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(54) **Sliding hinge for a domestic appliance**

(57) A hinge (235;535;635;735) is proposed for use in a domestic appliance (100) to rotationally connect a door (125,130) of the appliance to a body (105) of the appliance, wherein a decorative front panel (140) can be mounted in front of the door and arranged slidably in an essentially orthogonal direction relative to a rotation axis (242) of the door with respect to the body, the hinge including a support bracket (240) for connection to the body, a rotating bracket (241) for connection to the door, the rotating bracket being rotationally connected to the support bracket, and a driving mechanism (245-249; 545-551;645-646,665,261-263; 750,751,785,786,787,788) arranged to interact both with the support bracket and the rotating bracket to be operated when the rotating bracket is rotating. In the solution according to an embodiment of the invention, the rotating bracket includes an elongated guide structure (270) extending essentially orthogonally to the rotation axis of the door and a sliding block (271-274;271-274;671-674; 771-778) for connection to the decorative front panel, the sliding block being slidably guided along the elongated guide structure, wherein the sliding block cooperates with the driving mechanism to achieve a sliding of the sliding block along the elongated guide structure and a corresponding sliding of the decorative front panel with respect to the door during the rotation of the rotating bracket.

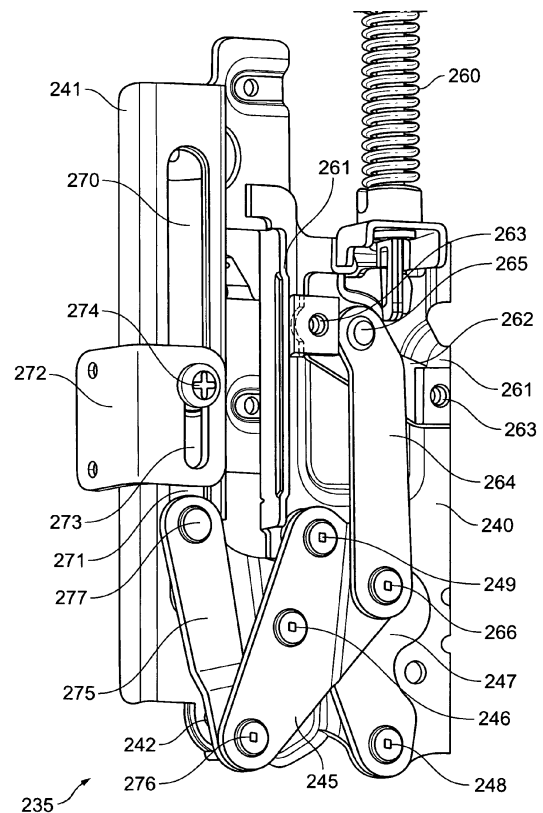


FIG. 2A

Description

[0001] The solution according to one or more embodiments of the present invention relates to the field of appliances. More specifically, this solution relates to hinges for appliances.

Background art

[0002] Appliances are routinely used to accomplish a number of household functions; for this purpose, the appliances may be either freestanding or integrated with other pieces of furniture. In the later case (but not only), a decorative front panel - normally with the same appearance of the other pieces of furniture - is mounted on the appliance. With reference in particular to a dishwasher integrated in a kitchen, the dishwasher is called of the built-in type when it has its control panel exposed or of the full-integrated type when it is completely covered by the corresponding decorative front panel; the dishwasher of the full-integrated type is totally indistinguishable from the other pieces of furniture of the kitchen (even if it requires to be opened to access the control panel).

[0003] In general, the dishwasher has a front load opening, which is closed by a corresponding door. The door is pivoted on top of a base of the dishwasher (by means of a pair of lateral hinges); in this way, the door may rotate (during its opening and closing) around a horizontal rotation axis raised from the floor. In some countries, the decorative front panel has the same length as the door (with the base of the dishwasher that is covered by a baseboard, or plinth, of the kitchen); in other countries, instead, the decorative front panel is longer than the door (so as to project below it).

[0004] In both cases, the lower end of the decorative front panel may interfere with the baseboard when the door is completely open (depending on a height of its pivoting area). This problem is generally addressed by providing a clearing in the baseboard under the decorative front panel.

[0005] Moreover, when the decorative front panel is longer than the door, it may interfere with the base of the appliance already during an initial opening of the door. Several techniques have been proposed in the art for tackling this problem.

[0006] Particularly, some known dishwashers are provided with a recess in their base for receiving the projecting portion of the decorative front panel. However, this recess involves a remarkable waste of room in the dishwasher; moreover, it requires the manufacturing of different versions of the same dishwasher (according to the lengths of the decorative front panels to be mounted).

[0007] Alternatively, it has been proposed to have the decorative front panel slide in parallel to the door when it is opened and closed.

[0008] Particularly, EP-A-1529482 describes a dishwasher with a spring mounted on the door for pushing the decorative front panel downwards. During the opening of the door, the decorative front panel reaches the base of the dishwasher, so as to be pushed upwards in opposition to the spring; vice-versa, when the door is closed the spring returns the decorative front panel to its rest position. However, this structure only allows the use of decorative front panels that are slightly longer than the door.

[0009] EP-A-1894509 instead proposes to add an articulated lever mechanism that automatically slides the decorative front panel. More specifically, the articulated lever mechanism includes an arcuate tie-rod that is coupled with a hinge of the door (formed by a bracket integral with a body of the dishwasher, and a rotating sector integral with the door) - more specifically, with the tie-rod that pivots around the rotating sector. A rod and an arm are then hinged to a free end of the tie-rod. The other end of the rod is hinged to the body, whereas the other end of the arm is hinged to the decorative front panel. Therefore, the opening of the door rotates the tie-rod; the tie-rod then rotates the arm, which in turn rotates the rod until it abuts against the decorative front panel, thereby moving the decorative front panel upwards.

[0010] A drawback of the structure described in EP-A-1894509 is that it requires the addition of a specific articulated lever mechanism to the dishwasher. This articulated lever mechanism is quite cumbersome and it protrudes below the hinges of the dishwasher; therefore, as above this requires the manufacturing of different versions of the same dishwasher (with or without the articulated lever mechanism according to the lengths of the decorative front panels to be mounted). Moreover, the sliding of the decorative front panel may be not immediate when the door is opened (since the articulated lever mechanism may have a certain dead time required by the rod to abut against the decorative front panel); therefore, the decorative front panel has to be maintained in any case raised from the floor to allow the initial opening of the door before the decorative front panel raises. Moreover, sliding connectors between the decorative front panel and the door are required both at their top and at their bottom (to avoid that the decorative front panel should detach from the door under the pressure of the rod abutting against it); this makes the mounting and the removal of the decorative front panel quite complex.

[0011] A similar mechanism but with a telescopic structure is disclosed in EP-A-1875850. As above, an arcuate tie-rod is hinged to the rotating sector of the hinge (integral with the door). In this case, however, the telescopic mechanism includes an L-shaped arm that is hinged at its corner to the bracket integral with the body of the dishwasher. A short side of the L-shaped arm is hinged to a free end of the tie-rod; a long end of the L-shaped arm instead consists of a telescopic rod, which is hinged to the decorative front panel. Therefore, the opening of the door rotates the tie-rod; the

tie-rod then rotates the L-shaped arm, which in turn moves the decorative front panel upwards (while the length of the telescopic rod adapts accordingly).

[0012] The structure described in EP-A-1875850 substantially suffers the same drawbacks pointed out above. Particularly, it requires the addition of a specific telescopic mechanism to the dishwasher; moreover, this telescopic mechanism is quite cumbersome and it protrudes below the hinges of the dishwasher (thereby requiring the manufacturing of different versions of the same dishwasher with or without the telescopic mechanism).

Summary of the Invention

[0013] In its general terms, a solution according to one or more embodiments of the present invention is based on the idea of implementing the sliding of the decorative front panel within the hinges.

[0014] Particularly, one or more aspects of a solution according to the invention are set out in the independent claims, with advantageous embodiments thereof that are set out in the dependent claims (whose wording is herein incorporated *verbatim* by reference).

[0015] More specifically, a first aspect of a solution according to the invention provides a hinge for use in a domestic appliance (for example, in a full-integrated dishwasher) to rotationally connect a door of the appliance to a body of the appliance; a decorative front panel can be mounted in front of the door, and arranged slidably in an essentially orthogonal direction relative to a rotation axis of the door with respect to the body (for example, this sliding direction extends within a plane being orthogonal to the rotation axis of the door and including it, or the sliding direction extends within a plane that is essentially parallel to a plane being orthogonal to the rotation axis of the door and including it; moreover, the rotation axis of the door either may have a fixed position with respect to the body throughout the rotation of the door, such as coincident with a fulcrum of the hinge when it is of the single fulcrum type, or it may move on a curved line during the rotation of the door, such as when the hinge is of the double fulcrum type). The hinge includes a support bracket for connection to the body, and a rotating bracket for connection to the door; the rotating bracket is rotationally connected to the support bracket. The hinge further includes a driving mechanism arranged to interact both with the support bracket and the rotating bracket to be operated when the rotating bracket is rotating. In the solution according to an embodiment of the invention, the rotating bracket includes an elongated guide structure, which extends essentially orthogonally to the rotation axis of the door. The rotating bracket further includes a sliding block for connection to the decorative front panel, which sliding block is slidably guided along the elongated guide structure. The sliding block cooperates with the driving mechanism to achieve a sliding of the sliding block along the elongated guide structure, and a corresponding sliding of the decorative front panel with respect to the door, during the rotation of the rotating bracket (for example, the driving mechanism may be a lever mechanism also used to operate a balancing device of the appliance, which lever mechanism cooperates with the sliding block by means of a crank mechanism, or the driving mechanism may be a dedicated first gear mechanism, which cooperates with the sliding block by means of a second gear mechanism). The present invention has the particular advantage that the mechanism that drives the translation of the decorative front panel with respect to the appliance door is integrated into the hinges of the invention themselves. Thus, there need not be any additional levers that are arranged below the hinge. Therefore, the invention allows in particular to use decorative front panels that are shorter as compared to the prior art in the sense that they do not need to reach below the appliance door in the closed state thereof in order to cover any visible levers below the hinge and that would disturb the esthetical impression generated by the appliance if visible during the closed state of the door. Such relatively short decorative panels are desirable in arrangements wherein the appliance is integrated into a kitchen furniture, in particular at a height position above a ground row of furniture.

[0016] A second aspect of a solution according to the invention provides a domestic appliance (for example, a dishwasher of the full-integrated type), which includes a body, a door, and a pair of the hinges of the first aspect of the invention that rotationally connect the door to the body at opposite sides thereof; each hinge has the corresponding support bracket connected to the body and the corresponding rotating bracket connected to the door. Particularly, in an embodiment of the invention the appliance further includes a decorative front panel mounted in front of the door and arranged slidably in an essentially orthogonal direction relative to a rotation axis of the door with respect to the body; in this case, the sliding block of each hinge is connected to the decorative front panel. The mounting of the decorative front panel in front of the door can be particularly easy in that it can involve a first step of fixing to the inner face of the decorative front panel that shall be mounted to the door at least one, preferably a pair of, sliding connectors in an upper end region of the decorative front panel and a pair of fastening brackets in a lower end region of the decorative front panel, a subsequent second step of introducing said at least one sliding connector into at least one, preferably a pair of, corresponding vertically elongated guide slots that are arranged in an upper end region of the door of the appliance and that are adapted for slidably guiding said sliding connector during the sliding of the decorative front panel with respect to the door, a subsequent third step of inserting said pair of fastening brackets into a pair of corresponding vertically elongated through-slots which are formed in a lower end region of the door and respectively at a mating position to the corresponding slide of the rotating bracket of the hinge so that the fastening brackets can be readily aligned with the corresponding

slides, and a subsequent fourth step wherein each fastening bracket is fixed to the corresponding slide by a screw. Thus, the opposing side faces of the door of the appliance in their lower end regions can comprise an access trough-hole which allows ready access to the respective slide of the hinge and to the screw. In that way, the screws can be reached e.g. by a screw driver or a wrench from the outside of the door in order to easily fix the fastening brackets to the slides of the hinges. With particular advantage, the fastening brackets can comprise a trimming slotted hole that extends in parallel to the elongated guide structure of the rotating bracket of the hinge when the decorative front panel that carries the fastening brackets is arranged in front of the door. The screws which function in that case in addition as trimming screws are then inserted through said access trough holes in the side faces of the door and through the respective trimming slotted holes for the fixation of the fastening brackets to the slides of the rotating bracket of the hinge. Thus, the decorative front panel can be readily vertically trimmed with respect to the door by an easy manual vertical translation of the decorative front panel and hence of the trimming slotted holes with respect to the slides of the hinge before finally fixing the trimming screws.

Brief description of the drawing

[0017] A solution according to one or more embodiments of the invention, as well as further features and the advantages thereof, will be best understood with reference to the following detailed description, given purely by way of a non-restrictive indication, to be read in conjunction with the accompanying drawings, wherein corresponding elements are denoted with equal or similar references and their explanation is not repeated for the sake of simplicity. In this respect, it is expressly intended that the figures are not necessary drawn to scale, with some details that may be exaggerated and/or simplified, and that, unless otherwise indicated, they are merely used to conceptually illustrate the structures and procedures described herein. Particularly:

FIG. 1 shows a side view of an exemplary dishwasher to which the solution according to an embodiment of the invention may be applied,

FIG.2A shows a hinge of the dishwasher according to a first embodiment of the invention,

FIG.2B-FIG-2D show the hinge according to the first embodiment of the invention in different operative conditions, FIG.3A-FIG-3B show operation of the dishwasher according to figure 1 including a pair of hinges according to the first embodiment of the invention,

FIG.4A shows an exemplary mounting scheme of a decorative front panel of the dishwasher according to a further embodiment of the invention,

FIG. 4B shows a corresponding dishwasher according to the mounting scheme of figure 4A without the decorative front panel

FIG.5A-FIG-5C show a hinge of the dishwasher according to a second embodiment of the invention in different operative conditions,

FIG.6A-FIG-6C show a hinge of the dishwasher according to a third embodiment of the invention in different operative conditions, and

FIG.7A-FIG-7G show a hinge of the dishwasher according to a fourth embodiment of the invention in different operative conditions.

Detailed description

[0018] With reference in particular to FIG.1, a side view of an exemplary dishwasher 100, to which the solution according to an embodiment of the invention may be applied, is shown. The dishwasher 100 includes a body 105, which has a base 110 for resting the dishwasher 100 on a support surface (not shown in the figure), such as a floor or a support surface of a suitable niche of a piece of furniture of a kitchen wherein the dishwasher 100 can be installed. Inside the body 105, there is provided a treatment chamber 115 with one or more pullout racks, not visible in the figure, for inserting items to be washed (for example, dishes, cutlery, glasses, pots, pans, and the like). The treatment chamber 115 has a front load opening 120, which is closed by a door that includes a door panel 125 and a control panel 130; the control panel 130 may be mounted on top of the door panel 125, in particular flush therewith, so as to be aligned with a top of the body 105. The door 125,130 is rotationally coupled to the base 110 by means of two lateral hinges (only one visible in the figure), generically denoted with the reference 135 (which will be described in detail in the following according to different embodiments of the invention, wherein they will be differentiated with corresponding references). In this way, the door 125,130 can rotate with respect to the body 105, around a horizontal rotation axis (raised from the floor), which in the figure extends perpendicularly to the sheet. Particularly the door 125,130 can be opened, preferably with a drop-down movement, so as to access the treatment chamber 115 in order to insert the items to be washed and to remove the items being washed. The door 125,130 can be closed, preferably with a pull-up movement, to enable the operation of the dishwasher.

[0019] The dishwasher 100 shown in the figure is of the full-integrated type, so as to be totally indistinguishable from other pieces of furniture of the kitchen when it is installed. For this purpose, the door 125,130 is completely covered by a decorative front panel 140 (for example, made of wood) with the same appearance as the other pieces of furniture of the kitchen. As described in detail in the following, the decorative front panel 140 can slide in a direction essentially orthogonal to the rotation axis of the door for avoiding any interference of the decorative front panel 140 with any baseboard (not shown) of the kitchen, when the door 125,130 is opened. The decorative front panel 140 is longer than the door 125,130, so that it projects below the door 125,130. As said above, however, the decorative front panel 140 need not be longer than the door panel 125, if not desired. As usual, the base 110 can have a front recess below the hinges 135 for avoiding an interference of the decorative front panel 140 with the base 110 when the door 125,130 is opened. The door panel 125 comprises two access through-holes 127 in a lower end region of each of its opposing lateral faces that are suitably arranged in correspondence with a rotating bracket (241, cf. figures 2A-C) of the hinge (235, cf. figures 2A-C, 4A-B) to provide ready access, in particular for the insertion of a screw driver or wrench, to a trimming screw 274 of a trimming structure (273-274, cf. figures 2A-C, 4A-B) of a sliding block (271-274, cf. figures 2A-C) of the hinge, in order to enable a user of the dishwasher to fasten the fastening brackets (272, not shown in figure 1, cf. figures 2A-C, 4A) and hence the decorative front panel (140) to a slide (271, cf. figures 2A-C) of the hinge and to trim a position of said fastening bracket on said slide and hence a vertical position of the decorative front panel (140) on the appliance door (125,130).

[0020] A hinge according to a first embodiment of the invention for the above-described dishwasher is shown in FIG. 2A. The hinge of the first embodiment of the invention, which is differentiated with the reference 235, includes a support bracket 240 and a rotating bracket 241; the support bracket 240 and the rotating bracket 241 are used to connect the hinge 235 to the body and to the door, respectively, of the dishwasher (not shown in the figure) - for example, by means of corresponding screws. The rotating bracket 241 is rotationally connected to the support bracket 240 by means of a single fulcrum pin 242, only partially visible in the figure; in this way, the door (connected to the rotating bracket 241) can rotate with respect to the body (connected to the support bracket 240) around the fulcrum pin 242, which then defines its rotation axis.

[0021] A driving mechanism 245, 246, 247, 248, 249 is arranged to interact both with the support bracket 240 and the rotating bracket 241, so as to be operated when the rotating bracket 241 is rotating. Particularly, the driving mechanism 245-249 in the first embodiment of the invention is of a lever type. This driving mechanism 245-249 includes a rocking arm 245 - for example, shaped like a rounded wedge pointing downwards (from a base to a tip thereof). The rocking arm 245 is rotationally connected to the rotating bracket 241 by means of a rocking pin 246 (for example, arranged close to an outer border of the rocking arm 245, at a center thereof). A rotational coupling 247, 248, 249 rotationally connects an inner end of the rocking arm 245 (in correspondence to the support bracket 240) to the support bracket 240 for rocking the rocking arm 245 around the rocking pin 246 when the rotating bracket 241 is rotating. Particularly, in the first embodiment of the invention the rotational coupling 247-249 includes a guide arm 247 (for example, shaped like a rounded half-arrow pointing upwards, from a tail to a tip thereof). A first guide arm end of the guide arm 247 (consisting of its lower tail) is rotationally connected to the support bracket 240 by means of a pin 248, which is arranged at an inner lower position of the support bracket 240 (substantially at the same height as the fulcrum pin 242); a second guide arm end of the guide arm 247 (consisting of its upper tip) is rotationally connected to the rocking arm 245 by means of a pin 249, which is arranged at the inner end of the rocking arm 245.

[0022] The driving mechanism 245-249 operates a door balancing device 260, per se known in the art. Said door balancing device 260 is used to counter-balance a weight of the door, with its decorative front panel (not shown in the figure), during the rotation of the door (when the hinge 235 is mounted in the dishwasher). For example, the door balancing device 260 may have a structure as described in EP-A-1183988, the entire disclosure of which is herein incorporated by reference. Briefly, the door balancing device 260 is formed by a stem surrounded by a spring, which is compressed when the stem is pulled down. For this purpose, a coupling mechanism 261, 262, 263, 264, 265, 266 couples the driving mechanism 245-249 with the balancing device 260. Particularly, this coupling mechanism 261-266 includes at least one rail structure 261 formed in the support bracket 240 (consisting of two rail structures 261 at opposite sides of the support bracket 240 in the example at issue); the rail structures 261 extend essentially orthogonally to the rotation axis of the door (preferably vertically when the hinge 235 is mounted in the dishwasher). The coupling mechanism 261-266 also includes a friction device 262, 263 that is used to brake the rotation of the door. The friction device 262-263 includes a friction lever 262, which is provided with an upper hook engaging a lower eye of the stem of the balancing device 260; the friction lever 262 is rotationally coupled to at least one friction block 263 (consisting of two friction blocks 263 at lateral sides of the friction lever 262 in the example at issue). Each friction block 263 is slidably guided along a corresponding rail structure 261, for generating friction therebetween varying according to a torque provided by the weight of the door, and its decorative front panel, during the rotation of the door. A coupling rod 264 has an (upper) first coupling rod end (slightly bent outwards in the example at issue) that is rotationally connected to the friction lever 262 by means of a pin 265, which is arranged below the hook of the friction lever 262 but spaced apart from it horizontally; moreover, the coupling rod 264 has a (lower) second coupling rod end that is rotationally connected to the inner end of the rocking

arm 245 by means of a pin 266, which is arranged at an inner vertex of the (upper) base of the rocking arm 245 (opposite the pin 249);

[0023] In the solution according to the first embodiment of the invention, the rotating bracket 241 includes an elongated guide structure 270, which extends essentially orthogonally relative to the rotation axis of the door (defined by the fulcrum pin 242). For example, the elongated guide structure 270 is formed along a longitudinal axis of the rotating bracket 241 by an internal channel, with an elongated access window (opened on the front in the figure). The rotating bracket 241 also includes a sliding block 271, 272, 273, 274, which is slidably guided along the elongated guide structure 270. Particularly, this sliding block 271-274 includes a slide 271, which is inserted into the channel of the elongated guide structure 270 so as to be slidably guided along it. The sliding block 271-274 also includes a fastening bracket 272, which is mounted on the slide 271 by means of a mounting structure (preferably a trimming structure) 273, 274. For this purpose, the fastening bracket 272 has a trimming slotted hole 273 on its front face facing the access window of the elongated guide structure 270 and extending along it; a trimming tap screw 274 is inserted through the trimming slotted hole 273 and the access window of the elongated guide structure 270, and it is then screwed into a threaded hole (not shown in the figure) formed in the slide 271, thereby gripping the fastening bracket 272 against the slide 271. The trimming slotted hole 273 on the front face of the fastening bracket 272 faces the access window of the elongated guide structure 270 in the sense that the elongated guide structure 270 forms itself an access window for the trimming screw 274 that reaches through the elongated guide structure 270 for fixing the fastening bracket 272 to the slide 271. The fastening bracket 272 abuts against a spacer (not indicated in the figure) of the slide 271 that maintains the fastening bracket 272 spaced apart from the elongated guide structure 270, so as to allow its sliding together with the slide 271. When the dishwasher is installed, the fastening bracket 272 is fastened to the decorative front panel; for example, for this purpose two self-tapping screws (not shown in the figure) are inserted through corresponding smooth holes formed in a lateral face of the fastening bracket 272 (from the right in the figure), and they are screwed into the decorative front panel, thereby gripping the fastening bracket 272 against the decorative front panel.

[0024] The sliding block 271-274 also cooperates with the driving mechanism 245-249 to achieve a sliding of the sliding block 271-274 along the elongated guide structure 270 and a corresponding sliding of the front panel with respect to the door (as described in detail in the following) during the rotation of the rotating bracket 241. For this purpose, in the first embodiment of the invention the sliding block 271-274 cooperates with the driving mechanism 245-249 via a crank mechanism 275, 276, 277 connected between the driving mechanism 245-249 and the sliding block 271-274, so as to convert the rocking of the rocking arm 245 into a translation of the sliding block 271-274 (and thereby achieve the above-mentioned sliding of the sliding block 271-274 along the elongated guide structure 270, and the corresponding sliding of the fastening bracket 272 and hence of the decorative front panel fixed to it with respect to the door). Particularly, this crank mechanism 275-277 includes a transmission arm 275 having a (lower) first transmission arm end rotationally connected to the rocking arm 245 by means of a pin 276, which is arranged at an outer end of the rocking arm 245 in correspondence to the rotating bracket 241 (for example, at its lower tip, so as to be substantially aligned with the rocking pin 246 and the pin 249). Moreover, the transmission arm 275 has an (upper) second transmission arm end rotationally connected to the slide 271 by means of a pin 277 (for example, arranged at a lower end of the slide 271 below the fastening bracket 272).

[0025] In order to explain operation of the hinge 235 according to the first embodiment of the invention, reference is now made to FIG.2B-FIG.2D that show the hinge 235 in different operative conditions.

[0026] Starting from FIG.2B, when the door (not shown) is closed, the rotating bracket 241 extends vertically in contact with the support bracket 240. The friction device 262-263 is maintained raised by the balancing device 260 with its spring extended. In this condition, a compass formed by the guide arm 247 and the rocking arm 245 around the pin 249 forms a small angle α , for example, of about 20-30°. At the same time, the slide 271 is at a lower position along the elongated guide structure 270.

[0027] With reference to FIG.2C, when the door (not shown in the figure) is opened, the rotating bracket 241 that is connected to the door rotates with respect to the support bracket 240 around the fulcrum pin 242 (counterclockwise in the figure), so as to move away from the support bracket 240 that is connected to the body (not shown in the figure). As a result, the rocking arm 245 pulls the guide arm 247 away from the support bracket 240, so as to cause it to rotate in the same direction (counterclockwise in the example at issue) with respect to the support bracket 240 around the pin 248. As a consequence, the coupling rod 264 applies a downwards pulling force to the friction lever 262 (as such known in the art); the pulling force corresponds to the torque generated by the weight of the door, with its decorative front panel (not shown in the figure), which pulling force changes according to a position of its center of gravity during the rotation of the door. At the same time, the resulting compression of the spring of the balancing device 260 applies an upward reaction force to the friction lever 262. The lines of actions of these two forces do not coincide, so that a corresponding torque is applied to the friction lever 262; this torque is transmitted to the friction blocks 263, thereby generating a corresponding friction with the rail structures 261. In this way, the obtained friction changes automatically according to the pulling force applied to the friction lever 262, so as to self-adapt to the position of the door during its rotation.

[0028] According to the first embodiment of the present invention, however, at the same time the rotation of the guide

arm 247 drives the rocking arm 245 to rotate with respect to the rotating bracket 241 around the rocking pin 246 in the opposite direction (clockwise in the example at issue). Therefore, the compass 247-245 enlarges by increasing the angle α . The rotation of the rocking arm 245 then pushes the transmission arm 275 away from the fulcrum pin 242, so as to translate the sliding block 271-274, and then the decorative front panel connected thereto upwards along the elongated guide structure 270 (i.e., along a direction essentially orthogonal to the rotation axis of the door, as defined by the fulcrum pin 242).

[0029] Moving to FIG.2D, the rotation of the rotating bracket 241 and then the opening of the door (not shown in the figure) stops when it reaches a maximum opening angle α of about 85-95° (for example, with the rotating bracket 241 that abuts against a bottom of the support bracket 240 and the guide arm 247 that abuts against the rotating bracket 241). In this condition, the slide 271 preferably reaches an upper end of stroke of the elongated guide structure 270.

[0030] Referring back to FIG.1, when the door 125,130 is closed and the hinges (generically denoted with the reference 135) are in the condition of FIG.2B, the top of the decorative front panel 140 is aligned with the top of the control panel 130 and with the top of the body 105.

[0031] Moving to FIG.3A, when the door 125,130 is opened and the hinges 135 are in the condition of FIG.2C, the decorative front panel 140 that is connected to the sliding blocks (not visible in the figure) of the hinges 135 translates upwards. As a result, the top of the decorative front panel 140 projects above the top of the control panel 130.

[0032] Moving further to FIG.3B, when the door 125,130 reaches its maximum opening angle and the hinges 135 are in the condition of FIG.2D, the decorative front panel 140 reaches a corresponding maximum upwards translation. In this way, the lower edge (shown but not indicated with a reference number in the figure) of the decorative front panel 140 can be received in the recess of the base 110 without any interference therewith. In particular, the recess of the base 110 can now have a depth smaller than the length of a portion of the decorative front panel 140 projecting below the door 125,130 when the door is closed (see FIG.1). Thereby, a corresponding waste of room in the dishwasher 100 is avoided, and the manufacturing of a single version of the dishwasher 100 for different lengths of the decorative front panel 140 is enabled.

[0033] The same operations are performed in reverse order when the door 125,130 is closed.

[0034] The above-described solution does not require any additional mechanism for providing the desired sliding movement, since it is implemented entirely within each hinge. In other words, the invention provides a sliding hinge that allows obtaining the sliding movement without the need of cooperating with any external component.

[0035] This makes the dishwasher more compact, since no components at all protrude below the hinges. As a consequence, it is possible to use a single version of the dishwasher for a number of different lengths of the decorative front panel that may range, merely as an illustrative example, from 650mm to 830mm. Particularly, the proposed solution may also be used with decorative front panels having the same or a shorter length of the door; in this case, it is then possible to avoid opening any clearing in the baseboard of the kitchen under the decorative front panel. More generally, this hinge is of universal applicability. Indeed, the same hinge may also be used with decorative front panels that are arranged in a fixed way - i.e., non-slidably - on the door by simply not connecting the fastening bracket of the hinge to the decorative front panel.

[0036] The first embodiment of the invention described above offers further advantages. Particularly, the hinge of the first embodiment of the invention, hereinafter referred to as compass sliding hinge, provides the desired result by exploiting a lever mechanism that is already available in the hinges known in the art for operating the balancing device of the dishwasher (suitably amended according to the first embodiment of the invention to cooperate with the added sliding block, so as to achieve its sliding).

[0037] The compass sliding hinge provides a very high translation of the decorative front panel (for example, merely as a non-restrictive indication in the range of 50-60 mm).

[0038] Moreover, the compass sliding hinge allows sliding the decorative front panel immediately as soon as the door starts opening. In this way, it is possible to use very long decorative front panels, which may almost reach the floor or the support surface of the dishwasher, without any problem (for example, with a small gap down to 0.1-0.3 mm).

[0039] Considering now FIG.4A and FIG. 4B, in FIG. 4A there is shown an exemplary mounting scheme of the decorative front panel 140 on the dishwasher (shown in the figure 4B) according to a further embodiment of the invention.

[0040] For this purpose, the fastening brackets 272 of two hinges (not shown in the figure) - for examples, as described above with reference to the first embodiment of the invention - are fastened to an internal face of the decorative front panel 140 (for example, by means of corresponding pairs of self-tapping screws). The fastening brackets 272 are arranged laterally about a lower end region of the decorative front panel 140, with the center of their trimming slotted holes 273 that are at the same height as the threaded holes of the corresponding slides (not shown in the figure), when the slides are at their lower positions along the elongated guide structures with the door (not shown in the figure) that is closed. Two sliding connectors 405 are also fastened to the internal face of the decorative front panel 140 (for example, by means of corresponding pairs of self-tapping screws). The sliding connectors 405 are arranged laterally about an upper end region of the decorative front panel 140, in particular at the same height of corresponding guide slots 131 that are provided in an upper end region of the door, in particular in the control panel 130 (shown in the figure 4B). For

example, the position of the fastening brackets 272 and of the sliding connectors 405 on the decorative front panel 140 may be determined practically in a convenient way by means of a suitable cardboard template.

[0041] When the dishwasher is being installed by the customer, the sliding connectors 405 are inserted into the above-mentioned corresponding guide slots 131 of the control panel 130. The fastening brackets 272 are then mounted on the slides 271 of the corresponding hinges by introduction into vertically elongated through slots 126 that are provided in a lower end region of the door, in particular in a lower end region of the door panel 125 (shown in the figure 4B) and that are adapted to allow a vertical movement of the fastening brackets during the sliding of the decorative front panel 140 with respect to the door 125, 130 during the rotation of the rotating bracket 241 of the hinge 235 (not shown in figure 4A-B, cf. figures 2A-D). Thus, the trimming screws 274 can always be perfectly aligned with the threaded holes of the slides by moving them along the trimming slotted holes 273 of the fastening brackets 272. Advantageously, the customer can easily insert and fasten the trimming screws into the threaded holes through the access through-holes 127 which are formed in the lower end region of each of the opposing lateral edges of the door panel 125 and which are suitably arranged in correspondence with the rotating bracket 241 of the hinge 235.

[0042] The above-described solution allows mounting and removing the decorative front panel in a very simple way. Moreover, the proposed trimming structure for mounting the fastening brackets on the slides of the hinges makes it possible to compensate for possible tolerances in the fastening of the fastening brackets to the decorative front panel. The same mounting and trimming scheme as described above with reference to the hinge 235 of the first embodiment of the invention is in addition applicable at least also for the second and fourth embodiment of the hinges (535, 735, respectively) of the present invention.

[0043] A hinge according to a second embodiment of the invention (which may be used, for example, in the same dishwasher described above) is shown in FIG.5A-FIG.5C in different operative conditions.

[0044] Starting from FIG.5A, the hinge of the second embodiment of the invention, which is differentiated with the reference 535, includes the same support bracket 240, rotating bracket 241, and fulcrum pin 242 (so that their description is not repeated for the sake of simplicity). The hinge 535 differs from the first embodiment of the invention in that a driving mechanism 545, 546, 550, 551 (as above arranged to interact both with the support bracket 240 and the rotating bracket 241 to be operated when the rotating bracket is rotating) includes a single rocking arm 545 - for example, with a rounded, slightly curved shape that is concave outwards. As above, the rocking arm 545 is rotationally connected to the rotating bracket 241 by means of a rocking pin 546 (for example, arranged at a center of a lower portion of the rocking arm 545). Moreover, a rotational coupling 550, 551 again rotationally connects an inner end of the rocking arm 545 (in correspondence to the support bracket 240) to the support bracket 240 for rocking the rocking arm 545 around the rocking pin 546 when the rotating bracket 241 is rotating. However, in the second embodiment of the invention the rotational coupling 550-551 includes a guide slotted hole 550 that is formed in the rocking arm 545; the guide slotted hole 550 extends along a curved line (for example, concave outwards at an upper portion of the rocking arm 545). The support bracket 240 is provided with a guide peg 551 integral therewith, which slidably guides the guide slotted hole 550.

[0045] The driving mechanism 545-551 operates the same door balancing device 260 as above (so that its description is not repeated for the sake of simplicity). For this purpose, a similar coupling mechanism 261, 262, 263, 264, 265, 566 couples the driving mechanism 545-551 with the balancing device 260; particularly, the coupling mechanism 261-264, 566 includes the same rail structures 261, friction lever 262, friction blocks 263, coupling rod 264, and pin 265 (so that their description is not repeated for the sake of simplicity), and a pin 665 (arranged below the hook of the friction lever 262 but spaced apart from it horizontally) that rotationally connects the (lower) second coupling rod end of the coupling rod 264 to the friction lever 262. Moreover, the rotating bracket 241 includes the same elongated guide structure 270 and the same sliding block 271-274, with its slide 271, fastening bracket 272, and trimming structure 273-274 formed by the trimming slotted hole 273 and the trimming tap screw 274 (so that their description is not repeated for the sake of simplicity). As above, the sliding block 271-274 also cooperates with the driving mechanism 545-551 to achieve a sliding of the sliding block 271-274 along the elongated guide structure 270 and a corresponding sliding of the front panel (not shown in the figure) with respect to the door during the rotation of the rotating bracket 241. For this purpose, the sliding block 271-274 cooperates with the driving mechanism 545-551 via a similar crank mechanism 275, 576, 277 connected between the driving mechanism 545-551 and the sliding block 271-274, so as to convert the rocking of the rocking arm 545 into a translation of the sliding block 271-274 (and thereby achieving the above-mentioned sliding of the sliding block 271-274 along the elongated guide structure 270, and the corresponding sliding of the fastening bracket 272 and hence of the front panel with respect to the door). Particularly, this crank mechanism 275, 576, 277 includes the same transmission arm 275 and pin 277, and a pin 576 (arranged at an outer end of the rocking arm 545) that rotationally connects the (lower) first transmission arm end of the transmission arm 275 to the rocking arm 545.

[0046] In the condition shown in FIG.5A, when the door (not shown) is closed, the rotating bracket 241 again extends vertically in contact with the support bracket 240. As above, the friction device 262-263 is maintained raised by the balancing device 260 with its spring extended. In this condition, a lower end of stroke of the guide slotted hole 550 reaches the guide peg 551. At the same time, the slide 271 is again at a lower position along the elongated guide structure 270.

[0047] With reference to FIG.5B, when the door (not shown) is opened, the rotating bracket 241 again rotates with respect to the support bracket 240 around the fulcrum pin 242 (counterclockwise in the figure). As a result, the rocking arm 545 operates the balancing device 260 in the same way as above (so that the corresponding description is not repeated for the sake of simplicity).

[0048] According to the second embodiment of the present invention, however, at the same time the rotation of the rotating bracket 241 causes the guide slotted hole 550 to move downwards with respect to the guide peg 551 (integral with the support bracket 240). Therefore, the rocking arm 545 rotates in the opposite direction (clockwise in the example at issue) with respect to the rotating bracket 241 around the rocking pin 546. As above, the rotation of the rocking arm 545 then pushes the transmission arm 275 away from the fulcrum pin 242, so as to translate the sliding block 271-274, and then the decorative front panel connected thereto (not shown in the figure) upwards along the elongated guide structure 270 (i.e., along a direction essentially orthogonal to the rotation axis of the door, as defined by the fulcrum pin 242).

[0049] Moving to FIG.5C, as above the rotation of the rotating bracket 241 and then the opening of the door (not shown in the figure) stops when it reaches its maximum opening angle (for example, with the rotating bracket 241 that abuts against a bottom of the support bracket 240), with the slide 271 that preferably reaches an upper end of stroke of the elongated guide structure 270. In this condition, an upper end of stroke of the guide slotted hole 550 reaches the guide peg 551.

[0050] The same operations are performed in reverse order when the door is closed.

[0051] This hinge of the second embodiment of the invention, hereinafter referred to as cam sliding hinge, provides the same advantages as described in detail above with reference to the compass sliding hinge (first embodiment of the invention). As can be easily understood from what has been said above, the advantages of the hinge 535 of the second embodiment of the invention comprise in particular the advantageous mounting and trimming scheme as described above - only as an example - with reference to the hinge 235 of the first embodiment of the invention.

[0052] Moreover, the cam sliding hinge has a slightly simpler structure as compared to the compass sliding hinge that reduces its cost. On the other hand, the cam sliding hinge provides a similar translation of the decorative front panel as compared to the compass sliding hinge. However, it has been observed in practical tests that the manual feeling experienced by a user when handling a dishwasher door with a decorative front panel and comprising sliding cam hinge is less satisfactory regarding the impression of its quality as compared to sliding hinge herein above.

[0053] A hinge according to a third embodiment of the invention (which may be used, for example, in the same dishwasher described above) is shown in FIG.6A-FIG.6C in different operative conditions.

[0054] Starting from FIG.6A, the hinge of the third embodiment of the invention, which is differentiated with the reference 635, includes the same basic structure of the support bracket 240, the rotating bracket 241 and the fulcrum pin 242 as compared to the above sliding hinge 235 and sliding cam hinge 535 (so that their description is not repeated for the sake of simplicity). The hinge 635 again has a driving mechanism 645, 646, 261, 262, 263, 665 (as above arranged to interact both with the support bracket 240 and the rotating bracket 241 to be operated when the rotating bracket is rotating) that includes a single rocking arm 645 (for example, with a rounded curved shape that is concave outwards). As above, the rocking arm 645 is rotationally connected to the rotating bracket 241 by means of a rocking pin 646 (for example, arranged at a center of a lower segment of the arm 646). The driving mechanism 645-646,261-263,665 again operates the same door balancing device of the dishwasher (not shown in the figure) via a similar coupling mechanism 261, 262, 263, 665; the coupling mechanism 261-263,665 includes the same rail structures 261, friction lever 262, and friction blocks 263 (so that their description is not repeated for the sake of simplicity), and a pin 665 (arranged below the hook of the friction lever 262 but spaced apart from it horizontally) that rotationally connects an upper end of the rocking arm 646 to the friction lever 262. Moreover, a rotational coupling 261, 262, 263, 665 again rotationally connects an inner end of the rocking arm 645 (in correspondence to the support bracket 240) to the support bracket 240 for rocking the rocking arm 645 around the rocking pin 646 when the rotating bracket 241 is rotating. However, in the third embodiment of the invention the rotational coupling 261-263,665 is based on the same coupling mechanism 261-263,665 that is used to operate the balancing device.

[0055] Moreover, the rotating bracket 241 includes the same elongated guide structure 270 as above. As better shown in FIG.6B, the rotating bracket 241 also includes a similar sliding block 671, 672, 674, which is slidably guided along the elongated guide structure 270. Particularly, this sliding block 671, 672, 674 includes a slide 671, which is inserted into the channel of the elongated guide structure 270 so as to be slidably guided along it. The sliding block 671, 672, 674 also includes a fastening bracket 672, which is now mounted on the slide 671 in a fixed position. For this purpose, the fastening bracket 672 has a mounting smooth hole (not shown in the figure) on its front face facing the access window of the elongated guide structure 270; a mounting tap screw 674 is inserted through the mounting smooth hole of the fastening bracket 672 and the access window of the elongated guide structure 270, and it is then screwed into a threaded hole (not shown in the figure) formed in the slide 671, thereby gripping the fastening bracket 672 against the slide 671. The fastening bracket 672 abuts against a spacer (not indicated in the figure) of the slide 671 that maintains the fastening bracket 672 spaced apart from the elongated guide structure 270, so as to allow its sliding. When the dishwasher is

installed, the fastening bracket 672 is fastened to the decorative front panel (not shown in the figure); for example, for this purpose two self-tapping screws (not shown in the figure) are inserted through corresponding smooth holes formed in a lateral face of the fastening bracket 672 (from the right in the figure), and they are screwed into the decorative front panel, thereby gripping the fastening bracket 672 against the decorative front panel.

[0056] As above the sliding block 671, 672, 674 also cooperates with the driving mechanism 645-646, 261-263, 665 to achieve a sliding of the sliding block 671, 672, 674 along the elongated guide structure 270 and a corresponding sliding of the front panel with respect to the door during the rotation of the rotating bracket 241. However, in the third embodiment of the invention, for this purpose the sliding block 671, 672, 674 cooperates with the driving mechanism 645-646, 261-263, 665 via a different crank mechanism 680, 681, so as to convert the rocking of the rocking arm 645 into a translation of the sliding block 671, 672, 674 (and thereby achieving the above-mentioned sliding of the sliding block 671, 672, 674 along the elongated guide structure 270, and the corresponding sliding of the front panel with respect to the door). Particularly, the crank mechanism 680-681 now includes an open transmission slot 680, which is formed at a bottom of the fastening bracket 672. The transmission slot 680 extends perpendicularly to the elongated guide structure 270, when the fastening bracket 672 is mounted on the slide 671, and particularly outwards from an inner border thereof. Moreover, the rocking arm 645 is provided with a transmission peg 681 integral therewith, which transmission peg 681 is slidably guided along the transmission slot 680.

[0057] In the condition shown in FIG.6A, when the door (not shown) is closed, the rotating bracket 241 again extends vertically in contact with the support bracket 240. As above, the friction device 262-263 is maintained raised by the balancing device of the dishwasher (not shown in the figure). In this condition, the transmission peg 681 is at an (inner) entrance of the transmission slot 680. At the same time, the slide 671 is again at a lower position along the elongated guide structure 270.

[0058] With reference to FIG.6B, when the door (not shown) is opened, the rotating bracket 241 again rotates with respect to the support bracket 240 around the fulcrum pin 242 (counterclockwise in the figure). As a result, the rocking arm 645 rotates in the opposite direction (clockwise in the example at issue) with respect to the rotating bracket 241 around the rocking pin 646. As a consequence, the rocking arm 645 directly applies a downward pulling force to the friction lever 262, so as to operate the friction device 262-263 and then the balancing device (not shown in the figure) in the same way as above (so that the corresponding description is not repeated for the sake of simplicity).

[0059] According to the third embodiment of the present invention, however, at the same time the rotation of the rocking arm 645 directly translates the sliding block 671, 672, 674, and then the decorative front panel connected thereto (not shown in the figure) upwards along the elongated guide structure 270 (i.e., along a direction essentially orthogonal to the rotation axis of the door, as defined by the fulcrum pin 242), while the transmission peg 681 moves outwards along the transmission slot 680.

[0060] Moving to FIG.6C, as the rotating bracket 241 continues rotating, the transmission peg 681 reaches an outer bottom of the transmission slot 680, and then inverts its movement direction, inwards along the transmission slot 680. As above, the rotation of the rotating bracket 241 and then the opening of the door (not shown in the figure) stops when it reaches its maximum opening angle (for example, with the rotating bracket 241 that abuts against a bottom of the support bracket 240), with the slide 671 that preferably reaches an upper end of stroke of the elongated guide structure 270. In this condition, the transmission peg 681 is again at the entrance of the transmission slot 680.

[0061] The same operations are performed in reverse order when the door is closed.

[0062] This hinge of the third embodiment of the invention, hereinafter referred to lever sliding hinge, provides the same advantages as described above with reference to the compass sliding hinge (first embodiment of the invention) and the cam sliding hinge (second embodiment of the invention).

[0063] Regarding the hinge 635 according to the third embodiment of the invention (also called herein lever hinge), the mounting of the decorative front panel 140 in front of the door 125, 130 can involve a first step of fixing to the inner face of the decorative front panel at least one, preferably a pair of, sliding connectors 405 in an upper end region of the decorative front panel and a pair of fastening brackets 672 in a lower end region of the decorative front panel, a subsequent second step of introducing said at least one sliding connector 405 into at least one, preferably a pair of, corresponding vertically elongated guide slots 131 that are arranged in an upper end region 130 of the door of the appliance, a subsequent third step of inserting said pair of fastening brackets 672 into a pair of corresponding vertically elongated through-slots 126 which are formed in a lower end region 125 of the door and respectively at a mating position to the corresponding slide 671 of the rotating bracket 241 of the hinge so that the fastening brackets can be readily aligned with the corresponding slides, and a subsequent fourth step wherein each fastening bracket is fixed to the corresponding slide by a mounting tap screw 674. When using a pair of the hinge 635 of the third embodiment, said fourth step involves an initial step of aligning the transmission slot 680 which is formed at a lower end of each of the fastening brackets 672 that have been fixed to the lower end region of the decorative front panel as described above with the transmission pegs 681 formed at the free ends of the rocking arms 645 of the left and the right hinge 635, respectively. Subsequently, for final fixation of the fastening brackets 672 to the slides 671 of the left and right hinge 635, the opposing side faces of the door 125 of the appliance in their lower end regions can comprise an access trough-hole 127 which allows ready access

to the respective slide 671 of the hinge and to the screw 274. In that way, the screws can be readily reached e.g. by a screw driver or a wrench from the outside of the door in order to easily fix the fastening brackets to the slides of the hinges.

[0064] However, it should be noted that, in order to provide the desired sliding movement, the lever sliding hinge requires the mounting of the fastening bracket on the slide; therefore, this also requires the presence of the decorative front panel (since the fastening brackets beforehand are fastened to the decorative front panel and afterward are mounted on the corresponding slides). Nevertheless, the sliding movement is implemented by the lever sliding hinge *per se* (including the fastening bracket), so that it can still be deemed a sliding hinge, even if possibly not *stricto sensu*. Therefore, the lever sliding hinge does not require any additional mechanism for sliding the decorative front panel.

[0065] Moreover, the lever sliding hinge has a far simpler structure as compared to the compass sliding hinge and the cam sliding hinge that strongly reduces its cost. On the other hand, the lever sliding hinge provides a somewhat lower translation of the decorative front panel as compared to the compass sliding hinge and the cam sliding hinge, merely as a non-restrictive example in the range of 40-50 mm; in addition, the translation movement in the lever sliding hinge depends on the operation of the friction device. In particular, the lever sliding hinge 635 requires somewhat precision in positioning the fastening bracket 672 on the decorative front panel 140, because it is necessary to align the left and right transmission slots 680 with the two transmission pegs 681 on the left and the right hinge, respectively.

[0066] A hinge according to a fourth embodiment of the invention (which may be used, for example, in the same dishwasher described above) is shown in FIG.7A-FIG.7H in different operative conditions.

[0067] Starting from FIG.7A, the hinge of the fourth embodiment of the invention, which is differentiated with the reference 735, is shown in a side view thereof. The hinge 735 includes essentially the same basic structure of the support bracket 240, the rotating bracket 241, and the fulcrum pin 242 (so that their description is not repeated for the sake of simplicity). The hinge 735 now uses a standard lever mechanism 261, 262, 263, 764, 765, 766 to operate the same balancing device 260 (so that its description is not repeated for the sake of simplicity). For example, this lever mechanism 261-263,764-766 includes the same rail structures 261, friction lever 262, and friction blocks 263 (so that their description is not repeated for the sake of simplicity); the lever mechanism 261-263,764-766 further includes an elongated rod 764 (for example, with a rounded curved shape and concave outwards). The rod 764 has an upper end rotationally connected to the friction lever 262 by means of a pin 765, which is arranged below the hook of the friction lever 262 but spaced apart from it horizontally; moreover, the rod 764 has a lower end rotationally connected to the rotating bracket 241 by means of a pin 766, which is arranged at a bottom of the rotating bracket 241 and slightly above the fulcrum pin 242.

[0068] In addition, as shown in an opposite side view of the hinge 735 provided in FIG.7B, the hinge 735 differs from the first, second and third embodiments of the invention described above in that a driving mechanism 750, 751, 785, 786, 787, 788 (as above arranged to interact both with the support bracket 240 and the rotating bracket 241 to be operated when the rotating bracket is rotating) is independent of the lever mechanism 261-263,764-766 used to operate the balancing device 260. The driving mechanism 750, 751, 785, 786, 787, 788 comprises a first gear mechanism 750, 751, 785, 786 comprising at least a first gear element 750 that is fixedly, i.e. non-rotationally, mounted on the support bracket. The first gear element 750 is mounted at the bottom of the support bracket 240, so as to be coaxial with the fulcrum pin 242 and then with the rotation axis of the door (not shown in the figure); the first gear element 750 is fixed on the support bracket 240 such that it cannot rotate with respect to it. In the example shown in the figure, the first gear element 750 consists of a first cogwheel portion 750, with its border extending along a circular arc defined by a central angle of about 90°-120° (facing inwards and upwards, towards the rotating bracket 241).

[0069] The driving mechanism 750, 751, 785, 786, 787, 788 comprises in addition a second gear mechanism 787, 788 that is mounted on the rotating bracket and arranged to interact with the first gear mechanism 750, 751, 785, 786, either directly with the first gear element 750 (not shown) or with the first gear element 750 via a second gear element 751 (not shown), via a second gear element 751 and a third gear element 785 (not shown) or via a second gear element 751, a third gear element 785 and a fourth gear element 786 (see figures 7B to 7H). The second gear mechanism 787, 788 is interacting with the first gear mechanism 750, 751, 785, 786 to be operated when the rotating bracket 241 is rotating. The second gear mechanism 787, 788 cooperates with the sliding block 771-778 to achieve the sliding of the sliding block along the elongated guide structure 270 and the corresponding sliding of the decorative front panel 140 (not shown in figure 7A) with respect to the door 125, 130 (not shown in figure 7A) during the rotation of the rotating bracket 241.

[0070] The first gear mechanism 750, 751, 785, 786 and the second gear mechanism 787, 788 are preferably configured to provide an overdrive wherein the gear ratio of the first gear mechanism 750, 751, 785, 786 with respect to the second gear mechanism 787, 788 is larger than 1.

[0071] The second gear mechanism 787, 788 preferably includes a worm screw 787. As shown in greater detail in FIG.7F, the worm screw 787 can have a threaded stem 787t (preferably with a right-hand thread). The worm screw 787 ends at its bottom with a further bevel gear 787v. The further bevel gear 787v and the bevel gear of the fourth gear element (see reference 786v in FIG.7E) preferably have about the same size, so that their gear ratio is preferably about equal to 1, in a merely and non-limiting example with 10 teeth both in the bevel gear of the fourth gear element and in the further bevel gear 787v. The worm screw 787 is also provided with a collar 787a in close proximity to the further

bevel gear 787v (slightly spaced apart from it). Returning to FIG.7B, the worm screw 787 is rotationally connected to the support bracket 240 above the fourth gear element 786, with their rotation axes orthogonal to each other. Particularly, the worm screw 787 extends along the elongated guide structure 270. For this purpose, the worm screw 787 is inserted into a through-hole of a stop element 788, which is sandwiched between the collar 787a and the further bevel gear 787v (immediately above and below the stop element 788, respectively); in this way, the interference of the stop element 788 with the collar 787a and the further bevel gear 787v prevents any translation of the worm screw 786 along the elongated guide structure 270, at the same time allowing its rotation about its longitudinal axis. The further bevel gear 787v is meshed with the bevel gear 786v. The threaded stem 787t is instead screwed in the worm gear 778, so as to screwably guide the slide 771.

[0072] Moreover, the rotating bracket 241 includes the same elongated guide structure 270 as above. The rotating bracket 241 also includes a similar sliding block 771, 772, 778 that is slidably guided along the elongated guide structure 270. As above, the sliding block 771-778 includes a slide 771, which is inserted into the channel of the elongated guide structure 270 so as to be slidably guided along it. The sliding block 771-778 also includes a fastening bracket 772, which is mounted on the slide 771 in a fixed position (again by means of a mounting tap screw, not shown in the figure, which is inserted through a mounting smooth hole of the fastening bracket 772 and the access window of the elongated guide structure 270, and it is then screwed into a threaded hole formed in the slide 771). However, in the fourth embodiment of the invention, a worm gear 778 is formed in the slide 771. In particular, the worm gear 778 includes a threaded through-hole, preferably with a right-hand thread, which extends along the elongated guide structure 270.

[0073] As above, the sliding block 771-778 cooperates with the driving mechanism 750-751 to achieve a sliding of the sliding block 771-778 along the elongated guide structure 270 and hence a corresponding sliding of the fastening bracket 772 and hence of the decorative front panel with respect to the door during the rotation of the rotating bracket 241. However, in the fourth embodiment of the invention, for this purpose the sliding block 771-774 cooperates with the driving mechanism 750-751 via a second gear mechanism 785, 786, 787, so as to convert the rotation of the second gear element 751 into a translation of the sliding block 771-778 (and thereby achieving the above-mentioned sliding of the sliding block 771-778 along the elongated guide structure 270, and the corresponding sliding of the front panel with respect to the door).

[0074] According to the invention, the driving mechanism 750, 751, 785, 786, 787, 788 of the hinge 735 of the fourth embodiment of the invention can be adapted in various ways to be integrated into the space that is available within the support bracket 240 and/or the rotating bracket 241. To that end, a gear ratio between the first gear mechanism 750, 751, 785, 786 and the second gear mechanism 787, 788 can be suitably implemented. That is preferably done by choosing said gear ratio suitably to achieve a required extent of the sliding of the decorative front panel 140 and of the corresponding sliding of the sliding block 771-778 along the elongated guide structure 270 during the opening of the door 125, 130 and the corresponding rotation of the rotating bracket 241 up to a maximum opening angle α of about 85 to 95 degrees.

[0075] In embodiments of the invention that are not shown in the figures and that require more space inside the hinge as compared to the hinge 735 shown in the figures 7A to 7H, the first gear element 750 that is fixedly mounted to the support bracket can be chosen sufficiently large to interact either directly with the second gear mechanism 787, 788 and still provide the required gear ratio to allow a required sliding of the decorative front panel. In alternative, the first gear element 750 can be chosen still sufficiently large (not shown) to interact with the second gear mechanism 787, 788 only via one or two additional gear elements (compare for example with the gear elements 751, 785 below) with suitably chosen gear ratio(s), instead of via the three additional gear elements 751, 785, 786 of the preferred embodiments described below with reference to the figures 7A to 7H.

[0076] In preferred embodiments of the invention, however, that are advantageous in that they require only little space inside the hinge, the first gear element 750 is chosen relatively small, such as shown for example in the figures 7A to 7H, wherein a suitable number of further gear elements with the required gear ratio(s) to allow a required sliding of the decorative front panel 140 is provided (compare for example with the gear elements 751, 785, 786 described below) and said further gear elements are arranged rotationally on the rotating bracket 241 to cooperate with both the first gear means 750 and the second gear mechanism 787, 788.

[0077] In the preferred embodiment shown in the figures 7A to 7H, the first gear mechanism 750, 751, 785, 786 can comprise a second gear element 751 that is rotationally mounted on the rotating bracket 241 and that is meshed with the first gear element 750 to be rotated during the rotation of the rotating bracket 241; the second gear mechanism 787, 788 interacts with the second gear element 751, either directly (not shown) or via a third gear element 785 (not shown) or via a third gear element 785 and a fourth gear element 786 (see figures 7B to 7H) to be operated when the second gear element 751 is rotating. Preferably, at least one of the second, third and/or fourth gear element 751, 785, 786, still preferably all, is/are embodied as gear wheels - compare the figures 7B-E and 7G-H. The first gear element 750 that is fixed to the support bracket 240 can be either a gear wheel (compare the figures 7B and 7G-H), or can in alternative be embodied as a part, in particular an integral part, of the support bracket 240 (not shown), in particular comprising a toothed arched portion corresponding only to a part of a circle corresponding at least to the maximum opening angle α

of the door hinge 735 of about 85 to 95 degrees.

[0078] As shown in greater detail in FIG.7C, the second gear element 751 can be formed by a second cogwheel 751a and a further second cogwheel 751b, which are coaxial and integral to each other. The second cogwheel 751s (hereinafter referred to as second small cogwheel) is preferably smaller than the first cogwheel portion (see reference 750 in FIG. 7B), so that a gear ratio between the second small cogwheel 751s and the first cogwheel portion is lower than 1, merely as a non-restrictive example of the order of 0.1-0.5, such as for example 0.25 (with 10 teeth in the second small cogwheel 751s and 10 teeth in the first cogwheel portion, corresponding to 40 teeth for its whole circumference). Moreover, the further second cogwheel 751b (hereinafter referred to as second big cogwheel) is bigger than the second small cogwheel 751s, so that a gear ratio between the second big cogwheel 751b and the second small cogwheel 751s is higher than 1, merely as a non-restrictive example of the order of 2-5, such as for example 3 (with 30 teeth in the second big cogwheel 751b and 10 teeth in the second small cogwheel 751s). Returning to FIG.7B, the second gear element 751 is rotationally connected to a bottom of the rotating bracket 241, with its rotation axis parallel to the one of the first cogwheel portion 750. The second small cogwheel (not visible in the figure because beneath the second big cogwheel 751b) is meshed with the first cogwheel portion 750.

[0079] Particularly, this first gear mechanism 750, 751, 785, 786 can include a third gear element 785. As shown in greater detail in FIG.7D, the third gear element 785 is formed by a third cogwheel 785s and a further third cogwheel 785b, which are coaxial and integral to each other. The third cogwheel 785s (hereinafter referred to as third small cogwheel) is smaller than the second big cogwheel (see reference 751b in FIG.7C), so that a gear ratio between the third small cogwheel 785s and the second big cogwheel is lower than 1, merely as a non-restrictive example of the order of 0.1-0.5, such as for example 0.33 (with 10 teeth in the third small cogwheel 785s and 30 teeth in the second big cogwheel). Moreover, the further third cogwheel 785b (hereinafter referred to as third big cogwheel) is bigger than the third small cogwheel 785s, so that a gear ratio between the third big cogwheel 785b and the third small cogwheel 785s is higher than 1, merely as a non-restrictive example of the order of 2-5, such as for example 3 (with 20 teeth in the third big cogwheel 785b and 10 teeth in the third small cogwheel 785s). Returning to FIG.7B, the third gear element 785 is rotationally connected to the rotating bracket 241 above the second gear element 751, with their rotation axes parallel to each other. The third small cogwheel 785s is meshed with the second big cogwheel 751b.

[0080] The first gear mechanism 750, 751, 785, 786 can in addition include a fourth gear element 786. As shown in greater detail in FIG.7E, the fourth gear element 786 is formed by a fourth cogwheel 786c and a bevel gear 786v, which are coaxial and integral to each other. The fourth cogwheel 786c is smaller than the third big cogwheel (see reference 785b in FIG.7D), so that a gear ratio between the fourth cogwheel 786c and the third big cogwheel is lower than 1, merely as a non-restrictive example of the order of 0.1-0.5, such as for example 0.5 (with 10 teeth in the fourth cogwheel 786c and 20 teeth in the third big cogwheel). Instead, the bevel gear 786v and the fourth cogwheel 786c have about the same size, so that their gear ratio is preferably about equal to 1, in a merely illustrative and non-limiting example with 10 teeth both in the bevel gear 786v and in the fourth cogwheel 786c. Returning to FIG.7B, the fourth gear element 786 is rotationally connected to the rotating bracket 241 above the third gear element 785, with their rotation axes parallel to each other. The fourth cogwheel (not visible in the figure because beneath the bevel gear 786v) is meshed with the third big cogwheel 785b.

[0081] In the condition shown in FIG.7B, when the door (not shown) is closed, the rotating bracket 241 again extends vertically in contact with the support bracket 240. At the same time, the threaded stem 787t is completely screwed in the worm gear 778; therefore, the slide 771 is at a lower end of stroke of the elongated guide structure 270, abutting against the collar 787a.

[0082] With reference to FIG.7G, when the door (not shown) is opened, the rotating bracket 241 again rotates with respect to the support bracket 240 around the fulcrum pin 242 (clockwise in the figure). As a result, the second gear element 751 is dragged in rotation in the same direction (clockwise in the example at issue) by the rotating bracket 241, because of the interference of its second small cogwheel (not visible in the figure because beneath the second big cogwheel 751b) with the first cogwheel portion 750 fixed on the support bracket 240. At the same time, the rotation of the second gear element 751 causes the third gear element 785 to rotate in the opposite direction (counter-clockwise in the example at issue), because of the meshing of its third small cogwheel 785s with the second big cogwheel 751b. In turn, the rotation of the third gear element 785 causes the fourth gear element 786 to rotate in the opposite direction (clockwise in the example at issue), because of the meshing of its fourth cogwheel (not visible in the figure because beneath the bevel gear 786v) with the third big cogwheel 785b. The rotation of the fourth gear element 786 causes the worm screw 787 to rotate in the same direction (clockwise in the example at issue), because of the meshing of its further bevel gear 787v with the bevel gear 786b. The rotation of the worm screw 786 then unscrews the threaded stem 787t from the worm gear 778, so as to translate the sliding block 771-778, and then the decorative front panel connected thereto (not shown in the figure) upwards along the elongated guide structure 270 (i.e., along a direction essentially orthogonal to the rotation axis of the door, as defined by the fulcrum pin 242).

[0083] Moving to FIG.7H, as above the rotation of the rotating bracket 241 and then the opening of the door (not shown in the figure) stops when it reaches its maximum opening angle (for example, with the rotating bracket 241 that abuts

against a bottom of the support bracket 240). In this condition, the slide 771 preferably reaches the upper end of stroke of the elongated guide structure 270.

[0084] It should be noted that since the gear ratio between the second small cogwheel of the second gear element 751 (not visible in the figure because beneath its second big cogwheel 751b) and the first cogwheel portion 750 is preferably lower than 1, the second small cogwheel rotates preferably faster than the rotating bracket 241. The second big cogwheel 751b, being integral with the second small cogwheel, then rotates at the same speed. Moreover, since the gear ratio between the third small cogwheel 785s and the second big cogwheel 751b is preferably lower than 1, the third small cogwheel 785s rotates preferably faster than the second big cogwheel 751b. The third big cogwheel 785b, being integral with its third small cogwheel 785s, then rotates at the same speed. Likewise, since the gear ratio between the fourth cogwheel 786c and the third big cogwheel 785b is preferably lower than 1, the fourth cogwheel 786c rotates preferably faster than third big cogwheel 785b. The bevel gear 786v, being integral with the fourth cogwheel 786c, then rotates at the same speed. At the end, since the gear ratio between the further bevel gear 787v and the bevel gear 786v is preferably equal to 1, the further bevel gear 787v rotates at the same speed as the bevel gear 786v. The threaded stem 787t, being integral with the further bevel gear 787v, then rotates at the same speed as well. In this way, the above-described structure implements an overdrive that increases the rotation speed of the threaded stem 787t with respect to the one of the rotating bracket 241, so as to allow obtaining the desired extent of translation of the sliding block 771-778 and then of the decorative front panel during the rotation of the door. Particularly, in the example at issue the rotation of the door by its maximum opening angle (such as 90°) causes a rotation of the second gear element 751 by $90^\circ / 0,25 = 360^\circ$, a rotation of the third gear element 785 by $360^\circ / 0,33 = 1.080^\circ$, and then a rotation of the fourth gear element 786 by $1.080^\circ / 0,5 = 2.160^\circ$; therefore, this rotation of the door causes the same rotation by 2.160° (i.e., by $2.160^\circ / 360^\circ = 6$ turns) of the worm screw 787, which can provide the desired translation of the decorative front panel (for example, merely as a non-restrictive indication in the range of 50-60 mm).

[0085] The same operations are performed in reverse order when the door is closed.

[0086] This hinge of the fourth embodiment of the invention, hereinafter referred to gear sliding hinge, provides the same advantages as described above with reference to the compass sliding hinge (first embodiment of the invention), cam sliding hinge (second embodiment of the invention) and lever sliding hinge (third embodiment of the invention). As can be easily understood from what has been said above, the advantages of the hinge 735 of the fourth embodiment of the invention comprise in particular the advantageous mounting and trimming scheme as described above - only as an example - with reference to the hinge 235 of the first embodiment of the invention.

[0087] Moreover, the sliding movement is obtained in the gear sliding in a completely independent way from the operation of the balancing device. On the other hand, this requires a dedicated mechanism.

Modifications

[0088] Naturally, in order to satisfy local and specific requirements, a person skilled in the art may apply to the solution described above many logical and/or physical modifications and alterations. More specifically, although this solution has been described with a certain degree of particularity with reference to one or more embodiments thereof, it should be understood that various omissions, substitutions and changes in the form and details as well as other embodiments are possible (for example, with respect to process parameters, materials, and dimensions). Particularly, different embodiments of the invention may even be practiced without the specific details (such as the numerical examples) set forth in the preceding description to provide a more thorough understanding thereof; conversely, well-known features may have been omitted or simplified in order not to obscure the description with unnecessary particulars. Moreover, it is expressly intended that specific elements and/or method steps described in connection with any embodiment of the disclosed solution may be incorporated in any other embodiment as a matter of general design choice.

[0089] For example, similar considerations apply if the hinge has a different structure or includes equivalent components (either separate to each other or combined together, in whole or in part). Particularly, the elongated guide structure of the rotating bracket and the corresponding sliding block may be replaced with any other mechanism allowing their sliding (for example, of the roller or dovetail type); moreover, the above-described examples of driving mechanisms (arranged to interact with the support bracket and the rotating bracket to achieve the desired sliding movement) are not exhaustive, with the same result that may also be achieved with a different structure (for example, with a combination of levers and gears). In any case, although the proposed structure allows using a single fulcrum hinge in most of the practical situations, the application of the same solution to any other hinge (even of the double fulcrum type) is contemplated.

[0090] It should also be noted that the proposed hinge lends itself to be put on the market even as a stand-alone product (to be used with whatever appliances).

[0091] Nothing prevents providing the rocking arm with a different shape, or rotationally connecting it to the rotating arm in another way and/or in another position. More generally, other (lever) driving mechanisms may be used to cause the rocking arm to rock during the rotation of the door (for example, based on a tie-rod and a return spring).

[0092] Particularly, the guide arm may have a different shape, and it may be rotationally connected to the support

bracket and to the rocking arm in another way and/or in another position.

[0093] Likewise, the guide slotted hole may have another shape and/or it may be arranged in another position (to cooperate with a mating guide peg); alternatively, it is also possible to form the guide slotted hole in the support arm and to provide the guide peg integral with the rocking arm (so as to have the guide peg that is slidably guided along the guide slotted hole).

[0094] The proposed hinge (apart in the case of the lever sliding hinge) is completely independent of the type of balancing device that is used in the dishwasher (and of the friction device included therein); as a result, it is possible to provide any other mechanism to couple the driving mechanism with the balancing device. Moreover, nothing prevents having a standard lever mechanism (to operate the balancing device) and an independent driving mechanism (coupled between the support bracket and the rotating bracket to achieve the desired sliding movement) even in the compass sliding hinge, the cam sliding hinge and/or the lever sliding hinge.

[0095] Any other mechanism may be used to couple the rocking arm with the friction device; alternatively, it is also possible to rotationally connect the rocking arm directly to the friction device in the compass sliding hinge and/or in the cam sliding hinge.

[0096] Vice-versa, it is possible to provide a distinct coupling rod to couple the rocking arm with the friction lever in the lever sliding hinge as well.

[0097] Any other crank mechanism may be used to couple the rocking arm with the sliding block (for example, a crank and slotted link); alternatively, it is also possible to use the transmission slot and the transmission peg in the compass sliding hinge and/or in the cam sliding hinge.

[0098] Moreover, the transmission slot may have another shape and/or it may be arranged in another position (to cooperate with a mating transmission peg); alternatively, it is also possible to form the transmission slot in the rocking arm and to provide the transmission peg integral with the fastening bracket. As above, nothing prevents using the transmission arm in the lever sliding hinge as well.

[0099] Similar considerations apply if a different gear mechanism is arranged to interact with the support bracket and the rotating bracket (so as to be operated by the rotation of the rotating bracket).

[0100] Particularly, the first gear element and the second gear element and/or their rotation axes may be arranged in different positions; moreover, these gear elements may be replaced with any equivalent components (for example, internal gears, single or double helical gears, and the like).

[0101] Likewise, the second gear mechanism may include any number of any other gear elements. For example, the bevel gears may be replaced by equivalent gear elements (for example, crown gears). More generally, whatever gear mechanism may be connected between the last gear element and the sliding block to achieve its sliding during the rotation of the door (for example, a rack driven by the medium cogwheel acting as a pinion).

[0102] In any case, the worm gear used to achieve the sliding of the sliding block during the rotation of the door may have another structure (for example, of the non-throated, single-throated or double-throated type).

[0103] More generally, the gear mechanisms may include any number of gear elements with any gear ratio between each pair of them (according to the desired extent of translation of the sliding block with the rotation of the door).

[0104] Similar considerations apply if the sliding block has a different structure or includes equivalent components (for example, with the fastening bracket that is snap fitted on the slide).

[0105] Particularly, when the crank mechanism is formed by the transmission slot (in the fastening bracket) and the transmission peg (in the rocking arm), it is also possible to provide a closed transmission slot with a removable transmission peg; in this case, it is possible to fasten the fastening brackets beforehand to the decorative front panel and to mount them afterward on the corresponding slides, and later on to mount the transmission pegs on the slides through the transmission slots.

[0106] The trimming structure (for trimming the position of the fastening bracket on the slide) may also be used in the lever hinge and/or in the gear hinge; vice-versa, a simple mounting structure (with the fastening bracket that is mounted in a fixed position along the slide) may be used in the compass hinge and/or in the cam hinge as well.

[0107] In any case, the trimming structure may be implemented with an equivalent structure (for example, with a discrete regulation of the position of the fastening bracket along the slide).

[0108] Alternatively, the elongated guide structure for the sliding block may have another length (so that the sliding block does not reach its upper end of stroke, even for the maximum opening angle of the door).

[0109] Similar considerations apply if the dishwasher has a different structure or includes equivalent components (either separate to each other or combined together, in whole or in part); particularly, the support bracket and the rotating bracket of each hinge may be connected to the body and to the door, respectively, of the dishwasher in any other way. Although in the preceding description reference has been made to a dishwasher, this is not to be interpreted in a limitative manner; indeed, the same hinges may also be used in a different appliance (for example, a oven, a fridge, a washing machine, a tumble dryer, and the like).

[0110] Naturally, the appliance with the proposed hinges lends itself to be put on the market even without the corresponding decorative front panel. In any case, the application of these hinges is not limited to appliances to be integrated

with other pieces of furniture.

[0111] The decorative front panel may be mounted on the dishwasher in another way (by performing different or alternative operations, even in a different order); moreover, it is possible to use sliding connectors with a different structure or arranged in a different position (for example, between the decorative front panel and the door panel).

[0112] In any case, the application of the above-described hinges is not limited to appliances of the full-integrated type (for example, being also possible in appliances of the built-in type with a door that opens laterally).

Reference Numerals

[0113]

α	opening angle
100	domestic appliance
105	body of the appliance
125	door panel, proximal portion
125, 130	door
126	vertically elongated through-slot
127	access through-hole
130	control panel, distal portion
131	guide slot
140	decorative front panel
235	hinge
240	support bracket
241	rotating bracket
242	rotation axis
245	rocking arm
246	rocking pin
245-249	driving mechanism
247	guide arm
248	rotational connection
249	rotational connection
247-249	rotational coupling
260	door balancing device
261	rail structure
261-265, 665	rotational coupling

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	261-265, 566	coupling mechanism
	261-263, 665	coupling mechanism
5	261-266	coupling mechanism
	262	friction lever
	262-263	friction device
10	263	friction block
	264	coupling rod
15	265	rotational connection
	266	rotational connection
	270	elongated guide structure
20	271	slide
	271-274	sliding block
25	272	fastening bracket
	273	trimming slotted hole
	273-274	mounting structure, trimming structure
30	274	screw
	275	transmission arm
35	275-277	crank mechanism
	275, 576, 277	crank mechanism
	276	rotational connection
40	277	rotational connection
	405	sliding connector
45	535	hinge
	545	rocking arm
	546	rocking pin
50	545-551	driving mechanism
	550	guide slotted hole
55	550-551	rotational coupling
	551	guide peg

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	566	rotational connection
	576	rotational connection
5	635	hinge
	645	rocking arm
	646	rocking pin
10	645-646, 665, 261-263	driving mechanism
	665	pin
15	671	slide
	672	fastening bracket
	671-674	sliding block
20	674	mounting structure, mounting tap screw
	680	transmission slot
25	680-681	crank mechanism
	681	transmission peg
	735	hinge
30	750	first gear element, first cogwheel portion
	750s	second cogwheel portion
35	750, 751, 785, 786	first gear mechanism
	750-751, 785-788	driving mechanism
	751	second gear element
40	751 b	further second cogwheel
	771	slide
45	772	fastening bracket
	771-778	sliding block
	778	worm gear, threaded hole
50	785	third gear element
	785b	further third cogwheel
55	785s	third cogwheel
	786	fourth gear element

786c	fourth cogwheel
786v	bevel gear
5 787	worm screw
787t	threaded stem
787v	further bevel gear
10 787, 788	second gear mechanism
788	rotational connection

Claims

1. A hinge (235;535;635;735) for use in a domestic appliance (100) to rotationally connect a door (125,130) of the appliance to a body (105) of the appliance, wherein a decorative front panel (140) can be mounted in front of the door and arranged slidably in an essentially orthogonal direction relative to a rotation axis (242) of the door with respect to the body, the hinge including a support bracket (240) for connection to the body, a rotating bracket (241) for connection to the door, the rotating bracket being rotationally connected to the support bracket, and a driving mechanism (245-249;545-551;645-646,665,261-263;750-,751,785,786,787,788) arranged to interact both with the support bracket and the rotating bracket to be operated when the rotating bracket is rotating,
characterized in that
the rotating bracket includes an elongated guide structure (270) extending essentially orthogonally to the rotation axis of the door and a sliding block (271-274;271-274;671-674;771-778) for connection to the decorative front panel, the sliding block being slidably guided along the elongated guide structure, wherein the sliding block cooperates with the driving mechanism to achieve a sliding of the sliding block along the elongated guide structure and a corresponding sliding of the decorative front panel with respect to the door during the rotation of the rotating bracket.
2. The hinge (235;535;635) according to claim 1, wherein the driving mechanism (245-249;545-551;645-646,261-263,665) includes a rocking arm (245;545;645) rotationally connected to the rotating bracket (241) around a rocking pin (246;546;646) arranged between an inner end of the rocking arm in correspondence to the support bracket (240) and an outer end of the rocking arm in correspondence to the rotating bracket, and a rotational coupling (247-249;550-551;261-263,665) rotationally connecting the inner end of the rocking arm to the support bracket for rocking the rocking arm around the rocking pin during the rotation of the rotating bracket, and wherein the hinge further includes a crank mechanism (275-277;275,576,277;680-681) connecting the outer end of the rocking arm to the sliding block (271-274;271-274;671-674) to achieve the sliding of the sliding block along the elongated guide structure (270) and the corresponding sliding of the decorative front panel (140) with respect to the door (125,130) during the rocking of the rocking arm.
3. The hinge (235) according to claim 2, wherein the rotational coupling (247-249) includes a guide arm (247) having a first guide arm end rotationally connected (248) to the support bracket (240) and a second guide arm end rotationally connected (249) to the inner end of the rocking arm (245).
4. The hinge (535) according to claim 2, wherein the rotational coupling (550-551) includes a guide slotted hole (550) formed in the rocking arm (545) or in the support bracket, the guide slotted hole extending along a curved line, and a guide peg (551) integral with the support bracket (240) or with the rocking arm, respectively, the guide slotted hole being slidably guided by the guide peg or the guide peg being slidably guided along the guide slotted hole, respectively.
5. The hinge (235;535;635) according to any claim from 2 to 4, wherein the hinge further includes a coupling mechanism (261-266;261-265,566;261-263,665) for coupling the driving mechanism (245-249;545-551;645-646,261-263,665) with a door balancing device (260) of the appliance for balancing a weight of the door (125,130) and of the decorative front panel (140) during the rotation of the door, the coupling mechanism being adapted to operate the balancing device during the rotation of the rotating bracket (241).
6. The hinge (235;535) according to claim 5, wherein the coupling mechanism (261-266;261-265,566) includes at least

one rail structure (261) formed in the support bracket (240), the at least one rail structure extending essentially orthogonally to the rotation axis (242) of the door, a friction device (262-263) comprising a friction lever (262) carrying at least one friction block (263) slidably guided along the at least one rail structure for generating a friction therebetween varying according to a torque provided by the weight of the door (125,130) and of the decorative front panel (140) during the rotation of the door, and a coupling rod (264) having a first coupling rod end rotationally connected (265;265) to the friction lever (262) and a second coupling rod end rotationally connected (266;566) to the inner end of the rocking arm (245;545).

7. The hinge (635) according to claim 5, wherein the coupling mechanism (261-263,665) includes at least one rail structure (261) formed in the support bracket (240), the at least one rail structure extending essentially orthogonally to the rotation axis (242) of the door, at least one friction lever (262) carrying at least one friction block (263) slidably guided along the at least one rail structure for generating a friction therebetween varying according to a torque provided by the weight of the door (125,130) and of the decorative front panel (140) during the rotation of the door, and a pin (665) rotationally connecting the inner end of the rocking arm (645) to the friction block.

8. The hinge (235;535) according to any claim from 2 to 7, wherein the crank mechanism (275-277;275,576,277) includes a transmission arm (275) having a first transmission arm end rotationally connected (276;576) to the outer end of the rocking arm (245;545) and a second transmission arm end rotationally connected (277;277) to the sliding block (271-274;271-274).

9. The hinge (635) according to any claim from 2 to 7, wherein the crank mechanism (680-681) includes a transmission peg (681) integral with the outer end of the rocking arm (645) or with the sliding block, and a transmission slot (680) formed in the sliding block (671-674) or in the outer end of the rocking arm, respectively, the transmission peg being slidably guided along the transmission slot during the rocking of the rocking arm.

10. The hinge (735) according to claim 1, wherein the driving mechanism (750,751,785,786,787,788) includes a first gear mechanism (750,751,785,786) comprising at least a first gear element (750) fixedly mounted on the support bracket (240) and a second gear mechanism (787,788) mounted on the rotating bracket (241) to interact with the first gear mechanism (750) to be operated when the rotating bracket (241) is rotating, wherein the second gear mechanism (787,788) cooperates with the sliding block (771-778) to achieve the sliding of the sliding block along the elongated guide structure (270) and the corresponding sliding of the decorative front panel (140) with respect to the door (125,130) during the rotation of the rotating bracket (241).

11. The hinge (735) according to claim 10, wherein the first gear mechanism (750,751,785,786) and the second gear mechanism (787,788) are configured to provide an overdrive wherein the gear ratio of the first gear mechanism (750,751,785,786) with respect to the second gear mechanism (787,788) is larger than 1.

12. The hinge (735) according to claim 10 or 11, wherein the first gear mechanism (750,751,785,786) comprises a second gear element (751) rotationally mounted on the rotating bracket (241) and being meshed with the first gear element (750) to be rotated during the rotation of the rotating bracket, wherein the second gear mechanism (787,788) interacts with the second gear element (751) to be operated when the second gear element (751) is rotating.

13. The hinge (735) according to claim 12, wherein the first gear element (750) includes at least a first cogwheel portion (750), and wherein the second gear element (751) includes a second cogwheel (751 s) meshed with the first cogwheel portion to be rotated during the rotation of the rotating bracket, and a further second cogwheel (751 b) coaxial and integral with the second cogwheel to be rotated during the rotation of the second cogwheel, the first cogwheel portion having a first gear rotation axis parallel to the rotation axis (242) of the door (125,130), and the second cogwheel and the further second cogwheel having a second gear rotation axis parallel to the rotation axis of the door.

14. The hinge (735) according to claim 12 or 13, wherein the first gear mechanism comprises a third gear element (785) and preferably in addition a fourth gear element (786) that is/are rotationally mounted on the rotating bracket (241), wherein the third gear element is meshed with the second gear element (751) and any fourth gear element (786) is meshed with the third gear element (785), wherein the second gear mechanism (787,788) interacts with the third or fourth gear element (785,786) respectively and at least one of the gear ratios of the first gear element (750) with respect to the second gear element (751), of the second gear element (751) with respect to the third gear element (785) and of the third gear element (785) with respect to any fourth gear element (786) is larger than 1.

15. The hinge (735) according to claim 14, wherein the third gear element (785) has a third cogwheel (785s) and is

meshed with the further second cogwheel (751b) to be rotated during the rotation of the further second cogwheel, and a further third cogwheel (785b) coaxial and integral with the third cogwheel to be rotated during the rotation of the third cogwheel, the third cogwheel and the further third cogwheel having a third gear rotation axis parallel to the rotation axis (242) of the door (125,130), and the fourth gear element (786) has a fourth cogwheel (786c) and is meshed with the further third cogwheel (785b) to be rotated during the rotation of the further third cogwheel, and a bevel gear (786v) coaxial and integral with the fourth cogwheel to be rotated during the rotation of the fourth cogwheel, the fourth cogwheel and the bevel gear having a fourth gear rotation axis parallel to the rotation axis of the door.

16. The hinge (735) according to any of claims 10 to 15, wherein the sliding block (771,778) includes a worm gear (778), wherein the second gear mechanism (787,788) includes a worm screw (787) rotationally connected (788) to the support bracket (240), the worm screw including a further bevel gear (787v) meshed with the bevel gear (786v) to be rotated during the rotation of the bevel gear, and a threaded stem (787t) coaxial and integral with the further bevel gear to be rotated during the rotation of the further bevel gear, the further bevel gear and the threaded stem having a worm gear rotation axis extending along the elongated guide structure (270), and wherein the threaded stem is coupled with the worm gear to achieve the sliding of the sliding block along the elongated guide structure and the corresponding sliding of the decorative front panel (140) with respect to the door (125,130) during the rotation of the threaded stem.
17. The hinge (735) according to claim 16, wherein the worm gear (778) includes a threaded hole (778) of the sliding block (771-778) extending along the elongated guide structure (270), the threaded stem (787t) being screwably guided in the threaded hole.
18. The hinge (735) according to any claim from 15 to 17, wherein a gear ratio between the second cogwheel (751s) and the first cogwheel portion (750), a gear ratio between the third cogwheel (785s) and the further second cogwheel (751b), a gear ratio between the fourth cogwheel (786c) and the further third cogwheel (785b), and/or a gear ratio between the further bevel gear (787v) and the bevel gear (786v) is lower than 1, and wherein a gear ratio between the further second cogwheel (751b) and the second cogwheel (751 s), a gear ratio between the further third cogwheel (785b) and the third cogwheel (785s), and/or a gear ratio between the bevel gear (786v) and the fourth cogwheel (786c) is higher than 1.
19. The hinge (235;535;635;735) according to any claim from 1 to 18, wherein the sliding block (271-274;271-274;671-674;771-778) includes a slide (271;271;671;771) slidably guided along the elongated guide structure (270), a fastening bracket (272;272;672;772) for fastening the sliding block to the decorative front panel (140), and a mounting structure (273-274;273-274;674) for mounting the fastening bracket on the slide.
20. The hinge (635) according to claim 19 when dependent directly or indirectly on claim 9, wherein the transmission slot (680) is open to receive the transmission peg (681) when the fastening bracket (672) being already fastened to the decorative front panel (140) is mounted on the slide (671).
21. The hinge (235;535;735) according to claim 19 or 20, wherein the mounting structure (273-274) includes a trimming structure (273-274) for trimming a position of the fastening bracket (272) on the slide (271) along the elongated guide structure (270).
22. The hinge (235;535;735) according to claim 21, wherein the trimming structure (273-274) includes a trimming slotted hole (273) formed in the fastening bracket (272), the trimming slotted hole extending along the elongated guide structure (270) when the fastening bracket is mounted on the slide (271), and a trimming screw (274) inserted through the trimming slotted hole and screwed in the slide for gripping the fastening bracket against the slide.
23. The hinge (235;535;635;735) according to any claim from 1 to 22, wherein the elongated guide structure (270) and the sliding block (271-274;271-274;671-674;771-778) are configured to have the sliding block reach an end of stroke of the elongated guide structure in correspondence to an opening angle (α) of the rotating bracket (241) reaching a maximum value comprised between 85-95°, the sliding block at the end of stroke preventing a further rotation of the rotating bracket.
24. A domestic appliance (100) including a body (105), a door (125,130), and a pair of hinges (235;535;635;735) according to any claim from 1 to 23 rotationally connecting the door to the body at opposite sides thereof, each hinge having the corresponding support bracket (240) connected to the body and the corresponding rotating bracket (241) connected to the door.

25. The appliance (100) according to claim 24, wherein the door comprises a distal portion (130) with respect to said pair of hinges (235;535;635;735), in particular a control panel (130), wherein the frontal face of the distal portion (130) in the two lateral regions thereof comprises two vertically elongated guide slots (131) that are arranged respectively at a mating position to take up one of two sliding connectors (405) that are arranged laterally about an upper end region of the decorative front panel (140) and wherein the guide slots (131) are adapted for slidably guiding said sliding connectors (405) during the sliding of the decorative panel with respect to the door (125,130).
26. The appliance (100) according to claim 25, wherein the door comprises a door panel (125) that forms a proximal portion (125) of the door with respect to said pair of hinges (235;535;635;735), wherein a lower end region of the frontal face of the door panel (125) in the two lateral regions thereof comprises two vertically elongated trough-slots (126) that are arranged respectively at a mating position to take up one of the two fastening brackets (272) that are arranged laterally about the lower end region of the decorative front panel (140) and wherein the vertically elongated trough-slots (126) are adapted to allow the insertion of the fastening brackets (272) and the vertical movement thereof during the sliding of the decorative panel with respect to the door (125,130).
27. The appliance (100) according to claim 26, wherein the door panel (125) in a lower end region of the two lateral faces thereof comprises two access through-holes (127) that are arranged respectively at a suitable height position to provide access to the slide (271) of the rotating bracket (241) of the hinge during the mounting of the decorative front panel (140) on the door (125,130), in order to enable the fixation of the fastening bracket (272) on the slide (271) by a trimming screw (274), in particular wherein the trimming screw is inserted into a trimming slotted hole (273) of fastening bracket (272) that extends in parallel to the elongated guide structure (270) of the rotating bracket (241) and that allows trimming of the position of the fastening bracket (272) on the slide (271).
28. The appliance (100) according to any of claims 24 to 27, further including a decorative front panel (140) mounted in front of the door (125,130) and arranged slidably in an essentially orthogonal direction relative to a rotation axis (242) of the door with respect to the body (105) of the appliance, the sliding block (271-274;271-274;671-674;771-778) of each hinge (235;535;635;735) being connected to the decorative front panel (140), and at least one sliding connector (405) slidably connecting the decorative front panel to the door, the at least one sliding connector being arranged at a distal position from the hinges.
29. The appliance (100) according to any of claims 24 to 28, wherein the appliance is of the full-integrated type with the decorative front panel (140) covering both the proximal portion (125) and the distal portion (130) of the door.

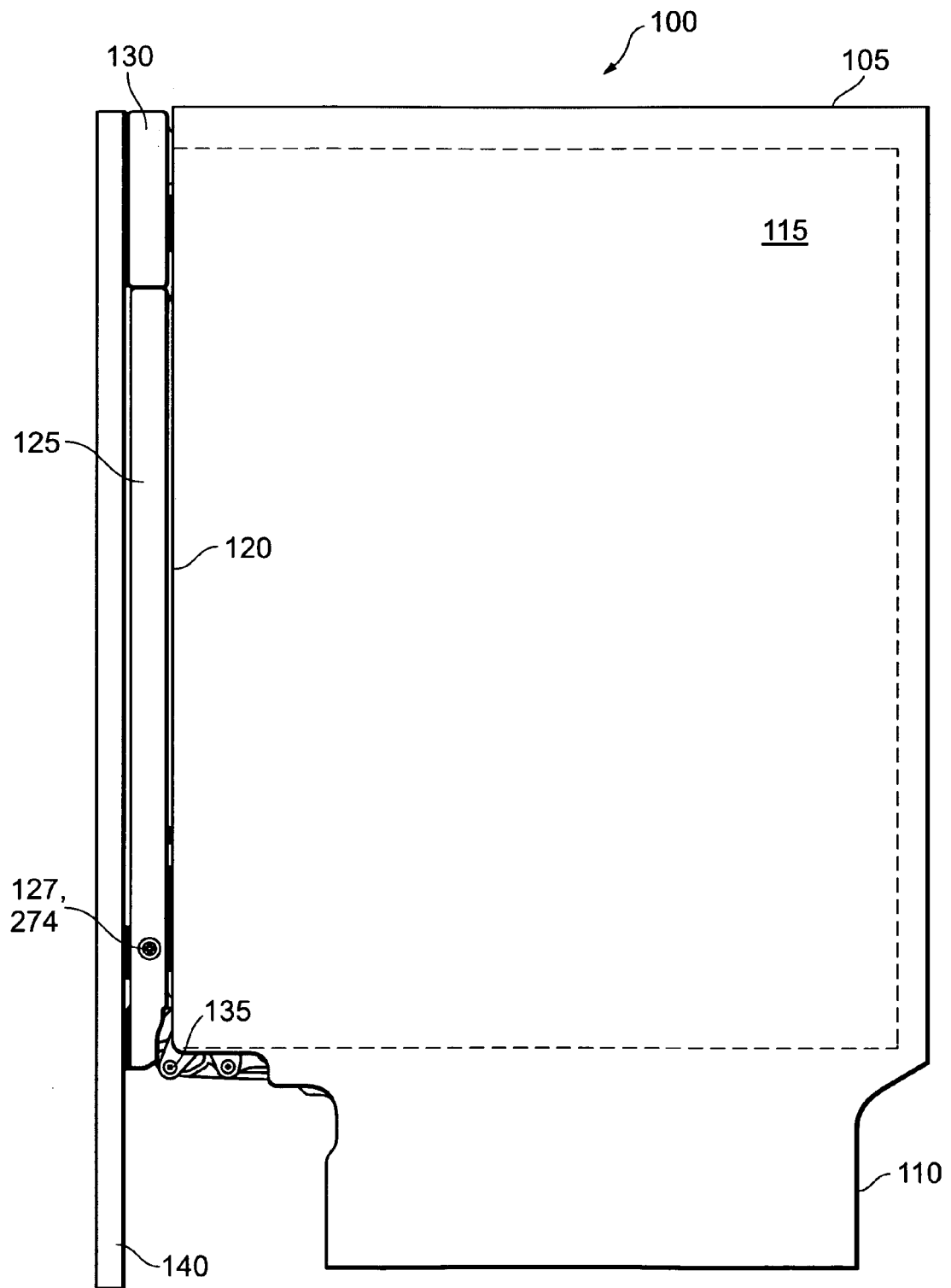


FIG. 1

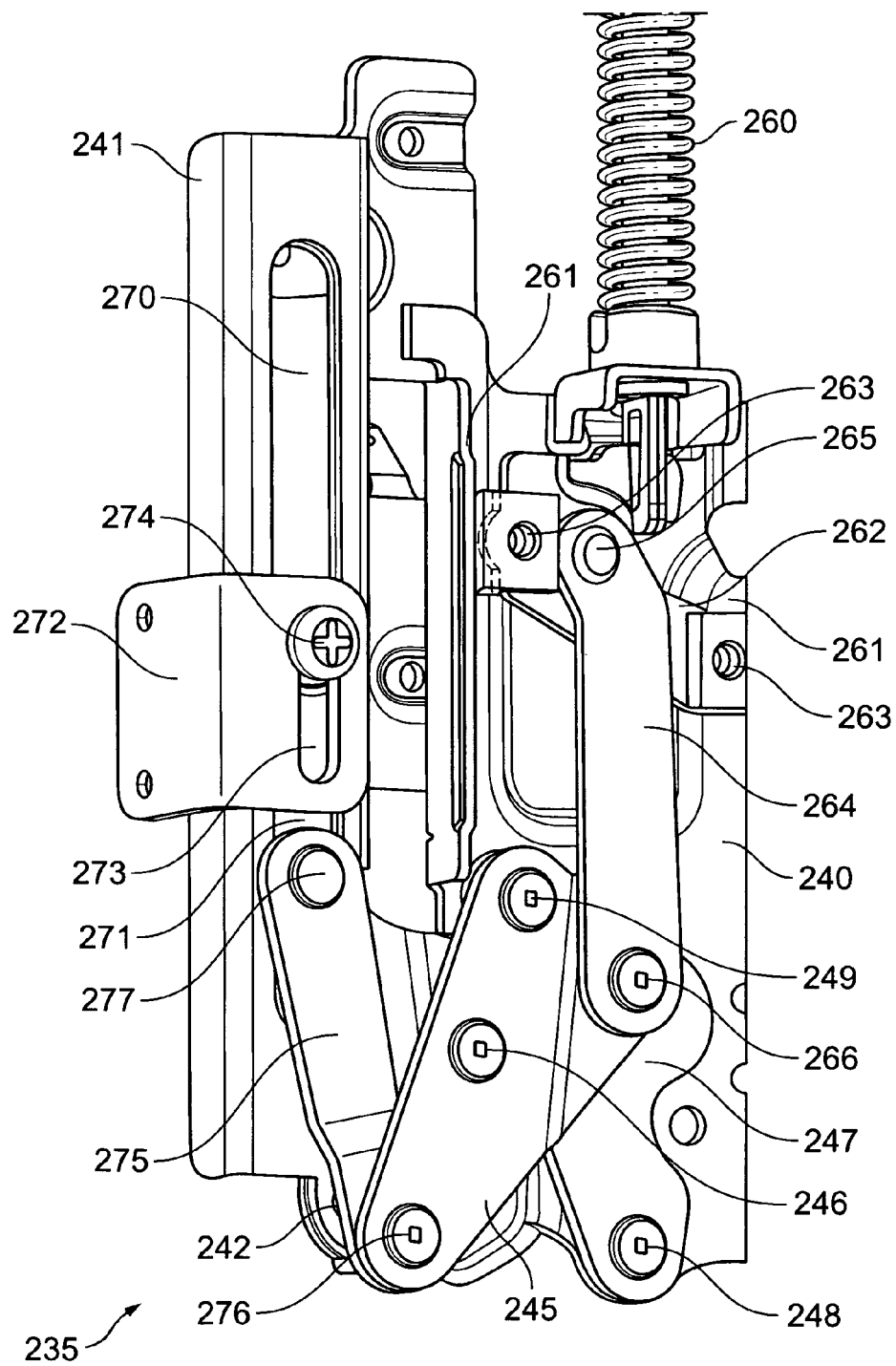


FIG. 2A

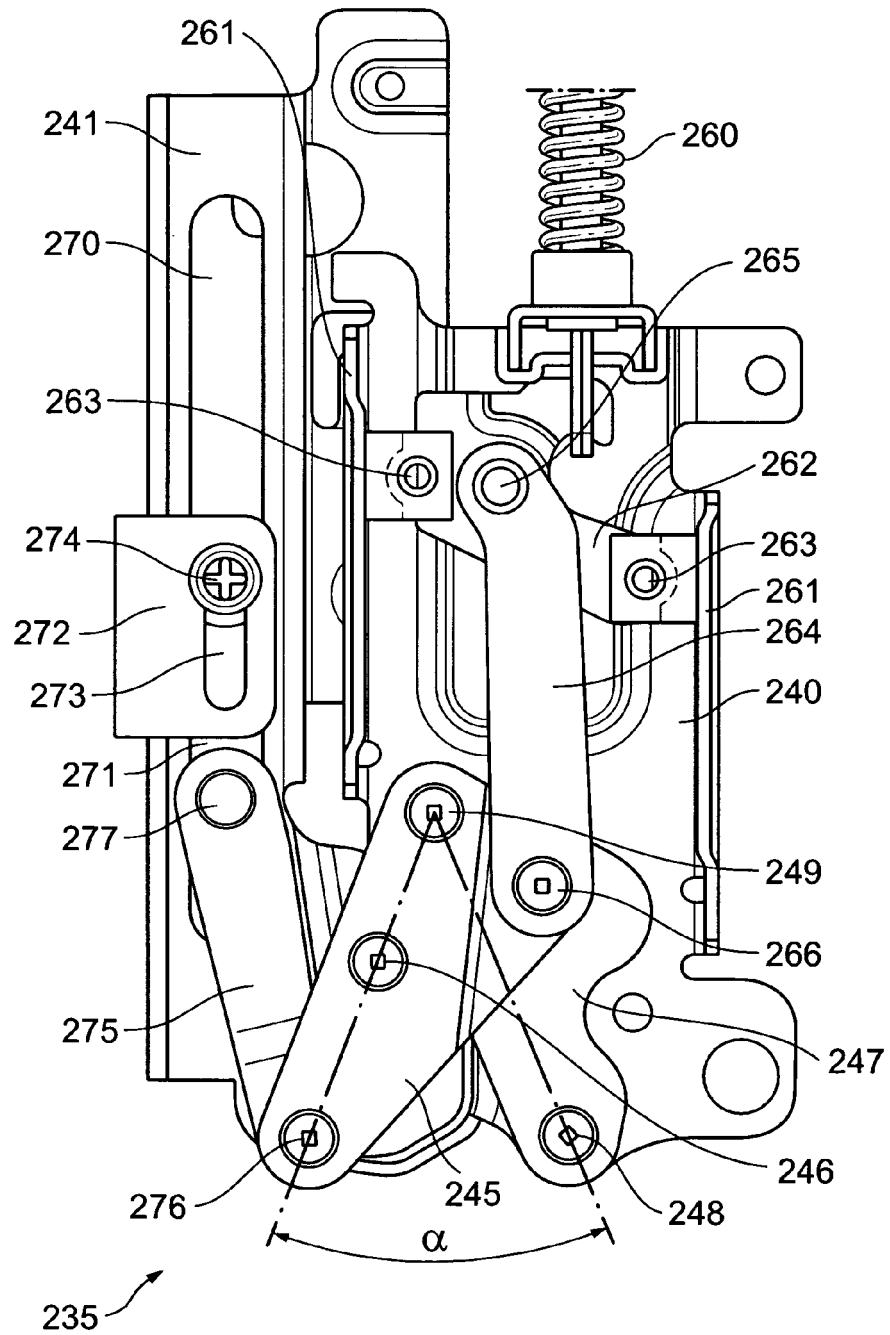
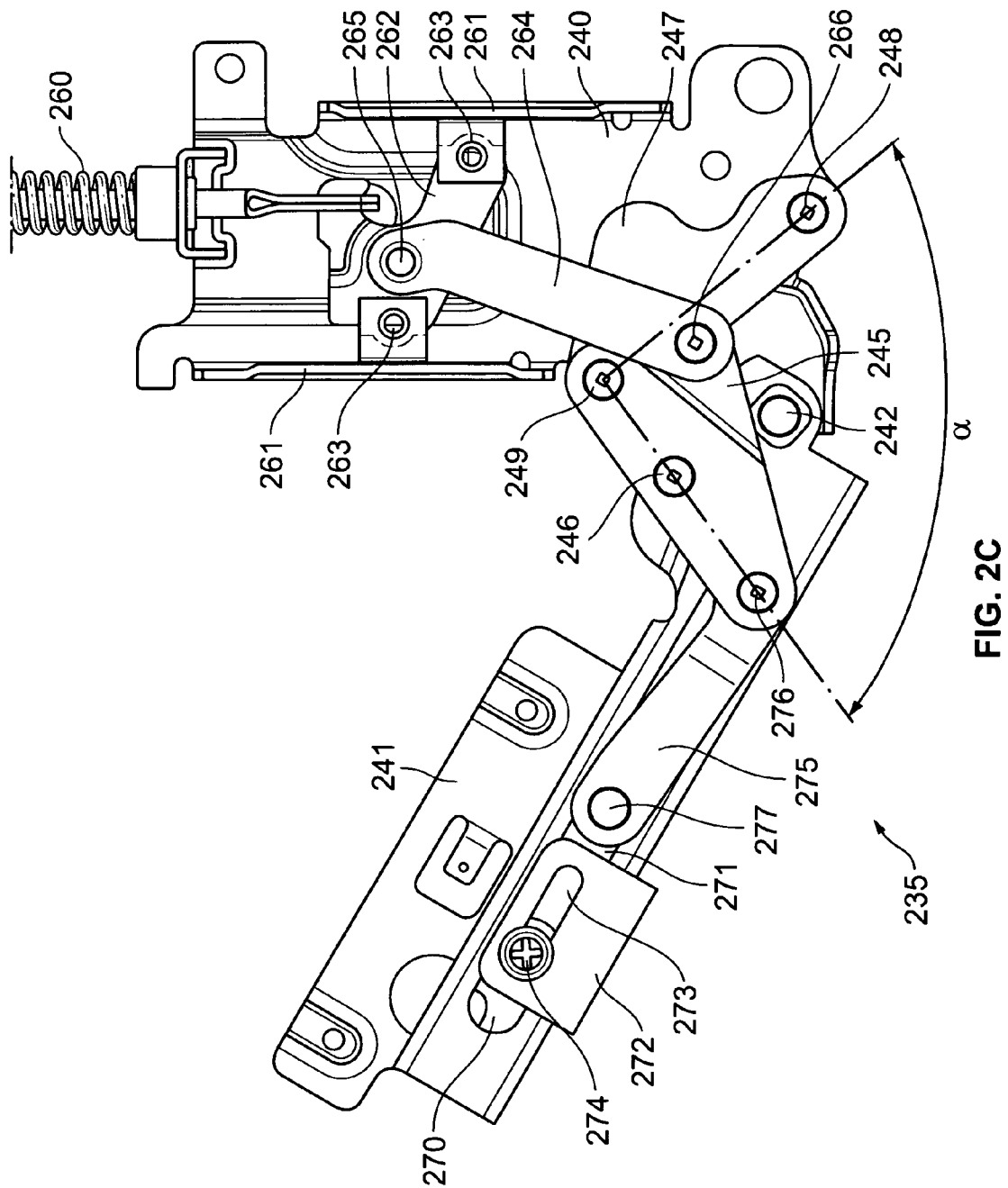
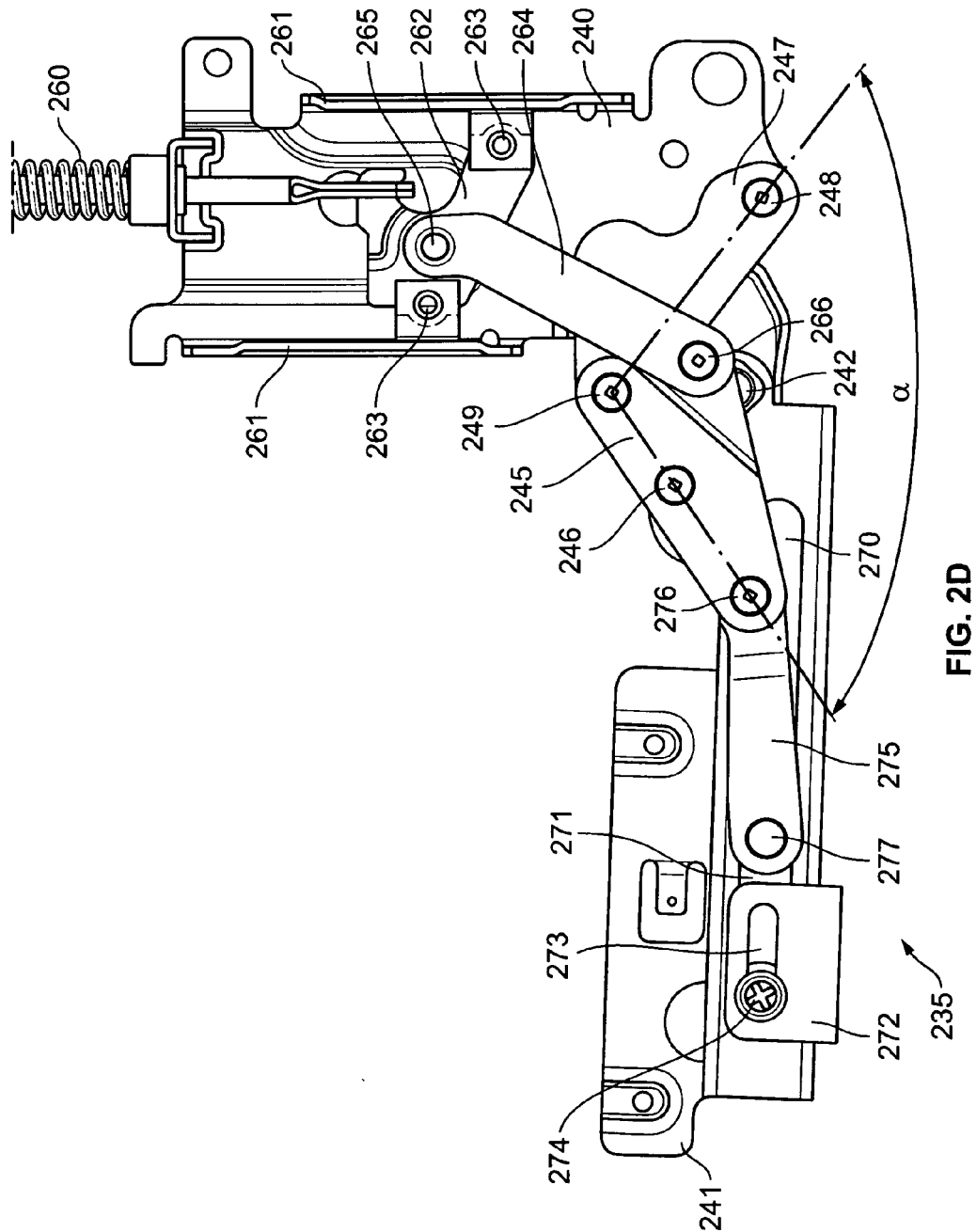


FIG. 2B





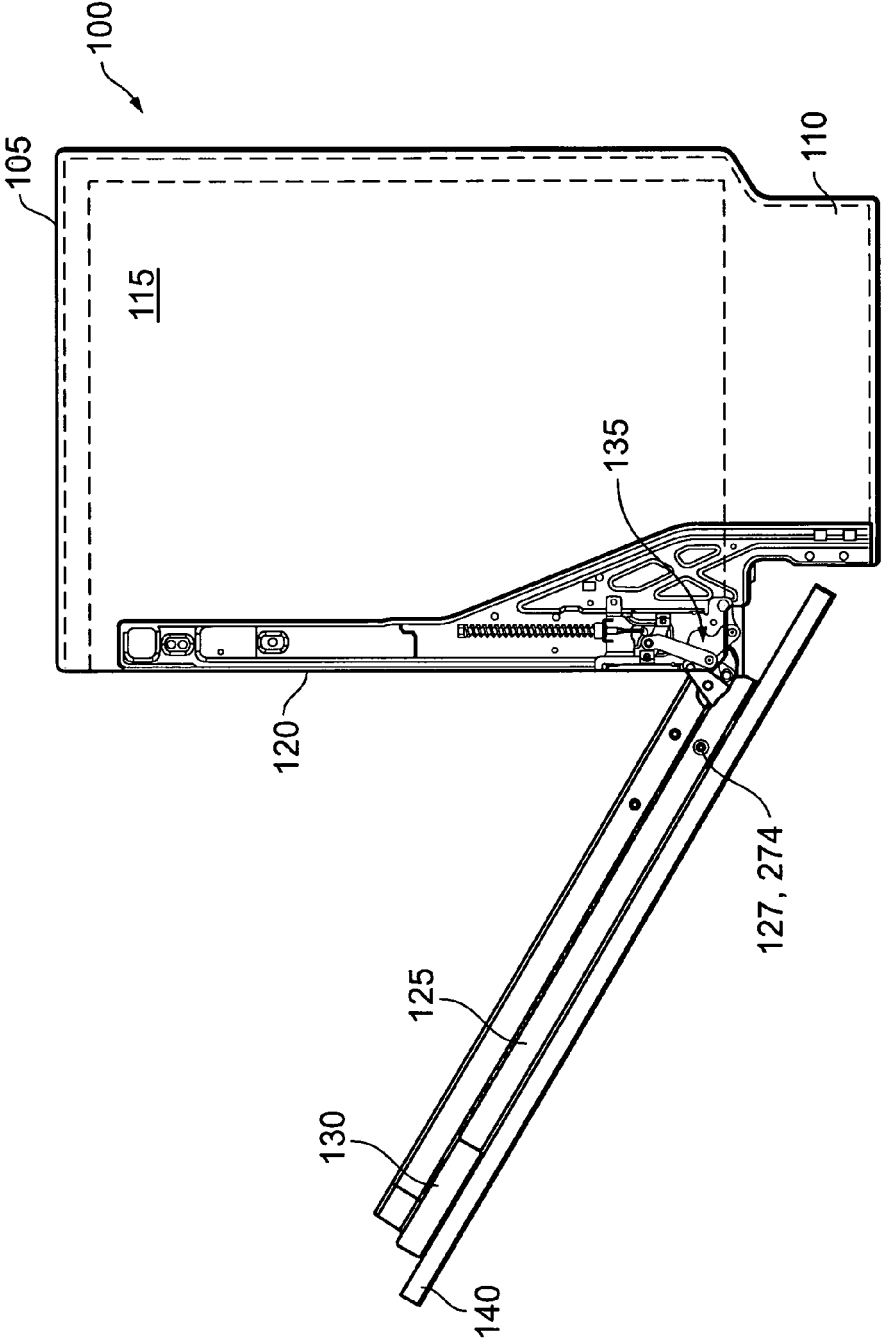


FIG. 3A

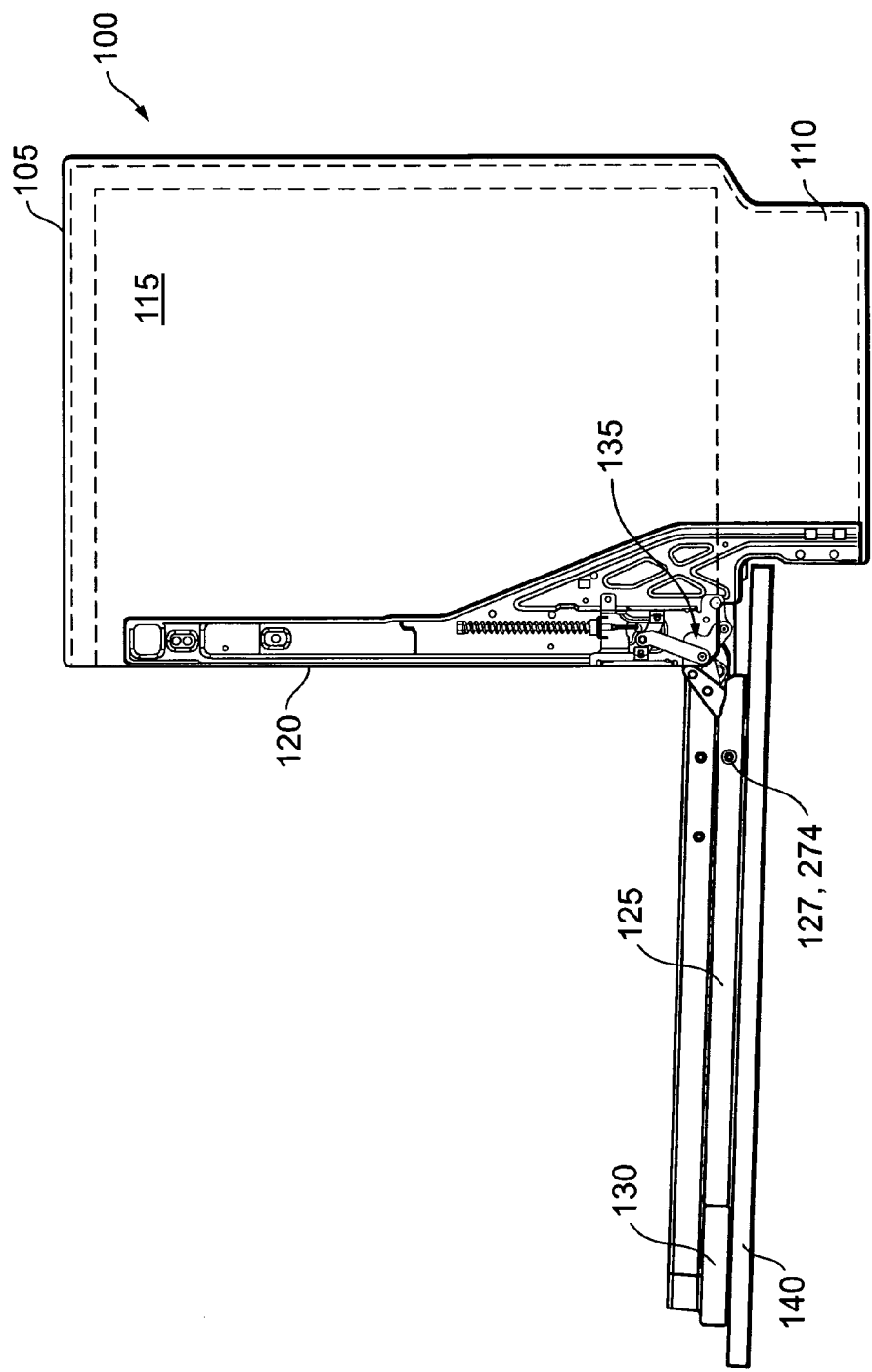


FIG. 3B

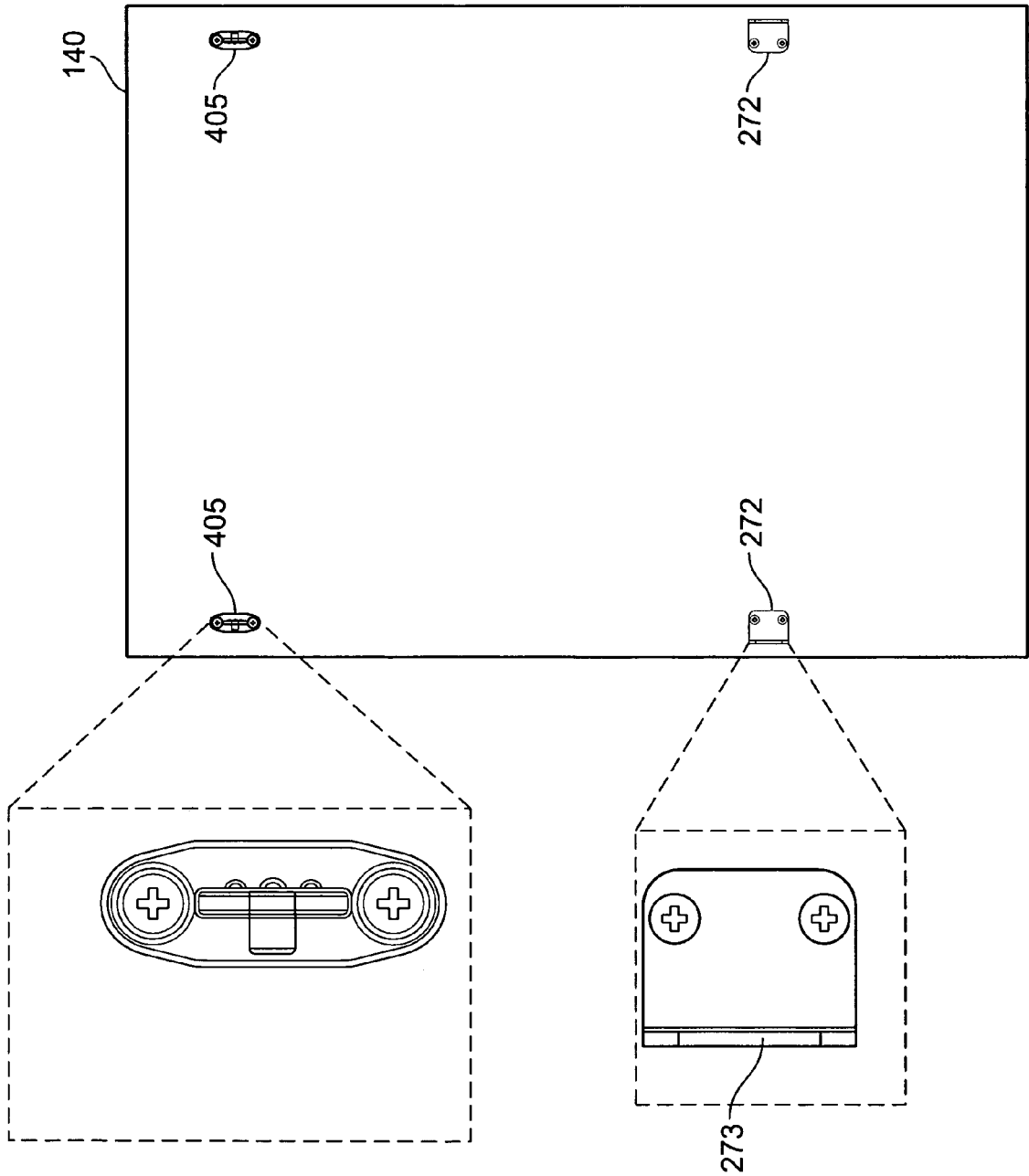
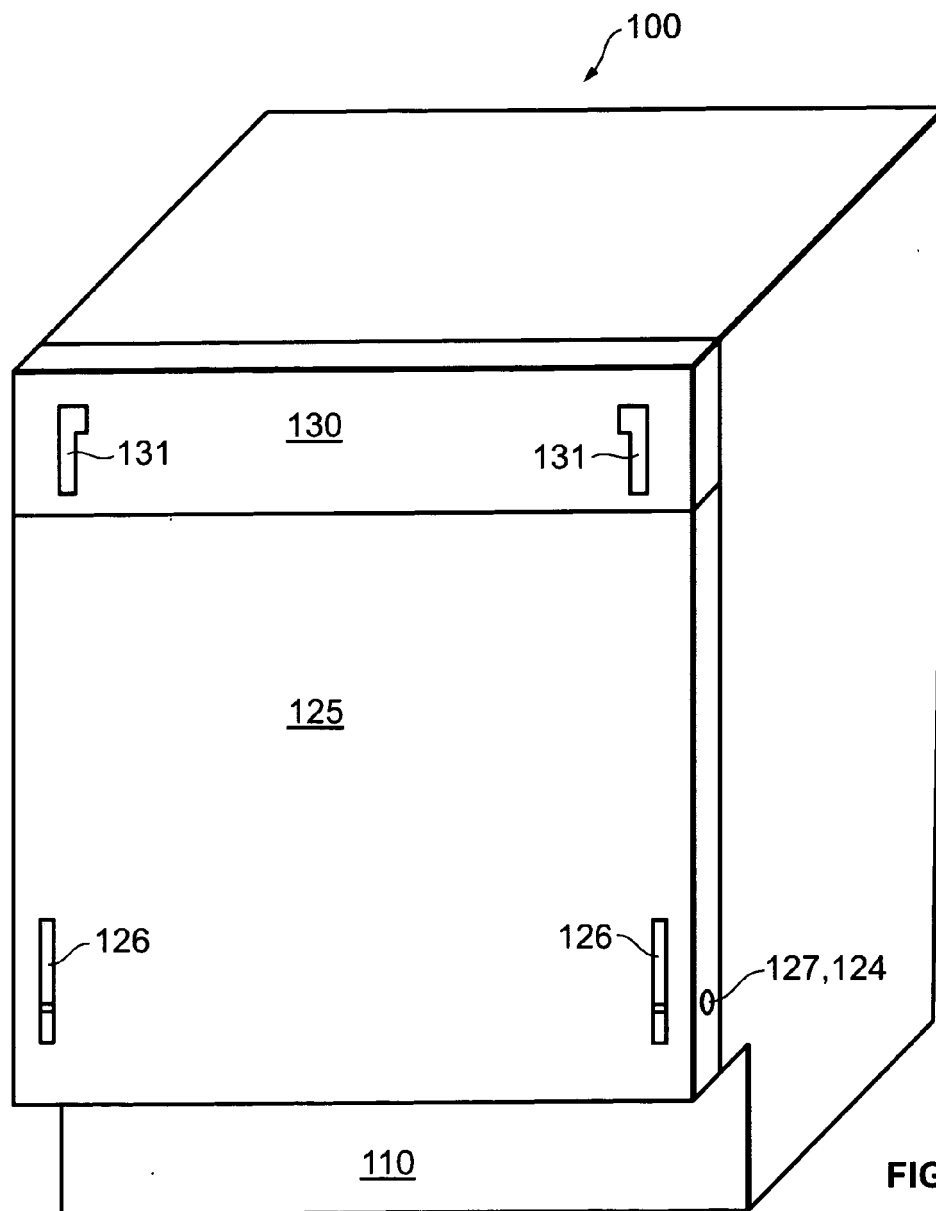


FIG. 4A



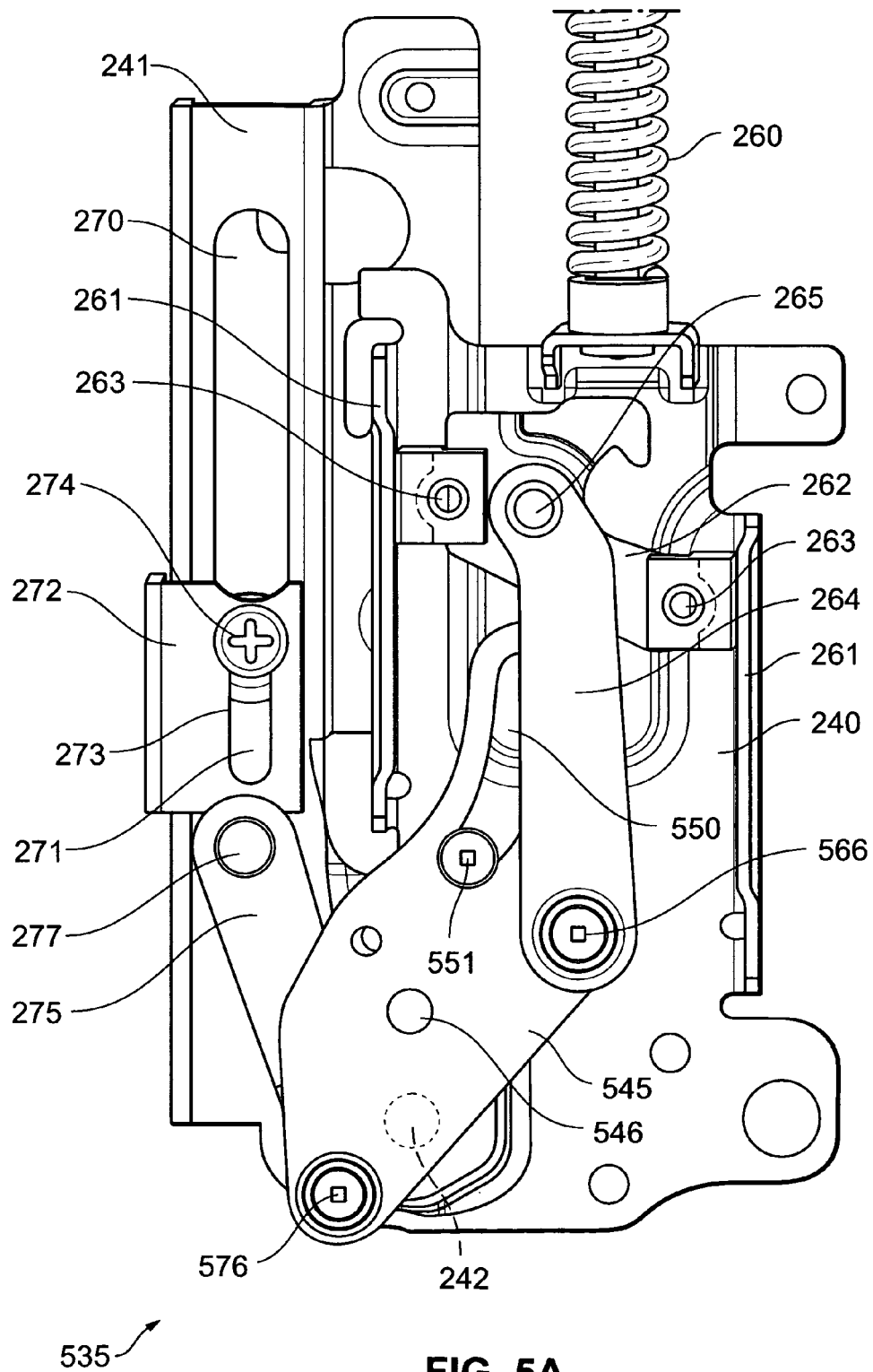


FIG. 5A

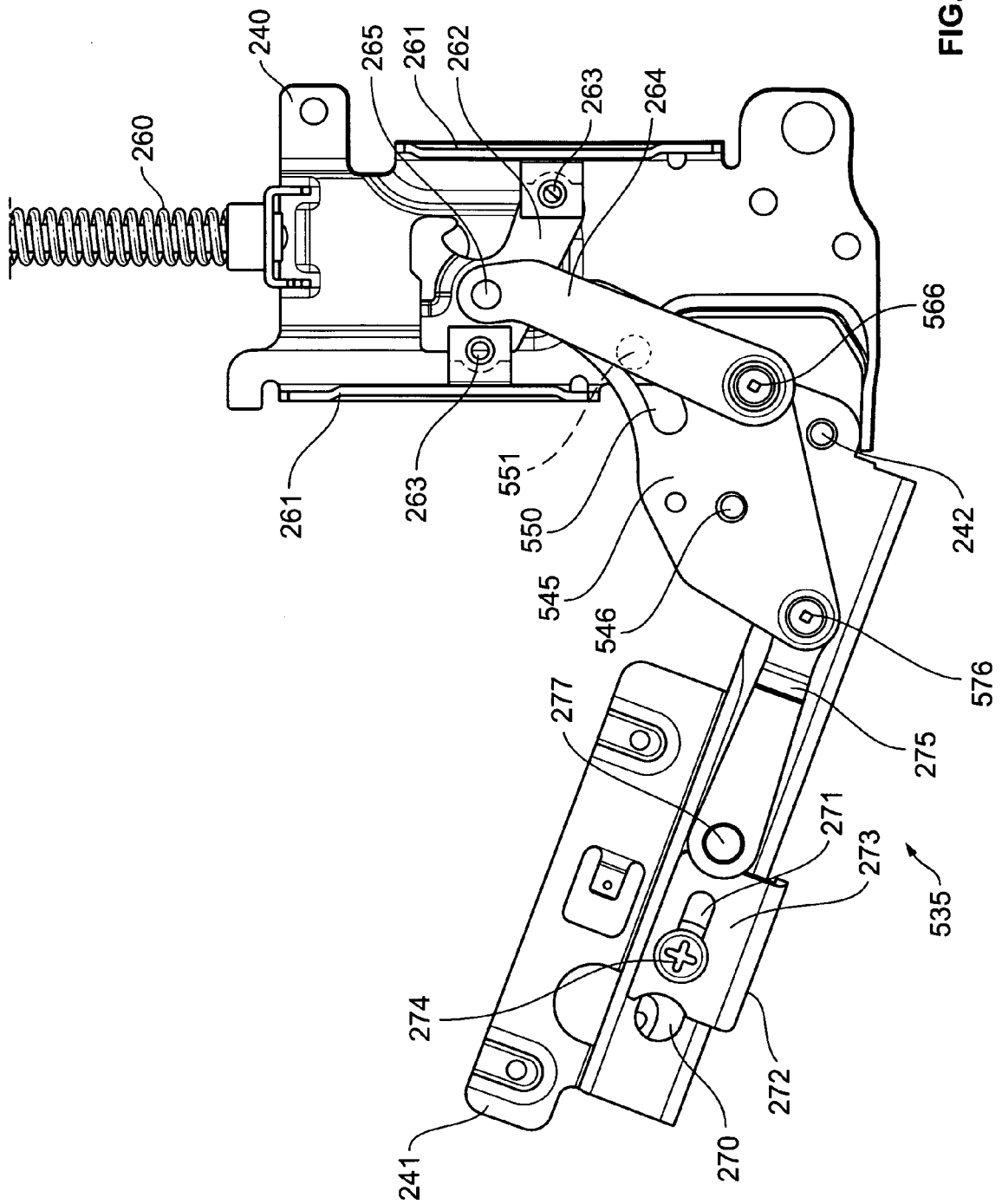


FIG. 5B

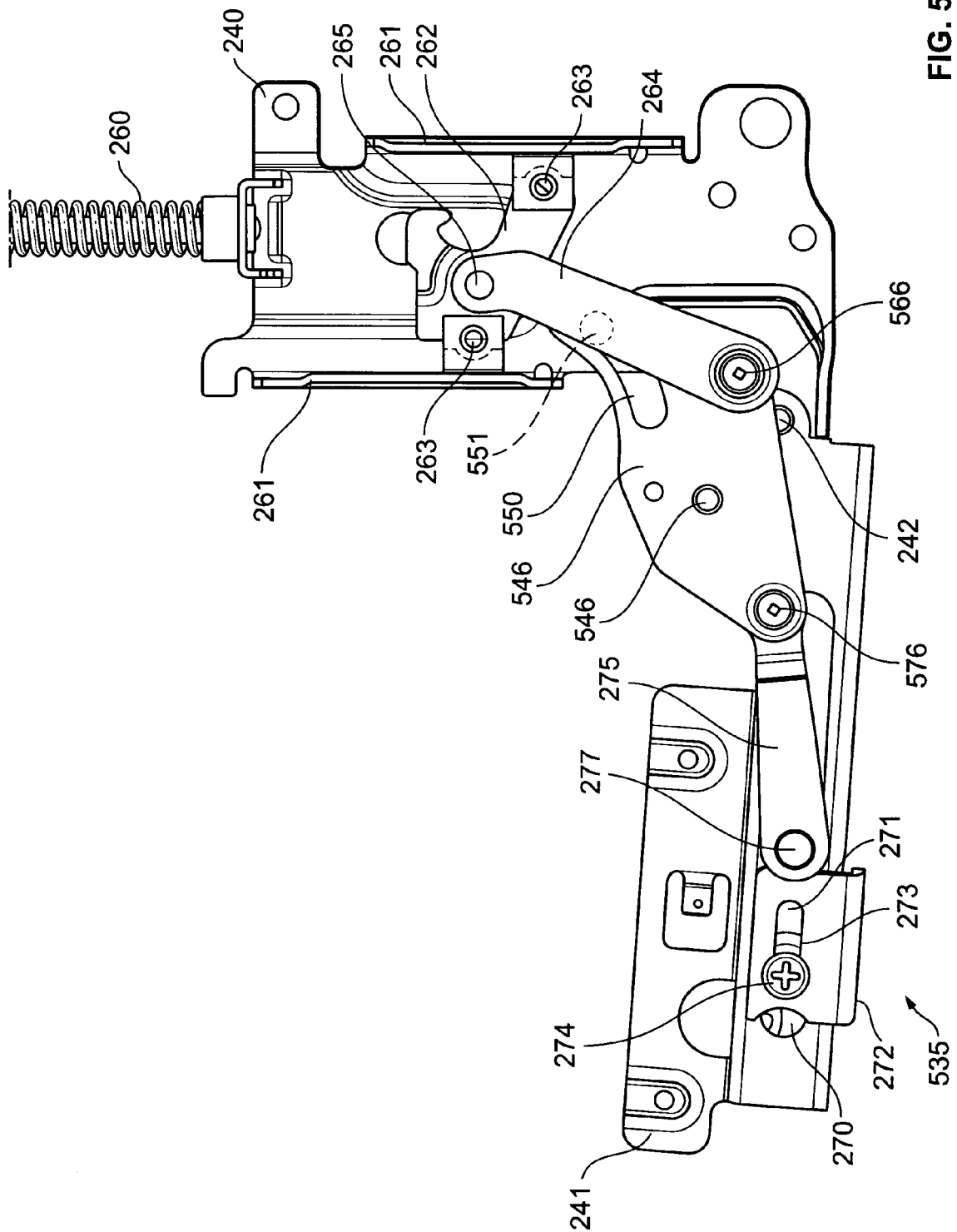


FIG. 5C

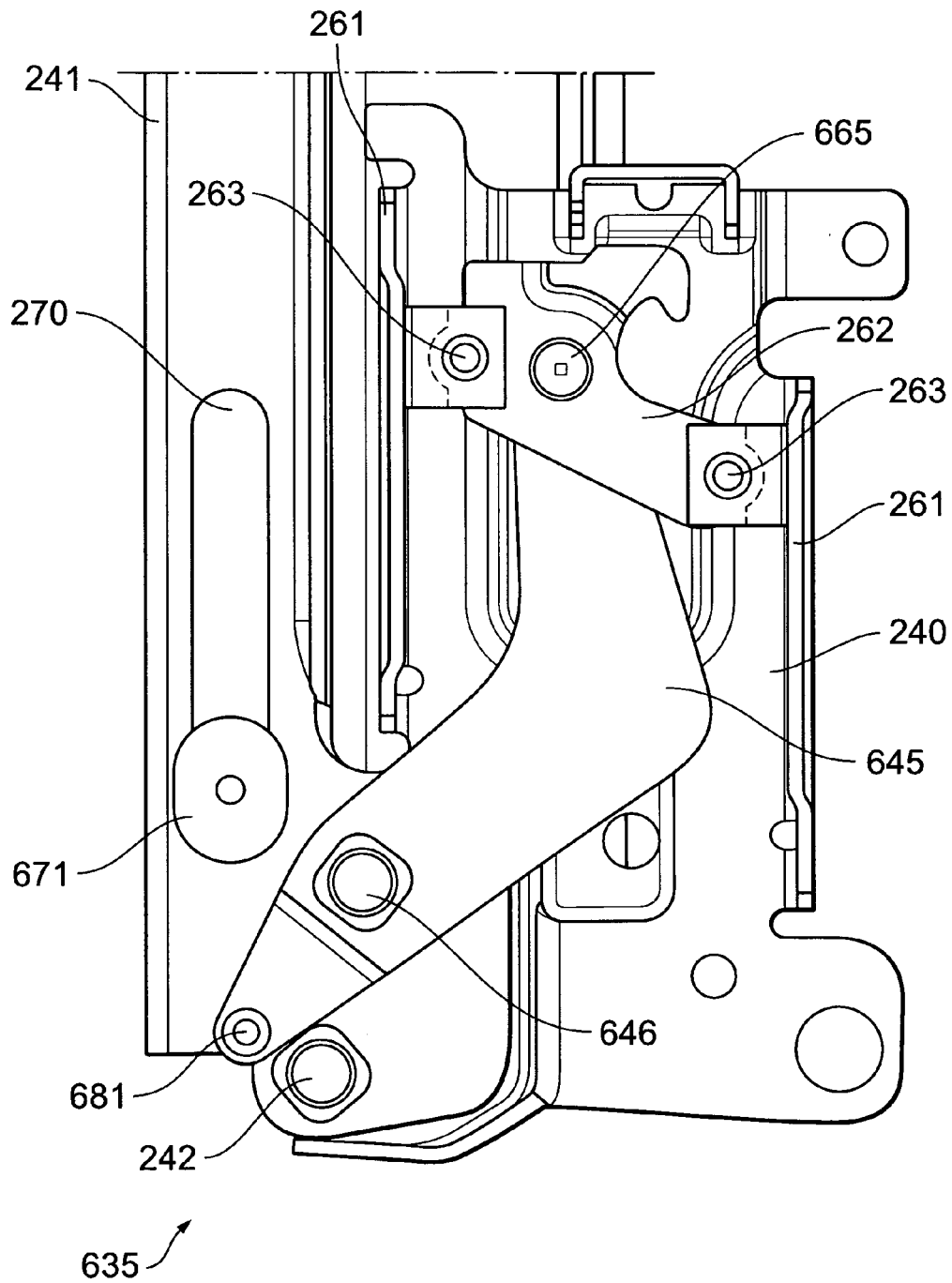


FIG. 6A

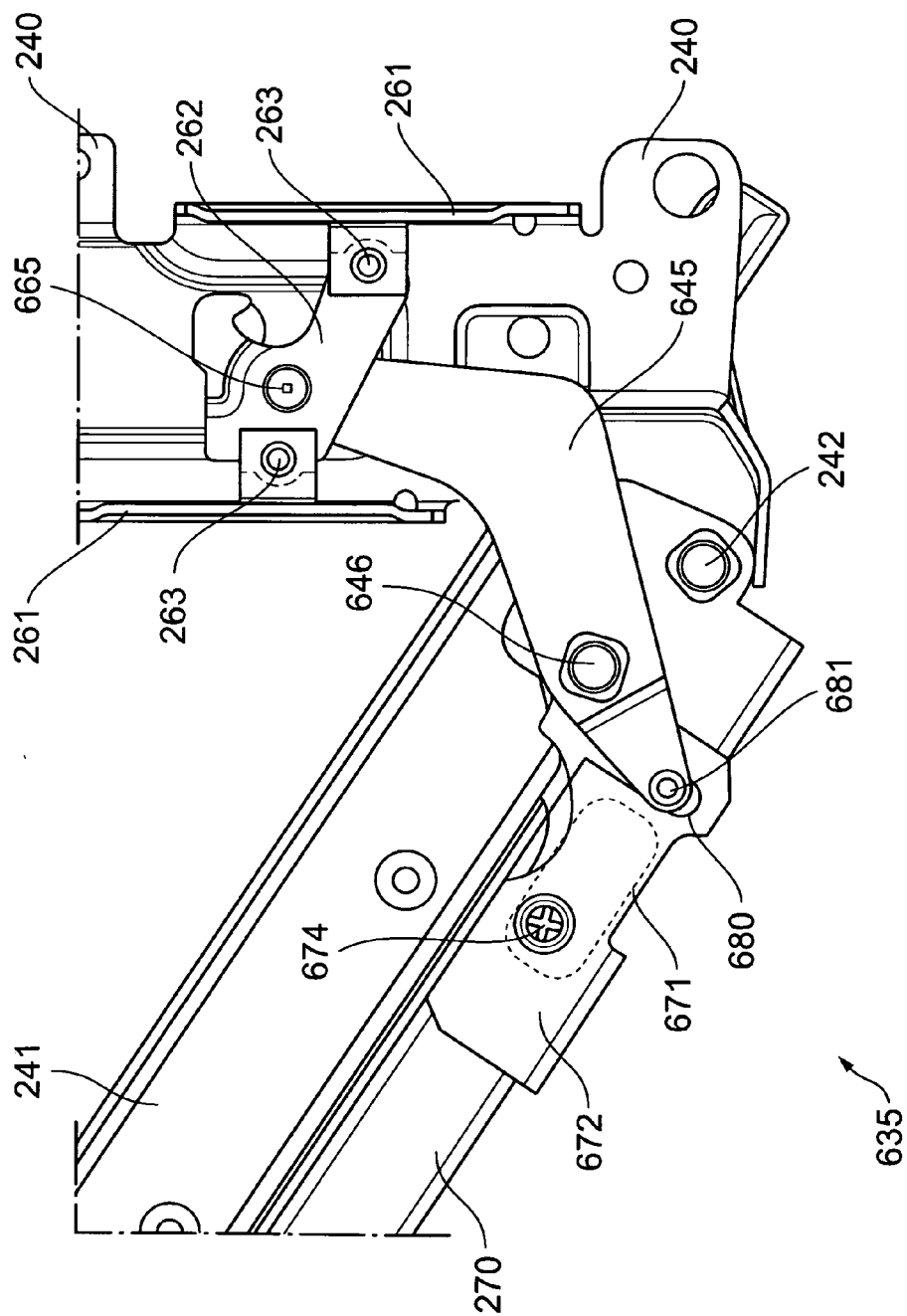


FIG. 6B

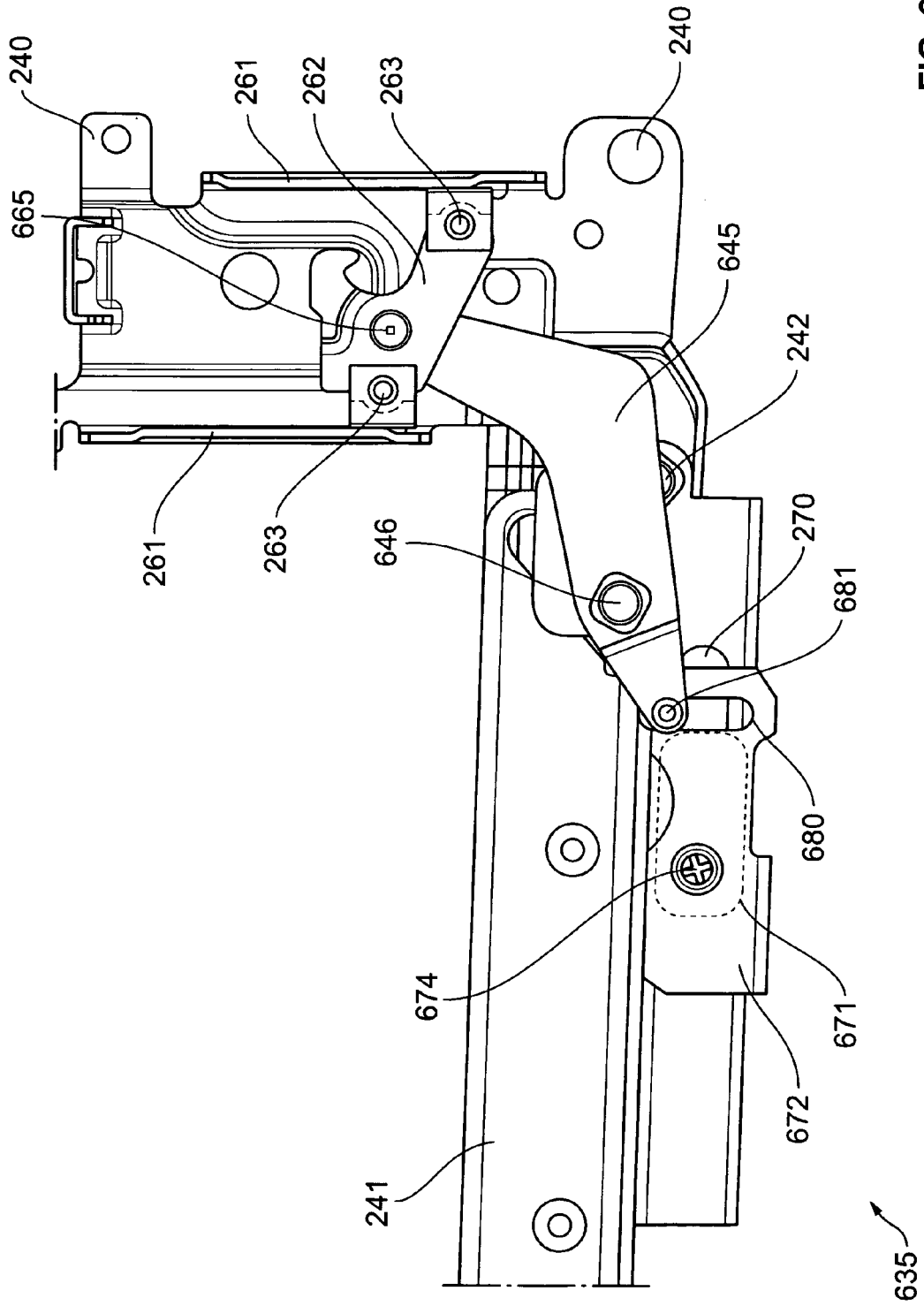


FIG. 6C

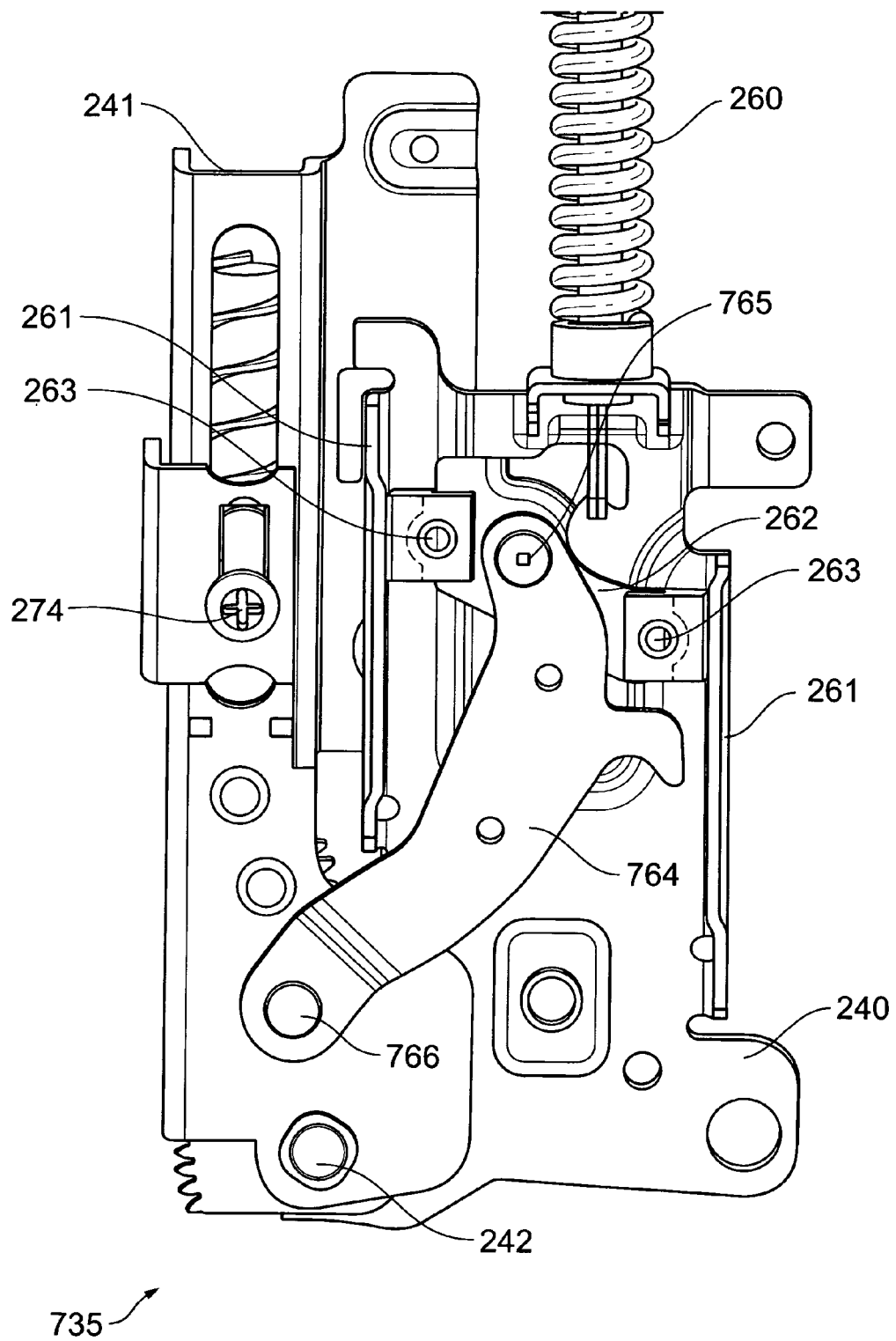


FIG. 7A

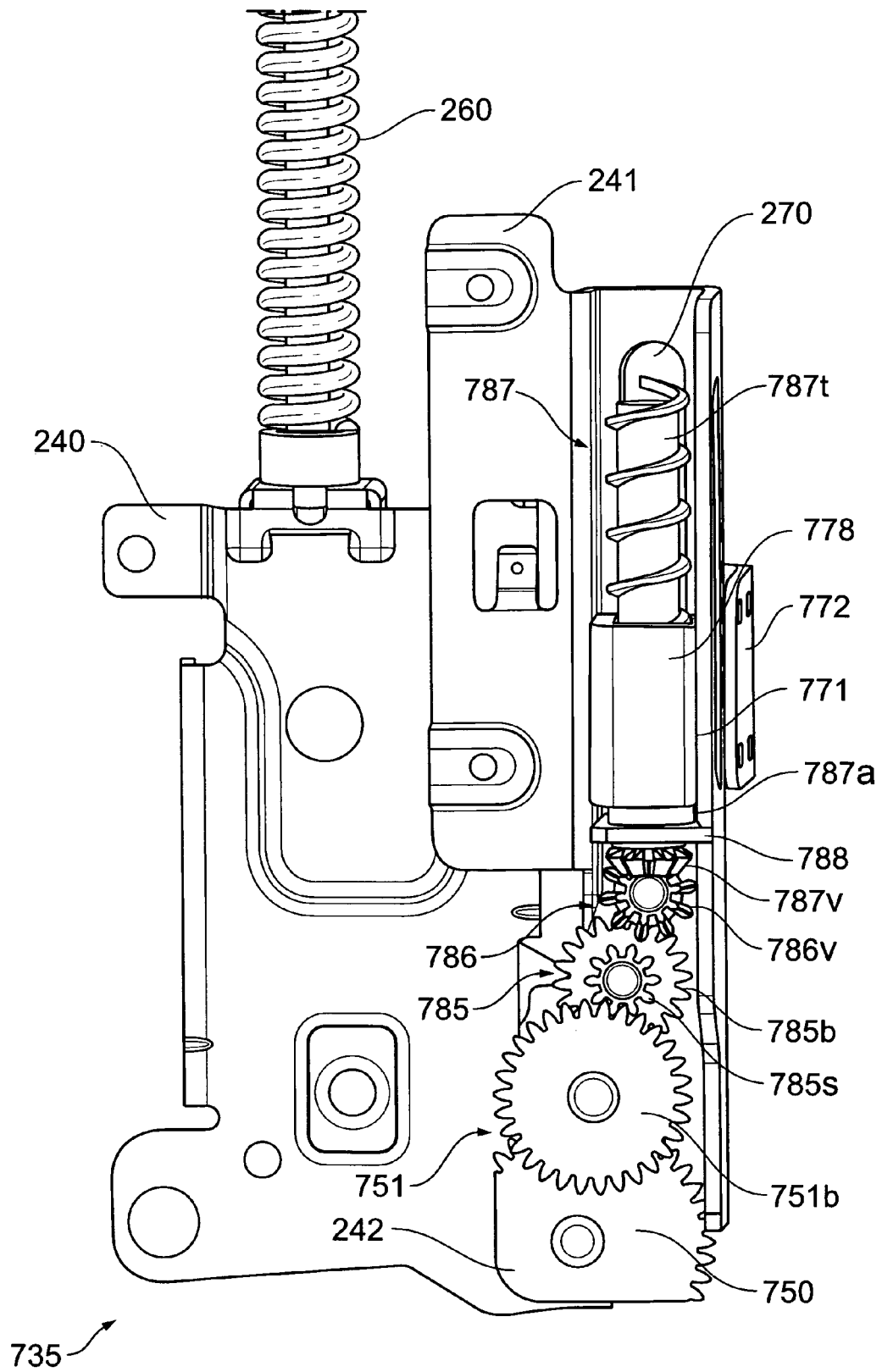


FIG. 7B

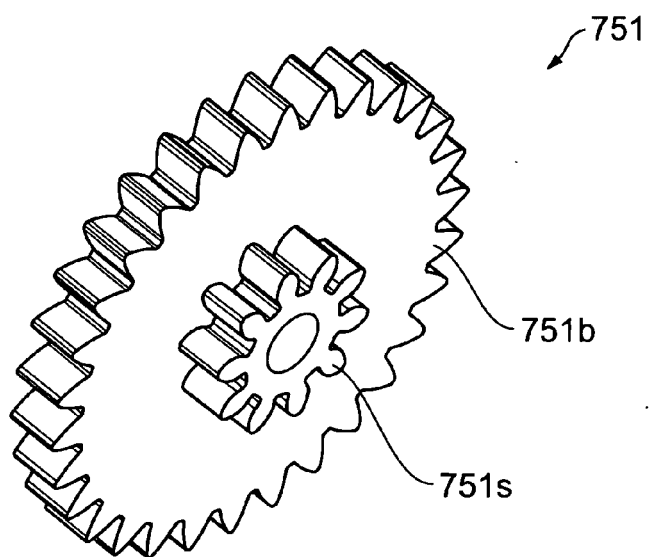


FIG. 7C

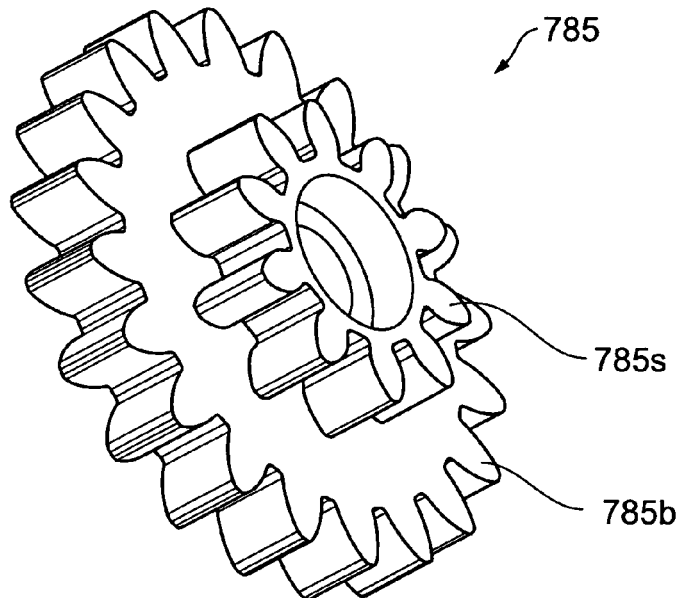


FIG. 7D

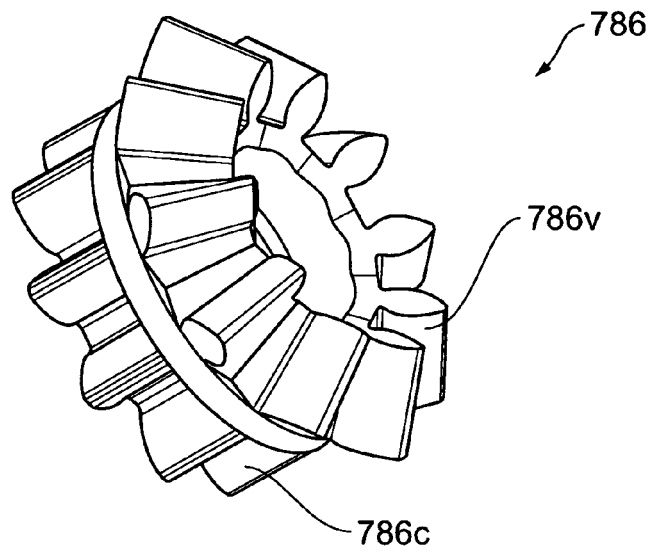


FIG. 7E

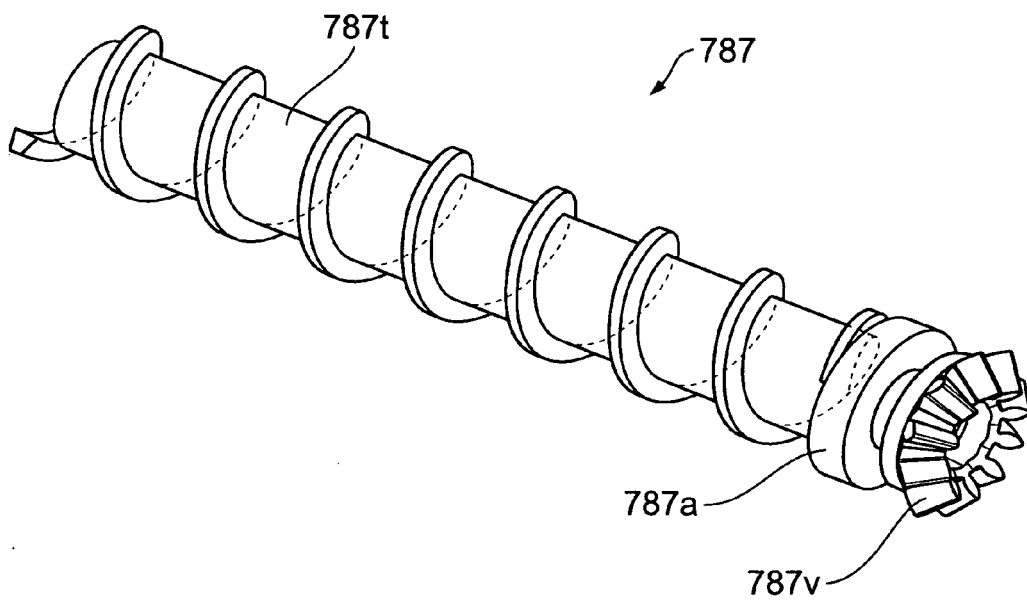
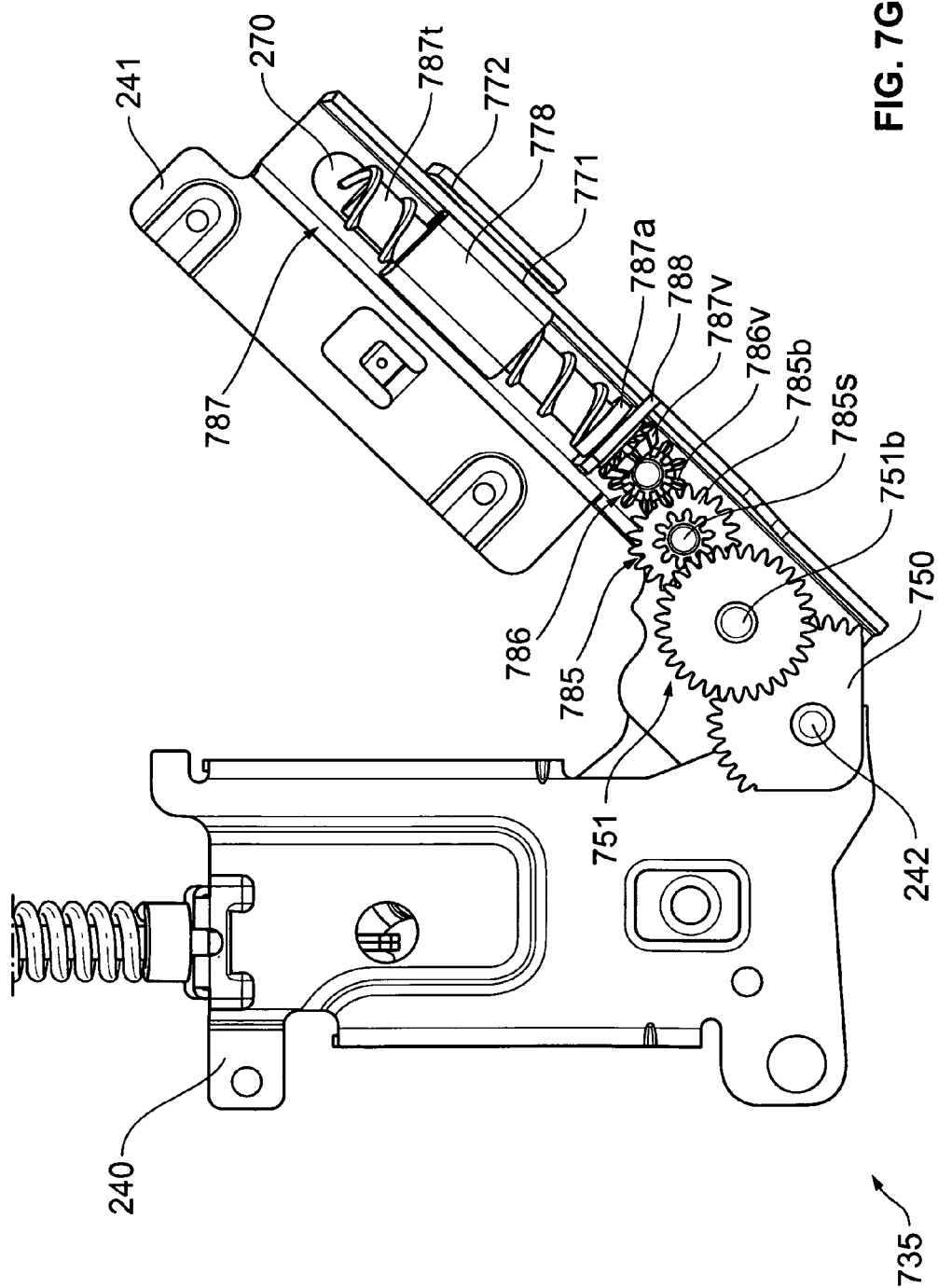
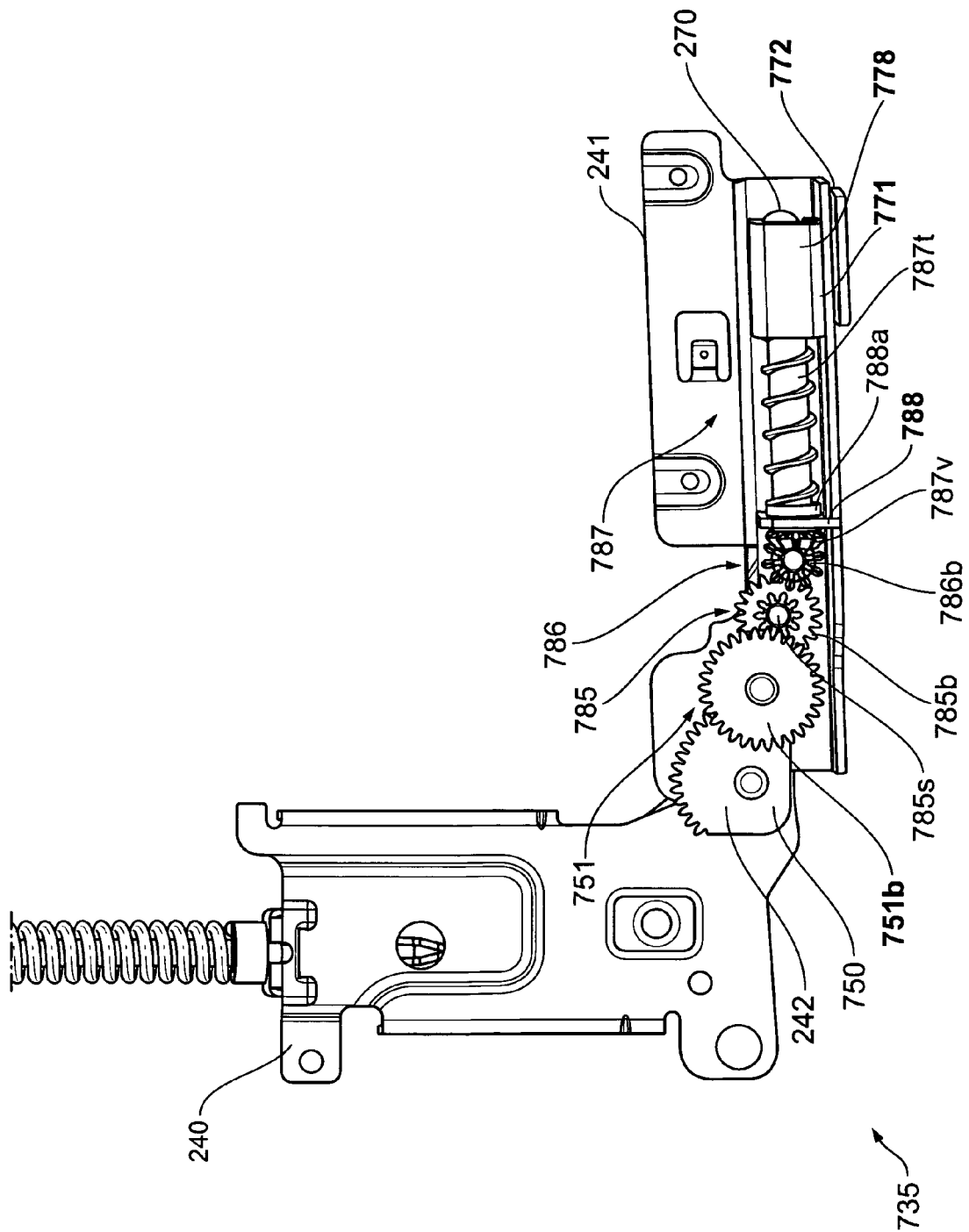


FIG. 7F







EUROPEAN SEARCH REPORT

Application Number
EP 10 00 8071

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 1 894 509 A1 (BONFERRARO SPA [IT]) 5 March 2008 (2008-03-05) * abstract *	1	INV. F24C15/02
A,D	EP 1 875 850 A1 (BONFERRARO SPA [IT]) 9 January 2008 (2008-01-09) * abstract *	1	
A,D	EP 1 529 482 A1 (BONFERRARO SPA [IT]) 11 May 2005 (2005-05-11) * abstract *	1	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC) A47L F24C E05F
Place of search		Date of completion of the search	Examiner
The Hague		14 January 2011	Van Kessel, Jeroen
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			

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EPO FORM 1503 03 82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 10 00 8071

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The members are as contained in the European Patent Office EDP file on
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14-01-2011

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- EP 1875850 A [0011] [0012]
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