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(54) **LOCK MECHANISM**

(57) A lock mechanism for locking together first and second relatively moveable components (50,51) comprises a lock body (10) having a bore (31) for receiving a bolt assembly (11) for securing to the two components so that the lock body and bolt assembly are substantially aligned when the components come together. The bolt assembly includes a locking member (36) which carries opposed balls (44) in a transverse bore (43) and which are driven radially outwardly into a groove (22) formed in the bore of the lock body, by an operating pin (18) mounted within the lock body. The locking member (36) is resiliently mounted to have freedom of movement in several directions, to facilitate entry of the locking member into the lock body. A servo motor (26) is arranged to draw the operating pin (18) out of the locking member thereby to allow the balls to move inwardly out of the groove, so releasing the lock.

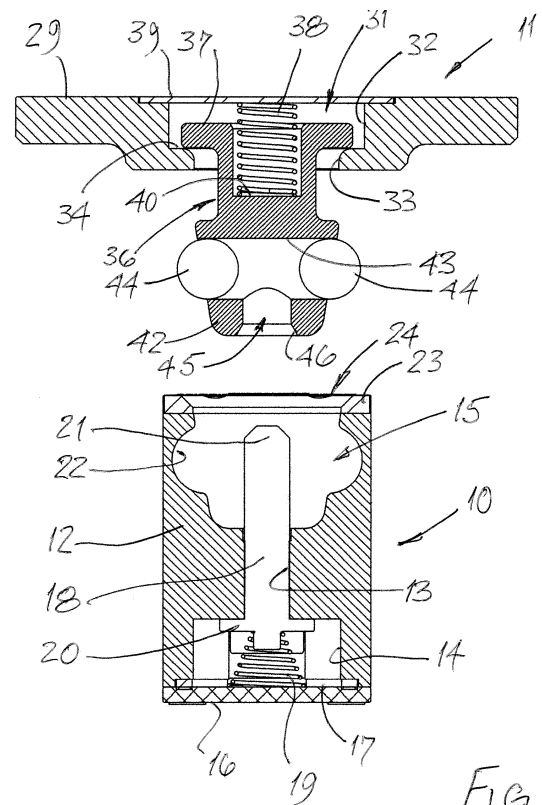


Fig. 1

## Description

**[0001]** This invention relates to a lock mechanism for use with two relatively moveable components, the lock mechanism being configured releasably to lock together those components against relative movement. This invention also relates to a commercial vehicle body provided with such a lock mechanism for locking a door which gives access to the body.

**[0002]** Frequently, there is a need to lock together two relatively moveable components to prevent relative movement, but which lock may be released to allow relative movement once more. For example, a door may be hinged to a door frame and when moved to the closed position, the door is to be locked closed, but may be unlocked to allow opening again. In the case of a hinged door of a building, there is a very large number of lock mechanisms able to fulfil this need. However, if the relative position of one of the components is not well defined relative to the other component (apart from the hinging movement), then the lock mechanism may malfunction. For instance, the relationship between a shutter or roller door and the building may not be precisely defined. Also, a door may be subject to damage, which can change the relationship between the door and the frame.

**[0003]** There is a particular problem with a door of a commercial vehicle body, which is not normally as rigidly constructed as a building; as such, there may be a misalignment between a part of the lock mechanism carried on the door and the part of the lock mechanism on a frame or perhaps a second door of the vehicle body, just consequent from normal use. The door may be subject to wear, and in the case of a roller door or shutter, the door guides may become worn so making the relationship between the door and its frame somewhat variable. Damage may also occur to the door and its frame or guides, so giving rise to possible misalignment of the parts of a lock mechanism provided to lock the door in a closed position. Any such misalignment may result in the lock mechanism malfunctioning, so preventing the door being locked in its closed position and possibly also preventing easy release of the lock mechanism.

**[0004]** A known form of lock mechanism for locking together first and second relatively moveable components has a lock body for attaching to the first component and a bolt assembly for attaching to the second component so as to be opposed to the lock body as the two components come together. The bolt assembly carries at least one ball (but more usually two or three balls) which is moveable outwardly relative to an outer surface of the bolt assembly to project therefrom and the lock body defines an opening for receiving the bolt assembly, the opening having an internal groove for receiving the at least one ball of the bolt assembly when projecting therefrom. An operating pin is carried by the lock body and is received in a bore in the bolt assembly when the two components come together, so as to move the at least one ball radially outwardly into the groove in the

lock body, thereby locking together the lock body and bolt assembly;

**[0005]** Examples of such lock assemblies are described for example in GB2444933 and US6077011. A problem with these assemblies is that the lock body mounted on the first component and the bolt assembly mounted on the second component must be accurately aligned when the two components are moving together, in order to allow locking to take place.

**[0006]** It is a principal aim of this invention to provide a lock mechanism which is able to accommodate a degree of misalignment between the two parts of the lock mechanism which come together as one of the components is moved relative to the other component to a position whereat the components are to be locked together, and to allow unlocking notwithstanding that misalignment.

**[0007]** According to one aspect of this invention there is provided a lock mechanism as described above for locking together first and second relatively moveable components, is characterised in that:

- the bolt assembly includes a locking member which is resiliently biased to a normal position but is moveable away therefrom against the resilient bias, the locking member being provided with the at least one ball moveable outwardly relative to the outer surface of the locking member to project therefrom;
- the operating pin is resiliently biased to a rest position but is moveable axially away from its rest position; and
- there is provided an operating mechanism for driving the operating pin axially away from its rest position so as to move at least partially out of the bore in the locking member when received therein, thereby allowing the at least one ball to move out of the groove in the lock body and so unlock the lock mechanism.

**[0008]** It will be appreciated that the lock mechanism of this invention is able to accommodate a degree of misalignment between the lock body and the bolt assembly as the two come together on relative movement between the two components, such as a door to an opening in a commercial vehicle body. This misalignment is accommodated by the locking member of the bolt assembly having limited degrees of freedom relative the component to which the bolt assembly is attached, whereby the locking member may still enter and lock to the lock body notwithstanding the misalignment. Such a component may be a so-called slam-door of a vehicle body, a roller shutter or other door arrangement. Thus, the lock mechanism of this invention is particularly useful for locking the door of a commercial vehicle body, which often is not constructed to have a high degree of rigidity. Additionally, the lock mechanism will allow unlocking despite that misalignment.

**[0009]** Preferably, the locking member is permitted to move both axially and transversely relative to its normal

position, against the resilient bias acting on the locking member. Further, the locking member may be permitted to move angularly, or rock, relative to its normal position, against the resilient bias acting on the locking member.

**[0010]** To facilitate the entry of the locking member into the opening in the lock body, the locking member may taper from its mounting to the bolt assembly towards the free end of the locking member. In addition, the open end of the opening in the lock body may be is bevelled or flared, to facilitate the entry of the locking member as the two components come together. Advantageously, the operating pin may have a tapered profile at its free end to facilitate the entry of the operating pin into the bore in the locking member as the two components come together.

**[0011]** The operating pin may be constrained to move solely axially, against the resilient bias acting thereon. That bias may be provided by a compression spring acting between the operating pin and the lock body. The operating mechanism is configured to move the operating pin axially away from the locking member to an extent sufficient to allow the at least one ball of the locking member to move radially inwardly. The operating mechanism may simply be mechanical, for example having a key lock appropriately connected to the operating pin. Preferably however the operating mechanism is electrically-powered and drives the pin axially in the direction out of the bore in the locking member. In one embodiment, the operating mechanism includes an electric motor driving a cam, and the cam engages a part of the operating pin so as to move the operating pin axially on driving the motor, to move the operating pin at least partially out of the locking member, so allowing the at least one ball to move out of the groove in the opening in the lock body.

**[0012]** In the case of the operating mechanism having an electric motor, an electrical control should be provided for the motor, to allow the operation thereof when required to release the lock mechanism. At its simplest, a key-operable switch may be provided so that the lock mechanism may be unlocked solely by a person in possession of the appropriate key. In the case of a commercial vehicle, the motor could be linked to a central locking arrangement for the vehicle, to be activated thereby. A further possibility is to provide a motor controller either connected to a vehicle electrical system or having a self-contained battery, the controller requiring the use of an electronic key, perhaps using a wireless radio-frequency or infra-red remote control or fob. Other possibilities include an RFID electronic key, a Bluetooth controller or even an app on a mobile phone. In all such cases it is preferred for the lock mechanism to reset a short time after being released, such that on a subsequent closing of the door, it will be locked in the closed position.

**[0013]** According to a second aspect, this invention extends to a commercial vehicle body having an access opening and a door for closing that opening, in combination with a lock mechanism of this invention as described above, wherein the lock body is secured to the vehicle

body at the opening and the bolt assembly is secured to the door in opposition to the lock body, so that the two come together on moving the door to close the opening.

**[0014]** By way example only, one specific embodiment of lock mechanism arranged in accordance with this invention will now be described with reference to the accompanying drawings, in which:-

Figure 1 is an axial sectional view through the two parts of the lock mechanism, these being a lock body and a bolt assembly;

Figure 2 is an isometric exploded view of the lock mechanism of Figure 1;

Figure 3 is a diagrammatic view of the lock mechanism of Figures 1 and 2, showing the lock body attached to a frame member and the bolt assembly attached to a door hinged to the frame member;

Figures 4A, 4B, 4C and 4D are show the lock mechanism of Figure 1, Figures 4A, 4B and 4C showing the inter-engagement of the bolt assembly with the lock body when there is misalignment therebetween, and Figure 4D showing the release of the lock mechanism; and

Figures 5A and 5B show on an enlarged scale the unlocking action of the lock mechanism.

**[0015]** Referring initially to Figures 1 and 2 there is shown a lock mechanism comprising a lock body 10 and a bolt assembly 11. The lock body 10 adapted for attachment to a door frame (not shown) for example of a commercial vehicle body, the frame defining an opening to the body. The bolt assembly 11 is adapted for attachment to a door (not shown) of the commercial vehicle body, for closing the opening defined by the door frame. When closed, the lock mechanism co-operates with the lock body to lock the door in the closed position.

**[0016]** The lock body comprises a housing 12 defining a through-bore 13 which, at its lower end (in the drawings) opens into a counter-bore 14 and at its upper end into a profiled opening 15 as will be described in detail below. A base plate 16 is bolted to the lower face of the housing 12 so as to close the counter-bore 14, a gasket 17 being fitted into a rebate in the lower face of the housing 12 and serving to seal the base plate to the housing. An operating pin 18 is a sliding fit within the through-bore 13, a conical compression spring 19 acting between the base plate 16 and a flange 20 provided on the pin 18 to bias the pin upwardly so that the flange 20 engages the inner end of the counter-bore 14. The upper end the operating pin 18 lies within the profiled opening 15 and has a frusto-conical form 21.

**[0017]** The profiled opening 15 is generally tapered from its upper end towards the through-bore 13 and has a groove 22 extending circumferentially around the inner

surface of the bore, part way between its ends, that groove being of part-circular cross sectional shape. A top plate 23 is bolted to the housing 12 at the upper end of the profiled opening 15, the top plate having a conical hole 24 aligned with the profiled opening 15.

**[0018]** A support bracket 25 (Figure 2) is attached to the base plate 16 and carries an electric servo motor 26 having an output shaft carrying a cam 27. The cam is disposed above the flange 20 of the operating pin 18 as shown in Figures 5A and 5B. The normal position of the operating pin is shown in Figure 5A with the flange thereof contacting the inner end of the counter-bore 14 (not shown in Figures 5A and 5B) and the cam 27 is disposed above the flange 20 but does not act thereon. Driving the servo motor shaft through 90° turns the cam 27 to the position shown in Figure 5B, so moving operating pin 18 against the action of the spring 19, and moving the flange 20 away from the inner end of the counter-bore 14.

**[0019]** The bolt assembly 11 comprises a mounting plate 29 provided with four holes 30 for attaching the plate to a door of a commercial vehicle body, or some other component with which the lock mechanism is to be used. The mounting plate 29 has a bore 31 having a larger diameter part 32 and a smaller diameter part 33, a rounded shoulder 34 being formed between the two parts. A locking member 36 is disposed in the bore 31, the locking member being a relatively loose fit in the smaller part 33 of the bore and having a flange 37 located in the larger part 32, the flange 37 being of a greater diameter than the smaller diameter part 33 so that the flange cannot pass therethrough. A compression spring 38 acts between a closing plate 39 for the larger diameter part 32 of the bore 31 and the blind end 40 of a bore formed in the locking member 36 whereby the flange 37 is urged into contact with the shoulder 34 between the two parts 33 and 34 of the bore 32.

**[0020]** Adjacent the lower end 42 of the locking member 36 there is a cross-bore 43 in which are located two balls 44, the open ends of the cross-bore 43 being peened over to retain the balls within that bore 43. The lower end 42 itself is rounded as shown and there is a hole 45 extending from the lower end into the cross-bore 43, the entrance to that hole having a bevelled edge 46.

**[0021]** Figure 3 shows the installation of the lock mechanism as described above to a frame member 50 and door 51 of a commercial vehicle body, the door being hinged to the frame member at a remote location not shown in the drawings. Three bolts 52 extend through holes provided in the lock body to secure the body to the frame member 50 and four bolts 53 secure the mounting plate 29 of the bolt assembly to the door 51. When the door is closed as shown in Figure 3, a lip 54 of the door is compressed against a seal 55 provided on the frame member 50 and the locking member 36 is received in the profiled opening 15 of the lock base 10. In this position, the operating pin 18 is located in the hole 45 in the locking member 36 to drive the balls 44 into the groove 22 so locking together the two parts of the lock mechanism.

**[0022]** Figures 4A to 4C show the locking action when the lock body and the bolt assembly and are somewhat misaligned, as the two components come together. The initial position is shown in 4A, with the locking member 36 out of axial alignment with the through-bore 13 in the lock body 10 and the operating pin 18 is urged by the spring 19 to its uppermost position. As the locking member 36 comes into engagement with the top plate 23, the rounded profile of the locking member at its lower end 42 and the conical profile of the top plate 23 causes the locking member to cant over against the action of the compression spring 38, as shown in Figure 4B. At the same time, the bevelled edge 46 at the entrance to the hole 45 is engaged by the conical form at the top of the operating pin 18 so allowing the pin to start entering the hole 45. Continued closing action of the door allows the locking member 36 to move into axial alignment with the profiled opening 15, but out of axial alignment with the bore 32 in the mounting plate 30 as shown in Figure 4C. In this position the operating pin 18 has moved fully between the balls 44, so forcing those balls radially outwardly into the groove 22 and preventing the locking member 36 moving away from the bolt assembly 10. Thus, the bolt assembly and lock body are locked together.

**[0023]** Unlocking of the bolt assembly 11 from the lock body 10 is performed by the servo motor 26 turning the cam 27 from its normal position (Figure 5A) through 90° to a further position where the cam drives the operating pin 18 against the action of the conical spring 19 (Figure 5B), so moving the upper end of the operating pin 18 away from the balls 44, as shown in Figure 4D. This allows the balls to move radially inwardly out of the groove 22 and so release the locking member from the lock body. The door may thus be opened, by hinging relative to the door frame.

**[0024]** Though not shown in the drawings, an electronic controller is provided for the servo motor 26 to supply the appropriate driving current for the motor when the lock mechanism is to be unlocked or is to be reset the after unlocking. Such a controller should be connected to the electrical system of the vehicle and requires the use of a security electronic key such as a RFID remote control or fob. The controller should be configured to respond solely to a signal from the remote control to release the lock mechanism, and also automatically to reset the lock mechanism to its original state a short time after being released. In this way, on a subsequent closing of the door, it will be locked in the closed position without further operator input.

**[0025]** In the foregoing description of the embodiment of this invention, reference has been made to the orientation of the lock body and bolt assembly as shown in the drawings, but it will be appreciated that the lock body and bolt assembly could be installed in any orientation, and not necessarily as illustrated. Also, though reference has been made to a hinged door of a commercial vehicle body, the lock mechanism may find uses in many other circumstances, when a moveable component is to be

locked to a fixed component or even to another moveable component, depending upon the application. For example, it could be used with a sliding door or shutter, again of a commercial vehicle body or some other construction.

### Claims

1. A lock mechanism for locking together first and second relatively moveable components (50 and 51), which mechanism comprises:

- a lock body (10) for attaching to the first component;
- a bolt assembly (11) for attaching to the second component so as to be opposed to the lock body as the two components come together, the bolt assembly carrying at least one ball (44) which is moveable outwardly relative to an outer surface of the bolt assembly to project therefrom;
- an opening (31) defined by the lock body for receiving the bolt assembly, the opening having an internal groove (22) for receiving the at least one ball of the bolt assembly when projecting therefrom; and
- an operating pin (18) carried by the lock body and being received in a bore (45) in the bolt assembly (11) when said two components come together so as to move the at least one ball (44) radially outwardly into the groove (22) in the lock body thereby locking together the lock body and bolt assembly;

#### characterised in that:

- the bolt assembly (11) includes a locking member (36) which is resiliently biased (19) to a normal position but is moveable away therefrom against the resilient bias, the locking member (36) being provided with the at least one ball (44) moveable outwardly relative to the outer surface of the locking member to project therefrom;
- the operating pin (18) is resiliently biased to a rest position but is moveable axially away from its rest position; and
- there is provided an operating mechanism (26, 27, 20) for driving the operating pin (18) axially away from its rest position so as to move at least partially out of the bore (13) in the locking member (36) when received therein, thereby allowing the at least one ball (44) to move out of the groove (22) in the lock body (10) and so unlock the lock mechanism.

2. A lock mechanism as claimed in claim 1, wherein the locking member (36) is permitted to move at least one of axially, transversely and angularly relative to said normal position thereof, against the resilient bi-

as (38) acting on the locking member.

3. A lock mechanism as claimed in any of the preceding claims, wherein the locking member (36) tapers towards the free end thereof.
4. A lock mechanism as claimed in any of the preceding claims, wherein the locking member (36) is biased by a compression spring (19) acting between the locking member and the bolt assembly.
5. A lock mechanism as claimed in any of the preceding claims, wherein the open end of the opening (24) in the lock body is bevelled or flared, to facilitate the entry of the locking member (36) as the two components come together.
6. A lock mechanism as claimed in any of the preceding claims, wherein the operating pin (18) has a tapered profile (21) at its free end to facilitate the entry of the operating pin into the bore in the locking member as the two components come together.
7. A lock mechanism as claimed in claim 6, wherein the operating pin (18) is constrained to move solely axially, against the resilient bias (19) acting thereon.
8. A lock mechanism as claimed in any of the preceding claims, wherein the operating pin (18) is biased by a compression spring (19) acting between the operating pin and the lock body.
9. A lock mechanism as claimed in any of the preceding claims, wherein the operating mechanism (26,27) is electrically-powered and drives the pin (18) axially in the direction out of the bore in the locking member (36) to an extent sufficient to allow the at least one ball (44) of the locking member to move radially inwardly.
10. A lock mechanism as claimed in claim 9, wherein the operating mechanism includes an electric motor (26) driving a cam (27), and the cam engages a part (20) of the operating pin (18) so as to move the operating pin axially on driving the motor.
11. A lock mechanism as claimed in claim 10, wherein there is provided a control circuit for the motor (26) such an operator may power the motor on demand, to unlock the mechanism by axially withdrawing the operating pin.
12. A lock mechanism as claimed in claim 11, wherein the control circuit for the motor (26) is arranged to reset the lock mechanism a short time after operation of the motor to unlock the mechanism.
13. A lock mechanism as claimed in any of the preceding

claims, wherein there are two diametrically-opposed balls (44) carried in a transverse bore (43) extending through the locking member (36).

14. A commercial vehicle body having an access opening and a door for closing said opening, in combination with a lock mechanism as claimed in any of the preceding claims, wherein the lock body (10) is secured to the vehicle body at said opening and the bolt assembly (11) is secured to the door in opposition to the lock body, so that the bolt assembly and lock body come together the door moving to close the opening.

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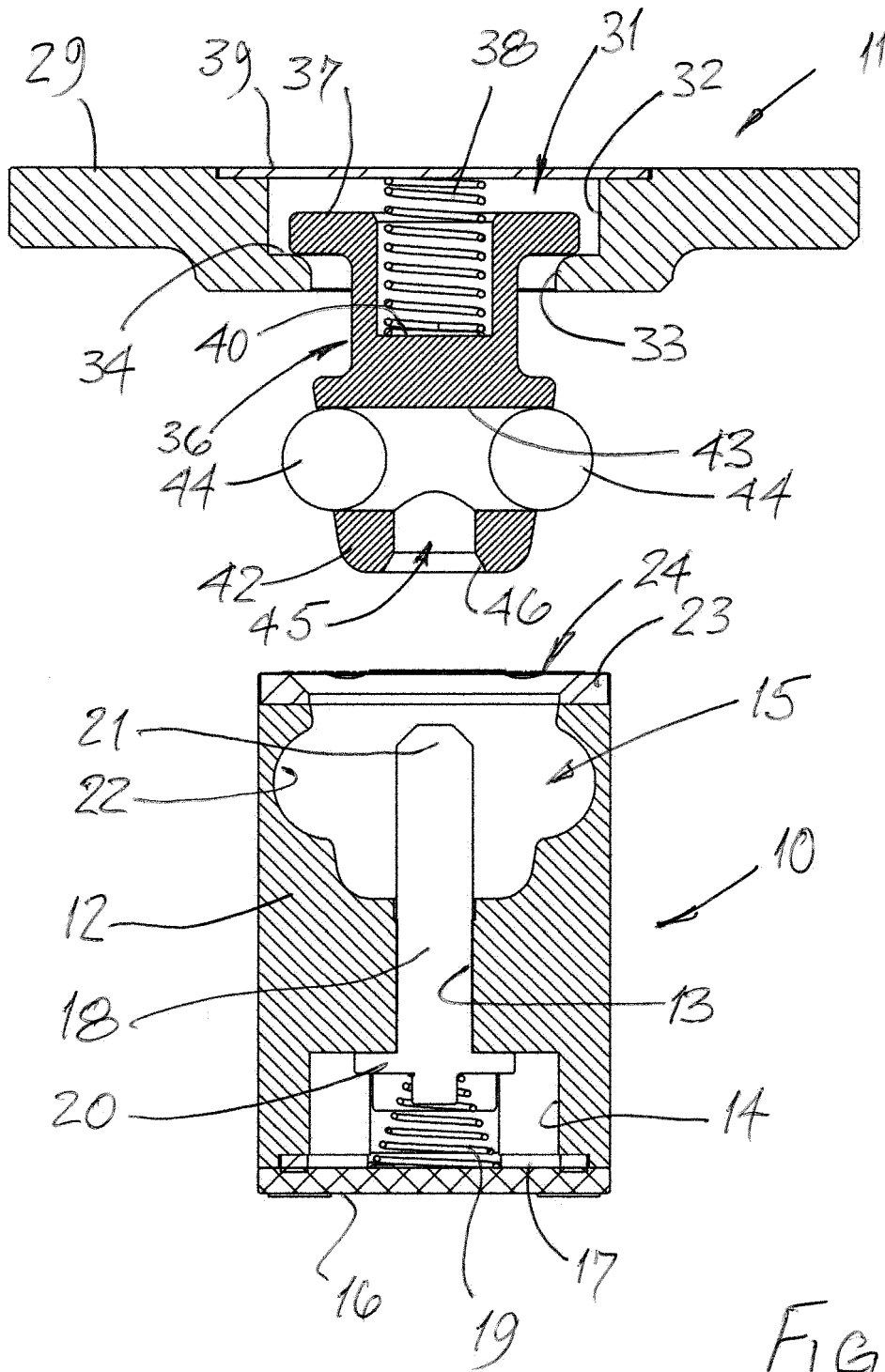


Fig. 1

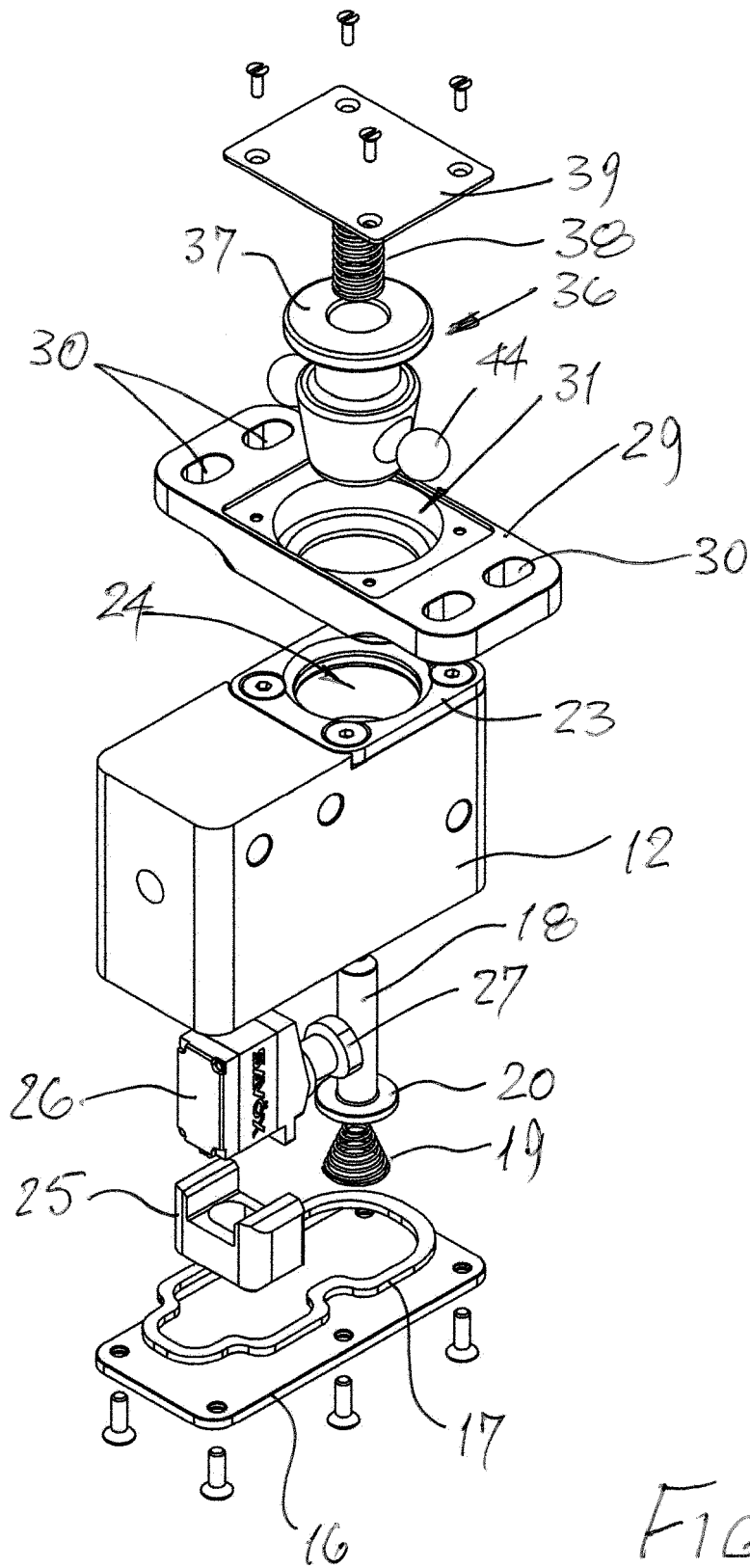
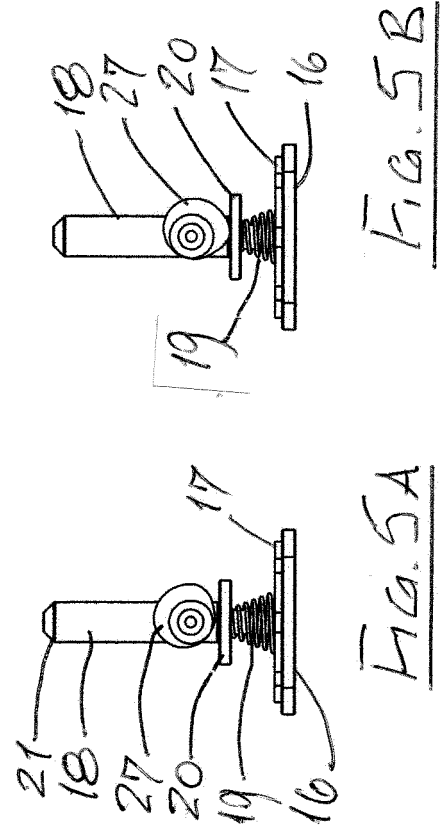
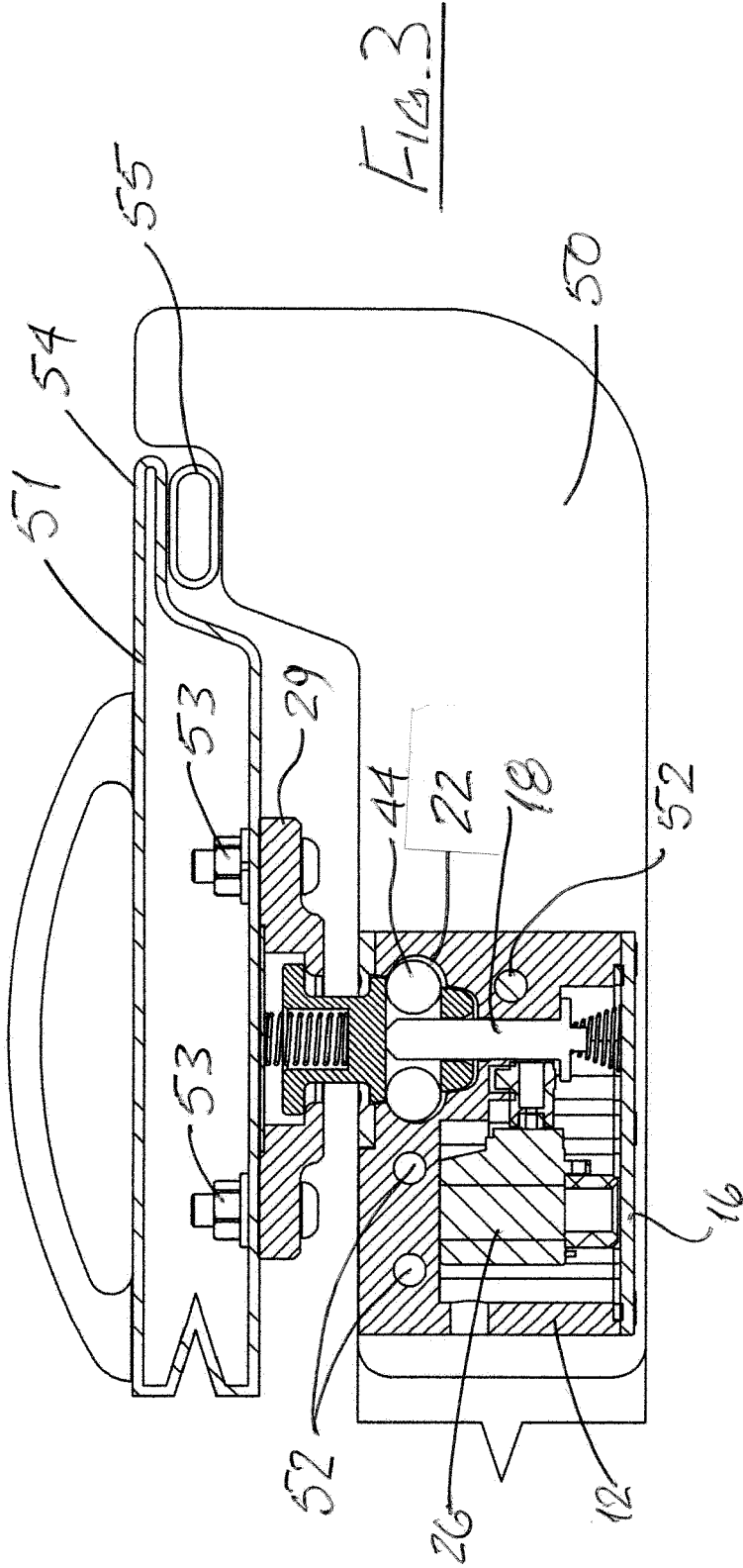


FIG. 2







EUROPEAN SEARCH REPORT

Application Number  
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Place of search		Date of completion of the search	Examiner
The Hague		10 March 2021	Van Beurden, Jason
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

**REFERENCES CITED IN THE DESCRIPTION**

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