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TITLE

Locking mechanism for sliding panel

TECHNICAL FIELD

The present invention relates to a locking mechanism for a sliding panel and to a sliding panel system, in particular an automatic door system, having such a locking mechanism.

PRIOR ART

EP 2 607 580 teaches a locking mechanism for a sliding door system for controlling access to a building opening. The door panel of the sliding door is mounted suspended from a carriage, wherein the carriage, together with panel, is movable in a running profile, arranged above the panel, for the concealment or clearance of the building opening. In order to arrest the panel in a desired position in the running profile, the locking mechanism arranged fixedly with respect to the running profile has a locking pin movable between a locking position and an unlocking position, which locking pin cooperates with a bracket on the carriage for the fixing of the carriage in the running profile.

Locking mechanism and carriage are now further configured such that, in said desired position, the locking pin and the carriage-side engagement bracket are oriented such that the locking pin, through movement into the locking position, engages in the bracket and so blocks the carriage in the running profile.

The actuating element for the locking pin is a lifting magnet having a magnetically movable armature, wherein a compression spring is provided in order to counteract the magnetic force for the purpose of resetting the armature or bolt.

Such an arrangement has the drawback that the force profile of the lifting magnet is heavily dependent on the position of the armature, and that the profile of the force of the lifting magnet and the profile of the force of the compression spring are not optimally coordinated.

EP 2 784 255 A2 discloses a fixing and locking unit for a partition wall system. For the locking, a closure element attached to the partition wall is rotated in such a way, that it engages a receptacle which is arranged stationary with respect to a guide rail.

REPRESENTATION OF THE INVENTION

An object of the present invention is to overcome these drawbacks and to provide an improved locking mechanism, in particular a carriage locking mechanism, for a sliding panel, in particular a sliding door.

This object is achieved by the locking mechanism according to claim 1. According to this, a locking mechanism, in particular a carriage locking mechanism, for at least one sliding panel, in particular a sliding door, for controlling a building opening is proposed, wherein the locking mechanism is configured to lock at least one sliding panel, wherein the locking mechanism comprises:

a first locking element, which is movably mounted;

an actuating device for moving the first locking element between an unlocking position and a locking position;

wherein the actuating device is a rotary drive,

and wherein the locking mechanism comprises two or more such rotary drives.

The locking element can be a bolt element, a bracket element or, more generally, a mating element, wherein this mating element can be brought into positive engagement with an element on the carriage or on the sliding panel with respect to the direction of movement. The locking element is preferably designed such that its movement between the unlocking position and the locking position is a swivel or rotation movement.

Within the context of the present invention, the phrase "*between the unlocking position and the locking position*" embraces both the movement toward the unlocking position and the movement toward the locking position, insofar as nothing different emerges from the context.

Alternatively, a design which enables this movement as a translation or displacement, or as a combination of pivot and displacement, can also be provided.

The present invention is based on the insight that a rotary drive can be used to actuate the locking mechanism. The rotary drive can be optimally adapted via a gear mechanism to the force profile which is necessary according to the specific application. When the armature is in the extended position, the known lifting magnet provides a relatively small lifting force, which then rises as the armatures is increasingly retracted. This lift-dependent force profile is disadvantageous, and which can be surmounted with a rotary drive, in particular a geared motor, particularly preferably an electric motor,

preferably with a downstream gear mechanism. It is also conceivable that the motor acts on the locking element via a cam disk in order to achieve a desired force profile. With a rotary drive, moreover, a larger lifting force than with a lifting magnet is available, while, at the same time, a compact and light construction and efficient and reliable functioning is given.

In principle, the locking mechanism can be used for sliding doors or windows.

In some illustrative embodiments, the locking mechanism is designed for a single sliding panel, in other illustrative embodiments for the locking of a plurality of (for instance two) panels mounted displaceably in parallel.

In a preferred illustrative embodiment, the rotary drive is an electric motor. This motor can be controlled, for instance, via PWM signals. Alternatively, hydraulic or other rotary drives would also be usable.

In one refinement, the locking mechanism comprises a pretensioning element, which is configured and arranged such that the first locking element, in the locking position and/or in the unlocking position, is under pretension.

In another refinement, the locking mechanism has an eccentric element mounted such that it is rotatable by the rotary drive, wherein the eccentric element is movable by means of the rotary drive between a first and a second position. The eccentric element is in this case configured and arranged such that the eccentric element, upon movement into the first position, acts on the first locking element in such a way that the first locking element moves into the locking position, and upon movement into the second position, acts on the first locking element in such a way that the first locking element moves into the unlocking position.

Preferably, the eccentric element is mounted directly, in particular in a rotationally secure manner, on the motor shaft and is configured as a rotary lever. The eccentric element can be shaped such that the rotary-position-dependent force profile has a pattern which is optimized according to the specific application. For instance, a spacing between rotational axes can rise more slowly within the first rotation sector than within the following rotation sector, whereby a larger lever, and hence a larger force, are available within the first rotation sector. The first rotation sector can be, for instance, the first 15° to 45°. Such a design can be advantageous, for instance, if the displacement of the sliding panel, due to a retaining seal on the closing edge, requires more force for opening than for the subsequent free displacement.

For the rotary lever, in the end positions stop buffers or damping elements can be

provided. This increases the working life of the gears. In addition, a pre-end-stop circuit can be provided.

The eccentric element thus allows the force profile to be adapted to the locking element through the shape of the eccentric element. The torque of the rotary drive can thus be optimized via a gear mechanism and a lifting-cam-like element (here the eccentric lever) that a motional and force profile which is optimal according to the specific application is obtained.

Preferably, said pretensioning element pretensions the first locking element counter to the action of the eccentric element. In other words, the pretensioning element presses the first locking element against the eccentric element. Thus, a good contact between eccentric element and first locking element is ensured and the pretensioning element helps in the return travel of the locking element after deflection by the eccentric element.

The pretensioning element can be a tension spring, in particular a leg spring having two legs. Alternatively, a compression spring design, helical spring design, volute spring design or other pretensioning design can also be used.

In one refinement, the eccentric element is configured and arranged such that it lies in a dead center when the first locking element is in the locking position and/or in the unlocking position. As a result of the dead center position, energy consumption is reduced (to zero) and wear is reduced, since the rotary drive is relieved of load. The dead center position ensures a clearly defined bearing point and limits the load on the drive. Furthermore, the first locking element, despite the above-described pretensioning action, cannot force the eccentric element out of its dead center position, whereby additional security is provided.

The plurality of rotary drives can effect movements simultaneously or alternatingly. Preferably, the two or more rotary drives can be configured redundantly, i.e. the rotary drives are independent of one another; if one fails, the other can singly, according to the invention, move the first locking element. Both rotary drives can thus be configured independently of each other in order to influence the movement of the same first locking element. The redundancy can relate to the mechanical, as well as to the electrical and electronic parts of the respective rotary drive. In this case, the locking mechanism can be refined such that each rotary drive respectively possesses an associated eccentric element and/or gear mechanism. The rotary drives can thus act on the first locking element via different, or alternatively the same eccentric elements or gear mechanisms. A non-positive

transfer of movement from the gear mechanism to the first locking element can, for instance, enable the gear mechanisms to be operated independently of one another.

In another refinement, the first locking element is configured as a catch. The catch can be produced, for instance as a bracket, from a piece of sheet metal. The catch can be of one-piece and/or multilayered construction. Preferably, the catch has a pivotable catch portion for making positive contact with a second locking element, for instance a hook element, fixedly connected to the sliding panel.

The first locking element thus complements the second locking element in a positive fit, that fixes the desired position, with the second locking element, which latter is fixedly connected, preferably via their carriages, to the sliding panel.

The catch portion can comprise a catch opening. Preferably, the catch has a Y–shape, wherein the stem serves as the catch portion and the two arms as bearing arms for the mounting in a housing of the locking mechanism.

In a preferred refinement, the locking mechanism further comprises one or more preferably stand-alone electrical storage devices. This electrical storage device can preferably be one or more capacitors. Other electrical storage devices, such as batteries, accumulators or miscellaneous electrical storage devices, can be used. The electrical storage device comprises serves for the emergency movement of the first locking element between the locking position and the unlocking position. Preferably, one or more electrical storage devices are exclusively assigned to each rotary drive in order to provide the redundancy. It is also conceivable that each rotary drive can access each energy storage device.

Preferably, a plurality of redundant electrical storage devices, for instance capacitors, are included, wherein a maximum energy content of one or more of the electrical storage devices is sufficient for at least one, preferably at least two, in particular exactly three, guaranteed movements of the first locking element out of the locking position into the unlocking position, or vice versa. It is thereby ensured that the locking mechanism, even in the event of an interruption to the power supply, can still execute a minimum of a predefined bolt movement. These can be, for instance, 1 to 10, preferably exactly 3 movements, between the unlocking position and the locking position.

In order to broaden the functionality, in one refinement, one or more manual unlocking mechanisms, in particular at least one or exactly two Bowden controls, can additionally be included, for the manual movement of the first locking element between the

locking position and the unlocking position. This too serves for the application-specific design of the locking mechanism or of the system which is geared to the purpose of use. Respectively an emergency locking mechanism can be fitted on one side of the door. Depending on the door, also just on one side, one unlocking mechanism, or none at all, can be provided.

The refinement of the mechanical unlocking mechanism, in particular for each Bowden control, makes it possible to provide two unlocking systems, which function independently of each other. Through the actuation of a Bowden control, a toggle lever, for instance, is moved, the movement of which effects a movement of the first locking element between the locking position and the unlocking position. In this case, the electronics unit can provide a switch, which is activated upon actuation of the mechanical unlocking mechanism and, when access is gained to electrical energy, sends a movement command to the door control system to move and lock it electrically. If the system, on the other hand, is currentless, then the first locking element is moved mechanically via the toggle lever. The door panels must then be moved manually.

As soon as the Bowden control is relieved of load again, the first locking element reassumes the original position prior to the mechanical actuation. The panels can then, where necessary, be moved manually. Through appropriate configuration of the second locking element, the second locking element can also be engaged in the first locking element if the latter is already in the locking position. For instance, the second locking element can be a hook element having a ramp, wherein the ramp runs up onto the first locking element and moves this. Via its pretensioning, the first locking element is easily moved back again as soon as the ramp has passed through and the locking is created. The system can thus be closed and locked in the absence of current.

The locking mechanism can have, moreover, an electronics unit, wherein this electronics unit is set up to conduct a periodic fault check on the locking mechanism or on parts thereof, wherein, in the fault check, predetermined parameters or groups of parameters are checked at a predetermined checking interval. In this fault check, preferably at least a first and a second predetermined parameter or group of parameters are checked with a first checking interval of 1 second to 30 seconds, preferably of 15 seconds, or with a second checking interval of 1 hour to 48 hours, preferably of 24 hours. A first parameter can be, for instance, the responsiveness of the rotary drive, a catch setting and the state thereof, which latter can be transmitted, for instance, to an alarm signaling system. A

second parameter can be, for instance, the energy content of an energy storage device.

In particular, the content of the electrical storage devices, the functionality of the individual components, and/or the current panel or locking position, can also be checked. This check further increases security, by virtue of reliable fault recognition.

A failure of the external power supplies or of the communication link to the door control system, as well as the breakdown of a subsystem, are recognized by the locking mechanism and a predefined action is induced, for instance an unlocking or a locking of the door in the open or closed position. For this, the relevant power supplies and the working of the bus connection to the door control system and between the two microcontrollers must be constantly monitored.

In one refinement, the electronics unit can be refined such that the at least two rotary drives can be operated redundantly. The locking electronics unit can thus be completely redundant. In the case of two electric motors, two bus transceivers, two microcontrollers and two power output stages can thus respectively be provided. Given normal functioning, the redundant locking system is supplied, for instance, by two external 24V power supplies for the feed to the logics and to the motor bridge. The two power supplies are respectively utilized by the master and by the slave subsystem.

In the simply constructed locking mechanism, the motor bridge feed can be separately connected in order, when the emergency escape and rescue route function is deactivated, to prevent unlocking of the locking mechanism if a fault should arise.

In this case, the at least two rotary drives are preferably configured to, acting in combination and/or in alternation, effect locking operations. An alternating use of the individual rotary drive prolongs the working life of the locking mechanism, since each rotary drive effects fewer locking operations. The term "*alternating*" embraces both direct changeover after each locking actuation and changeover after a multiplicity of, for instance 2, 3, 5, 7, 10, 50, 100, 1000 actuations, with the one rotary drive, before the same or a different number of actuations are performed with the other rotary drive.

Furthermore, in illustrative embodiments having a plurality of rotary drives, it is conceivable to install different or the same rotary drives. Also different or the same gear mechanisms or cam disks or eccentric elements can be installed.

A joint use of the rotary drives can be declared if particularly tough movements have to be executed. Alternating use of the rotary drives can be utilized, for instance, in respect of smooth movements. Two rotary drives can also be used on a part of the

movement, while otherwise only one rotary drive is in work.

With the present locking mechanism it is possible, with a single locking mechanism design, to realize a multiplicity of functions, which is advantageous in a number of respects. Thus this design can be utilized, for instance, for hard and smooth movements.

A standard (without emergency escape and rescue function) or an emergency escape and rescue door with carriage or panel which are lockable in the closed position, can be realized. Obviously, in this and the following examples, respectively only one, or else two or more panels, are present.

In particular in the case of a double-leaved sliding door, the middle, where both panels meet in the closed position, can serve as the locking point. In this case, the carriage and/or the sliding panel can be locked at its top edge or at its closing edge.

A standard or an emergency escape and rescue door with carriage or panel which are lockable in the closed position, wherein the locking mechanism is constructed redundantly, can be realized.

In this case, the operating mode can be *"exit locked"*, in which the emergency escape & rescue redundant operation is maintainable. The opening command can be triggered by a monitored internal sensor. A further operating mode is "*night locked*", in which case the sensors are inactive and the opening command can be generated, for instance, by means of a suitably placed and designed push button. The push button can be, for instance, a green, monitored and luminous push button.

A standard or an emergency escape and rescue door with respectively carriage and panel, which are locked in the open position, can be realized. This function holds the panels on the open position, which can be employed, for instance, in motor ships in rough waters.

Also for fire doors, which may possibly be designed to make use of the chimney effect for smoke removal, an open position can be provided in an emergency.

A standard or an emergency escape and rescue door with respectively carriage and panel, which additionally or alternatively are lockable in at least one intermediate position, can be realized. This can be used in standard or emergency escape and rescue doors. In this case, the panel opening travel can be limited by locking in an intermediate position. An intermediate position solution can be employed, for instance, in closing systems for pharmacies in order to allow an additional option for full opening, namely that of a gap opening for night shopping. In this case, the first locking element can in the locking

position provide a stop (instead of a full engagement), so that the panel opening travel is limited.

Also a break–out locking can be realized, in which, for instance, an emergency escape and rescue door with rotary fitting, thus a combination of sliding and side-hung door, is provided. To this end, a sliding panel, which also has the character of a hinged panel, is used. In an emergency escape situation, this panel can be swung out in the direction of escape, which further reduces the obstruction of the escape route. Additionally to the sliding system, a swing-out system is provided. Preferably, the panel is then locked via a closing-edge-side push rod. Preferably, two opposite-moving swing-sliding panels are herein provided, wherein a mutual locking of the two panels, which locking takes place close to the closing edge or on the closing edge side, and preferably also a locking to the ground and/or locking of the carriage, is provided. In addition, the hinged panels can be lockable to the non-swing-out profile above the panels. The unlocking can be realized, for instance, via a push bar. In the "*night locked*" operating mode, the emergency escape and rescue function can be maintained even when the door is locked.

A standard or an emergency escape and rescue door with respectively carriage and panel, which are lockable via a rod-operated locking mechanism preferably attached to the closing edge of the panels, can be realized. The first locking element, for instance the catch, can, for instance, be laterally provided with bayonet openings. A rod locking can thereby be realized, wherein the closing rods are located in the sliding panels and are moved automatically by the locking mechanism. Compared to the present-day solutions, where the rod drive is located in the sliding panel and not fixedly in the locking mechanism in the running profile, this would signify a substantial simplification. A share of glass on the door could also be increased, since the middle lock does not have to be installed. A multipoint locking can thus preferably also be realized vertically to the ground.

A standard or an emergency escape and rescue door with respectively carriage and panel, which are lockable via a hook locking mechanism preferably attached to the closing edge of the panels, can be realized.

Fail-safe and/or fail-secure functions and further functions can also be realized.

Where it makes sense, these functions can also be combined with one another.

The present invention further relates to a computer program product for a locking mechanism as described above, wherein the computer program product comprises a computer program code, which computer program code, when executed in an integrated

circuit, causes the integrated circuit to move the rotary drives such that

- a standard door function, in particular a redundant standard door function, and/or

- an emergency escape and rescue door function, in particular a redundant emergency escape and rescue door function, in particular in combination with an "EXIT locked" program setting, and/or

- an intermediate position locking, for instance for pharmacies,

- and/or further above-stated functions,

is realized or realizable.

The program setting or function: "EXIT locked" herein signifies that a standard setting of the locking mechanism is that in which the door is locked. From outside, entry cannot be gained into the building interior, from inside the door is unlocked via an opening command (sensor, sensing device, etc.) and thus makes it possible to leave the building.

A further aspect of the present invention is to define a system, in particular a door system, comprising the at least one sliding panel, in particular a sliding door, for controlling the building opening, at least one locking mechanism for locking the at least one sliding panel, as described above. Preferably, this system comprises a computer program product as described above. The system can herein secure the sliding panel in a predetermined arrestment position and realize at least one of the above functions.

In each illustrative embodiment, the system can have one or more sliding panels and one or more locking mechanisms, and preferably comprise a computer program product as described above. In this case, carriage and/or panel, for instance, can be provided with a second locking element, which second locking element is in the locking position respectively positively connected to the first locking element. Both second locking elements can engage in the same first locking element.

Preferably, the locking mechanism(s) are thus respectively arranged such that the arrestment position is an open setting, a closed setting, or an intermediate setting of the sliding panel.

In a preferred illustrative embodiment, the at least one sliding panel has a closing edge, wherein the system comprises at least one transmission element, in particular a push rod, running substantially parallel to the closing edge, for transmitting the movement of the rotary drive(s), wherein the transmission element is operatively connected, by its locking-mechanism-side portion, to the first locking element, and thus is movable by way of the movement of the first locking element, and is configured with the locking-mechanism-

remote portion(s) for the locking of the at least one sliding panel. The transmission element can then directly actuate a bolt for engagement in a ground recess (so-called ground locking mechanism) and/or for the arrestment of the closing edge via hook elements.

In one illustrative embodiment, the carriage can be locked and/or, via the transmission element, locking is additionally or alternatively realized against the ground or against another fixed object, or between converging panels. A multipoint locking can thus be realized.

In any event, a complex, expensive middle lock, for instance, can be avoided, which, moreover, offers the advantage that a glass area of the panel can be enlarged, since no middle lock has to be installed.

In general, an unlocking of the in the emergency escape and rescue situation can be realized via an emergency locking mechanism, for instance via Bowden controls or push bars.

Moreover, an unlocking lever can respectively be provided for each rotary drive for manual unlocking. This lever can be arranged, for instance, directly on the rotary drive shaft and can be rotatable, for unlocking, through 90 degrees, or somewhat more. Where a plurality of geared motors are provided, preferably each possesses an own unlocking lever. The unlocking mechanism can be monitored electronically, so that unlocking is realized as soon as an unlocking lever is actuated.

A number of illustrative embodiments, which serve for a better understanding of the invention, have now been described. The various features of the illustrative embodiments can herein be combined to form further illustrative embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

Preferred embodiments of the invention are described below with reference to the drawings, which serve merely for illustration and should not be interpreted restrictively. In the drawings:

fig. 1 shows a door system having a carriage locking mechanism according to the invention according to a first embodiment;

fig. 2 shows the carriage locking mechanism according to the invention according to the first embodiment in a perspective view from below from the front;

fig. 3 shows the carriage locking mechanism according to fig. 2 from above from the rear;

fig. 4 shows the carriage locking mechanism according to fig. 2 from below;

figures 5, 6 show details under the catch from above, from the rear;

fig. 7 shows the rotary lever in the closed setting;

fig. 8 shows the rotary lever in the open setting;

fig. 9 shows the chassis of the carriage locking mechanism according to fig. 1;

fig. 10 shows the catch of the carriage locking mechanism according to fig. 1,

fig. 11 shows an energy storage device of the carriage locking mechanism according to fig. 1;

fig. 12 shows two carriages with the catch in the locking position and the unlocking position;

fig. 13 shows a double-leaved door system having a bar locking mechanism against the ground, wherein the locking mechanism is in the open position;

fig. 14 shows the system according to fig. 13, wherein the locking mechanism is in the closed position;

fig. 15 shows a double-leaved door system having a bar locking mechanism and middle swing bolt element, wherein the locking mechanism is in the open position; and

fig. 16 shows the system according to fig. 15, wherein the locking mechanism is in the closed position.

DESCRIPTION OF PREFERRED EMBODIMENTS

With reference to figures 1 to 14, a preferred embodiment of the carriage locking mechanism 10 according to the invention is now described.

Figure 1 shows a sliding door system 1 having two glass sliding door panels 2, 3 in closed position, for controlling a building opening 5 in the direction of passage D. The two oppositely movable sliding door panels 2, 3 are mounted on carriages 40 (see figures 12–14) having carriage wheels 8 (see **Figure 12**), such that they are displaceable along a closing direction S in a horizontal running profile 4. In the middle of the running profile 4 in the longitudinal direction is arranged the carriage locking mechanism 10. The carriages 40 are respectively provided with a second locking element, a hook element 80 (see fig.

12), which is configured and arranged such that it can be caught by the carriage locking mechanism 10 (namely in the opening 132 of the catch 13, see below) in order to effect the locking. The door panels 2, 3 make contact with each other along their main closing edges 20 and 30, respectively, running in the vertical direction V, and have vertical secondary closing edges 21, 31. **Figure 2** shows a perspective view of the carriage locking mechanism 10 from obliquely below. The carriage locking mechanism 10 comprises a frame-like chassis 11 as the housing, which in **Figure 9** is shown in isolation. The one-piece chassis 11 is a one-piece angular plate, bent into a U–shape, having a flat bottom bracket 111 and three flat side brackets 112–114 protruding perpendicularly from the bottom bracket 111. The space formed between the brackets 112–114 serves to receive the various assemblies of the carriage locking mechanism 10 and is covered in the upward direction in fig. 2 by a pivotably mounted catch 13.

The position specification "*at the top*" means: "*on the catch side*"; "*at the bottom*" means: "*remote from the catch*".

The first side bracket 112 forms a first side face of the carriage locking mechanism 10. In the first side bracket 112, a downwardly (i.e. in fig. 9 upwardly) open recess 1121 having undercuts for the reception of Bowden controls 15 (see below), or parts thereof, and of cables 122 for supplying power to a microswitch unit 12 for monitoring the catch 13, are provided. The cables 122 are herein received in a further undercut 1127 of the recess 1121. In addition, a multiplicity of through holes 1122–1126 is provided. These through holes 1122–1126 comprise an upper first catch recess 1122, arranged close to the rear side (i.e. in relation to the bottom bracket 111), for the reception of the catch 13, two recesses 1123, 1124 for cylinder head screws 121 (see fig. 3) of the microswitch unit 12, and two recesses 1125, 1126 for the fastening of the microswitch unit 12. Furthermore, a lateral projection 1128, having a thickening which is free on its end face, for the fastening of cables, and an upper fastening bracket 1129, protruding in the longitudinal direction of the bottom bracket 111, for the purposes of assembly, for instance by means of a screw connection 9 through the bracket 1129, are provided.

The second side bracket 113 forms a second side face, lying opposite the first, of the carriage locking mechanism 10. In the second side bracket 113 are provided: an upper second catch recess 1132, arranged at the rear close to the margin and opposite the first, for the reception of the catch 13, a lateral projection 1138 having a thickening which is free on its end face, for fastening purposes, and an upper fastening bracket 1139, running in the

longitudinal direction of the bottom bracket 111, for the purposes of assembly, for instance by means of a screw connection 9 through the bracket 1139.

The third side bracket 114 runs parallel to and between the first and second side bracket 112, 113 and likewise has a downwardly open third recess 1141 having undercuts on for the reception of the Bowden control, wherein the undercuts of the recesses 1121 and 1141 are mutually aligned. In this case, the third side bracket 114 is arranged offset toward the second side bracket 113.

The fastening brackets 1129, 1139 have recesses, into which screws 9 can be inserted for the fastening of the carriage locking mechanism 10 to the running profile 4, or in fixed arrangement relative thereto.

The catch 13 is now described with additional reference to **figure 10**, which shows the catch 13 in isolation. The catch 13 is configured as a one-piece sheet-metal bent part and conceals an upper opening of the U–shaped chassis 11 between the first and second side bracket 112, 113, which upper opening adjoins the bottom bracket 111. The catch 13 is mounted pivotably in the catch recesses 1122, 1132 and reaches from these recesses 1122, 1132 to the bottom bracket 111 and beyond the latter.

The catch 13 has a Y–shape, wherein a distal catch portion 131, projects up toward and over the bottom bracket 111, forms a stem of the Y–shape, and two arm portions 133, 134, which start in the proximal region of the catch portion 131, form the arms of the Y–shape.

In its installation position located on the end face of the chassis U–shape, the catch portion 131 projects forward and substantially perpendicularly beyond the bottom bracket 111 and has on its free distal end a quadrilateral catch opening 132, in which hook elements 80 of the carriages 40 (see figures 12–14) can be engaged for the securement thereof.

The first arm portion 133 has on its proximal free end a free first pin element 1330, which projects toward the first side bracket 112 and which is configured to engage in the first catch recess 1122 and engages in a pivot bearing 135 (see figure 3), whereby the catch 13 is pivotably mounted in the chassis 11. A further first catch bracket 1331, protruding toward the first side bracket 112 and from the catch 13 and having a through hole 1332, is arranged distally from the first pin element 1330 on the arm portion 133.

Figure 3 shows the locking mechanism 10 from above from the rear. A tension spring 14 having a middle, hollow-cylindrical coil portion 140, and, protruding therefrom,

mutually oppositely arranged first tension spring leg 141 and a second tension spring leg 142, spring-loadable relative to the first about the axis of the hollow cylinder, are visible. The tension spring 14 is pushed with the coil portion 140 in mounting arrangement over this first pin element 1330, wherein the first tension spring leg 141 reaches forward onto the rear edge of the first side bracket 112, and the second tension spring leg 142 reaches into said through hole 1332 of the first catch bracket 1331, whereby the catch 13 is mounted in the first side bracket 112 in the chassis 11 such that it is pivotable in the first catch recess 1122 and is pretensioned by the tension spring 14 in the downward direction, thus toward the locking position.

The second arm portion 134 in fig. 10 has on its proximal end a free, second pin element 1340, which projects toward the second side bracket 113 and which is configured to engage in the second catch recess 1132 of the second side bracket 113, and there likewise engages in a further pivot bearing 135 (see fig. 3). The catch 13 is thus mounted pivotably, and substantially perpendicularly to the bottom bracket 111, in the frame 11. A further, second catch bracket 1341, protruding toward the second side bracket 113 and from the catch 13, serves as an upper stop for a toggle lever of the Bowden control 15 (see below).

The arm portions 133, 134 have a bending zone 1333, 1343.

Proximally alongside the protruding catch portion 131 are provided through openings 1310, 1311 through the catch 13, into which tongues project, from below, with latching bosses of sliding plate elements 1312 and are latched in place on the top side (see also fig. 2). These sliding plate elements 1312 are made, for instance, of polyoxymethylene, in particular of POM–500 AV (for instance Delrin® 500 AF) or polyethylene, in particular of UHMW–PE (for instance GUR®).

Between the first and the third side bracket 112, 114 are arranged two first and second installation dummies 1610, 1620, which are arranged side by side and are screwed to the bottom bracket 111 via countersunk screw connections 163, in which a first geared motor 161 and a second geared motor 162, respectively, are mounted (see fig. 3). The geared motors 161, 162 are electric motors, preferably having a transmission ratio which is tailored to requirements, for instance between 1:10 and 1:10,000. The motor power amounts, for instance, to between 1 Watt and 200 Watt, preferably 5 Watt.

A first and second motor shaft 1611, 1621 of the first and second geared motor 161, 162, respectively, run parallel to each other and project out of the interior of the chassis 11

and perpendicularly through and beyond the bottom bracket 111. On those shaft portions 1611, 1621 which project outward over the bottom bracket 111 through recesses 1111, a first and second rotary lever 171, 172, respectively, are arranged in a rotationally secure manner (see fig. 2).

The rotary levers 171, 172 are configured as two-armed levers having respectively a first lever arm 1711 and 1721 and an opposite second lever arm 1712 and 1722 (see fig. 3). The rotary levers 171, 172 are secured to the respective motor shaft 1611, 1621 via a cylinder screw 173. The fixing screws 173 reach through the respective rotary lever 171, 172 transversely to the corresponding motor shaft 1611, 1621.

On the bottom bracket 111 are arranged, per rotary lever 171, 172, respectively two cylindrically shaped and damping buffer stops 1110, which are screwed to the bottom bracket 111 and project outward from there, as rotary movement limiters of the respective first lever arm 1711 or 1721. The two buffer stops 1110 are arranged such that the rotary lever 171, 172 can execute, out of a first horizontal stop position according to fig. 2, a rotation of, for instance, 1° to 5° beyond the vertical direction V, thus a rotation of, for instance, 91°–95°. This allows the rotary levers 171, 172 to lie, in the vertical position, in a dead center position.

The second lever arm 1712, 1722 has a rounded end face for contact against the respective sliding plate 1312, thus protrudes out of the horizontal in the rotational direction of the lever. The rotary lever 171, 172 is thus configured as an eccentric element, so that, in the first stable first position, the rotary lever 171, 172 rests against the upper buffer stop 1110, thus in the horizontal position according to fig. 2, and the sliding plate elements 1312, when the catch 13 is in the lower closing setting, rest against the end face of the second lever arm 1712, 1722 under the tension of the tension spring 14. Upon a rotation of the first lever arm 1712, 1722, the rotary lever 171 or 172 is pivoted through somewhat more than 90° relative to the opposite lower buffer stop 1110 into the second position, the vertical position, the second lever arm 1712 or 1722, which slides along the sliding element 1312, due to its eccentrically round shape, forces the sliding plate element 1312, and thus the catch 13, successively away from the shaft 1611, 1621 of the motor 161 or 162, so that the catch 13 is pivoted in the pivot bearings 135 and the catch portion 131 makes its way out of the locking position (continuous reference symbol line in fig. 12) upward into an unlocking position (dashed reference symbol line 13 in fig. 12) which releases the carriages 40. Figure 12 thus shows the catch 13 in both settings relative to the

hook elements 80 of the carriages 40.

In this case, the rotation of the rotary levers 171, 172 into the vertical position through somewhat more than 90° has the effect that the rotary lever 171, 172, in the second position, lies in said dead center position. Thus, the geared motor 161 or 162, neither in the first position (horizontally oriented rotary lever 171, 172 lying against the upper buffer stop 1110 and catch 13 lying on the upper edge of the frame 11 or indirectly against the buffer 1110), nor in the second position (vertically oriented rotary lever 171, 172 in dead center position against the lower buffer stop 1110), are has to expend energy in order to hold the position, which is advantageous from an energy-efficient and safety aspect.

In addition, it is evident from the drawings that the rotary levers 171, 172 can be skeletonized, which saves on material. The rotary levers 171, 172 can be produced, for instance, by a zinc die casting process.

Limiting the interior of the U–shape of the chassis 11 in the direction of the rear side is arranged a main circuit board 18, which extends between the first and the second side bracket 112, 113 and parallel to the bottom bracket 111 of the chassis 11. The circuit board 18 is shown in fig. 3 and in **figures 7 & 8** and is connected via screw connections 183 to the installation dummies 1610, 1620 or the motors 161, 162. The motor shafts 1611, 1621 breach the circuit board 18 and project over the outer face of the circuit board. Onto these protruding portions is respectively mounted an actuating lever 181, 182, which is clamped via a retaining ring 184 to the corresponding shaft 1611, 1621. The first and second actuating lever 181, 182 are respectively of one-armed design, wherein, in the free end of the arm, a permanent magnet 185, which casts its magnetic field toward the circuit board 18, is accommodated.

Since the actuating levers 181, 182 are now – like the rotary levers 171, 172 – fitted in a rotationally secure manner on the respective motor shaft 1611, 1621, the actuating levers 181, 182 have the same range of movement, thus are also rotatable through somewhat more than 90° between the buffer stops 1110. In the end settings of the actuating levers 181, 182, an outer Hall sensor 186 is respectively fitted between permanent magnet 185 and circuit board 18. Correspondingly, respectively two outer Hall sensors 186, which are assigned to the end positions and are circularly arranged, are provided per actuating lever 181, 182. Conductor paths 187 for the operation of the Hall sensors 186 are visible. In order to provide a pre-end stop circuit, between the outer Hall sensors 186 are respectively arranged two inner Hall sensors 188, which alert the electronics unit of the

carriage locking mechanism 10 that the lever 181, 182 is approaching one of its end positions.

In addition, on the circuit board 18 are provided further electronic components such as microcontroller 189 and print socket 1890 and the like.

Via the print socket 1840, an energy storage device 21, 22 can be plugged in. As the energy storage devices 21, 22 there are provided two independent, thus redundant capacitors 21, 22 having an adequate capacity of 5,000 microfarad to 100,000 microfarad, which are arranged on a separate circuit board 200 (see **Figure 11**). The energy storage device 21, 22 supplies energy, which can be fed to the geared motors 161, 162, wherein the energy for up to three unlocking or locking movements, with an energy charge. In this case, exactly one capacitor 21 or 22, respectively, is assigned to each geared motor 161, 162.

Via the print socket 1890, the power supply and communication with the main control system is realized.

As a further manual unlocking option, a Bowden control 15 having an elbowed unlocking lever 151 is provided, as is now described with reference to **Figures 4–6**. The unlocking lever 151 is pivotably mounted on a rotary shaft 152 under the second catch bracket 1341 of the catch 13 on the third bottom bracket 111 in the chassis 11. A first toggle lever arm 1511 herein projects downward and has two receptacles 153 for two Bowden control cables 154, 155. The receptacles 153 are respectively provided with adjusting screws 156, with which the Bowden control 15 is adjustable. The Bowden control cables 154, 155 run respectively in the through the undercuts of the first and third recesses 1121, 1141 of the first and third side brackets 112 and 114, respectively. The pull cables 154, 155 are screwed to the third side bracket 113 via hexagon nuts 157, wherein between the nuts 157, situated close to the toggle lever, and the first toggle lever arm 1511 are clamped one or two compression springs 158, which clamp the unlocking lever 151 into the starting position (closed setting) (see fig. 4). The second toggle lever arm 1512 projects upward from the rotary shaft 152 and provides a contact portion 1513, which is in contact with the lower face of the second catch bracket 1341 (figures 5, 6).

If now the Bowden control 15 is activated, then the compression springs 158 are compressed and the unlocking lever 151 is pivoted about the rotary shaft 152 out of the starting position (fig. 6) into the actuating position (fig. 5), whereupon the contact portion 1513 presses upward against the second catch bracket 1341 and thus pivots the catch 13

out of the locking position against the tension spring 14 into the unlocking position.

A further microswitch assembly 19 for monitoring the unlocking lever 151 is secured via a screw connection 193 and a holder plate 194 to the bottom bracket 111, wherein supply lines 195 are provided to control the assembly 19.

Figures 13 and **14** show a further embodiment comprising a push rod locking mechanism having two push rods 6, which run along the main closing edges 20, 30 in the respective panel 2 or 3. The panels 2, 3 are displaceably mounted on respectively two carriages 40 in the profile rail 4 and shown in the closed setting. The carriage locking mechanism 10 is now fitted in the middle of the profile 4 and coupled with the push rods 6 in an upper portion 61, for instance via a bayonet fastening, such that a movement of the locking element 13 out of the locking position according to fig. 14 into the unlocking position according to fig. 13 pulls the rods 6 vertically upward along with it. In the locking setting according to fig. 14, the system 1 is locked, since the push rods 6 engage positively, with free ends 62, in ground recesses 600 in the ground 60 for a multipoint locking. These ground recesses 600 can be appropriately reinforced. If there is now an unlocking, then the catch 13 moves upward and pulls the push rods 6 vertically upward out of the ground recesses 600, see fig. 13. At the same time, the mechanical coupling between the catch 13 and the push rods 6 is undone such that the panels 2, 3 can be pivoted or slid open. In this case, the push rod 6, in the closed setting, prevents the inner hinged panels from being swung out and the outer sliding panels 2, 3 from being slid open.

Additionally or alternatively, the push rods 6 can also effect a locking along the main closing edges 20, 30. **Figures 15** and **16** show a locking mechanism having a single push rod 6 and a middle swing bolt 63, which is attached to the main closing edge 30.

In fig. 15, the catch 13 is in release setting, whereby the push rods 6 are pulled up and the hook element 63 coupled with the push rod 6 is not in engagement with the mating element on the other main closing edge 20; the door is thus unlocked.

In fig. 16 the catch 13 is in the closed setting, whereby the push rod 6 moves the hook element 63 for engagement in the other main closing edge 20 and thus locks the door. Thus only one push rod 6 is necessary. There can also be provided a plurality of hook elements 63 over the main closing edge 20, 30, and/or a plurality of push rods 6. Also on both closing edges 20, 30 there are provided swing bolts 63, which are configured for engagement in the respectively other closing edge 30, 20. Moreover, a ground engagement with the push rod(s) 6, as mentioned above, can be realized.

Correspondingly, along the main closing edges 20, 30 a simple and cost-effective multipoint locking mechanism, which can reach into the ground 60, can thus be realized. No middle locks are necessary for this, which allows for example the enlargement of a glass area of the door leaf, since no middle lock has to be integrated.

Also on secondary closing edges 21, 31 (see fig. 1), the sliding panels can be locked via locking elements by way of one or more push rods 6.

Instead of a door system 1, the present invention can also relate to a window system, wherein the panel is then a window panel and not a door panel.

It should be noted that a locking mechanism for a sliding door system 1 without carriage 40 can have the same construction, wherein the second locking element is then fastened directly or indirectly to the door panel 2, 3. The second locking element can, for instance, also be a push rod 6, which runs along the main closing edge of the door and reaches, in the locking position, into a recess in the ground, wherein the push rod, upon the unlocking movement, is pulled out of the ground recess, so that the door is unlocked.

REFERENCE SYMBOL LIST

1	sliding door system	1141	third recess
2, 3	sliding panel		
20, 30	main closing edge	12	microswitch element
21, 31	secondary closing edge	121	screw
4	running profile	122	cable
40	carriage		
5	building opening	13	catch
		131	catch portion
10	carriage locking mechanism	1310,1311	through opening in 13
		1312	sliding plate element
11	chassis		
111	bottom bracket of 11	132	catch opening
1110	buffer stop		
1111	recess for motor shaft	133	first arm portion of 13
1112	assembly recess	1330	first pin element
112	first side bracket of 11	1331	first catch bracket
1121	first recess	1332	through hole
1122	first catch recess	1333	bending zone of 133
1123,1124	recess for 12		
1125,1126	fastening recesses	134	second arm portion von 13
1127	further recess	1340	second pin element
1128	lateral projection	1341	second catch bracket
1129	fastening bracket	1343	bending zone of 134
113	second side bracket of 11	135	pivot bearing
1132	second catch recess		
1138	lateral projection	14	tension spring
1139	fastening bracket	140	coil region of 14
		141	first leg of 14
114	third side bracket of 11	142	second leg of 14

15	Bowden control
151	unlocking lever
1511	first toggle lever arm
1512	second toggle lever arm
1513	contact portion of 1511,1512
152	rotary shaft
153	receptacle
154,155	pull cables
156	adjusting screw
157	hexagon nut
158	spring
161	first geared motor
1610	installation dummy for 161
1611	shaft of 161
162	second geared motor
1620	installation dummy for 162
1621	shaft of 162
163	screw connection to 111
171	first rotary lever
1711	first lever arm of 171
1712	second lever arm of 171
172	second rotary lever
1721	first lever arm of 172
1722	second lever arm of 172
173	fixing screw
18	circuit board with electronics unit
181	first actuating lever
182	second actuating lever
183	screw connection
184	retaining ring
185	permanent magnet
186	outer Hall sensor
187	conductor path
188	inner Hall sensor
189	microcontroller
1840,1890	print socket
19	monitoring assembly for 151
193	screw connection
194	holder plate
195	line
21	first electrical storage device
22	second electrical storage device
200	circuit board
6	push rod
60	ground
600	ground recess
61	carriage-locking-side portion of 6
62	carriage-locking-remote portion of 6
63	swing bolt
8	carriage wheel
80	hook element
D	direction of passage
S	closing direction
V	vertical direction

Patentkrav

1. Låseindretning (10) til mindst en skydefløj (2;3) til kontrol af en bygningsåbning (5), omfattende:
et første låseelement (13), som er monteret bevægeligt;
en aktiveringsindretning (161;162) til bevægelse af det første låseelement (13) mellem en oplåsningsposition og en låseposition;
hvor aktiveringsindretningen (161;162) er et rotationsdrev,
kendetegnet ved, at
låseindretningen (10) omfatter to eller flere sådanne rotationsdrev (161,162).

2. Låseindretning (10) ifølge krav 1, hvor rotationsdrevet (161;162) er en elektrisk motor, især en gearmotor.

3. Låseindretning (10) ifølge krav 1 eller 2, endvidere omfattende et forspændingselement (14), som er udformet og anbragt på en sådan måde, at det første låseelement (13) er i forspænding i låsepositionen og/eller i oplåsningspositionen.

4. Låseindretning (10) ifølge et af kravene 1 til 3, som har et excenterelement (171;172), som er monteret således, at det er drejeligt via rotationsdrevet (161;162), hvor excenterelementet (171;172) ved hjælp af rotationsdrevet (161;162) kan bevæges mellem en første og en anden position, og hvor excenterelementet (171;172) er udformet og anbragt på en sådan måde, at excenterelementet (171;172) ved bevægelsen til den første position indvirker på det første låseelement (13) således, at det første låseelement (13) bevæger sig til låsepositionen, og ved bevægelsen til den anden position indvirker på det første låseelement (13) således, at det første låseelement (13) bevæger sig til oplåsningspositionen.

5. Låseindretning (10) ifølge krav 3 og 4, hvor forspændingselementet (14) forspænder låseelementet (13) mod virkningen af excenterelementet (171, 172).

6. Låseindretning (10) ifølge krav 4 eller 5, hvor excenterelementet (171;172) ligger i et dødpunkt, når det første låseelement (13) er i låsepositionen og/eller i oplåsningspositionen.

7. Låseindretning (10) ifølge et af kravene 1 til 6, hvor de to eller flere rotationsdrev (161;162) er udformet redundant og fortrinsvis uafhængigt af hinanden er udformet til bevægelsesindvirkning på det samme første låseelement (13), hvor fortrinsvis hvert rotationsdrev (161;162) respektivt indvirker på det første låseelement (13) via et tilhørende excenterelement (171,172).

8. Låseindretning (10) ifølge et af kravene 1 til 7, som yderligere omfatter en eller flere fortrinsvis autarkiske elektroakkumulatorer (21;22), fortrinsvis en kondensator, til nødbevægelse af det første låseelement (13) mellem låsepositionen og oplåsningspositionen.

9. Låseindretning (10) ifølge krav 8, som fortrinsvis omfatter flere redundante elektroakkumulatorer (21,22), hvor et maksimalt energiindhold i en eller flere af elektroakkumulatorerne (21,22) er tilstrækkeligt for mindst en, fortrinsvis mindst to, især nøjagtigt tre nødbevægelser af det første låseelement (13) fra låsepositionen til oplåsningspositionen eller omvendt.

10. Låseindretning (10) ifølge et af kravene 1 til 9, som yderligere omfatter en eller flere manuelle oplåsninger (15), især mindst et eller nøjagtigt to Bowdentræk, til manuel bevægelse af det første låseelement (13) mellem låsepositionen og oplåsningspositionen.

11. Låseindretning (10) ifølge et af kravene 1 til 10, som har en elektronik (18), hvor elektronikken (18) er indrettet til at foretage en periodisk fejlkontrol af låseindretningen (10), hvor forudbestemte parametre eller parametergrupper kontrolleres i et forudbestemt kontrolinterval i forbindelse med fejlkontrollen, hvor fortrinsvis mindst en første og en anden forudbestemt parameter eller parametergruppe i forbindelse med fejlkontrollen kontrolleres med et første kontrolinterval fra 1 sekund til 30 sekunder, fortrinsvis fra 15 sekunder, eller med et andet kontrolinterval fra 1 time til 48 timer, fortrinsvis fra 24 timer.

12. Låseindretning (10) ifølge et af kravene 1 til 11, hvor elektronikken (18) er indrettet på en sådan måde, at de mindst to rotationsdrev (161,162) kan drives redundant, hvor de mindst to rotationsdrev (161,162) fortrinsvis er udformet til kombineret og/eller skiftevis virkende at bevirke låseaktiveringsprocesser.

13. Computerprogramprodukt til en låseindretning (10) ifølge et af kravene 1 til 12, hvor computerprogramproduktet omfatter en computerprogramkode, hvilken computerprogramkode, når denne er udført i et integreret kredsløb, får det integrerede kredsløb til at bevæge rotationsdrevene (161;162) på en sådan måde, at
- en standarddørfunktion, især en redundant standarddørfunktion, og/eller
- en flugt- og redningsdørfunktion, især en redundant flugt- og redningsdørfunktion, især er realiseret med en funktion "UDGANG låst".

14. Anlæg (1), især døranlæg, omfattende den mindst ene skydefløj (2;3) til kontrol af bygningsåbningen (5), hvilket anlæg (1) omfatter mindst en låseindretning (10) ifølge et af kravene 1 til 12 og fortrinsvis et computerprogramprodukt ifølge krav 13 til låsning af den mindst ene skydefløj (2;3) i en forudbestemt låseposition, hvor anlægget (1) omfatter fortrinsvis to eller flere låseindretninger (10) ifølge et af kravene 1 til 12 og fortrinsvis et computerprogramprodukt ifølge krav 13 til realisering af flere forudbestemte låsepositioner, hvor låseindretningen (låseindretningerne) (10) er respektivt anbragt på en sådan måde, at låsepositionen er en åben stilling, en lukket stilling eller en mellemstilling af skydefløjene (2;3).

15. Anlæg (1) ifølge krav 14, hvor den mindst ene skydefløj (2;3) har en lukkekant (20;30), hvor anlægget (1) omfatter mindst et overføringselement (6), som forløber i det væsentlige parallelt med lukkekanten (20;30), især en skubbestang, hvor overføringselementet (6) på sit afsnit (61), der befinder sig på låseindretningssiden, er funktionsforbundet med det første låseelement (13) og således kan bevæges ved bevægelsen af det første låseelement (13) og er udformet med afsnittet (afsnittene) (62), der befinder sig i afstand fra låseindretningen, til låsning af den mindst ene skydefløj (2;3).

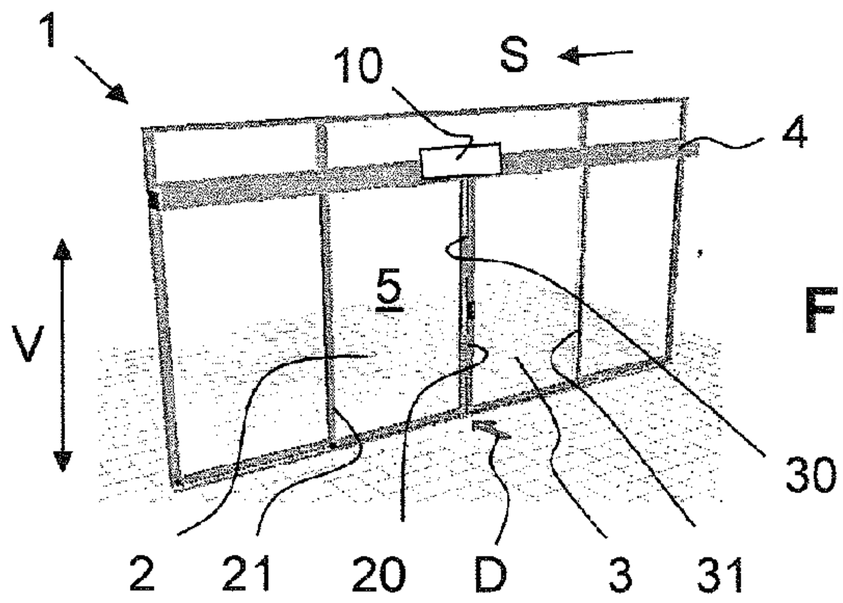

FIG. 1

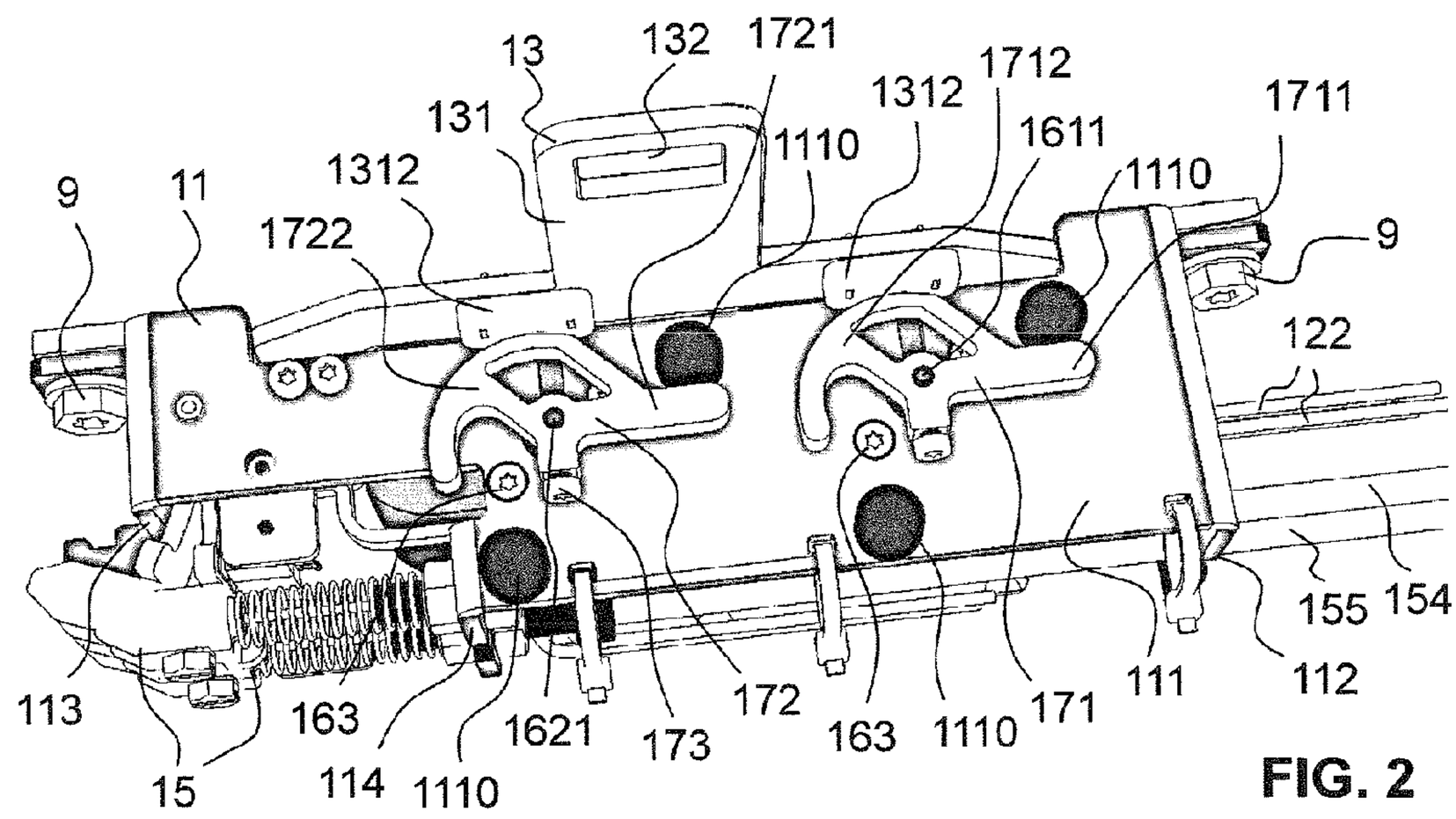

FIG. 2

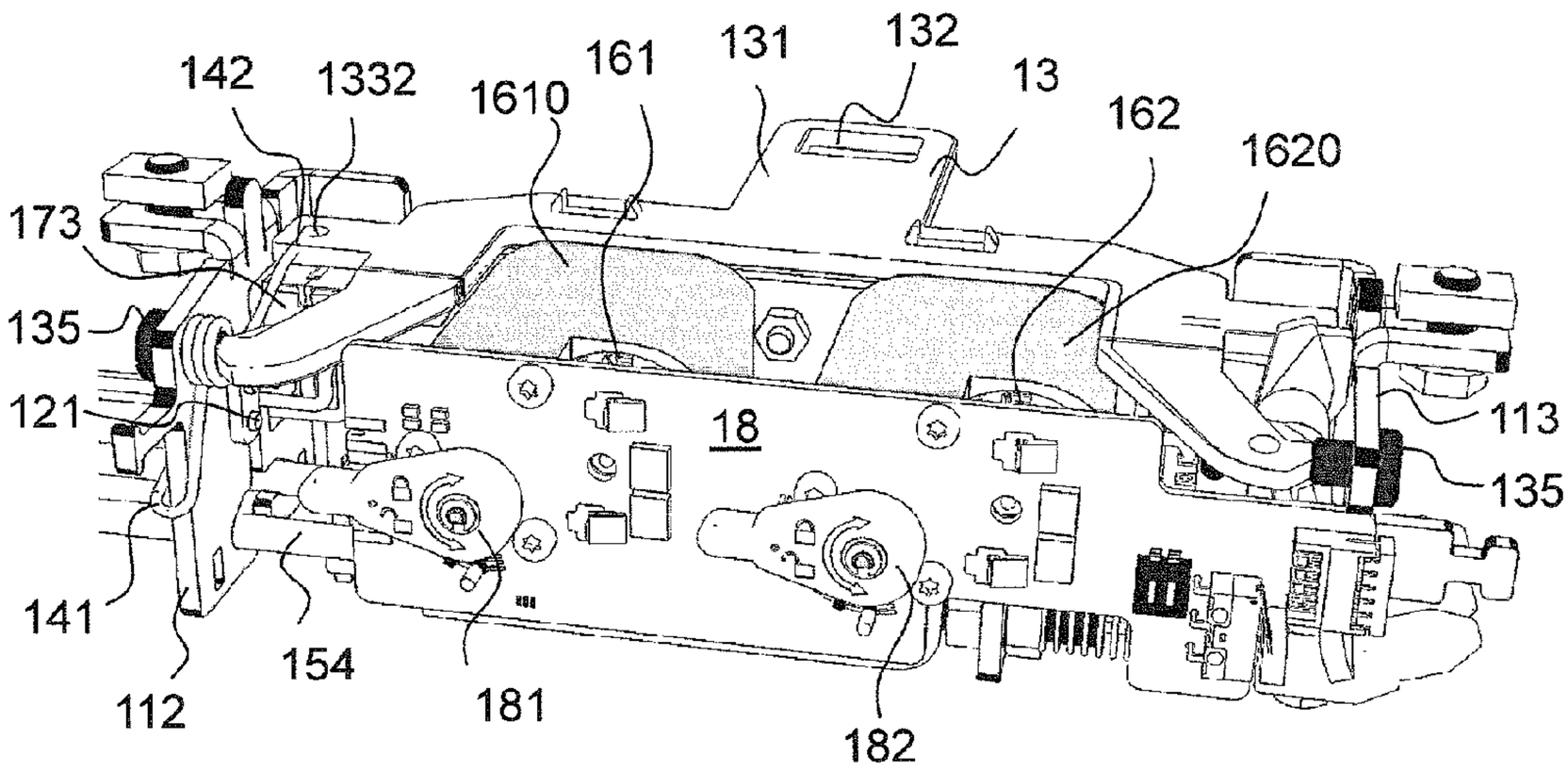

FIG. 3

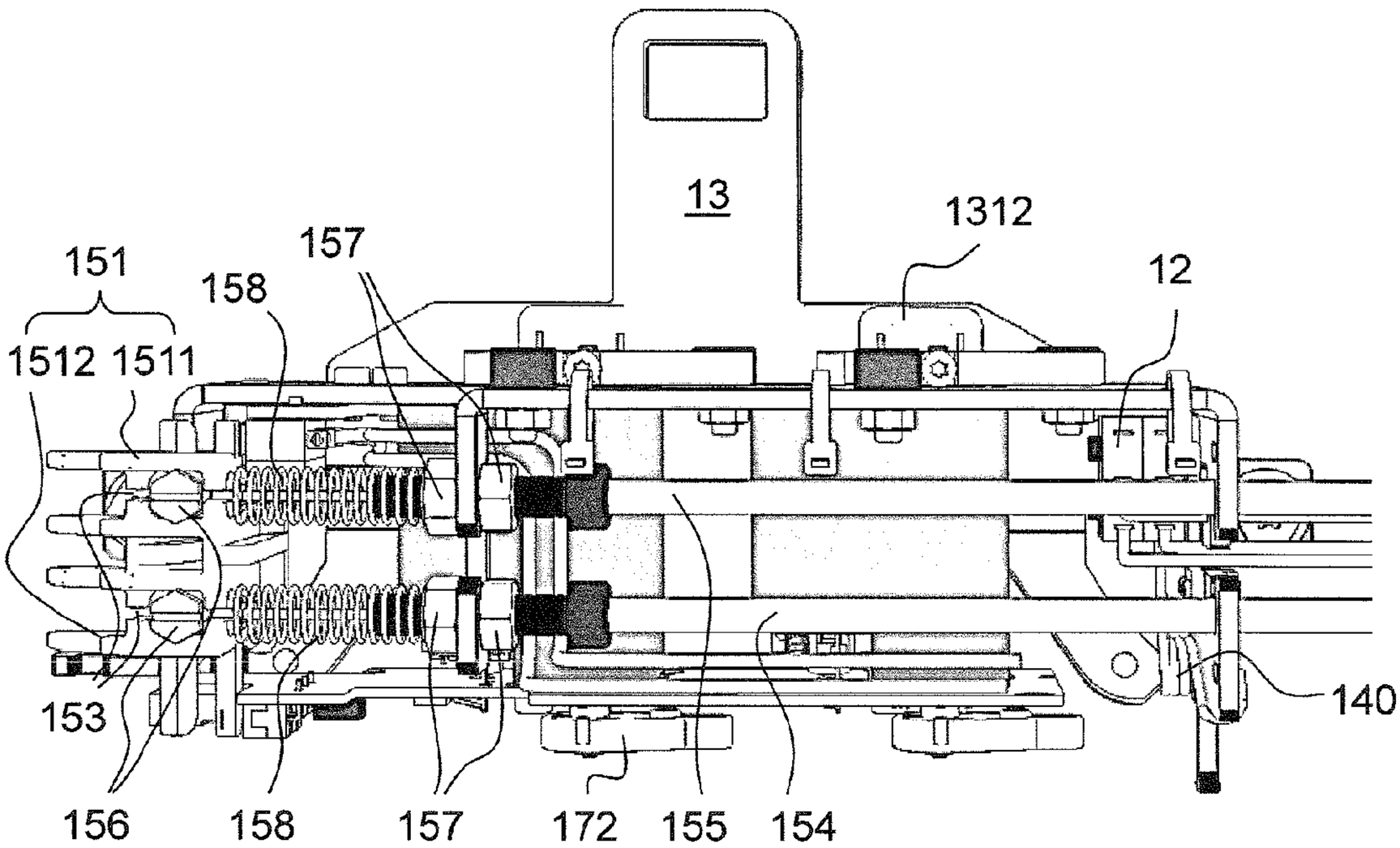

FIG. 4

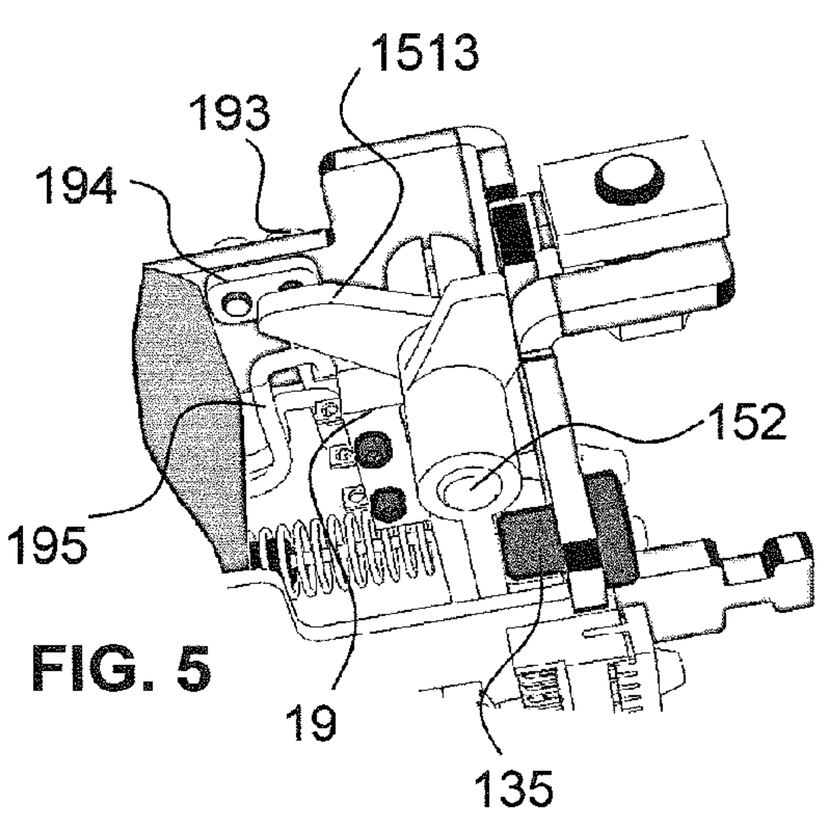

FIG. 5

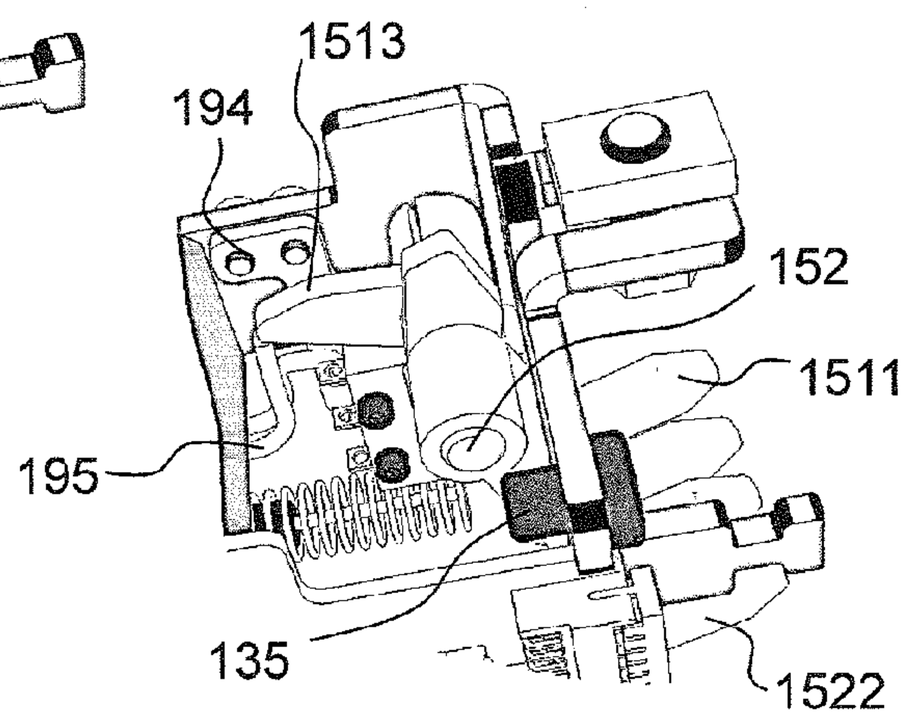

FIG. 6

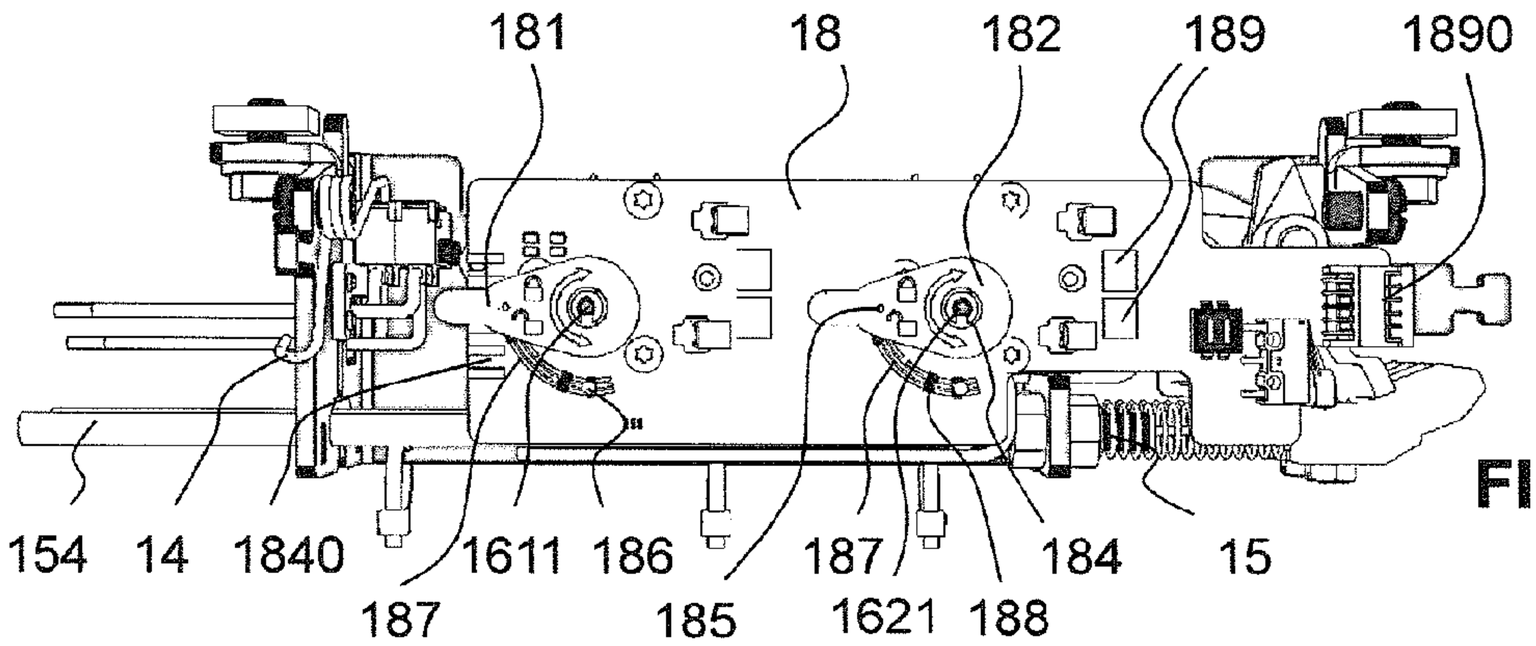

FIG. 7

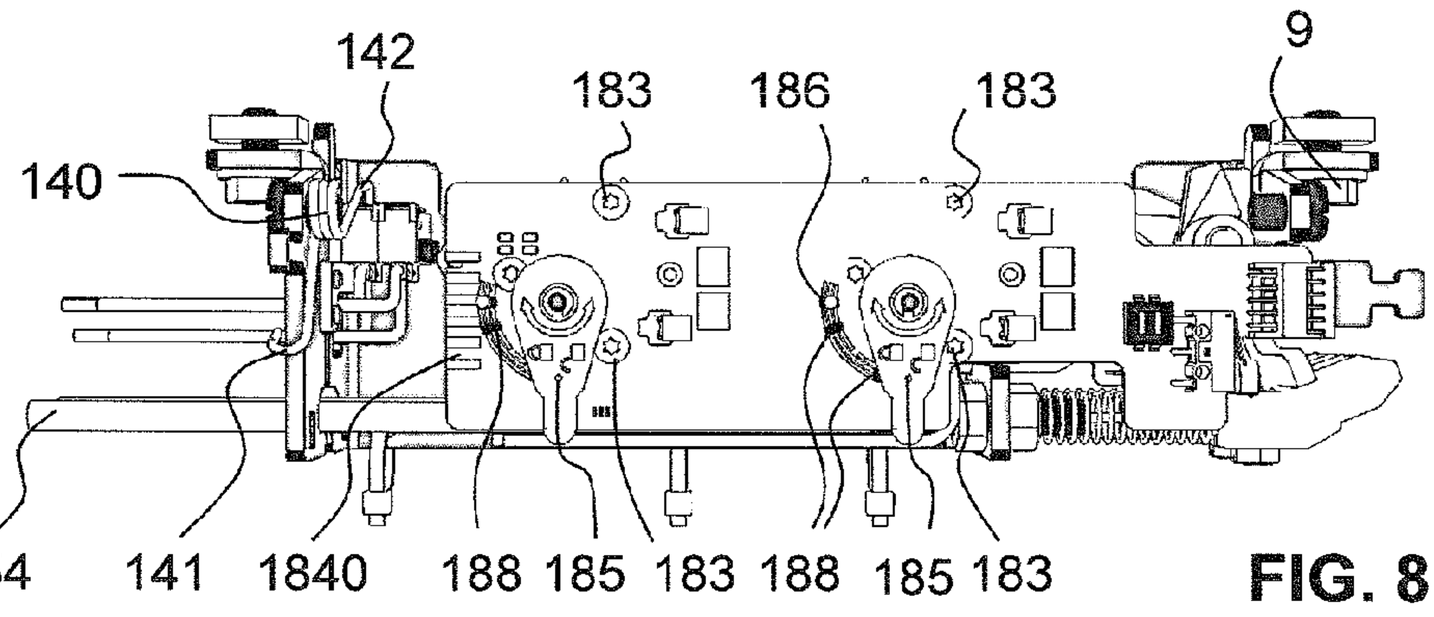

FIG. 8

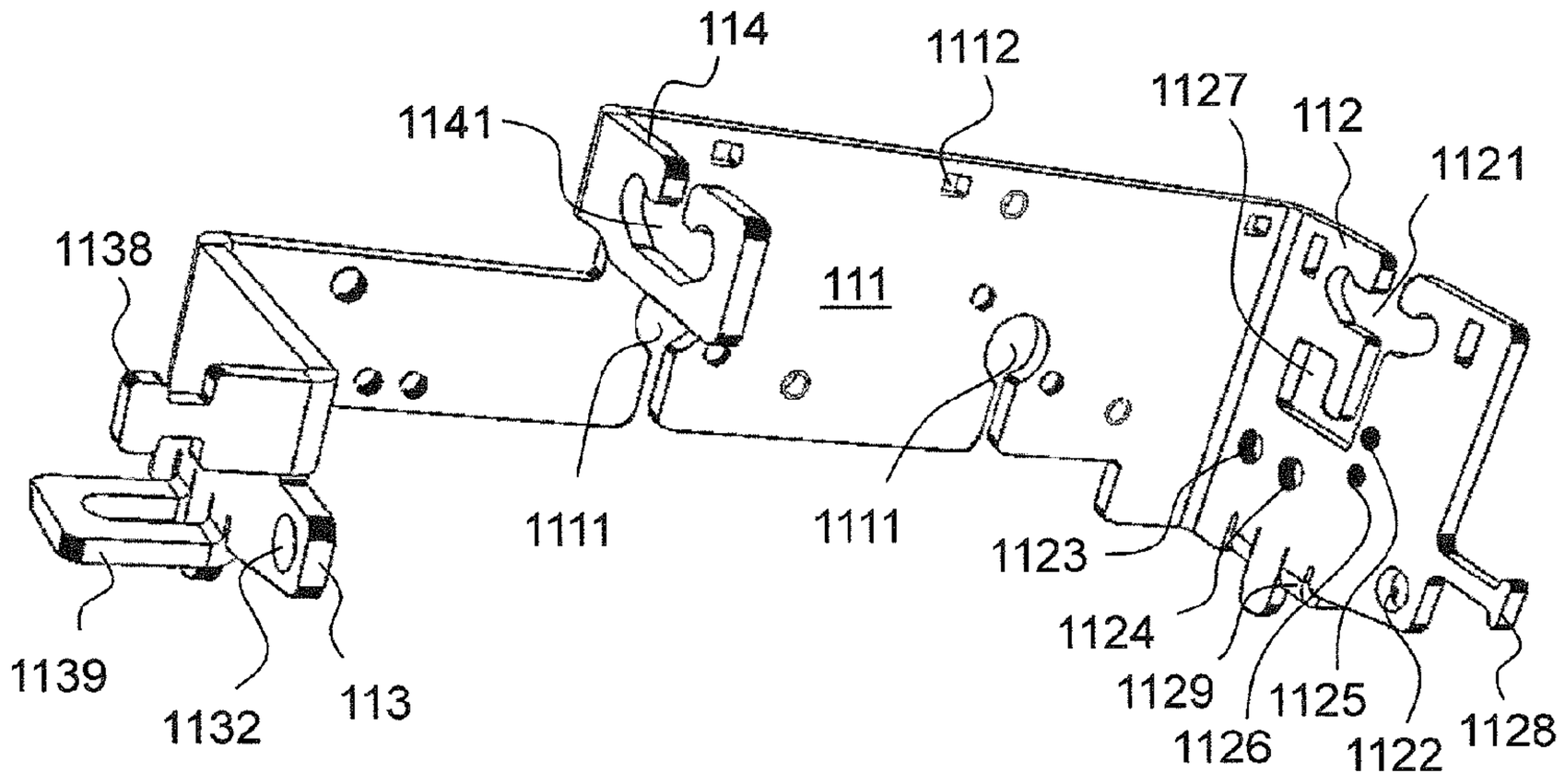

FIG. 9

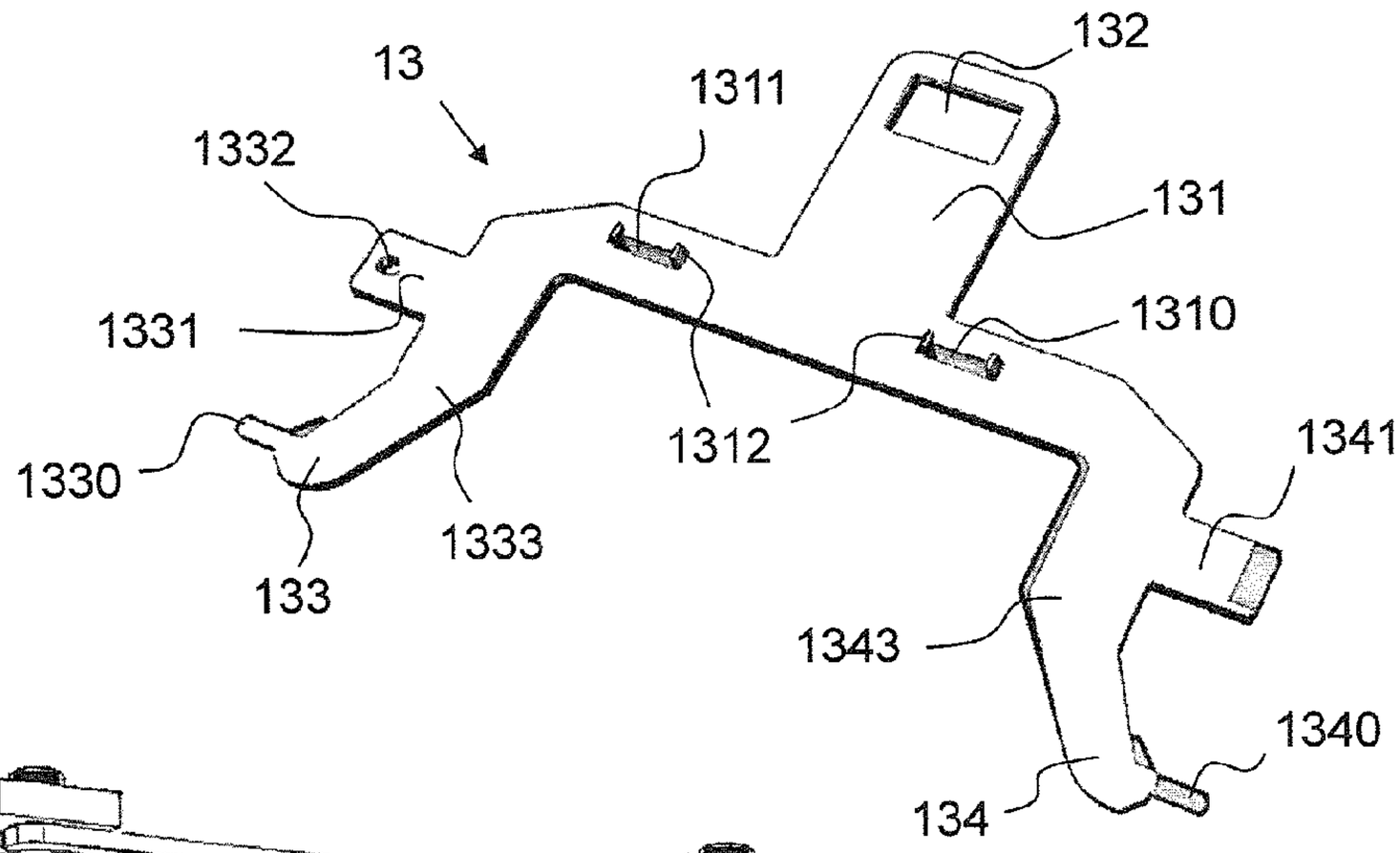

FIG. 10

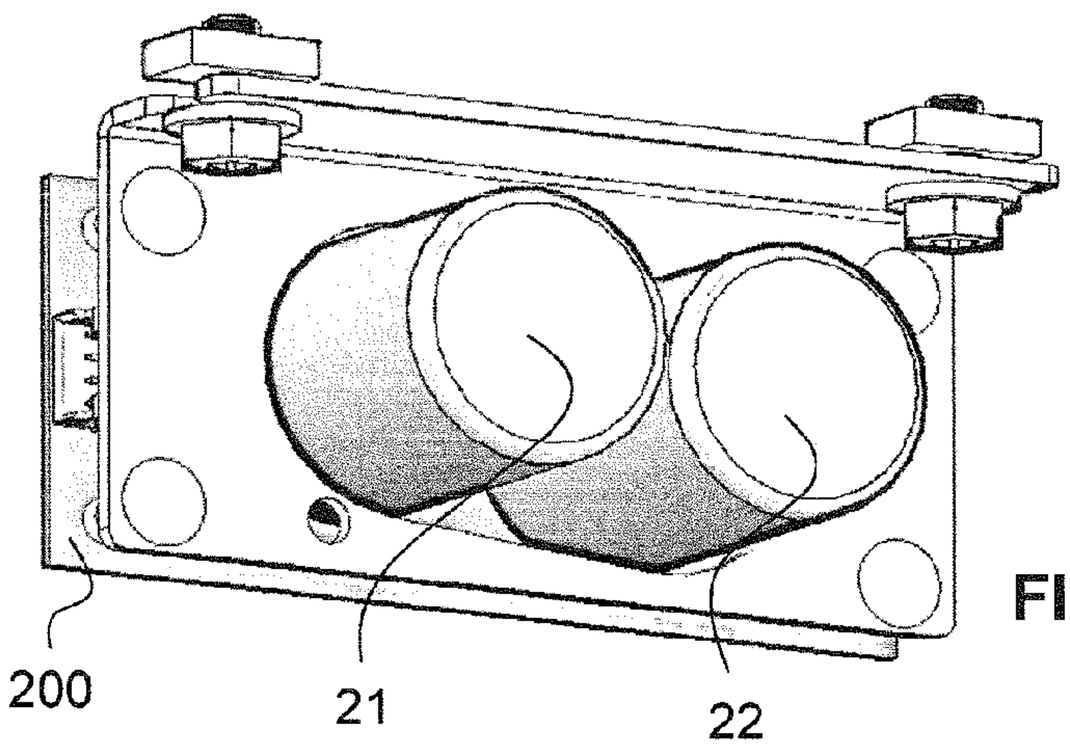

FIG. 11

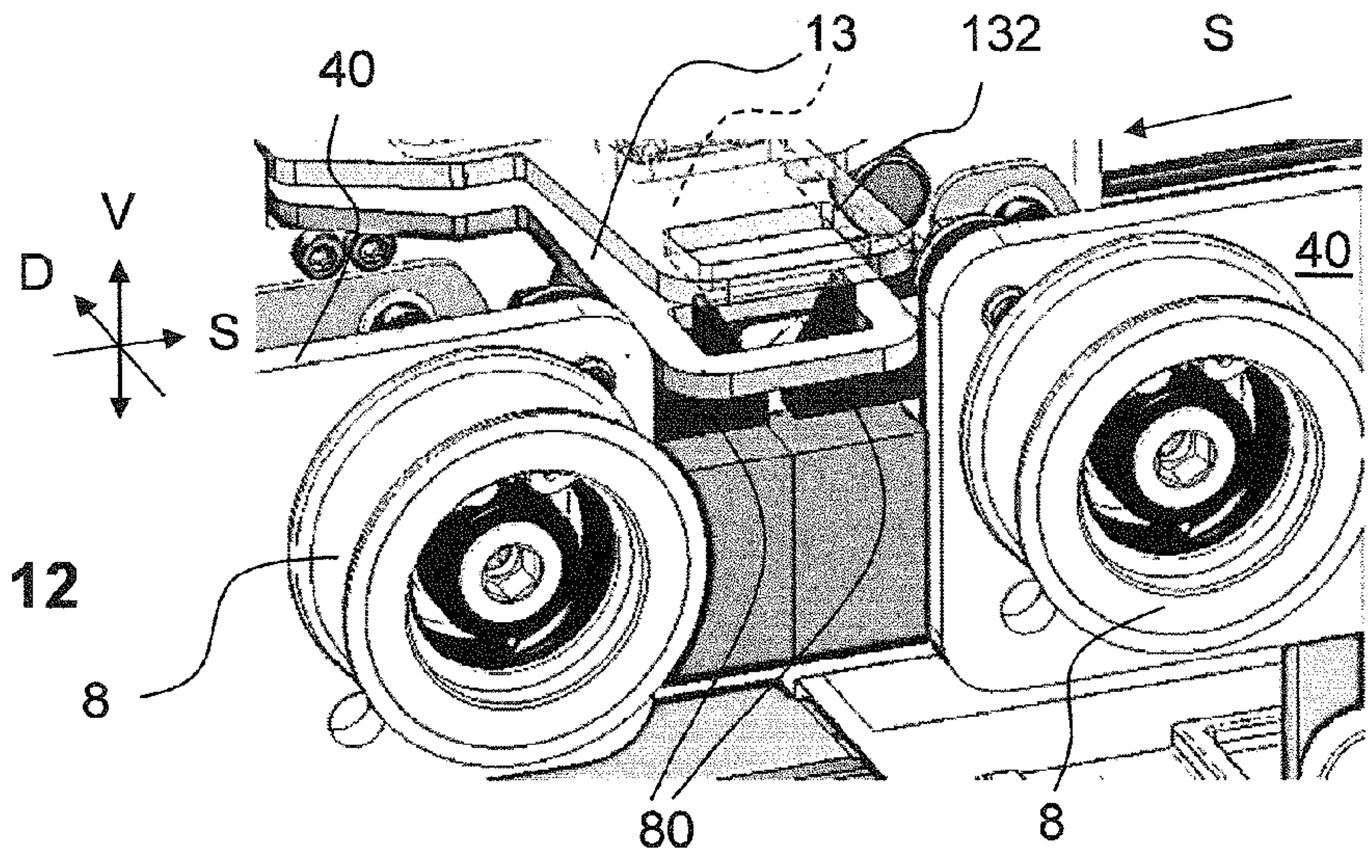

FIG. 12

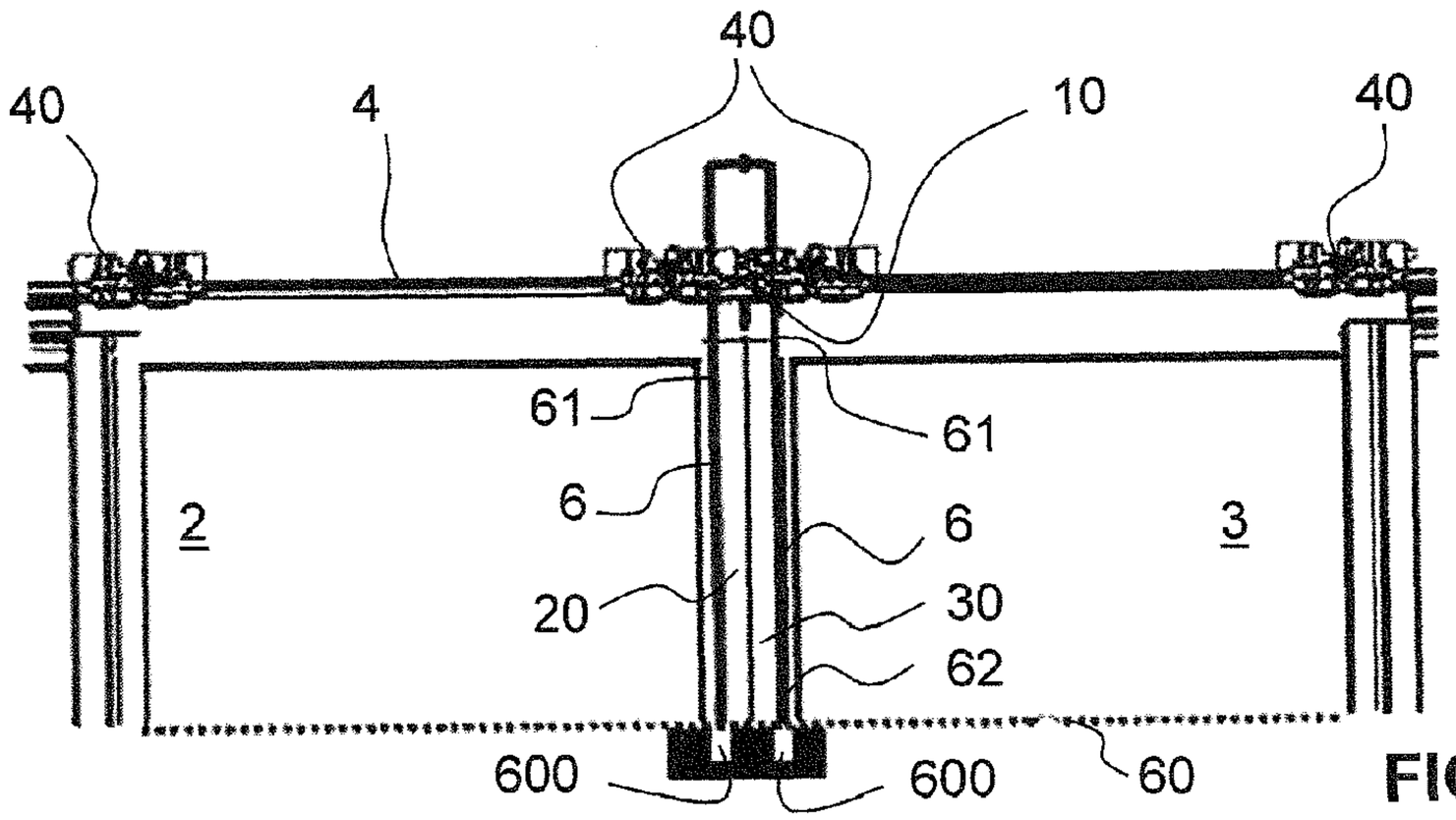
40
40
4
10
40
61
61
6
6
2
3
20
30
62
600
600
60

FIG. 13

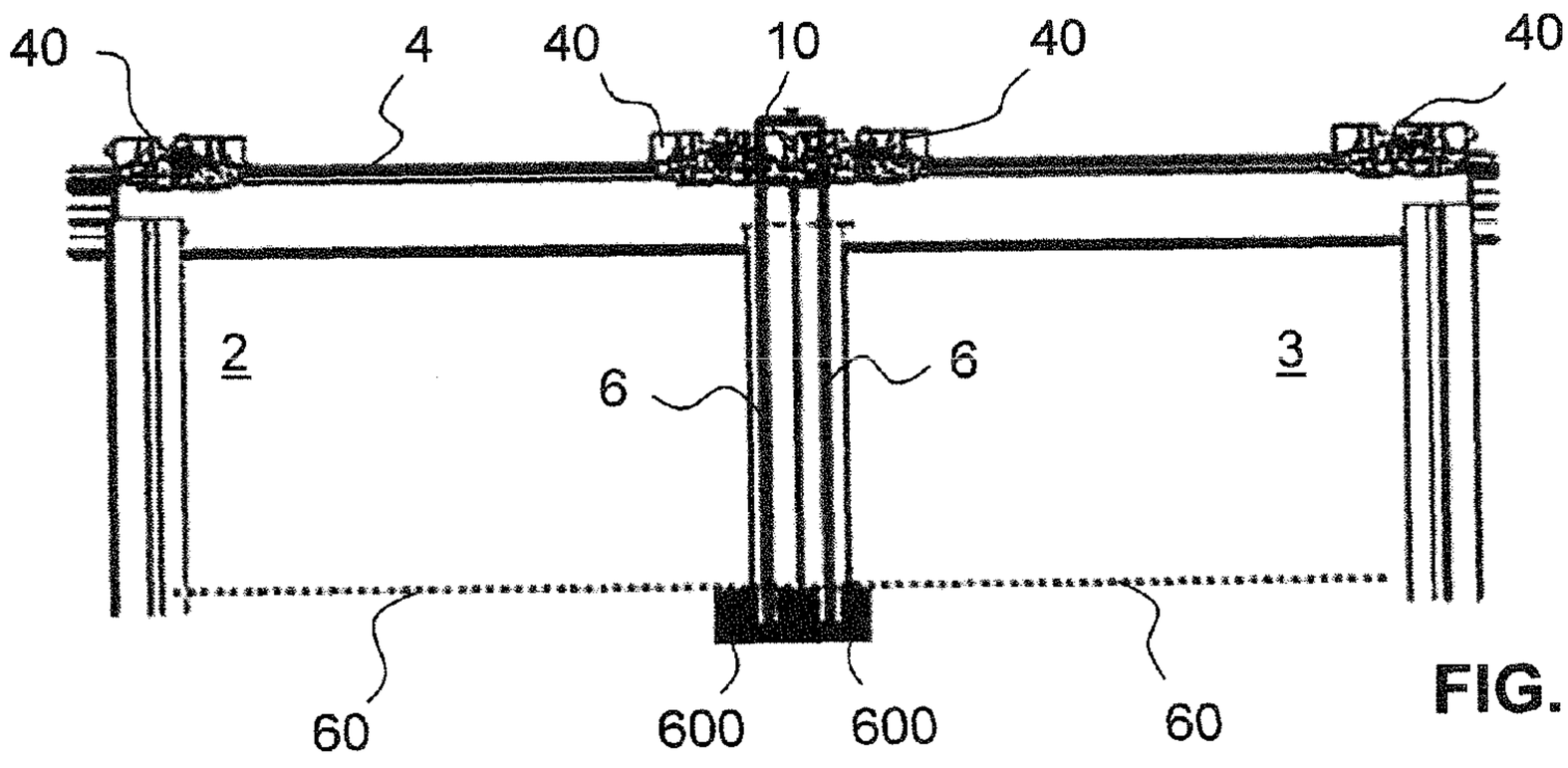
40
4
40
10
40
40
2
6
6
3
60
600
600
60

FIG. 14

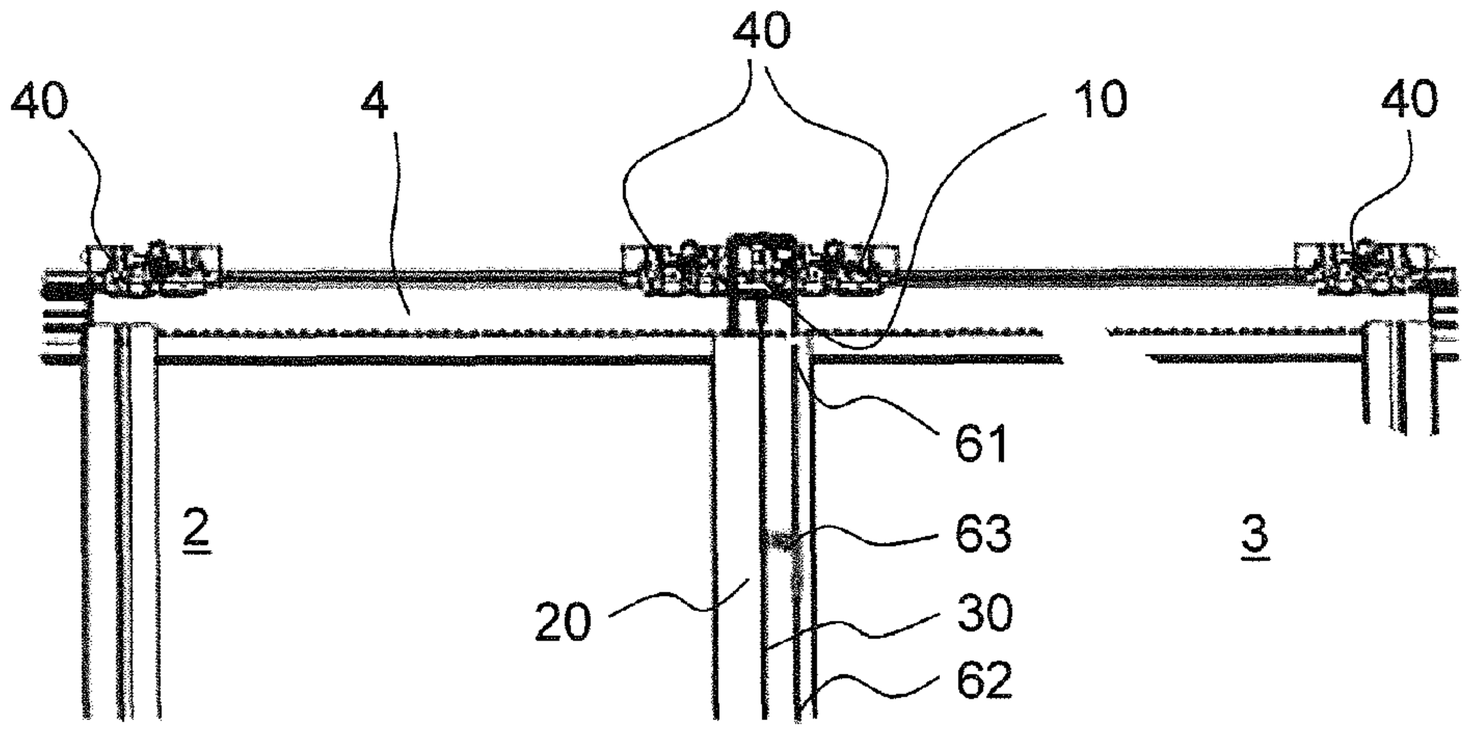

FIG. 15

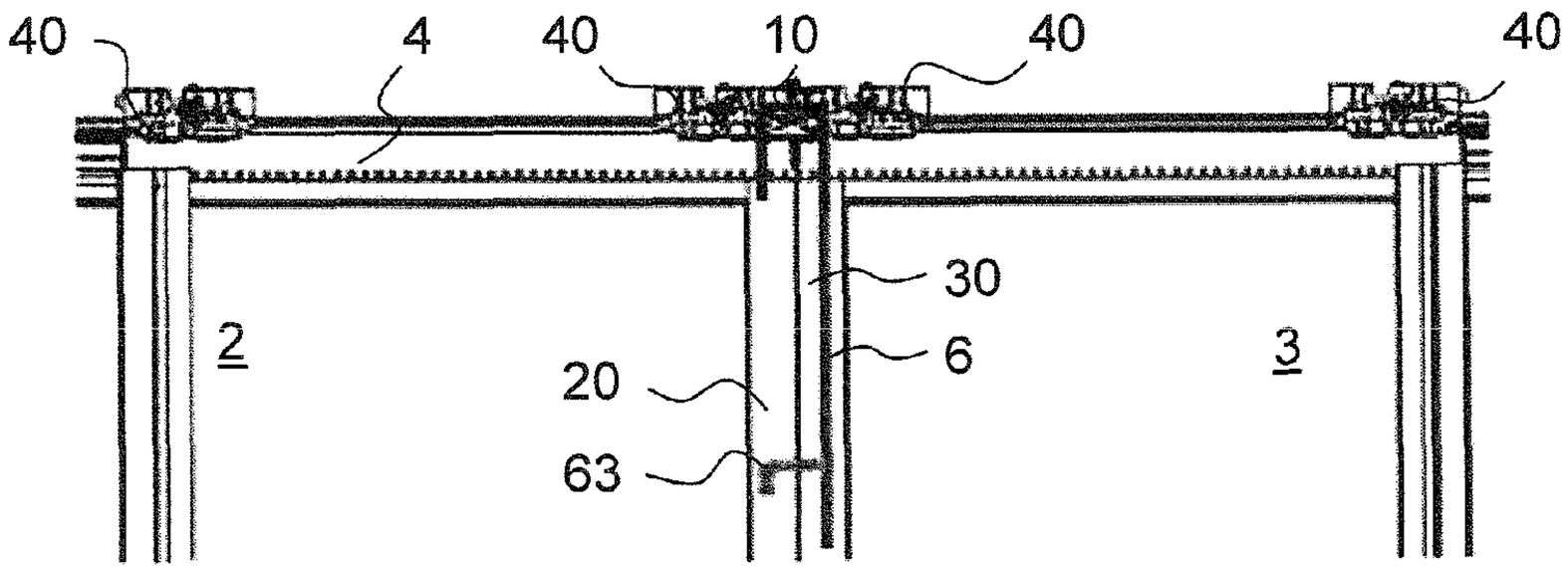

FIG. 16