

ELECTROMECHANICAL LOCK WITH A ROLLER-FORMED LOCKING PART

The present invention relates to a lock for locking a container.

Generic locks have an electromechanical actuator for the latch. The latch is therefore moved preferably reciprocally not by hand but by the electromechanical, or respectively in particular motor-operated, actuator between the locking position and the unlocking position. These types of locks are used for example for locking containers in which documents or data media or similar are collected. These items can be relevant to security or respectively be subject to secrecy so that they cannot be reopened by anyone, but only when certain requirements are met. It can be arranged for example for a preset code to be input in the lock, or the lock may be opened at specific times only, etc..

Generic locks can also be used in this sense for example for locking containers in which matter hazardous to the environment or similar is collected. Here, too, it can be significant for the lock to be opened under certain circumstances only.

Practice shows that containers fitted with such locks are often overfilled in such a way that they can be closed only by application of considerable force. This results in problems with automated opening of the lock, since considerable forces are acting on the lock due to excess pressure in the container; in the case of generic locks this makes automatic opening difficult or respectively prohibits it completely. It should be taken into consideration here especially that generic locks must be provided with a power source, generally an electric battery, because of the electromechanical actuator of the lock. For these locks to be operated maintenance-free over a long period the power requirement of the electromechanical actuator for opening the lock must be as minimal as possible.

For these reasons the aim of the present invention is to improve generic locks to the extent where they can also be opened by means of the electromechanical actuator in the event of increased inner pressure in the container, using minimal energy expenditure only.

In a first aspect the present invention provides a lock for locking a container, whereby the lock has a first locking part and at least one second locking part and at least one latch, and the first locking part has at least one receiving opening for receiving at least one partial section of the second locking part and the latch is locked by an electromechanical fastening device of the lock between at least one locking position, in which the second locking part is retained in the receiving opening of the first locking part, and at least one unlocking position, in which the second locking part can be pulled out from the receiving opening of the first locking part, characterised in that the latch has at least one latch wall and at least one latch opening and the second locking part has at least one swivel-mounted roller, whereby in the unlocking position the roller can be pulled out from the first locking part through the latch opening and is locked in the locking position by the latch wall in the first locking part, and the latch wall has a latch wall guide track for engagement with the roller at least in certain areas between the locking position and the unlocking position.

According to the invention there is provision for arranging on the second locking part at least one swivel-mounted roller which engages and rolls along the latch wall guide track of the latch whenever the latch is moved out of its locking position in the direction of the unlocking position for opening the lock. As a result of this, frictional forces generated from increased inner pressure in the container are clearly reduced at the lock or respectively between the second locking part and the latch. The resulting effect is that in the event of correspondingly high forces acting on the lock the latch can also still be moved with minimal energy expenditure from the locking position to the unlocking position, with the energy consumption for this movement of the latch being minimal and energy storage provided in the lock for the electromechanical actuator, in particular electric batteries or storage batteries, having a long service life seldom needing to be changed.

For the sake of completeness it should be pointed out that the electromechanical actuator is generally provided not only for opening the lock, therefore shifting the latch from the locking position to the unlocking position, but is mostly also utilised for

closing the lock, therefore moving the latch from the unlocking position to the locking position. But this need not be mandatory. It can also be provided for the lock to be lockable by hand and for the electromechanical actuator to be provided for the opening procedure only.

For the sake of completeness it is pointed out that the term "locked" means the state in which the second locking part cannot be withdrawn from the receiving opening of the first locking part, but is held therein by the latch. When the latch is in the locking position the lock cannot be opened. It should also be pointed out for the sake of completeness that in the unlocking position the second locking part can advantageously be pulled out not only from the receiving opening or respectively the latch opening, but can also be inserted into the receiving opening or respectively latch opening of the unlocking position.

Preferred embodiments of the invention provide for the roller to be positively driven between the locking position and the unlocking position on the latch wall guide track.

In general terms, the roller does not however always have to lie on the latch wall guide track in the locking position. There can also be some clearance provided, so that if there is no overpressure in the locked containers the roller does not constantly lie on the latch wall guide track, but comes to bear thereon only when the container lid is raised by corresponding inner pressure in the container or by the effect of some other force.

With preferred embodiments as a rule it is provided for the latch to be mounted movably in the or respectively inside the first locking part. The latch can be shifted reciprocally along a linear or curved guide track. Particularly preferred embodiments however ensure that the latch is swivel-mounted about a latch axle in the first locking part and is preferably rotatable by the electromechanical actuator about the latch axle, preferably reciprocally. In its basic form the latch can be configured substantially disc-shaped. The advantage of the pivotable mounting on a latch axle in any case is that this variant enables the latch to be mounted in a structurally simple way, for example via a corresponding pivot bearing, in particular a ball bearing, such that greater forces acting

on the latter also do not result in functional impairment to the latch.

Preferred embodiments of the invention ensure that the latch wall guide track is configured curved. This is preferably a circular-segment-shaped formation. But a departure can also be made from the circular-segment shape, for example if the aim is to not only close the lock but also still brace the container lid on the container during movement of the latch from the unlocking position into the locking position.

In preferred embodiments of the invention the electromechanical actuator has an electromotor, preferably powered by means of an electric battery or storage battery, for moving or respectively rotating the latch between the locking position and the unlocking position, preferably reciprocally. It can be provided for the electromechanical actuator to have a worm gear by means of which the electromotor acts on the latch. Other embodiments of the invention can also be provided, where a correspondingly electrically operated magnet or other electric drive known from the prior art is used in place of an electromotor for moving the latch.

With high inner pressure in the locked containers, abruptly occurring high forces, which can accelerate the latch suddenly in the unlocking position direction, can act on the latch at the point when the roller is in transition from latch wall to latch opening. This can result in damage to or respectively destruction of the electromechanical actuator which is generally very slightly dimensioned in terms of the minimal energy consumption. To avoid this, particularly preferred embodiments ensure that a coupling is arranged and/or acts between the latch and the electromechanical actuator moving the latch. It is also favourably provided for the latch to be uncoupled by means of the coupling, preferably directly, before the unlocking position of the electromechanical actuator is reached. Uncoupled means the state in which the coupling is opened, therefore the latch is no longer coupled to the electromechanical actuator, but can move relative to the latter without the electromechanical actuator having to be moved at the same time. In terms of the solution to the abovementioned problem preferred embodiments ensure that the latch can be uncoupled from the electromechanical actuator when a force from the roller acting on the latch in the unlocking direction position exceeds a force threshold value,

whereby it is preferably provided for the force threshold value to be greater than the forces which can be applied to the latch by the electromagnetic actuator.

Further characteristics and details of preferred variants of the invention will emerge from the following description of an inventive embodiment, in which:

- Figure 1 shows a vertical section through a container fitted with an inventive lock;
- Figure 2 shows a frontal view of the lock, whereby the second locking part is located fully outside the first locking part;
- Figure 3 shows a view from the direction opposite that of Figure 2;
- Figure 4 shows a detailed view of this embodiment, whereby the second locking part is locked in the receiving opening of the first locking part;
- Figure 5 shows an illustration similar to Figure 4, whereby however the second locking part has been removed from the receiving opening of the first locking part;
- Figure 6 shows a view corresponding to Figure 3, whereby however the lid is removed from the housing of the first locking part;
- Figure 7 shows a locking position, whereby the housing of the first locking part is removed;
- Figure 8 an illustration corresponding to Figure 7, whereby the second locking part is located at the transition between a locking position and an unlocking position;
- Figure 9 shows a view similar to Figure 7, whereby the latch is located in an unlocking position, and
- Figure 10 shows a detailed illustration of essential coupling components.

Figure 1 shows a vertical section through a container 2 with a container body 3 and a container lid 4, which can be locked with an lock 1 according to the invention. In the illustrated embodiment the container lid 2 is arranged pivotably on the container body 3, but this is just one example. Inventive locks can be used very diversely for all possible types of containers known from the prior art, but can be used for other purposes also. In the illustrated embodiment in any case the first locking part 5 is arranged on the container body 3 and the second locking part 6 is arranged on the container lid 4. A reverse arrangement is understandably just as feasible. The second locking part 6 is

fixed on the container lid 4 via a fastening device 15 which in the illustrated embodiment constitutes elastic suspension of the second locking part 6 and thus permits movement of the second locking part relative to the container lid 4 and also to the first locking part 5 within certain limits. The second locking part 6 has the roller 12 swivel-mounted on it according to the invention, and when the container lid 4 is closed it can be inserted and locked there in the receiving opening 8 of the first locking part 5 along with the roller 12. In the illustrated embodiment the first locking part 5 has a housing 29 which substantially covers the latch 7 to the point where it is not visible in Figure 1.

Figure 2 shows a view in which the second locking part 6 likewise has been removed from the first locking part 5. In contrast to Figure 1, Figure 2 and the following illustrations also no longer show the container 2 illustrated by way of example. Figure 2 illustrates the elastically deformable fastening device 15 particularly well, by which the second locking part can be attached elastically to the container lid 4 on the container 2, therefore on the container body 3, or as shown in the example in Figure 1. In the specific case illustrated here the fastening device 15 has two leaf springs 16, between which the second locking part 6 is held. Embodiments with only one leaf spring 16 or more than two leaf springs 16 or other elastically deformable configurations are naturally also feasible. Alternatively, it is also feasible that not the fastening device 15 but the second locking part itself is configured elastically deformable. The elastic suspension or respectively formation of the second locking part 6 enables deformations of the container 2 caused in any case by excessive loading or for other reasons to be balanced out such that despite this deformation it is ensured that the second locking part 6 can be introduced to the receiving opening 8 and can be withdrawn therefrom while the lock remains securely lockable and unlockable.

Figure 3 shows the same situation as in Figure 2, but from the opposite side. In Figure 4 the second locking part 6 is in the receiving opening 8 of the first locking part 5 in the locking position. The latch wall 10 of the latch 7, even more clearly visible in the following figure, locks the receiving opening 8 so far that the second locking part 6 or respectively its roller 12 cannot be pulled out of the receiving opening 8. The second locking part 6 is accordingly locked in the first locking part 5 in the illustrated position.

Figure 5 is an illustration similar to Figure 4. Here, though, the second locking part 6 is pulled out of the receiving opening 8. Following removal of a cover of the housing 29, Figure 6 shows a view into the first locking part 5. This illustration first shows the latch 7 configured at least approximately disc-shaped in the illustrated embodiment, which is swivel-mounted on the latch axle 14 in the housing 29 or respectively in the first locking part 5. For the roller 12 of the second locking part 6 to be able to be locked, as in the illustrated embodiment, the latch 7 has the circular-segment-shaped latch wall 10. Viewed in the direction of rotation, in addition to this latch wall 10 there is the latch opening 11, via which the second locking part 6 or respectively its roller 12 can be introduced and extended. The illustrated embodiment has the electromechanical actuator 9 for rotating the latch 7. Essential components of this electromechanical actuator 9 are in the illustrated embodiment of the electromotor 17 which engages in a gearing 21 via the worm gear 18 and a transmission gear wheel 31 for rotating the latch 7. As explained hereinbelow in detail, in the illustrated embodiment this gearing 21 is not attached directly to the latch 7; rather, the coupling 19 is arranged or respectively acts between the latch 7 and the electromechanical actuator 9 moving the latch 7.

For the sake of completeness it is again pointed out that in the illustrated embodiment the batteries provided for power supply of the electromotor 17 are stored in the battery compartment covered by a battery compartment lid 32. The illustrated arrangement is naturally only one of many possible realisations.

The housing 29 of the first locking part 5 has also been omitted in the following figure, yet to be described for the sake of clarity. Figure 7 shows the latch 7 in the locking position in which the latch wall 11 locks the second locking part 6 and its roller 12 so that the second locking part 6 cannot be withdrawn from the receiving opening 8 of the first locking part 6, no longer illustrated here. To rotate the latch from the locking position illustrated in Figure 7 in the direction of the unlocking position illustrated in Figure 9, the motor 17 is accordingly started. By way of the worm gear 18 and the transmission gear wheel 31 engaged in the gearing 21, the latch 7 is rotated for this purpose about its latch axle 14. At the same time the roller 12 of the second locking part 6 engages and rolls along the latch wall guide track 13 of the latch wall 10, at least with

corresponding inner pressure in the container. If the latch opening 11, as shown in Figure 9, is aligned with the roller 12 then the unlocking position is reached and the second locking part 6 can be withdrawn from the receiving opening 8 of the first locking part 5. Due to inventive rolling of the second locking part 6 on the latch 7 with increased inner pressure in the container the friction forces to be overcome when the latch moves are so slight that they can still be overcome without major energy expenditure by the relatively slightly dimensioned electromechanical actuator 9. The effect of this is that there is also no apprehension of jamming of the lock 1 in the closed state in the event of increased inner pressure in the container 4.

It is to be noted that the latch wall guide track is tapered so that, as the roller rolls along the guide track it causes a progressive tightening of the engagement between the first locking part and the second locking part.

An intermediate position as shown in Figure 8 is reached on the way from the locking position illustrated in Figure 7 to the unlocking position illustrated in Figure 9, in which the end of the latch wall 10 pointing to the latch opening 11 is passed on the axis of rotation of the roller 12. With corresponding inner pressure in the container, which tries to pull the second locking part 6 out of the first locking part 5, acceleration forces which press or respectively accelerate the latch 7 further in the direction of the unlocking position independently of the electromechanical actuator 9 in this situation act on the latch 7. In the event of corresponding inner pressure in the container or respectively traction on the second locking part 6 these forces can clearly be higher than they can be applied to and/or taken up by the electromechanical actuator 9. To prevent these acceleration forces suddenly occurring on the latch 7 from resulting in damage to or destruction of the electromechanical actuator 9, in the illustrated embodiment of the invention the coupling 19 is provided which acts between the electromechanical actuator 9 and the latch 7. The coupling 19 ensures that in the situation illustrated in Figure 8 the latch 7 can be uncoupled from the electromechanical actuator 9 in the event of corresponding tractive forces acting on the second locking part 6 before the unlocking position is reached.

In the concrete embodiment the coupling 19 has a coupling part 20 mounted movably relative to the latch 7 for this purpose, whereby the electromechanical actuator 9 engages in the coupling part 20 via the gearing 21. Figure 8 shows a window-like recess 33 in the coupling part 20, which gives a view of the interior of the coupling 19. The window-like recess 33 is shown correspondingly in Figures 7 and 9, but in reality does not have to be present.

In the illustrated embodiment the coupling part 20 is swivel-mounted about the latch axle 14 in the first locking part 5. Also, the coupling part 20 is pivotable relative to the latch 7, as long as the contact element 22 loaded by means of the spring 30 allows this. This is always the case when forces acting between the latch 7 and the electromechanical actuator 9 exceed the coupling-triggering force dependent on the resilience constant of the spring 30 and the form of the coupling guide track 23. The detailed structure of the coupling 19 as configured in this embodiment can be explained particularly well based on Figure 10, since here the spring 30, the contact element 22 and the coupling guide track 23 are particularly easy to see inside the coupling part 20. In the illustrated embodiment the spring 30 and therefore also the contact element 22 are fixed to the latch 7. The spring-loaded contact element 22 engages in a coupling guide track 23, or respectively rests on it, which in the illustrated embodiment is fastened to the coupling part 20. Naturally, the spring-loaded contact element 22 and the coupling guide track 23 can also be fixed to the coupling part 20 and the latch 7 the other way round. In the illustrated embodiment the coupling guide track 23 has a first, here depressed, section 24. The coupling part 20 is coupled to the latch 7 when the contact element 22 is arranged in this first section 24.

This first section of the coupling guide track 23 is delimited by a shoulder 25 of the coupling guide track 23 adjoining the first section 24. When the contact element 22 is pushed into the second section 26 of the coupling guide track 23 by corresponding forces acting on the latch 7, which is arranged on the side of the shoulder 25 averted from the first section 24, the latch 7 is uncoupled from the coupling part 20. It then runs along the second section 26 of the coupling guide track 23, rotating the latch 7, without the coupling part 20 also revolving, with the electromechanical actuator 9 being

uncoupled from the latch 7. The spring force of the spring 30 and the form of the shoulder 25 are synchronised to one another such that coupling is triggered or respectively uncoupled at a force threshold value, ensuring that no damage to or respectively destruction of the electromechanical actuator 9 can result when the position of the roller 12 shown in Figure 8 is reached.

With respect to the first section 24 of the coupling guide track 23 it should be pointed out that this first section 24 has a position 27 in which the contact element 22 is deflected to the maximum from its spring loading. In the illustrated embodiment there are bevelled sections 28 between this position 27 and the shoulder 25 and on the side of the position 27 averted from the shoulder. Together with the spring 30 and the contact element 22, here configured as a roller, these bevelled sections 28 create a certain dampening effect of the coupling 19 when the electromechanical actuator 9 starts up and switches off.

If the coupling is released due to correspondingly occurring forces, then reconnection can take place from corresponding rotation of the electromechanical actuator 9, that is, the contact element 22 travels along the coupling guide track 23 back to the position 27. Alternatively, it is also possible that in the event of corresponding release of the latch 7 the contact element 22 automatically returns to the coupling position 27 due to spring loading of the spring 30 and the form of the coupling guide track 23, whereby the latch 7 and the coupling part 20 return to the state of forced fit in which they rotate conjointly about the latch axle 14.

It should be pointed out in conclusion that depending on application inventive locks can be combined or respectively fitted out with a wide range of additional technologies known from the state of the art. This makes it feasible for example for the lock to have an identification function which can be used to check input of access code etc. via transponder as to whether opening of the lock is permissible or not. It is also feasible to fit the lock with an auxiliary device which enables locating of the lock and therefore of the container, for example via GPS or radio systems. In addition, for example in containers for foodstuffs or drugs, a function can also be integrated into the lock which

plots the chronological temperature profile.

Alternatively or in addition, tremor and/or incline and/or moisture meters are also feasible which can be integrated into the lock, in case this is significant for normal use of the container in which the lock is integrated.

Legend

1	lock	18	worm gear
2	container	19	coupling
3	container body	20	coupling part
4	container lid	21	gearing
5	first locking part	22	contact element
6	second locking part	23	coupling guide track
7	latch	24	first section
8	receiving opening	25	shoulder
9	electronic actuator	26	second section
10	latch wall	27	position
11	latch opening	28	bevelled section
12	roller	29	housing
13	latch wall guide track	30	spring
14	latch axle	31	transmission gear wheel
15	fastening device	32	battery compartment lid
16	leaf spring	33	window-like recess
17	electromotor		

Claims:

1. A lock for locking a container, whereby the lock has a first locking part and at least one second locking part and at least one latch, and the first locking part has at least one receiving opening for receiving at least one partial section of the second locking part and the latch is locked by an electromechanical fastening device of the lock between at least one locking position, in which the second locking part is retained in the receiving opening of the first locking part, and at least one unlocking position, in which the second locking part can be pulled out from the from the receiving opening of the first locking part, characterised in that the latch has at least one latch wall and at least one latch opening and the second locking part has at least one swivel-mounted roller, whereby in the unlocking position the roller can be pulled out from the first locking part through the latch opening and is locked in the locking position by the latch wall in the first locking part, and the latch wall has a latch wall guide track for engagement with the roller at least in certain areas between the locking position and the unlocking position.
2. The lock as claimed in claim 1, characterised in that the roller is forcibly actuated between the locking position and the unlocking position on the latch wall guide track.
3. The lock as claimed in claim 1 or 2, characterised in that the latch is swivel-mounted about a latch axle in the first locking part and is pivotable about the latch axle.
4. The lock as claimed in any one of claims 1 to 3, characterised in that the latch wall guide track is curved, preferably circular-segment-shaped.
5. The lock as claimed in any one of claims 1 to 4, characterised in that the lock has an elastically deformable fastening device for elastic fastening of the second locking part on the container and/or the second locking part is configured elastically deformable.
6. The lock as claimed in claim 5, characterised in that the elastically deformable fastening device has at least one, preferably at least two, leaf springs, on which or between which the second locking part is held.

7. The lock as claimed in any one of claims 1 to 6, characterised in that the electromechanical actuator has an electromotor, operated preferably by means of a battery, by which the latch can be moved preferably rotatably, and preferably by a worm gear, between the locking position and the unlocking position, preferably reciprocally.

8. The lock as claimed in any one of claims 1 to 7, characterised in that a coupling is arranged and/or acts between the latch and the electromechanical actuator moving the latch.

9. The lock as claimed in claim 8, characterised in that the latch can be uncoupled preferably directly from the electromechanical actuator by means of the coupling prior to reaching the unlocking position.

10. The lock as claimed in claim 9, characterised in that the latch can be uncoupled from the electromechanical actuator whenever a force from the roller acting on the latch in the direction of the unlocking position exceeds a force threshold value, whereby it is preferably provided for the force threshold value to be greater than the forces which can be applied to the maximum to the latch by the electromagnetic actuator.

11. The lock as claimed in any one of claims 8 to 10, characterised in that the coupling has a coupling part mounted mobile relative to the latch, whereby the electromechanical actuator engages preferably exclusively and/or via a gearing on the coupling part.

12. The lock as claimed in claim 3 and 11, characterised in that the coupling part is swivel-mounted about the latch axle in the first locking part.

13. The lock as claimed in claim 11 or 12, characterised in that a spring-loaded contact element, which engages in a coupling guide track or lies thereon, is fastened on one of the parts selected from a group formed by the coupling part and the latch, whereby the coupling guide track is fastened on the other of the parts, selected from the

group formed from the coupling part and the latch.

14. The lock as claimed in claim 13, characterised in that the coupling guide track has a first, preferably depressed, section, whereby the coupling part is force-fitted with the latch when the contact element is arranged in the first section, and the coupling guide track has a shoulder adjoining the first section, whereby the latch is uncoupled from the coupling part whenever the contact element is arranged in a second section of the coupling guide track which is arranged on the side of the shoulder averted from the first section.

15. The lock as claimed in claim 14, characterised in that the first section of the coupling guide track has bevelled sections between a position, in which the contact element is deflected to the maximum by its spring loading, and the shoulder as well as on the side of the position turned away from the shoulder.