

Description

The present invention relates to a long-distance elevator particularly of the type in which a cab and a counterweight are suspended from a driving sheave around which a plurality of ropes are doubly wound at a ratio such as 2:1 and 3:1. In particular, the invention is concerned with a device for suppressing the vibration of the ropes during operation of the elevator.

Elevators which are double wound with sheaves on the cab to obtain a 2:1 ratio or larger, will experience rope oscillations when installed for runs which are of long duration.

In some cases, the travel of an elevator is as large as 500 to 600 meters as in the cases of tall buildings and dams. In general, lateral oscillation or interference of ropes do not occur when the travel distance is about 150 meters or so. Unfortunately, however, lateral oscillation of the rope inevitably takes place when the travel distance exceeds 150 meters or so. In addition, troubles such as mutual interference of the ropes tends to occur particularly in the case where the ropes are wetted as often experienced in mines. The mutual interference of the ropes may be considerable particularly when the resonance frequency of the rope coincides with the frequency of lateral vibration of the rope, and even rotational oscillation of the cab may occur in the worst case.

Accordingly, it is an object of the present invention to provide a rope vibration suppressing device which is designed to effectively suppress lateral oscillation and mutual interference of ropes during running of the elevator cab.

A vibration suppressing device for an elevator is known from US 3686051 comprising a pair of guide rolls each having a semi-circular cross-section, the guide rolls being arranged in an abutting condition.

According to the present invention, there is provided a vibration suppressing device for an elevator comprising: a pair of guide rolls having grooves each having a semi-circular cross-section, the guide rolls being arranged in an abutting condition, characterised by said guide rolls being fixed at a position above a grooved sheave, said grooved sheave being rotatably mountable on the top wall of the elevator cage, and having grooves each having a cross-section with an arcuate bottom portion for receiving a portion of a rope of the elevator, the cross-section linearly diverging from both ends of the arc.

In a preferred form of the invention, the arcuate cross-section of the bottom of each groove in the grooved sheave has a radius slightly greater than the radius of the rope which is to be received in this groove, while the distance between the bottom of the groove and the surface of the sheave is about 1.5 times as large as the diameter of the rope preferably, the radius of the semi-circular cross-section of the groove in the guide roll is slightly greater than the

radius of the rope to be received in the groove.

In order to prevent lateral oscillation of the ropes, it is necessary that the ropes are firmly gripped. This could be realized by adopting sheaves having deep grooves. The deep groove could be formed such that the groove has a semi-circular bottom and both ends of the semi-circular form extend vertically to form parallel walls so as to receive a rope. In such a case, however, the rope would tend to come off the groove by jumping over the parallel wall. On the other hand, a V-shaped groove suffers a problem in that the rope which is deformed by load is pressed onto the groove bottom so as to cause a wear and deformation of the groove with the result that the rope cannot smoothly clear the groove, although it can prevent the rope from jumping off the groove.

According to the present invention, the groove in the grooved sheave has an arcuate bottom which receives a portion of the rope and the cross-section of the groove is so determined as to have walls which linearly diverge from both ends of the arc of the groove bottom. With this arrangement, it is possible to securely grip the rope so as to suppress lateral oscillation, while eliminating deformation of the groove due to wear and preventing the rope from jumping off the groove.

In one embodiment two grooved guide roll pairs on the cab may be provided on either side of the cab sheave to guide movement of the rope onto and off the cab sheave.

The aforesaid and other objects and advantages of the invention will become more readily apparent from the following detailed description of a preferred embodiment of the invention when taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a fragmentary sectional view of a portion of a grooved cab sheave used in the prior art;

FIG. 2 is a side elevational view of a prior art elevator system using the sheave of FIG. 1;

FIG. 3 is a view similar to FIG. 1 but showing the cab sheave formed in accordance with this invention;

FIG. 4 is a view similar to FIG. 2 but showing the rope vibration suppressing assembly of this invention; and

FIG. 5 is a fragmented elevational view of one of the guide roll pairs used to feed rope onto and off of the cab sheave.

A conventional elevator and sheave arrangement will be described with specific reference to FIGS. 1 and 2. Referring to FIG. 2, an elevator has a cab 1, a sheave 10 rotatably mounted on the top wall of the cab 1, a hoisting traction sheave 3, a balance sheave 4, a balance weight 5 and ropes R. Referring to FIG. 1 which is a sectional view of the sheave 10, the sheave 10 has grooves each having a substantially semi-circular cross-section which is slightly greater than the circular cross-section of each rope R₁, R₂ and

R₃. In operation, the rope is pressed onto the sheave so that the rope is slightly deformed into an oval form in cross-section. This tends to cause wear and deformation of the groove which receives the deformed rope. In this prior art, however, this problem is overcome because the substantially semi-circular cross-section of the groove is determined to be slightly greater than the corresponding portion of the cross-section of the rope.

As will be seen from FIG. 2, the rope R is fixed at its one end to the top of the hoistway and is suspended therefrom. The rope R then goes around the sheave 10, the traction sheave 3 and the counterweight sheave 4. The rope then leads upward so as to be connected to the top of the hoistway.

An embodiment of the present invention will be described with reference to FIGS. 3-5. A grooved sheave 10 rotatably fixed to the top of the cab has grooves each having a cross-section defined by an arcuate bottom which receives a part of each rope and by walls which linearly diverge from both ends of the arc of the bottom as shown in FIG. 3. In one embodiment of the present invention, the arcuate bottom portion has a radius R which is not smaller than the rope radius (rope having a diameter of 13mm) but does not exceed rope radius plus 0.35mm, taking into account possible deformation of the rope under the load. The distance h between the groove bottom and the sheave surface is determined to be 1.5 times as large as the rope diameter, while a distance d between parallel tangent lines to adjacent ropes (14mm in this case) is greater than the rope diameter and is preserved between adjacent ropes. The angle A of divergence of the groove is preferably within the range of 30°±5°. A vibration suppressing guide as shown in FIG. 4 is situated at a position which is about 1 to 1.5 meters above the top wall of the cab. The guide has guide rollers 11 and 12 with grooves each having a semi-circular cross-section slightly greater than the semi-circle of the rope cross-section as seen in FIG. 5. The sheaves and the rolls are preferably made from polymeric nylon.

Rollers 11, 12 are mounted on threaded studs 13, 14 on a support 19 above the top wall of the cab and secured by nuts 15 to 18.

According to the present invention, it is possible to effectively suppress the vibration of ropes during running of a cage in a long-distance elevator system.

The depth of the grooves on the cab sheave and the fact that they are provided with a base radius which is substantially equal to the radius of the hoist ropes ensures that the cab sheave will firmly grip the ropes. The linear outwardly diverging sides of each sheave groove ensures that the ropes will not climb out of the grooves, and the guide rollers provide smooth feeding of the ropes into and out of the sheave grooves.

Since many changes and variations of the dis-

closed embodiment of the invention may be made without departing from the invention concept, it is not intended to limit the invention otherwise than as required by the appended claims as interpreted by the specification.

Claims

1. A vibration suppressing device for an elevator comprising: a pair of guide rolls (11, 12) having grooves each having a semi-circular cross-section, the guide rolls being arranged in an abutting condition, characterised by said guide rolls (11, 12) being fixed at a position above a grooved sheave (10), said grooved sheave (10) being rotatably mountable on the top wall of the elevator cage, and having grooves each having a cross-section with an arcuate bottom portion for receiving a portion of a rope of the elevator, the cross-section linearly diverging from both ends of the arc.
2. A vibration suppressing device for an elevator according to claim 1, wherein the arcuate cross-section of the bottom of each groove in said grooved sheave has a radius (R) greater than the radius of the rope which is to be received in this groove, while the distance (h) between the bottom of said groove and the surface of said sheave is substantially 1.5 times as large as the diameter of said rope.
3. A vibration suppressing device for an elevator according to claim 1 or 2 wherein the radius of said semi-circular cross-section of said groove in said guide roll is greater than the radius of said rope to be received in this groove.
4. An elevator incorporating a vibration suppressing device as claimed in any preceding claim and adapted to suppress lateral oscillation and mutual interference of the ropes of the elevator during running of the elevator.

Patentansprüche

1. Schwingungsunterdrückungsvorrichtung für einen Aufzug mit:
einem Paar Führungsrollen (11,12) mit Rillen, die jeweils einen halbkreisförmigen Querschnitt aufweisen, wobei die Führungsrollen aneinander angrenzend angeordnet sind,
dadurch gekennzeichnet,
daß die Führungsrollen (11,12) in einer Position oberhalb einer mit Rillen versehenen Seilscheibe (10) befestigt sind, die drehbar auf der Decken-

R₃. In operation, the rope is pressed onto the sheave so that the rope is slightly deformed into an oval form in cross-section. This tends to cause wear and deformation of the groove which receives the deformed rope. In this prior art, however, this problem is overcome because the substantially semi-circular cross-section of the groove is determined to be slightly greater than the corresponding portion of the cross-section of the rope.

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2. A vibration suppressing device for an elevator according to claim 1, wherein the arcuate cross-section of the bottom of each groove in said grooved sheave has a radius (R) greater than the radius of the rope which is to be received in this groove, while the distance (h) between the bottom of said groove and the surface of said sheave is substantially 1.5 times as large as the diameter of said rope.
3. A vibration suppressing device for an elevator according to claim 1 or 2 wherein the radius of said semi-circular cross-section of said groove in said guide roll is greater than the radius of said rope to be received in this groove.
4. An elevator incorporating a vibration suppressing device as claimed in any preceding claim and adapted to suppress lateral oscillation and mutual interference of the ropes of the elevator during running of the elevator.

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wandung der Aufzugskabine befestigbar ist und deren Rillen jeweils einen Querschnitt mit einem bogenförmigen Bodenbereich zur Aufnahme eines Bereichs eines Aufzugseils aufweisen, wobei der Querschnitt sich von beiden Enden des Bogens ausgehend linear erweitert.

2. Schwingungsunterdrückungsvorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß der bogenförmige Querschnitt des Bodens jeder Rille in der mit Rillen versehenen Seilscheibe einen Radius (R) aufweist, der größer ist als der Radius des in dieser Rille aufzunehmenden Seils, während der Abstand (h) zwischen dem Rillenboden und der Umfangsfläche der Seilscheibe im wesentlichen das 1,5-fache des Seildurchmessers beträgt.
3. Schwingungsunterdrückungsvorrichtung nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß der Radius des halbkreisförmigen Querschnitts der Rille in der Führungsrolle größer ist als der Radius des in dieser Rille aufzunehmenden Seils.
4. Aufzug mit einer Schwingungsunterdrückungsvorrichtung nach einem der vorangehenden Ansprüche, die zum Unterdrücken seitlichen Oszillierens und gegenseitiger Beeinflussung der Aufzugsseile während des Fahrens des Aufzugs vorgesehen ist.

Revendications

1. Dispositif de suppression des vibrations pour ascenseur, qui comprend une paire de rouleaux de guidage (11, 12) munis de gorges ayant chacune une section semi-circulaire, les rouleaux de guidage étant disposés en appui, caractérisé en ce que lesdits rouleaux de guidage (11, 12) sont fixés dans une position située au-dessus d'une poulie à gorges (10), celle-ci étant montée rotative sur la paroi supérieure de la cage de l'ascenseur et possédant des gorges ayant chacune une section qui possède une portion de fond en forme d'arc pour recevoir une portion d'un câble de l'ascenseur, la section divergeant linéairement à partir des deux extrémités de l'arc.
2. Dispositif de suppression des vibrations pour ascenseur selon la revendication 1, dans lequel la section en forme d'arc du fond de chaque gorge de la poulie à gorges possède un rayon (R) légèrement supérieur au rayon du câble qui doit se loger dans cette gorge, tandis que la distance (h)

entre le fond de la gorge et la surface de la poulie est d'environ 1,5 fois plus grande que le diamètre du câble.

3. Dispositif de suppression des vibrations pour ascenseur selon la revendication 1 ou 2, dans lequel le rayon de ladite section semi-circulaire de ladite gorge formée dans ledit rouleau de guidage, est supérieur au rayon dudit câble qui doit se loger dans cette gorge.
4. Ascenseur comprenant un dispositif de suppression des vibrations selon une quelconque des revendications précédentes et adapté pour supprimer les oscillations latérales et les gênes mutuelles des câbles de l'ascenseur pendant la marche de l'ascenseur.

