007] There are known hinges which may include means, such as dampers or elastic means, for counterbalancing or holding back the door, eventually loaded by the unknown weight of a panel assembled during the apparatus installation, in whatever intermediary position between the closing and the opening positions.

[0008] The main drawback of the known hinges consists in the necessity to adjust counterbalancing means with complicated, difficult and expensive regulations or when the deficiency of said counterbalancing means causes the door movements too hard, or too yielding.

[0009] Another drawback consists in that the counterbalancing regulation of the known hinges must be done during the final installation phase of the related apparatus by unskilled workers, which may regulate badly or skip the regulations with risks of physical damages for the user and the apparatus.

[0010] Another drawback consists in the inadequate operation stability of the known hinges because of use and variations of the environmental conditions.

[0011] The main object of the present invention is to propose a counterbalanced hinge device with vertical and frontal movement of a door particularly for dishwashing machine or electrical household appliances and similar, in which the door has also a panel that does not interfere with baseboards or other elements adjacent and beneath the door.

[0012] Other object is to propose a hinge indifferent

to the variations of the operational conditions, fit for counterbalancing the door countering its weight and allowing its stop in every position.

[0013] Another object is to propose a hinge for counterbalancing doors having varying weight in an interval of several kilograms without needing regulations or settings.

[0014] A further object of the invention is to propose a hinge having great constructive simplicity and small encumbrance, as well as economically convenient.

[0015] The aforesaid objects are achieved according to the content of the claims.

[0016] The features of the invention are underlined as follows, with particular reference to the enclosed drawings, in which:

- figure 1 shows a side view of the hinge object of the present invention assembled to an apparatus in a closing condition, in which some elements have been removed for better underlining others;
- figure 2 shows a view of the figure 1 hinge in an opening condition;
- figure 3 shows a view of a variant of the figure 1 hinge;
- figure 4 shows a view of the figure 3 hinge in the opening condition.

[0017] For assembling the door to the related apparatus there are generally two hinges of the type here described, that are assembled, for instance, in correspondence of the two lower corners of the opening which the door must close in such a way that this latter rotates on axes parallel to the line joining the two hinges.

[0018] For simplicity in the following it will refer to a single hinge only with the same assembly orientation and keeping in mind that the same constructive and functional considerations are equally applicable for the other possible hinge.

[0019] With reference to figures 1 and 2, numeral 1 indicates a connection mean substantially flat and blocked to a fixing element 10 of the dishwashing machine and numeral 2 indicates a support mean fixed to the door having the optional panel. The support mean 2 has a substantially elongated shape and extends along a vertical plane almost parallel to the connection mean 1.

[0020] The support mean 2 is linked to the connection mean 1 by means of a crank 4 and a first arm 6.

[0021] An end of the crank 4 is hinged through a first pivot 5 to the connection mean 1 and the remaining end is rotatably connected to the support mean 2 by means of a first pin 3.

[0022] An end of the first arm 6 is hinged through a second pivot 9 to the connection mean 1 and the remaining end is rotatably connected to the support mean 2 by means of a second pin 7.

[0023] The pivots, first 5 and second 9, and the pins, first 3 and second 7, have fulcrums and axis respectively

orthogonal to the plane of the connection mean 1. The first pivot 5 is fixed to the door closer than the second pivot 9 and is fixed below this latter. The first pin 3 is positioned close to a lower peripheral portion of the support mean 2 and the second pin 7 has a position more central than the longitudinal development of the support mean 2.

[0024] The distance between the pivots, first 5 and second 9, is bigger than the distance between the pins, first 3 and second 7, so that it causes, changing from a closing condition C of the door to an opening condition A of the same door, this latter raising and moving away from the related opening of the dishwashing machine or the appliance.

[0025] The hinge includes balancing means 11, for instance consisting of a spring 13 stressed and reacting in extension or compression, and cam means 15 constituted by a shaped plate having approximately a quadrilateral shape.

[0026] An end of the balancing means 11 is fixed to the fixing means 10 and the remaining end is rotatably fixed to a vertex of the plate 15, while the opposite vertex is rotatably cascade connected to articulated members 8 and to the support mean 2. Consequently a related movement of the cam means 15, countered by the balancing means 11, corresponds to each movement of the door from the closing condition C to the opening condition A and vice versa. Then the balancing means 11, by means of the articulated members 8 and the support mean 2, exert an elastic closing force to the couple of opening forces generated by the door weight and transmitted by this latter to the support mean 2.

[0027] Friction means 14 are rotatably connected to the two remaining vertexes of the plate 15, by means of studs 17. The friction means 14 slide with the cam means 15 between two walls 12 of the connection mean 1. The walls 12 are almost parallel and perpendicular to the plane defined by the connection mean 1.

[0028] The balancing means 11 and the articulated members 8 transmit to the cam means 15 respectively an elastic closing force and a reaction force. These opposed forces are misaligned and therefore exert to the cam means 15 a torque, which rotate these latter. The couple of rotating force is transmitted by the cam means 15 to the friction means 14, which transmit consequently to the walls 12 a torque reaction. Then each friction mean 14 exerts a pressure against the respective wall 12 so producing mutual frictions, particularly producing static friction and a door counterbalancing.

[0029] The free longitudinal edges of the walls 12 are folded up toward the inside of the connection mean 1, one towards the other, in such a way to prevent the disengagement of the friction means 14 from said connection mean.

[0030] For instance the friction means 14 consist of sliding blocks or idle rollers 16 fit for friction sliding on the walls 12. The sliding block or idle rollers 16 are made of plastic material characterized in a predetermined fric-

tion coefficient for creating such friction forces to counterbalance an overall weight of the door and/or panel, ranging from 6 to 14 kilograms.

[0031] The articulated members 8 include a connecting rod 20 whose end are rotatably connected respectively to the first pin 3 and to a first end of a rocking lever 21 that is centrally pivoted on the connection mean 1 by means of a third pivot 23. The articulated members 8 further include a second arm 22 whose ends are rotatably connected respectively to the second end of the rocking lever 21 and to the balancing means 11 to convert the support mean motion in a linear motion of the cam means 15.

[0032] The hinge device further includes sliding means 24 fixed to the connection mean 1 and interposed between this latter and the support mean 2 in order to prevent the door transversal clearance, by slidably mating the support mean 2.

[0033] The hinge also includes a block mean 25 and a stop mean 26 respectively carried out in the connection mean 1 and in the support mean 2. The stop means 26 mate the block mean 25 in correspondence of the opening condition A.

[0034] During the hinge operation, changing from the closing condition C to the opening condition A, the door stresses the hinge with a progressively increasing opening torque, since the weight of the door operates with a progressively increasing arm. Contemporarily there is the extension of the balancing means 11 with the increase of elastic force transmitted to the cam means 15 and to the support mean 2. Consequently there is an increase of the pressure exerted by the friction means 14 against the respective walls 12 and an increase of the closing force exerted by the balancing means 11. The progressive pressure raise increases the static friction so counterbalancing the progressive increase of the opening torque allowing the door stop also in conditions close to the opening condition A. The closing force increase contributes to the balancing of the opening torque.

[0035] A hinge variant provides that the walls 12 instead of being parallel, may be convergent. The convergence approximately in the direction of the first pivot 5 increases progressively the pressure exerted by the friction means 14 against the walls 12 and therefore the frictions changing from the closing condition C to the opening condition A.

[0036] It is also useful to underline that the convergence in the opposite direction causes opposite effects.

[0037] Particularly the variant shown in the figures 3 and 4 highlights that the farthest wall 12 from the support mean 2 is tilted toward the pivot 5 while the closest wall 12 to the support 2 is nearly parallel to this latter in correspondence of the closing condition C.

[0038] This variant further provides that the elastic closing force of the balancing means 11 and the reaction force of the articulated members 8 are slightly misaligned, for instance of 1 to 5 millimeters and preferably

2,5 millimeters, in correspondence of the closing condition C so that changing from this condition to the opening condition A the sliding block 16, or the idle roller, which slides on the tilted wall 12, causes the rotation of the plate 15 and the progressive misalignment of the elastic closing force from the reaction force and the progressive increase of the arm of said couple and the intensity of said couple so as to transmit a couple of rotating forces progressively higher, which is transmitted by the cam means 15 to the friction means 14. These friction means 14 consequently transmit to the walls 12 a reaction couple progressively greater and such to continuously counterbalance the weight force increase of the door and the optional panel during opening.

[0039] Vice versa, moving the door between the opening condition A and the closing condition C, the force game is opposite and therefore it is guaranteed the continuous counterbalancing of the door which remains in balance in any position between the two conditions, opening A and closing C.

[0040] The main advantage of the present invention is to provide a hinge device for opening and closing a door, also with a panel, without interference with baseboards or other elements close or below the door and fit for counterbalancing the door countering the weight of this latter and allowing its stop in any final or intermediary position.

[0041] Another advantage is to provide a hinge to counterbalance doors having a weight varying in a wide interval, without needing adjustments or settings.

[0042] A further advantage of the invention is to provide a hinge device very easy to make and operate and very cheap.

Claims

1. Counterbalanced hinge device with vertical and frontal movement of a door particularly for dishwashing machine, including a connection mean (1) to fixing means (10) of the dishwashing machine and a support mean (2) to which the door is connected, said hinge device including a crank (4) pivoted on the connection mean (1) and rotatably connected to the support mean (2), a first arm (6) pivoted on the connection mean (1) and rotatably connected to the support mean (2) and balancing means (11) connected to the fixing means (10) and to the support mean (2), said hinge device being **characterized in that** includes:

- cam means (15) rotatably connected to the balancing means (11) and to articulated members (8), these latter being connected to the support mean (2);
- friction means (14) connected to the cam means (15) and fit for friction mating the connection mean (1) for the door counterbalancing

in correspondence of its change from a closing condition (C) to an opening condition (A) and vice versa;

said cam means (15) being subject to at least a couple of opposed and misaligned forces, respectively of the balancing means (11) and the articulated members (8), such to produce friction forces of the friction means (14) on said support mean (2) for contributing in counterbalancing the door.

2. Device according to claim 1 **characterized in that** the articulated members (8) include:

- a connecting rod (20) whose end is rotatably connected to the support mean (2) and the remaining end to the first end of a rocking lever (21), hinged to the connection mean (1);
- a second arm (22) whose ends are rotatably connected respectively to the second end of the rocking lever (21) and to the cam means (15).

3. Device according to claim 2 **characterized in that** the cam means (15) include a plate almost quadrilateral-shaped whose two opposed vertexes are connected to the balancing means (11) and to the second arm (22) and whose remaining two vertexes are rotatably connected to the friction means (14).

4. Device according to any of the preceding claims **characterized in that** the friction means (14) are constituted by a couple of sliding block (16).

5. Device according to any of the preceding claims **characterized in that** the friction means (14) are constituted by a couple of idle rollers (16).

6. Device according to claim 1 **characterized in that** the connection mean (1) include at least a wall (12) on which the friction means operate (14).

7. Device according to claim 5 **characterized in that** at least the wall (12) has the free longitudinal end folded up toward the inside of the support mean (1).

8. Device according to claim 1 **characterized in that** the connection mean (1) includes two facing and parallel walls (12).

9. Device according to claim 1 **characterized in that** the connection mean (1) includes two facing and convergent walls (12).

10. Device according to claim 8 **characterized in that** the wall (12) farthest from the support mean (2) is tilted toward the pivot (5) and the wall (12) closest to the support mean (2) is almost parallel to this latter in correspondence of the closing condition (C).

11. Device according to claim 1 or claim 9 **characterized in that** the cam means (15) are subject to the couple of opposed and misaligned forces from 1 to 5 millimeters, in correspondence of the closing condition C. 5
12. Device according to claim 1 **characterized in that** the friction means (14) are made of material having a predetermined friction coefficient such to allow a continuous balancing of the door having a weight varying from 6 to 14 kilograms. 10
13. Device according to claim 1 **characterized in that** the balancing means (11) are constituted by a spring (13) reacting in compression or extension. 15
14. Device according to any of the preceding claims **characterized in that** further includes sliding means (24) interpose between the connection mean (1) and the support mean (2). 20
15. Device according to any of the preceding claims **characterized in that** the support mean (2) provides a stop mean (26) fit to mate a block mean (25) of the connection mean (1) in correspondence of the opening condition (A). 25

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