

Safety brake and method for unlocking a safety brake

The invention relates to a safety brake for a load receiving means of a lift, with a fixing means which can be brought into a locked and an unlocked state and which in the locked state fixes the load receiving means to a rail, as well as a method for unlocking such a safety brake after a braking process.

Safety brakes are used with a number of different operating principles. A large part thereof have a clamping mechanism which, after activation by a speed limiter system, produce a clamping action between components of the safety brake and at least one stationary rail, which is mounted parallel to the travel path of the load receiving means, with use of the kinetic energy of the moving load receiving means. Due to self-locking in the clamping mechanism, some of these safety brakes can be unlocked again after the braking process only with considerable expenditure of force.

A safety brake of the kind stated in the foregoing is known from EP 0 899 231 A1 and is explained in more detail in the descriptive part with reference to Fig. 2.

In order to unlock safety brakes, which have a self-locking clamping mechanism, again after a braking process these have to be moved against the movement direction present before the braking process, which usually happens by moving the load receiving means. Such a movement is usually produced by lifting the load receiving means by the drive unit of the lift or by lowering the load receiving means by the drive unit with utilisation of the weight force of the load receiving means and possibly an additional load. For overcoming the mentioned self-locking of the clamping mechanism there is needed a displacement force which is substantially increased by comparison with normal operation. This increased displacement force in many cases exceeds the available force of the drive unit or the weight force of the load receiving means. Unlocking by manipulation at the safety brake is usually not possible, since in the case of braking this is not accessible.

The present invention has the object of creating equipment by which unlocking of such safety brakes is made possible with substantially reduced release force, i.e. by exclusive use of the unassisted drive unit of the lift or the weight force of the load receiving means.

Fulfilment of the specified object is recited in the independent claims 1 and 11 with respect to the most significant features thereof and in the dependent claims with respect to further advantageous embodiments.

- 5 The advantages achieved by the invention are essentially to be seen in that simple and economic safety brakes, which need to overcome substantial frictional forces for unlocking thereof, are usable without the drive units having to apply more than the lifting force required for normal operation and without the load receiving means having to be loaded with additional loads for unlocking after a braking process from an upward movement.

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In order, for unlocking the safety brake with the assistance of the abutments movable relative to the fixing means, to be able to exert a blow on these fixing means, these abutments are expediently fixedly connected with the load receiving means so that the blow can be produced by simple vertical movement of the load receiving means.

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The fixing means is preferably so connected with the load receiving means that it is displaceable relative to the load receiving means parallel to the stationary rail within a limited displacement path, wherein the abutments form the limitation of this displacement path. For unlocking the safety brake after a braking process the load receiving means can
20 thereby be moved and accelerated over a limited displacement path, without hindrance by the fixing means fixedly seated on the rail, before one of the abutments fixedly connected with the load receiving means collides with this fixing means and unlocks this by a blow utilising the kinetic energy of the moved load receiving means.

- 25 In a further preferred embodiment of the invention at least one of the abutments forming the limitations of the displacement path is adjustable, for example in the manner that the limitation consists of an abutment screw with a fixing nut. The displacement path can thus be optimised in correspondence with the prevailing conditions.

- 30 The fixing means is, with advantage, held in normal operation by at least one spring element in contact with the abutment forming the upper limitation of the displacement path and connected with the load receiving means, wherein this spring element has to compensate for at least the weight force of the fixing means. By this measure it is avoided that in the case of a braking process from a downward movement of the load receiving
35 means, in which the greatest braking forces arise, the fixing means firmly clamped to the stationary rail collides against the said upper abutment like a hammer. On unlocking of the

safety brake through lifting the load receiving means by the drive unit of the lift, the load receiving means moves upwards relative to the fixing means, which is fixedly seated on the stationary rail, and against the spring force until an abutment forming the lower limitation of the displacement path collides with the fixing means and thereby helps to
5 unlock the clamping mechanism thereof.

It is advantageous to achieve the limited displaceability of the fixing means relative to the load receiving means in such a manner that the two components are connected together by way of linear guides or pivot guides. Collar screws in guide slots, dovetail or prismatic
10 sliding guides, parallelogram linking lever guides or parallelogram leaf spring guides are suitable forms of embodiment for that purpose.

Displacement paths having a length limited to 5 to 30 mm have proved advantageous for the different conditions of use and variants of safety brakes.
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For lifts which have a counterweight and in which a safety brake has to secure the load receiving means even before excess speed in upward direction it is advantageous to use a fixing means which is effective as a unit in both directions of movement of the load receiving means, wherein different braking forces can be generated for the downward
20 direction and the upward direction. For lifts without a counterweight, fixing means which function only in the downward direction of the load receiving means are sufficient.

Embodiments of the invention are illustrated in Figs. 1 to 8 and explained in more detail in the following description.
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- Fig. 1 shows a schematic illustration of a lift with the safety brake according to the invention,
- Fig. 2 shows an embodiment for a fixing means effective in both directions of travel of the load receiving means,
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- Fig. 3 shows an embodiment for a fixing means effective only in the downward direction of travel of the load receiving means,
- 35 Fig. 4 shows, schematically, a safety brake according to the invention after a braking process from a downward movement of the load receiving means,

Fig. 5 shows, schematically, the same safety brake at the instant of the unlocking process, and

5 Figs. 6, 7 and 8 show embodiments of the safety brake with different solutions for realisation of the displaceability of the fixing means.

Fig. 1 shows schematically a lift installation equipped with a safety brake according to the invention. This essentially consists of a load receiving means 2 guided at guide rails 1, a
 10 drive unit 3, a counterweight 4, a number of support cables 5 and a speed limiter system 6. The load receiving means 2 comprises a cage 10, a cage frame 11, upper guide shoes 12 and two safety brakes 13 according to the invention. Such a safety brake 13 is composed of a fixing means 14 and a brake bracket 16, which is connected with the load receiving means 2 and onto which the fixing means 14 is fastened, the bracket 16 additionally
 15 carrying two lower guide shoes 17.

The load receiving means 2 and the counterweight 4 are suspended at the support cables 5, which are guided over a drive pulley 18 of the drive unit 3, and are moved back and forth along the guide rails by the drive system formed from these components. In the case
 20 of exceeding a speed limit, a speed limiter cable 20, which in the normal case is moved synchronously with the load receiving means, is blocked by a speed limiter 21 which by way of a trigger lever 15 activates the fixing means 14, which are connected together by way of a coupling mechanism 22, of the two safety brakes 13. A clamping effect between the fixing means 14 and the guide rails 1 is then produced, with utilisation of the kinetic
 25 energy of the load receiving means 2, in clamping mechanisms contained in the safety brakes.

Fig. 2 shows a possible embodiment of a fixing means 14. The guide rail of a load receiving means is denoted by 1. A base body 23 has a cut-out 24, in which the guide rail
 30 1 projects. A first brake shoe 26 supported by biased spring elements 25 is arranged in the base body 23 on one side of the cut-out 24. A second brake shoe 27, which is supported on an eccentric 28 mounted in the base body 23, is present on the other side of the cut-out. This eccentric is connected in rotationally secure manner with a ride-on disc 29, the periphery of which would laterally contact the guide rail, but which has at its
 35 circumference a flattened location 30 which in the spring-centred normal position of the ride-on disc 29 prevents this contact. A trigger mechanism 31 actuated by way of the

trigger lever 15 (Fig. 1) in the case of excess speed by the speed limiter cable 20 causes a rotation of the eccentric 28 together with the ride-on disc 29 to such an extent that the non-flattened part of the periphery of the ride-on disc 29 contacts the guide rail 1. Due to the relative movement between guide rail 1 and the ride-on disc 29, the latter is rotated together with the eccentric 28 until an abutment, which is not illustrated here, stops the rotation, whereupon the ride-on disc 29 is constrained to slide on the guide rail 1. The rotation of the eccentric 28 has the effect that this moves the second brake shoe 27, which is supported thereon, against the guide rail and the latter is clamped between the two brake shoes 26 and 27, wherein the resilient support of the first brake shoe 26 determines the clamping force in dependence on the eccentric stroke. Depending on the direction of movement of the load receiving means 2 present at the instant of triggering, the ride-on disc 29 together with the eccentric 28 is rotated in positive or negative rotational sense. The maximum angles of rotation, which are limited by abutments, are of different size for the positive and the negative rotational sense, whereby different eccentric strokes with correspondingly different clamping and braking forces arise, the forces being adapted to the requirements for braking from downward movement or upward movement.

In order to unlock the self-locking clamping between the fixing means 14 and the guide rail 1 which is present after an instance of braking, this fixing means 14 has to be moved oppositely to the direction of movement of the load receiving means 2 present before the safety braking, which usually takes place by displacing the load receiving means 2 with the assistance of the drive unit 3. In that case the eccentric 28 is rotated by the ride-on disc 29 back into its spring-centred normal position in which clamping forces are no longer produced. The unlocking movement requires a substantial expenditure of force.

Fig. 3 shows a further possible embodiment of the fixing means 14. A base body 32 has a cut-out 34 in which the guide rail 1 projects. A block-shaped brake plate 23 is embedded in the base body 32 on one side of the cut-out and the base body 32 includes a clamping ramp on the opposite side. A trigger mechanism 36 connected with the speed limiter cable 20 (Fig. 1) by way of the trigger lever 15 (Fig. 1) carries a cylindrical clamping body 37 arranged in the space between the clamping ramp 35 and the guide rail 1. On triggering of the safety brake the blocked speed limiter cable has the effect that the trigger mechanism 36 lifts the clamping body 37 and brings it into contact with the guide rail 1 and the clamping ramp 35 moving relative thereto, so that the clamping body 37 is wedged between guide rail 1 and clamping ramp 35. The load receiving means is braked by friction and deforming of the guide rail 1.

In order to unlock the self-locking clamping between this fixing means 14 and the guide rail 1 present after an instance of braking, this fixing means 14 has to be moved oppositely to the direction of movement of the load receiving means 2 present before the safety braking, which is usually carried out by displacing the load receiving means with the assistance of the drive unit. In that case the cylindrical clamping body 37 moves out of the wedging gap, so that clamping forces are no longer present. The unlocking movement requires a substantial expenditure of force.

Fig. 4 and Fig. 5 illustrate the mode of operation of the safety brake 13 in accordance with the invention, mounted at a load receiving means 2. The guide rail 1, the fixing means 14, the brake bracket 16, the lower guide shoe 17 and a spring element 41 can be recognised. The fixing means 14 is fastened to the brake bracket 16 by two collar screws 43, which are guided in the slots 42, to be vertically displaceable. An upper abutment 44, which is integrated in the brake bracket 16, and the lower guide shoe 17 limit the displacement travel. Releasable screws 40 and the positioning screw 45 enable setting of an optimal displacement path. In normal operation the spring element 41 keeps the fixing means 14 in contact - against the weight force thereof - with the upper abutment 44. The position of the fixing means 14 after a braking process from a downward movement of the load receiving means is illustrated in Fig. 4, which also corresponds with the position in normal operation. The clamping mechanism, which is fixedly seated on the guide rail 1 by self-locking, of the fixing means 14 is unlocked in the manner that, with the assistance of the drive unit 3 of the lift, the load receiving means 2 is moved upwardly with the greatest possible acceleration, whereby after a travel path corresponding with the limited displacement path the lower guide shoe 17, which serves as a lower abutment, hits against the fixing means 14 and, with utilisation of the kinetic energy of the entire load receiving means, unlocks the clamping mechanism. Fig. 5 shows the safety brake at the instant of the described impact.

The unlocking action of the safety brake according to the invention is also given in the case of braking processes from an upward movement of the load receiving means 2. There is used in that case either a double-acting fixing means 14 or two single-acting fixing means 14 each associated with a respective direction of movement (Fig. 2 shows an example for a double-acting fixing means and Fig. 3 shows an example for a single-acting fixing means). After triggering of the safety brake due to excess speed of the load receiving means 2 in upward direction, the fixing means 14 firmly clamps against the guide

5 rail 1 in frictional-locking manner and is thereby displaced relative to the brake bracket 16 against the force of the spring element 41 until abutment with the lower guide shoe 17. The fixing means 14 usually remains in this position even after standstill of the load receiving means 2. For unlocking the clamping mechanism, which is fixedly seated at the guide rail 1, of the fixing means 14 the load receiving means 2 together with the brake bracket 16 is lowered with the greatest possible acceleration, which usually takes place with the assistance of the drive unit 3. After a dropping movement of the load receiving means corresponding with the limited displacement path, the upper abutment 44 hits against the fixing means 14, whereby the self-locking of the clamping mechanism is overcome and this is unlocked.

Figs. 6, 7 and 8 illustrate further embodiments of the safety brake according to the invention.

15 In the case of the safety brake according to Fig. 6 the vertical displaceability between the fixing means 14 and the brake bracket 16 is achieved in the manner that the two components are connected together by way of a prismatic sliding guide 46. The same effect would also be achieved with a dovetail sliding guide.

20 Fig. 7 shows a safety brake in which the vertical displaceability of the fixing means 14 is achieved in the manner that this is connected with the brake bracket 16 by way of parallel guidance linking levers 47.

25 A further possible embodiment of the safety brake 13 is illustrated in Fig. 8, in which the vertical displaceability of the fixing means 14 is achieved in the manner that the latter is connected with the brake bracket 16 by way of parallel guidance leaf springs 48. This solution has the advantage that through upward biasing of the parallel guidance leaf springs 48 the additional spring elements 41 required in the other embodiments can be dispensed with.

Reference Numeral List

	1	guide rail
	2	load receiving means
5	3	drive unit
	4	counterweight
	5	support cable
	6	speed limiter system
	7	-
10	8	-
	9	-
	10	cage
	11	cage frame
	12	upper guide shoe
15	13	safety brake
	14	fixing means
	15	trigger lever
	16	brake bracket
	17	lower guide shoe
20	18	drive pulley
	19	-
	20	speed limiter cable
	21	speed limiter
	22	coupling mechanism
25	23	base body
	24	cut-out
	25	spring element
	26	first brake shoe
	27	second brake shoe
30	28	eccentric
	29	ride-on disc
	30	flattened location
	31	trigger mechanism
	32	base body
35	33	brake plate
	34	cut-out

	35	clamping ramp
	36	trigger mechanism
	37	clamping body
	38	-
5	39	-
	40	screw
	41	spring element
	42	slots
	43	collar screws
10	44	upper abutment
	45	positioning screw
	46	prismatic sliding guide
	47	parallel guidance link levers
	48	parallel guidance leaf springs
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Patent Claims

1. Safety brake (13) for a load receiving means (2) of a lift, with a fixing means (14) which can be brought into a locked and an unlocked state and which in the locked state
5 fixes the load receiving means (2) to a rail (1), and with at least one abutment (17, 44) which is movable relative to the fixing means (14) and which by means of a blow on the fixing means (14) brings this from the locked state into the unlocked state.
2. Safety brake (13) according to claim 1, wherein the at least one abutment (17, 44)
10 is fixedly connected with the load receiving means (2).
3. Safety brake (13) according to claim 2, wherein the fixing means (14) is so connected with the load receiving means (2) that it is displaceable relative to the load receiving means (2) within a limited displacement path and wherein an upper and a lower
15 abutment (17, 44) each form a respective one of an upper and a lower limitation of this displacement path.
4. Safety brake (13) according to claim 3, wherein the position of at least one of the abutments (17) is adjustable in the direction of the displacement path of the fixing means
20 (14).
5. Safety brake (13) according to one of claims 3 and 4, wherein during normal operation of the lift at least one spring element (25, 48) keeps the fixing means (14) in contact with the abutment (44) which forms the upper limitation of the displacement path.
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6. Safety brake (13) according to one of claims 3 to 5, wherein the displaceability of the fixing means (14) relative to the load receiving means (2) is achieved in that the connection thereof with the load receiving means (2) is effected by means of screws (43) in guide slots (42), by means of a dovetail or prismatic sliding guide (46), parallel guidance
30 link levers (47) or parallel guidance leaf springs (48).
7. Safety brake (13) according to one of claims 3 to 6, wherein the displacement path between the fixing means (14) and the load receiving means (2) is 5 mm to 30 mm.
- 35 8. Safety brake (13) according to one of claims 3 to 7, wherein the fixing means (14) comprises a single fixing mechanism which can brake the load receiving means (2) from



both directions of movement, and wherein the fixing means (14) is brought from the locked into the unlocked state in that after a braking process from a movement of the load receiving means (2) in downward direction the lower abutment (17) hits against the fixing means (14) and after a braking process from a movement of the load receiving means (2) in upward direction the upper abutment (44) hits against the fixing means (14).

9. Safety brake (13) according to one of claims 3 to 8, wherein the fixing means (14) comprises a base body (23) with a cut-out (24) for the rail (1), on one side of which a first brake shoe (26) supported by spring elements (25) is present and on the opposite side of which a second brake shoe (27) is present, wherein the latter is supported on an eccentric (28) which is mounted in the base body (23) and which is connected in rotationally fast manner with a ride-on disc (29) having a flattened location (30) at the circumference thereof, and that on activation of the safety brake (13) the ride-on disc (29) connected with the eccentric is rotated to such an extent about its axis by a trigger mechanism (31) that the non-flattened part of its periphery presses against the rail (1), wherein in consequence of the relative movement between the rail (1) and the ride-on disc (29) the latter is further rotated together with the eccentric (28) until a stop to rotation occurs, so that the eccentric (28) moves the second brake shoe (27) supported thereon against the rail (1) and the latter is clamped between the two brake shoes (26, 27).

10. Safety brake (13) according to one of claims 3 to 8, wherein the fixing means (14) comprises a base body (32) with a cut-out (34) for the rail (1), on one side of which a brake plate (33) is present and on the other side of which a clamping ramp (35) extending at an inclination relative to the rail (1) is present, and the fixing means (14) comprises a trigger mechanism (36) and a clamping body (37), and wherein on activation of the safety brake by the speed limiter system (6) of the trigger mechanism (36) the clamping body (37) is so guided between the rail (1) and the clamping ramp (35) moving relative to the latter that the clamping body (37) is wedged between these two.

11. Method for unlocking a safety brake (13) for a load receiving means (2) of vertical conveying equipment after a braking process, wherein the safety brake (13) is provided with a fixing means (14) which is so connected with the load receiving means (2) that it is displaceable relative to the load receiving means (2) within a limited displacement path, and the safety brake (13) is equipped with abutments (17, 44) which are fixedly connected with the load receiving means (2) and form the limitations of the displacement path, and wherein the safety brake (13) is unlocked after a braking process in that the load receiving



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means (2) is moved oppositely to its movement direction present before the braking process, so that one of the abutments (17, 44) hits against the fixing means (14).