June 24, 1952 N. S. BATEMAN 2,601,585

CABLEWAY

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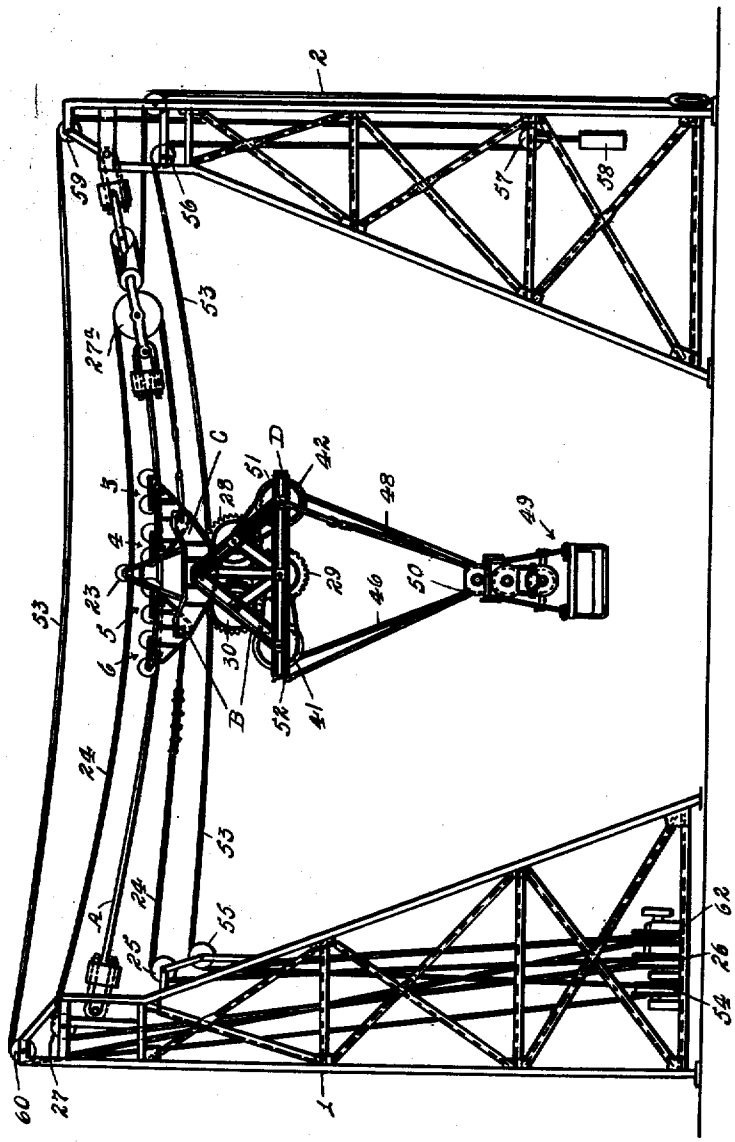


Fig. 1

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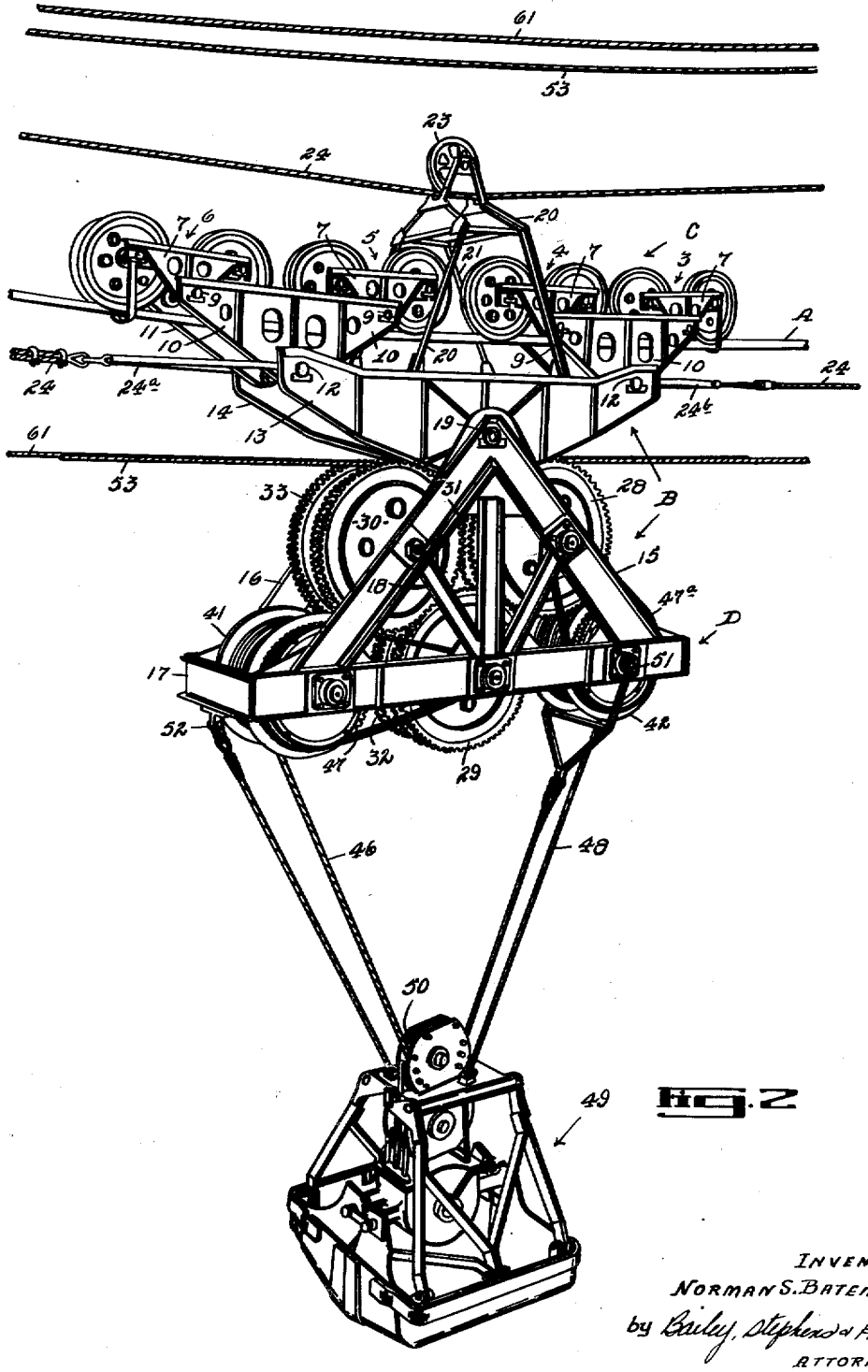


Fig. 2

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CABLEWAY

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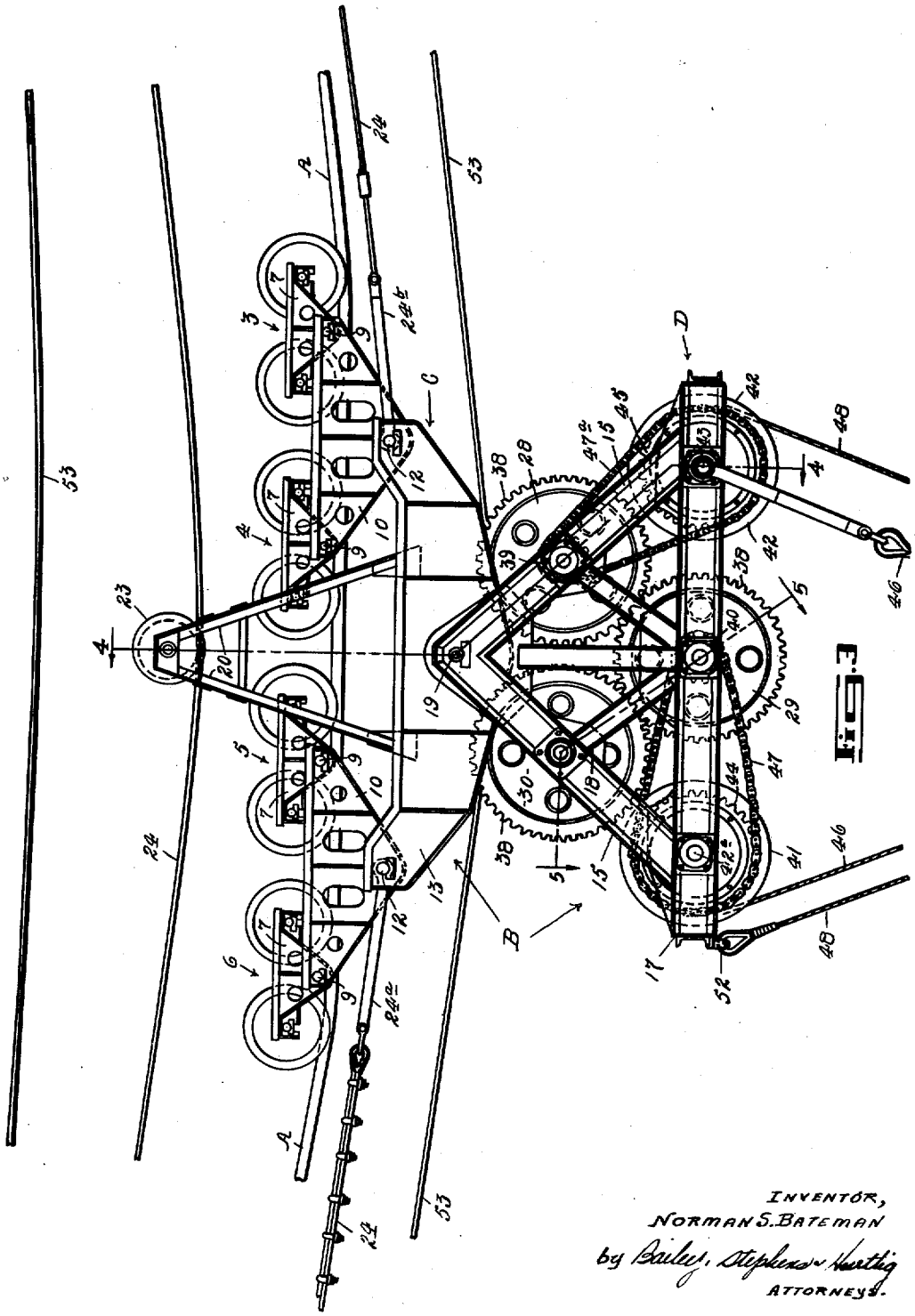


Fig. 3

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CABLEWAY

Filed March 22, 1949 6 Sheets-Sheet 4

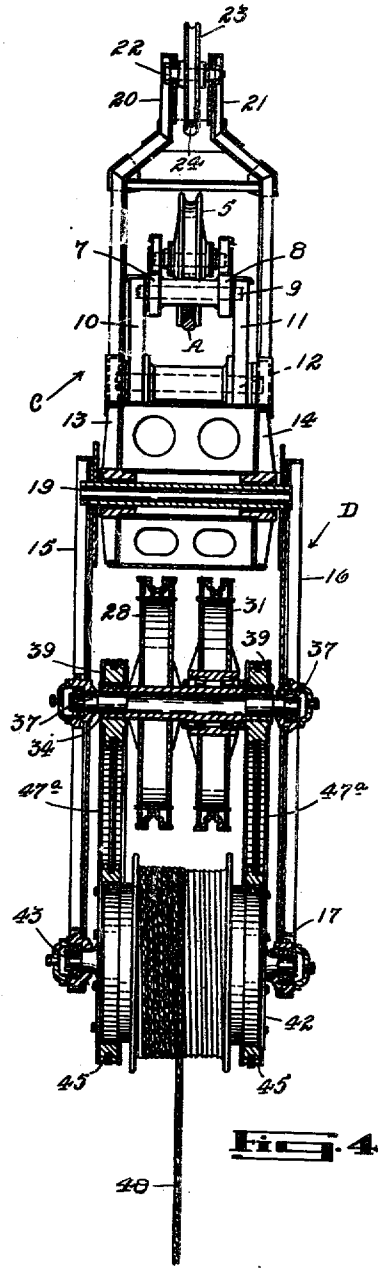


Fig. 4

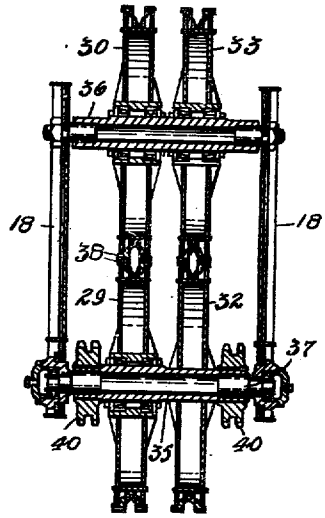


Fig. 5

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CABLEWAY

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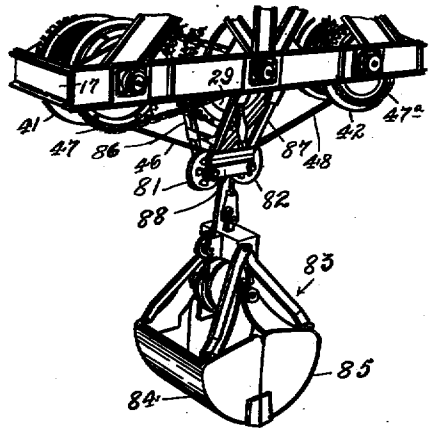


Fig. 9

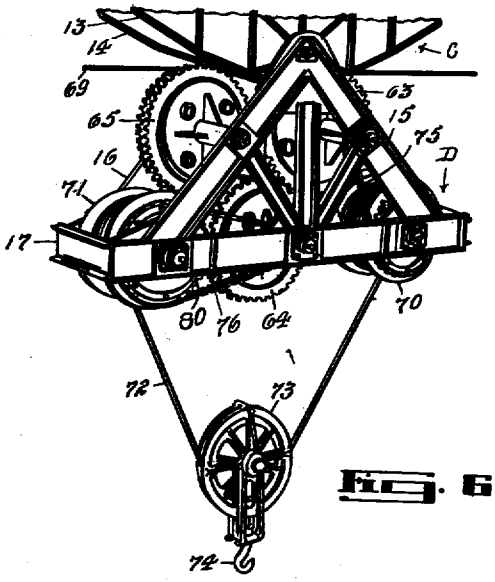


Fig. 6

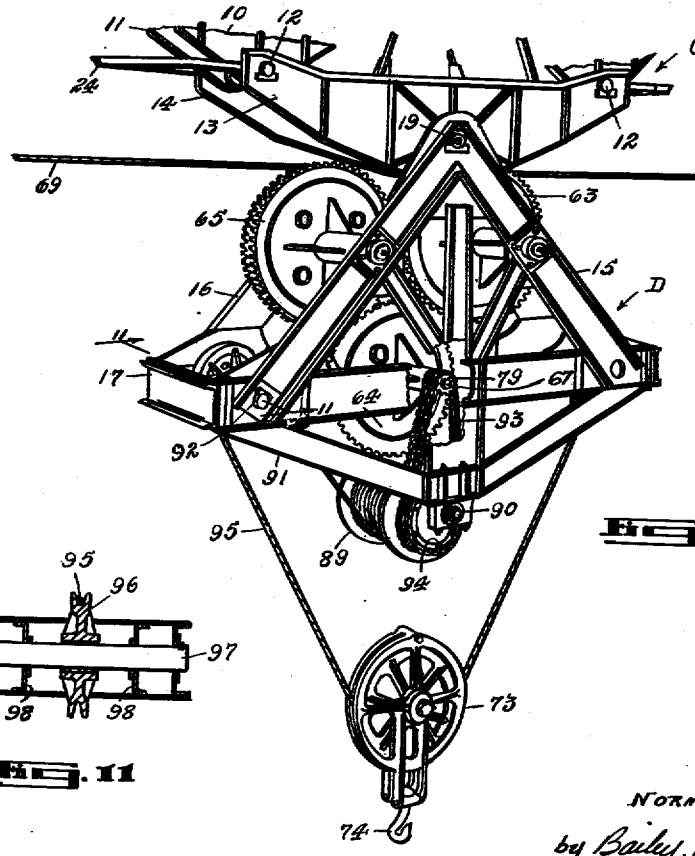


Fig. 10

Fig. 11

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CABLEWAY

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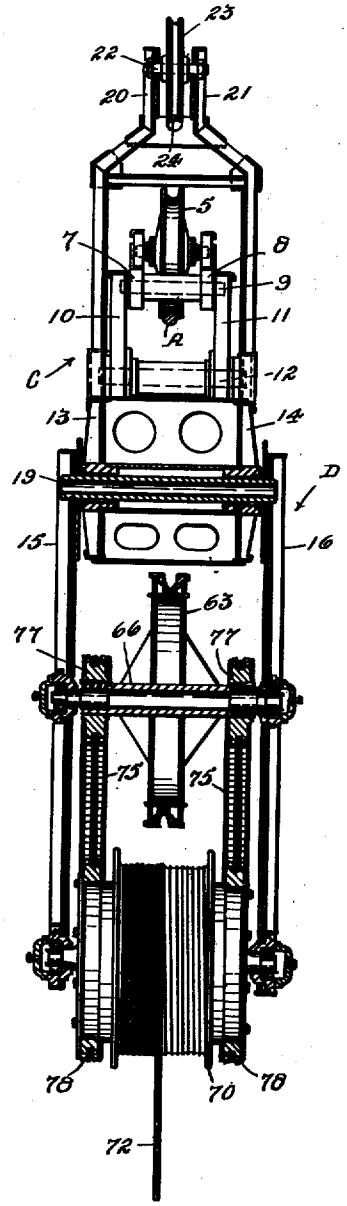


Fig. 7

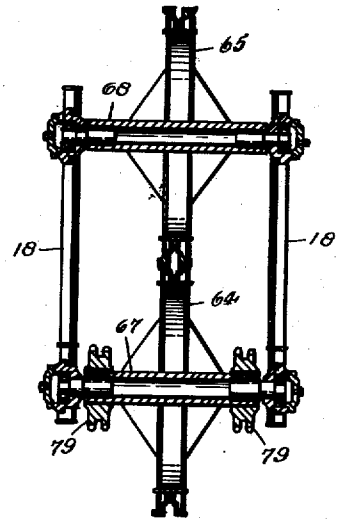


Fig. 8

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Patented June 24, 1952

2,601,585

UNITED STATES PATENT OFFICE

2,601,585

CABLEWAY

Norman S. Bateman, Toronto, Ontario, Canada, assignor to Construction Improvements Limited, Toronto, Ontario, Canada, a company of Canada

Application March 22, 1949, Serial No. 82,800

13 Claims. (Cl. 212—72)

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This is a continuation in part of my application, Serial No. 721,023, filed January 9th, 1947, and since forfeited.

The invention relates to cableways of the general type in which some sort of carriage is arranged to be traversed between head and tail towers, the carriage running on a cable and having a bucket or other load-handling device suspended from it and the traversing of the carriage and the raising and lowering or other manipulation of the suspended, load-handling device being controlled, through cables, from motors located at the head tower.

As is well known, the difficulties arising from the unavoidable sag in the cables led to the use of so-called fall-rope-carriers and button lines which, in turn, led to other difficulties and complications, all of which have been proposed to be met by what for convenience will be termed an "endless line" type of cableway. Since it is that type of cableway with which the present invention is concerned, and also because it is not widely known, it will be briefly described as an aid to more ready understanding of the improvements later to be set forth.

In the "endless line" type of cableway as heretofore proposed, the carriage was intended to be traversed by an endless conveying line attached to opposite ends of the carriage, trained over suitable idler sheaves at the head and tail towers and operated by a motor-driven drum at the head tower. A second endless line (also trained over idler sheaves and operated by a motor-driven drum at the head tower) was frictionally coupled to a sheave mounted on the carriage, this line serving as a power transmission line to rotate the sheave on the carriage. This sheave, in turn, was the driver for a drum, also mounted on the carriage and serving to take up or let out a hoisting line (the actual load-supporting line) in accordance with the rotation of the sheave. An example of this type of cableway appears in Patent No. 1,934,478.

One of the primary objects of the invention is an improved cableway carriage of the endless line type especially adapted for two-line operation; that is to say, incorporating two sheaves and two hoisting drums, each set having its own transmission line. Such an arrangement is suitable for dump bucket operation, one line, sheave and drum controlling the raising and lowering of the bucket, and the other line, sheave and drum controlling the opening and closing of the bucket.

The attempted operation of endless line type cableways, as heretofore proposed, has encountered difficulties which it is a further object of this invention to overcome. For instance, when the carriage is started or stopped, it tends to oscillate relatively to the transmission line; also, even when not so oscillating, the traversing carriage tilts as its wheels follow the varying course of

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the track cable due to sag. Such oscillation and tilting (which latter also accelerates wear of the track cable) tend to effect at least a partial rotation of the carriage sheave and drum. It will be apparent that when it is desired to use two endless transmission lines, two hoisting drums and two hoisting lines, one set for affecting the raising and lowering of a dump bucket and the other set for controlling the opening and closing of the bucket, any such oscillation or tilting may result in premature, partial opening of the bucket.

It has been found that these difficulties can be overcome successfully by the use of a novel form of carriage structure. In general, the carriage of this invention consists of two separate, articulated units, namely, a wheeled truck unit and a hanger unit freely coupled to it by a single point, pivotal suspension. Preferably, and to secure the maximum advantages of the invention, the truck unit incorporates a number of relatively floating wheels running on the track cable, and has the ends of the "endless" conveying line attached to it: and the suspended hanger unit incorporates the sheave and hoisting drum elements which control the load-supporting device which depends from the hanger unit. It has been discovered that by virtue of such an arrangement, wear on the track cable is minimized, the oscillation and tilting above mentioned are confined to the truck unit, and the hanger unit is so stabilized by its depending load as to remain relatively steady at all times. In the result, the carriage can be maneuvered at high speeds with the load under safe control at all times.

Another object of the invention is to so relate the outgoing and return stretches of the endless transmission line that the inevitable sag in the return stretch, preferably supplemented by suitable constant tension counterweights, will at all times tend to minimize the development of such slack in the other stretch of the line as might interfere with full power being transmitted to the transmission sheave. A further effect of this arrangement is that the transmission line return stretch will create an uplift on the carriage proportionate to the tension applied to the line.

A further object of the invention is so to control the return stretch of the conveying line that at all times the tensions set up in the conveying line will have the effect of creating an uplift which will act to reduce the vertical forces acting against the track cable.

Further objects and advantages of the invention will be apparent from the following description and the accompanying drawings, in which:

Figure 1 is a schematic side elevation of a cableway including a two-transmission line carriage representing a preferred embodiment of the invention adapted to operate a dump bucket;

Figure 2 is an enlarged perspective view of the carriage and bucket;

Figure 3 is a side elevation of the carriage;

Figure 4 is a vertical sectional view taken on the line 4—4 of Figure 3;

Figure 5 is a vertical sectional view taken on the line 5—5 of Figure 3;

Figure 6 is a broken-out perspective view of a single transmission line carriage, showing the hanger unit and a portion of the truck assembly;

Figure 7 is a vertical sectional view through the structure shown in Figure 6, the section being taken on the same line as is the section 4—4 of Figure 3;

Figure 8 is a vertical sectional view through Figure 6, taken on the same line as the section 5—5 of Figure 3;

Figure 9 is a partial view in perspective showing an arrangement of load control lines adapted to provide vertical two-line suspension;

Figure 10 is a broken-out perspective view of a modified structure in which a single load drum is supported centrally of the hanger unit; and

Figure 11 is an enlarged cross sectional view taken on the line 11—11 of Figure 10.

Like numerals of reference indicate corresponding parts in the various figures.

Referring to the drawings and first particularly to Figures 1 to 5 inclusive, in which a complete embodiment of the invention is shown, there is provided a track cable A suitably suspended between head and tail towers 1 and 2, respectively, with any desired means being employed for keeping said track cable taut.

B indicates the carriage, as a whole, which is adapted for movement lengthwise of the track cable and which, as above stated, consists of a truck unit C and a hanger unit D.

In the illustrated embodiment of the invention the truck unit incorporates a plurality of (meaning more than two), and preferably at least four, two-wheeled components, each of which is capable of rocking with respect to each of the others about a horizontal axis extending transversely of the track cable. Not only does such an arrangement spread the total load of the carriage over a greater length of cable, but it also tends to minimize the oscillation of the truck unit as a whole, in that the wheeled components are relatively floating and impart a desirable degree of flexibility to the truck unit, all to the end of securing maximum stability for the hanger unit of the carriage.

More specifically, the truck unit C in this embodiment of the invention consists of four two-wheeled trucks 3, 4, 5 and 6 respectively, each having opposed inverted-triangular-shaped side plates 7 and 8 pivoted near opposite top ends to the wheel axles and provided near their apices with aligned openings for the reception of a bearing pin 9 about the axis of which each truck is free to rock.

Adjacent pairs of bearing pins 9 are located at the remote corners of inverted-triangular-shaped beam members (herein for convenience designated "secondary" beams) each of which consists of pairs of side plates 10, 11. Like the side plates 7, 8, these secondary beams are provided near their apices with aligned openings to receive a bearing pin 12 about the axis of which each secondary beam is free to rock. Bearing pins 12, in turn, are located at the remote ends of a primary beam which consists of side plates 13, 14. It will be recognized that such an arrangement of floating wheeled units accommodates itself readily to the track cable.

The hanger unit of the carriage, herein of generally triangular form, comprises two identical side members 15 and 16 arranged in spaced parallel relation to one another and rising from the opposed sides of a rectangular frame 17 of rigid construction to which they are secured. Suitable reinforcing means, such as cross braces 18, may be employed between frame members to further increase rigidity of the hanger unit frame.

In accordance with the invention, the hanger unit is freely suspended from the truck unit, being coupled to it at the apex of the hanger unit solely by a single point, pivotal connection such as the pivot pin 19 which extends through the hanger unit side members and, midway of their length, through the primary beam side plates 13, 14.

With a two-unit carriage structure so articulated, the hanger unit is found to possess remarkable stability or steadiness, even in the course of high speed operation of the cableway and, with its suspended load, to partake of none of the objectionable rocking and tilting which is characteristic of single unit, rigid carriages.

A frame comprising side members 20 and 21 supported by the respective side members 13 and 14 which constitute the primary beam, rises from said beam in converging relation to a point centrally of the carriage and above the truck assembly where it is provided with suitable bearings for a cross pin 22 carrying an idle sheave 23.

The carriage is adapted to be moved forwardly and backwardly along the track cable A by means of the conveying line 24 which has connections at its one end through a connector 24a with the truck unit C, from which it is trained over an idle sheave 25 on the head tower and extends downwardly around the reversible drum 26 of the hoist engine, thence upwardly and around an idler sheave 27 on the head tower from which it runs above the track cable A towards the tail tower 2, thence downwardly around a pulley 27a suitably supported from said tail tower and returns to the carriage and is attached to the connector 24b extending toward the corresponding end of the truck unit, so as to provide a substantially endless line motivated by the hoist engine through the drum 26. Any suitable means may be employed for tensioning the conveying line between the carriage and the tail tower.

The conveying line in its stretch between the sheave 27 and the head tower sheave 27a is unsupported and is passed beneath the idler sheave 23, which latter is positioned on a lower plane than the sheaves 27 and 27a, whereby the tensions set up in the conveying line will create an uplift against the sheave 23 carried by the carriage which will have the effect of reducing the vertical forces acting against the track cable.

Journaled in the hanger unit are two parallel trains of wire rope transmission sheaves, the one train comprising three edgewise aligned sheaves 28, 29 and 30, and the other train comprising the three edgewise aligned sheaves 31, 32 and 33.

The individual sheaves of each train are so arranged in relation to those of the other train as to provide three pairs of horizontally aligned sheaves, each pair comprising one sheave of each train of sheaves, and these three pairs of sheaves are mounted on tubular shafts 34, 35 and 36, respectively, extending transversely of the carriage and supported at their ends by suitable pins 37 fixed to and extending inwardly from the respective sides of the carriage frame.

Each sheave is provided with peripheral teeth 38 constituting gears and the sheaves of each train of sheaves are preferably arranged in such relation to each other that together they form a substantial triangle in side elevation, with the uppermost sheaves of each train (28 and 30 of one train and 31 and 33 of the other train) spaced from one another and with the gears of such upper, or endmost, sheaves of each train meshing with the gears of the lowermost, or central, sheave of the same train. In other words the sheaves of each train are geared successively from one end sheave to the other through the lower, or central, sheave but the two endmost sheaves are not geared to one another.

The sheaves mounted on the shafts 34 and 35 are so related to said shafts that one sheave of said pair on a shaft is fixed to the shaft to turn therewith while the other sheave on the same shaft is freely rotatable thereon and the sequence is reversed on successive shafts from the endmost so that where the sheave 31 of one train of sheaves is free to rotate on the shaft 34 the sheave 28 of the opposed train rotates with the shaft, while the sheave 29 of the same train as the sheave 28 is free on the shaft 35 and the opposed sheave 32 trained with the free running sheave 31 on the shaft 34 is fixed to its shaft 35.

The sheaves 30 and 33 are freely rotatable on their shaft 36.

As the sheaves of each train of sheaves are of equal diameter their speed of rotation will be equal and each will assist in transmitting the power of the transmission lines.

The shafts 34 and 35 are provided with fixed sprockets 39 and 40 respectively located within the frame member of the hanger unit at opposite sides of the unit.

41 and 42 are drums rotatably mounted within the frame 17 of the hanger unit rearwardly and forwardly respectively of the paired sheaves 29 and 32, on shafts 42a and 43, respectively, which shafts carry fixed sprockets 44 and 45, respectively.

The drum 41 to which is connected a line 46, is operatively connected to the shaft 35 at opposite ends of the latter through the medium of the sprocket chains 47 connecting the sprockets 44 of the shaft 42a with the sprockets 40 of the shaft 35, so that on rotation of said shaft 35 due to the rotation of the sheave 32 the said drum 41 will be rotated in a like direction to wind the line 46 around the said drum, or to pay it out from the drum, according to the direction of rotation of the sheave 29.

The drum 42 to which is connected the line 48 is operatively connected to the shaft 34 at opposite ends of the latter through the medium of the sprocket chains 47a connecting the sprockets 45 of the shaft 43 with the sprockets 39 of the shaft 34, so that on the rotation of the said shaft 34 due to the rotation of the sheave 28 the said drum 42 will be rotated in a like direction to either wind the line 48 around its drum or, to pay it out, according to the direction of rotation of the sheave 28.

In the embodiment of the invention now being described the line 46 is shown as that employed to raise or lower a bucket 49 and for this purpose the pulley 50 of said bucket rides on the said line and the end of said line which extends from the drum 41 has connection with the frame 17 at the end of the latter which is farthest removed from said drum, as shown at 51, so that said bracket will ride in the bight of the line 46 whereby the vertical pull of any load will at all times act on a plane through the vertical axis of the hanger unit.

The line 48 is represented as that employed to control the opening and closing of the jaws of the bucket 49, through its cooperation with suitable mechanism carried by the said bucket and acting directly on said jaws, and to this end said line extends through said bucket in proper operative engagement with said jaw control mechanism and has its free end extended upwardly and attached to the end of the frame 17 opposite to that at which the drum 42 is located, as shown at 52.

As the particular construction of the bucket does not form a feature of the present invention such construction is not shown or described in detail herein, it being thought sufficient to simply show the lines 46 and 48 directed therethrough.

53 is an endless transmission line, or rope, through the medium of which the sheave 28 is rotated to cause rotation of the drum 42.

The transmission line 53 winds around the hoist drum 54 to provide the required friction to properly move the line and then extends upwardly and around the sheave 55, carried by the head tower, from whence it extends over the transmission sheave 30, under and around the sheave 29 and thence over the sheave 28, from whence it extends to and over a sheave 56 carried by the tail tower and thence downwardly and around a tension sheave 57 carrying a suitable counterweight 58, thence upwardly and over an idler sheave 59 on the head tower. From here it doubles back and returns, above the track cable, to the head tower and over the sheave 60 of said head tower and thence downwardly to the hoist drum 54.

It will thus be seen that on the movement of the line 53 towards the head tower the sheave 28 will be rotated counter-clockwise and as this sheave is keyed to the shaft 34 the said shaft will be rotated and through its sprocket and chain connection with the shaft 43 which carries the drum 42 the said drum will be rotated in a direction to wind the line 48 therearound to open the bucket. Owing to the fact that the other sheaves 29 and 30 of the same train of sheaves in which the sheave 28 is connected, are free on their shafts 35 and 36 said shafts will not be affected and consequently the rotation of the sheaves of this train will not affect the drum 41. Movement of the transmission line in the opposite direction will of course result in rotation of the drum 42 in the direction to cause the line 48 to be unwound from the drum 42 to close the bucket.

61 (Figure 2) is an endless transmission line by means of which the drum 41 controlling the movement of the line 46 is moved in either direction.

The transmission line 61 has frictional engagement with the engine hoist drum 62 from whence it extends upwardly around a suitable guide sheave carried by the head tower and thence to the carriage where it extends over the transmission sheave 33, under the transmission sheave 32 and upwardly over the transmission sheave 31, from which it passes to an idler sheave carried by the tail tower and thence downwardly beneath a tension sheave provided with a suitable counterweight, and then upwardly and over a guide sheave carried by the tail tower from which in its return stretch it returns above the track cable to the head tower and around a guide

sheave carried thereby, from whence it returns to the hoist drum 62. Owing to the fact that the transmission line 61 and its various guide sheaves and constant tension counterweight lie on the same horizontal plane as the line 53 and its guide sheaves and counterweight, those of the said line 61 do not appear in the drawings but it is not thought necessary to show same as the arrangement will be readily understood from the description herein.

When the transmission line 61 is drawn, through the operation of the engine drum 62, towards the head tower the sheaves 31 and 33 which are free on their shafts 34 and 36 will be rotated but will not cause rotation of the shaft 34 to affect the drum 42, but the shaft 35 to which the sheave 32 is keyed will be rotated and the rotation of this shaft 35 will, due to the chain and sprocket connection between it and the shaft 42a, cause the drum 41 to be rotated in a direction to cause the line 46 to be wound around the drum 41 to raise the bucket. Movement of line 61 in the opposite direction will of course result in rotation in the opposite direction to lower the bucket.

Movement of the transmission line 53 in a direction away from the head tower, either while the line 61 is inactive, or at a lesser speed than said line, will of course cause a lowering of the line 48 and therefore permit of the jaws of the bucket opening to release the load.

The return stretches of the endless transmission lines 53 and 61 running between tail and head towers are unsupported and the weight of these parts of the lines combined with the pull of the constant tension counterweights will at all times automatically provide in the other stretches of the respective lines constant tension sufficient to insure the full power on said other stretches, or tension sides, of the lines being communicated to the transmission sheaves, whether the carriage should be stationary or moving at any speed in either direction. Furthermore the weight of the unsupported portions of the return stretches of the lines will create an uplift on the carriage proportionate to the tension applied to the lines.

It will have been noted that there are two separate transmission lines, or ropes, each controlling the rotation of a travelling drum and each having its power communicated to its drum by a train of transmission sheaves, and further that as each transmission line and the conveying line is operatively connected to its own individual drum of the hoisting engine it is apparent that the different transmission lines and the conveying line may be operated at like, or different speeds, at will, by the simple provision of means for rotating the drums of the hoisting engine at different speeds and while the present disclosed invention does not deal with the particular method of imparting rotation to the different engine drums at varying speeds it does assume to provide a carriage including independently operated drums which may be rotated in either direction at variable speeds while the carriage would be stationary, or would be traversed in either direction, and which will operate smoothly and efficiently under the proportionately varying speeds at which the different parts may be driven.

The operation of the embodiment of the invention described thus far, assuming that the various cables have been reeved through the carriage, the head and tail towers and the engine drums as hereinbefore described, is as follows:

Assuming that the bucket 49 is in its lowered position, stationary, and with its jaws open and ready to be closed about the load, the transmission line 53 is moved, by means of rotation of the engine drum, in the direction towards the head tower to cause the load grip control line 48 through the associated geared sheaves 28, 29 and 30 and their chain and sprocket connections with the drum 42, to be wound around said drum 42, thus drawing on the said line 48 and causing the jaws of the bucket to close. It is now required that the load be raised and this is accomplished by causing the transmission line 61 to be moved in the direction towards the head tower to cause the rope 46 through the association of the gears 30, 32 and 33 and the chain and sprocket connection with the drum 41, to be wound around said drum 41 until the load has been raised the required height, upon which the movement of the said transmission line is halted. The carriage may be caused to commence its traversing course along the trackway A at any time after the jaws of the bucket have been closed about the load, and this is brought about by simply causing the traversing line 24 to be operated in the desired direction. Thus the proportionate hoisting and traversing speeds may be regulated at will simply by controlling the speeds of the engine drums, thus permitting of the attainment of the highest practical lifting speed of the load in hand and the highest practical traversing speed irrespective of the weight of the load. Of course if the traversing line be rotated in the same direction as the transmission lines and simultaneously with them, the carriage will travel in the direction of the pull and the drums 41 and 42 will then have no motion provided that all lines have identical speeds. If the speed of one or both transmission lines were increased or decreased from that of the traversing line the carriage drum, or drums, would rotate in either a positive or negative direction, at a speed proportionate to the increase or decrease with respect to the traversing line.

As the carriage nears the load dropping point the load can be lowered by simply causing the movement of the transmission line 61 in the direction to cause the drum 41 to pay out the hoisting line 46 and, when desired, either during the lowering of the load or subsequently the jaws of the bucket may be opened to release the load by causing movement of the transmission line 53 in the direction to cause the drum 42 to pay out the line 48 to permit of the opening of the jaws of the bucket through the operation of the means provided therefor which is controlled by said line 48.

It is apparent that under the influence of the load the inclination of the track cable will vary continually as the carriage moves lengthwise of said cable. However, this deviation of the track cable from the horizontal and the continually varying degree of such deviation will not cause any deviation of the hanger unit from the vertical nor will it in any way cause movement of the transmission lines or the sheaves controlled thereby, owing to the fact that the hanger unit has only a single point, pivotal connection with the primary beam and the said primary beam in turn has floating connection with the trucks through a series of single point pivotal connections.

In Figures 6 to 8 inclusive the invention is

shown as applied to a cableway having but one line to the load-handling device for the purpose of raising or lowering same.

In this case a single train of transmission sheaves is employed comprising the sheaves **63**, **64** and **65** mounted on rotatable shafts **66**, **67** and **68** respectively and the sheaves are geared together successively in the train, according to the arrangement and gearing of the sheaves **28**, **29** and **30**. An endless transmission line **69** frictionally coupled to the sheaves of the train and to a drum of the stationary hoist provides means for operating the sheaves in either direction.

Drums **70** and **71** are mounted forwardly and rearwardly respectively of the sheave **64** and each has an end of a hoisting line **72** secured thereto whereby rotation of said drums in opposite directions will cause the ends of said line to be wound around, or payed out from, said drums, according to the direction in which said drums are rotated.

A suitable fall block **73** depends from the bight of the hoisting line **72** and carries a hook **74**, or other suitable means for engaging the load to be raised or lowered.

Coincident rotation of the drums **70** and **71** in opposite directions is affected by means of sprocket chains **75** and **76** respectively, the chain **75** connecting the sprocket **77** fixed to the shaft **66** to which the sheave **63** is secured with the sprockets **78** fixed to the drum **70** and the chain **76** connecting the sprockets **79** fixed to the shaft **67** to which the sheave **64** is secured with the sprockets **80** fixed to the drum **76**.

It will thus be seen that when it is desired to raise a load to which the fall block **73** is connected it is simply necessary to cause the lower stretch of the endless transmission line **69** to be moved, through the medium of the engine hoist drum with which it is coupled, in a direction towards the head tower, thus rotating the sheaves **63** and **64** which through their connections with the drums **70** and **71** respectively will cause said drums to rotate in opposite directions and wind the ends of the hoisting line **72** therearound. Movement of the transmission line in the opposite direction will cause coincident rotation of the drums **70** and **71** in opposite directions to cause the hoisting line to be payed out and thus lower the fall block **73** and its load.

It will be noted that in all cases the size of the sprockets may vary in accordance with the ratio that may be required under varying conditions for reduction of revolutions per minute between the transmission sheaves and the drums, and that any other suitable arrangement to alter this ratio may be employed, whereby a practical hoisting speed in relation to the traversing speed may be attained in a simple manner.

In Figure 9 a modified arrangement of the load control lines of a two-transmission line carriage is shown whereby to provide vertical two-line suspension.

In this embodiment the arrangement and operation of the various load control drums, sheaves, and transmission lines is as shown in Figures 1 to 5 so that the lines **46** and **48** may be wound around, or payed out from, their respective drums **41** and **42** coincidently, or independently of one another at like or different speeds.

In this modified embodiment a pair of idle pulleys **81** and **82** are supported for rotation in edgewise spaced relation to one another lengthwise of the carriage directly beneath the sheaves **29** and **32** midway of the length of the hanger unit and with their axes of rotation parallel to that of the drums **41** and **42**.

The lines **46** and **48** are extended inwardly and over the respective pulleys **81** and **82** from which they extend downwardly in slightly spaced relation to one another to the load-handling device **83**, which in this instance is shown as being a dump bucket having the usual jaws **84** and **85** adapted to be opened and closed as required.

The line **46** in this embodiment is intended to control the opening and closing of the jaws of the bucket and for this purpose has connection with suitable jaw operating mechanism carried by the bucket. This jaw operating mechanism is not shown in detail as same does not constitute a feature of the present invention.

The line **48** is shown as being attached to the top of the bucket whereby to serve as the hoisting line.

It is obvious that there are many ways by which the pulleys **81** and **82** may be supported but for purposes of illustration one means is shown comprising frame members **86** and **87** extending downwardly from opposite sides of the frame **17** converging to slightly spaced relation to one another centrally of the hanger unit to provide spaced members **88** in which the axles of said pulleys are journaled.

In Figures 10 and 11 a modified embodiment of a single transmission line carriage is illustrated in which a single load drum with fleeting means is shown as a substitute for the load drums **70** and **71**, with appropriate means whereby the substitution may readily be made.

In this modification the construction and arrangement of the sheaves is identical to that shown in Figure 6 but the load drums **70** and **71** are omitted and the single load drum **89** is located in the longitudinal centre of the carriage frame beneath the centre sheave **64**. This drum **89** has its shaft journaled at opposite ends, as shown at **90**, in a sub-frame **91** which is preferably attached for quick removal at its ends to the main frame part **17** of the hanger unit by means of the bolts **92** so that it can conveniently be removed and the load drums **70** and **71** mounted in the frame in place thereof.

The load drum **89** is driven by a chain **93**, or chains, connecting the sprocket **79** on the shaft **67** of the sheave **64** and the sprocket **94** carried by said load drum. In this manner rotation of the load drum in either direction can be effected by movement of the transmission line **69** in the required direction. The hoisting line **95** which has its one end attached to the drum **89** and its other end attached to one end member of the frame part **17** is trained from said drum towards that end of the carriage which is opposed to that to which the line is connected and extends over a fleeting sheave **96** between which latter and the frame end to which the line is attached said line drops to provide a bight in which the fall block **73** is adapted to ride.

The fleeting sheave **96** slides on a shaft **97** which extends transversely of the frame **17** and carries stop members **98** adapted to limit the movement of the sheave transversely of the carriage to that necessary to the reversal of the line in the winding operation.

It will be understood that in each of the modified forms illustrated in Figures 6 to 11, the truck units and the suspension of the hanger units may be, and preferably are, as described in connection with the form of the invention shown in Figures 1 to 5, with all the advantages as above pointed out.

While I have shown and described herein the present preferred forms of construction for carrying out my invention, these are capable of variation and modification without departing from the spirit of the invention. I, therefore, do not wish to be limited to the precise details of construction set out herein, but desire to avail myself of such variations and modifications as come within the scope of the appended claims.

What I claim is:

1. In a cableway of the kind including a track cable, a carriage incorporating a load drum and a sheave for operating the drum, and endless conveying and transmission lines for traversing the carriage and operating the sheave, respectively: the carriage comprising a primary beam member, secondary beam members spaced apart above and each having a single point, pivotal connection with the primary beam member, at least four two-wheeled trucks for riding the track cable, each truck having a single point, pivotal connection with one of the secondary beam members, an idler sheave for riding the return stretch of the conveying line, a support for such idler sheave mounted on the primary beam member, connections at opposite ends of the primary beam member for the ends of a conveying line, and a hanger structure suspended from and having a single point, pivotal connection with the primary beam member, the axis of said connection being normal to a vertical plane passing through the track cable and a load drum and sheave mounted on said suspended hanger structure.

2. In a cableway of the kind including a track cable, a carriage incorporating a load drum and a sheave for operating the drum, and endless conveying and transmission lines for traversing the carriage and operating the sheave, respectively: the carriage comprising a primary beam member, secondary beam members spaced apart above and each having a single point, pivotal connection with the primary beam member, at least four two-wheeled trucks for riding the track cable, each truck having a single point, pivotal connection with one of the secondary beam members, and a hanger structure suspended from and having a single point, pivotal connection with the primary beam member, the axis of said connection being normal to a vertical plane passing through the track cable and a load drum and sheave mounted on said suspended hanger structure.

3. In a cableway of the kind including a track cable, a carriage incorporating a load drum and a sheave for operating the drum, and endless conveying and transmission lines for traversing the carriage and operating the sheave, respectively: the carriage comprising a wheeled truck unit adapted to ride the track cable, an idler sheave for riding the return stretch of the conveying line, a support for such idler sheave mounted on the truck unit and extending above the wheels thereof, a hanger unit suspended from the truck unit by a single point, pivotal connection, and a load drum and sheave mounted on the said hanger unit.

4. In a cableway of the kind including a track cable, a carriage incorporating a load drum and a sheave for operating the drum, and endless conveying and transmission lines for traversing the carriage and operating the sheave, respectively: the carriage comprising a plurality of two-wheeled trucks and a frame structure uniting and suspended from the trucks, each truck having a pivotal connection with the frame structure permitting the trucks to rock individually in the plane of the track cable, connections at opposite ends of the frame structure for the ends of a conveying line, a hanger unit depending from and having a single point, pivotal connection with the truck frame structure, the axis of said connection being normal to a vertical plane passing through the track cable, a pair of load drums mounted on the hanger unit, sheave trains for operating said drums, and endless transmission lines individual to said sheave trains.

5. In a cableway of the kind including a track cable, a carriage incorporating a load drum and a sheave for operating the drum, and endless conveying and transmission lines for traversing the carriage and operating the sheave, respectively: the carriage comprising a plurality of two-wheeled trucks and a frame structure uniting and suspended from the trucks, each truck having pivotal connection with the frame structure permitting the trucks to rock individually in the plane of the track cable, a hanger unit depending from and having a single point, pivotal connection with the truck frame structure, the axis of said connection being normal to a vertical plane passing through the track cable, and a load drum and sheave mounted on the hanger unit.

6. In a cableway of the kind including a track cable, a carriage incorporating a load drum and a sheave for operating the drum, and endless conveying and transmission lines for traversing the carriage and operating the sheave, respectively: the carriage comprising a wheeled truck unit adapted to ride the track cable, a hanger unit suspended from the said truck unit by a single point, pivotal connection, the conveying line being secured to opposite ends of the truck unit and a load drum and sheave mounted on the hanger unit.

7. In a cableway of the kind including a track cable, a carriage incorporating a load drum and a sheave for operating the drum, and endless conveying and transmission lines for traversing the carriage and operating the sheave, respectively: the carriage comprising a plurality of two-wheeled trucks and a frame structure uniting and suspended from the trucks, each truck having a pivotal connection with the frame structure permitting the trucks to rock individually in the plane of the track cable, a hanger unit depending from and having a single point, pivotal connection with the truck frame structure, the axis of said connection being normal to a vertical plane passing through the track cable, a pair of drums mounted in said hanger unit, endless power transmission lines individual to said drums, and means including sheave trains for transmitting the power from said transmission lines to said drums whereby said drums may be rotated in either direction at variable speeds either while the carriage is stationary or is traversing in either direction.

8. In a cableway of the kind including a track cable, a carriage incorporating a load drum and a sheave for operating the drum, and endless conveying and transmission lines for traversing

the carriage and operating the sheave, respectively: the carriage comprising a plurality of two-wheeled trucks and a frame structure uniting and suspended from the trucks, each truck having a pivotal connection with the frame structure permitting the trucks to rock individually in the plane of the track cable, a hanger unit depending from and having a single point, pivotal connection with the truck frame structure, the axis of said connection being normal to a vertical plane passing through the track cable, a pair of drums mounted in said hanger unit, endless power transmission lines individual to said drums, load control lines individual to said drums, idle pulleys positioned beneath and in substantially the longitudinal centre of said hanger unit receiving said load control lines and directing same downwards in spaced relation to one another, and means including sheave trains for transmitting the power from said transmission lines to said drums.

9. In a cableway of the kind including a track cable, a carriage incorporating a load drum and a sheave for operating the drum, and endless conveying and transmission lines for traversing the carriage and operating the sheave, respectively: the carriage comprising a plurality of two-wheeled trucks and a frame structure suspended from the trucks, each truck having a pivotal connection with the frame structure permitting the trucks to rock individually in the plane of the track cable, a hanger unit depending from and having a single point, pivotal connection with the truck frame structure, the axis of said connection being normal to a vertical plane passing through the track cable, a hoisting drum and a load grip control drum mounted in said hanger unit, ropes individual to said drums, a pair of sheave trains in said hanger unit, an endless transmission line for each said sheave trains, and driving connections between said sheave trains and said drums respectively.

10. In a cableway of the kind including a track cable, a carriage incorporating a load drum and a sheave for operating the drum, and endless conveying and transmission lines for traversing the carriage and operating the sheave, respectively: the carriage comprising a wheeled truck unit adapted to ride the track cable, a hanger unit suspended from the said truck unit by a single point, pivotal connection, the conveying line secured to opposite ends of the truck unit, a pair of drums mounted in said hanger unit, ropes individual to said drums, a pair of sheave trains arranged in parallel in said hanger unit on shafts individual to the respective pairs of horizontally aligned sheaves, one pair of sheaves being free on its shaft and the remaining pairs of sheaves being so arranged that the one side sheave only of one pair of sheaves is fixed to its shaft and the other side sheave only of the next pair of sheaves is fixed to its shaft, means operatively connecting the fixed sheaves with said drums respectively, and an endless transmission line for each sheave train.

11. In a cableway of the kind including a track cable, a carriage incorporating a load drum and a sheave for operating the drum, and endless conveying and transmission lines for traversing the carriage and operating the sheave, respectively: the carriage comprising a wheeled truck unit adapted to ride the track cable, a hanger unit suspended from the said truck unit by single point, pivotal connection, the conveying line being secured to opposite ends of the truck unit, a pair of drums mounted in said

hanger unit, ropes individual to said drums, a pair of sheave trains arranged in parallel in said hanger unit on shafts individual to the respective pairs of horizontally aligned sheaves, one pair of sheaves being free on its shaft and the remaining pairs of sheaves being so arranged that the one side sheave only of one pair of sheaves is fixed to its shaft and the other side sheave only of the next pair of sheaves is fixed to its shaft, means operatively connecting the fixed sheaves of the sheave trains with the respective drums, and an endless transmission line for each sheave train operable through variable speed driving means in either direction to cause rotation of said drums at like or different speeds.

12. In a cableway of the kind including a track cable, a carriage incorporating a load drum and a sheave for operating the drum, and endless conveying and transmission lines for traversing the carriage and operating the sheave, respectively: the carriage comprising a wheeled truck unit adapted to ride the track cable, a hanger unit suspended from the said truck unit by a single point, pivotal connection, the conveying line being secured to opposite ends of the truck unit, a pair of drums mounted in said hanger unit, fall ropes extending from the respective drums and having their free ends suspended from the hanger unit, a pair of sheave trains arranged in parallel in said carriage, shafts individual to the respective pairs of horizontally aligned sheaves, one pair of sheaves being freely rotatable on their shaft and the remaining pairs of sheaves each having one of its sheaves fixed to its shaft and its other sheave free on its shaft, the fixed sheave of one pair of sheaves being in one train and the fixed sheave of the other pair of sheaves being in the other train, means operatively connecting said fixed sheaves with the respective drums, and a transmission line for each of said sheave trains whereby to effect rotation of said drums independently of one another.

13. In a cableway including head and tail towers, a track cable suspended between said head and tail towers, a carriage comprising a wheeled truck unit adapted to ride the track cable, a conveying line for traversing said carriage along said track cable, an idler sheave for riding the return stretch of the conveying line, a support for said idler sheave mounted on the truck unit and extending above the wheels thereof, a hanger unit suspended from the truck unit by a single point, pivotal connection, a pair of drums mounted on said hanger unit, sheaves mounted on said hanger unit, and endless transmission lines engaging said sheaves for operating said drums, the return stretches of said transmission lines running over idle sheaves supported by said head and tail towers, respectively, above the return stretch of said conveying line and being unsupported between the last mentioned idle sheaves.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
516,864	Hulett	Mar. 20, 1894
566,849	Dusedau	Sept. 1, 1896
956,150	Norris	Apr. 26, 1910
1,789,472	Meany et al.	Jan. 20, 1931
1,934,478	Bateman	Nov. 7, 1933