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(54) Rotary Locking Device

(57) A rotary locking device comprises a locking element (4) guided for rotary movement relative to a mounting base (1) from a first position, in which a blade portion of the locking element (4) is located in an idle position, to a second position, in which the blade portion (4B) is extended relatively to the mounting base (1) for locking engagement within a latching recess (17) of a movable member to be locked relative to the mounting base (1). A rotary driving element (8) is mounted for rotation coaxially with the locking element (4) and is arranged to make driving engagement with the locking element (4) via a coupling allowing lost motion between the driving element (8) and the locking element (4). The

coupling biases the driving element (8) relatively to the locking element (4) in a direction of movement towards the first position. A latching element is secured on the mounting base (1) and is arranged for movement from an idle position to a latching position in which it engages with the locking element (4) to latch the same in the second position. During rotation of the driving element (8) to transfer the locking element (4) from said first to said second position, the locking element (4) is biased relatively to the driving element (8) by the lost motion coupling. Upon arrest of the locking element (4) in the second position the driving element (8) can undergo lost motion to cause movement of the latching element from the idle to the latching position.

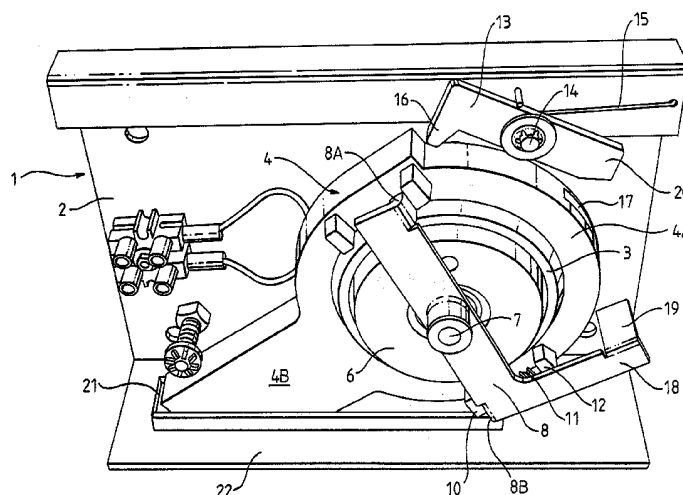


FIG. 1

EP 1 357 245 A2

Description

[0001] This invention concerns a rotary locking device, more especially for use in the locking and unlocking of doors by remote control.

[0002] It is known to effect remotely controlled locking and unlocking of doors by means of an electrically actuatable bolt that is slidable in a vertical direction to provide a locking engagement between the lintel of a door and the adjacent horizontal upper edge of the door. The remotely actuatable device may thus conveniently be provided in a housing that is accommodated within the lintel of the door, the bolt being capable of actuation to project downwardly from the lintel of the door and engage within a locking recess provided in the upper edge of the door.

[0003] Particularly in the case of publicly accessible buildings, it is a requirement of such a locking device that the bolt should be securely retained in the locking position against casual displacement, for example by means of unauthorised tampering with the lock, and the known devices that achieve this object whilst readily enabling the lock to be remotely controlled by an electrical actuator are relatively complicated and correspondingly expensive.

[0004] Rotary electrical actuators, such as rotary solenoids, tend to be less complicated and less expensive than the known actuators utilised for providing rectilinear movement of the bolts of known latching devices, but rotary latches suffer the disadvantage that they are not sufficiently tamper proof.

[0005] It is accordingly an object of the present invention to provide a rotary locking device that is capable of being actuated by simple means, whilst providing the required degree of security when in the locked condition.

[0006] The invention accordingly provides a rotary locking device comprising a locking element guided for rotary movement relatively to a mounting base from a first position, in which a blade portion of the locking element is located in an idle position, to a second position, in which said blade portion is extended relatively to said mounting base for locking engagement within a latching recess of a movable member to be locked relatively to said mounting base, a rotary driving element mounted for rotation coaxially with said locking element and arranged to make driving engagement with the latter via a coupling allowing lost motion between the driving element and the locking element, said coupling biasing said driving element relatively to said locking element in a direction of movement towards said first position, and a latching element secured on said mounting base and arranged for movement from an idle position to a latching position in which it engages with said locking element to latch the same in said second position, the arrangement being such that during rotation of said driving element to transfer the locking element from said first to said second position, the locking element is biased relatively to the driving element by said lost motion cou-

pling whereas upon arrest of said locking element in the second position the driving element can undergo lost motion to cause movement of said latching element from the idle to the latching position.

[0007] The arrangement in accordance with the invention accordingly has the advantage that the blade of the rotary locking element is securely latched in the locking position against potential movement by tampering, provided only that the driving force applied to rotate the driving element is sufficient to overcome the bias provided by the lost motion coupling and any force required to maintain the latching element in engagement with the rotary locking element. Such force is capable of being provided by an actuator such as a conventional rotary solenoid that is of simple and inexpensive construction.

[0008] Further preferred features and advantages of the invention will become apparent from the following description taken in conjunction with the drawings in which:

Figure 1 is a perspective view of a rotary locking device in accordance with one embodiment of the invention,

Figure 2 is a front elevation of the device shown in Fig. 1,

Figure 3 is a view corresponding to Fig. 2 showing the device in an locked condition, and

Figure 4 is a cross-sectional view taken on the line IV-IV of Fig. 3.

[0009] Referring to the drawings, a locking device in accordance with one embodiment of the invention comprises a mounting base indicated generally by the reference 1, the mounting base including a back plate 2 from which extends a generally cylindrical mounting sleeve 3 upon which a locking element 4 is arranged for rotational movement. The locking element 4 comprises a hub portion 4A engaging around the sleeve 3 and a blade portion 4B arranged for movement from an idle condition as shown in Fig. 2 to a locking condition as shown in Fig. 3. The locking device is designed, for example, to be accommodated within the lintel of a doorway, with the plane of the locking element 4 located vertically, so that in the locking condition the blade 4B projects downwardly into a recessed locking plate 5 mounted within the upper edge of a door that is to be locked by means of the device.

[0010] Within the sleeve 3 of the mounting base 1 is accommodated a rotary solenoid 6 of conventional construction, having a rotary drive shaft 7. Mounted upon the drive shaft 7 is a driving element 8 in the form of a two armed lever having at its respective ends angled lugs 8A and 8B arranged for contact with corresponding axially extending stops 9 and 10 of the locking element 4.

[0011] The driving element 8 is biased in a clockwise direction relatively to the locking element 4, as viewed in the drawings, by means of a compression spring 11 held between the lug 8B and a further stop 12 of the locking element 4. The driving element 8 is thus allowed

[0012] A two armed latching lever 13 is pivotally mounted on a shaft 14 fixed to the mounting base 1 and is biased in a clockwise direction by means of a torsion spring 15 located on the shaft 14 and engaging between the base 1 and the lever 13. One end of the latching lever 13 carries a latching tooth 16 that, upon counter-clockwise pivoting movement of the lever 13, can engage within a radial recess 17 in the locking element 4 in order to retain the latter in the locked position shown in Fig. 3. The driving element 8 has an elbow 18 carrying an intumed lug 19 for engagement with an arm 20 of the latching lever 13 as described below.

[0013] The latching device can be actuated for movement of the locking element 4 from the unlocked position of Fig. 2 to the locked position of Fig. 3 by energising the solenoid 6 to cause movement of the drive shaft 7 and the driving element 8 in an anti-clockwise direction. The locking element 4 is accordingly moved in an anti-clockwise direction under the force of the compression spring 11 engaging the against the stop 12, in order to cause the blade portion 4B to be extended through a slot 21 in a flange 22 extending from the back plate 2.

[0014] The rotary movement of the locking element 4 is arrested by engagement of the forward edge of the blade portion 4B against an end of the slot 21, in which position the recess 17 is located opposite to the tooth 16 of the latching lever 13.

[0015] Following arrest of the blade portion 4B, the driving element 8 can continue to undergo rotation with the drive shaft 7 until the lug 19 engages the arm 20 of the latching lever 13 in order to rotate the latter in a counter-clockwise direction and to bring the tooth 16 into latching engagement with the recess 17. The blade portion 4B of the locking element is thus securely held in a locking position and cannot be released by force applied thereto in an attempt to cause clockwise rotation out of the recess of the locking plate 5.

[0016] It will thus be seen that secure latching of the rotary locking element 4 can be achieved despite the fact that the rotary solenoid 6 is capable of exerting a limited torque and cannot itself be locked in an actuating position.

[0017] The shaft 7 may be biased in a clockwise direction, for example by means of a conventional clock spring, in order that a restoring force is applied to the driving element 8 when energisation of the solenoid 6 is ceased. Thus, initial clockwise lost motion of the driving element 8 disengages the lug 19 from the lever 13 whilst the locking element 4 remains in the locked condition. Upon corresponding release of the tooth 16 from the re-

cess 17, the locking element 4 can move in a clockwise direction together with driving element 8 and returns to the unlocked condition shown in Fig. 2.

[0018] In order to ensure that energisation of the solenoid 6 to actuate the lock can only be effected when a door is in the closed position, the locking plate 5 may be provided with a magnet 23 for causing actuation of a sensor 24 located on the base 1. A signal can thus be derived by an appropriate control means to enable remote actuation of the solenoid 6.

[0019] Whilst one embodiment of the invention has been described above, it will be appreciated that various modifications and alterations may be made thereto without departing from the scope of the invention. For example, although in the described arrangement the solenoid 6 is a single acting solenoid that is energised to cause locking of the device and that is returned to the unlocked condition by a return spring, the reverse arrangement is possible wherein the lock is spring loaded to the locked condition and can be restored to the unlocked condition by energisation of the solenoid. Furthermore, a double-acting solenoid could be provided, thus avoiding the need for return spring loading.

[0020] Although the device described is intended to be tamper proof, the device could be adapted to enable manual over-ride of the locking device by means of a special tool.

[0021] The blade 4B could be provided with a strain gauge in the blade in order to provide a signal that an attempt is being made to open the door. Such a signal could be stored to provide a record of attempted opening of the door. The blade 4B could also be manufactured in two parts, joined by 'shear pins' which break if sufficient side-load is applied to the blade when in the locked position. A continuity wire fitted across the two blade parts would provide indication that the pins had been broken.

[0022] The 'break-out' feature would be useful where a door (for example) may normally be locked but must provide an exit in an emergency.

[0023] If desired position switches could be incorporated to detect when the blade portion 4B is in the locked and unlocked position. An indicator device could also be associated with the mounting base 1 in such a manner as to indicate the state of the lock.

[0024] The lock could also be made the subject of an intelligent central control incorporating a digital voice for providing information to local users. Such an arrangement may be particularly suitable when the device is utilised in public buildings and offices.

Claims

1. A rotary locking device comprising a locking element (4) guided for rotary movement relatively to a mounting base (1) from a first position, in which a blade portion (4B) of the locking element (4) is lo-

cated in an idle position, to a second position, in which said blade portion (4B) is extended relatively to said mounting base (1) for locking engagement within a latching recess (17) of a movable member to be locked relatively to said mounting base (1), a rotary driving element (8) mounted for rotation coaxially with said locking element (4) and arranged to make driving engagement with the latter via a coupling allowing lost motion between the driving element (8) and the locking element (4), said coupling biasing said driving element (8) relatively to said locking element (4) in a direction of movement towards said first position, and a latching element secured on said mounting base (1) and arranged for movement from an idle position to a latching position in which it engages with said locking element (4) to latch the same in second position, the arrangement being such that during rotation of said driving element (8) to transfer the locking element (4) from said first to said second position, the locking element (4) is biased relatively to the driving element (8) by said lost motion coupling whereas upon arrest of said locking element (4) in the second position the driving element (8) can undergo lost motion to cause movement of said latching element from the idle to the latching position.

2. A rotary locking device as claimed in claim 1 wherein said driving element is coupled to a rotary solenoid for transmitting rotary motion to the driving element in at least one direction.
3. A rotary locking device as claimed in claim 1 or 2 wherein said solenoid is double acting.
4. A rotary locking device as claimed in any preceding claim wherein said blade is formed in two parts, joined by "shear pins" arranged to break under a predetermined side-load applied to the blade when in the locked position; and wherein a continuity wire is fitted across the blade, breakage of which may indicate that the pins have been broken.

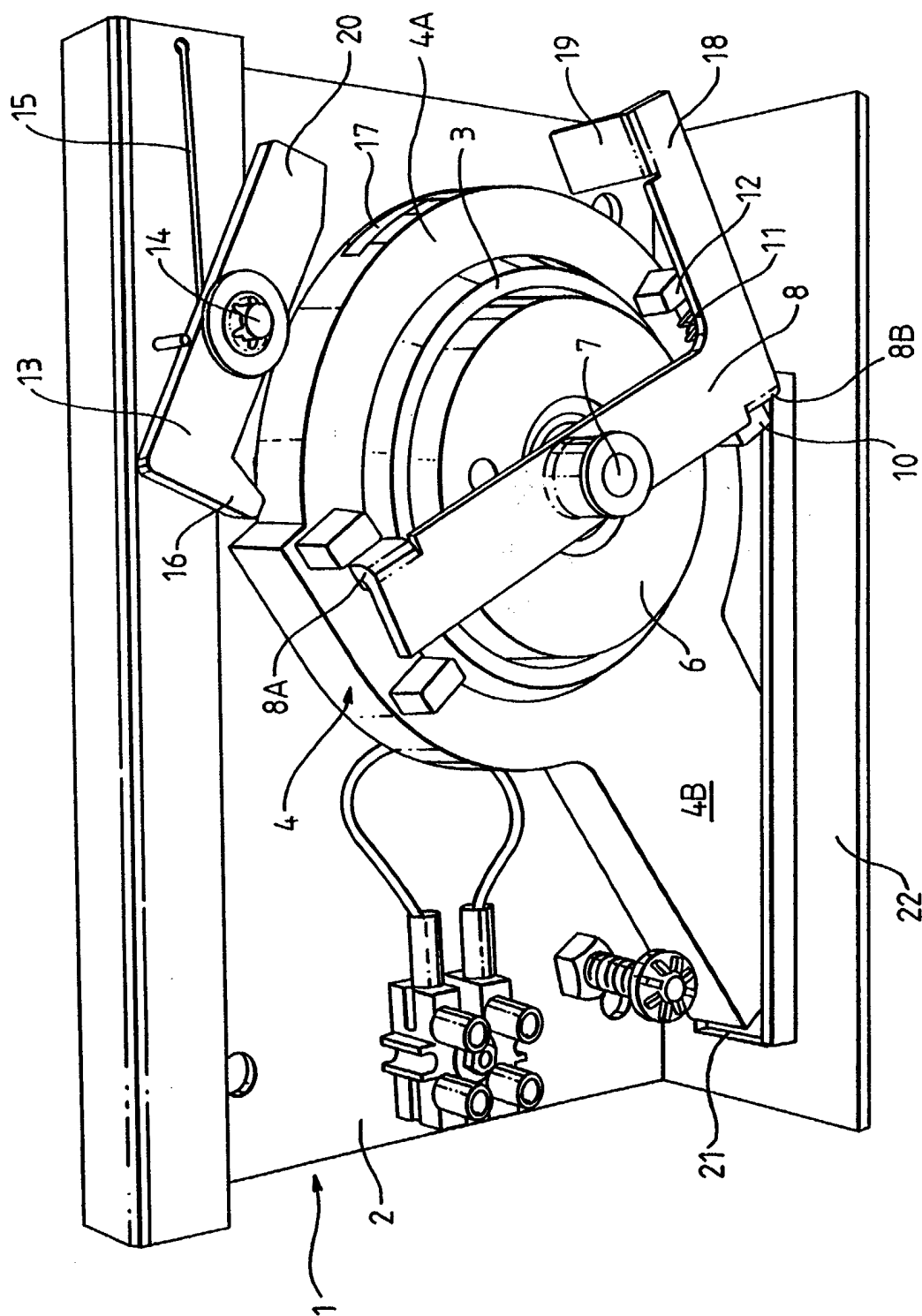


FIG. 1

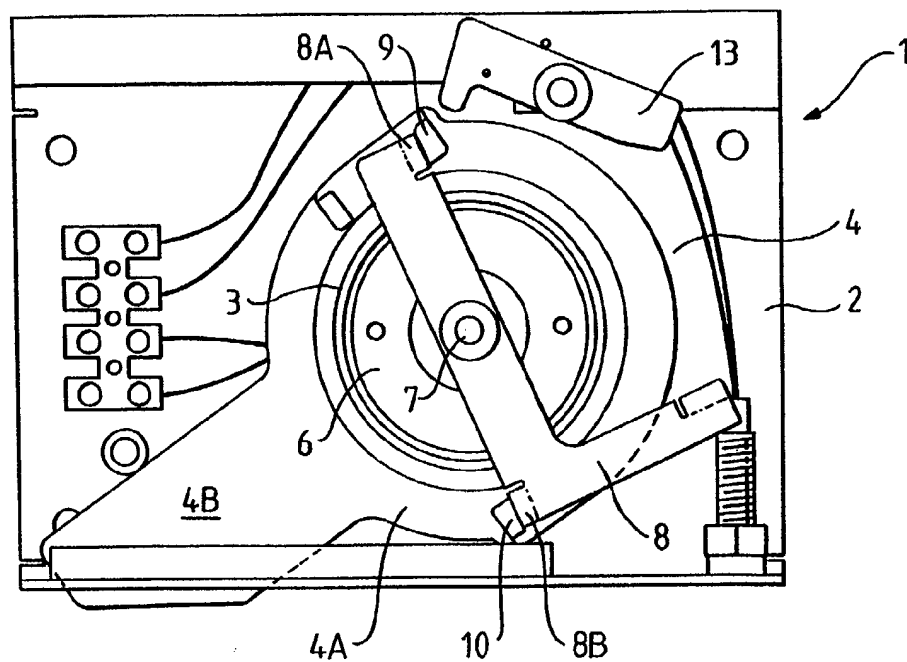


FIG. 2

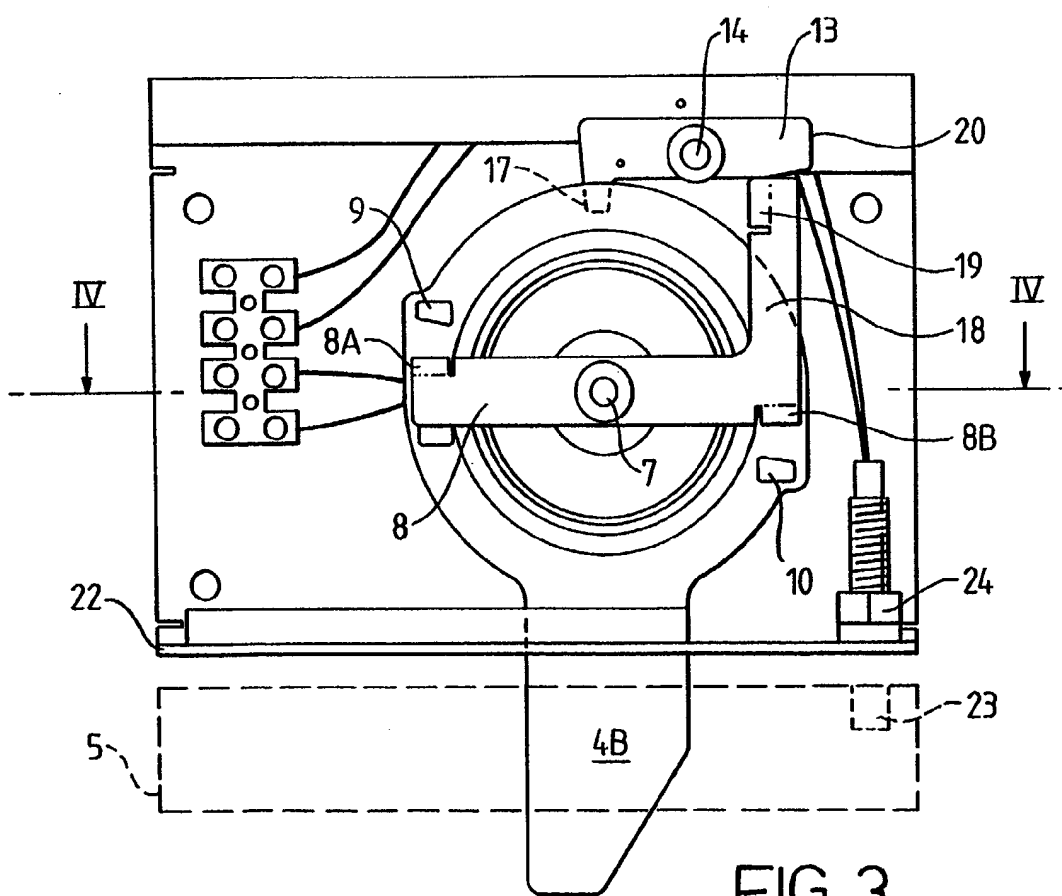


FIG. 3

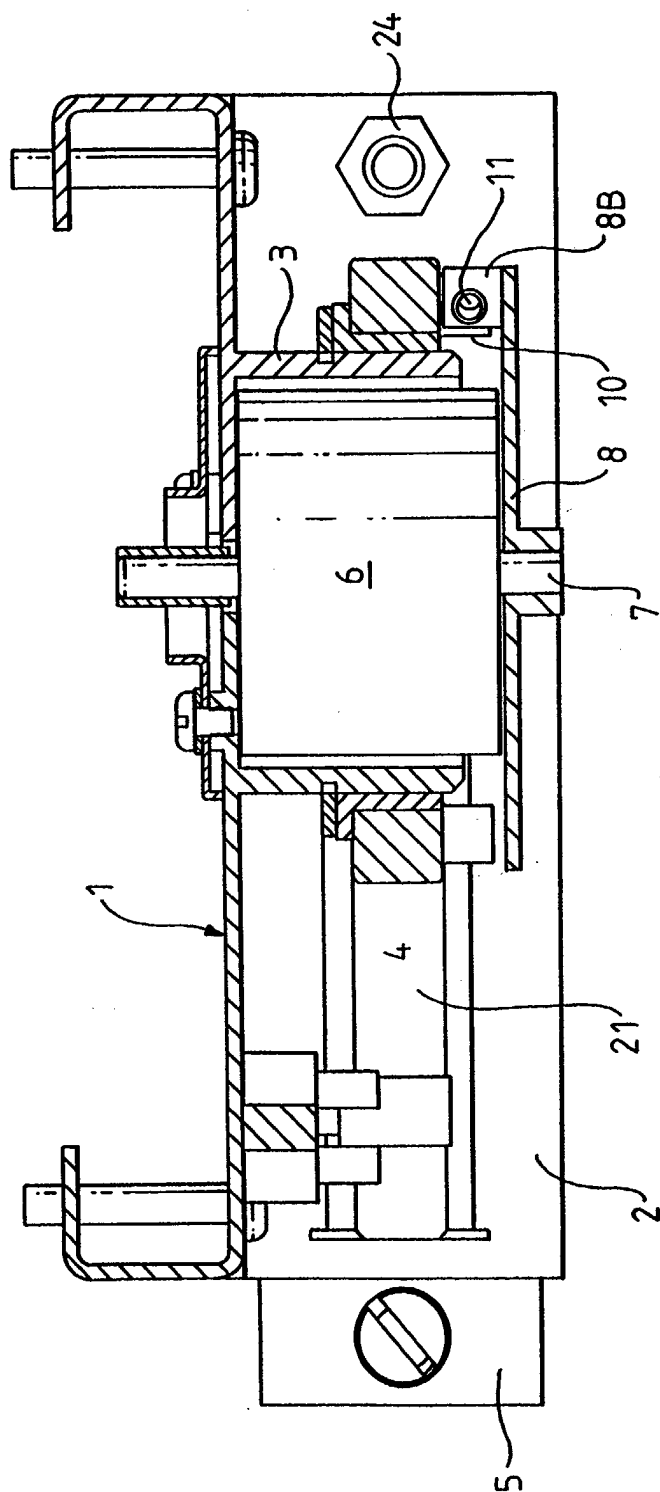


FIG. 4