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(54) **AN APPARATUS FOR TRANSPORTING A LOAD FROM A FIRST TO A SECOND LEVEL**

(57) An apparatus (4) for transporting a load from a first to a second level, in particular a stairlift, comprising: a frame (9) which is displaceable along a rail (3) and which is provided with support, guide and drive means arranged to engage the rail (3), a load carrier (10) which is rotationally mounted on said frame (9) by means of a shaft (101) to be rotated around a horizontal axis, and means for maintaining the load carrier (10) in a predetermined rotational position relative to the direction of gravity, wherein said apparatus further comprises an emergency rotation blocking arrangement for preventing said rotation between the load carrier (10) and said frame (9), said rotation blocking arrangement comprising: a first braking member (21) rigidly connected to said shaft (101), a second braking member (22) connected to said frame (9), at least one third braking member (23) arranged between said first braking member (21) and said second braking member (22). The second braking member (22) is connected to said frame (9) in such a manner that it extends at a small distance around said shaft (101) and is movable relative to said frame (9) in a radial direction relative to said shaft (101), and that movement of said third braking member (23) to a narrower part of a wedge shaped gap (231) between the first and second braking members causes said second braking member (22) to engage said shaft (101) and thereby blocking rotation of the second braking member (22) in said tangential direction relative to the first braking member (21) and the shaft (101).

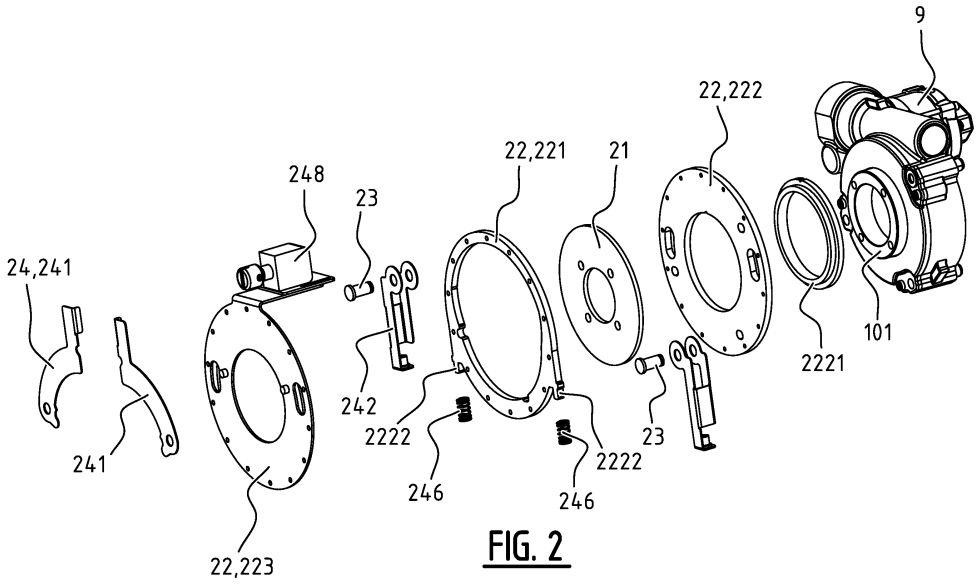


FIG. 2

EP 3 747 817 A1

Description

[0001] An apparatus for transporting a load from a first to a second level, in particular a stairlift, comprising: a frame which is displaceable along a rail and which is provided with support, guide and drive means arranged to engage the rail, a load carrier which is rotationally mounted on said frame to be rotated around a horizontal axis, and means for maintaining the load carrier in a predetermined rotational position relative to the direction of gravity, which position-maintaining means comprise at least one adjusting motor having a shaft to which the load carrier is fixed and arranged to rotate the load carrier relative to the frame around said horizontal axis, wherein said apparatus further comprises an emergency rotation blocking arrangement for preventing said rotation between the load carrier and said frame, said rotation blocking arrangement comprising: a first braking member rigidly connected to said shaft, a second braking member connected to said frame, at least one third braking member arranged between said first braking member and said second braking member, wherein said first braking member has a primary braking surface which is strip shaped and extends along at least a section of a circle around said axis, wherein said second braking member has at least one secondary braking surface which extends at a distance from said primary braking surface at an angle in such a manner that the distance between the two surfaces varies, thereby forming a substantially wedge shaped gap between the primary and secondary surfaces having a wider part and a narrower part, the wedge shaped gap widening in a tangential direction around said axis, wherein in a normal operation mode said third braking member is held in a fixed position relative to said second braking member by a retaining member such that it extends in the wider part of said wedge shaped gap where it cannot engage both the primary and secondary braking surfaces at the same time, and wherein in a braking operation mode said retaining member is moved relative to said second braking member such that said third braking member is allowed to move to the narrower part of said wedge shaped gap, thereby engaging both the primary and secondary braking surfaces.

[0002] Such an apparatus is described in EP 3 326 955 A1, which is incorporated herein by reference. It comprises an emergency blocking mechanism for preventing the carrier from uncontrolled rotational movement should the means for maintaining the carrier in the predetermined rotational position fail, in particular to prevent injuries to person sitting on the carrier.

[0003] The invention aims at an alternative, more reliable, more robust, and/or a more simple emergency blocking solution.

[0004] To that end said second braking member is connected to said frame in such a manner that it extends at a small distance around said shaft and is movable relative to said frame in a radial direction relative to said shaft, and that the movement of said third braking member to said narrower part of said gap causes said second braking member to engage said shaft and thereby blocking rotation of the second braking member in said tangential direction relative to the first braking member and the shaft. Preferably said second braking member comprises a tertiary braking surface being a cylindrical inner surface of said second braking member, said tertiary braking surface extending around and facing the shaft, and engaging the outer surface of said shaft for said rotation blocking action.

[0005] In normal operation the carrier and the frame can be rotated relative to each other. If an unexpected situation occurs (such as if a sensor on the carrier senses that the rotational angle exceeds an acceptable maximum) or for instance any time that the apparatus is at a standstill or switched off, the retaining member will be moved, whereby the third braking members move into one of the two adjacent narrow parts of the wedges where it contacts both surfaces. If in such a case there would be a rotation between the carrier and the frame, the frictional forces of both surfaces will cause the third braking members to move deeper into narrower part of the wedge, and push the second braking member against the shaft, thereby blocking the relative rotation between the carrier and the frame, and at any incremental angle.

[0006] Preferably, after the movement of said third braking member to said narrower part of said gap, the engagement of both the primary and secondary braking surfaces by the third braking member as such also blocks rotation of the second braking member in said tangential direction relative to the first braking member, as described in EP 3 326 955 A1. Hereby a double braking action is achieved. The third braking member may even being deformed by the engagement forces, and in any case completely blocks the relative rotation between the carrier and the frame.

[0007] Said second braking member preferably comprises at least two secondary braking surfaces, being at least one first secondary braking surface and at least one second secondary braking surface, said at least one first secondary braking surface forming a first substantially wedge shaped gap widening in a first tangential direction around said axis, and said at least one second secondary braking surface forming a second substantially wedge shaped gap widening in a second tangential direction around said axis, said second tangential direction being the opposite of said first tangential direction, and said at least one third braking member being allowed by said retaining member in said braking operation mode to move to a narrower part of one of said first and second substantially wedge shaped gaps, thereby allowing said at least one third braking member to block rotation of the second braking member in either tangential direction relative to the first braking member.

said at least first secondary surface and said at least second secondary braking surface preferably form two separate substantially wedge shaped gaps, and said at least one third braking member are at least two separate

third braking members, each extending in a respective substantially wedge shaped gap.

[0008] Said primary braking surface is preferably at least a section of a cylindrical surface.

[0009] Said at least one third braking member preferably has the form of a cylinder, and the axis of said cylinder extends parallel to both the primary and secondary braking surfaces.

[0010] The wider part(s) of said wedge shaped gap(s) extend(s) preferably substantially vertically above the narrower part(s) of said wedge shaped gap(s) and said third braking member(s) rest(s) on (a) carrying edge(s) of said retaining member in the normal operation mode.

[0011] Said retaining member is preferably movable between an upper position in said normal operation mode and a lower position in said braking operation mode.

[0012] Said retaining member is preferably held in said upper position in normal operation by the force of an electrically powered electromagnet, such that it moves to said lower position in braking operation if electrical power to said electromagnet is absent.

[0013] Said retaining member is preferably connected to a resilient biasing member which is arranged to move said retaining member from said fixed position in normal operation mode to said braking operation mode.

[0014] The invention will now be elucidated by means of a preferred embodiment as shown in the figures, wherein:

Figure 1 shows a perspective view of an exemplary embodiment of a stairlift;

Figure 2 shows an exploded perspective view of a an emergency rotation blocking arrangement mountable between a displaceable frame and a carrier for a stairlift as shown in figure 1;

Figures 3 and 4 show partial front views (left) and partial cross sectional views (right) of the emergency rotation blocking arrangement of figure 2 in a normal operation mode and a braking operation mode respectively; and

Figure 5 shows a cross sectional view of the emergency rotation blocking arrangement of figure 2 in the braking operation mode.

[0015] Figure 1 shows an system 1 for transporting a load from a first to a second level, in the shown embodiment a stairlift system, which comprises a rail 3 which is placed along a staircase 2 and which encloses an angle α with the horizontal H, and an apparatus 4 movable along rail 3 for transporting the load between the different levels. Rail 3, which in the shown embodiment has a round cross-section, is supported by a number of posts 5 which are arranged distributed along staircase 2 and which are fixed to a protruding part extending along rail 3. Rail 3 is further provided with a propelling part in the form of a gear rack 8. Stairlift 4 comprises a frame 9 which is displaceable along rail 3 and on which a load carrier 10 is mounted, here in the form of a chair with a seat 11, back rest 12, armrests 13 and a footrest 14. Chair 10 is connected to frame 9 by a rotatable shaft for rotating around a horizontal axis, and arranged in frame 9 and carrier 10 is a level maintaining mechanism consisting of, among other parts, an adjusting motor connected to said shaft so that the position of chair 10 can be kept constant at all times irrespective of the inclination of rail 3. For further details of an embodiment of a system as shown here, reference is made to European patent application publication EP 2 216 284 A1, which is incorporated herein by reference. This description will hereafter focus on the emergency rotation blocking arrangement between the frame 9 and the load carrier 10.

[0016] An emergency rotation blocking arrangement as shown in figure 2 is mounted between the frame 9 and a load carrier 10. The rotation blocking arrangement comprises a first braking member 21, a second braking member 22, two third braking members 23 having a cylindrical body, and a retaining member 24 for holding the third braking members 23 in position.

[0017] The first braking member 21 is rigidly connected to said rotatable shaft 101 of the adjusting motor and to the load carrier 10 by means of bolts 211. The first braking member 21 is disc shaped and comprises a cylindrical outer surface.

[0018] The second braking member 22 comprises a substantially ring shaped body 221 extending around said cylindrical outer surface of the first braking member 21, such that it can rotate relative thereto. The ring shaped body 221 is rigidly attached to and between a disc shaped back plate 222 and a disc shaped front plate 223, between which also the first braking member 21 extends. The second braking member 22 is connected to the frame 9 by bolts 224 extending through slot shaped holes in the braking member 22, such that the second braking member 22 can translate laterally in a radial direction relative to the shaft 101. The back plate 222 is provided with a cylindrical hole, wherein a friction ring 2221 is mounted, said friction ring providing a cylindrical inner braking surface which faces the outer cylindrical surface of the shaft 101.

[0019] The retaining members 24 each comprise an upper part 241 and a lower part 242. The lower part 242 of each retaining member 24 can slide up-and-down between two extreme positions relative to the lateral sides of the ring shaped body 221 of the second braking member 22. The upper part 241, which has substantially the shape of a quarter circle extending around the axis of the shaft 101, is hingeably connected to the lower part 242, wherein the third braking member 23 acts as the hinge's shaft. A biased spring 246 is provided for each retaining member 24, of which the upper end pushes against a fixed stop surface on a protrusion 2222 on the second braking member 22, and the lower end pushes against a stop surface of the lower part 242 or the retaining mem-

ber 24, thereby pushing the retaining member 24 towards the lower position. Furthermore an electromagnet 248 is provided, which is mounted on top of the front plate 223 of the second braking member 22. When, in the normal operation mode, the electromagnet 248 is powered, it pulls the outer ends of the upper parts 241 against it, thereby holding the retaining member 24 in the upper position against the force of spring 246. If, in the braking operation mode, the electromagnet is not powered, the outer ends of the upper parts 241 are released and the spring 246 pushes the retaining member 24 to the lower position.

[0020] The ring shaped body 221 of the second braking member 22 comprises a recess in the upper half of its inner circumferential wall around the first braking member 21, such that the surface of said recess face the outer surface of the cylindrical part 212. As shown in figures 4A and 4B, said the surface of the recess is shaped such that the surface of each recess 225 and said surface of the cylindrical part 212 form substantially wedge shaped gaps 231 on the lateral sides, having a wider part in its upper region and a narrower part in its lower region.

[0021] In the normal operation mode, when the retaining members 24 are forced to be in the upper position by the electromagnet 248, the retaining members 24 carry the third braking members 23 such that their bodies are forced to extend in the wider parts of the wedge shaped gaps 231, as shown in figure 3. In that position the first braking member 21 and the second braking member 22, and thereby the frame 9 and the load carrier 10, can freely rotate relative to each other.

[0022] In the braking operation mode, when the retaining member 24 is forced to be in the lower position by the spring 246, the third braking members 23 are moved downward such that their bodies will move to the narrower part of the wedge shaped gaps 231, as shown in figure 4. In that position the body of one of said third braking members 23 is pulled deeper into the narrower part of the gap 231 by the rotation of the shaft 101 and thereby said third braking member blocks rotation between the first braking member 21 and the second braking member 22, and thereby the frame 9 and the load carrier 10. Furthermore, by the movement of the braking member 23 into the narrower part of the wedge shaped gap 231 the second braking member 22 is pushed in lateral radial direction, whereby the inner cylindrical surface of the friction ring 2221 in the back plate 222 is pushed against the outer surface of the shaft 101, as shown in Figure 5, thereby also blocking rotation between the frame 9 and the load carrier 10.

[0023] The invention has thus been described by means of a preferred embodiment. It is to be understood, however, that this disclosure is merely illustrative. Various details of the structure and function were presented, but changes made therein, to the full extent extended by the general meaning of the terms in which the appended claims are expressed, are understood to be within the principle of the present invention. The description and drawings shall be used to interpret the claims. The claims should not be interpreted as meaning that the extent of the protection sought is to be understood as that defined by the strict, literal meaning of the wording used in the claims, the description and drawings being employed only for the purpose of resolving any ambiguity found in the claims. For the purpose of determining the extent of protection sought by the claims, due account shall be taken of any element which is equivalent to an element specified therein.

Claims

1. An apparatus (4) for transporting a load from a first to a second level, in particular a stairlift, comprising:

a frame (9) which is displaceable along a rail (3) and which is provided with support, guide and drive means arranged to engage the rail (3),
a load carrier (10) which is rotationally mounted on said frame (3) to be rotated around a horizontal axis, and
means for maintaining the load carrier (10) in a predetermined rotational position relative to the direction of gravity, which position-maintaining means comprise at least one adjusting motor having a shaft (101) to which the load carrier (10) is fixed and arranged to rotate the load carrier (10) relative to the frame (9) around said horizontal axis,
wherein said apparatus (4) further comprises an emergency rotation blocking arrangement for preventing said rotation between the load carrier (10) and said frame (9), said rotation blocking arrangement comprising:

a first braking member (21) rigidly connected to said shaft (101),
a second braking member (22) connected to said frame (9),
at least one third braking member (23) arranged between said first braking member (21) and said second braking member (22),
wherein said first braking member (21) has a primary braking surface which is strip shaped and extends along at least a section of a circle around said axis,
wherein said second braking member (22) has at least one secondary braking surface which extends at a distance from said primary braking surface at an angle in such a manner that the distance between the two surfaces varies, thereby forming a substantially wedge shaped gap (231) between the primary and secondary surfaces having a wider part and a narrower part, the wedge shaped gap (231) widening in a tangential

direction around said axis,
wherein in a normal operation mode said third braking member (23) is held in a fixed position relative to said second braking member (22) by a retaining member (24) such that it extends in the wider part of said wedge shaped gap (231) where it cannot engage both the primary and secondary braking surfaces at the same time, and
wherein in a braking operation mode said retaining member (24) is moved relative to said second braking member (22) such that said third braking member (23) is allowed to move to the narrower part of said wedge shaped gap (231), thereby engaging both the primary and secondary braking surfaces,
characterized in that said second braking member (22) is connected to said frame (9) in such a manner that it extends at a small distance around said shaft (101) and is movable relative to said frame (9) in a radial direction relative to said shaft (101), and that the movement of said third braking member (23) to said narrower part of said gap (231) causes said second braking member (22) to engage said shaft (101) and thereby blocking rotation of the second braking member (22) in said tangential direction relative to the first braking member (21) and the shaft (101).

2. The apparatus according to claim 1, wherein said second braking member (22) comprises a tertiary braking surface being a cylindrical inner surface of said second braking member (22), said tertiary braking surface extending around and facing the shaft (22), and engaging the outer surface of said shaft for said rotation blocking action.

3. The apparatus according to claim 1 or 2, wherein, after the movement of said third braking member (23) to said narrower part of said gap (231), the engagement of both the primary and secondary braking surfaces by the third braking member as such also blocks rotation of the second braking member (22) in said tangential direction relative to the first braking member (21).

4. The apparatus according to claim 1, 2 or 3, wherein said second braking member comprises at least two secondary braking surfaces, being at least one first secondary braking surface and at least one second secondary braking surface, said at least one first secondary braking surface forming a first substantially wedge shaped gap widening in a first tangential direction around said axis, and said at least one second secondary braking surface forming a second substantially wedge shaped gap widening in a second tangential direction around said axis, said second tangential direction being the opposite of said first tangential direction, and said at least one third braking member being allowed by said retaining member in said braking operation mode to move to a narrower part of one of said first and second substantially wedge shaped gaps, thereby allowing said at least one third braking member to block rotation of the second braking member in either tangential direction relative to the first braking member.

5. The apparatus according to claim 2, wherein said at least first secondary surface and said at least second secondary braking surface form two separate substantially wedge shaped gaps, and said at least one third braking member are at least two separate third braking members, each extending in a respective substantially wedge shaped gap.

6. The apparatus according to any of the previous claims, wherein said primary braking surface is at least a section of a cylindrical surface.

7. The apparatus according to any of the previous claims, wherein said at least one third braking member has the form of a cylinder, and the axis of said cylinder extends parallel to both the primary and secondary braking surfaces.

8. The apparatus according to any of the previous claims, wherein the wider part(s) of said wedge shaped gap(s) extend(s) substantially vertically above the narrower part(s) of said wedge shaped gap(s) and said third braking member(s) rest(s) on (a) carrying edge(s) of said retaining member in the normal operation mode.

9. The apparatus according to claim 8, wherein said retaining member is movable between an upper position in said normal operation mode and a lower position in said braking operation mode.

10. The apparatus according to any of the previous claims, wherein said retaining member is held in said upper position in normal operation by the force of an electrically powered electromagnet, such that it moves to said lower position in braking operation if electrical power to said electromagnet is absent.

11. The apparatus according to any of the previous claims, wherein said retaining member is connected to a resilient biasing member which is arranged to move said retaining member from said fixed position in normal operation mode to said braking operation mode.

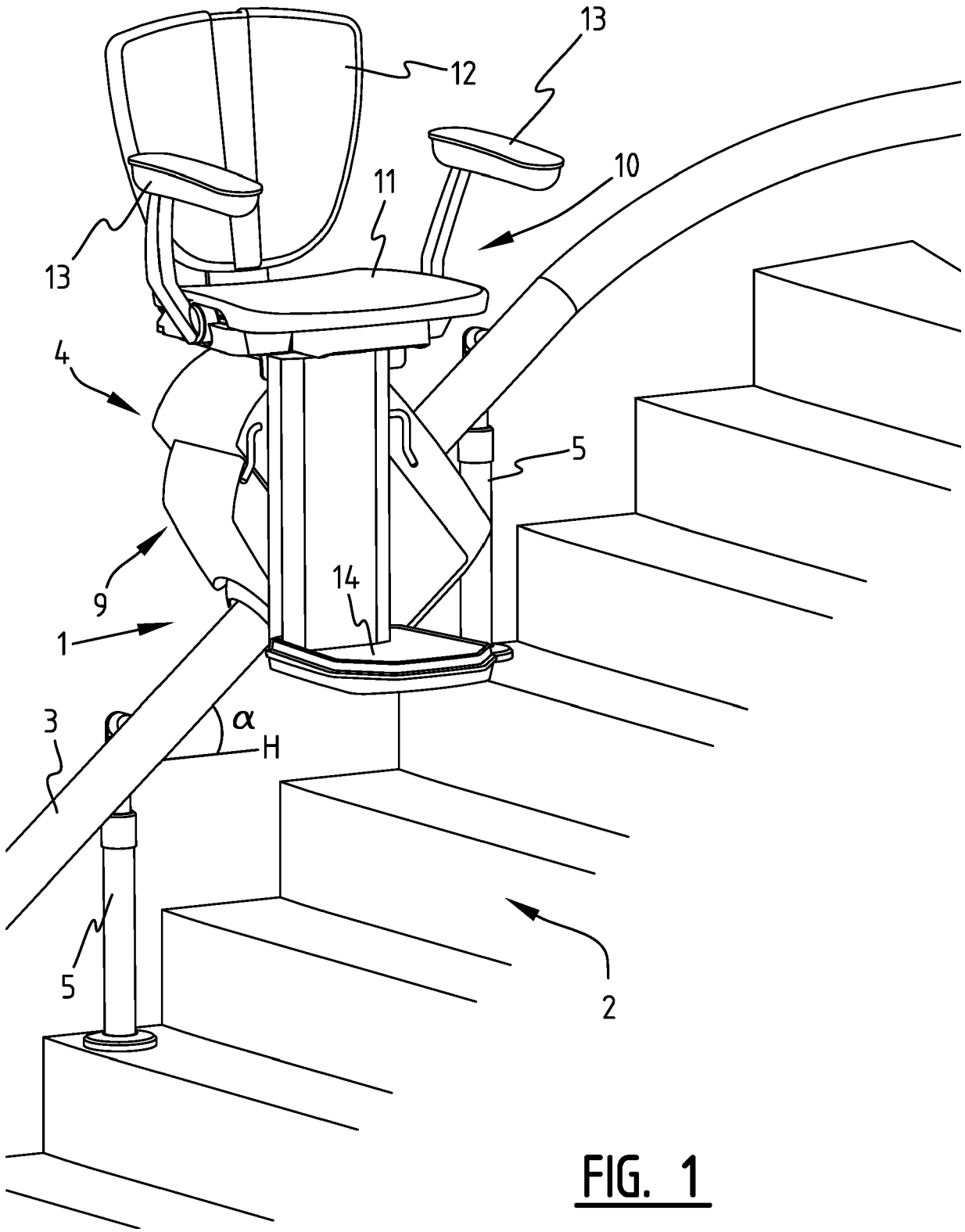
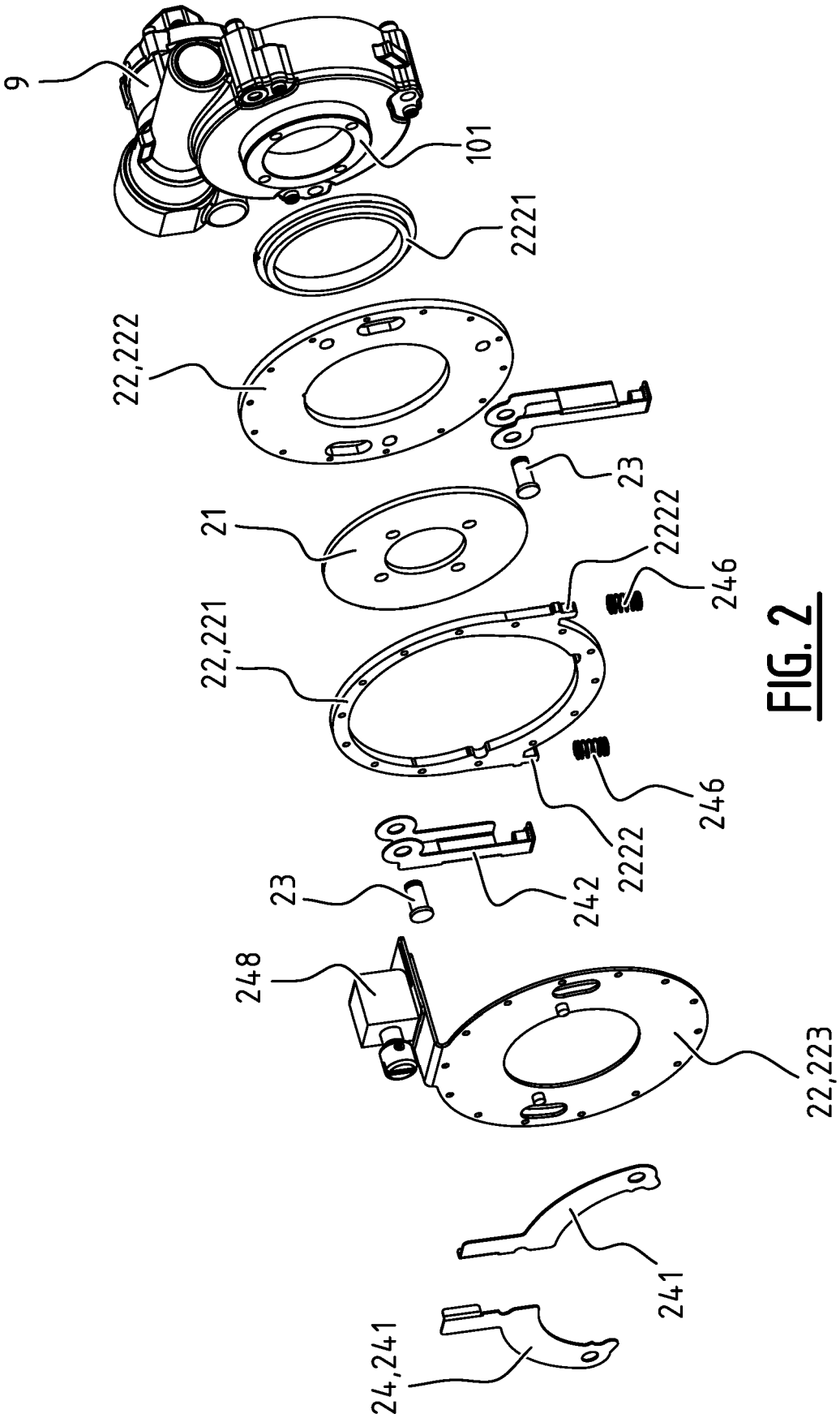


FIG. 1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101
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24,241

FIG. 2

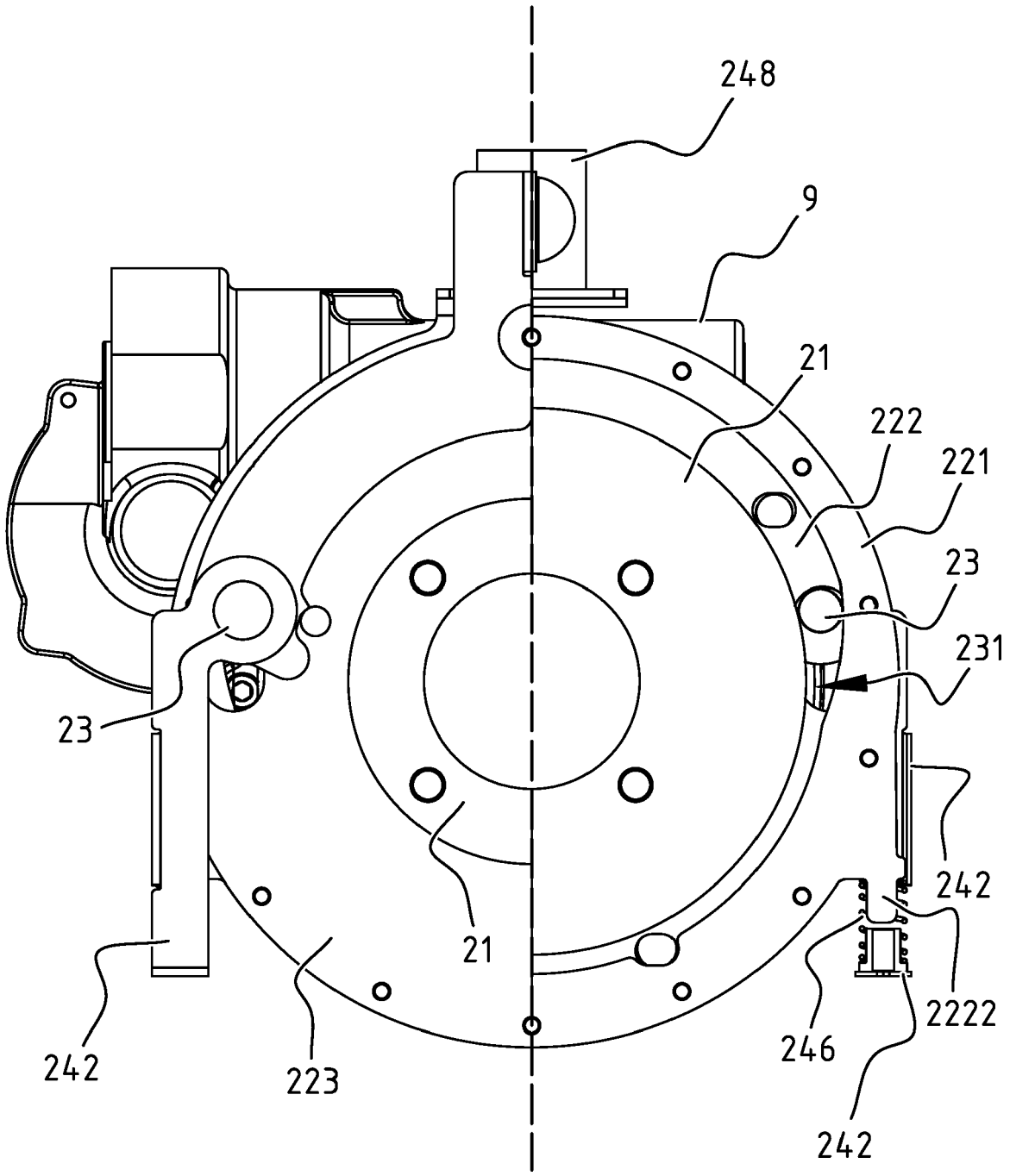

FIG. 3

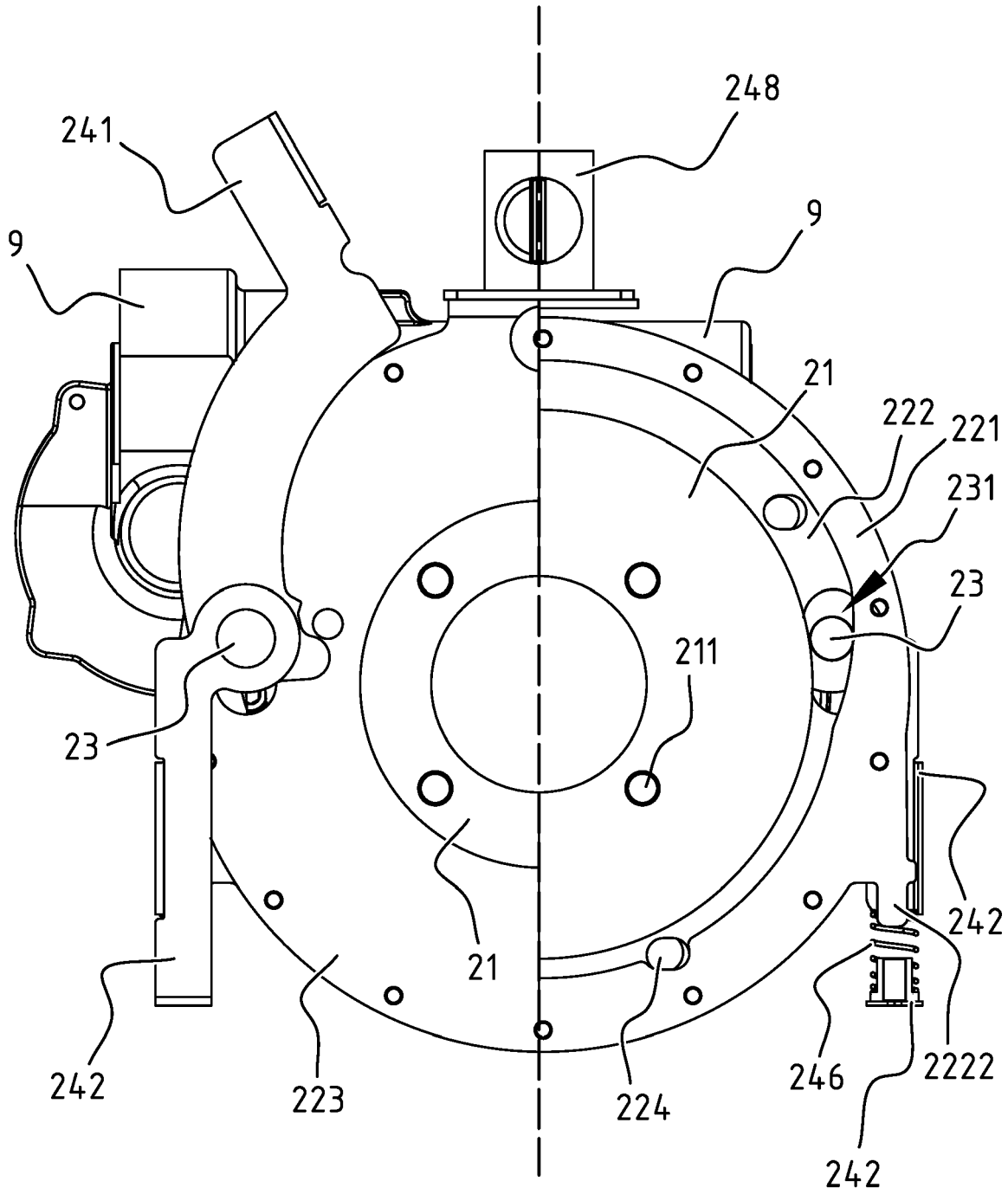
248
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FIG. 4

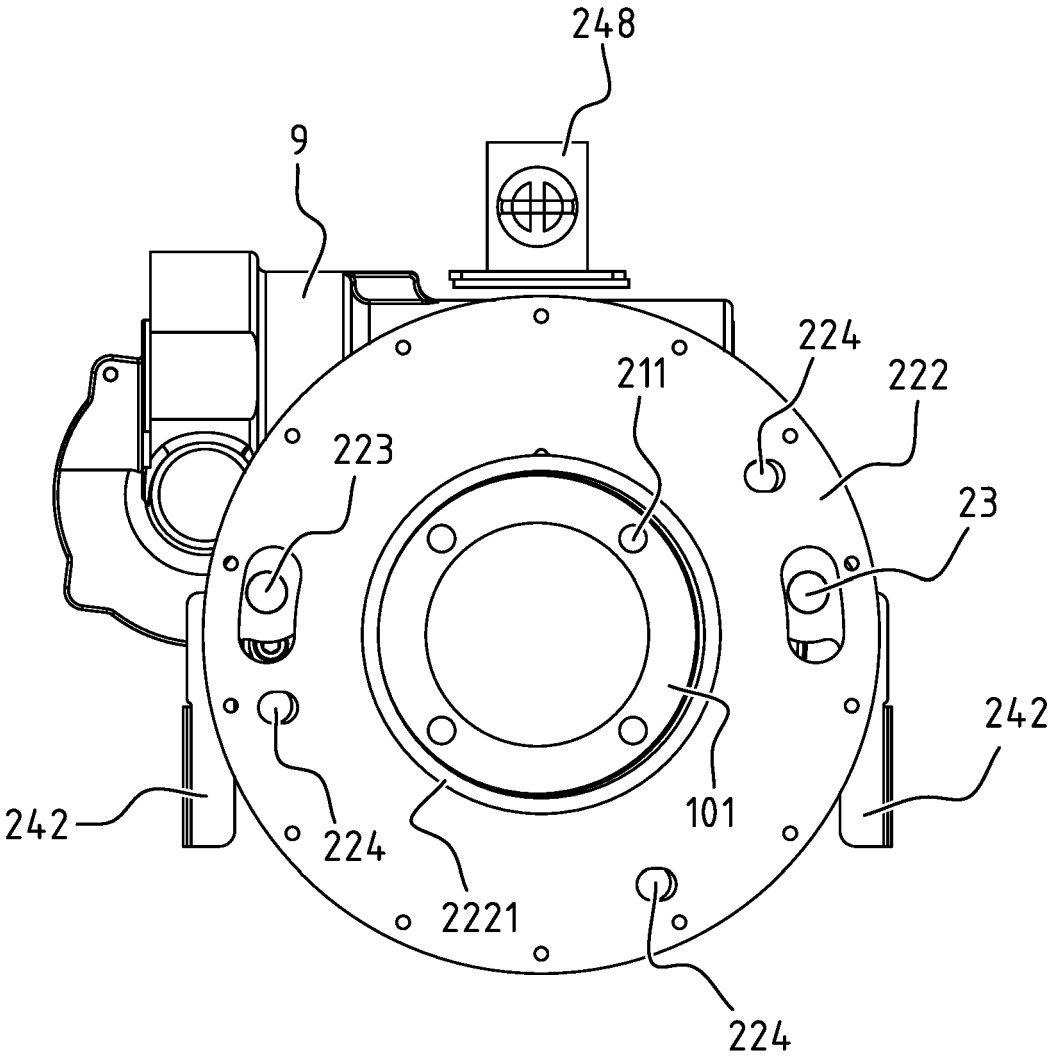

FIG. 5

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EUROPEAN SEARCH REPORT

Application Number
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DOCUMENTS CONSIDERED TO BE RELEVANT

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
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CATEGORY OF CITED DOCUMENTS

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