

Progressive Safety Device

Technical Field

This invention relates to elevators, specifically, elevator safety devices.

5 Background Art

Safety regulations concerning the design of elevators require a progressive safety on the elevator car or its counterweight if the elevator is operated at or above certain speeds, e.g., .8 meters per second, so that the car or counterweight will be decelerated at a fast, but comfortable rate when the car or counterweight is moving at a maximum or critical speed. A maximum deceleration of 10 meters per second² is prescribed but peaks up to 25 meters per second² for up to 40 ms are permitted.

The progressive safety, one of several types of safety known in the prior art, provides deceleration that increases with distance, and is usually complex and expensive. Usually, there is an entire safety block (assembly) that consists of a resilient member, such as a prestressed spring coil and a braking surface that is forced against the guide rail by a rather complex array of levers and wedges operating on the resilient member. Other similarly operating safeties use disks, springs and eccentric members to force the brake surface against the rails. This type of safety device presents several disadvantages, in addition to being extremely

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expensive. Among them, the safeties are difficult to maintain, (often requiring lubrication of the various moving parts they contain to operate the brake), and the brake forces decrease gradually as the linings wear, e.g., after test stops are made, which is a major problem with existing safeties.

A progressive safety is shown in German published application 2604157. That safety has a pivoted wedge that guides a safety gear, and a set of disk springs pushes on the guiding wedge. The guide wedge needs a special mounting arrangement, however, and the springs, because of their special shape, need a special mount, which takes up significant space. The safety roller also wears on only one side, and the springs require a critical adjustment for the safety to operate properly.

Disclosure of Invention

An object of the present invention is to provide a structurally simple, compact, inexpensive progressive safety that needs nearly no maintenance and whose brake force does not deteriorate rapidly.

According to the present invention, there is provided a progressive safety device, for braking an elevator car or counterweight, characterized by:

a housing, said housing being attached to the elevator car or the counterweight, and receiving a guide rail;

a brakelining, said lining being attached to the housing and located on one side of the rail;

a leaf spring attached to the housing, said leaf spring defining with a second side of the rail opposite said one side a tapered area; and

a roller, said roller being located within said tapered area and adapted to be connected to a governor connected to the car or counterweight for being directed initially towards the narrow end of said area by the governor

to engage the rail and thereupon be forced progressively further towards the narrow end with deflection of said leaf spring by rolling along the rail as the car or counterweight moves.

In the preferred embodiment an elevator

5 safety (for the car or counterweight) has a brake shoe that is located on one side of the guide rail. On the opposite side of this rail is a roller and a spring (e.g., a pivoting leaf spring), which defines, on one side of the rail, a tapered area (an area wider
10 at one end). The roller is normally at an at-rest position in the wider end. When the elevator enters an overspeed condition, this roller is pulled upward (by a governor) forcing the roller between the spring and the rail. As a result of movement of the
15 safety roller in that one direction, the roller is continually pushed up against the spring towards (in the opposite direction) the narrower end of the area. The brake pad (on the other side of the rail) is pulled tighter and tighter against the rail, as this happens,
20 producing a progressively increasing deceleration force that is limited by the pressure applied by the leaf spring. The actuating roller engages a soft material stop, which is at the narrow end of the area, and this stop is worn slightly, by the roller, during operation
25 of the safety. This wear serves to compensate for any wear in the roller, but, in particular, in the brake pad, by allowing the roller to locate somewhat higher in the narrow area between the spring and the rail.

30 An embodiment of the invention will now be described by way of example and with reference to the accompanying drawing.

Brief Description of the Drawing

Fig. 1 is a sectional elevation view of a progressive safety embodying the present invention;

35 Fig. 2 is a sectional plan view along the line I in Fig. 1;

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Fig. 3 is a sectional plan view of the roller; and Fig. 4 is a diagrammatic elevation view of an elevator safety system employing a governor to operate a safety embodying the present invention.

5 In the progressive safety shown in Figs. 1 and 2, a housing frame 1 is configured like tongs, with a channel-like portion 2. This housing is attached to an elevator car or counterweight and partially surrounds a guide rail 3 for the elevator car or the counterweight. Part of the
10 housing defines a brake shoe 4 with a brake lining 5, e.g., made of brass. The brake lining 5 is positioned to engage (slide on) one surface 6 of the rail 3. A "free" safety roller (safety actuator gear) 8 is located in the portion 2, but next to the other (the opposite) rail surface, surface
15 7. The safety guide roller has a collar-like portion 9, a circular raised area on the roller. The roller 8 is actually disposed in the portion 2 between the surface 7 and a leaf spring 10, which is also in the portion 2, and which in this embodiment comprises an assembly of two individual leaf
20 springs 11, 12. One spring 12, the one facing the rail, contains a slot to guide the roller in the tapered area. The slot receives the collar 9, which may be roughened to improve its traction on the rail. The springs are pivotally attached by circular end pieces on pivot mounts 13
25 and 14 in the housing. As a result of this mounting arrangement, the springs can flex in and out within the housing (under pressure of the roller 8, as explained below). This spring motion is shown in Fig. 1 by the dotted lines, which show their "moved" positions. These springs, as
30 arranged, define a profiled or tapered portion, defining a tapered area (shaped like a trapezoid) in which the roller 8 moves. At the upper end of this tapered area (at the narrowest portion) is a brass stop 16 in the housing, which stop contains a recessed portion 17, giving the stop a
35 spool-like shape. The stop 16 is engaged by the roller 8

and the collar portion 9 rests in the recessed portion 17 when this happens.

The roller 8 contains a hole or bore 8A which receives a pin 20A which is attached to a safety gear linkage 20. The linkage 20, as well as the roller 8 and the springs 11 and 12, are held in place in the housing by an end plate assembly 1A which includes a first plate 1B and a smaller plate 1C (which compensates for the space occupied by the linkage 20) that holds the springs 11 and 12 in place in the housing. The linkage 20, as Fig. 4 shows, is attached by a cable 19 to a governor 18 (known in the prior art) which rotates as the car or counterweight moves, pulling the linkage 20 up when its rotational speed exceeds a preestablished speed level.

The safety device operates in the following manner, which is explained in conjunction with the diagrammatic view shown in Fig. 4, which shows a governor operated safety arrangement in a simplified elevator. When the descending counterweight assumes an excessive velocity (for any reason whatsoever), the speed governor 18 connected to the car or counterweight operates, and through the governor rope 19 and safety gear linkage 20, trips the safety guide roller, lifting the safety guide roller 8 up against the spring 21 (See Fig. 2). The roller is then drawn progressively further and further into the tapered area between the spring and the surface 7, because the collar contacts the rail and rolls upward towards the narrow end of the tapered area. As a result, the leaf springs are deflected away from the rail by the upward motion of the roller as this happens. Ultimately, the roller moves high enough in the tapered area to engage the stop 16, all the time rotating. At that point, it bites slightly into the recessed portion 17 cutting away part of the stop. The brake shoe is progressively forced harder and harder against the rail surface during this rapidly occurring sequence, and thereby applies a

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braking force on the rail; that force increases progressively as the roller moves towards the stop. While this happens, the car and counterweight are smoothly slowed from the overspeed condition.

5 The rail and the roller and the springs are made of hardened steel, though the roller may be hardened only at its surface, so that the roller's surface, namely, the collar 9, does not wear substantially during test operations of the safety. Every operation of the safety,
10 it must be emphasized, will produce some wear in the brake lining, but this wear is compensated by the wear in brass stop 16: it allows the roller to move higher and
higher during each stop, which provides "dimensional compensation", so to speak, for any reduction in the
15 thickness of the brake lining.

Once the safety is actuated, the roller is wedged very tightly in the upper portion of the tapered area. But, it can be reset very easily. The safety housing simply is raised slightly (e.g., by raising the car),
20 an operation which causes the safety roller to roll in the opposite direction (down). Ultimately, the roller is manually reset within the housing frame to its "free"
position at the bottom. The roller is very loose in
25 this initial or reset position, and the benefit from this is that contact between the roller and the rail during normal elevator operation is avoided, which prevents inadvertent safety operation, e.g., from vibration.

30 The foregoing will suggest, to one skilled in the art, modifications, variations and alterations in the foregoing embodiment without departing from the true scope of the invention described and claimed.

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Claims

1. A progressive safety device for braking an elevator car or counterweight, characterized by:

a housing, said housing being attached to the elevator car or the counterweight, and receiving a guide rail;

a brake lining, said lining being attached to the housing and located on one side of the rail;

a leaf spring attached to the housing, said leaf spring defining with a second side of the rail opposite said one side a tapered area; and

a roller, said roller being located within said tapered area and adapted to be connected to a governor connected to the car or counterweight for being directed initially towards the narrow end of said area by the governor to engage the rail and thereupon be forced progressively further towards the narrow end with deflection of said leaf spring by rolling along the rail as the car or counterweight moves.

20 2. A progressive safety device as described in claim 1, characterized in that a stop is located in the housing in said narrow portion of said tapered area, said stop being in a position therein to be engaged by said roller and made of softer metal than the roller, whereby wear on the stop compensates for wear in the brake lining.

25 3. A progressive safety device as described in claim 1 or 2, characterized in that said roller contains a collar portion, said portion being roughened and engaging the rail when said roller is pulled towards said narrow portion.

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4. A progressive safety device as described in claim 3, characterized in that said leaf spring comprises an assembly of two or more leaf springs and one spring contains a slot for receiving said collar portion,
5 to guide said roller in the tapered area.

5. A progressive safety device as described in any preceding claim wherein said narrow end is at the upper end of said tapered area.

6. A progressive safety device substantially
10 as hereinbefore described with reference to the accompanying drawing.
