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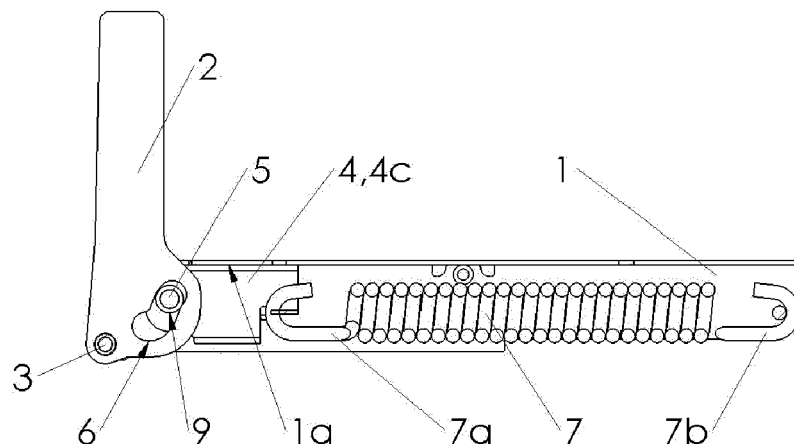
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(54) **HINGE FOR A HOUSEHOLD APPLIANCE**

(57) Hinge for connecting the door of a home appliance to the body of the home appliance, comprising: . a base body (1) and an arm (2), which are connected to each other by means of a hinging pin (3) in such a way that each of them (1,2) is rotatable with respect to the

other (2,1) in the two possible directions of rotation around the rotation axis (A) of the hinging pin (3); . operating means for generating a force that is used to rotate the base body (1) and the arm (2) with respect to each other towards a first typical reciprocal position.

Fig.2a



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Description

[0001] The present invention relates to a hinge for connecting the door of a home appliance to the body of the home appliance, according to the preamble of claim 1.

[0002] The document DE102011008252 A1 shows a hinge having all the characteristics indicated in the preamble of claim 1.

[0003] In addition to what is indicated in the preamble of claim 1, the transmission body of said known hinge is also provided with a cavity, in which a damper is housed in a mobile way. Said damper is intended to interact with some abutment surfaces in order to generate damping forces which, upon complete opening of the door, counteract the weight force which acts on the door and, upon complete closing of the door, the force generated by the operating means. In this way one varies the overall force applied to the arm during the closing of the door and the overall force applied to the operating means during the opening of the door.

[0004] In the case of this known hinge, the reciprocal rotation between the base body and the arm is thus controlled at all moments by the sliding of the transmission pin into the guiding slit.

[0005] On the other hand, there is nothing for guiding the movement of the transmission body along the direction of longitudinal extension of the base body, therefore it is possible to have, within the play present between the internal surface of the base body and the external surface of the transmission body, small movements perpendicular to the direction of longitudinal extension of the base body of the hinge. These small movements can involve some inaccuracies and cause noise.

[0006] The document DE10152907 A1, too, discloses a hinge, which has all the characteristics indicated in the preamble of claim 1. In the case of said known hinge the transmission body is substantially L-shaped and the transmission pin is rigidly connected to the shorter part of said L. The guiding means comprise, in addition to what is indicated in the preamble of claim 1, a second guiding slit and a guiding pin. This guiding pin, too, is rigidly connected, like the transmission pin, to the L-shaped transmission body, but to its long part.

[0007] On the other hand, the second guiding slit is placed in the base body and the guiding pin is inserted in it in such a way that, upon the reciprocal rotation between the base body and the arm, the guiding pin slides in said second guiding slit.

[0008] In the case of this known hinge, the reciprocal rotation between the base body and the arm is thus controlled at all moments both by the sliding of the transmission pin in the first guiding slit and by the sliding of the guiding pin in the second guiding slit. The simultaneous action of the two guiding slits allows to determine, thanks to their shape and extension, a precise regime of the reciprocal rotation between the base body and the arm. During this the sliding of the transmission pin in the first guiding slit is particularly useful to carry out the reciprocal

rotation and the sliding of the guiding pin in the second guiding slit is particularly useful to guide the movement of the transmission body along a desired and provided direction.

[0009] To this precise rotation regime corresponds, thanks to the action of the transmission means, a just as precise regime of the forces acting on the arm during the opening or the closing of the door, so that one can obtain both a complete opening, at about 90°, and a complete closing of the door, at about 0°, and the maintenance in perfect balance of intermediate opening positions of the door, between 20° and 70°, in which the force exerted by the operating means and transmitted by the transmission means compensates for the weight force which acts on the door.

[0010] Said known hinge performs its task very well, but the presence of two different guiding slits with the associated transmission pin and guiding pin involves a complex kinematic system, whereby the production costs of such a hinge are high and greater than other known hinges which are simpler from the construction point of view.

[0011] Starting from the previously described technical context, the aim of the present invention is to propose a hinge of the type indicated at the beginning which is simpler than the known hinges from a construction point of view and which in any case allows to obtain the same results obtainable by the more complex known hinges.

[0012] In the case of a hinge of the type indicated at the beginning, said aim is achieved according to the invention if the hinge additionally has the characteristics as in the characterizing part of claim 1.

[0013] In the case of the hinge according to the invention, the reciprocal rotation between the base body and the arm is thus controlled at all moments both by the sliding of the transmission pin in the guiding slit and by the sliding of the contact surface of the base body on the level guiding surface. The simultaneous action of the guiding slit and of the level guiding surface allows to determine, as in the known prior art case, a precise regime of the reciprocal rotation between the base body and the arm. During this the sliding of the transmission pin in the guiding slit is particularly useful to carry out the reciprocal rotation and the sliding of the contact surface of the base body on the level guiding surface is particularly useful to guide the movement of the transmission body along the direction of longitudinal extension of the base body.

[0014] To this rotation regime corresponds, thanks to the interaction, made possible by the transmission means, between the arm and the operating means, a just as precise regime of the forces acting on the arm during the opening or the closing of the door, so that by the hinge according to the invention it is possible to obtain, although in the presence of fewer components and of a much simpler structure than that of the known hinges from a construction point of view, the same results obtainable by the prior art hinges, that is to say, a complete opening or closing of the door and the maintenance in perfect bal-

ance of the intermediate opening positions of the door between 20° and 70°.

[0015] If, as it is claimed in claim 2, the level guiding surface is made up of an internal surface of the base body 1, it is possible to use for this purpose a surface already present in the hinge. If then, as it is claimed in claim 3, the base body has a box-like cross section, the level guiding surface can be made up of the internal surface of one of the walls forming the base body. And if then, as it is claimed in claim 4, the box-like cross section of the base body is open, the wall of the base body having the level guiding surface can be the one opposite to the open side of the base body.

[0016] With reference to the contact surface, it is advantageous that it is made up, as it is claimed in claim 5, of a portion of the external surface of the transmission body, since it is already present in the hinge. As an alternative, if it is appropriate to change the friction coefficient between the level guiding surface and the contact surface, the latter is made up, as it is claimed in claim 6, of a portion of the external surface of an intermediate body, which is arranged in a fixed way on a portion of the external surface of the transmission body and is made of a material different from that of which the transmission body is made.

[0017] Further advantages and characteristics of the invention will be more evident from the following description of embodiments of the hinge according to the invention, which are shown as a non-limiting example on the basis of the enclosed drawings, in which:

figures 1 and 2a schematically show a perspective view and a longitudinal section, along the section line B-B of figure 1, of the hinge according to the invention, the base body and the arm being in a first typical reciprocal position;

figure 2b schematically shows a representation similar to that of figure 2a, but in the case of a second embodiment of the operating means;

figures 3 and 4 schematically show a view from the bottom of the hinge of figures 1 and 2a and, in an enlarged scale, a cross section along the section line C-C of figure 3; figures 5 to 7 show the hinge of figure 2a in a sequence of possible positions which may be assumed during the movement of opening of the door;

figure 8 shows a Cartesian coordinate system (X,Y), in which the midline of the guiding slit and the position of the centre of the transmission pin are represented with reference to some opening angles of the door; figures 9 and 10 show a side view similar to figure 2a and a cross section similar to figure 4 in the case of another embodiment of the hinge according to the invention.

[0018] The figures show a hinge for connecting the door of a home appliance to the body of the home appliance, but the door and the home appliance are not

shown. Such a hinge comprises a base body 1 and an arm 2, which are connected to each other by means of a hinging pin 3 in such a way that each of them 1,2 is rotatable with respect to the other 2,1 in the two possible directions of rotation around the rotation axis A of the hinging pin 3. Usually, the base body 1 is fixed to the body of the home appliance and the arm 2 is fixed to the door. However, the contrary is also possible, that is to say, it is also possible to fix the arm 2 to the body of the home appliance and the base body 1 to the door. For the invention it is not important which of the two situations is selected. The figures represent the first situation, in which the base body 1 is fixed, since it is fixed to the body of the home appliance, while the arm 2 rotates with respect to the base body 1, since it 2 is fixed to the door.

[0019] The hinge also comprises some operating means and some transmission means.

[0020] The operating means act to generate a force which is used to rotate the base body 1 and the arm 2 with respect to each other towards a first typical reciprocal position, that is to say, that which corresponds to the situation of completely closed door. In this situation, shown for example in figure 2a, the door and, therefore, the arm 2 fixed to it form with the vertical an angle of about 0°. Figure 7 shows a second typical reciprocal position of the base body 1 and of the arm 2, that is to say, that which corresponds to the situation of completely open door, in which the door and, therefore, the arm 2 fixed to it form with the vertical an angle of about 90°.

[0021] The transmission means interact with the operating means and with the arm 2 both to transmit and apply to the arm 2 the force generated by the operating means and to transmit and apply to the operating means the external force which is applied on the door of the home appliance to rotate the base body 1 and the arm 2 with respect to each other towards their second typical reciprocal position, that is to say, that which corresponds to the situation of completely open door shown for example in figure 7.

[0022] The transmission means comprise at least one transmission body 4 and one transmission pin 5. The transmission body 4 is mobile along the direction of longitudinal extension B of the base body 1, which coincides with the section line B-B visible in figure 1, and on it 4 the operating means act to move it along said direction of longitudinal extension B. The transmission pin 5 is rigidly connected to the transmission body 4 and the arm 2 acts on it.

[0023] The hinge also comprises some guiding means for guiding in the two possible directions of rotation the reciprocal rotation between the base body 1 and the arm 2 around the rotation axis A of the hinging pin 3. The guiding means comprise at least one guiding slit 6, which extends in the arm 2. In said guiding slit 6 the transmission pin 5 is inserted in such a way that upon a reciprocal rotation between the base body 1 and the arm 2 it 5 slides in the guiding slit 6 and the transmission body 4, which is rigidly connected to the transmission pin 5, moves

along the direction of longitudinal extension B.

[0024] According to the invention the guiding means also comprise a level guiding surface 1a, which extends parallel to the direction of longitudinal extension B of the base body 1. Always according to the invention, the guiding slit 6 extends in length and has edges that are shaped according to curved lines in such a way that during the sliding of the transmission pin 5 in it 6 the force F that said guiding slit 6 transmits to the transmission pin 5, always comprises also a force component F_y that is directed, perpendicularly to the direction of longitudinal extension B, towards the level guiding surface 1a. By effect of said force F_y the transmission body 4, which is rigidly connected to the transmission pin 5, is always pushed towards the level guiding surface 1 and a contact surface 4a;4b of it 4 is always pressed against the level guiding surface 1a and therefore slides on it 1a during the movement of the transmission body 4 along the direction of longitudinal extension B.

[0025] The force F and its component F_y have been represented for example, in a qualitative way, in figure 8 with reference for example to the situation of door open at 50°.

[0026] This figure shows, with reference to a Cartesian coordinate system X,Y having origin in the rotation axis A of the hinging pin 3 (shown for example in figure 5), the middle axis of the guiding slit 6 and the relative position of the centre of the transmission pin 5 in some positions of the door identified by the indicated opening angle. As one can see in figure 8, although sliding within the respective guiding slit 6, the transmission pin 5 is always on a straight line parallel to the X axis. This is due to presence of the guiding surface 1a, against which the contact surface 4a;4b of the transmission body is pressed. Therefore, when according to the invention it is stated that the force F, which the guiding slit 6 transmits to the transmission pin 5, always comprises also a force component F_y that is directed, perpendicularly to the direction of longitudinal extension B, towards the level guiding surface 1a, it is meant that such a force component F_y is present, although with a different intensity module, for any opening angle of the door.

[0027] The level guiding surface 1a is suitably formed by an internal surface of the base body 1. If, as it is shown in the figures, the base body 1 has a box-like cross section, then the level guiding surface 1a is formed by the internal surface of one of the walls that make up the base body 1. If the box-like cross section of the base body 1 is open, then the wall of the base body 1 which has the level guiding surface 1a is the one opposite to the open side of the base body 1, it as it is shown in figure 4 or 10.

[0028] In a first embodiment, shown for example in figure 4, the contact surface is formed by a portion 4a of the external surface of the transmission body 4. As an alternative, in a second embodiment, shown in figure 10, the contact surface is formed by a portion 4b of the external surface of an intermediate body 8, which is arranged in a fixed way on a portion of the external surface

of the transmission body 4 and is made of a material different from that of which the transmission body 4 is made.

[0029] The transmission body 4 suitably extends, with two of its parts 4c which are reciprocally parallel and are provided with reciprocally opposite through-holes 4d, on both sides of the arm 2 to enclose between said two parts 4c at least one section of the guiding slit 6. In that case the transmission pin 5 is inserted and constrained in the two through-holes 4d.

[0030] As to the operating means, two embodiments are provided.

[0031] A first embodiment provides that the operating means consist of a traction spring 7, see figures 2a and 5 to 7, which is arranged inside the base body 1 and is hooked with a first end 7a to the base body 1 and with a second end 7b to the transmission body 4.

[0032] A second embodiment of the operating means provides that the operating means consist of a compression spring 10. In that case the base body 1 has a transverse closing wall with a hole and the transmission body 4 has an elongate part, which extends through said hole and has an abutment-like end. It is also provided, see figure 2b, that the compression spring 10 is wound around the elongate part of the transmission body 4 and rests with a first end 10a on the transverse closing wall and with a second end 10b on the abutment-like end of the elongate part of the transmission body 4.

[0033] On the transmission pin 5 a roller 9 can also be arranged in a freely rotatable way, said roller 9 being in contact with the edges of the guiding slit 6 and facilitating sliding.

[0034] The operation of the hinge according to the invention is as follows.

[0035] In the closed position of the door the base body 1 and the arm 2 are in the situation shown in figures 2a and 9 or in figure 2b. The opening angle of the door is 0°. In this position the return action of the traction spring 7 or of the compression spring 10 is still active, therefore the door is pressed against the body of the home appliance. In order for this to happen, the guiding slit 6 has been designed in such a way that, when the door is in the position at 0°, the transmission pin 5 is not in the end-of-stroke position yet, but in a position close to the end-of-stroke position, therefore it 5 could advance a little more in the guiding slit 6 before having to stop. This situation can be seen in figures 2a, 2b, 9. To this end-of-stroke position of the transmission pin 5 in the guiding slit 6 an opening angle of -3° is associated, see figure 8, that is to say, if the body of the home appliance was not present, the door would invade the space in which the body of the home appliance is, and this guarantees that the closed door is pressed against the body of the home appliance. When one opens the door with one's hand, one must overcome the force of the traction spring 7 or of the compression spring 10. If one leaves the door before reaching the 20° of opening, the return force of the traction spring 7 or of the compression spring 10 closes

the door again. As the opening angle of the door increases, the transmission pin 5 slides in the guiding slit 6, see figures 5 to 7, and the transmission body 4 is pulled along the direction of longitudinal extension B and said longitudinal movement causes an increase in the return force of the traction spring 7 or of the compression spring 10, which are progressively more and more respectively stretched or compressed. In the opening range between 20°, figure 5, and 70°, figure 6, it is possible to reach the balance between the weight force acting on the door and the return force exerted by the traction spring 7 or by the compression spring 10 and the door remains in balance in its open position. The force F_y acting on the transmission pin 5 is transmitted to the transmission body 4, therefore during the longitudinal movement of the transmission body 4 the contact surface 4a or the contact surface 4b of it 4 is pressed against the level guiding surface 1a and the transmission body 4 is forced by the level guiding surface 1a to perform a perfectly rectilinear longitudinal movement along the direction of longitudinal extension B.

[0036] In the open position of the door the base body 1 and the arm 2 are in the situation shown in figure 7. The opening angle of the door is about 90°, more precisely 86°, because in this situation, too, the transmission pin 5 is not in its end-of-stroke position, but in a position close to it. The return action of the traction spring 7 or of the compression spring 10 is maximum, but the weight force, to which the door is subjected, prevails. If one starts closing the door with one's hand, that is to say, if the opening angle of the door decreases, the transmission pin 5 slides in the guiding slit 6 in an opposite direction with respect to what occurs during the opening of the door and the movement of the transmission body 4, which is pulled along the direction of longitudinal extension B in an opposite direction with respect to what occurs during the opening of the door, causes a progressive release of the traction spring 7 or of the compression spring 10, which are progressively less and less respectively stretched or compressed. Thus, one has again the opening range between 20°, figure 5, and 70°, figure 6, in which it is possible to reach the balance between the weight force acting on the door and the return force exerted by the traction spring 7 or by the compression spring 10, therefore the door remains in balance in its the open position. The force F_y is obviously transmitted to the transmission body 4 also during the closing of the door, therefore the contact surface 4a or the contact surface 4b of the transmission body 4 is pressed against the level guiding surface 1a and the transmission body 4, guided by the level guiding surface 1a, performs again a perfectly rectilinear longitudinal movement, without movements perpendicular to the direction of longitudinal extension B.

Claims

1. Hinge for connecting the door of an electric household major appliance to the body of the electric

household major appliance, comprising:

- . a base body (1) and an arm (2), which are connected to each other by means of a hinging pin (3) in such a way that each of them (1, 2) is rotatable with respect to the other (2, 1) in the two possible directions of rotation around the rotation axis (A) of the hinging pin (3);
- . operating means, for generating a force that is used to rotate the base body (1) and the arm (2) with respect to each other towards a first typical reciprocal position;
- . transmission means, which interact with the operating means and with the arm (2) both to transmit and apply to the arm (2) said force generated by the operating means and to transmit and apply to the operating means the external force that is applied onto the door of the electric household major appliance to rotate the base body (1) and the arm (2) with respect to each other towards a second typical reciprocal position,
- said transmission means comprising at least one transmission body (4), which is mobile along the direction of longitudinal extension (B) of the base body (1) and on which the operating means act to move it along said direction of longitudinal extension (B), and a transmission pin (5), which is rigidly connected to the transmission body (4) and on which the arm (2) acts;
- . guiding means, for guiding in the two possible directions of rotation the reciprocal rotation of the base body (1) and of the arm (2) around the rotation axis (A) of the hinging pin (3), said guiding means comprising at least one guiding slit (6), which extends in the arm (2) and in which the transmission pin (5) is inserted in such a way that upon a reciprocal rotation between the base body (1) and the arm (2) it (5) slides in the guiding slit (6) and the transmission body (4) - which is rigidly connected to the transmission pin (5) - moves along said direction of longitudinal extension (B), **characterised in that** said guiding means also comprise a level guiding surface (1a), which extends parallel to the direction of longitudinal extension (B) of the base body (1), and **in that** said guiding slit (6) extends in such a way in length and has edges that are shaped in such a way according to curved lines that during the sliding of the transmission pin (5) in the guiding slit (6) the force (F) that said guiding slit (6) transmits to the transmission pin (5) always comprises also a force component (F_y) that is directed, perpendicularly to the direction of longitudinal extension (B), towards the level guiding surface (1a), therefore the transmission body (4), which is rigidly connected to the transmission pin (5), is always pushed towards the level

- guiding surface (1a) and a contact surface (4a;4b) of it (4) is always pressed against said level guiding surface (1a) and therefore slides on it (1a) during the movement of the transmission body (4) along the direction of longitudinal extension (B) of the base body (1). 5
2. Hinge according to claim 1, **characterised in that** said level guiding surface (1a) is formed by an inner surface of the base body (1). 10
3. Hinge according to claim 2, **characterised in that** the base body (1) has a box transverse section and **in that** said level guiding surface (1a) is formed by the inner surface of one of the walls that make up the base body (1). 15
4. Hinge according to claim 3, **characterised in that** the box transverse section of the base body (1) is open and **in that** the wall of the base body (1) that has the level guiding surface (1a) is the one opposite to the open side of the base body (1). 20
5. Hinge according to one of claims 1 to 4, **characterised in that** the contact surface (4a) is formed by a portion of the outer surface of the transmission body (4). 25
6. Hinge according to one of claims 1 to 4, **characterised in that** the contact surface (4b) is formed by a portion of the outer surface of an intermediate body (8), which is arranged in a fixed way on a portion of the outer surface of the transmission body (4) and is made of a material different from that of which the transmission body (4) is made. 30 35
7. Hinge according to one of claims 1 to 6, **characterised in that** the transmission body (4) extends, with its two reciprocally parallel parts (4c) which are provided with reciprocally opposite through-holes (4d), on both sides of the arm (2) to enclose between said two parts (4c) at least one section of the guiding slit (6) and **in that** the transmission pin (5) is inserted and constrained in the two through-holes (4d). 40 45
8. Hinge according to one of claims 1 to 7, **characterised in that** the operating means consist of a traction spring (7), which is arranged inside the base body (1) and is hooked with a first end (7a) to the base body (1) and with a second end (7b) to the transmission body (4). 50
9. Hinge according to one of claims 1 to 7, **characterised in that** the base body (1) has a transverse closing wall with a hole, **in that** the transmission body (4) has an elongate part that extends through said hole and has an abutment-like end and **in that** the operating means consist of a compression spring (10), which is wound around the elongate part and rests with a first end (10a) on the transverse closing wall and with a second end (10b) on the abutment-like end. 55
10. Hinge according to one of claims 1 to 9, **characterised in that** on the transmission pin (5) a roller (9) is arranged in a freely rotatable way and is in contact with the edges of the guiding slit (6).

Fig.1

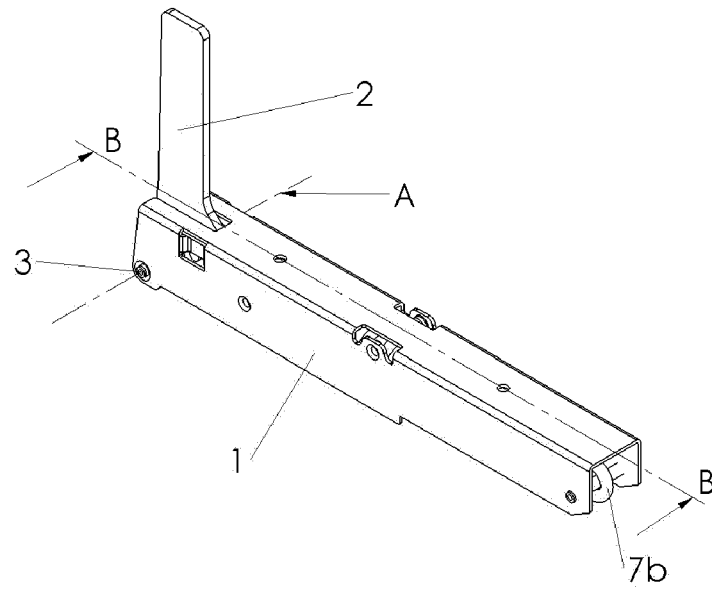


Fig.2a

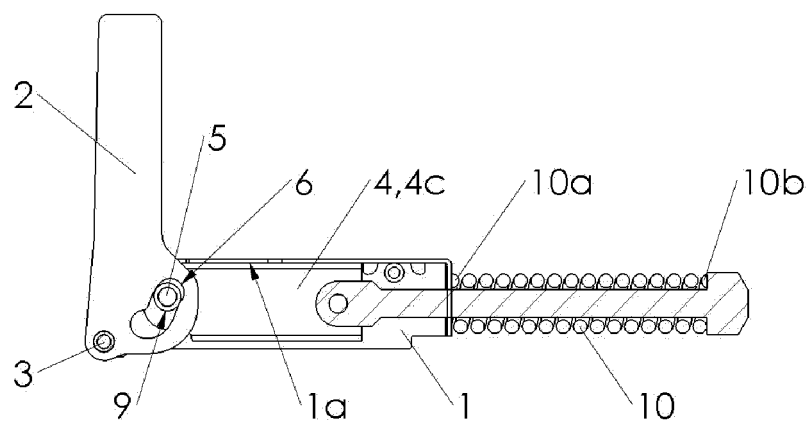
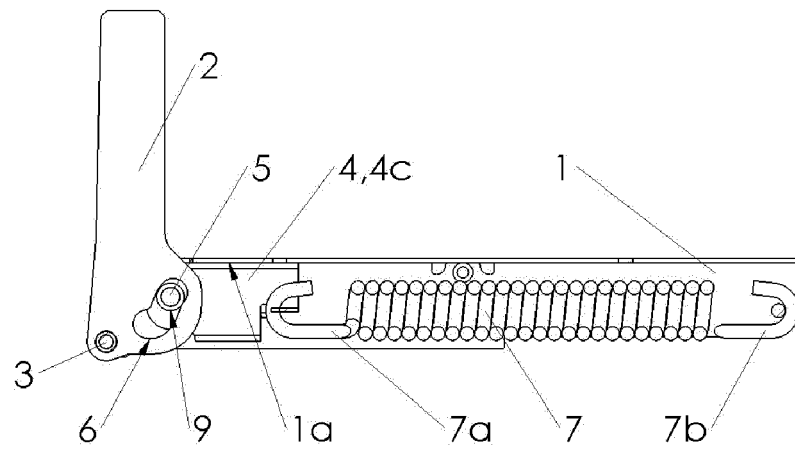


Fig.2b

Fig.3

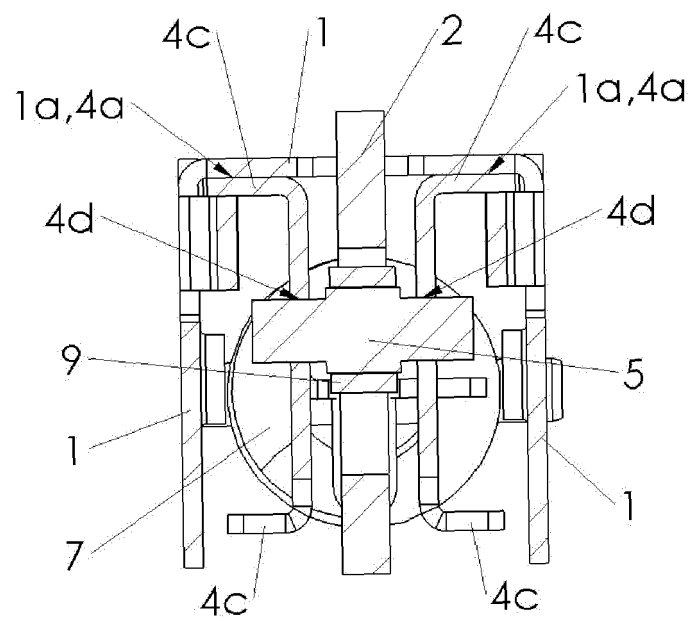
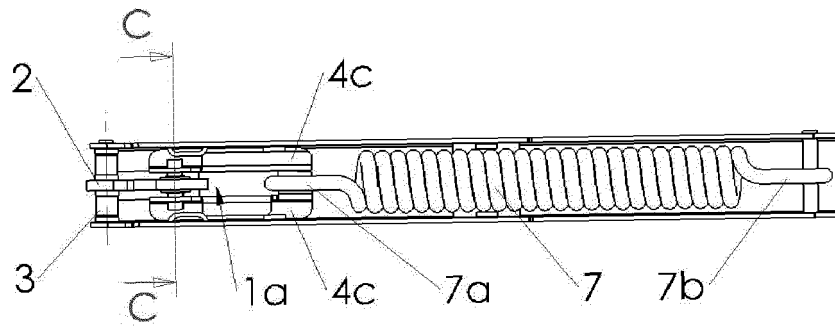


Fig.4

Fig.5

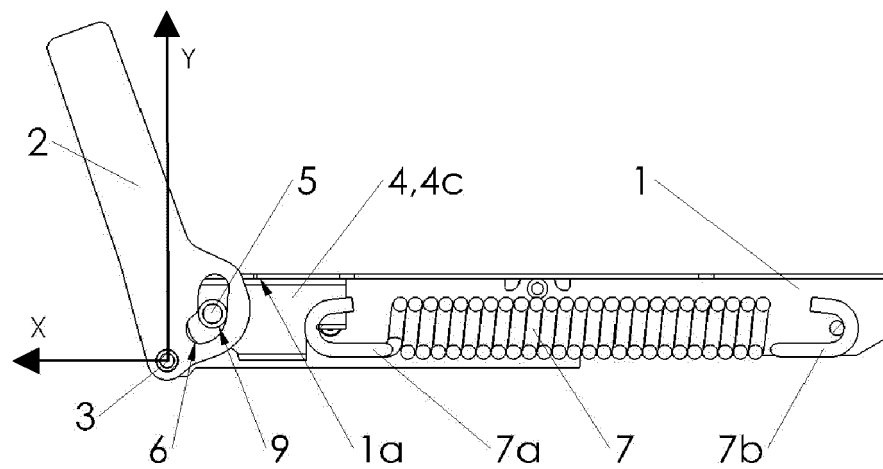


Fig.6

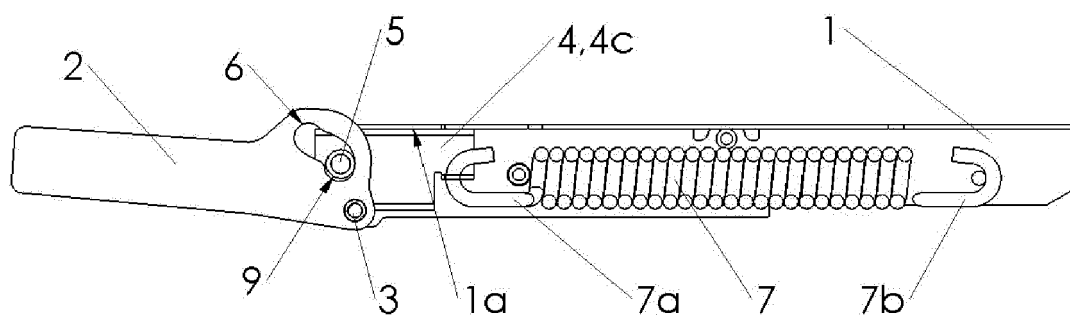
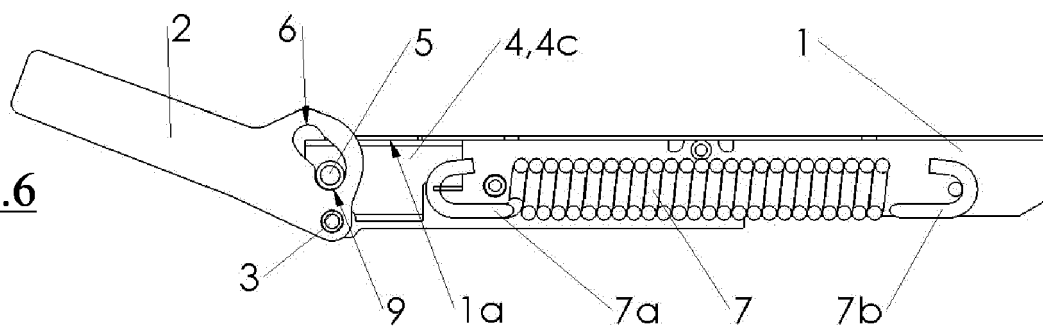


Fig.7

Fig. 8

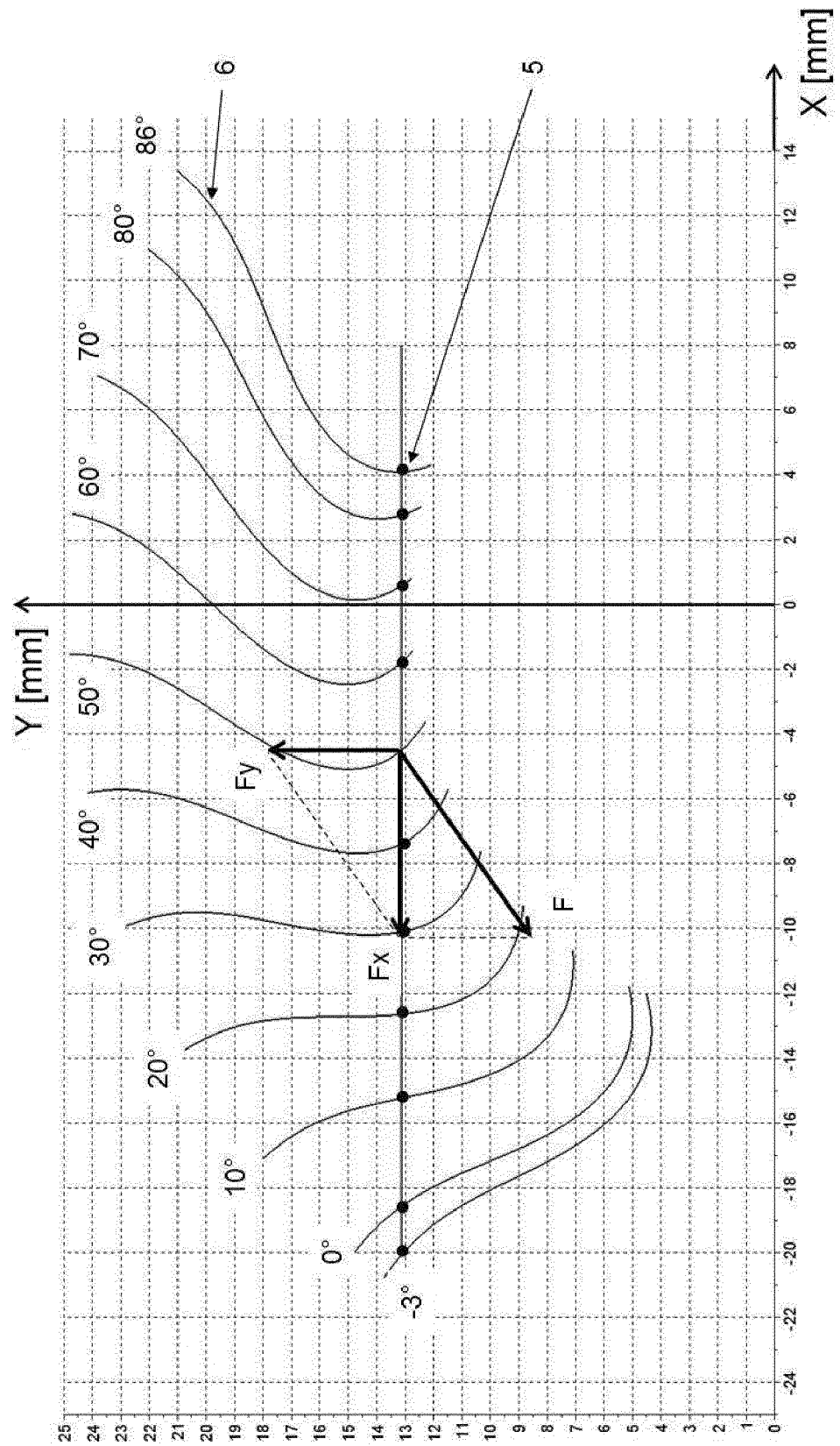


Fig.9

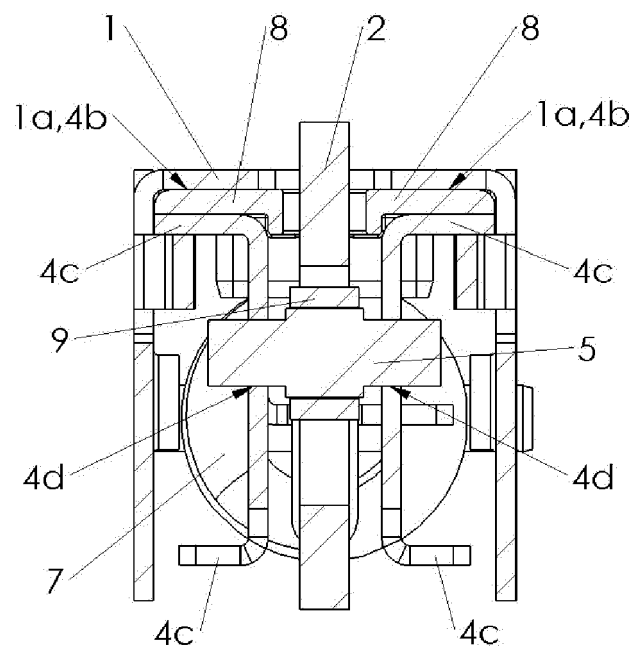
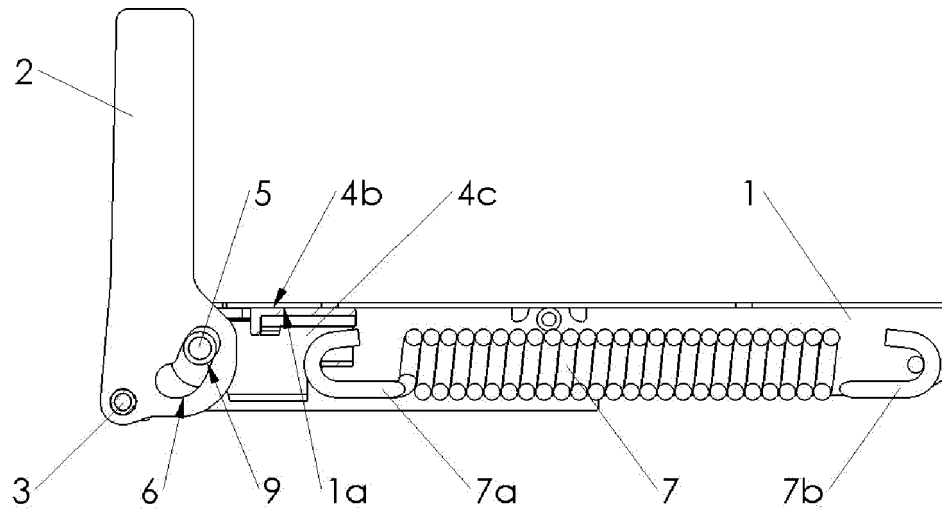


Fig.10



EUROPEAN SEARCH REPORT

 Application Number
 EP 16 15 9428

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Place of search The Hague		Date of completion of the search 18 August 2016	Examiner Wagner, Andrea
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			

EPO FORM 1503 03/02 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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REFERENCES CITED IN THE DESCRIPTION

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