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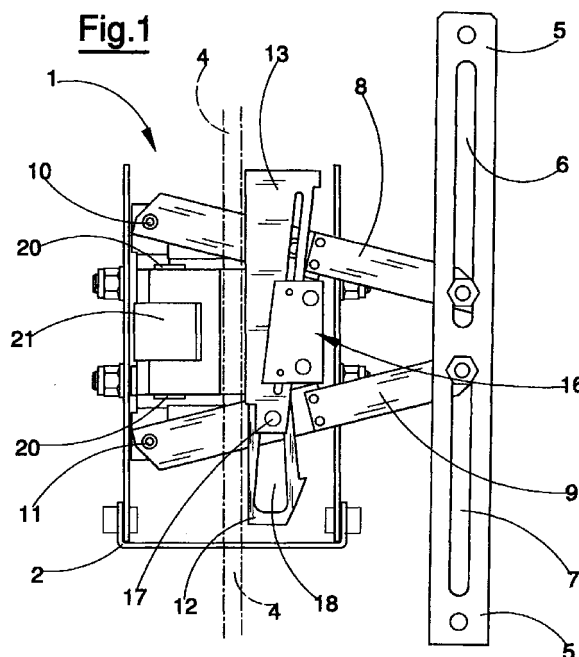
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(54) **A safety braking device for elevator**

(57) The invention relates to a safety braking device for elevators, able to operate both during ascent and descent, which comprises two wedges (12 and 13), one for braking a cabin in descent and another for braking the cabin in ascent, each of which wedges is associated to a guide having an inclined plane and can assume, independently of the other wedge, an active braking position, in which it is compressed contactingly between a guide having an inclined plane and a fixed vertical element (4). The wedges are arranged side-by-side and are actuated independently by two levers (8 and 9) commanded independently by a bracket (5), to which they are connected relatively moveably in slots (6 and 7). The bracket (5) is fixed to a cable (3) which commands brake activation.



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Description

[0001] The invention relates in particular to a safety device, destined to be mounted on the cabin of an elevator, able to brake the cabin both on an upwards and a downwards journey. The device fulfils its objective by means of two blocking wedges which intervene automatically in case of excessive cabin speed. One of the two wedges is effective on an upward journey while the other acts on the downward journey.

[0002] A device of this type is taught in the prior art, in which the wedges are located vertically one above the other, one in the upper and one in the lower parts of a support which is solidly constrained to the cabin.

[0003] Prior art devices of the above-cited type are particularly unwieldy, especially in a vertical direction. Generally speaking, it would be best if the braking device were as small as possible, given the limited space available in the elevator shaft.

[0004] The main aim of the present invention is to provide a safety device which is constructionally simple and economical, and which is of a relatively contained mass.

[0005] An advantage of the invention is that it provides a device with reduced masses both vertically and horizontally.

[0006] A further advantage is that it provides a safety device having remarkable flexibility and reliability.

[0007] These aims and advantages and more besides are attained by the present invention, as it is characterised in the claims that follow.

[0008] Further characteristics and advantages of the present invention will better emerge from the detailed description which follows of a preferred but non-exclusive embodiment of the invention, illustrated in the form of a non-limiting example in the accompanying figures of the drawings, in which:

figure 1 is a schematic side view in vertical elevation of the invention, in the configuration assumed during normal elevator operation;

figure 2 is a partially-sectioned plan view from above of figure 1;

figure 3 is the view of figure 1, with some parts removed better to evidence others;

figure 4 is the view of figure 3 with some other parts removed better to evidence others;

figure 5 shows the device of figure 3 in a configuration assumed when the elevator is moving at an excessive speed in an upwards direction;

figure 6 shows the device in the view of figure 4, in a configuration assumed when the elevator is moving at an excessive speed in a downwards direction.

[0009] With reference to the above-mentioned figures, 1 denotes in its entirety a safety braking device for elevators, for braking an elevator travelling both in an

upwards and in a downwards direction.

[0010] The device 1 comprises a support 2 destined to be solidly constrained to the cabin of the elevator.

[0011] A flexible organ, for example a cable 3, is predisposed in the elevator shaft and is commanded by means of a control device of known type to make the cabin go up and down during normal operation. A fixed metal element 4 is also present in the shaft, elongate in a vertical direction throughout more or less the whole length of the shaft.

[0012] A bracket 5 with two vertically-extending slots 6 and 7 is arranged on a vertical section of the cable 3, with the slots 6 and 7 virtually parallel to the cable 3 and aligned one with another, with one arranged above the other in a vertical direction. The slots 6 and 7 act as sliding guides for each for one of two cursors. Each cursor has hinged to it, about a pivot with a horizontal rotation axis perpendicular to the lengthwise extension of the slots 6 and 7, an end of a lever, respectively 8 and 9 in the figures, which lever has an opposite end pivoted to the support 2 about a pivot, respectively 10 and 11 in the figures, also having a horizontal rotation axis. The levers 8 and 9 are located coplanarly one above the other and are both able to rotate along a vertical plane.

[0013] The device 1 comprises two blocking wedges 12 and 13, one for downwards braking and the other for upwards braking. The wedges 12 and 13 are at least partially superposed in a horizontal direction so as to occupy a very small area in a vertical direction. Each wedge also has an end hinged at an intermediate point of the corresponding levers 8 and 9. The wedge 13 for upwards blocking has a lower end hinged to the lower lever 9 (figure 3), while the wedge for downwards blocking has an upper end which is hinged to the upper lever (8) (figure 4). The two wedges 12 and 13 are plate-shaped and lie vertically, are parallel to each other and arranged one by the side of the other, at the same height.

[0014] Each wedge 12 or 13 is operatively associated to a guide 14 or 15 solidly constrained to the support 2. The two guides 14 and 15 each comprise an inclined plane for interacting with a corresponding wedge 12 and 13. The two inclined planes exhibit opposite inclinations and are arranged one by the side of the other on a same block 16 solidly constrained to the support 2.

[0015] Each wedge 12 or 13 can assume an active cabin-braking position (figures 5 and 6) and an inactive position (figures 3 and 4). In the active position the wedge 12 or 13, which is contactingly forced between the guide 14 or 15 and the fixed vertical element 4 having at least a height equal to the cabin run, can block the cabin by effect of the friction exerted against the surface of the fixed element 4, as will be better explained herein below. In the inactive position the wedge 12 and 13 is not forced between the fixed element 4 and therefore

does not block the cabin.

[0016] The two levers 8 and 9 are connected to the bracket 5 and the relative wedges 12 and 13 so that, during normal elevator operation, both wedges are in the inactive position and during abnormal operation (excessive speed) in downwards (or upwards) direction the consequent relative displacement between the support 2 and the bracket 5 causes the displacement of the downwards-acting wedge 12 (or upwards-acting wedge 13) into the active position.

[0017] During normal elevator operation the two cursors coupled slidingly in the slots 6 and 7 of the bracket are situated in proximity of an end-run limit position in the relative slot. The lower cursor is close to the upper limit of the lower slot 7 while the upper cursor is close to the lower limit of the upper slot 6.

[0018] A first activation lever (in the present example the lower lever 9) is hinged to the corresponding wedge (in the present example the upwards-acting wedge 13) by means of a pivot 17 which is at least partially housed in an aperture 18 made in the body of the other wedge (in this case the downwards-acting wedge 12). The pivot 17 can move internally of the aperture 18. The activating levers 8 and 9 of the wedges are mobile along a vertical plane situated by the side of and contiguously to the two wedges 12 and 13. The downwards-acting wedge 12 is interposed between the lower lever 9 and the upwards-acting wedge 13, which is laterally more external than the downwards-acting wedge 12 and to which the lever 9 itself is connected. The aperture 18 afforded on the downwards-acting wedge 12 enables the lower lever 9 to be connected to the upwards-acting wedge 13 by means of the pivot 17 which crosses the aperture 18. Furthermore, the aperture 18 is conformed so as to enable the wedges 12 and 13 to displace between their operative and non-operative positions without the pivot 17 of the more external of the wedges, in this case the upwards-acting wedge 13, interfering with the laterally more internal of the wedges, in this case the downwards-acting wedge 12.

[0019] The device 1 comprises a counter-wedge 19, constrained oscillatingly to the support 2, arranged to one side of the fixed vertical element 4 opposite to the side the wedges 12 and 13 act upon. The counter-wedge 19 can co-operate with both wedges 12 and 13 in the cabin braking action, both in upwards and downwards movement.

[0020] In the illustrated example, the counter-wedge 19 is rotatably coupled, about a pivot 20 with a vertical rotation axis parallel to the fixed vertical element 4, to an arm 21 developing horizontally, which arm is in turn rotatably coupled, about a pivot 22 having a vertical axis, to the support 2. The arm 21 extends in a parallel direction to the axes of the pivots 10 and 11 constraining levers 8 and 9 to the support 2. The longitudinal axis of the arm 21 is coplanar to the pivot 10 and 11 axes and is interposed between said axes.

[0021] One or more elastic elements, constituted for

example by Belleville washers, here generically referred-to as springs 23, mounted on the support 2 and arranged by the side of the levers 8 and 9, can act on the counter-wedge 19, and precisely can act on the opposite side to where the fixed vertical element 4 is located, and on which the wedges 12 and 13 and the counter-wedge 19 act.

[0022] During cabin braking the springs 23 are pre-disposed to press the counter-wedge 19 on to the fixed element 4 together with the action of the wedge 12 or 13 activated due to the presence of excessive speed. The counter-wedge 19 co-operates with the wedge to brake the cabin. The springs 23 act on the counter-wedge 19 only when there is an excessive cabin speed, either upwards or downwards. During normal operation the counter-wedge 19 is not pressed by the springs 23 against the element 4.

[0023] When one of the two wedges 12 and 13 is called upon to act, the fixed element 4 is compressed between whichever of the two shafts 12 or 13 is operating and the counter-wedge 19, which act as brake shoes.

[0024] The device operation will now be briefly described.

[0025] During normal operating conditions, with the cabin still or moving at a predetermined speed, the cable 3 and the support 2 anchored to the cabin are not in relative motion. The two wedges 12 and 13, as well as the counter-wedge 19, are therefore kept in the inactive position and do not brake the cabin.

[0026] When the cabin accelerates in a downwards direction above the accepted speed, the device automatically intervenes to brake it as follows. Owing to the effect of the downwards acceleration, the cabin and cable have relative motion, and the support 2 anchored to the cabin displaces downwards with respect to the bracket 5 anchored to the cable. The lower cursor, to which the lower lever 9 is hinged, can slide along the lower slot 7 so that the lower lever 9 stays practically still with respect to the support 2, maintaining the wedge 13 in the inactive position. The upper cursor, on the other hand, interacts contactingly with the lower limit of the upper slot 6, so that the upper lever 8 is rotated upwards about the pivot 10 on the support 2 (compare figures 4 and 6).

[0027] Consequently the downwards-acting wedge 12 is pushed upwards relatively to the support 2 and is guided by the relative inclined plane 14 towards the element 4 which vertically lifts in the elevator shaft.

[0028] The contact between the wedge 12 and the fixed element 4 automatically also activates the counter-wedge 19. The arm 21 to which the counter-wedge 19 is constrained tends to rotate (in clockwise direction with reference to figure 2) about the pivot 22 connecting it to the support 2, opposingly to the action of the springs 23. The springs are thus loaded, in a cabin-braking situation, by the relative motion of the counter-wedge supporting arm 21 against the support 2.

[0029] The compression of the springs 23 determines a locking force between the wedge 12, the counter-wedge 19 and the element 4, which force brakes the cabin and is adjustable by means of regulation of the springs 23. The springs should be regulated so that the braking force is sufficient to block the cabin, but should not be so strong as to render difficult or impossible the unblocking of the cabin once the emergency situation has subsided.

[0030] Should the cabin exceed the permitted speed in an upwards direction, the cabin and the cable are relatively mobile, and the support 2 displaces upwards with respect to the bracket 5. Owing to this relation motion, the upper lever 8 stays still with respect to the support 2, maintaining the relative wedge 12 in the inactive position, while the lower lever 9 is rotated downwards about the pivot 11 on the support 2 (compare figures 1 and 3), drawing the wedge 13 downwards to block descent. The wedge 13 is guided by the relative inclined plane 15 towards the fixed element 4. The contacting interaction between the wedge 13 and the fixed element 4 causes the counter-wedge 19 to intervene, in the same way as for the downwards braking described above, so that the fixed element 4 is compressed between the wedge 13 and the counter-wedge 19, and the cabin is braked.

Claims

1. A safety braking device for elevators, for braking a cabin both in ascent and in descent, comprising:
 - a support (2) destined to be solidly constrained to the cabin;
 - a bracket (5) destined to be connected to a cable (3) commanded by means of a command device to rise and fall at a same speed as the cabin during normal operation of the elevator;
 - two wedges (12 and 13), one of which operates to brake the cabin in descent and another of which operates to brake the cabin in ascent, each of which wedges (12 and 13) is associated to one of two guides (14 and 15) solidly constrained to the support (2), each of which wedges being able to assume an active position in which the cabin is braked, in which active position a wedge is compressed contactingly between an inclined and a fixed vertical element (4) having a length which is at least equal to a run of the cabin, and an inactive position, in which the wedge is not compressed against the inclined plane; said wedges (12 and 13) being arranged side by side so as to be at least partially superposed in a horizontal direction;
 - two levers (8 and 9) for actuating the wedges (12 and 13), which levers (8 and 9) are pivoted to the support (2), each of which levers (8 and

9) being connected to the bracket (5) and to one of the wedges (12 and 13), so that during normal elevator operation conditions both wedges (12 and 13) are in inactive positions and so that during a faulty ascending or descending elevator operation condition in which the cabin is travelling at an excessive speed, a consequent relative motion between the support (2) and the bracket (5) determines a displacement into the active position of the relative wedge (12 or 13);

a counter-wedge (19) constrained oscillatingly to the support (2), arranged to one side of the fixed vertical element (4) opposite to a side where the wedges (12, 13) act and able to co-operate with said wedges (12, 13) during a braking action of the cabin;

at least one spring (23), predisposed to press, whenever a faulty situation occurs, the counter-wedge (19) on to the fixed vertical element (4) in such a way that the fixed vertical element (4) is compressed between the counter-wedge (19) and the wedge (12 or 13).

2. The device of claim 1, characterised in that a first lever (9) is hinged to one of the wedges (13) by means of a pivot (17) at least partially housed internally of an aperture (18) made in another of the wedges (12), said pivot (17) being interpositioned between the first lever (9) and the wedge (13), and being able to move internally of the aperture (18).
3. The device of claim 1 or 2, characterised in that said at least one spring (23) is located on the support (2) by a side of the wedges (12, 13) and the counter-wedge (19) and at a same height as the wedges (12, 13) and the counter-wedge (19).
4. The device of claim 3, characterised in that the counter-wedge (19) is constrained to an arm (21) pivoted to the support (2) and extending in a parallel direction to an axis of the pivot (10 and 11) of the cable-command levers (8 and 9), said spring (23) being predisposed to act on said arm (21).
5. The device of any one of the preceding claims, characterised in that the wedges (12 and 13) are associated to two guides (14 and 15) for nearing the wedges (12 and 13) to the fixed vertical element (4) by effect of vertical displacements, either downwards or upwards, of the wedges (12 and 13) with respect to the support (2), each guide (14 and 15) being able to act on one of the wedges (12 and 13) and having an opposite inclination to an inclination of another of the guides (14 and 15), and being arranged one aside another on a same block (16) solidly constrained to the support (2).

6. The device of any one of the preceding claims, characterised in that each lever (8 and 9) has an end which is hinged to a cursor coupled slidingly to said bracket (5).

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7. The device of any one of the preceding claims, characterised in that the wedges (12 and 13) are plate-shaped and arranged parallel one by a side of another.

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Fig.1

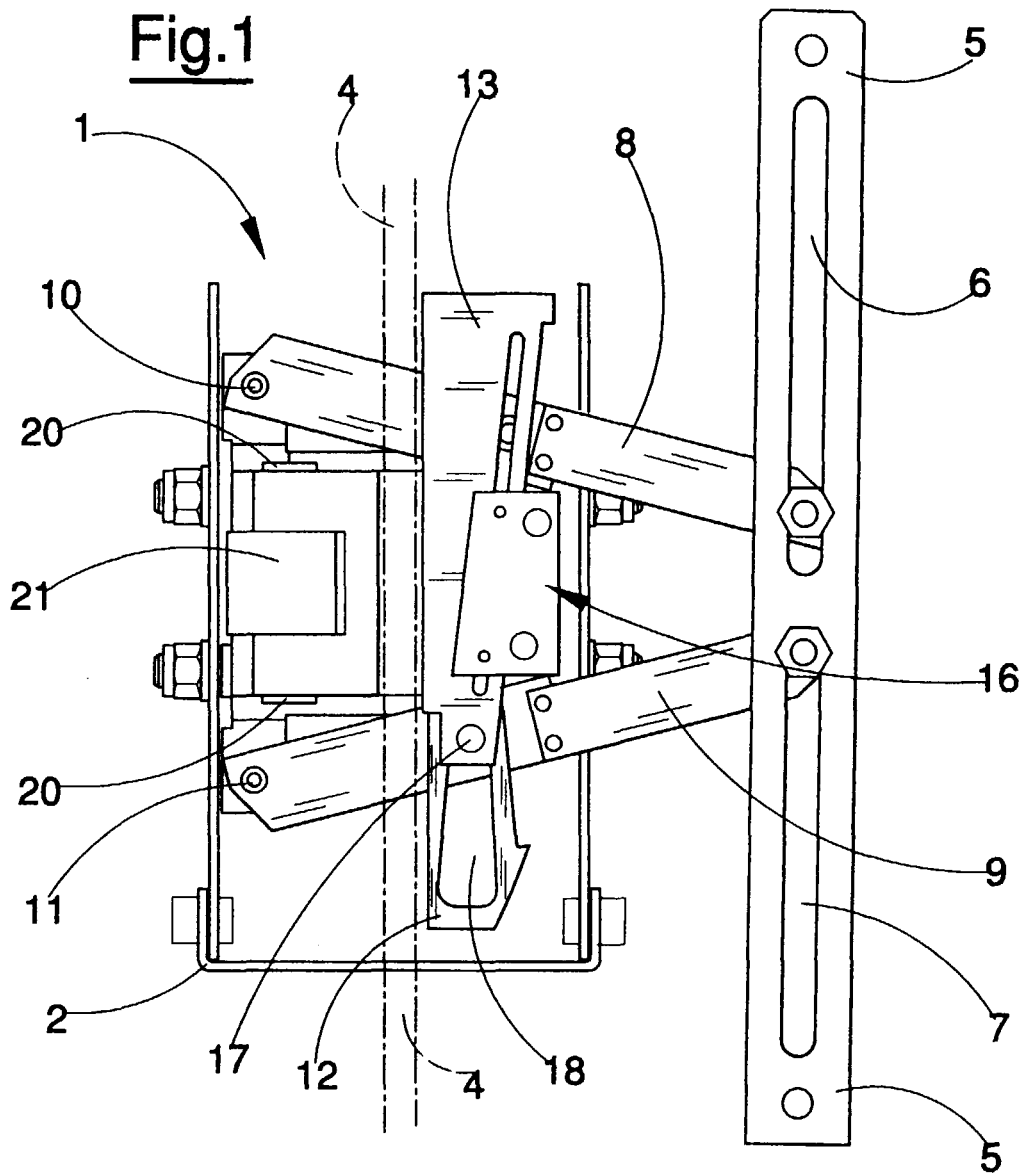
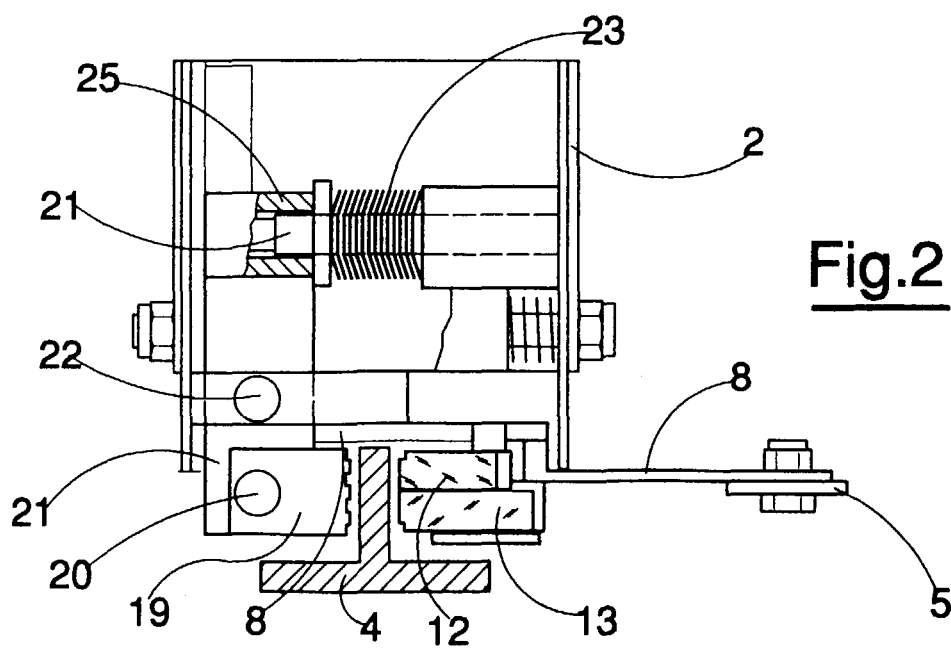
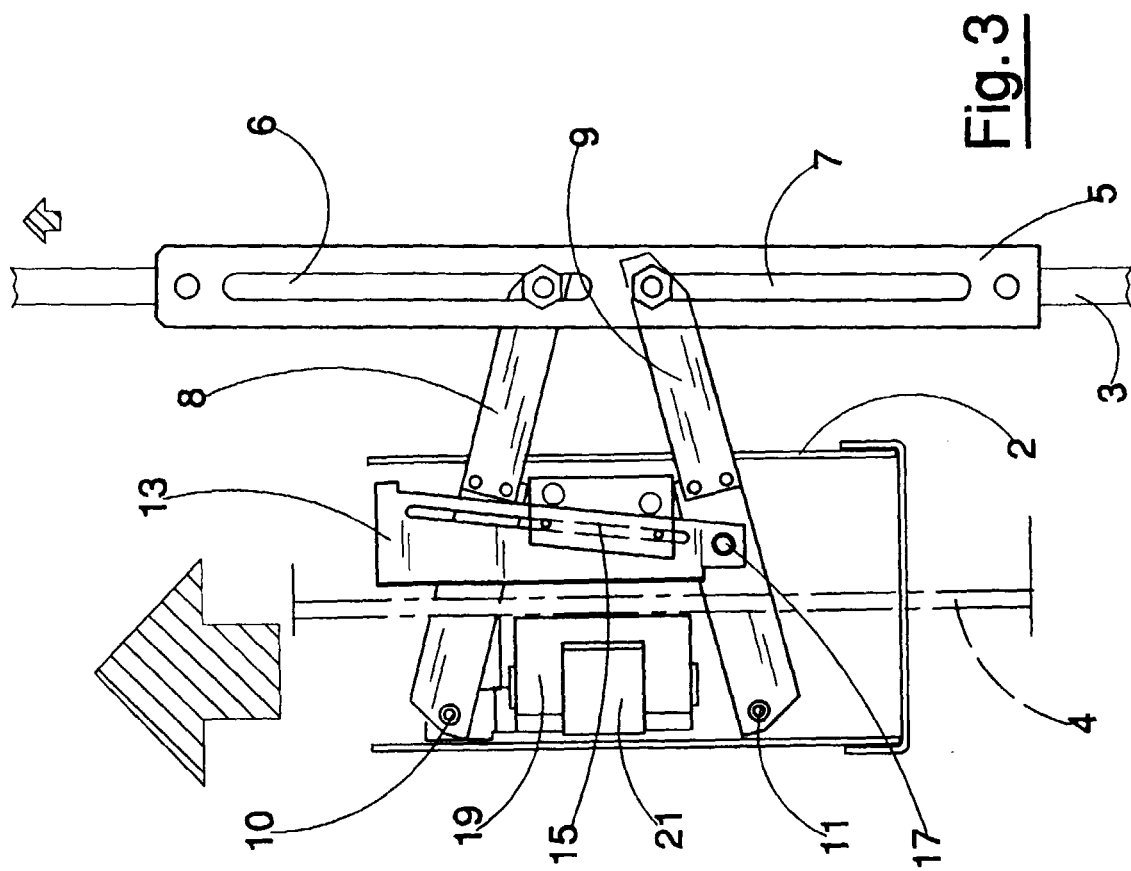
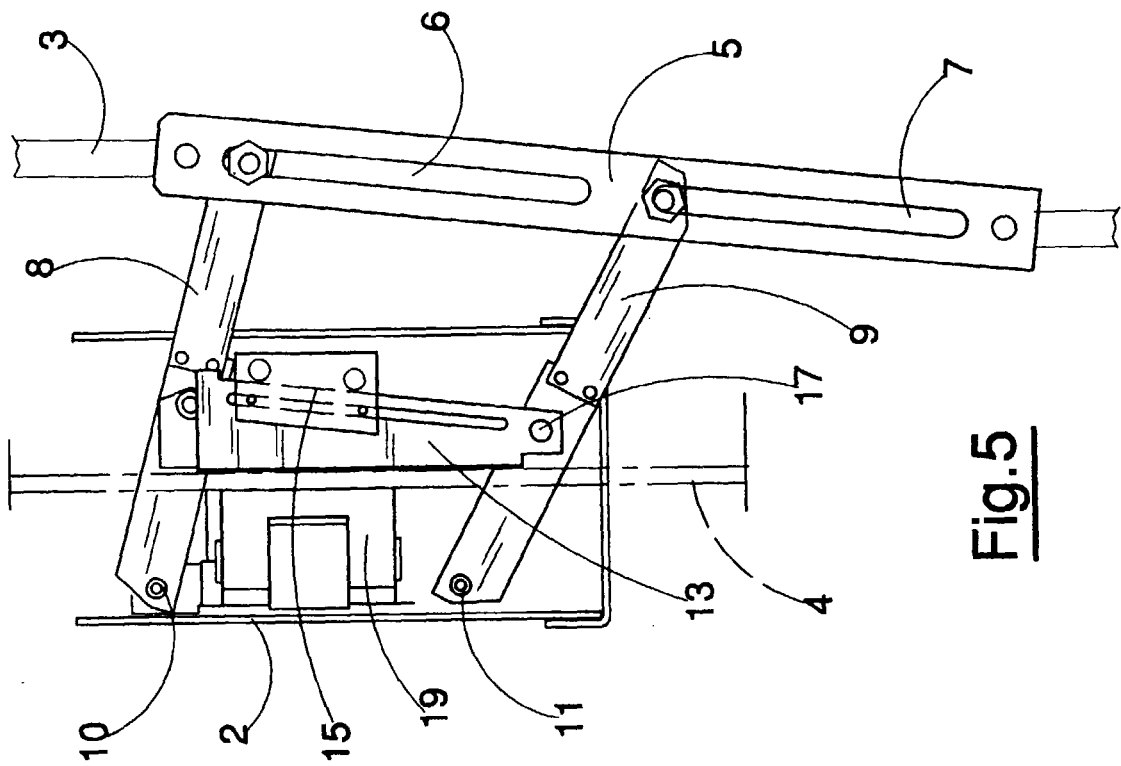
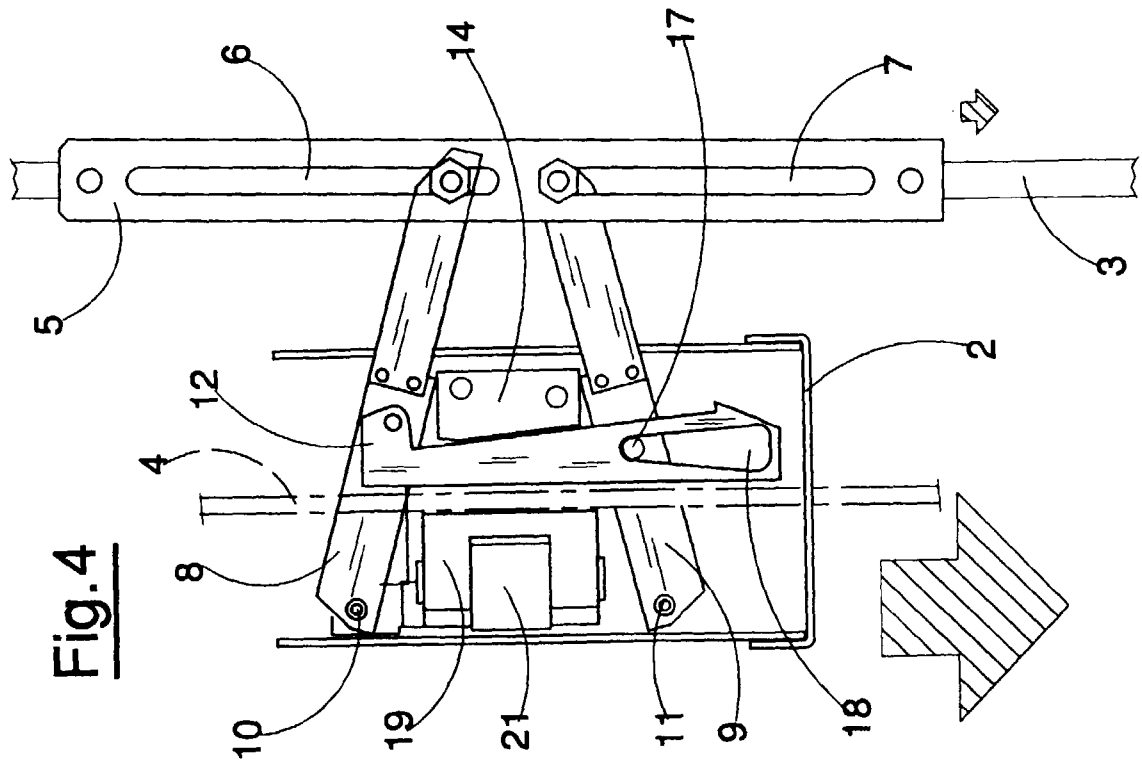
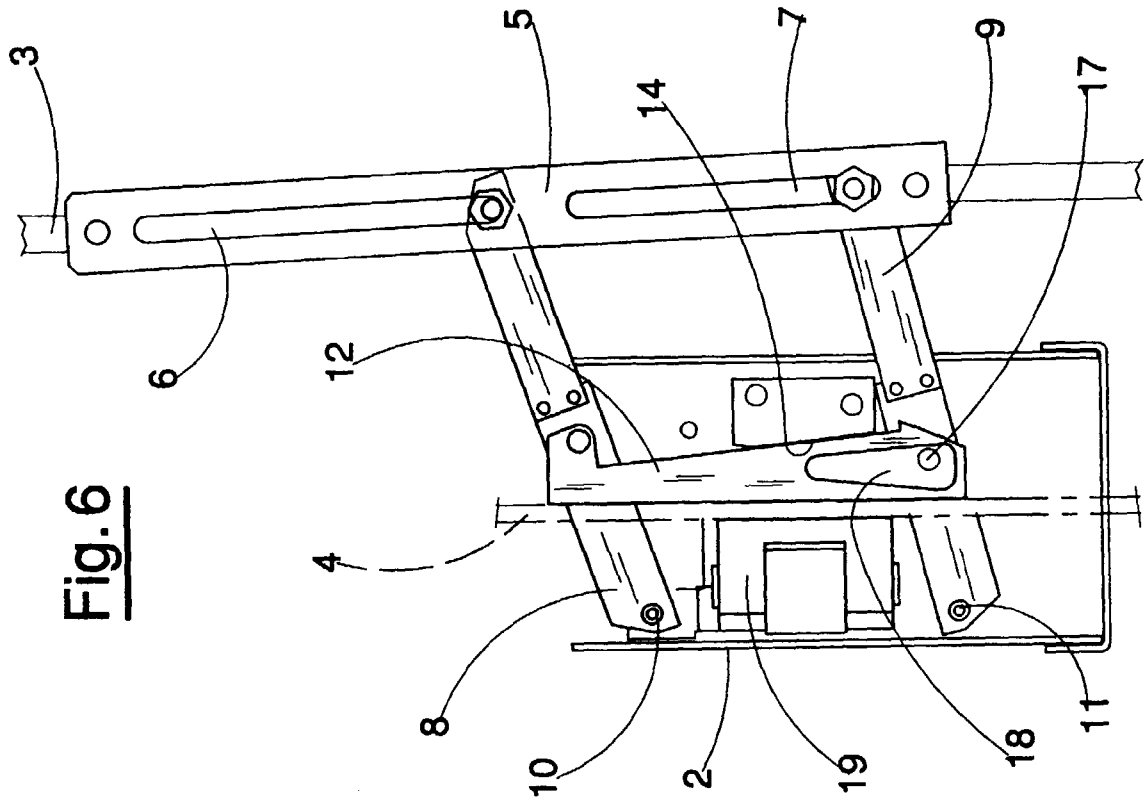


Fig.2









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EUROPEAN SEARCH REPORT

Application Number
EP 98 83 0697

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	DE 296 14 516 U (HAUSHAHN C GMBH CO) 2 January 1998 * the whole document * -----	1-7	B66B5/22
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			B66B
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 15 March 1999	Examiner Salvador, D
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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**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 98 83 0697

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15-03-1999

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DE 29614516 U	02-01-1998	EP 0825145 A	25-02-1998

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