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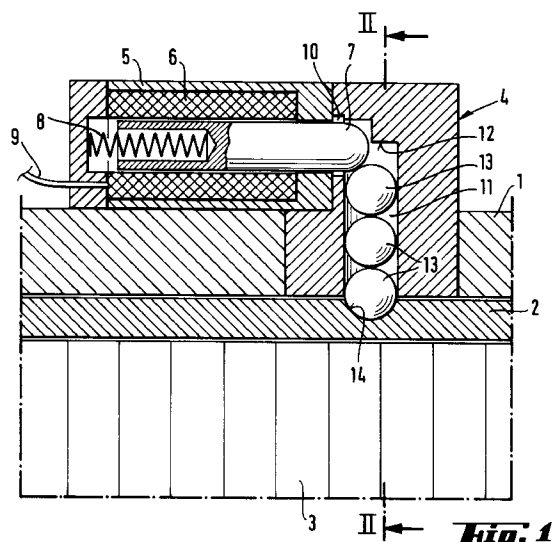
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(54) **Electromechanical cylinder lock.**

(57) Electromechanical cylinder lock, especially a cylinder lock with rotatable locking discs, including a lock housing (1) and inside thereof a turnable inner cylinder (2) enclosing mechanical locking members, which in their locking position prevent turning of the inner cylinder (2) with respect to the lock housing (1), and solenoid means (5), which independently of said mechanical locking members is arranged to control the turning of the inner cylinder (2) with respect to the lock housing (1). The lock is provided with at least one locking element (13), which is movable substantially in the radial direction with respect to the inner cylinder (2) from a locking position, in which the locking element (13) is partly located in a recess or the like (14) arranged in the inner cylinder and partly in the lock housing (1) preventing turning of the inner cylinder (2) with respect to the lock housing (1), into a releasing position of the inner cylinder (2) and vice versa. In addition the lock includes a second locking element (7) movable substantially in the longitudinal direction of the lock housing (1) and which under the influence of the solenoid means (5) is arranged to control the radial movements of the first locking element (13).



The invention relates to an electromechanical cylinder lock, especially a lock with rotatable locking discs, in accordance with the preamble of claim 1.

Prior arrangements are known, in which in addition to purely mechanical locking operation the lock is also provided with solenoid-operated locking members, with which the right to use the mechanical opening function can be controlled and restricted when necessary. For instance in accordance with US-A-4603564 there is a solenoid attached to the lock housing and controlling a separate locking member, with which the turning movement of the force transmission members can be prevented even after the locking mechanism itself is opened by inserting and turning the correct key in the lock. However, this prior arrangement requires space and is impractical, as the electrically operated locking members are entirely located outside of the actual lock housing.

An aim of this invention is to provide a new improved electromechanical cylinder lock, which has an uncomplicated construction and from which the drawbacks appearing in the known techniques are eliminated.

The aim can be met with an arrangement in accordance with which the lock is provided with at least one locking element, which is movable substantially in the radial direction with respect to the inner cylinder from a locking position, in which the locking element is partly located in a recess or the like arranged in the inner cylinder and partly in the lock housing preventing turning of the inner cylinder with respect to the lock housing, into a releasing position of the inner cylinder and vice versa. In addition the lock includes a second locking element movable substantially in the longitudinal direction of the lock housing and which under the influence of the solenoid means is arranged to control radial movements of said first locking element. According to the invention the effect of the locking elements depending on electrical control is directed to the inner cylinder of the lock itself by making use of an advantageous combination of different movements of the first and second locking elements.

The second locking element can, with advantage, be an armature member of the solenoid means, or a member operably connected thereto, which under the influence of the solenoid means is arranged to allow movement of said first locking element into a position releasing the inner cylinder.

To accommodate the locking elements, the lock housing is with advantage provided with a channel extending in the longitudinal direction of the inner cylinder one end of which longitudinal channel is connected with a transverse channel extending towards the inner cylinder. By providing a protrusion or the like (which in all positions of the locking elements restricts radial movement of the locking elements located in the transverse channel away from the inner cylinder)

between the longitudinally extending channel and the transverse channel it is possible to ensure that movement of the second locking element towards the transverse channel can always be transmitted into radial movement of the first locking element towards the inner cylinder.

An arrangement with favourable construction will be obtained when the solenoid means, locking elements and channels are located in a separate solenoid unit capable of being fixed to the lock housing.

In a favourable embodiment of the invention the first locking element comprises a number of balls, whereby a separate ball is provided for cooperation with the second locking element and with the inner cylinder, respectively.

In the case of an electromechanical cylinder lock including a set of locking discs turnable with a key of the lock and a locking bar, which in their locking position jointly prevent turning of the inner cylinder with respect to the lock housing, the locking elements can, in their locking position, with advantage be arranged on the one hand to allow turning of the locking discs by means of the key of the lock into the position for releasing the lock mechanism and on the other hand to prevent turning of the inner cylinder with respect to the lock housing. For its part this makes picking of the lock mechanism more difficult, because in the lock type in question when the lock mechanism is in its releasing position the inner cylinder has to be turned a bit further so that the groove in the lock housing would press the locking bar itself into a position finally releasing the inner cylinder. On the other hand if the lock mechanism has not first been opened, both the actual lock mechanism and the locking means depending on electric control simultaneously prevent turning of the inner cylinder with respect to the lock housing, which will effectively prevent any attempt to break the lock.

The invention will now be further described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 shows, in section, a solenoid arrangement in a cylinder lock according to the invention, the locking elements being shown in the locking position,

Figure 2 shows a section on line II-II of Figure 1, and

Figure 3 shows a sectional view similar to Figure 1 with the locking elements in the releasing position for the inner cylinder.

In the drawings 1 indicates a lock housing of the cylinder lock, inside of which there is an inner cylinder 2 enclosing a stack of locking discs 3 turnable with the key 19 of the lock.

Figure 2 shows in addition a locking bar 15 included in the locking mechanism and which, in the locked position, is located partly in a groove 16 in the lock housing 1 and partly in a slot 17 in the inner cylinder

2, thereby preventing turning of the inner cylinder 2 with respect to the lock housing 1. Correspondingly, the inner cylinder 2 can be released to turn with respect to the lock housing 1 by turning the locking discs 3 by the key 19 of the lock into a position, in which the peripheral notches 18 included therein line up at the position of the slot 17 to create a uniform channel, into which the locking bar 15 is free to move when pressed thereinto by a bevelled surface 16a in the groove 16. The operation of this kind of cylinder lock with rotatable locking discs is known as such and it is deemed unnecessary to describe it here in any more detail.

Projecting outwardly of the lock housing 1 is a solenoid unit 4 including a solenoid 5, a channel 10 extending in the longitudinal direction of the lock housing and a channel 11 connected thereto and extending in the radial direction with regard to the inner cylinder 2. The solenoid 5 includes a coil arrangement 6 and an armature member 7, which is urged by a spring 8 towards the channel 11. A wire 9 is provided for feeding electric current to the coil arrangement 6.

The armature member 7 serves as a locking member movable in the channel 10 extending in the longitudinal direction of the lock housing under the influence of the solenoid 5 and the spring 8 and acts on a locking element 13 located in the radial channel 11. According to the embodiment shown in the drawings the locking element 13 constitutes a set of balls, preferably made of steel, and here shown as three in number. Using three balls means that a separate ball is provided for cooperation with the inner cylinder 2 and the armature member 7, respectively. The member 7 has the same diameter as one of the balls and its rounded end simulates half a ball.

The inner cylinder 2 is provided with a recess 14 arranged to cooperate with the locking elements 7 and 13 so that turning of the inner cylinder 2 with respect to the lock housing 1 can be controlled by means of the solenoid 5 independently of the actual locking mechanism 3 and 15-18 of the lock.

If, in the arrangement shown in Figures 1 and 2, an actuating voltage is applied to the solenoid 5, the coil 6 generates a force on the armature member 7 in the direction of the channel 10 which acts with the force of the spring 8 to press the armature member 7 into a position projecting into the radial channel 11 where it can press the balls 13 in the channel 11 radially towards the inner cylinder 2 and thus hold the innermost ball 13 in the recess 14 in the inner cylinder 2. When this has occurred, even if the locking discs 3 are turned by the key 19 of the lock in the clockwise direction in Figure 2 into the positions required for opening the actual locking mechanism of the lock, the innermost ball 13 located in the recess 14 prevents any turning of the inner cylinder 2. Thus, the line of balls 13 prevents the locking bar 15 from moving into the notches 18 in the discs 3, since the bar 15 does

not receive the necessary urging from the bevelled surface 16a, into its releasing position in which the locking bar 15 is partly located in the slot 17 in the inner cylinder 2 and partly in the channel formed jointly by the peripheral notches 18 in the locking discs 3. Hence, when the locking mechanism is not first opened by the correct key, the balls 13 and the locking bar 15 together prevent effectively any attempt at a forced turning of the inner cylinder 2 for the purpose of breaking the locking elements 13.

Figure 3 shows the situation where there is no voltage applied to the solenoid 5. Here, the inner cylinder 2 has been turned causing the balls 13 to move further into the channel 11 radially away from the inner cylinder 2, the armature member 7 being pushed to the left against the force of the spring 8 by urging from the balls to make room for them in the radial channel 11. Thus, in this case, turning of the inner cylinder 2 merely takes place against the force of the spring 8 and once this has been overcome, the inner cylinder 2 can turn with respect to the lock housing 1.

There is a protrusion 12 between the channels 10 and 11 for limiting the movement of the balls 13 away from the inner cylinder 2 and thereby ensure that the armature member 7 can always move in to block the radially outer end of the channel 11 when the recess 14 is available to receive the radially innermost ball 13.

Instead of balls 13, a single elongate locking element with rounded ends could be used. In practice, also the actual solenoid arrangements can be implemented in many different ways, for instance so that the coil 6 does not directly act on a locking element movable in the channel 10. In this case, if required, some form of coupling may be arranged between the armature member of the solenoid and the locking element for resisting the forces possibly transmitted via the balls 13, whereby a weaker and, thus, also less expensive solenoid could be used. As described, the electromagnetic energisation is used only to augment the spring force and hold the second locking element in a position in which it obstructs radial outward movement of the first locking element. This arrangement is preferred but it is not ruled out that in some applications the direction in which the solenoid acts can be reversed by changing the direction of the current flow in the coil 6 and when this occurs, electromagnetic energisation can be used to oppose the spring force either to withdraw the second locking element from the first or to reduce the turning moment required on the key to move the first locking member radially outwardly.

The invention is not limited to the embodiment shown, since several modifications are feasible within the scope of the following claims.

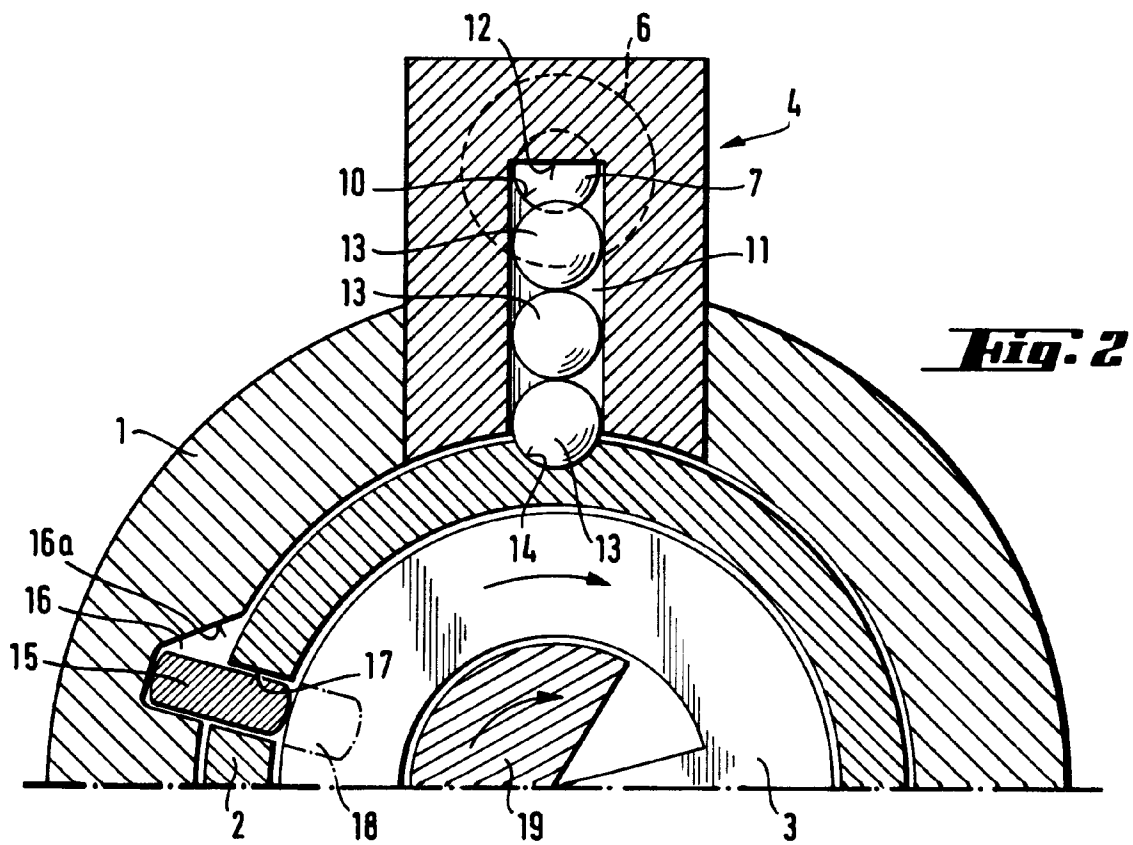
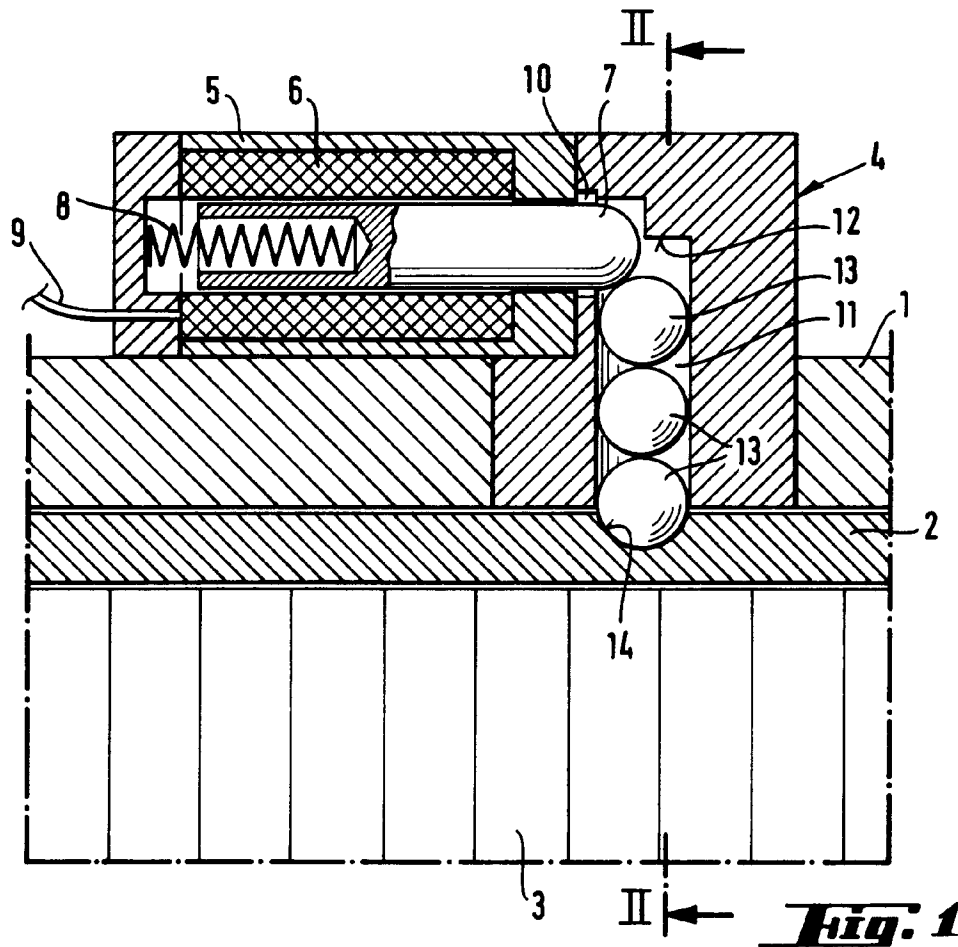
Claims

1. An electromechanical cylinder lock including a lock housing (1) and inside thereof a turnable inner cylinder (2) enclosing mechanical locking members, which in their locking position prevent turning of the inner cylinder (2) relative to the lock housing, and solenoid means (5), which independently of said mechanical locking members is arranged to control the turning of the inner cylinder (2) relative to the lock housing, characterised in that the lock is provided with at least one locking element (13), which is movable substantially in the radial direction with respect to the inner cylinder (2) from a locking position, in which the locking element (13) is partly located in a recess or the like (14) arranged in the inner cylinder and partly in the lock housing (1, 4) preventing turning of the inner cylinder (2) with respect to the lock housing (1), into a releasing position of the inner cylinder (2) and vice versa, and in that the lock includes a second locking element (7) movable substantially in the longitudinal direction of the lock housing (1) and which, under the influence of the solenoid means (5), is arranged to control radial movements of the first locking element (13).

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2. An electromechanical cylinder lock according to claim 1, characterised in that said second locking element (7) is an armature member of the solenoid means (5), or a member operably connected thereto, which under the influence of the solenoid means (5) is arranged to allow movement of said first locking element (13) into a position releasing the inner cylinder (2).

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3. An electromechanical cylinder lock according to claim 1 or claim 2, characterised in that for said locking elements, the lock housing (1, 4) is provided with a channel (10) extending in the longitudinal direction of the inner cylinder (2), one end of which channel (10) is connected with a transverse channel (11) extending towards the inner cylinder (2), and in that arranged between said longitudinally extending channel (10) and said transverse channel (11) there is a protrusion or the like (12), which in all positions of the locking elements restricts the radial movement of the locking elements (13) located in the transverse channel (11) away from the inner cylinder (2), so that movement of said second locking element (7) towards the transverse channel (11) can always be transmitted into radial movement of the first locking element (13) towards the inner cylinder (2).

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4. An electromechanical cylinder lock according to any one of the preceding claims, characterised in that said solenoid means (5), locking elements (7; 13) and channels (10; 11) are located in a separate solenoid unit (4) fixed to the lock housing (1).
5. An electromechanical cylinder lock according to any one of the preceding claims, characterised in that said first locking element (13) comprises a number of balls, so that a separate ball is provided for cooperation with said second locking element (7) and with the inner cylinder (2), respectively.
6. An electromechanical cylinder lock in accordance with any one of the preceding claims, including a set of locking discs (3) turnable with a key (19) of the lock and a locking bar (15), which in their locking position jointly prevent turning of the inner cylinder (2) with respect to the lock housing (1), characterised in that in their locking position the locking elements (7; 13) are arranged on the one hand to allow turning of the locking discs (3) by means of the key (19) of the lock into the position for releasing the lock mechanism and on the other hand to prevent turning of the inner cylinder (2) with respect to the lock housing (1).



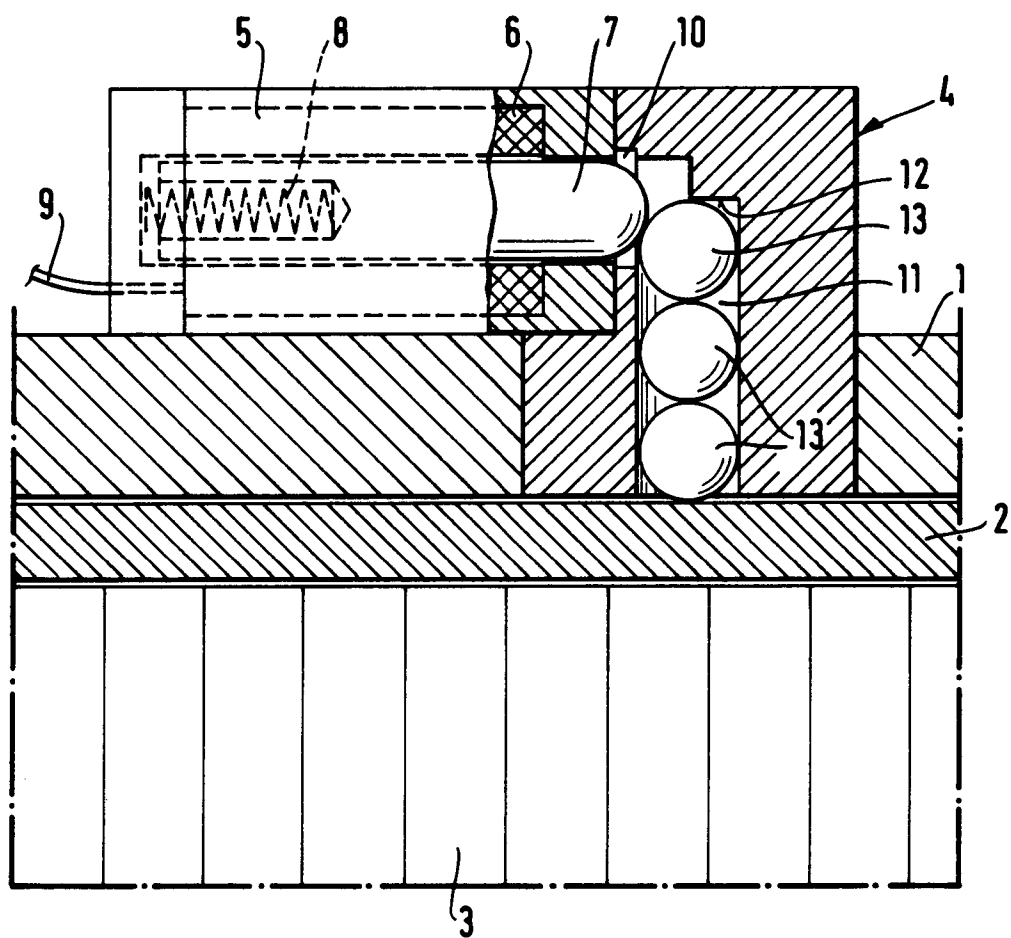


Fig. 3



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number

DOCUMENTS CONSIDERED TO BE RELEVANT			EP 92304117.2
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	WO - A - 88/05 853 (BERCHTOLD) * Fig. 1-3; claims 1-11 *	1-4, 6	E 05 B 49/00
A	EP - A - 0 324 096 (BKS GMBH) * Fig. 1-9; claims 1-9 *	1-4, 6	
A	EP - A - 0 298 193 (BKS GMBH) * Fig. 1-5; claims 1-9 *	1-4, 6	
A	DE - A - 3 630 597 (BAUER KABA) * Fig. 1-6B; claims 1-7 *	1-4, 6	
D, A	US - A - 4 603 564 (KLEINHÄNY) * Fig. 1-5; claims 1-5 *	1-4, 6	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			E 05 B
The present search report has been drawn up for all claims			
Place of search VIENNA		Date of completion of the search 21-10-1992	Examiner CZASTKA
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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