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[54] GUIDE ROPE STABILIZER

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[52] **U.S. Cl.** ....**187/95**, 15/210 B, 188/1 B, 174/42
[51] **Int. Cl.** **B66b 7/02**
[58] **Field of Search** ....187/95, 96; 188/1 B; 174/42; 15/102, 210 B, 256.6; 248/358 A

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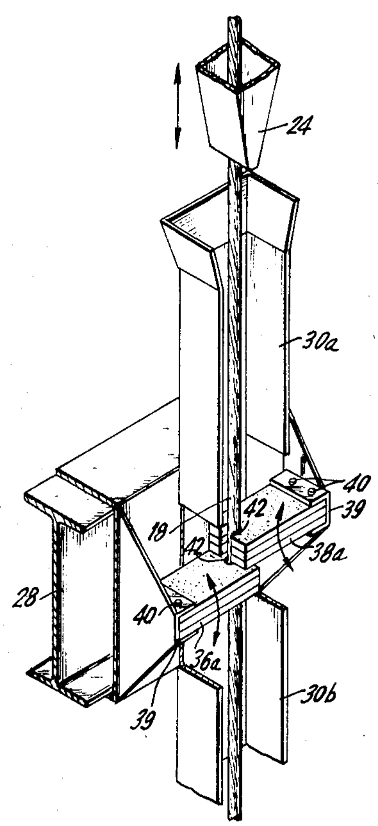
[57] **ABSTRACT**

A device for stabilizing fixed guide ropes in a mine shaft elevator system comprises flexible leaf members secured at one of their ends along and transversely to the shaft. In their normal position, the free ends of the leaf members transversely engage the guide ropes and prevent their undesired movement. When the guide rope shoe carried on a cage passes by the device, the leaf members are radially flexed and thus separated to permit the shoe to pass thereby, after which the leaf members return to the initial guide rope stabilizing position.

15 Claims, 9 Drawing Figures



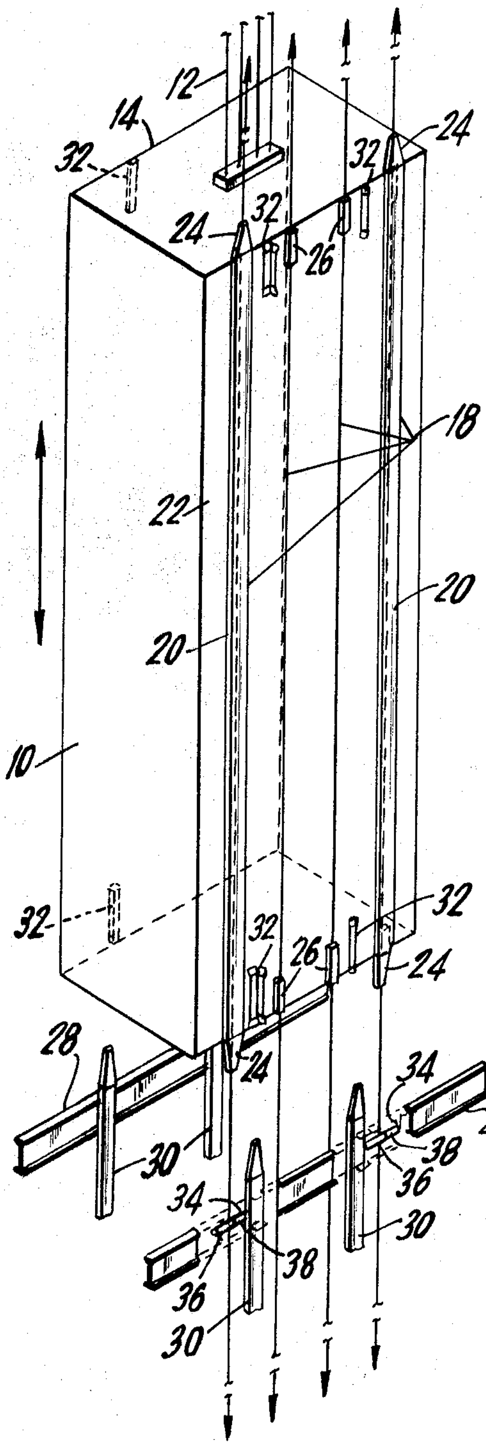


FIG. 1

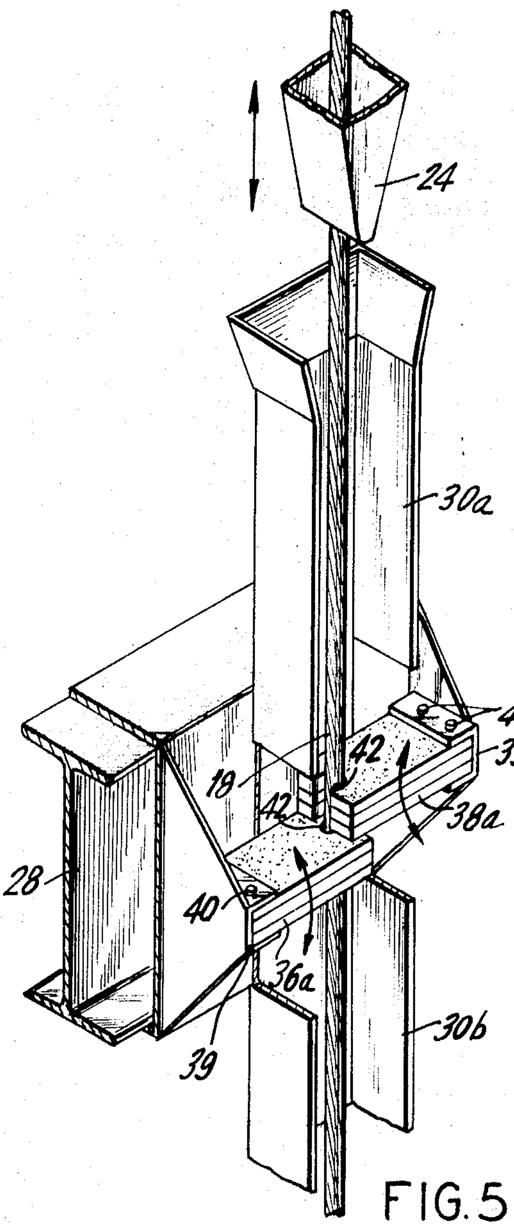


FIG. 5

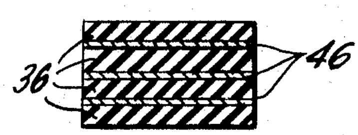


FIG. 3

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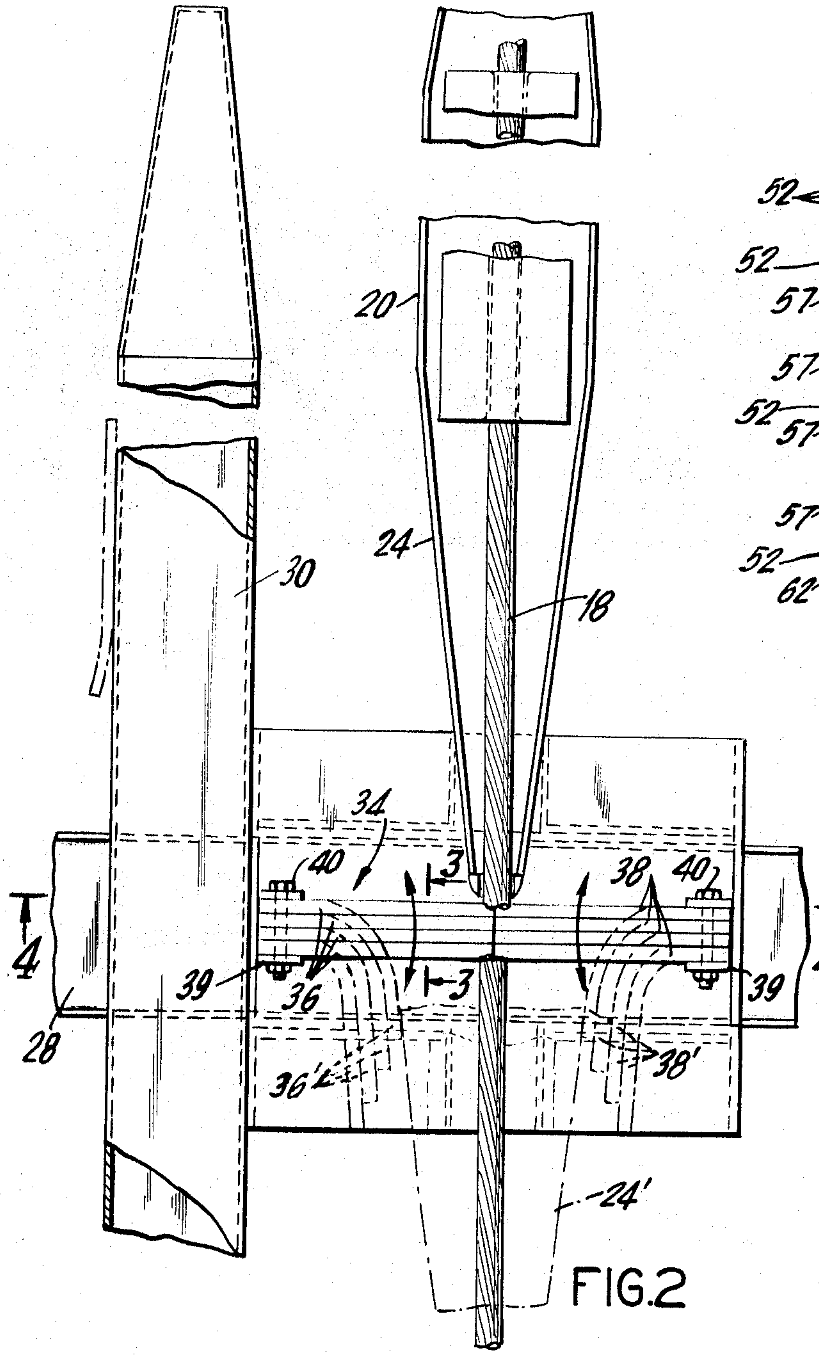

FIG.2

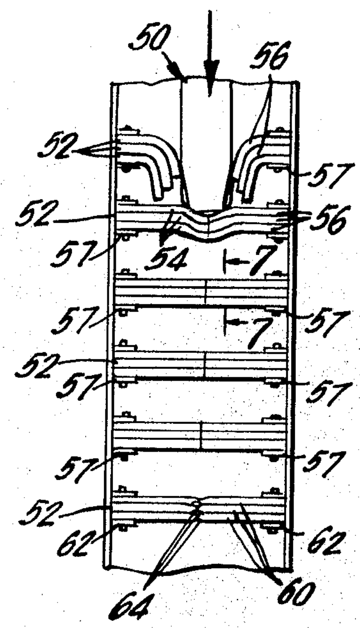

FIG.6

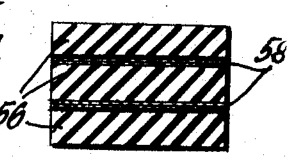

FIG. 7

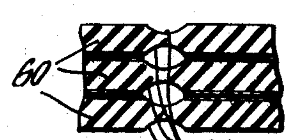

FIG. 8

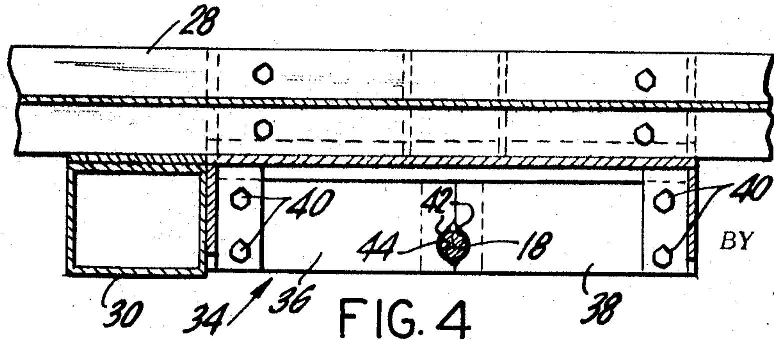

FIG. 4

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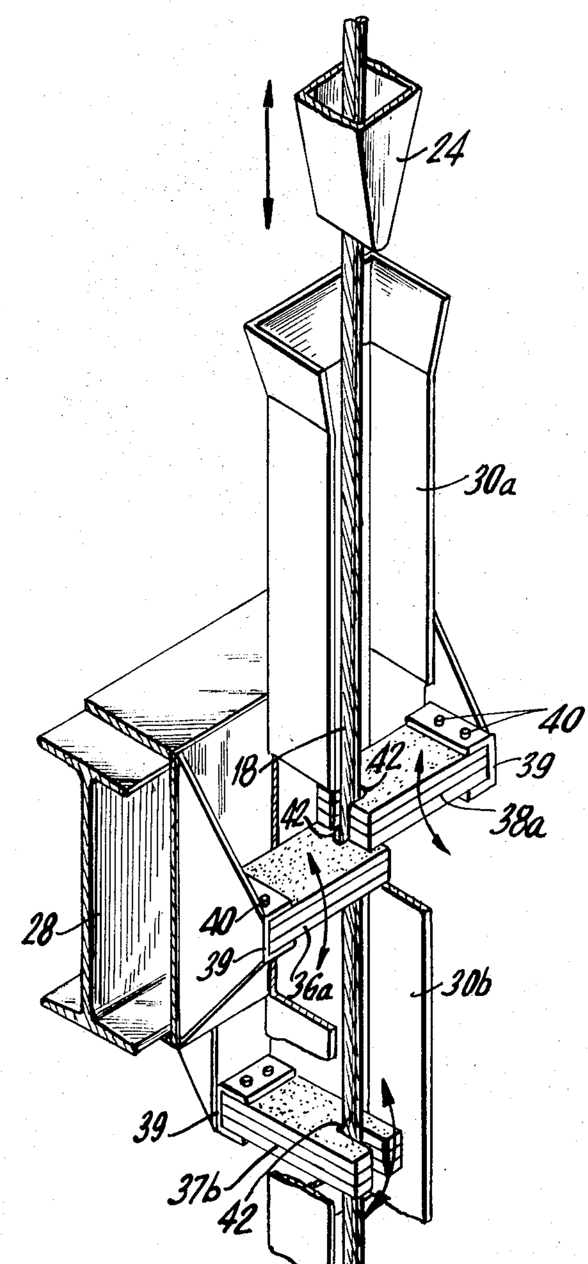

FIG. 5A

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GUIDE ROPE STABILIZER

The present invention relates generally to elevators, and particularly to a device for providing stability to ropes provided in a mine shaft or elevator chute to guide the vertical movement of the elevator car or cage.

In recent years, it has become the accepted practice in the mining industry to utilize rope guides instead of fixed guides to guide the elevator car, (or cage or skip as it is commonly called) along the shaft. The use of guide ropes has gained wide acceptance in the mining industry as a result of its provision of smoother cage guidance, simpler shaft steel installation, and increased reliability and reduced maintenance requirements. The guide ropes are maintained under tension and secured at their upper and lower ends at positions corresponding to the upper and lower limits of cage travel. It is common for the cage to carry a number of tapered guide rope shoes through which the guide ropes pass, thereby to provide the desired guidance for the cage as it moves vertically along the shaft.

While the guide ropes achieve considerable stabilization of cage movement, it is still generally necessary to provide fixed guides at loading or unloading stations along the shaft to achieve a more positive and secure cage stabilization at these locations. The use of such fixed guides has been fairly satisfactory in achieving smooth and adequately rapid entry of the cage onto the fixed guides in elevator systems in which single level hoisting is used, and where the length of the fixed guides does not exceed 50–60 feet. However, in mining elevator systems in which guide ropes are used in multiple level shafts, and in which the length of the fixed guides above the point of guide rope anchorage is greater than 50–60 feet, considerable difficulty has been experienced in achieving the desired smooth and fast entry of the cage onto the fixed guides.

Several attempts have been made to overcome this problem including the belling out of the guide shoes mounted on the cage, providing additional tension on the guide ropes, or reducing the speed of the cage at the point of entry onto the fixed guides. These approaches have, however, all been found wanting as either presenting problems of maintenance (in requiring frequent replacement of the guide shoes), safety, or efficiency of elevator operation, by reducing the total hoisting cycle time, thereby reducing the production capability of the mine.

As a result of these deficiencies, it has been proposed to dispose guide rope stabilizers in the regions adjacent the fixed guides to reduce the swing or harmonics of the guide rope, and thereby prevent misalignment of the guide shoes on the cage with the fixed guides. The basic requirement of these stabilizers is that they engage the guide rope to maintain its stability, that is, prevent swinging about its points of anchorage, while still permitting the unobstructed vertical passage of the cage guide shoes.

To this end, several devices including rigid horizontally reciprocating springs, spring positioned tension bars, multiple-pivot linkages, and pneumatic operated reciprocating cylinders, have been suggested for use as guide rope stabilizers. These devices are relatively complex in nature, and all present serious problems in maintenance and excessively high likelihood of failure. In elevator systems, in which safety and reliability of operation are prime requisites, these suggested devices are clearly inadequate for their intended use. As a result, the need in the mining industry for a reliable and practical rope guide stabilizer remains.

It is an object of the present invention to provide an improved guide rope stabilizing device for use in mine shaft elevator systems, or the like.

It is a further object of the present invention to provide a guide rope stabilizing device for use in a mining elevator system or the like, which is less complex, and hence more reliable over longer periods of use, than devices of this type that have been heretofore proposed.

It is another object of the invention to provide a stabilizing device of the type described which allows smoother, faster, and positive entry of a rope guided cage or skip onto fixed guides in a mine shaft or elevator chute.

It is still a further object of the present invention to provide a stabilizing device of the type described which can be readily modified to act as a braking or retarding mechanism.

To these ends, the stabilizing device of the invention is in the form of a pair of flexible leaf-like members attached at one of their ends in the chute so as to allow radial flexing of their free ends. The free ends are configured to define an opening through which the guide rope is passed, enabling the leaf-like members to securely engage and thus stabilize the guide rope in a plane perpendicular to the longitudinal axis of the guide rope.

As herein described, the stabilizing device may comprise a plurality of such leaf-members in a laminated arrangement. If desired, to provide improved flexing and holding properties for the device, thin lubricating members may be interposed between two adjacent laminated leaf members. The free ends of the laminated leaf members may either be in an abutting relationship, or in a spaced, staggered overlying relationship. Moreover, the device of the invention may be readily modified to act as a braking or retarding mechanism by the interposition of thin abrasive lamination leaves between the laminated resilient leaf members.

To the accomplishment of the above, and to such further objects as may hereinafter appear, the present invention relates to a rope guide stabilizer substantially as defined in the appended claims, and as described in the following specification taken together with the accompanying drawings in which:

FIG. 1 is a simplified perspective view of a typical elevator cage hoisting and guiding system in which the rope guide stabilizer of the invention is incorporated;

FIG. 2 is an elevation on an enlarged scale of the rope guide stabilizer of the invention;

FIG. 3 is a cross-sectional view taken approximately across the line 3—3 of FIG. 2;

FIG. 4 is a cross-sectional view taken across the line 4—4 of FIG. 2;

FIG. 5 is a fragmentary perspective of a second embodiment of the invention;

FIG. 5A is a modification of the embodiment shown in FIG. 5;

FIG. 6 is a simplified elevation of a modification of the invention;

FIG. 7 is a cross-sectional view taken across the line 7—7 of FIG. 6 and

FIG. 8 is a fragmentary elevation on an enlarged scale of a portion of the embodiment of FIG. 6.

The stabilizer device of the present invention is herein described as incorporated in a mine shaft elevator system to stabilize the guide ropes at locations at which the guide shoes carried by the cage must be aligned with the fixed guide shoes. It is, however, to be understood that the stabilizer of the invention may also be employed to advantage in elevator systems used in apartment and office dwellings in which guide ropes are employed to constrain the vertical movement of the car. While the term "guide rope" is used in the specification and claims, it is to be understood that this term contemplates the use of any rope, cable or the like that is attached at its extreme ends and maintained under tension so that it has the tendency to swing or oscillate away from a perfectly vertical orientation, particularly at positions removed from its anchored ends.

FIG. 1 illustrates a cage or skip **10** which is arranged for vertical movement in both the up and down directions along a mine shaft. The cage **10** is moved by means of hoist ropes **12** secured at their lower ends to the roof **14** of cage **10**, and to a conventional hoist mechanism (not shown) at their upper ends.

To ensure proper orientation of the cage as it moves along the shaft, guide ropes **18**, here shown as being four in number and lying in a substantially common vertical plane, are provided. The upper ends of the guide ropes **18** are anchored in the headframe of the shaft (not shown), and the lower ends of the guide ropes are anchored at the bottom of the shaft. Guidance of the cage **10** is achieved by respectively passing two of the guide ropes **18** through a pair of guide shoes **20** secured to wall **22** of cage **10**, and having tapered end portions **24** extending symmetrically above and below that wall. The inner pair of guide ropes **18** pass through additional guide rope shoes **26** secured to the upper and lower ends of wall **22** of cage **10**.

Although the guide ropes **18** are maintained under tension, there is still a tendency for them to swing or oscillate away from a perfectly vertical orientation, particularly at locations removed from its anchored upper and lower ends. Thus, when the cage **10** is to approach a landing, or a loading or unloading position, it is necessary to have additional control over the car. For this reason, at these locations, members here shown as steel I-beams **28** are mounted in the shaft, each carrying a pair of spaced fixed shaft guides **30**. A plurality of guide shoes **32** are adapted to be received onto the tapered ends of shaft guides **30** at those desired locations. To ensure proper alignment of the guides **30** and shoes **32** at these locations, it is necessary to provide additional stabilization to the guide ropes **18** so that cage **10** is fixed in a position permitting the smooth and rapid entry of the cage guide shoes **32** onto the fixed guides **30**.

In accord with the present invention, a stabilizer device generally designated **34**, is secured to the steel I-beam **28** to provide additional stabilization to the guide ropes **18**. As seen best in FIG. **2**, stabilizer device **34**, two of which are preferably provided as shown in FIG. **1**, comprises a pair of sections of laminated flexible leaf members **36** and **38** disposed transversely to rope **18**, each of which is mounted at one end to a bracket **39**, such as by means of a fastener **40**. Bracket **39** is in turn secured to I-beam **28**. The individual leaf elements **36**, **38** of each section, here shown as four in number, may be made of any suitable flexible, high impact and abrasion resistant material, such as rubber, neoprene, or other plastic material and are normally oriented, as shown in FIG. **2**, in a substantially horizontal position shown in the solid line position of the members in FIG. **2**. The abutting free ends of the leaf members **36** and **38** are so configured by the provision therein of cutouts **42**, to define an opening **44** through which the guide rope **18** passes. The dimensions of opening **44** are selected such that encirclement of guide rope **18** by leaf members **36** and **38** when in their normal horizontal position, is sufficiently close to prevent any appreciable swinging or movement of the guide rope. In this manner, the guide ropes **18** passing through stabilizer device **34** are reliably stabilized in a plane parallel to the plane of lamination of leaf members **36** and **38**. If desired, to improve the flexing properties of the laminated leaf members, relatively thin lubricating members **46** (FIG. **3**) may be sandwiched between leaf members **36** and **38**.

When the cage **10** enters the fixed shaft guides **30** a short distance, the tapered ends **24** of the guide rope shoes **20** engage the free ends of the leaf members **36**, **38** and cause them to progressively flex radially downwardly to cause the leaf members to assume the flexed position indicated by the broken lines at **36'** and **38'** in FIG. **2**, in which they are spread and spaced apart from the guide rope **18**. The corresponding position of tapered end **24** of guide rope shoe **20** is indicated at **24'** and is also shown in broken lines in FIG. **2**.

As soon as cage **10** has moved past the location of the fixed shaft guides **30**, so that the guide rope shoes **20** have completely bypassed the stabilizer device **34**, the previously flexed leaf members **36**, **38** quickly spring back to their normal, horizontal position in which their free ends once again surround and stabilize the guide rope **18**. Symmetrical arrangement of the guide rope shoes **20** and the tapered ends **24** thereof at the top and bottom of cage **10** as seen in FIG. **1**, allows the stabilizing operation to take place in either direction of cage movement along the longitudinal axis of the guide rope.

In the embodiment of FIG. **5**, the sections of laminated, flexible leaf members **36*a*** and **38*a*** are vertically spaced and partially overlap one another when in their normal horizontal position rather than being in the abutting relationship as in the previously described embodiment. As before, a cutout **42** is formed in the free ends of each leaf member to accommodate a portion of the periphery of guide rope **18**. The overlapping of the leaf member ends enclosing or surrounding the guide rope provides somewhat improved retention of the guide rope when the laminated leaves are in their normal position, as compared to the embodiment illustrated in FIGS. **1–4**.

In further distinction to the earlier described embodiment, the tapered end **24** of the guide rope shoe which separates the free ends of the leaf members, also enters into an upper fixed female-type guide shoe **30A** prior to passing through the leaf members, and then into a lower, fixed, female-type guide shoe **30*b***, which can extend to any desired vertical length along the shaft.

In a deep, multiple-level mine shaft, precise cage positioning in the horizontal plane would be achieved by installing relatively short length sections of fixed guides with the guide rope stabilizers of the invention as described above. Between shaft levels, where cage guidance is less critical, that guidance would be achieved by the guide ropes alone.

The embodiment of FIG. **5A** is substantially similar to that of FIG. **5**, except for the inclusion of at least one additional section of a laminated flexible leaf member **37*b*** vertically spaced (e.g., below) and horizontal to laminated leaf member **36*a***, the horizontal axis of leaf member **37*b*** being oriented at right angles to the horizontal axis of both leaf members **36*a*** and **38*a***, the leaves of member **37*b*** being held fixed at one end by U-shaped flange **39**. As in leaf members **36*a***, **38*a***, a cutout **42** is provided at the free end of leaf member **37*b*** to accommodate a portion of the periphery of guide rope **18**. The additional leaf member oriented at right angles to members **36*a*** and **38*b*** can provide maximum rope securement with fewer or more flexible guide rope stabilizing leaves. This promotes smoother pass-through of the guide rope stabilizer release and longer stabilizer leaf life.

The device of the present invention may be modified as shown in FIGS. **6–8** to provide braking and retardation of an object generally designated **50** as it moves downwardly in the shaft. In that embodiment, a plurality of vertically spaced groups **52** of flexible leaf members having gradually decreasing (as viewed in a downward direction) flexibility are arranged along the shaft. Each group of leaf members is composed of two sections of stiff laminated leaf members **54** and **56**, each of which has a high coefficient of friction and is secured at one end as at **57**, to a fixed location in the shaft such as an I-beam member (not shown). To adjust the braking action of each of the laminated groups on the object, a relatively thin abrasive leaf **58** of a material having a high coefficient of friction is sandwiched or interposed between the flexible leaf members **54**, **56** as shown in FIG. **7**. To achieve a uniform braking action, the thickness and rigidity of leaves **58** may be decreased at lower positions in the shaft. The operation of the system is similar to that described above in that the object as it moves downwardly in the shaft contacts and then spreads apart the flexible leaf members by causing the latter to be radially flexed downwardly. The initial resistance to the downward movement of the object offered by the laminated leaf members and the subsequent engagement of the flexed ends of the leaf members **54**, **56** and the rigid friction leaves **58** with object **50**, produce the desired braking or retarding effect on the object.

To achieve extremely rapid deceleration or braking on the object, a single group of laminated membranes **60** may extend completely across the path of movement of object **50** and be secured at its opposite ends as at **62**. The membranes **60** are weakened along their central longitudinal axes by the formation of arcuate cutouts **64** (FIG. **8**) formed at the upper and lower surfaces of each of the membranes.

When the object **50** contacts the upper one of membranes **60** it will cause it to rupture at its thus weakened midpoint, followed by the successive rupturing of the remaining membranes, thereby to achieve a controlled amount of energy absorption which in turn provides the desired braking effect on object **50**.

The rope guide stabilizer device of the invention thus enables secure retention of the guide ropes at those locations at which the guide rope shoe is to engage the fixed guide, thus permitting the smooth, rapid and positive entry of the former into the latter. The stabilizer device of the invention requires only a minimum number of components all of which are reliable and mechanically simple; that is, there are no complex mechanical components or linkages as required in the prior art devices of this type. As a result, the stabilizer device of the invention operates in a far more efficient and reliable manner than any of the prior art devices, and ensures a long period of trouble-free operation, which is essential in an elevator system.

The device of the invention may be readily modified to act as a braking or retarding device for use, for example, in an elevator system.

While several embodiments of the invention have been herein specifically described, it will be apparent that many modifications may be made therein, all without departing from the spirit and scope of the invention.

What is claimed is:

1. In a system for moving an elevator car vertically along a shaft, said system comprising elevator guide rope means extending substantially along the vertical length of the shaft and anchored at its extreme ends, and car guide means secured to said car and passing over said guide rope means; means for stabilizing the position of said guide rope means including first and second flexible leaf means fixedly secured at one of their ends at a predetermined location in the shaft transverse to said rope guide means, the free ends of said flexible leaf means having cutouts formed therein for receiving said guide rope means when in a first normal position, and being radially movable when contacted by said car guide means toward a second flexed position in which the free ends of said leaf means are spaced from said guide rope means, thereby to permit said car guide means to pass by said stabilizing means.

2. The system of claim 1, in which the free ends of said leaf means are in a substantially abutting relationship, said cutouts, when said leaf means are in said first normal position, forming an opening closely surrounding and thereby stabilizing said guide rope means.

3. The system of claim 2, in which said resilient leaf means comprises first and second pluralities of laminated flexible leaf members, each fixedly secured at opposing ends thereof, and each having said cutout formed in the free ends thereof.

4. The system of claim 1 in which said resilient leaf means comprises first and second pluralities of laminated leaf members each fixedly secured at opposing ends thereof, and each having said cutout formed in the free ends thereof.

5. The system of claim 4, in which said pluralities of laminated leaf members are vertically spaced in said shaft and have their free ends, when said leaf members are in their said first position, in an overlapping relationship.

6. The system of claim 4, further comprising relatively thin lubricating members interposed between at least two adjacent ones of said leaf members.

7. The system of claim 3, further comprising relatively thin lubricating members interposed between at least two adjacent ones of said leaf members.

8. In a system for controlling the movement of an elevator car vertically along a shaft, guide rope means vertically extending along said shaft and anchored at the upper and lower ends thereof to define a vertical course for said car and having a tendency of swinging away from a perfectly vertical orientation, guide shoe means carried by said car and passing over said guide rope means, and fixed guide means positioned in said shaft for receiving said guide shoe means; means for stabilizing said guide rope means when said guide shoe means approaches said fixed guide means, said stabilizing means comprising, first and second sections of laminated flexible leaf members, means mounting opposing ends of said leaf members in said shaft transverse to said guide rope means, the free ends of said leaf members being normally in a first horizontal position in which they enclose and thus stabilize said guide rope means against swinging away from a vertical orientation, said leaf members being free to flex radially downward when contacted by said guide shoe means, thereby to permit said guide shoe means to pass thereby, and to return to said first normal position to once again enclose said guide rope means after said guide shoe means no longer contacts said leaf member free ends.

9. In the system of claim 8, cutouts formed in the free ends of said leaf members to define, when said leaf members are in their normal position, an opening through which said guide rope means is passed.

10. In the system of claim 9, thin lubricating members sandwiched between adjacent ones of said leaf members.

11. The system of claim 8, in which the free ends of said leaf members in said first and second sections are in a substantially abutting relationship with one another.

12. In the system of claim 11, cutouts formed in the free ends of said leaf members to define, when said leaf members are in their normal position, an opening through which said guide rope means is passed.

13. The system of claim 8, in which said first section of leaf members is vertically spaced from said second section of leaf members, and has its free ends partially overlapping the free ends of said second section.

14. In the system of claim 13, cutouts formed in the free ends of said leaf members to define, when said leaf members are in their normal position, an opening through which said guide rope means is passed.

15. The system of claim 8, wherein a third section of laminated leaves is provided spaced vertically from said first and second sections and substantially horizontal therewith, said third section being oriented at substantially right angles to said first and second sections.

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