Oct. 9, 1934. G. A. HALFVARSON 1,976,494

LOCK DOWN COMPENSATOR

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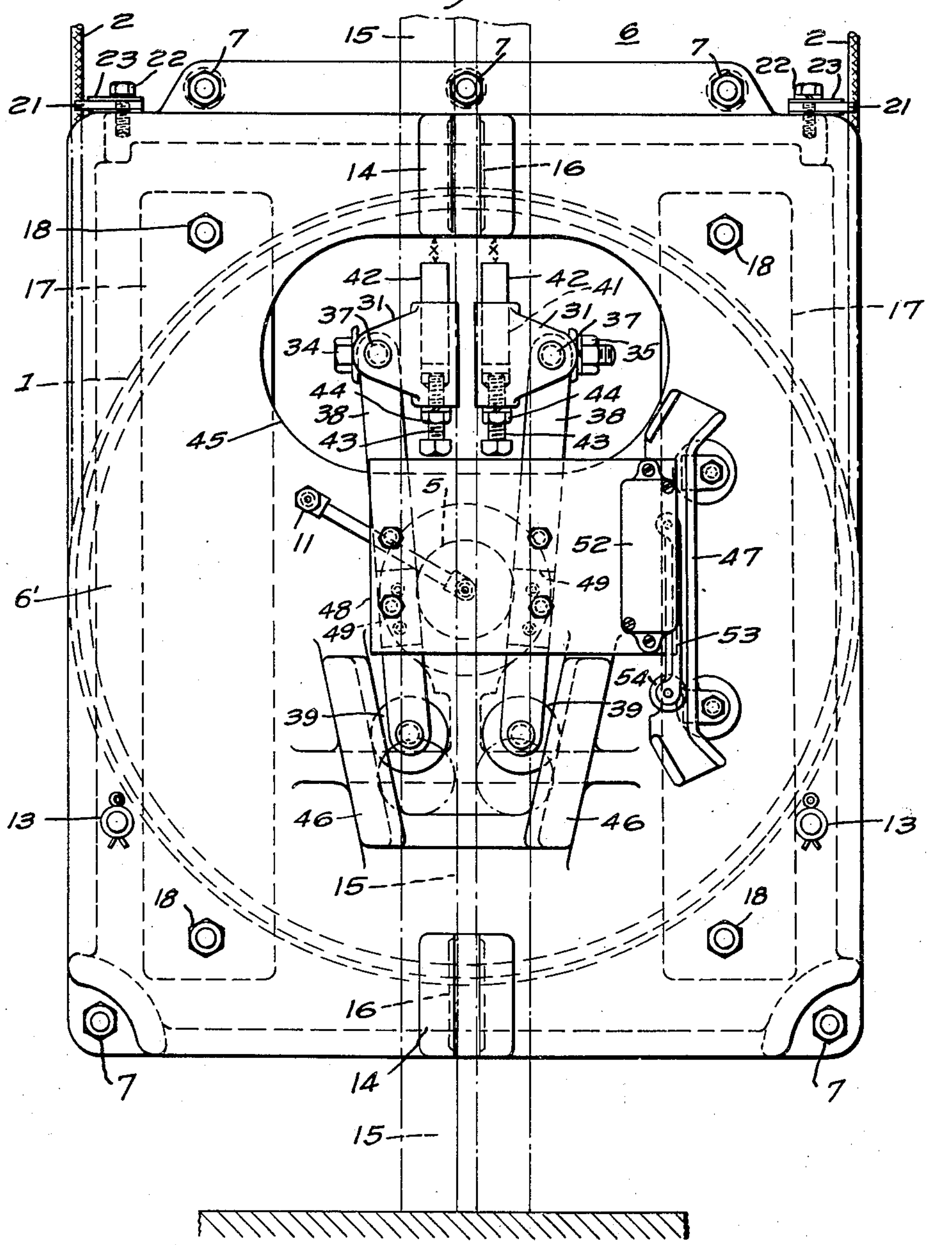
Fig. 1.



WITNESSES:

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Fig. 2.

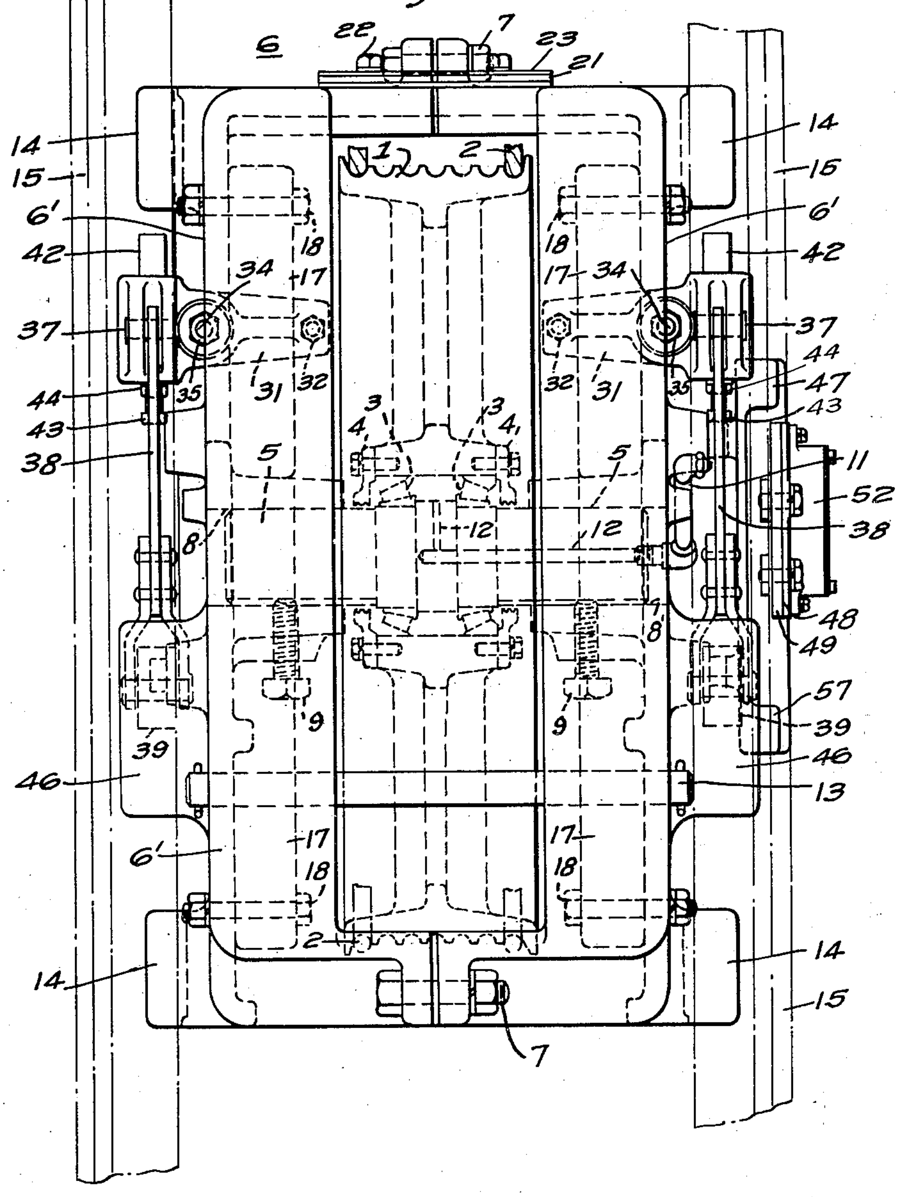

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Fig. 3.

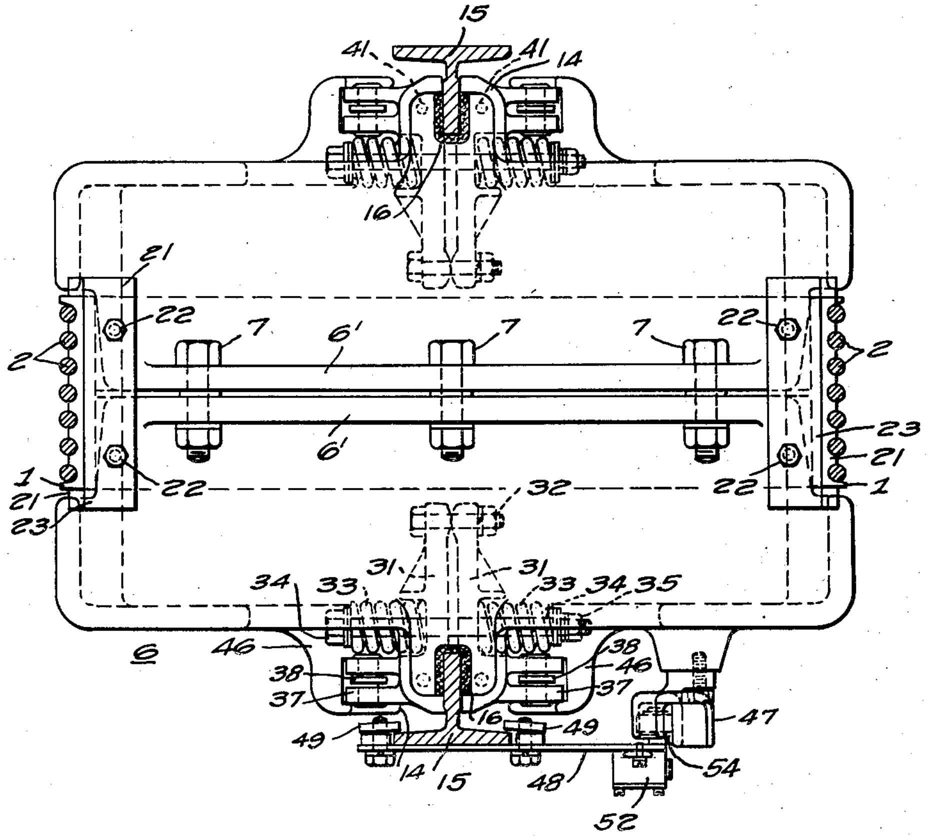
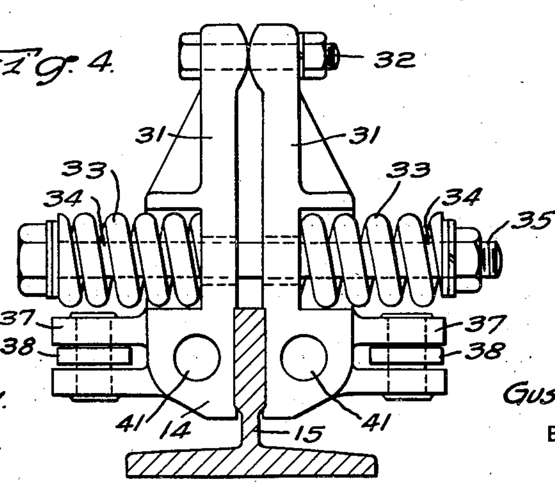


Fig. 4.



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Patented Oct. 9, 1934 1,976,494

UNITED STATES PATENT OFFICE

1,976,494

LOCK DOWN COMPENSATOR

Gustaf A. Halfvarson, Chicago, Ill., assignor to Westinghouse Electric Elevator Company, Chicago, Ill., a corporation of Illinois

Application December 9, 1932, Serial No. 646,364

8 Claims. (Cl. 187—22)

My invention pertains to cable idler sheaves and more specifically it relates to elevator compensator sheaves for guiding and restraining the compensating cables as the elevator car travels up and down the hatchway.

It is customary practice to provide modern elevator systems with compensating cables the ends of which are attached to the elevator car and the counterweight respectively, and the intermediate portions of which hang down to the bottom of the hatchway. As the car travels up the hatchway the weight of the hoist cable between the car and the hoist sheave decreases, but the weight of the compensating cable hanging below the car increases at the same rate, and the balance of the system is thus maintained.

By providing a sheave through which the compensating cables pass at the bottom of the hatchway, the cables are guided and restrained in their movements, and by attaching suitable weights to the sheave, the cables may be normally tensioned a predetermined amount thereby improving the tractive effort of the hoist sheave on the hoist cables.

Difficulties have been experienced when abnormal conditions caused the safety braking device to suddenly grip the guide rails and retard the descent of either the car, or the counterweight, and the body which was ascending continued to rise thereby permitting slack to develop in the hoist cables after which the ascending body fell back and snapped the cables. Under such conditions the compensator sheave would also snap the cables when falling back after being jerked up from the bottom of the hatchway.

Previous attempts to remedy these difficulties by fastening the compensator sheave down to the bottom of the hatchway have been unsatisfactory, since the total length of the cables in an elevator system does not remain constant but varies in accordance with changing conditions of wear, loading and temperature. Hence, when the cables were locked down in such a manner as to make a rigid system abnormal detrimental stresses were set up.

It is accordingly an object of my invention to provide a compensator sheave which normally moves freely in a vertical direction but which yieldingly resists excessive movement.

It is also an object of my invention to provide a self-adjusting elevator compensator sheave which will guide and restrain the movements of the compensating cables.

It is also an object of my invention to provide a compensating sheave which will float freely on the compensating cables within predetermined vertical limits, but which will definitely resist and limit upward motion beyond such limits.

A further object of my invention is to provide a compensating sheave which will permit the normal expansion and contraction of the cables and prevent the development of slack cable in the system.

The invention itself, however, both as to its organization and its method of operation, together with additional objects and advantages thereof, will best be understood from the following description of a specific embodiment, when read in connection with the accompanying drawings, in which:

Figure 1 is a side elevational view of my compensator sheave in assembled relation with the associated guide rails;

Fig. 2 is a front elevational view thereof;

Fig. 3 is a top plan view thereof; and

Fig. 4 is a plan view of the rail gripping jaws.

Referring more specifically to the drawings, the compensator comprises a cable sheave 1 which hangs in the lower loop of the compensating cables 2 near the bottom of the hatchway. As shown in Fig. 2, the hub of the sheave 1 is provided with roller bearings 3 secured by retaining rings 4 through which a stationary shaft 5 is disposed to support a weight frame 6 comprising a pair of heavy side plates 6′ joined together by suitable bolts 7. Each side plate 6′ is provided with a bearing 8 for receiving one end of the shaft 5 and a set screw 9 for locking the shaft stationarily therein. A grease fitting 11 is connected to a passageway 12 which extends through the stationary shaft 5 to lubricate the bearings 3 on which the sheave rotates. Cable guard rods 13 extend between the side plates 6′ adjacent the periphery of the cable sheave 1.

Guide shoes 14 extend laterally from the side plates to cooperative engagement with a pair of T-guide rails 15 secured in the bottom of the hatchway in any suitable manner. Each guide shoe 14 may be provided with a wear resisting lining 16. The sheave 1 is free to rotate on its roller bearings 3 within the weight frame 6 which is restrained from rotation by the vertical guide rails 15.

The weight frame 6, being supported on the sheave, tensions the cables 2 continuously but permits normal expansion and contraction of the cables because they move freely up and down between the vertical guide rails 15. To provide sufficient tension, weights 17 are fastened within the weight frame 6 by bolts 18 or any suitable fastening means, and by selecting the proper size or number of weights the proper tension may be provided. Cable wipers 21 may be secured on the upper side of the weight frame in cooperative relation to the cables by suitable screw bolts 22 and retaining plates 23.

Clamped to each guide rail 15 are rail gripping jaws 31 which are hinged together in pairs by a bolt 32 extending through openings near the inner ends of the jaws, as shown in Figs. 3 and 4. Biasing springs 33 are compressed against intermediate portions of the jaws 31 by a bolt 34 which extends loosely through an enlarged opening in each jaw. Each bolt 34 is threaded at one end and receives a nut 35 by which the tension of the springs 33 may be adjusted to provide a predetermined resilient tension on the jaws. Although the jaws may be adjusted to grip the rails 15 with any desired pressure, I have found it preferable to apply sufficient pressure to resist vertical movement along the rail with a force of about one hundred pounds.

A pivotal bearing 37 is provided on the end of each rail gripping jaw adjacent the rail. From each pivotal bearing 37 a link arm 38 is suspended having a roller 39 journalled in the lower end thereof, as shown in Fig. 1. A socket 41 is also provided near the end of each jaw for receiving a fiber bumping plug 42 which may be adjusted vertically by suitable screw bolts 43 extending upwardly through the bottom of each orifice, as shown clearly in Fig. 1. A lock nut 44 is provided on each screw bolt in order that a predetermined adjustment of the bumper plugs 42 may be permanently maintained.

The rail clamping jaws 31 are locked to the rails adjacent the compensating sheave at such a position that their inwardly projecting ends extend through an opening 45 in the side plate 6′ as shown in Fig. 1. Each pair of suspended rollers 39 hangs adjacent opposite sides of the stem of the associated T-guide rail 15, and the side plate 6′ of the compensating sheave is provided with a braking face comprising a laterally projecting inclined plane surface 46 adjacent each roller 39 to force the latter against the rail stem when the sheave is lifted by the cables more than a predetermined amount. The pair of inclined planes 46 adjacent each pair of rollers, are disposed at a slight angle to the vertical guide rail 15 in such a manner that they converge inwardly and downwardly. Similar pairs of rollers and inclined planes are provided on each side of the sheave.

When the inclined surfaces 46 are lifted more than a predetermined amount they force the rollers 39 into binding engagement with the stem of the rail 15 thereby resisting the upward movement of the sheave. Even though the rail clamping jaws 31 are adjusted to slip when a force of one hundred pounds is applied thereto, it will be understood that a much greater retarding force is applied to oppose the upward movement of the sheave because of the binding action of the rollers 39 as they are wedged between the rail 15 and the inclined planes 46. To accentuate this effect the engaging surfaces may be especially prepared in any suitable manner to increase the coefficient of friction. For the faces of the inclined planes and the rollers I have found that hard smooth surfaces are desirable, such as chilled cast iron for the inclined plane and tool steel for the rollers. The rollers are preferably made with smooth faces having a mild oil temper.

On one of the side plates 6′ a guiding channel 47 having out-turned ends is secured in any suitable manner, as by means of bolts or screws. A panel 48 is fastened to the base of the guide rail 15 by suitable clamps 49 as shown in Fig. 3. Mounted on the edge of the panel 48 is a switch 52 having a depending actuator arm 53 provided with a roller 54 journalled at the lower end. The guide channel 47 is so disposed on the side plate 6′ relative to the roller 54 on the switch arm that the switch will be actuated when the vertical movements of the compensator sheave exceed certain predetermined limits. The switch 52 may be connected to interrupt the control circuits, actuate an alarm, or accomplish any other desired result, either when the compensator is locked or when the cables have stretched excessively and allowed the compensator to drop down.

To adjust my lock down compensating sheave for proper operation, the compression springs 33 on each pair of rail gripping jaws 31 are released sufficiently to permit sliding the jaws and rollers 39 down until the latter are in proper locking position. In this position each of the four bumper plugs 42 is adjusted to obtain a clearance of about 2½ inches at X, as shown in Fig. 1. The jaws are now lifted until the bumper plugs 42 are nearly in contact with the lower edges of the guide shoes 14 on the side plates 6′ of the compensator sheave, and the springs 33 are again compressed to clamp the jaws 31 to the rails.

It will be apparent that when properly adjusted, as above set forth, my compensator sheave is normally free to move up and down a predetermined distance, but when it is lifted slightly more than a predetermined distance the rollers 39 are wedged between the converging plane surfaces 46 and the rail 15 thereby gripping the latter with a force which prevents further upward movement of the compensator.

When the sheave and its weight frame are lowered by expansion or stretching of the compensating cables, the bumper plugs 42 are engaged by the lower edges of the guide shoes 14 on the side plates. Since the weight of the compensating sheave structure is much greater than the slippage resistance of the jaws 31, on the rails, the jaws are caused to slide downwardly on the rails thereby automatically maintaining the proper adjustment. The compensating sheave being thus automatically readjusted for cable stretching will always permit free vertical movement of the sheave through a predetermined distance before the retarding force is applied.

It will be seen that I have provided a simple, compact, rugged compensator which continuously applies a predetermined tensioning force to the compensating cables while permitting free vertical movement through a constant distance which is not modified by the cables stretching or expanding, and which applies a predetermined resisting force when the compensator sheave is lifted up more than a predetermined distance.

Although I have shown and described a specific embodiment of my invention, I am fully aware that many modifications thereof are possible. My invention, therefore, is not to be restricted except as necessitated by the prior art and the scope of the appended claims.

I claim as my invention:

1. The combination with an elevator system comprising an elevator car, a counterweight, and an interconnected compensating cable, of a sheave hanging in the loop of said compensating cable, a frame supported by said sheave, braking means associated therewith to apply a retarding force thereto when said sheave has been lifted a predetermined distance, and means for supporting the braking means independently of said frame to control said predetermined distance.

2. The combination with an elevator system comprising an elevator car, a counterweight, and an interconnected compensating cable, of a sheave hanging in the loop of said compensating cable, a frame supported by said sheave, braking means associated therewith to apply a retarding force thereto when said sheave has been lifted a predetermined distance, means for supporting the braking means independently of said frame, and means for automatically readjusting said distance when the sheave is lowered whereby said distance is maintained constant irrespective of wearing or stretching of the compensating cable.

3. A device for tensioning and guiding elevator compensating cables comprising a cable receiving sheave, a weight frame supported thereon, vertical guide rails for guiding the movements of said frame, means for applying a braking force to retard upward movement of said frame comprising rail clamping jaws, rollers suspended therefrom, and means carried by said frame to engage said rollers when the frame moves upwardly.

4. A device for tensioning and guiding elevator compensating cables comprising a cable receiving sheave, a weight frame comprising a pair of side plates secured together in enclosing relation around said sheave, a shaft extending freely through said sheave, means for securing the ends of said shaft stationarily in the side plates, vertical guide rails, guide shoes on said side plates extending in operable relation to said guide rails, resilient clamping means secured to each guide rail, braking elements associated therewith, and means on said side plates for engaging said braking elements to apply a predetermined braking force to said side plates when they are lifted by the cable.

5. A device for tensioning and guiding elevator compensating cables comprising a cable receiving sheave, a weight frame supported by said sheave, vertical guide rails for guiding the weight frame, a plurality of braking elements, means movably mounted on the guide rails for supporting said braking elements, means on the weight frame for positioning the braking elements and their supporting means within predetermined limits in accordance with the position of the frame, and means on said frame for engaging the braking elements to apply a braking force to the frame when it is lifted by the cables.

6. A device for tensioning and guiding elevator compensating cables comprising a cable receiving sheave, a weight frame supported by said sheave, vertical guide rails for guiding the weight frame, a plurality of braking elements, friction clamping means disposed on the guide rails for supporting said braking elements, means responsive to downward movement of the frame for moving the friction clamping means downwardly on the guide rails, and means on said frame for causing the braking elements to apply a braking force to the frame when it is lifted by the cables.

7. A device for tensioning and guiding elevator compensating cables comprising a cable receiving sheave, a weight frame supported by said sheave, vertical guide rails for guiding the weight frame, a plurality of braking elements, means for supporting the braking members, means for movably clamping the supporting means to the guide rails with a predetermined pressure, means responsive to a predetermined downward movement of the frame for moving the supporting means downwardly, and means on said frame for engaging the braking elements to apply a braking force to the frame when it is lifted beyond a predetermined distance by the cables.

8. A device for tensioning and guiding elevator compensating cables comprising a cable receiving sheave, a weight frame supported by said sheave, vertical guide rails for guiding the weight frame, braking faces on said frame, braking elements disposed to be wedged between the braking faces and the guide rails to provide a braking effect on the frame upon upward movement of the cables, and means for supporting the braking elements a predetermined distance out of engagement with said braking faces to permit a predetermined upward movement of the cables before bringing the braking effect into action.

GUSTAF A. HALFVARSON.