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(54) A HEIGHT-ADJUSTING DEVICE FOR SHELVES OF APPLIANCES

(57) The present invention provides for a height-adjusting device for shelves of appliances, in particular for dishwasher racks, comprising: a support member (18), defining a substantially planar surfaces having an upper edge (26) and a lower edge (27) and extending in a substantially vertical first plane, when in use; a locking element (30), having a proximal end, hinged with said support member (18) at a first pivot axis (B) that is normal to said first vertical plane and provided towards said lower edge (27), and a distal end having a pin (34) that is operably linked via a biasing member (100) to a second pivot axis (C) vertically spaced apart from said first pivot axis (B) towards said upper edge (26) and that is normal to said first vertical plane, wherein said locking element (30) is configured to move about said pivot axis (B) relative to said support member (18) between an engaged position and a disengaged position, opposite said engaged position relative to a second plane (T) perpendicular to said first plane and containing said first pivot axis (B) and said second pivot axis (C); a bracket member (38), slidably coupleable with said support member (18) so as to allow vertical movement of said bracket member (38) relative to said support member (18) between a top position and a bottom position, comprising: a first cam surface (43), having at least one locking seat (44), configured to lockingly engage with said pin (34) of said locking element (30) when in said engaged position, when moving said bracket member (38) from said top position towards said bottom position; a second cam surface (47), configured to operably engage with said pin (34) of said locking element (30) so as to move said locking element (30) from said engaged position to said disengaged position and toggle said biasing member (100) from a first biasing disposition, where said locking element (30) is biased towards said first cam surface (43), to a second biasing disposition, where said locking element (30) is biased away from said first cam surface (43), when moving said bracket member (38) to said top position, and a third cam surface (48), configured to guidingly engage with said pin (34) of said locking element (30) so as to move said locking element (30) from said disengaged position to said engaged position and toggle said biasing member (100) from said second biasing disposition to said first biasing disposition, when moving said bracket member (38) from said top position to said bottom position.

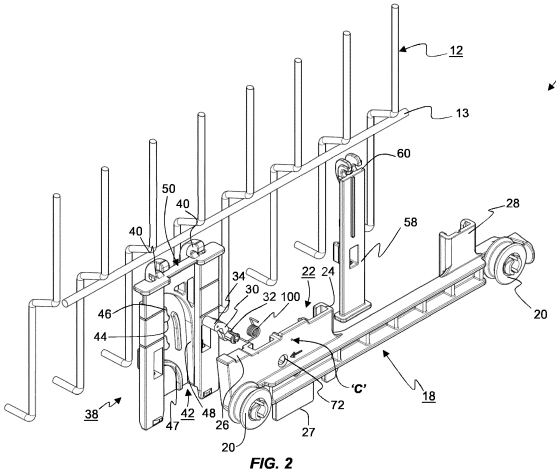

FIG. 2

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Description

[0001] The present invention generally relates to the field height-adjusting devices for shelves of appliances, and in particular, to height-adjusting devices for dishwasher racks.

Introduction

[0002] Electric household appliances such as dishwashers and refrigerators may be provided with shelves which are adjustable heightwise.

[0003] In particular, domestic dishwashers are typically provided with racks intended to receive the dishes to be washed. The racks can usually be extracted laterally in order to allow loading and unloading of the dishes. Dishwashers may also be provided with devices for adjusting the vertical position of the racks, this function being useful for optimising the arrangement of the load. One example of an effective solution realising such kind of device is described on document EP3387981A1. Here, a multilevel adjusting system is provided that works without any locking and unlocking component(s) that require activation by a user and where different stable vertical positions are reached by simply grabbing and pulling the rack upwards until the adjusting system autonomously locks onto and unlocks from each one of the different levels.

[0004] However, the relative position of the pivotable locking element (latch) of the adjusting device disclosed in document EP3387981A1 is determined by the mutual position between its centre of gravity (CoG) and its free rotation axis, and the movement from a first stable position to a second stable position is simply controlled by the locking element's weight force acting on the CoG around its free rotation axis. Considering the relatively small dimension of the locking element and its relatively low weight, it is possible, or even likely, that accumulated dirt within the adjusting device (e.g. residuals from food, such as fat, or detergent) and/or the water itself (i.e. the water surface tension when the latch is wet) can affect the latch's mobility, as well as, its position, for example, by "gluing" the latch to any of the other components of the system.

[0005] Therefore, it is an object of the present invention to provide an improved vertical position adjusting device (i.e. height adjusting) for shelves of appliances, in particular, for dishwasher racks, with a self-actuating locking/unlocking function (i.e. no manual user interaction other than moving the shelf up or down) for moving and locking a shelf into different height levels, and that is optimised to minimise or prevent malfunction caused by accumulated dirt or water surface tension.

Summary of the Invention

[0006] According to a first aspect of the invention, there is provided a height-adjusting device for shelves of appliances, in particular for dishwasher racks, comprising:

a support member, defining a substantially planar surfaces having an upper edge and a lower edge and extending in a substantially vertical first plane, when in use;

a locking element, having a proximal end, hinged with said support member at a first pivot axis (B) that is normal to said first vertical plane and provided towards said lower edge, and a distal end having a pin that is operably linked via a biasing member to a second pivot axis (C) vertically spaced apart from said first pivot axis (B) towards said upper edge and that is normal to said first vertical plane, wherein said locking element is configured to move about said pivot axis (B) relative to said support member between an engaged position and a disengaged position, opposite said engaged position relative to a second plane (T) that is perpendicular to said first plane and containing said first (B) and second pivot axis (C);

a bracket member, slidably coupleable with said support member so as to allow vertical movement of said bracket member relative to said support member between a top position and a bottom position, comprising:

a first cam surface, having at least one locking seat, configured to lockingly engage with said pin of said locking element when in said engaged position, when moving said bracket member from said top position towards said bottom position;

a second cam surface, configured to operably engage with said pin of said locking element so as to move said locking element from said engaged position to said disengaged position and toggle said biasing member from a first biasing disposition, where said locking element is biased towards said first cam surface, to a second biasing disposition, where said locking element is biased away from said first cam surface, when moving said bracket member to said top position, and

a third cam surface, configured to guidingly engage with said pin of said locking element so as to move said locking element from said disengaged position to said engaged position and toggle said biasing member from said second biasing disposition to said first biasing disposition, when moving said bracket member from said top position to said bottom position.

[0007] This provides the advantage of a locking ele-

ment that is always biasingly engaged with a respective cam surface, i.e. the first cam surface for moving the shelf up and locking it at different height levels and the second cam surface for moving the shelf back to its lowermost position, therefore, providing a latch mechanism that is not easily affected by any food residue or residual water. In particular, the toggleable biasing member is adapted to force the locking element towards and into operable engagement with a respective cam surface once its pin has passed the toggle point (i.e. the plane defined by the first (B) and second (C) pivot axis) by releasing the energy temporarily stored in the biasing element (from movement of the shelf by the user).

[0008] Furthermore, the present invention provides the advantage of providing an audible feedback to the user when moving into any one of the two stable positions (the engaged or disengaged position), i.e. when the biasing element toggles from one side to the other, the then released biasing force will audibly snap the locking element into engagement with a respective cam surface.

[0009] Moreover, the present invention provides a simplified mechanism that is more robust and easier to use.

[0010] Advantageously, said first cam surface may comprise a plurality of locking seats spaced apart along said first cam surface, each one is configured to lockingly engage with said pin of said locking element when in said engaged position.

[0011] Advantageously, said first cam surface may further comprise a plurality of inclined surfaces, each one situated vertically above a respective one of said plurality of locking seats, configured to slidingly engage with said pin of said locking element when moving said bracket member towards said top position, during use.

[0012] Advantageously, said bracket member may further comprise an upper stop member adapted to bear against said upper edge of said support member when in said bottom position.

[0013] Advantageously, said support member may further comprise an auxiliary vertical guide slidably coupleable with an auxiliary bracket member.

[0014] Advantageously, said biasing member may be a torsion spring, formed by at least one coil having a first arm, tangentially emerging from a first end of said at least one coil, and a second arm, tangentially emerging from a second end of said at least one coil, and which is configured to provide a biasing force about a centre axis of said at least one coil between said first arm and said second arm. Preferably, said first arm may be pivotally coupled to said second pivot axis (C) and said second arm may be pivotally coupled to said pin of said locking element, such that said centre axis of said at least one coil is arranged in parallel to said first pivot axis (B) and said second pivot axis (C).

[0015] Advantageously, said third cam surface may be formed to follow a substantially parabolic curve and convergingly joins with a top portion of said first cam surface.

[0016] Advantageously, a bottom portion of said first cam surface may seamlessly join with a start portion of said second cam surface.

[0017] It is understood that the height-adjusting device of the present invention does not use the dishwasher appliance rack as an active part and therefore does not require it to have specific geometrical form or shape. Thus, the height-adjusting device of the present invention may be designed to be attached/fixed to any suitable rack or shelf.

[0018] Further, the present claims form an integral part of the teaching provided in connection with the invention.

Brief Description of the Drawings

[0019] Embodiments of the invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 shows a partial perspective view of a dishwasher appliance rack provided with an embodiment of the height-adjusting device according to the present invention;

Figure 2 shows an exploded perspective view of a portion of the dishwasher appliance rack and the height-adjusting device of Figure 1;

Figure 3 shows a side view of (a) the bracket member(s) only attached to the rack of the dishwasher appliance and (b) the assembled height-adjusting device attached to the rack of the dishwasher appliance;

Figure 4 shows a series of side views of a portion of the dishwasher appliance rack and attached height-adjusting device moving from (a) a bottom position with the rack fully down, via (b) a middle position to (c) a top position with the rack fully up, and

Figure 5 shows a detailed partial side view of the height-adjusting device when moving from the bottom position (rack fully down) to a top position (rack fully up) and back to its bottom position (rack fully down) in a step-by-step series including (a)-(e): the rack is moved up into its upmost locking position, (f)-(g): the rack is moved into its top position rotating the locking element (latch) from its engaged position to its disengaged position and at the same time, toggling the biasing member from its first biasing disposition into its second biasing disposition, and (h)-(j): the rack is moved down to its bottom position guiding the locking element from its disengaged position back to its engaged position and toggling the biasing member from its second biasing disposition to its first biasing disposition.

[0020] In the drawings, like reference numerals refer to like parts.

Detailed Description of Examples

[0021] The described example embodiment relates to an assembly that allows the support and the height-ad-

justment of a shelf or rack, in particular, a rack of a dishwasher appliance. The assembly is generally composed of two symmetrical pairs of height-adjusting devices, one for the left side and the other one for the right side of the rack, however, it is understood that it is sufficient to describe the basic concept of the present invention with reference to only one of the two height-adjusting devices. Further, it is understood that the example embodiment of the height-adjusting device described may also be used to adjust the height of shelves in other household appliances, such as, for example, refrigerators.

[0022] Certain terminology is used in the following description for convenience only and is not limiting. The words 'right', 'left', 'lower', 'upper', 'front', 'rear', 'upward', 'down' and 'downward', 'top' and 'bottom' designate directions in the drawings to which reference is made and are with respect to the described component when assembled and mounted. The words 'inner', 'inwardly' and 'outer', 'outwardly' refer to directions toward and away from, respectively, a designated centreline or a geometric centre of an element being described (e.g. central axis), the particular meaning being readily apparent from the context of the description. Further, relative positional terms, such as, 'distal', 'proximal', 'lateral' and 'medial' are understood in their normal meaning and in relation to a specific element being described.

[0023] Further, as used herein, the terms 'connected', 'attached', 'coupled', 'mounted' are intended to include direct connections between two members without any other members interposed therebetween, as well as, indirect connections between members in which one or more other members are interposed therebetween. The terminology includes the words specifically mentioned above, derivatives thereof, and words of similar import.

[0024] Further, unless otherwise specified, the use of ordinal adjectives, such as, 'first', 'second', 'third' etc. merely indicate that different instances of like objects are being referred to and are not intended to imply that the objects so described must be in a given sequence, either temporally, spatially, in ranking or in any other manner.

[0025] With reference to Figure 1, a portion of a dishwasher and its washing chamber 10 is shown. One or more rack(s) 12 may be housed inside the chamber 10 and may be movable with respect to the chamber 10 in a horizontal direction (indicated by the double arrow 'A') between an extracted position (i.e. as shown in Figure 1) and a retracted position (i.e. when moved back into the chamber 10). The rack 12 may be connected to the chamber 10 by means of a pair of telescopic guides 14, of a type known per se, which allow the rack 12 to be moved in the direction 'A'. In this particular example, the rack 12 is connected to the lateral telescopic guides 14 by means of two height-adjusting devices 16 wherein the height-adjusting devices 16 also support the rack 12 transferring the weight of the rack 12 to the lateral telescopic guides 14, as well as, adjust the vertical distance between the rack 12 and the lateral telescopic guides 14, at two or more predefined levels.

[0026] Referring now to Figure 2, each one of the height-adjusting devices 16 comprises a support bracket 18 configured to operably engage with a corresponding lateral guide 14. For example, the support bracket 18 may be provided with a pair of wheels 20 adapted to slidably engage with a corresponding lateral guide 14. The support bracket 18 may be formed by a body elongated in the horizontal direction 'A'. The support bracket 18 further comprises a main vertical guide 22 formed for example by two L-shaped projections 24 facing each other. The support bracket 18 has an upper contact surface (i.e. upper edge) 26 and a lower edge 27, the function of which will become clear below. The support bracket 18 may also comprise an auxiliary vertical guide 28 having a C-shaped cross section that is arranged at a distance from the main vertical guide 22 in the horizontal direction 'A'.

[0027] The height-adjusting device 16 comprises a locking element 30 (i.e. a latch) that is hinged on the support bracket 18 at its proximal end 32 so as to allow rotation of the locking element's distal end about a horizontal pivot axis ***'B'*** that is also perpendicular to the direction 'A' (rack extraction direction), as well as, a vertical first plane (2D) defined by the two degrees of freedom (DOF) of the rack 12 (i.e. horizontal movement 'A' and vertical movement 'V'). Furthermore, the locking element 30 has a pin 34 that is situated at the distal end thereof.

[0028] A biasing member, e.g. a torsion spring 100, is provided so as to operably link the locking element 30 and the support bracket 18. In particular, one first arm of the torsion spring 100 is pivotably attached to the pin 34 and the second arm of the torsion spring 100 is pivotably attached to the support bracket 18 at a horizontal pivot axis ***'C'.*** In this particular example embodiment, pivot axis ***'C'*** is vertically spaced apart from the pivot axis ***'B'*** in a direction towards the upper contact surface or edge 26.

[0029] The functional link between the support bracket 18, the torsional spring and the pin 34 of the rotatable locking element 30 provides two stable biasing dispositions of the torsional spring 100. The first biasing disposition provides a biasing force acting on the pin 34 of the locking element 30 (i.e. latch) in a direction towards a first cam surface 42 (i.e. the locking element 30 is in its engaged position), and the second biasing disposition provides a biasing force acting on the pin 34 of the locking element 30 (i.e. latch) in a direction opposite to the direction of the first biasing disposition (i.e. the locking element 30 is in its disengaged position). Preferably, the torsional spring 100 is dimensioned such that biasing force provided between the first and second arm of the torsion spring is sufficiently greater than the force provided by the weight of the locking element 30.

[0030] Referring now to Figures 2 and 3, the height-adjusting device 16 further comprises a sliding bracket 38 provided with fixing formations 40 for fixing it to the side wall of the rack 12. The sliding bracket 38 has a reverse cam surface 42 configured to operably engage with the pin 34 of locking element 30 during use. The

reverse cam surface 42 comprises three distinct sections, a first cam surface 43 on one side, having two vertically spaced apart locking seats 44 arranged to form a sawtooth profile with inclined sections 46 situated vertically above respective locking seats 44, a third cam surface 48 on a side opposite the first cam surface 43, formed as a continuous wall surface following a parabolic curve and convergingly joining with the top end of the first cam surface 43, and a second cam surface 47, continuing from a bottom end of the first cam surface 43 and which is configured to downwardly 'guide' and rotate the pin 34 away from the first cam surface 43 until the pin 34 (i.e. the central pivot connection with the first arm of the torsion spring 100) has moved passed a toggle plane ***'T'***, at which point the torsion spring 100 is toggled from its first stable biasing disposition into its second stable biasing disposition. The intended toggle plane ***'T'*** is a 2-dimensional plane that is perpendicular to the first plane and which passes through pivot axis ***'B'*** and ***'C'*.**

[0031] During use, the sliding bracket 38 is configured to slidingly engage with the vertical guide 22 of the support bracket 18 so as to allow 'free' sliding movement in a vertical direction (i.e. 1 DOF) relative to the support bracket 18. In this particular embodiment, the sliding bracket 38 may generally have the form of a thin plate with two parallel lateral flanks that are adapted to engage slidably with the L-shaped projections 24 of the vertical guide 22. The sliding bracket 38 has an upper wall 50 configured to abuttingly engage with the upper surface 26 of the support bracket 18, so as to function as a stopper for the sliding bracket 38 when moving into the lowermost position of the rack 12. Further, the sliding bracket 38 may comprise an additional wall 54 provided between the first cam surface 43 and the third cam surface 48, and which is configured to prevent the locking element 30 from rotating into its disengaged position while still operably engaged with the first cam surface and before engaging with the second cam surface 47.

[0032] In addition to the sliding bracket 38, the height-adjusting device 16 (vertical position adjusting device) may further comprise an auxiliary bracket 58 that is horizontally spaced apart from the sliding bracket 38 (along direction 'A') and adapted to slidably engage with an auxiliary guide 28 provided on support bracket 18. The auxiliary bracket 58 is provided with fixing formations for fixing it to a horizontal bar 13 of the side wall of the rack 12. The horizontal bar 13 of the rack 12 that is fixedly engaged with the auxiliary bracket 58 may also form an upper stop 60 adapted to rest on the upper surface of the auxiliary guide 28 when the rack 12 is in the lowermost position. The auxiliary bracket 58 is to provides a greater stability to the rack 12 when in a raised position.

[0033] The mode of operation of the height-adjusting device 16 is now described with reference to Figures 4(a), (b) and (c) and Figures 5(a)-(j).

[0034] Figure 4(a) shows the rack 12 and the height-adjusting device 16 in its lowermost position. In this position the upper wall 50 of the sliding bracket 38 rests on the upper contact surface 26 of the support bracket 18. In the same way, the horizontal bar 13 of the rack 12 with which the auxiliary bracket 58 is engaged rests on the upper surface of the auxiliary guide 28. Also, the pin 34 of the locking element 30 is situated in an upper vertex formed by the top portion of the first cam surface 43 and the end portion of the third cam surface 48, and with the torsional spring 100 pushing the pin 34 toward the first cam surface 43 (i.e. engaged position).

[0035] Starting from the position shown in Figure 4(a), in order to adjust the height of the rack 12, the user simply pulls the rack 12 upwards. The attached sliding bracket 38 is also moved upwards sliding vertically within the vertical guide 22 of the support bracket 18. While moving the rack 12 / sliding bracket 38, pin 34 slides along the first cam surface 43 until it reaches the inclined surface 46 of the first locking seat 44 (see Figure 5(b)). Continuing to lift the rack 12, the pin 34 is rotated by inclined surface 46 so as to push the pin 34 closer to the toggle plane ***'T'*** and compress the first and second arm of the torsional spring 100 until the pin has passed the locking seat 44 (see Figure 5(c)) at which point the locking element 30 rotates back about the pivot axis 'B' and into engagement with the first cam surface 43. The sudden release of the compressed torsional spring 100 will snap the pin 34 onto the first surface cam 43 and generate an audible clicking noise providing the user with an audible feedback that the rack 12 has reached one of the locking positions.

[0036] At the point shown in Figure 5(c), the pin 34 engages with the locking recess 36 on the support bracket 18 and the locking seat 44 on the sliding bracket 38 at the same time. When the pin 34 is engaged in this way, it prevents reverse movement of the sliding bracket 38 back into its previous position, therefore, locking the rack 12 at this new vertical position. Thus, the pin 34 of the locking element 30 acts as a bolt and is clamped between the engaging locking seat 44 of the sliding bracket 38 and the locking recess 36 of the support bracket 18 keeping the rack 12 stably in the selected adjustment position.

[0037] Figures 5(d) and (e) illustrate a repeat of the operation illustrated in Figures 5(b) and (c) but moving the rack 12 into a second vertical adjustment position (i.e. a vertical position of the rack 12 that is higher than the previous one). The number of vertical adjustment positions (i.e. vertical locking positions) is determined by the number of locking seats 44 provided on the first cam surface 43. In this particular example embodiment, the height-adjusting device 16 comprises two locking seats 44 so as to provide for three different heights of the rack 12 (i.e. lowermost position, first locking seat 44 and second locking seat 44). Each time the locking element snaps back into a new locking position, an audible clicking noise provides confirmation that a new height level has been reached and locked.

[0038] A window 70 may be provided on the sliding bracket 38 in the region of each one of the locking seats 44 so as to provide the user with a visual confirmation

that the pin 34 is locked in a particular locking seat 44 (visual check of the height level).

[0039] In order to move the rack 12 back into its lowermost position, the rack 12 must first be unlocked by grabbing and pulling the rack 12 upwards into its top position (upmost position). As shown in Figure 5(f), during this operation, the pin 34 is moved out of engagement with the locking seat 44 and into sliding engagement with the second cam surface 47 where the pin 34 is moved towards and past toggle plane 'T'. At the point where the pin 34 crosses toggle plane 'T', the first arm of the torsional spring 100 is also moved passed toggle plane 'T' moving the torsion spring 100 into a second biasing disposition where the first arm of the torsion spring 100 pushes and biases the locking element 30 towards the third cam surface 48. The toggling action of the locking element 30 and torsion spring 100 generates another audible clicking noise providing the user with an audible feedback confirming that the sliding bracket 38 and rack 12 have been unlocked to be moved back to the bottom position (see Figures 5(f)-(g)).

[0040] In order to prevent the sliding bracket 38 from being pulled out of engagement with the vertical guide 22 o the support bracket 18, two teeth 66 are provided at the bottom edge of the sliding bracket 38 that are configured to abuttingly engage with respective seats 68 formed at the bottom edge of the support bracket 18 (see Figure 5(g)).

[0041] Referring now to Figures 5(h)-(j), accompanying the rack 12 when moved down, the lowermost level of the rack 12 is reached when the upper edge 50 of the sliding bracket 38 abuttingly engages with the upper edge 26 of the support bracket 18. While lowering the rack 12, the pin 34 slidingly engages with the third cam surface 48 following a substantially parabolic curve until the pin 34 (and the first arm of the torsion spring 100) move passed the toggle plane ***'T'*** at which point the torsion spring 100 is toggled back into its first biasing disposition now pushing the pin 34 of the locking element 30 back towards the first cam surface 43, and moving back into its starting position (see Figure 5(j) and (a)).

[0042] In order to provide the user with feedback that the height-adjusting device 16 has reached a stable position, several artifices may be applied in addition to the audible clicking noise that can be heard each time the locking element 30 engages with a locking seat 44 or changes between the engaged position and the disengaged position.

[0043] For example, in the example embodiment of the present invention as illustrated in the accompanying Figures, a horizontal groove may be provided on the sliding bracket 38 that will become visible when the support bracket 18 reaches a stable (i.e. locked) height level. A level number may also be provided above each one of these grooves so as to improve the ease of use when trying to position the two sides of the rack 12 on the same level. In addition, a spyhole 72 may be provided on the support bracket 18 (e.g. indicated by an arrow) to allow the user to inspect the pin 34 of the locking element 30 when in a locking position. Further, the locking element 30 may be made of a different material and/or has a color that differs from the material and/or color of the support bracket 18, so as to further improve detectability of the locking element's 30 position though the spyhole 72. Furthermore, the sliding bracket 38 may comprise several spyholes 70, e.g. one for each stable position, through which the user can inspect the position of the pin 34.

[0044] It will be appreciated by persons skilled in the art that the above embodiments have been described by way of example only and not in any limiting sense, and that various alterations and modifications are possible without departing from the scope of the invention as defined in the appended claims.

Claims

1. A height-adjusting device for shelves of appliances, in particular for dishwasher racks, comprising:

   a support member (18), defining a substantially planar surfaces having an upper edge (26) and a lower edge (27) and extending in a substantially vertical first plane, when in use;
   a locking element (30), having a proximal end, hinged with said support member (18) at a first pivot axis (B) that is normal to said first vertical plane and provided towards said lower edge (27), and a distal end having a pin (34) that is operably linked via a biasing member (100) to a second pivot axis (C) vertically spaced apart from said first pivot axis (B) towards said upper edge (26) and that is normal to said first vertical plane, wherein said locking element (30) is configured to move about said pivot axis (B) relative to said support member (18) between an engaged position and a disengaged position, opposite said engaged position relative to a second plane (T) perpendicular to said first plane and containing said first pivot axis (B) and said second pivot axis (C);
   a bracket member (38), slidably coupleable with said support member (18) so as to allow vertical movement of said bracket member (38) relative to said support member (18) between a top position and a bottom position, comprising:

      a first cam surface (43), having at least one locking seat (44), configured to lockingly engage with said pin (34) of said locking element (30) when in said engaged position, when moving said bracket member (38) from said top position towards said bottom position;
      a second cam surface (47), configured to operably engage with said pin (34) of said

locking element (30) so as to move said locking element (30) from said engaged position to said disengaged position and toggle said biasing member (100) from a first biasing disposition, where said locking element (30) is biased towards said first cam surface (43), to a second biasing disposition, where said locking element (30) is biased away from said first cam surface (43), when moving said bracket member (38) to said top position, and

a third cam surface (48), configured to guidingly engage with said pin (34) of said locking element (30) so as to move said locking element (30) from said disengaged position to said engaged position and toggle said biasing member (100) from said second biasing disposition to said first biasing disposition, when moving said bracket member (38) from said top position to said bottom position.

2. A height-adjusting device according to claim 1, wherein said first cam surface (43) comprises a plurality of locking seats (44) spaced apart along said first cam surface (43), each one configured to lockingly engage with said pin (34) of said locking element (30) when in said engaged position.

3. A height-adjusting device according to claim 2, wherein said first cam surface (43) further comprises a plurality of inclined surfaces (46), each one situated vertically above a respective one of said plurality of locking seats (44), configured to slidingly engage with said pin (34) of said locking element (30) when moving said bracket member (38) towards said top position, during use.

4. A height-adjusting device according to any one of the preceding claims, wherein said bracket member (38) further comprises an upper stop member (50) adapted to bear against said upper edge (26) of said support member (18) when in said bottom position.

5. A height-adjusting device according to any one of the preceding claims, wherein said support member (18) further comprises an auxiliary vertical guide (28) slidably coupleable with an auxiliary bracket member (58).

6. A height-adjusting device according to any one of the preceding claims, wherein said biasing member (100) is a torsion spring, formed by at least one coil having a first arm, tangentially emerging from a first end of said at least one coil, and a second arm, tangentially emerging from a second end of said at least one coil, and configured to provide a biasing force about a centre axis of said at least one coil between said first arm and said second arm.

7. A height-adjusting device according to claim 6, wherein said second arm is pivotally coupled to said second pivot axis (C) and said first arm is pivotally coupled to said pin (34) of said locking element (30), such that said centre axis of said at least one coil is arranged in parallel to said first pivot axis (B) and said second pivot axis (C).

8. A height-adjusting device according to any one of the preceding claims, wherein said third cam surface (48) is formed so as to follows a substantially parabolic curve convergingly joining with a top portion of said first cam surface (43).

9. A height-adjusting device according to any one of the preceding claims, wherein a bottom portion of said first cam surface (43) seamlessly joins with a start portion of said second cam surface (47).

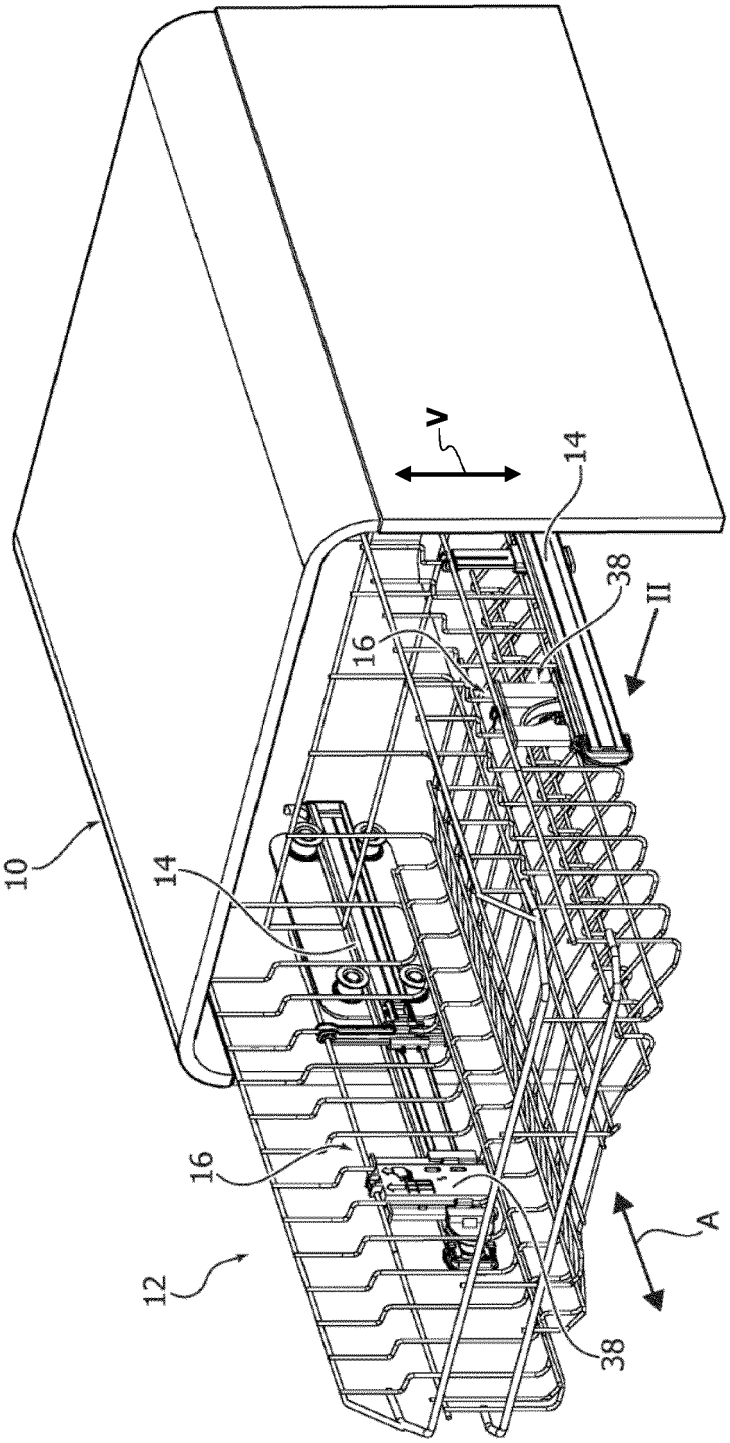

FIG. 1

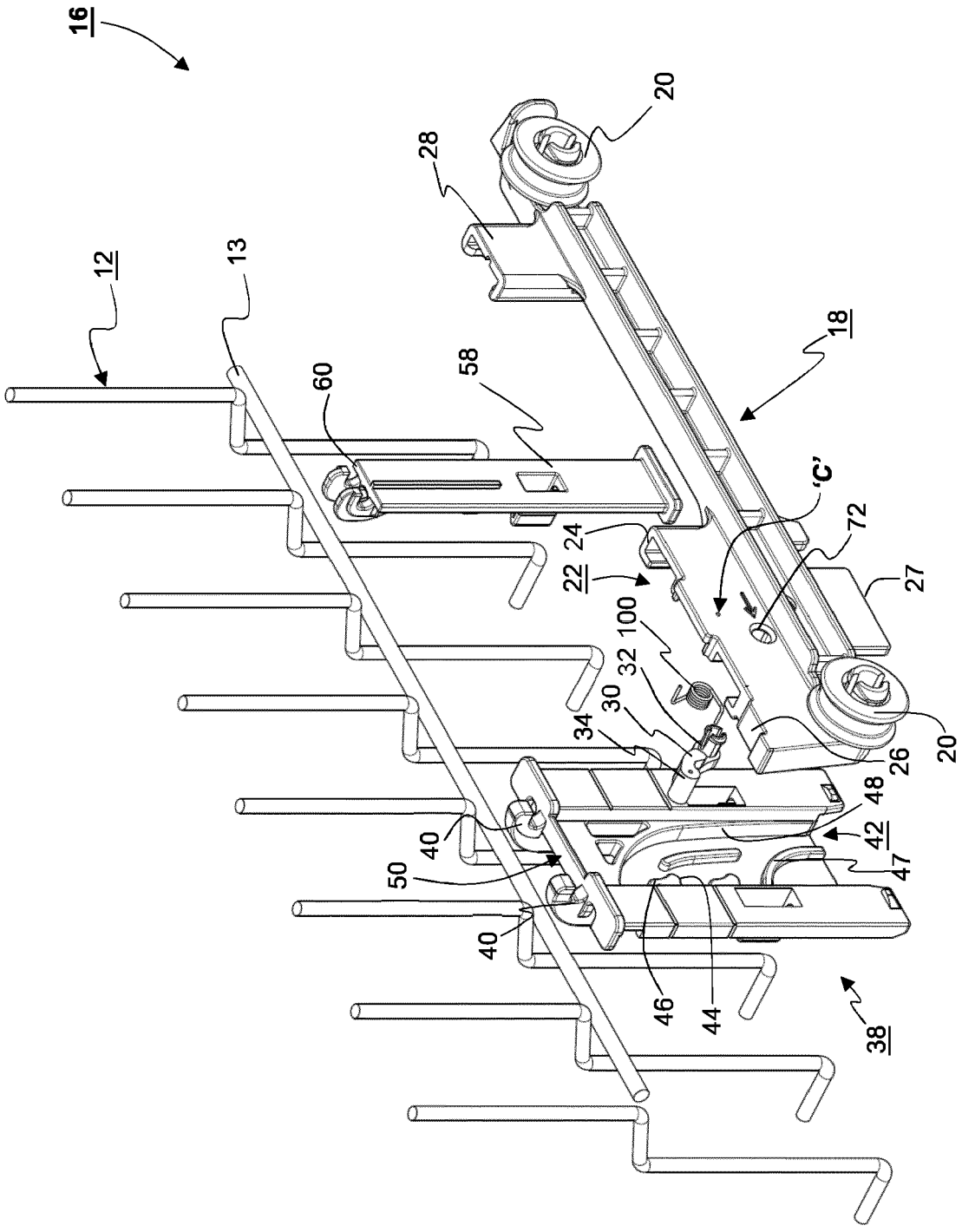
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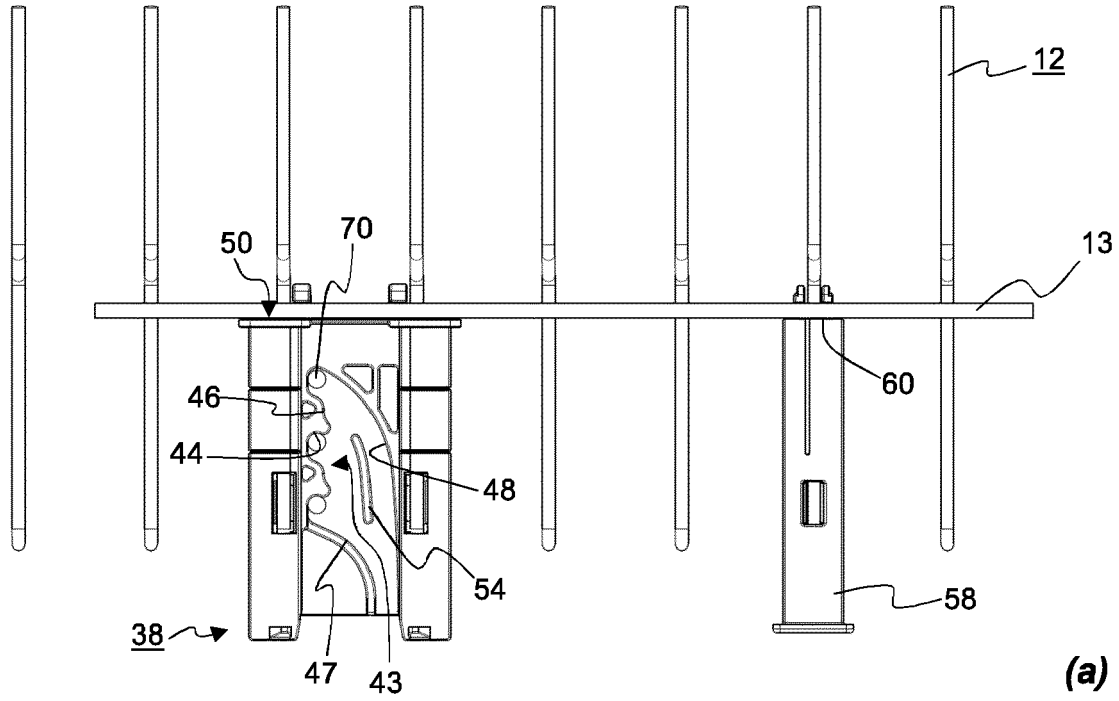
FIG. 2



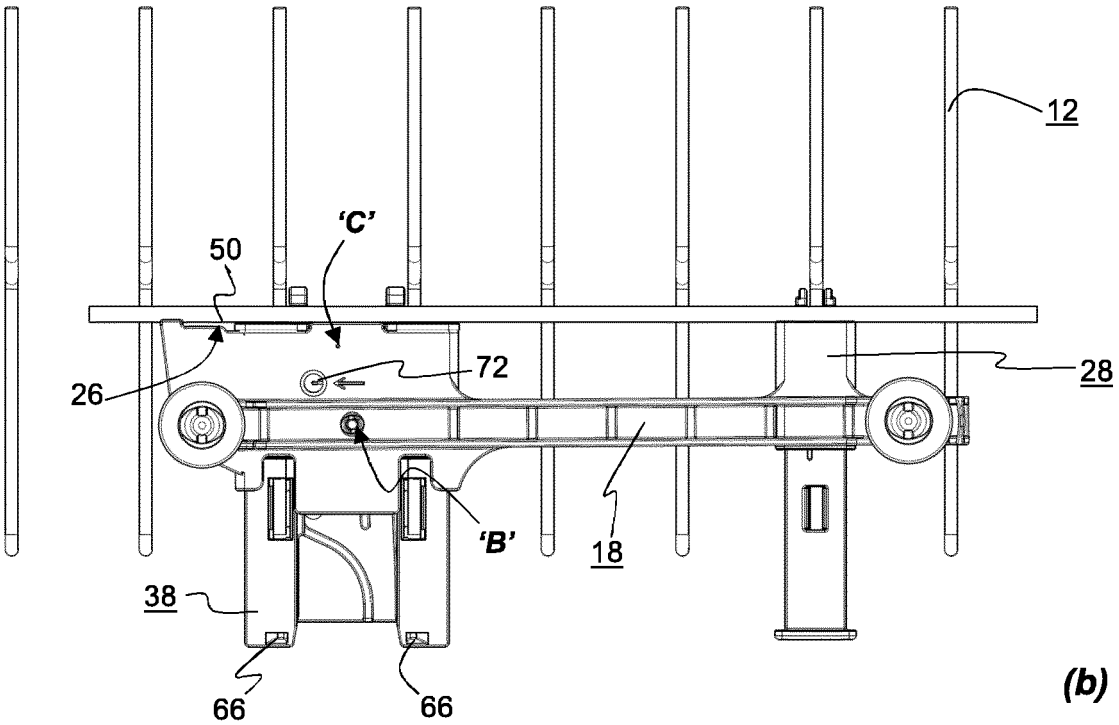
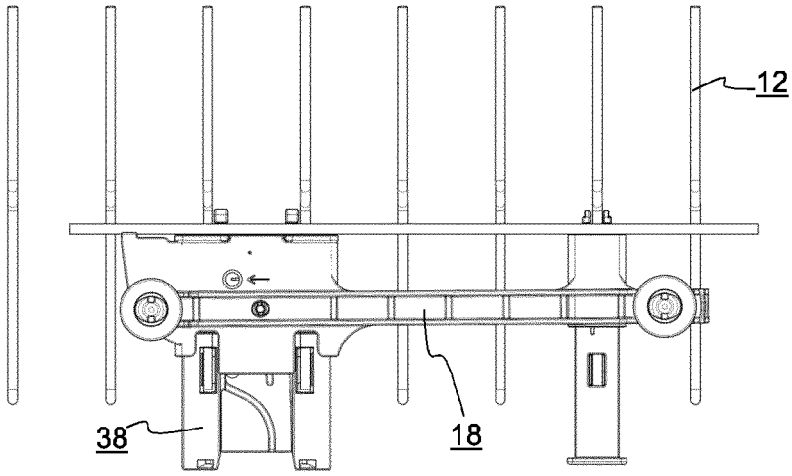
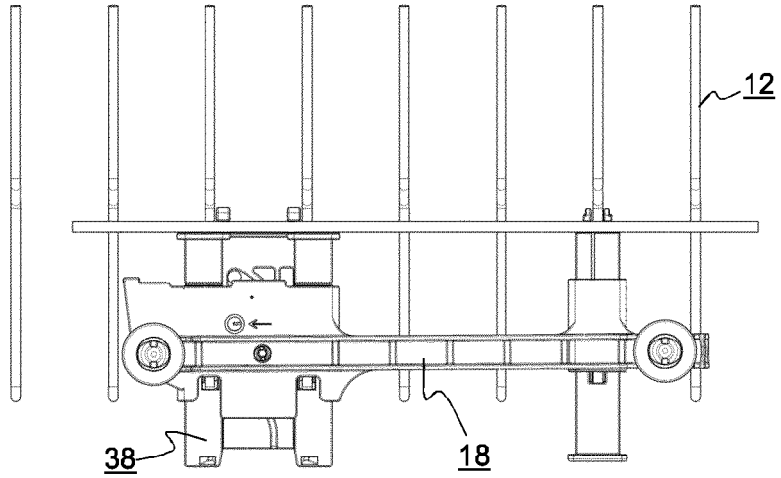


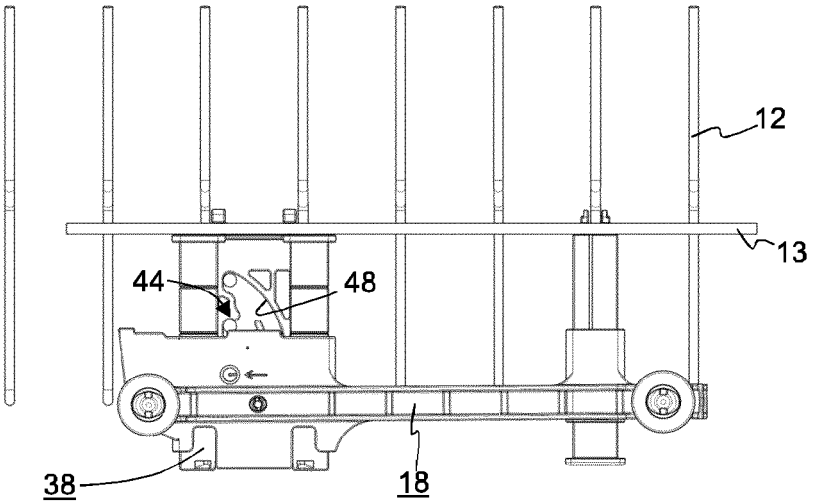
FIG. 3



(a)



(b)



(c)

FIG. 4

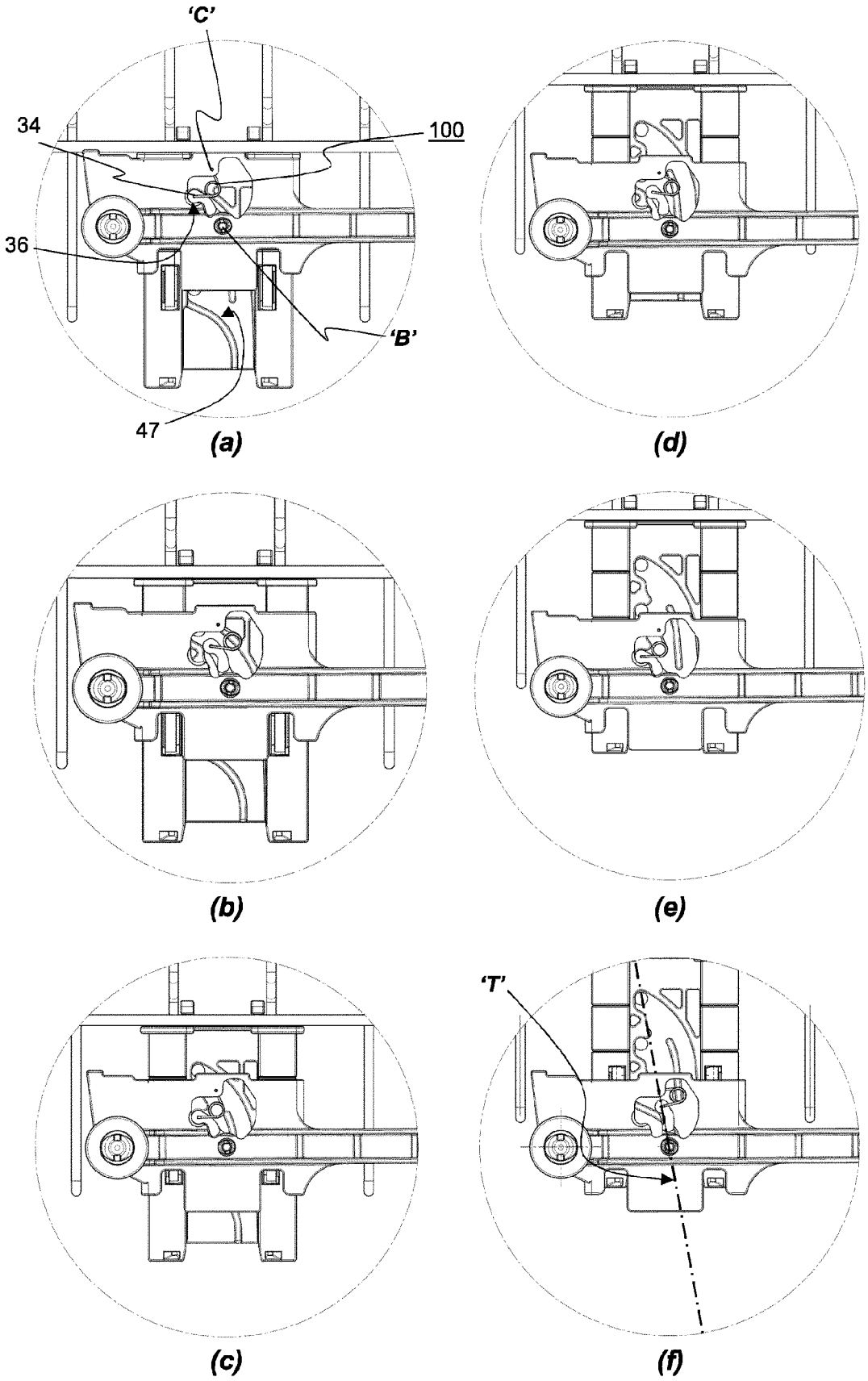


FIG. 5

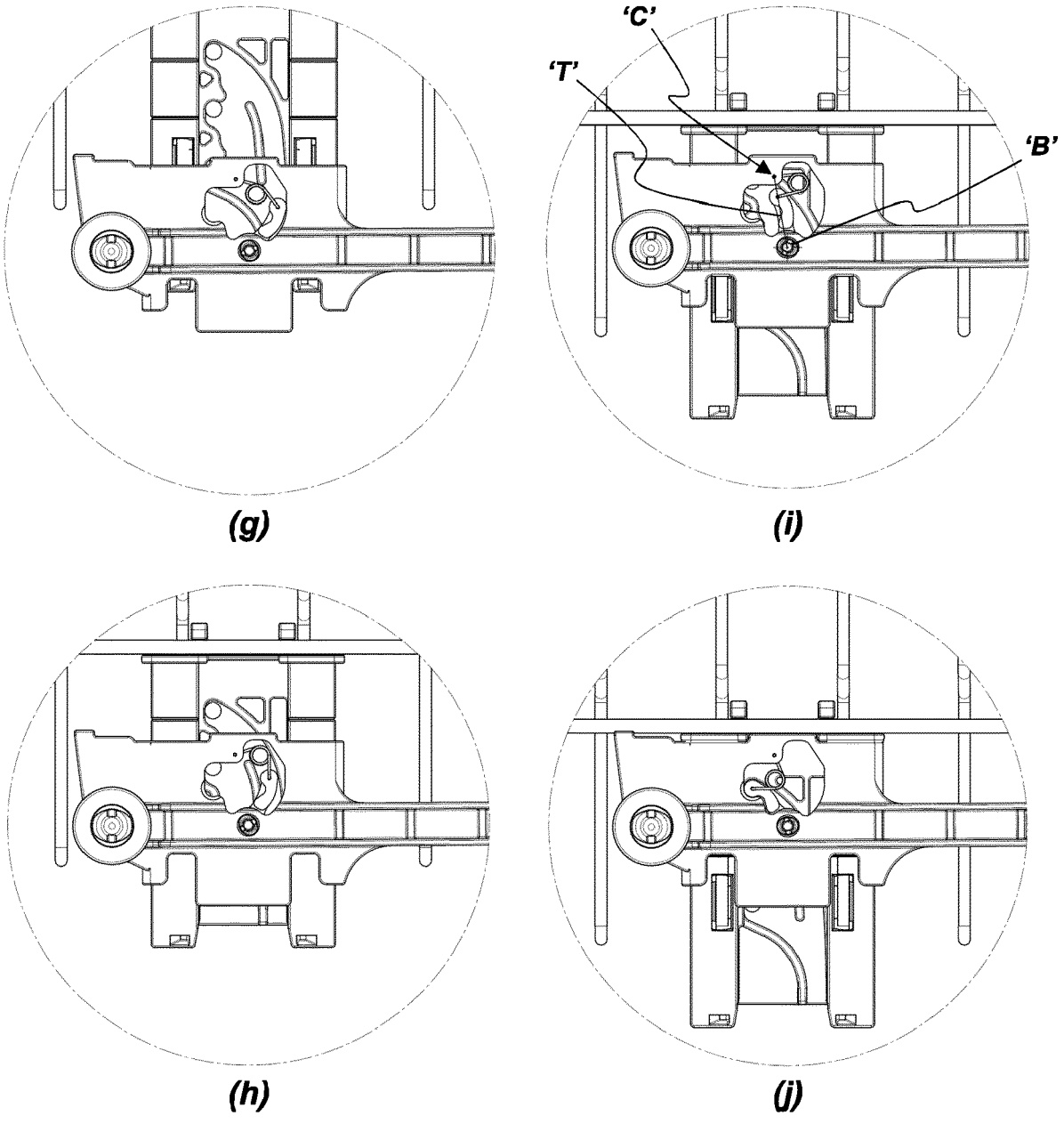


FIG. 5 (cont.)

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EUROPEAN SEARCH REPORT

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EP 20 16 9298

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A,D	EP 3 387 981 A1 (ILLINOIS TOOL WORKS [US]) 17 October 2018 (2018-10-17) * column 2, paragraph [0012] - column 4, paragraph [0018] * * column 4, paragraph [0023] - column 5, paragraph [0028]; figure 2 *	1-9	INV. A47L15/50
A	US 2006/237042 A1 (WEAVER DAVID C [US] ET AL) 26 October 2006 (2006-10-26) * the whole document *	1-9	
A	WO 2009/147612 A2 (ITW IND COMPONENTS SRL [IT]; ALA GIANBATTISTA [IT]) 10 December 2009 (2009-12-10) * the whole document *	1-9	
A	DE 200 19 706 U1 (HACHTEL STEFFEN [DE]) 18 January 2001 (2001-01-18) * the whole document *	1-9	
A	US 2013/300269 A1 (GARNETT WILLIAM NATHAN [US] ET AL) 14 November 2013 (2013-11-14) * the whole document *	1-9	TECHNICAL FIELDS SEARCHED (IPC) A47L F25D A47B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	7 October 2020	Lodato, Alessandra

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07-10-2020

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 3387981 A1	17-10-2018	EP 3387981 A1	17-10-2018
		US 2018289236 A1	11-10-2018
US 2006237042 A1	26-10-2006	US 2006237042 A1	26-10-2006
		WO 2006116384 A1	02-11-2006
WO 2009147612 A2	10-12-2009	EP 2320786 A2	18-05-2011
		KR 20110026418 A	15-03-2011
		US 2011017890 A1	27-01-2011
		WO 2009147612 A2	10-12-2009
DE 20019706 U1	18-01-2001	DE 20019706 U1	18-01-2001
		EP 1208791 A1	29-05-2002
		ES 2242692 T3	16-11-2005
US 2013300269 A1	14-11-2013	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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Patent documents cited in the description

- EP 3387981 A1 **[0003] [0004]**