Adjustable system for counterbalancing hangers with horizontal articulation axis for household electric appliances

An adjustable system for counterbalancing hinges includes a first member (101) and a second member (102), pivotally connected to each other, a mechanism (104, 105, 106) including a member (106) movable in accordance with the hinge opening angle, an extendible member (22) including a helical spring (23) subject to compressive stress, the extendible member being connected with the movable member (106), a cable (24) having an end fastened to the end of the extendible member (22) opposite to the one connected with the movable member (106) while the other end of the cable is fixed to the first member (101), and adjusting means (31, 32) acting on the cable (24) and aimed at changing the compressive stress on the spring (23).
Description

The present invention concerns an adjustable counterbalancing system, specially suitable for hinges with horizontal axis, used as articulation of the door and body of a household electric appliance.

Generally speaking, the present system is fitted for all auto-balancing hinges that counterbalance during opening and closing operations of the door.

The system is equipped with a mechanism that moves in relation with the hinge movement, connected with an elastic extendible member, stressed so that its elastic reaction varies in accordance with the door position and balances the torque produced by the door weight.

More particular, but not exclusively, the object of the present invention is a counterbalancing system of the above described type, applied to a particular hinge, such as the one disclosed in the Italian Patent No. 1.235.584 of the same Applicant.

This hinge, shown in a prospective view in Fig. 1, is substantially constituted by a first member 1, aimed at being fastened to the frame structure of the electric household appliance A, and a second member 2, aimed at being fastened to the door P of the electric household appliance, pivotally connected to the first member 1 in 3.

In order to counterbalance the door weight, the hinge is provided with a mechanism constituted by cooperating members 4, 5, 6, located between the first and the second members, as described in the above mentioned Italian Patent.

The member 6 is connected with a counterbalancing system that has an extendible member 7 formed by a first spring end connecting member 8, a helical spring 9, that is subjected to tensile stress, and a second spring 35, that is subjected to compressive stress, and means for adjusting the extendible element 7 extends, gradually increasing the reaction force caused by the spring 9, that is subjected to the tensile stress, and thus counterbalances the torque produced by the door weight.

The torque increases in accordance with the lever arm increase that depends on the door opening angle. While closing the door, the spring 9 is gradually released, reducing the counterbalancing force.

This type of counterbalancing system produces various drawbacks, some of which are mentioned below.

If the spring breaks, the counterbalancing force does not exist any longer, and the door is free to turn downwards, provoking the risk of accidents and serious damages to the appliance.

The use of helical spring, subjected to tensile stress, results in low fatigue strength and considerable waste of elastic material used to produce the springs.

Moreover, it is not possible to adjust and/or change the counterbalancing force, if the hinge is mounted on the appliance and the same hinge cannot be used for different electric household appliances with doors of different weights.

The main object of the present invention is to propose a counterbalancing system that resolves the above reported problems by making use of a spring that is subjected to compressive stress, and means for adjusting the counterbalancing force.

Other features of the invention, not resulting from what has been stated, will be better seen from the following description in accordance with the contents of claims and with reference to the enclosed drawings, in which:

- Fig. 1 shows a hinge for household appliance equipped with a counterbalancing system made in accordance with the prior art;
- Fig. 2 shows a lateral view of a hinge equipped with the counterbalancing system of the present invention, when the hinge is closed;
- Fig. 2A shows a particular of the hinge illustrated in fig. 2;
- Fig. 2B is a sectional view taken along the line B-B of fig. 2;
- Fig. 3 shows the same view as Fig. 2, but with the hinge open;
- Fig. 3A is an enlarged sectional view taken along the line A-A of fig. 3;
- Fig. 4 is an enlarged view of particular B of fig. 3 in a different functional position;
- Fig. 5 shows a constructive variant with the hinge closed;
- Fig. 6 shows the same variant illustrated in fig. 5, but with the hinge open;
- Fig. 7 shows a perspective view of a particular of the variant shown in fig. 5.

With reference to the drawings, the adjustable counterbalancing system, that is the subject of the present invention, is applied to a particular kind of hinge, described in the introductory part, such as the one disclosed in the Italian Patent No. 1.235.584, but it is obvious that this type of hinge has been used as a mere example, therefore the same system can be applied also to other types of hinge, performing the same function within the same inventive idea.

With reference to figs. 2 and 3, the hinge includes a
first member 101, fastened to the frame structure of the electric household appliance and a second member 102, fastened to the appliance door.

The two members 101 and 102 are pivotally connected to each other in 103.

The member 101 has a transversal "C"-like part that defines three walls 101a, 101b, 101c (see fig. 2B).

Moreover, the system is equipped with a mechanism that includes cooperating members 104, 105, 106, located between the first member 101 and the second member 102.

The free end of the member 106, that protrudes from the mechanism, moves in accordance with the hinge opening-closing movement.

With reference to fig. 2, the lower end of a link member 21 is carried, pivoted in 20, by the member 106, while the other end of the link member 21 is engaged with an end of an extendible member 22.

The extendible member 22 includes two "T"-like flat bars 22a, 22b, situated side by side and longitudinally opposite to each other, and by a helical spring 23, set around the flanked stems of the "T"-like bars, so as to be compressed between the two opposite heads of the "T"-like bars.

The end, opposite to the head, of the bar 22a, is fastened to the link member 21, while the corresponding end of the other flat bar 22b, opposite to the above mentioned head of the flat bar 22a, is connected with the free end of a cable 24.

The cable 24 extends upwards and then is sent downwards turning around a roller 25 that is rotatably supported by the member 101.

The other end of the cable 24 is fixed in a point 26 by a clamp 27 constituting a part of a guide-support plate member 28 (fig. 3A).

The guide-support plate member 28 includes a plate, fixed to the member 101 by nails or rivets 29, and featuring a slot 30 that acts as a horizontal guide for a cylindrical small barrel 31.

A pin 33, acting as a stationary stop, is also fastened to the plate member 28.

The barrel 31, as seen in fig. 3A, has a first groove 31a that engages the cable 24, a second groove 31b, and a threaded hole 31c.

The second groove 31b engages slidingly with the slot 30 so as to obtain a guided sliding connection between the barrel 31 and the guide-support plate member 28.

The threaded hole 31c engages a screw 32, the head 32a of which rests turningly against the wall 101a of the member 101, so that it is possible to act on the head 32a of the screw by a key 34 from outside of the wall 101a.

The above described counterbalancing system exploits the elastic reaction of the helical spring 23, that is pre-loaded according to a predetermined value, when the door is closed, and, during opening of the door, the spring is gradually compressed between the wider heads of the two flat bars 22a, 22b.

According to a constructive variant, illustrated in figures 5, 6, 7, the free end of the cable 24 is fixed directly to a link member 121, functionally similar to the analogous member 21, and the extendible member 22 is subjected, by interpositions of a roller 125, to the stresses transmitted thereto by the cable 24 during the door opening.

More precisely, the end of the flat bar 22b of the extendible member 22, opposite to the head, is shaped in such a way that it can hook in a seat 101d made in the member 101 (fig. 7), while the respective end of the other bar 22a features a fork 122, that bears rotably the roller 125, sending back downwards the cable 24.

In this way, when the door is opened, the member 121 moves down (fig. 6), causing the stress the extendible member 22, and subsequently, compression of the spring 23, like in the previously described solution.

The main advantage of the described system, in both proposed versions, results from the fact that, if the spring 23 breaks, i.e. as usually happens when the wire of which the coils are made breaks, the counterbalancing force does not stop to act, but continues to exert its action, although with a slightly lower intensity, since the spring 23 remains still compressed between the flat bars 22a, 22b preventing the door from falling freely.

It is to be pointed out, that after the hinge has been mounted on the appliance, it is possible to adjust the counterbalancing action of the extendible member 22 without removing the hinge.

This is performed by inserting of a suitable key 34 in the head of the spring 32 and rotating the spring in order to move the barrel 31 leftwardly or rightwardly (see fig. 4).

The barrel 31 movement causes releasing or tensioning of the cable 24, that, correspondingly reduces or increases the compression of the pre-loaded spring 23, that results in reduction or increase of the counterbalancing action.

Another advantage results from the fact that the spring 23 is subjected to compressive stress, therefore its production requires less elastic wire and its fatigue strength is increased with respect to a helical spring subjected to tensile stress.

It is also to be pointed out that the spring 23 can be used to define the maximum hinge opening by adjusting the barrel 31 using the screw 32 until the turns of the spring 23 are packed when the hinge is opened at most.

Claims

1. Adjustable system for counterbalancing hinges, particularly for hinges having horizontal hinge axis for household electric appliances, each of the said hinge including a first member (101) and a second member (102) pivotally connected to each other, a lever mechanism situated between the said first
member (101) and second member (102) and including a movable member (106) that is moved in accordance with the hinge opening angle and that is connected to an extendible member (22) subjected to tensile stress so that it reacts elastically according to the position of the said door (P) and counterbalances the torque generated by the weight of the door (P), the said system being characterised in that it includes:

- a helical spring mounted on the said extensible member (22) so that it is subjected to a compressing stress as a consequence of the door (P) being opened;
- a cable (24) with an end fixed to the said first member (101) and the other end connected to a free end of the said extensible member (22);
- adjustment means (31, 32) acting on the said cable (24) so as to change the pre-load imposed by the said cable (24) on the said helical spring (23).

2. System according to claim 1, characterised in that said extendible member (22) includes a pair of "T"-shaped plate bars arranged side by side and opposite to each other, with the said helical spring (23) set around both of them and being located between their wider heads, the narrow end of one of the said "T"-shaped plate bars being fastened to the free end of the said cable (24) while the corresponding narrow end of the other plate bar is fixed to a link member (21) pivotally connected to the said movable member (106).

3. System according to claim 1, characterised in that said extendible member (22) includes a pair of "T"-shaped plate bars arranged side by side and opposite to each other, with the said helical spring (23) set around both of them and being located between their wider heads, the narrow end of one of the said "T"-shaped plate bars being fastened to the said first member (101) while the corresponding narrow end of the other plate bar bears a roller (125) with which the said cable (24) is in engagement, the free end of the said cable (24) is in engagement, the free end of the said cable (24) being fastened to a link member (121) pivotally connected to the said movable member (106).

4. System according to claim 1, characterised in that the said cable extends inside the said first member (101) longitudinally, and is then turned back downwards, and in that the said adjustment means (31, 32) exerts their action on the return section of the cable.

5. System according to claim 1 or 3, characterised in that said adjustment means include a barrel (31) whose position is changed by translation means (32), the said barrel (31) acting on the said cable to change its extension profile and to pre-load accordingly more or less the said spring (23).

6. System according to claim 5, characterised in that the said barrel (31) is slidably supported in a slot (30) made in a plate (28) fixed to the said member (101).

7. System according to claim 6, characterised in that the said translation means include a threaded member (32) in engagement with a threaded hole (31c) made in the barrel (31), and in that the said threaded member (32) can be operated, rests against a wall (101a) of the said first member (101), so that it is possible to engage the head (32a) of the threaded member from outside the said wall (101a) by means of a key (34).

8. System according to claim 1 or 3, characterised in that the said adjustment means include:
   - a plate member (28) fastened to the first member (101) and featuring a slot (30) and a pin (33);
   - a barrel (31) featuring a circumferential groove (31b) in engagement with the said slot (30), a further groove (31a) in engagement with the said cable (24), and a threaded hole (31c);
   - a threaded member (32) set in screw engagement with the said threaded hole (31c) and resting, with possibility of rotation, against a wall (101a) of the said first member (101), so that the said threaded member (32) is made accessible from outside the said wall (101a).

9. System according to claim 1 or 3, characterised in that the turns of the said spring (23) are packed when the hinge is in the maximum opening position, so as to define a maximum opening stop.
The present search report has been drawn up for all claims.

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document with indication, where appropriate, of relevant passages</th>
<th>Relevant to claim</th>
<th>CLASSIFICATION OF THE APPLICATION (Int.Cl.6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y</td>
<td>EP-A-0 437 815 (V-ZUG) * column 1, line 45 - line 54 * * column 2, line 47 - column 3, line 36; figures 1,2 *</td>
<td>1,5-8</td>
<td>E05F1/12</td>
</tr>
<tr>
<td>Y</td>
<td>GB-A-2 055 343 (AB NORDPLAT) * page 1, line 68 - line 115; figure 1 *</td>
<td>1,5-8</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>EP-A-0 551 234 (ESSWEIN) * column 6, line 47 - column 8, line 31; figure 3A 3B *</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>FR-A-2 504 182 (FAUVEL) * page 1, line 1 - line 25; figure 1 *</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

E05F
A47L

The present search report has been drawn up for all claims.

THE HAGUE 6 September 1995 Guillaume, G

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