Automatic Elevator Wire-rope Tension Equalization Equipment

Safety of the elevator rope
is your safety

Lifecycle of the elevator rope
is your lifecycle.

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Elevator vibration and Elevator safety

The Uneven Wear of Sheave

One best way(repair) to prevent rope vibration is to eliminate the difference between tensile force of each rope. When the tensile force is even, cliff can be blocked to reduce the uneven wear of sheave while increasing the power of traction machine, preventing falling accident or sudden elevate accident due to the rope slip. Therefore, stolving vibration problem of the rope directly leads to elevator safety.

Longitudinal Vibration of Rope

Longitudinal vibration is more important than transversal vibration among all vibrations transferred directly to the car in elevator system. It is a vibration which is highly likely to be caused by the cliff of rope, therefore an immediate measure is needed.

The Understanding of Elevator Design

A breakdown due to the electronic/electric device problems can be fixed simply. However, breakdown due to mechanical/physical causes of elevator design cannot be fixed simply.

The Understanding of an Accident of Unknown Cause

It is true that elevator maintenance service enterprises have much experience and know-how to repair electronic/electric errors and many other problems. However, mechanical/physical problems related to elevator design are more fundamental, which is more difficult to deal with. It is difficult to analyze the resonance oscillation, or the vibration especially caused by the slip of each rope. Dealing with the problem and offering solution is another challenge.
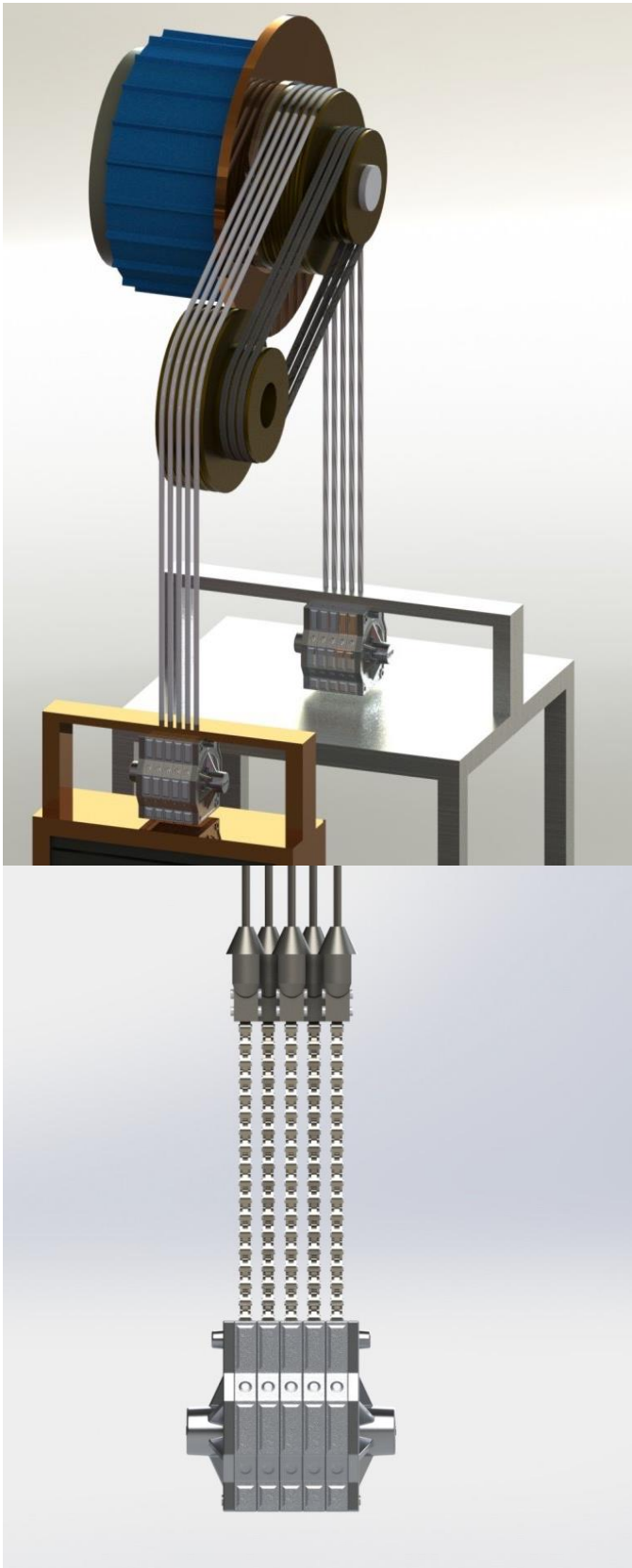
The Uneven Wear of Sheave and the Cause of Rope Vibration

Multiple elevator ropes are installed for safety reasons.

Proportion to the stretch ratio of mechanical movement of pulley of traction machine, each of wire-ropes stretches unevenly.

Therefore, relatively more frictions are caused due to weight overload of rope that is stretched relatively less than others, causing the difference in diameter of groove on pulley. The difference in diameter leads to the difference in circular constant and slip happens.

Diameter of pulley 5>1>3 >4>2

Elongation percentage of rope

elongation

1단계신율   2단계신율   3단계신율   Time
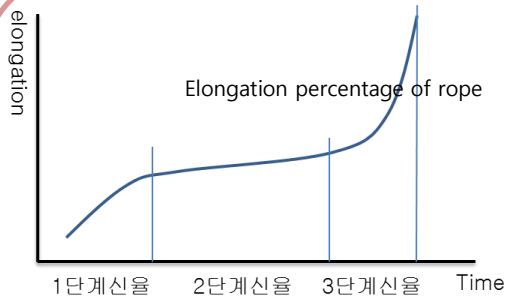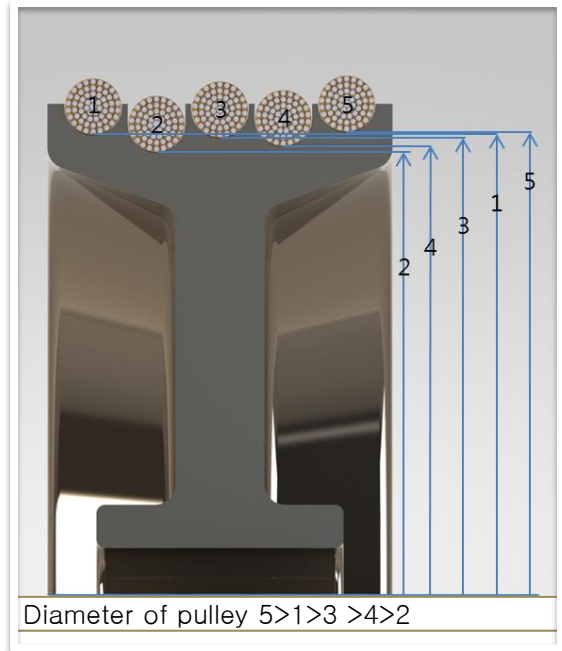
Level 1: structural elongation => Early part of usage, Rope should be readjusted often.

Level 2: elasticity elongation=> Adaptation stage, elongation increases gradually

Level 3: eternal elongation=> Intensified abrasive wear, elongation happens rapidly, replacement required.

Sheave groove

D

D

rove

Rope

A   A'
B   B'

A   B   A' B'
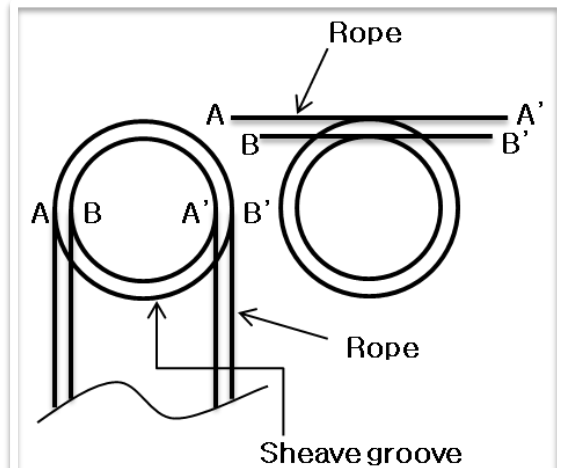
Rope

Sheave groove

The Progress of Uneven Wear of Sheave and Rope

As illustrated above, A-A' groove match ups the momentum of rope, while B-B' groove is smaller than the momentum of rope creating slop.
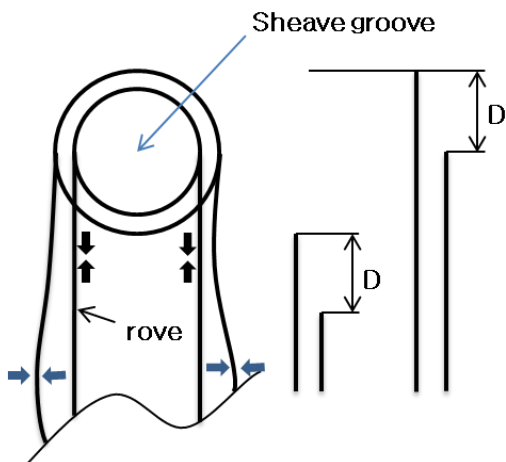
Length difference D is scarcely created even the lift head changes, changing the ratio of tension(weight) between the short and long rope. This affects greatly in high speed condition.

Why is tension imbalance of Rope a Problem?

1. The uneven wear of rope and sheave(pulley) is aggravated, **shortening the lifecycle** of equipment.
2. **Abnormal vibration** occurs on the elevator.
3. **Fall accident can happen** due to the intermittent slip on rope of sheave(pulley)
4. Inertial resistance weakens that car cannot stop on right place of each floor sometimes, therefore **door cannot be opened.**
5. **The issue of cost** comes up when scrutiny and frequent inspection is needed for an elevator with troubles.

When does automatic tension controller take action?

☝Tensil force arises according to elongation percentage of rope

⊗Happens rapidly on the initial stage of installation.
⊗Stretches for an average of 500~600mm of elongation percentage within a year(12months).
⊗Tensil force readjustment is needed frequently.
⊗If not adjusting the "rope tension" automatically in real-time, "imbalance of rope tension" due to elongation cannot be fixed until the next adjustment.

☝Gradual alteration in the stage of adaptation.

⊗Adjusting the elongation of rope regularly
⊗The uneven wear of sheave, which has been created already since the initial stage of installation, causes the difference in circular constant of each rope. That is, the rope across a sheave groove with relatively bigger circular constant moves faster than the rope across a sheave groove with smaller circular constant, creating slip between ropes.
⊗ Adjusting the rope tension automatically in real-time is necessary when the imbalance between ropes increases.

☝Rope stretches rapidly after some period of time in the adaptation stage.

⊗Distortion occurs proportional to the friction of sheave and the reciprocating motion of flexing of rope.
⊗Weight can be concentrated on a single strand.
⊗Rope should be replaced as soon as possible.
⊗An automatic tension equalization equipment is necessary in this stage.

Structural factors cause rope slip!

First=> rope slip due to the uneven wear of sheave

The tension imbalance of each rope creates uneven wear on each rope, causing distinction of the dimeter of sheave groove, which creates rope slip while rotational driving process of sheave.

®*longitudinal vibrations, slip between ropes, intensified friction with sheave*
®*distortion process of rope be accelerated*
®*rapid change in elongation due to the stiffen of rope*

Alternative: rope should receive an even tension.

Second=> rope slip due to distinction of weight between car and counterweight

The proper capacity of car is designed to be 50% of the counterwieght. (That is, when counterweight becomes heavy and car is full, the car is heavier)
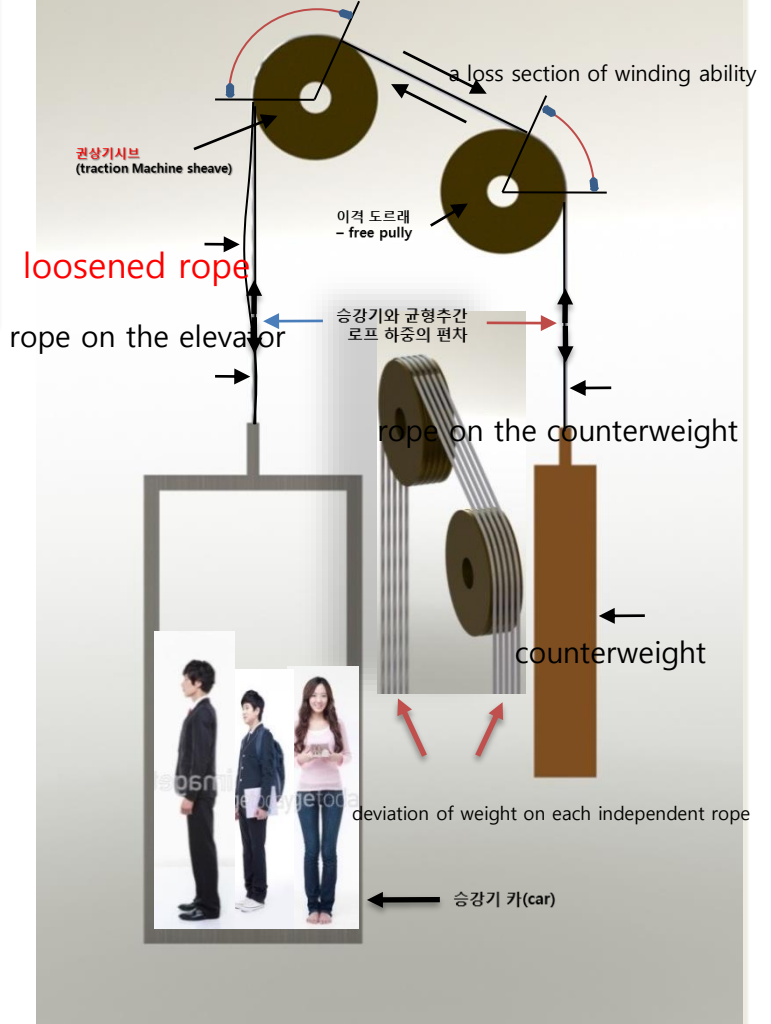
If the deviation of weight between car and counterweight happens but the friction between sheave and rope maintains the deviation, slip can be prevented.

However if weight is biased on a single strand due to the imbalance of weight on each rope, the winding ability can be weakened. This can cause the elevator to suddenly fall or elevate when the rope "slips" on sheave.

®*Intermittent fall accident due to rope slip*
®*Difficulty to open/close the elevator door when the car stops on a wrong place.*

Alternative
Rope should be receiving even tension.

a friction section of winding ability

a loss section of winding ability

권상기시브
(traction Machine sheave)

이격 도르래
– free pully

loosened rope

rope on the elevator

승강기와 균형추간
로프 하중의 편차

rope on the counterweight

counterweight

deviation of weight on each independent rope

승강기 카(car)

Elevator traction machine: a machine as a transfer method of rope that drives car up/down rotating the sheave.

Third=> rope slip due to the decline of slip coefficient caused by impuregnated oil on rope

Exclusive oil for rope is applied inward and outside to prevent the abrasion of rope&sheave, and the corrosion of wire rope. The low slip coefficient of rope can cause decline in winding ability and rope slip

Alternative
®*Increase slip coefficient by adding the number of rope*
®*Control wire-rope with equal tension automatically in real-time*
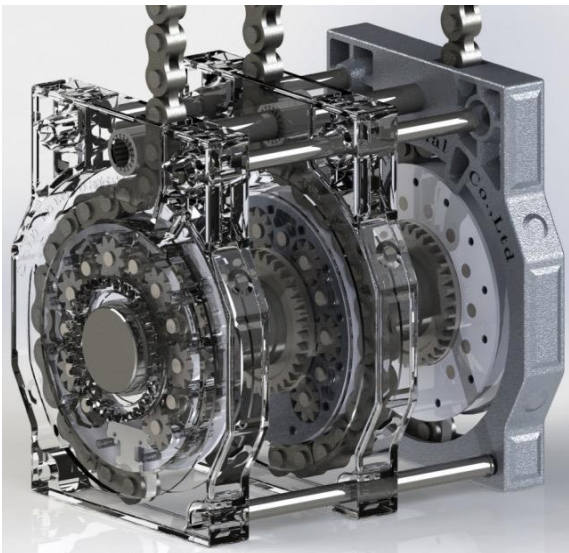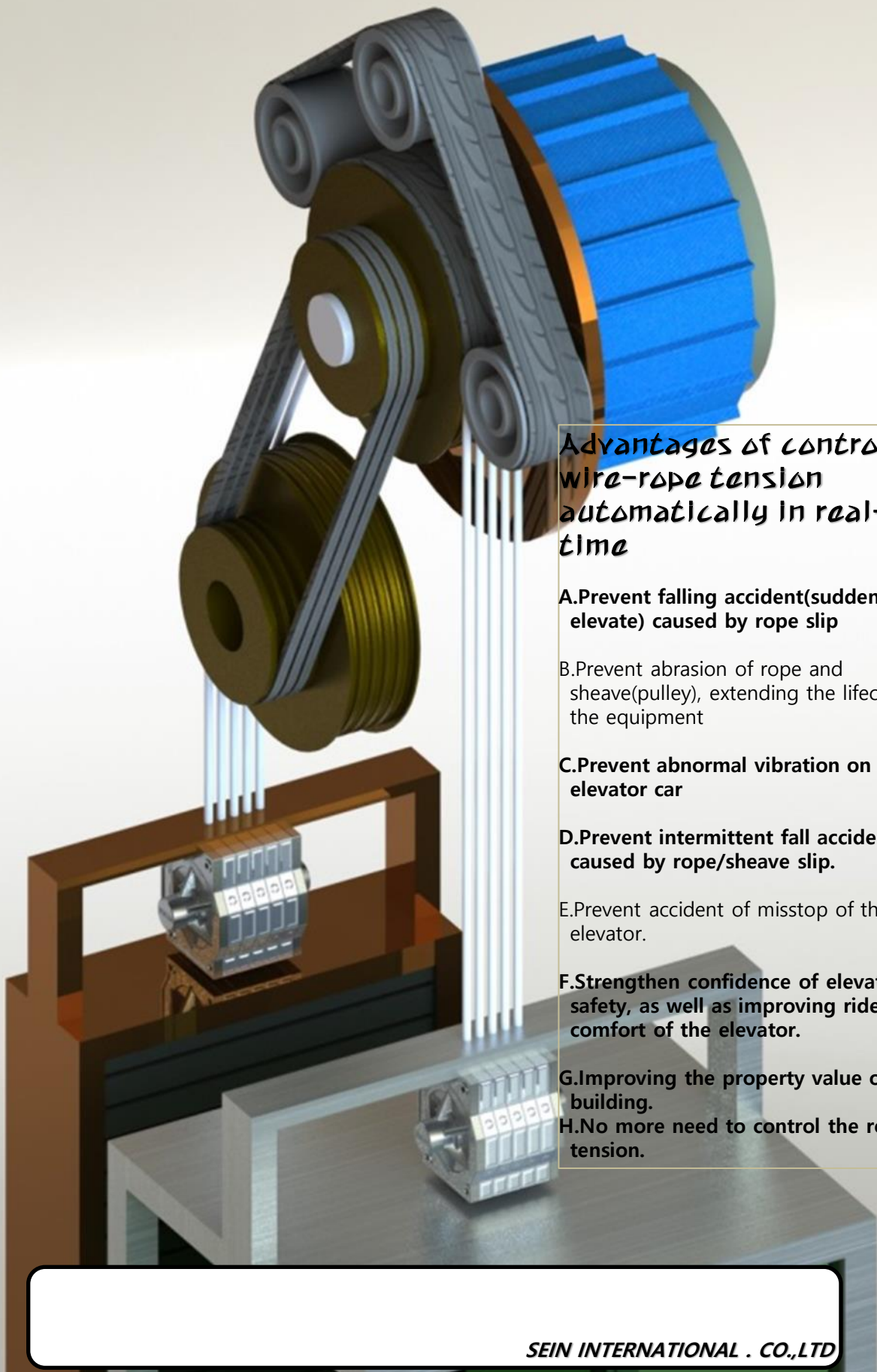
Advantages of controlling wire-rope tension automatically in real-time

A.Prevent falling accident(sudden elevate) caused by rope slip

B.Prevent abrasion of rope and sheave(pulley), extending the lifecycle of the equipment

C.Prevent abnormal vibration on the elevator car

D.Prevent intermittent fall accident caused by rope/sheave slip.

E.Prevent accident of misstop of the elevator.

F.Strengthen confidence of elevator safety, as well as improving ride comfort of the elevator.

G.Improving the property value of building.
H.No more need to control the rope tension.

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