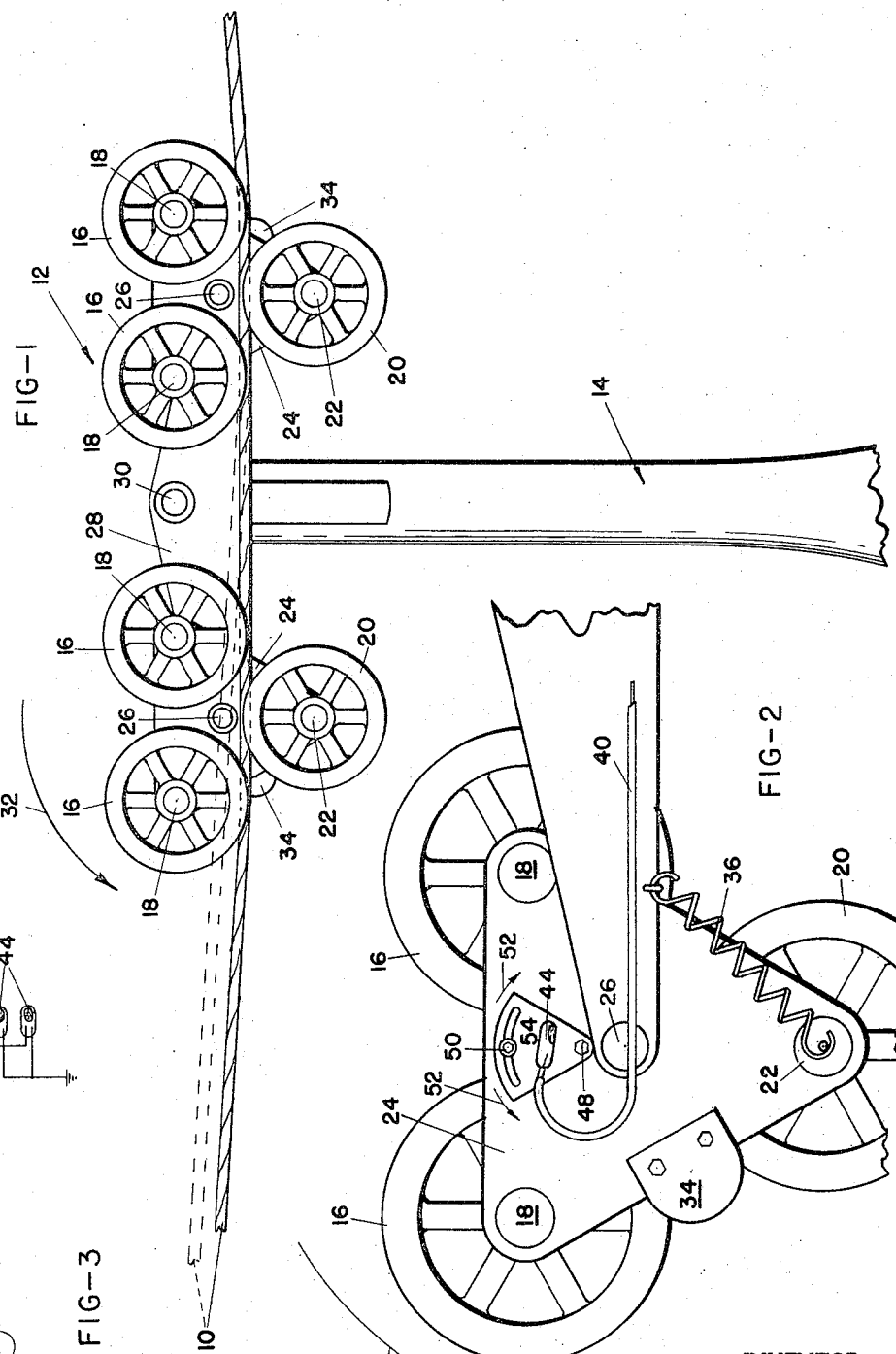
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TRAMWAY ROPE DISPLACEMENT INDICATOR

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TRAMWAY ROPE DISPLACEMENT INDICATOR

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This invention relates in general to an aerial tramway having a circulating rope and in particular in an indicator for annunciating the displacement of the circulating traction rope with respect to any of its guide sheaves.

Aerial tramways conventionally include at least one endless circulatng traction rope trained about a powered drive sheave at one end mounted on a drive terminal and at the other end an idling tension sheave mounted on a carriage forming a part of the tension terminal and adapted to maintain tension on the traction rope. Also conventionally a plurality of rope guiding the towers intermediate the two terminals are provided and are designed to control the circulating movement of the traction rope over its entire path. These towers are provided with rope guiding sheaves which are primarily disposed in vertical planes and either support the circulating traction rope or depress the rope as required. Less frequently sheaves disposed in horizontal or oblique planes are employed under peculiar circumstances.

Since many aerial tramways are of the type employed to carry aerial ski-lift chairs, the collection of snow and ice on the working parts is a condition with which one is concerned. After a period of inoperation in below freezing temperatures ice may collect on the immobilized parts so that when the tramway is again mobilized the ice must be broken away by the movement of the traction rope and the subsequent movement of the relative parts.

In some instances ice forming upon a cable will cause the cable to "jump" out of its desired path with respect to the guiding sheaves. At other times during the operation of the tramway high winds may exert excessive lateral loads upon the cable and cause its accidental displacement from the guiding sheaves. In the event of the displacement of a traction rope from whatever cause, it is desirable if not absolutely necessary that this displacement be immediately known to the operator.

It is therefore an object of the present invention to provide an indicator by means of which an operator may be informed of the displacement of the traction rope with respect to its guiding sheaves irrespective of the location of said displacement along the circulating traction rope.

It is known to employ sensing devices which are disposed to be struck by the traction rope when it is shifted from its proper placement with respect to its guiding sheaves. However when ice forms upon the traction rope its circumference may be sufficiently increased to strike the sensing device and thus give an inaccurate indication of displacement to the tramway operator. Since normally traction ropes are provided with spindles or other attachments for supporting ski-lift chairs, or transport buckets, etc., the sensing devices of the prior art cannot completely encircle the traction rope but are normally disposed at no more than three sides of the traction rope and in most instances only one side, i.e., that side in the direction which the traction rope is most apt to deflect when displaced from its proper relationship to the guide sheaves. It has been found however that in some instances these prior arts sensing devices are inadequate since the lateral loads applied to cables by winds and other forces tending to cause a cable to swing can cause them to miss completely the sensing device upon being displaced from their guiding sheaves and thus fail to give any indication of a displaced rope when such indication is required.

It is therefore a further object of the present invention to provide a tramway rope displacement indicator which is designed to properly function at any time when the tramway rope is displaced from its predetermined relative position to any or all of the rope guiding sheaves.

Another object of the present invention lies in the provision of means for indicating displacement of a tramway rope which means is maintained in an inoperative position by the proper placement of the circulating traction rope and operable to annunciate displacement of the rope by its inherent bias to move to an indicating position when not restrained by said circulating rope.

It is yet another object of the present invention to provide a tramway rope displacement indicator which is not rendered inoperative by the normal accumulation of ice and snow under adverse conditions.

Further objects of the present invention will become apparent from the following description when considered in conjunction with the accompanying drawings wherein:

FIGURE 1 is an elevational view of a guide sheave tower having a depression sheave assembly;

FIGURE 2 is an enlarged fragmentary elevational view taken 180° from FIGURE 1, parts broken away for convenience of illustration; and

FIGURE 3 is a schematic wiring diagram.

In the embodiment of the invention shown, the numeral **10** indicates in its entirety an endless circulating traction rope of an aerial tramway, only a portion of which is shown, and associated with a depression sheave assembly **12** mounted upon an intermediate tower **14**. In this illustration the natural tendency of the traction rope **10** is to raise above the full line position shown. Therefore the depression sheaves **16—16** are disposed in a horizontal plane above the traction rope **10** and are journaled on horizontal axes **18—18** for rotation as the traction rope **10** circulates and causes the sheave **16** to roll upon the tramway rope **10**.

The sheaves **16** conventionally are provided with an annular groove not shown, which groove receives at least half and preferably more of the diameter of the traction rope **10**. Other sheaves **20** journaled at **22** are disposed diametrically of the traction rope **10** from the sheave **16** to confine the rope in its desired path with respect to the guide sheaves **16**.

The journals **18** and **22** of the several sheaves are mounted on sheave frames **24**, shown in a first position, which are disclosed to be rotatably mounted on journals **26** extending axially parallel to the journals **18** and **22** from the ends of an evener frame **28** which is rotatably mounted upon further journal **30** mounted on the tower **14** and disposed axially parallel to the journals **18**, **22** and **26**.

Obviously if desired a single sheave frame **24** may be mounted on the journal **30** thus omitting the evener frame **28** and the second identical sheave frame **24**. But for most installations to provide proper control of the circulating path of the circulating traction rope **10** I employ the device substantially as shown. It will thus be seen that where the moment applied from the traction rope **10** to the depression sheave assembly **12** is upwardly the traction rope **10** is maintained in a desired path against upward displacement by the several sheaves **16**.

Slight variations occasioned by a heavy load being carried by the wire rope **10**, as in the fore-mentioned events of ski-lift chairs or ore hauling buckets, will be compensated by limited pivotal movement of the sheave frames **24** about their journals **26** and similar movements of the evener frames **28** about their journal **30**.

Each of the sheave frames **24** is yieldably biased toward a second position wherein it is rotated about its journal **26** for a fraction of a complete circle. In the embodiment shown this rotation will be approximately 30° in the di-

rection of the arrows indicated by the reference numerals **32—32**. This bias may be in the form of an overbalancing weight differential. For example, two sheave wheels **16** are disposed above a single sheave **20**. Alternately if the weight is normally disposed below the journal **26**, as in a supporting sheave assembly (not shown) an additional overbalancing weight **34** may be supplied to bias the sheave frame **24** for rotation. Complementary thereto or as an alternate means I may provide the bias by means of an induced mechanical bias as indicated by the application of a tension spring **36**. Of course any means for providing the bias by which the sheave frame **24** is caused to rotate from its first position and thus displace a journal **18** of a traction rope guiding sheave **16**, with respect to its support, will be sufficient to provide movement to activate annunciating means **36**, disclosed in FIGURE 3.

In said annunciating means **36** a source of electrical power **38** is connected in an electrical circuit **40** to energize an annunciator **42** here seen to be a visible light but which may take the form of an audible indicator. The circuit also includes any number of circuit control switches **44—44** connected in parallel to each other. In FIGURE 3 I have shown two switches one of which is to be attached to each of the sheave frames **24** as shown in FIGURE 2 of the drawing.

The switches **44** are preferably of the mercury type and each is fixed upon a segment **46** of a disc. A fastening means, for example, stub bolt **48**, is provided to pivotally mount the segment on the sheave frame **24** and an anchoring means such as an additional bolt **50** is provided to adjustably fix the segment to the sheave frame **24** in a selected adjusted position within its arcuate travel limits as indicated by the arrows **52—52**. The bolt **50** passes through the arcuate slot **54** formed in the segment so that by loosening said bolt **50** the angular position of the mercury switch **44** with respect to the horizontal when the traction rope **10** is emplaced with respect to its guide sheave **16** is adjusted and fixed so that the electrical circuit is open. Then when the cable is displaced and moved for example from the full line position of FIGURE 1 to the dotted line position the bias, for example **34** or **36**, causes the journal **18** to move as shown by arrow **32** thus making connection in the control switch **44** and actuating the annunciator **42** for observation by the tramway operator.

While I have shown a pivotal motion, it will be understood that other lost motion connection between the journal **18** and the tower **14** may supplant the lost motion connection embodied in the pivotally mounted sheave frame **24**.

Having thus described my invention I desire to secure by Letters Patent of the United States the following:

1. In an aerial tramway having an endless circulating traction rope guided by rope supporting sheaves supported on towers, means of the nature aforesaid for indicating displacement of said rope from its predetermined relationship with said rope supporting sheaves, comprising, in combination:

a sheave frame journaled on a substantially horizontal axis on said tower, for tilting in a substantially vertical plane;

more than one rope supporting sheave journaled on said sheave frame for rotation in a plane substantially parallel to the plane of said tilting movement with the axis of at least one of said sheaves laterally offset from a line through said sheave journal and the point of contact of said traction rope with the immediately aforesaid sheave so that force of said traction rope maintains said sheave frame in a first normal pivotal position;

means of yieldably biasing said sheave frame to a second pivotal position comprising a mechanical force existing between said sheave frame and said tower member; and

an annunciator adapted to activate upon tilting movement of said sheave frame from said first normal position to signal such event, characterized by an electrically energized signaling device supplied with energy through a series connected level sensitive switch carried by said sheave frame to interrupt current only when said frame is moved to said second position.

2. In an aerial tramway having an endless circulating traction rope guided by rope supporting sheaves supported on towers, means of the nature aforesaid for indicating displacement of said rope from its predetermined relationship with said rope supporting sheaves, comprising, in combination:

a sheave frame journaled on a substantially horizontal axis on said tower, for tilting in a substantially vertical plane;

more than one rope supporting sheave, positioned to support said traction rope from both above and below, journaled on said sheave frame for rotation in a plane substantially parallel to the plane of said tilting movement with the axis of at least one of said sheaves laterally offset from a line through said sheave journal and the point of contact of said traction rope with the immediately aforesaid sheave so that force of said traction rope maintains said sheave frame in a first normal pivotal position;

means of yieldably biasing said sheave frame to a second pivotal position comprising a mechanical force existing between said sheave frame and said tower member; and

an annunciator adapted to activate upon tilting movement of said sheave frame from said first normal position to signal such event, characterized by an electrically energized signaling device supplied with energy through a series connected level sensitive switch carried by said sheave frame and adapted to interrupt current only when said frame is moved to said second position.

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