Jan. 3, 1950 E. A. SAHLIN 2,493,553

SAFETY APPARATUS FOR ELEVATORS

Filed Aug. 18, 1948 2 Sheets-Sheet 1

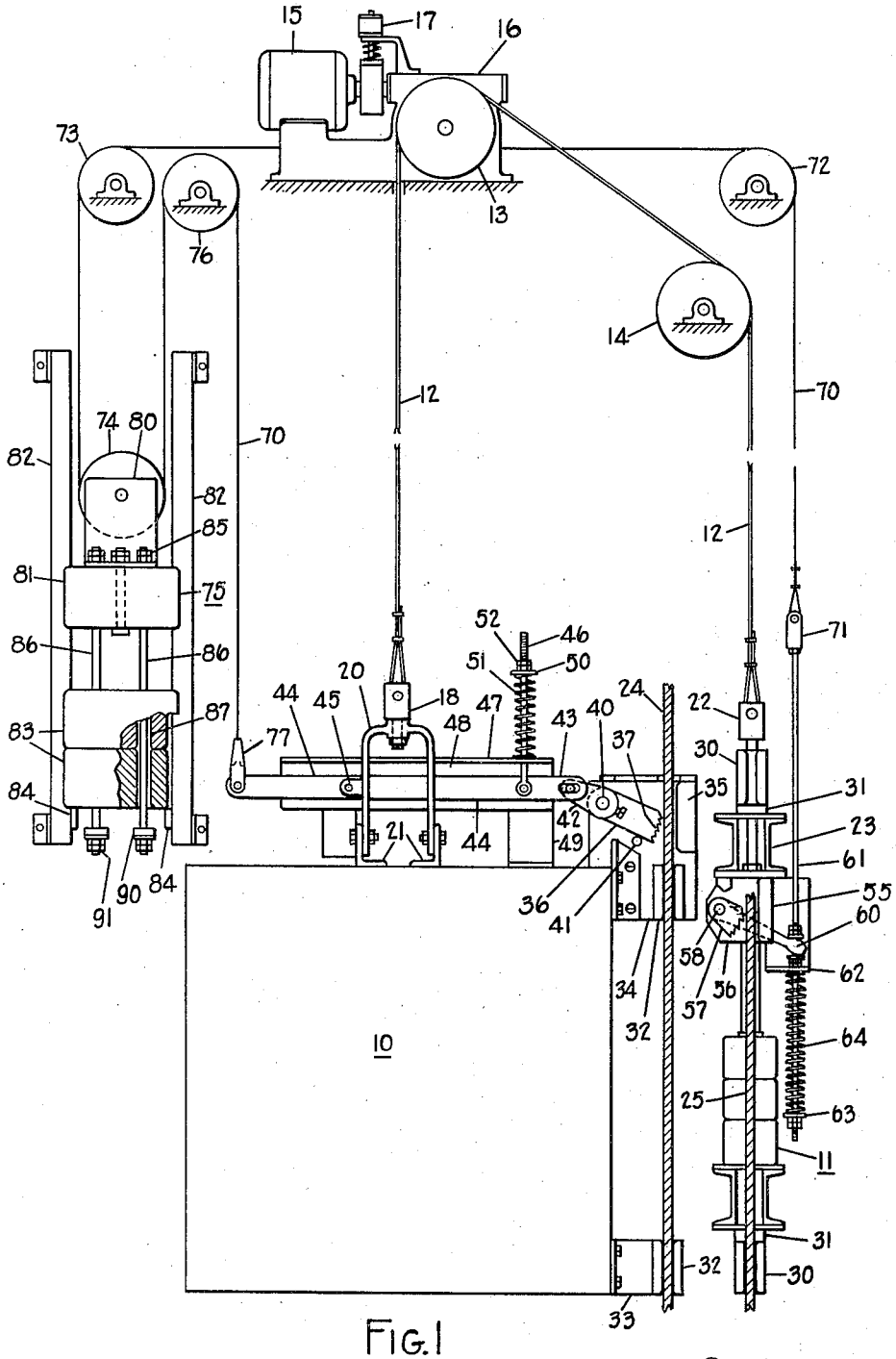

FIG. 1

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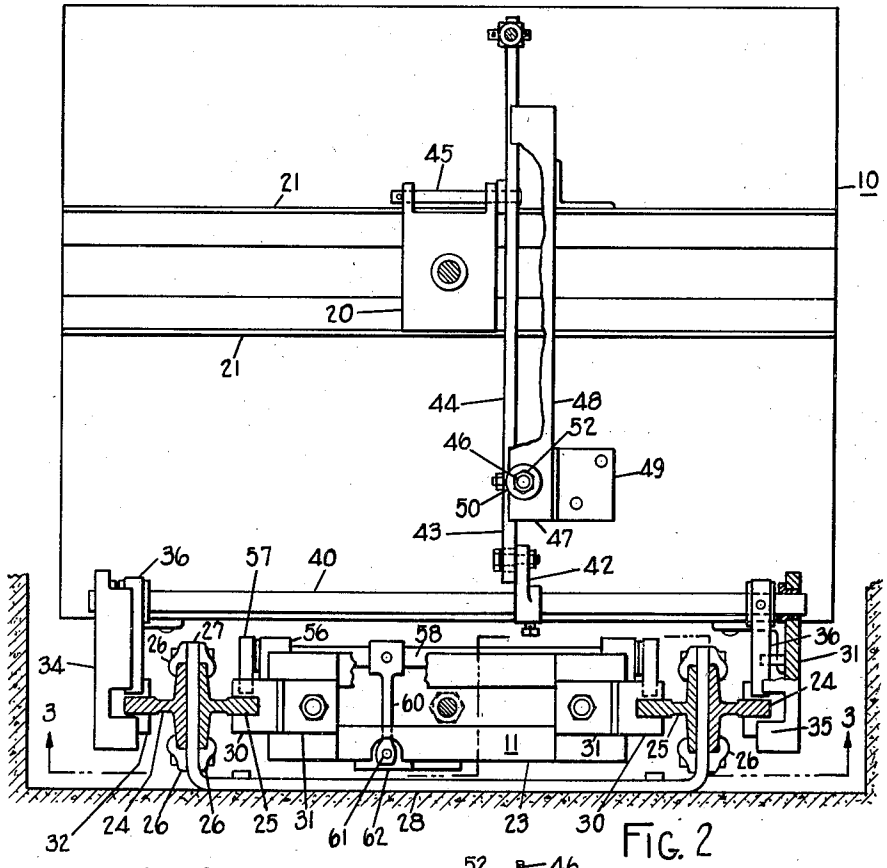

FIG. 2

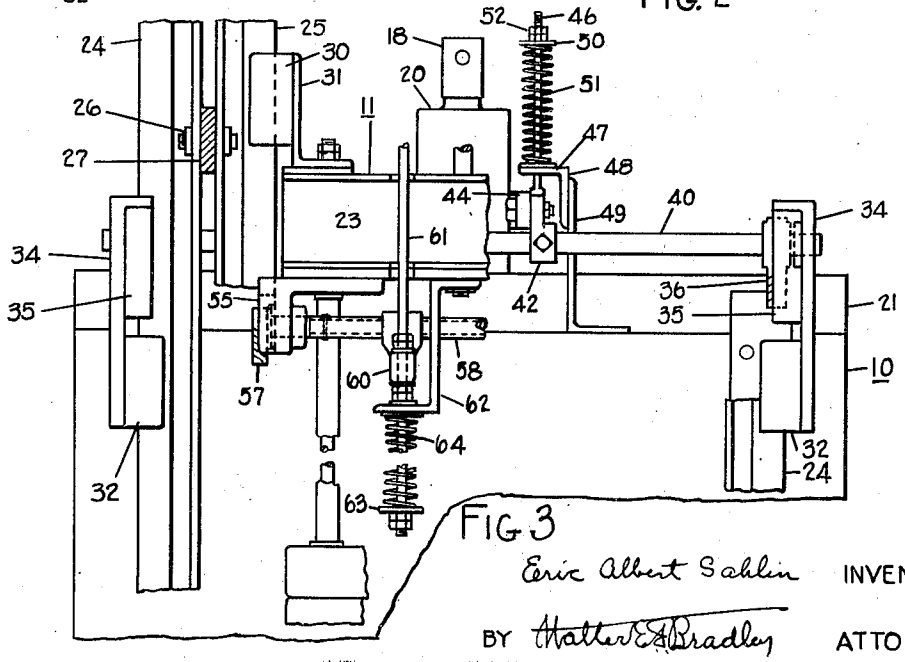

FIG. 3

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SAFETY APPARATUS FOR ELEVATORS

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7 Claims. (Cl. 187—87)

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The invention relates to safety apparatus for elevators.

Various safety devices are provided in elevator systems among which is mechanism for preventing the fall of the car and its counterweight when the hoisting ropes break. This is effected by applying safety brakes to the guide rails for the car and counterweight to retard the descent and bring them to a stop. In certain types of elevator installations, such as dumbwaiters, mechanism actuated on the parting of the hoisting ropes is the only mechanism utilized to apply the safety brakes. The invention is especially directed to elevator safety mechanism in which the safety brakes are applied upon parting of the hoisting ropes. Such mechanism is usually referred to as broken rope safety mechanism.

The object of the invention is to provide broken rope safety mechanism which is of simple construction, reliable in operation, in which the force for operating the safety is moderate and in which the safety mechanism may be readily reset.

The invention involves operating the safety brakes by means of a trip rope connected between the car and counterweight safety brakes. This trip rope passes over mechanism which acts, upon parting of the hoisting ropes, to exert a force sufficient to apply the safety brakes and which allows for enough travel of the car and counterweight to bring them to a stop without unduly increasing the applying force.

In carrying out the invention according to the arrangement which will be described, the trip rope is connected at its ends to operating levers for the car and counterweight safety brakes. These levers are biased as by springs to maintain the brakes disengaged from the guide rail. The trip rope passes around a sheave of a tensioning device. This sheave is biased by a weight sufficiently to maintain the trip rope taut. When the hoisting ropes part, the trip rope acts to lift the weight which picks up added weight. This causes operation of the levers to apply the brakes to the rails. Ample movement of the tensioning device is afforded for the safety brakes to bring the car and counterweight to a stop. This arrangement provides a force limited by the amount of the weights for acting on the operating levers and obviates parting of the trip rope or damage to the safety mechanism.

Features and advantages of the invention will be apparent from the above statements and from the following description and appended claims.

The invention will be described as applied to dumbwaiters, for which it is especially suitable.

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In the drawings:

Figure 1 is a somewhat schematic view of a dumbwaiter installation embodying the invention;

Figure 2 is an enlarged plan view of the dumbwaiter car and counterweight of Figure 1, showing the construction of the safety brakes; and

Figure 3 is a view taken along the line 3—3 of Figure 2.

Referring to the drawings, the dumbwaiter car 10 and counterweight 11 are suspended by a hoisting rope 12 which passes over a driving sheave 13 and deflector sheave 14. The driving sheave is driven by a hoisting motor 15 through reduction gearing arranged in casing 16. 17 is the electromechanical brake for the motor. At the car end, the hoisting rope is secured by a hitch 18 to a U-shaped hitch bracket 20, in turn secured to cross angles 21 on the top of the car. At the other end, the hoisting rope is secured by a hitch 22 to the counterweight framework 23.

A pair of guide rails 24 is provided for the dumbwaiter car. These rails are positioned in back of the car. A pair of guide rails 25 is provided for the counterweight. The guide rails are of the conventional T form and are secured as by clamps 26 on opposite sides of the arms 27 of U-shaped brackets 28 mounted at intervals along the hoistway wall. These U-shaped brackets span the counterweight, the counterweight rails facing toward the counterweight and the car rails facing opposite the counterweight rails. Guide shoes 30 are carried by the counterweight, one on each side at the top and bottom, for cooperating with guide rails 25 to guide the counterweight. These guide shoes are mounted on L-shaped brackets 31 secured to the counterweight framework. Guide shoes 32 are carried by the car, one at each side at the top and bottom, for cooperating with guide rails 24 to guide the car. The lower two of guide shoes 32 are mounted on brackets 33 secured to the bottom of the car while the upper two of guide shoes 32 are mounted on brackets 34 secured to the top of the car.

A safety brake is provided on the top of the car for engaging the rails 24, this brake comprising a pair of rail clamps, one for each rail. Each rail clamp comprises an abutment 35 formed on the bracket 34 to face the side of the rail. On the opposite side of the rail is a dog 36 formed with teeth 37 for engaging the rail and clamping it between the dog and abutment. An operating shaft 40 extends across the back of the car and is pivotally mounted in the brackets 34. The dogs 36 are secured to this shaft opposite the abut-

ments 35. These dogs are normally disengaged from the rails, resting against the pins 41. An operating arm 42 is secured to shaft 40 intermediate its ends. This arm in turn is operatively connected as by a pin and slot connection, to the end 43 of a lever 44. This lever is pivotally mounted on a pin 45 supported by a lug formed on hitch bracket 20. Near the end 43 of lever 44 is pivotally secured a rod 46. This rod extends upwardly through an aperture in the leg 47 of an angle 48 mounted on a bracket 49 secured to the top of the car. On this rod between leg 47 and a seat 50 is a compression spring 51. Nuts 52 are provided on the threaded end of this rod for adjusting the compression of the spring.

A similar safety brake is provided at the top of the counterweight for engaging the rails 25, this brake comprising a pair of rail clamps, one for each rail. Each clamp comprises an abutment 55 formed on a bracket 56 secured to the counterweight framework. The abutment faces one side of the rail while on the other side of the rail is a toothed dog 57. An operating shaft 58 extends across the counterweight framework to which the dogs are secured. An operating arm 60 is secured to this shaft. The end of the operating arm is connected to a lift rod 61. This rod extends downwardly through an aperture in the horizontal leg of an angle 62. On this rod between the horizontal leg and a seat 63 is a compression spring 64. Nuts are provided on the threaded end of this rod for adjusting the compression of the spring.

The operating lift rod 61 for the counterweight safety brake is connected to the operating lever 44 for the car safety brake by a trip rope 70. This rope is secured at one end by a hitch 71 to the lift rod 61. From this rod, the rope extends upwardly and over an idler sheave 72, thence over another idler sheave 73 and downwardly and around a sheave 74 forming part of a tensioning device 75. From sheave 74, the trip rope extends upwardly and around a third idler sheave 76 and thence downwardly to the car where its other end is secured by a hitch 77 to the other end of operating lever 44. Sheave 74 is mounted on an angle 80 secured as by a bolt to a weight 81. This weight is sufficient to maintain the trip rope taut. Weight 81 is guided for vertical movement on a pair of vertical guide bars 82. Also arranged for vertical movement on guide bars 82 is a pair of additional weights 83. These weights are below the weight 81 and are spaced therefrom, resting on lugs 84 secured to the guide bars. Extending downwardly from weight 81 and supported thereon as by the nuts 85 is a pair of rods 86. These rods pass through enlarged apertures 87 in weights 83 and have stop collars 90 on their lower ends supported by nuts 91. The collars are spaced from the weights enough to allow for any stretching of the hoisting ropes. The compression of springs 51 and 64 is adjusted to hold the dogs disengaged from the rails against the tension of weight 81 and the additional force involved in accelerating the trip rope system in operation of the car.

In operation, upon the parting of the hoisting rope 12, the downwardly moving body, say the car, starts to fall while the counterweight quickly stops its upward movement and starts to fall. As a result the trip rope 70 lifts the weight 81, carrying with it the rods 86. As soon as the clearance between collars 90 and weights 83 is taken up, these weights are lifted off lugs 84. These weights added to weight 81 are sufficient to overcome the force of springs 51 and 64 to lift the dogs into engagement with the rails, applying the safety brakes to bring the car and counterweight to a stop. The force applied to the trip rope does not increase unduly as the weights move upwardly to allow for downward movement of the car and counterweight until they come to a stop. There is ample distance between the tensioning device sheave 74 and idler sheaves 73 and 76 to enable the car and counterweight to be brought to a stop under full load conditions. This obviates any damage to the safety mechanism and enables the mechanism to be readily reset when the hoisting rope has been replaced.

While the invention has been described as applied to both car and counterweight safeties, it is applicable to installations in which a safety brake is provided only on one of these bodies, particularly the elevator car. In such case the end of the trip rope would be connected directly to the movable body not provided with the safety brake.

As many changes could be made in the above construction and many apparently widely different embodiments of this invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. In an elevator system in which the car and its counterweight are driven through hoisting roping and in which a safety brake is provided for one of such movable bodies, said safety brake being normally in unoperated condition, operating mechanism for said safety brake comprising; a trip rope extending between said bodies and connected at one end to said safety brake; means for tensioning said trip rope; and means actuated by said tensioning means upon the parting of said hoisting roping to cause actuation of said safety brake by said trip rope.

2. In an elevator system in which the car and its counterweight are driven through hoisting roping and in which a safety brake is provided for the car and a safety brake is provided for the counterweight, said safety brakes being normally in unoperated condition, operating mechanism for said safety brakes comprising; a trip rope connected at its ends to said safety brakes; means for tensioning said trip rope; and means brought into action by said movement of said tensioning means upon the parting of said hoisting roping to exert sufficient force through said trip rope to cause actuation of said safety brakes.

3. In an elevator system in which the car and its counterweight are driven through hoisting roping and in which a safety brake is provided for the car and a safety brake is provided for the counterweight, operating mechanism for said safety brakes comprising; an operating member for each safety brake biased to brake disengaged position; a trip rope connected at its ends to said operating members; means for tensioning said trip rope, said trip rope acting upon the parting of said hoisting ropes to move said tensioning means; and means brought into action by said movement of said tensioning means to exert sufficient force through said trip rope to cause actuation of said safety brakes by their operating members.

4. In an elevator system in which the car and its counterweight are driven through hoisting roping and in which a safety brake is provided on

the car for engaging the car guide rails and a safety brake is provided on the counterweight for engaging the counterweight guide rails, operating mechanism for said safety brakes comprising; an operating lever for each safety brake biased to brake disengaged position; a trip rope connected at its ends to said operating levers; a weighted sheave for tensioning said trip rope, said trip rope acting upon the parting of said hoisting roping to lift said weighted sheave; and additional weight picked up by said weighted sheave after a certain amount of upward movement thereof for causing operation of said levers to apply said safety brakes to their respective guide rails.

5. In an elevator system in which the car and its counterweight are driven through hoisting roping and in which a safety brake is provided on the car for engaging the car guide rails and a safety brake is provided on the counterweight for engaging the counterweight guide rails, operating mechanism for said safety brakes comprising; an operating lever for each safety brake biased to brake disengaged position; a tensioning sheave; a weight hanging from said sheave; additional weight supported below said first named weight and adapted to be picked up by said first named weight upon upward movement thereof; and a trip rope connected at its ends to said operating levers and passing around said tensioning sheave, said trip rope acting upon the parting of said hoisting roping to lift said first named weight to pick up said additional weight, the total weight of said first named and additional weights being sufficient to cause operation of said levers to apply said safety brakes to their respective guide rails.

6. In an elevator system in which the car and its counterweight are driven through hoisting roping and in which a safety brake is provided on the car for engaging the car guide rails and a safety brake is provided on the counterweight for engaging the counterweight guide rails, operating mechanism for said safety brakes comprising; an operating lever for said car safety brake; an operating lever for said counterweight safety brake; means acting on said car safety brake operating lever to bias said car safety brake to disengage said car guide rails; means acting on said counterweight safety brake operating lever to bias said counterweight safety brake to disengage said counterweight guide rails; a tensioning sheave; a weight hanging from said sheave; additional weight supported below said first named weight and adapted to be picked up by said first named weight upon upward movement thereof; a pair of idler sheaves above said tensioning sheave; and a trip rope connected at its ends to said operating levers and passing by way of said idler sheaves downwardly around said tensioning sheave said

trip rope acting upon the parting of said hoisting roping to lift said first named weight to pick up said additional weight, the total weight of said first named and additional weights being sufficient to cause operation of said levers against the force of said biasing means to apply said safety brakes to their respective guide rails, the distance between said tensioning sheave and said idler sheaves being at least equal to the distance required to bring the car and counterweight to a stop.

7. In an elevator system in which the car and its counterweight are driven through a hoisting rope and in which a safety brake is provided on the car for engaging the car guide rails and a safety brake is provided on the counterweight for engaging the counterweight guide rails, operating mechanism for said safety brakes comprising; an operating lever for said car safety brake; an operating lever for said counterweight safety brake; a spring acting on said car safety brake operating lever to bias said car safety brake to disengage said car guide rails; a spring acting on said counterweight safety brake operating lever to bias said counterweight safety brake to disengage said counterweight guide rails; a tensioning sheave; a weight hanging from said sheave; rods depending from said weight; additional weights below said first named weight through which said rods pass; means for supporting said additional weights; stops on said rods operable after a certain amount of upward movement of said first named weight to lift said additional weights off their supports to add their weight to that of said first named weight; bars for guiding the vertical movement of said weights; a pair of idler sheaves above said tensioning sheave; and a trip rope connected at its ends to said operating levers and passing by way of said idler sheaves downwardly around said tensioning sheave, said trip rope acting upon the parting of said hoisting rope to lift said first named weight to pick up said additional weights, the total weight of said first named and additional weights being sufficient to cause operation of said levers against the force of said springs to apply said safety brakes to their respective guide rails, the distance between said tensioning sheave and said idler sheaves being ample to enable the safety brakes to bring the car and counterweight to a stop.

ERIC ALBERT SAHLIN.

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