

Catch device, for instance for a lift cage or counterweight.

The present invention concerns a catch device e.g. for a lift cage or counterweight, said catch device comprising a wedge case, an action wedge acting from one side on the lift guide and which is activated by means of a separate transmission member, such as a rope, and a counterwedge acting on the lift guide from the opposite side, the movement of said wedges being guided to go directly or indirectly along guiding surfaces in the wedge case.

On lifts with a cage velocity over 1 m/s usually glide catch devices are employed as a safety measure when for one reason or another the velocity of the lift cage increases to be excessively high. Glide catch devices catch on the guides in the lift shaft, which most usually number two or four. When each guide has a glide catch device of its own, the catch devices are synchronized by mediation of a separate synchronizing linkage. The glide catch device has a sliding surface with high friction coefficient, which is urged against the guide when the glide catch device goes into action and slows the lift down, or stops it, with the aid of friction.

Various device designs have been worked out for lift catch devices. One of the commonest types is a large-sized, U-shaped spring made of spring steel, between the ends of which the wedge enters when it catches on the guide. In addition, many catch devices feature a separate detachment wedge, with the aid of which the catch device is disengaged from the guide after catching has occurred. Disengagement is effected by lifting the lift cage.

The greatest drawback of catch devices of prior art is their high price and large size. The high price is due, among other things, to the circumstance that, for instance, the springs which are used are not standardized parts. A further drawback of previously known catch devices is a result of the variations of force occurring in connection with the catching action, because the value of the friction coefficient is different at different points along the guide, depending e.g. on the surface quality of the guide, the temperature

of the friction material that is used, and the velocity of the lift cage.

The object of the present invention is to provide a glide catch device for lifts in which the drawbacks mentioned above have been eliminated and with the aid of which also several other advantages are gained over existing catch devices. The catch device of the invention is characterized in that the wedge case comprises a force member which produces a force substantially parallel to the guiding surface, acting on the counterwedge.

The catch device according to an advantageous embodiment of the invention is characterized in that the guiding surface of the counterwedge has been so inclined that the distance from the upper margin of the guiding surface to the lift guide is larger than the corresponding distance from the lower margin of the same guiding surface.

The catch device according to another advantageous embodiment of the invention is characterized in that the distance between the upper margins of the guiding surfaces equals or is larger than the distance between the corresponding lower margins of the guiding surfaces, and that the angle of inclination is the same as the wedge angle of the corresponding wedge.

The catch device according to a third advantageous embodiment of the invention is characterized in that the distance between the upper margins of the guiding surfaces is smaller than the distance between the corresponding lower margins of the guiding surfaces.

The catch device according to a further advantageous embodiment of the invention is characterized in that the element in the force member causing the force is a spring.

Among the advantages common to the catch devices according to the above-mentioned embodiments over catch devices of prior art, it may be mentioned that in the catch device of the invention in the normal operating range inexpensive standard springs can be used,

which moreover have less power than presently used springs. Furthermore, the catch device of the invention affords the advantage that variations of friction coefficient at different points along the guides have no equally great effect on the attainable friction force as in conventional catch devices. In a way, the catch device is self-regulating.

The catch device of the invention is described in the following in detail, referring to the drawings, wherein:-

Fig. 1 presents the catch device of the invention, seen from the front,

Fig. 2 presents the same catch device, partly sectioned,

Fig. 3 presents further the same catch device, seen from above and partly sectioned,

Fig. 4 shows the action wedge, sectioned along the line IV-IV in Fig. 1,

Fig. 5 presents further the same catch device, seen from the front and simplified, and

Fig. 6 displays graphically the values of the attainable friction force, plotted over the friction coefficient.

The catch device comprises a wedge case 8, which has been fixed in the catch device frame 4 with spring-loaded bolts 5. For lateral adjustment of the wedge case 8, the catch device comprises adjustment screws 7, which are braced against the catch device frame 4. The wedge case 8 is so positioned in relation to the lift guide 30 that the guide is located approximately centrally in the wedge case, as seen from the front. Hereby on one side of the guide will lie the guiding surface 16a provided in the wedge case 8 and on the other side is an equivalent guiding surface 16b. Both guiding surfaces are inclined against the lift guide, preferably so that both guiding surfaces are parallel and that the guiding surface 16a

is at its upper margin farther away from the lift guide than at its lower margin. The angle of inclination depends on whether the lift guides are lubricated or not. With lubricated guides the angle of inclination is about 3° and with unlubricated guides, about 8° .

5 Along the guiding surface 16a travels the action wedge 9. Similarly, a counterwedge 10 travels along the guiding surface 16b. As friction-reducing elements between the guiding surface and the wedge, balls 15 are used, whereby the gliding friction has been replaced with rolling friction. In order that the balls 15 might
10 better maintain their intended place, the guiding surfaces have been provided with rolling grooves 16 having a depth slightly less than the radius of the balls 15. Similarly, the surfaces facing the wedge case of the wedges 9 and 10 have been provided with equal rolling grooves 15a. The holding of the balls 15 in their rolling
15 grooves has been further ensured with retainer cotter pins 12 in the wedge case at the lower end of the grooves. At the top end, similar retainer pins 11 have been affixed to the wedges 9 and 10. Both wedges 9 and 10 further present a guiding groove 31 to keep the wedges at proper distance from the wedge case. The wedge case
20 is provided with retainer pins 13 with their free end in the wedge guiding groove, thus preventing the wedge from moving too far out of contact with the wedge case or falling out from the wedge case altogether. On the vertical face, running along the guide 30, of the wedges 9 and 10 has been provided a separate braking surface 28
25 which has better friction characteristics than the wedge material. On the lower part of the action wedge 9 has been attached a separate adjustment plate 32, which mates with the lower surface 33 of the wedge case. At the top end of the action wedge 9 has similarly
30 been attached a synchronizing rod 34 for simultaneous action of the different catch devices. Between the wedge case 8 and the upper end of the counterwedge 10 has been interposed a compression spring 24, which pushes the counterwedge obliquely downward. The compression spring 24 has been fixed in place with a fixing screw 35, which is
35 fixed in the counterweight 10 but may move in relation to the wedge case in the hole 36, which has a diameter larger than the diameter of the fixing screw 35. The surface 37 in the wedge case 8 against which the compression spring acts is so inclined that the spring force acting on the counterwedge 10 is parallel with the guiding

surface 16b. The wedge case has, furthermore, guard plates 38, which prevent any potential lateral movement of the wedges out from the wedge case. At the same time they exclude unnecessary dirt and foreign particles from the wedge case.

5 The operation of the catch device of the invention shall be briefly described in the following. When the downward velocity of the lift cage increases to be too high, the velocity limiter (not depicted in the figure) is activated and acts on the catch device in such a way that the action wedge 9 rises upwards. As the lift cage, and at
10 the same time the wedge case 8, moves downwards, the braking surface 28 of the action wedge 9 sticks to the lift guide 30, whereby the action wedge 9 continues its relative upward movement in relation to the wedge case 8. The wedge case 8 is therefore set in movement laterally to the left, as depicted in the figure, whereby
15 at the same time the wedge case 8 pushes the bolts 5 to the left with the aid of the sleeves 40 attached to the bolts. The sleeves 40 move in holes provided in the catch device frame 4. As a consequence of the lateral movement, the compression springs 39 on the bolts 5 are compressed and, furthermore, the braking surface 28 of
20 the counterwedge 10 comes into contact with the lift guide 30, whereby the relative movement in relation to the wedge case 8 of both wedges continues upwards and the movement of the wedge case continues to the left, until the adjustment screw 23 touches the lower surface 33 of the wedge case. When, after catching, the lift
25 is set free by lifting it, the movement is opposite and the springs 39 pull the wedge case 8 back into position. The catch device is so adjusted that both the action wedge 9 and the counterwedge 10 contact the lift guide 30 before the action wedge 9 stops in its top position. When the action wedge rises upwards towards the limit
30 of its top position, the counterwedge 10 also rises upwards under friction effect, against the spring force F. The friction force between the wedges and the lift guide 30 obtainable due to wedge effect with the spring force F is very high, whereby the attainable braking power is high. When the wedge angle, and at the same time
35 also the direction of the spring force relative to the lift guide, has the magnitude α , and considering the fact that owing to the ball bearing arrangement the friction force acting on the rear

surface of the wedges is nearly zero, the attainable friction force can be calculated from the formula:

$$F_s = 2\mu F \left(\sin \alpha + \frac{\cos^2 \alpha - \mu \sin \alpha \cos \alpha}{\sin \alpha + \mu \cos \alpha} \right)$$

The symbol μ stands for the friction coefficient between the lift guide and the braking surfaces 28 of the wedges. In Fig. 6 are graphically shown the friction forces found from the above formula for different values of the friction coefficient. Of the calculated results two graphs have been plotted, one representing the results when the wedge angle is 5° and the other, when the wedge angle is 8° . For comparison, in the same connection has been plotted, with dot-and-dash lines, the friction force obtainable with a catch device according to the state of art, over the friction coefficient. The spring force is then usually parallel to the normal force, i.e., perpendicular against the lift guide. It is clearly seen from the graphs that with friction coefficient values below 0.85 clearly higher friction against the braking surface is achieved with the catch device of the invention than with conventional catch devices. Correspondingly, friction coefficients higher than 0.85 are exceedingly difficult to attain. From the foregoing follows inversely that with the catch device of the invention and using a spring of lower effect equal friction forces are obtained as with conventional catch devices and using powerful, large springs. Fig. 6 also reveals the independence, better than in the case of conventional catch devices, of the catch device of the invention of variations in friction coefficient between different points on the lift guide. The variation of friction coefficient is influenced by the surface quality of the lift guide at different points, the temperature of the friction material that is used, the velocity of the lift cage, etc. Let us assume that with the materials at our disposal a nominal friction coefficient of $\mu = 0.5$ is obtained between the lift guide and the braking surfaces of the wedges, and that the variation of the friction coefficient owing to various factors is $\pm 25\%$. The maximum of the friction coefficient is then 0.3125 and the minimum, 0.1875. We can read from the graphs in Fig. 6 that with conventional catch devices the friction force $F_s = 0.5 * F$ is obtained, where thus F stands for the spring force.

Similarly we find for the maximum of the friction force $0.625 * F$ and for the minimum, $0.375 * F$. From these figures we can calculate that the variation of friction force is the same as that of the friction coefficient, i.e., $\pm 25\%$ of the nominal friction force. In the case of the catch device of the invention, calculation with the same values of friction coefficient and of variation yields the following values, on assumption that the wedge angle is 8° : nominal friction force $1.2929 * F$, maximum friction force $1.3931 * F$, and minimum friction force $1.544 * F$. Hereby the variations of friction force, related to nominal friction force, are -10.7% and $+7.8\%$. Thus we may note that when the catch device of the invention is used, the variation of braking force in the event of catching is substantially less than that encountered when conventional catch devices are used. The consequence is better, and more reliable, catching than with catch devices conforming to the state of art.

It is obvious to a person skilled in the art that the invention is not exclusively confined to the example presented in the foregoing and that, instead, different embodiments of the invention may vary within the scope of the claims stated below.



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CLAIMS

1. A catch device e.g. for a lift cage or counterweight, said catch device comprising a wedge case (8), an action wedge (9) acting from one side on the lift guide and activated by a separate transmission member, such as a rope, and a counterwedge (10) acting on the lift guide from the opposite side, the movement of said wedges having been directed to pass directly or indirectly along guiding surfaces (16a and 16b) provided in the wedge case (8), characterized in that the wedge case (8) comprises a force member (24) which causes a force substantially parallel to the guiding surface (16b) on the counterwedge (10).

2. Catch device according to claim 1, characterized in that the guiding surface of the counterwedge (10) is so inclined that the distance between the top margin of the guiding surface (16b) and the lift guide is greater than the equivalent distance at the lower margin of the same guiding surface.

3. Catch device according to claim 1 or 2, characterized in that the distance between the top margins of the guiding surfaces (16a and 16b) equals or is larger than the distance between the lower margins of respective guiding surfaces, and that the angle of inclination (α) of the guiding surfaces (16a and 16b) is the same as the wedge angle of the respective wedge (9,10).

4. Catch device according to claim 1 or 2, characterized in that the distance between the top margins of the guiding surfaces (16a and 16b) is less than the distance between the lower margins of respective guiding surfaces.

5. Catch device according to any one of the preceding claims, characterized in that in the force member (24) the element producing the force is a spring.

6. A catch device as claimed in Claim 1, substantially as described with reference to Figures 1 - 5 of the accompanying drawings.