My invention relates to compensating sheaves for elevators and more particularly to mechanism for controlling the vertical movements of compensating sheaves.

In the operation of elevator cars provided with counterweights and compensating sheaves, it may happen that the safety brake is applied to a car with such force as to cause it to decelerate at a much greater rate than the gravity rate at which the counterweight normally decelerates. In such an instance this difference between the rate of deceleration of the car and the counterweight applies a force to the compensating cables to raise the compensating sheave. Where a lock-down compensator such as is illustrated in Hallvarson Patent No. 1,976,494 of October 9, 1934, is used, the upward movement of the compensator sheave is restrained, tying the mass of the counterweight and other moving parts to the car to prevent excessive car retardation. This places a strain on the compensating cables which, if excessive, may damage them.

It may happen that the counterweight will continue its upward run after the car has been stopped against its bumper or buffer in the pit, thus causing the compensating cables to apply an upwardly directed force to the compensating sheave. In cases of this nature where the upwardly directed force against the lock-down compensating sheave becomes excessive, it is likely to cause serious damage to the cables or other parts of the elevator system.

One object of my invention is to provide a compensating sheave mechanism which will permit the normal expansion and contraction of the hoisting and compensating cables of the elevator while preventing any development of slack in the cables and which will so control the sheave that it will offer a predetermined resistance to a continued rise of the cables after they rise beyond a predetermined distance.

Another object is to provide a compensating sheave mechanism which will cause the compensating sheave and cables to exert a braking action on the counterweight when the car has been stopped against its bumper in the pit and the counterweight continues its upward movement.

A further object is to provide a compensating sheave mechanism which will so control the compensating sheave as to avoid breakage of the compensating cables when they are subjected to excessive strains.

It is also an object to provide a compensating sheave mechanism which will permit the sheave to move upwardly beyond its highest normal compensating position when the compensating cables apply an upwardly directed force beyond a predetermined value and at the same time to apply a predetermined braking effect to further upward movement of the sheave after it moves above its normal compensating position.

An additional object is to provide a compensating sheave mechanism which will permit the compensating sheave to freely move upwardly a predetermined distance and, when it is forced beyond such distance, to provide a predetermined resistance or braking effect against such further movement.

For a better understanding of my invention, reference may be had to the accompanying drawings, in which:

Figure 1 is a view in side elevation of my improved compensating sheave unit.

Fig. 2 is a view in front elevation of the sheave unit shown in Fig. 1.

Fig. 3 is a top plan view thereof, and

Fig. 4 is a top plan view of the rail gripping jaws embodied in the unit.

Referring more particularly to the drawings, I have illustrated a compensating sheave mechanism comprising a cable receiving sheave 1 which hangs in the lower loop of a plurality of compensating cables 2 near the bottom of a hatchway (not shown). The hub of the sheave 1 is provided with roller bearings 3 secured by retaining rings 4 through which a shaft 5 is disposed to support a weight frame 6. The frame 6 comprises a pair of heavy side plates 7 and 8 joined together by suitable bolts 9. Each side plate is provided with a bearing 10 for receiving the ends of the shaft 5. A pair of setscrews 11 are mounted in the lower part of the bearings for locking the shaft therein.

A plurality of guide shoes 14 extend laterally from the upper and the lower ends of the side plates into cooperative engagement with a pair of guide rails 15 and 16, the lower ends of which may be secured in the bottom of the hatchway in any suitable manner. 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 and 16.

Inasmuch as the weight frame 6 is supported on the sheave, which, in turn, is supported in the lower loop of the compensating cables, the weight of the frame and the sheave tensions the cables to continuously permit normal expansion and contraction thereof because the frame may move freely up and down between the vertical guide rails 15 and 16. If desired, suitable weights may
be added to the side plates to increase the tension on the compensating cables.

A pair of rail-gripping jaws 19 and 20 hinged together by a bolt 21, are clamped to the guide rail 15 by a bolt 24 which extends through suitable openings in the central portions of the jaws as shown in Figs. 3 and 4. A pair of biasing springs 22 and 23 are compressed against the intermediate portions of the jaws 19 and 20 by the bolt 24 which extends loosely through an enlarged opening in each jaw. The bolt 24 is threaded at one end to receive a nut 25 by which the tension of the biasing springs 22 and 23 may be adjusted to provide a predetermined resilient tension on the jaws. Although the jaws may be adjusted to grip the rail 15 with any desired pressure, it is found preferable to supply sufficient pressure to resist movement along the rail with a force of, say, 100 pounds. A similar pair of jaws are mounted on the guide rail 16.

A pivotal bearing 27 is provided on the end of each rail-gripping jaw remote from the rail. From each pivotal bearing 27 is suspended a braking element comprising a link arm 28 having a brake shoe or roller 29 journaled at its lower end (Fig. 1).

A socket 31 is provided in the upper surface of each jaw for receiving a fiber bumper plug 32 which may be adjusted vertically by a suitable screw bolt 33 extending upwardly through the bottom of the socket (Fig. 1). A lock nut is provided on each screw bolt so that a predetermined adjustment of the bumper plugs 32 may be permanently maintained.

The rail-clamping jaws are clamped on the rails adjacent to the compensating sheave in such position that their inwardly projecting ends extend through openings 34 in the side plates 7 and 8 and the suspended links 28 and rollers 29 hang adjacent to opposite sides of the associated guide rail, with the tires of the rollers facing the guide rails. The openings 34 should be large enough to permit the sheave frame to move up or down freely for a short distance without knocking against the rail-clamping jaws.

As illustrated in Fig. 1, a brake-operating lever arm 35 is pivotally suspended from a pivot pin 36 mounted in the side of the plate 7 so as to swing downwardly in a plane parallel to the guide rail 15. A stop lug 37 is mounted on the plate 7 in position to be engaged by a shoulder 38 on the lower end of the arm 35. The lug should be so placed that it will limit the movement of the lower end of the lever inwardly toward the guide rail 15 but will permit it to move away from the rail.

A compression spring 40 is mounted between a cup 41 formed on the lower end of the lever arm and a spring cup 42 mounted on the inner end of a stud bolt 43, the body of which passes loosely through a boss disposed on the frame plate 1. A pair of screw-threaded nuts 45 and 46 are mounted on the bolt 43 at opposite sides of the boss 44 so that the amount of compression in the spring 40 may be adjusted to exert a predetermined pressure biasing the lever arm 35 against the stop lug 37. The spring 40a are mounted on the opposite side of the guide rail 15. Similar lever arms and springs are mounted on the opposite frame plate 8 for operating the suspended rollers adjacent to the guide rail 16.

The lever arms 35 and 35a are provided with cup-shaped portions 48 and 49 which nest or seat the rollers 29 when the sheave frame moves up a given amount and hold them in braking position against the rail 15, under the pressure of the springs 40 and 40a.

In order to adjust the compensating sheave for proper operation, the bolts 24 are loosened sufficiently to release the clamping springs 22 and 23 sufficiently to permit sliding the jaws and the rollers 29 along the guide rails until the rollers are in proper braking position with reference to the lever arms 35 and 35a. With the gripping jaws in these positions, each of the four bumper plugs 32 should be adjusted to obtain a clearance of 0.005 inch between the bumper plugs and the guiding shoes 14. The jaws are now moved upwardly along the rails until the bumper plugs 32 are nearly in contact with the lower edges of the guide shoes 14 on the side plates 1 and 8. In this position, the bolt 24 is tightened sufficiently to compress the springs 22 and 23 to clamp the jaws 19 and 20 to the rails with the desired amount of pressure. This pressure should be of such a value that it will hold the jaws in position on the rails but at the same time low enough to be overcome by the weight of the sheave and its frame when they rest upon the jaws.

It will be apparent that, when properly adjusted, as above set forth, my improved compensating sheave is normally free to move up and down a predetermined distance.

When the sheave and its frame are lowered beyond the predetermined distance allotted for free play by expansion or stretching of the compensating cables or the car cables, the bumper plugs are engaged by the lower edges of the guide shoes 14 on the side plates. Inasmuch as the weight of the compensating sheave structure is greater than the slippage resistance of the jaws 19 and 20 on the rails, the weight of the sheave structure causes the jaws to slide downwardly on the rails, thereby automatically maintaining the proper adjustment for the predetermined amount of free play for the sheave and frame. The compensating sheave, being thus automatically readjusted for cable stretching, will always permit free vertical movement through a predetermined distance.

It will also be evident that when the elevator car reaches a predetermined rate of movement downwardly to the left-hand side of the guide rail 15. This action will cause a slight retardation of the sheave unit until the rollers reach the cups 48 and 49. At this point, a larger retarding force on the sheave unit will be applied by the compression springs 40 and 40a which are sufficient to prevent slacking of the elevator lifting cables under the maximum braking effort of the elevator lever arm 35a and the lever arm 35b and yet tends to lift the sheave unit it will overcome the predetermined friction between the rollers 29 and the rails 15 and 16 and then the rollers will slide upwardly along the rails, thus preventing breaking the elevator cables due to excessive stress, but yieldingly resisting the upward travel of the sheave unit beyond the upper limit of its normal free play position.
ing friction between the rollers and the guide rails will be determined by adjusting the bolts 43 to compress the springs to a point where they will give such predetermined braking friction as is desired.

In another case the car may be stopped against its bumper in the pit, and the counterweight tend to continue its upward movement. Again the compensating unit will be moved upward, and, when its movement extends beyond its normal upper free play limit, the compensating sheave will be clamped to its rails to prevent the lift cables from slackening. As the car cannot go lower, a considerable strain will be placed on the compensating cables. If they are stressed beyond a predetermined limit which, if exceeded, would probably damage them, the force transmitted to the compensating sheave will cause it to slide along its rails retarded by a friction determined by the springs 40 and 40a. Thus the maximum retardation will be applied to the counters and damage to the cables will be prevented.

By the foregoing construction, it will be seen that I have provided a compensating sheave mechanism which will permit a predetermined upward movement of the compensating sheave but which will apply a braking action of a predetermined value when the compensating sheave unit exceeds its predetermined free upward movement.

Although I have illustrated and described only one specific form of my invention, it is to be understood that changes therein and modifications thereof may be made without departing from its spirit and scope.

I claim as my invention:

1. 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 frame, a plurality of braking rollers, friction clamping means disposed on the guide rails for supporting said braking rollers, means responsive to downward movement of the frame for causing the friction clamping means downwardly on the guide rails, means on said frame for causing the braking rollers to apply a predetermined braking force to the frame when it is lifted by the cables, and spring means for limiting the braking force.

2. 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 for rotatively supporting said sheave in said frame, guide shoes on the frame extending in operable relation to the guide rails, resilient clamping devices secured to each guide rail, braking elements associated therewith, braking operating arms pivotally mounted on the frame for engaging said braking elements to apply a braking force to the frame when it is lifted by the compensating cable, and spring means mounted between the frame and the arms for limiting the braking effect to a predetermined value.

3. A compensating sheave mechanism for elevators comprising a frame, a plurality of guide shoes on the frame for engaging a pair of guide rails, a cable receiving sheave rotatably mount-