A. E. NORRIS.

CABLEWAY APPARATUS.

APPLICATION FILED DEC. 3, 1904.

956,150.

Patented Apr. 26, 1910.

4 SHEETS—SHEET 1.

Fig. 1

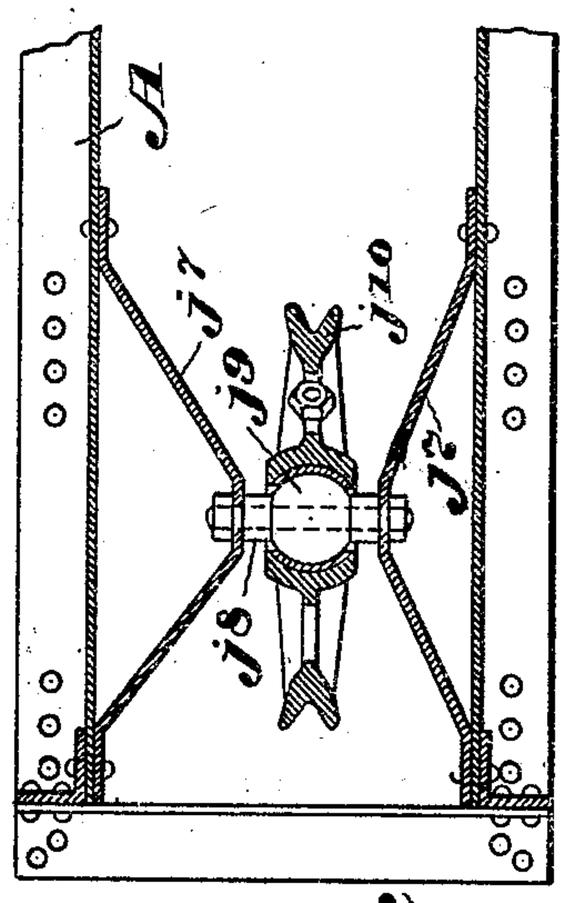


Fig. 12

Fig. 2

Witnesses:
Horace A. Crossman.
Everett L. Emery.

Inventor:
Almon E. Norris:
by Emery, Booth & Powell
Attys.

A. E. NORRIS.

CABLEWAY APPARATUS.

APPLICATION FILED DEC. 3, 1904.

956,150.

Patented Apr. 26, 1910.

4 SHEETS—SHEET 2.

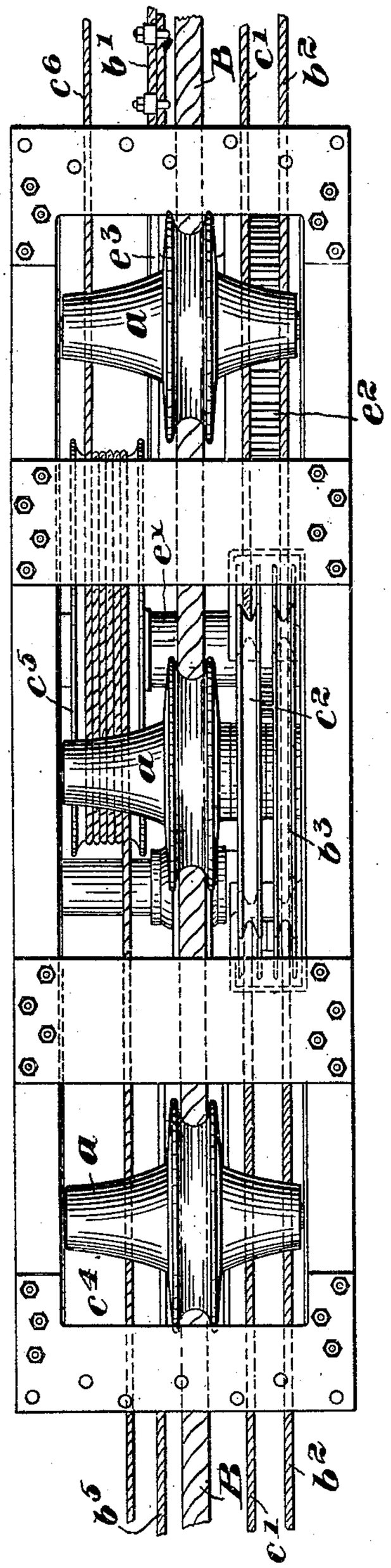


Fig. 3

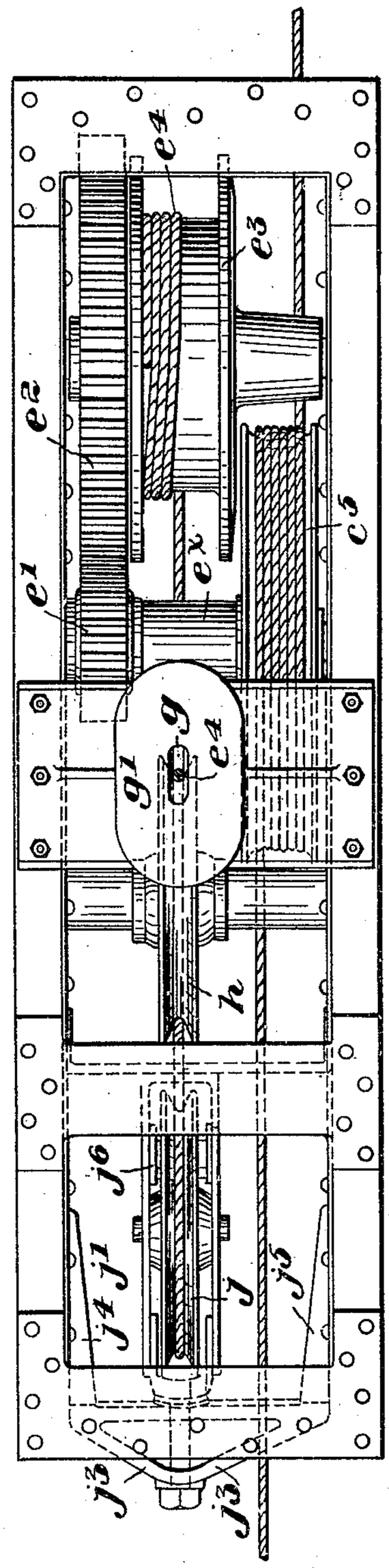


Fig. 4

Witnesses:
Horace A. Crossman.
Everett L. Emery.

Inventor:
Almon E. Norris.
by Emery, Booth & Powell
Attys.

A. E. NORRIS.

CABLEWAY APPARATUS.

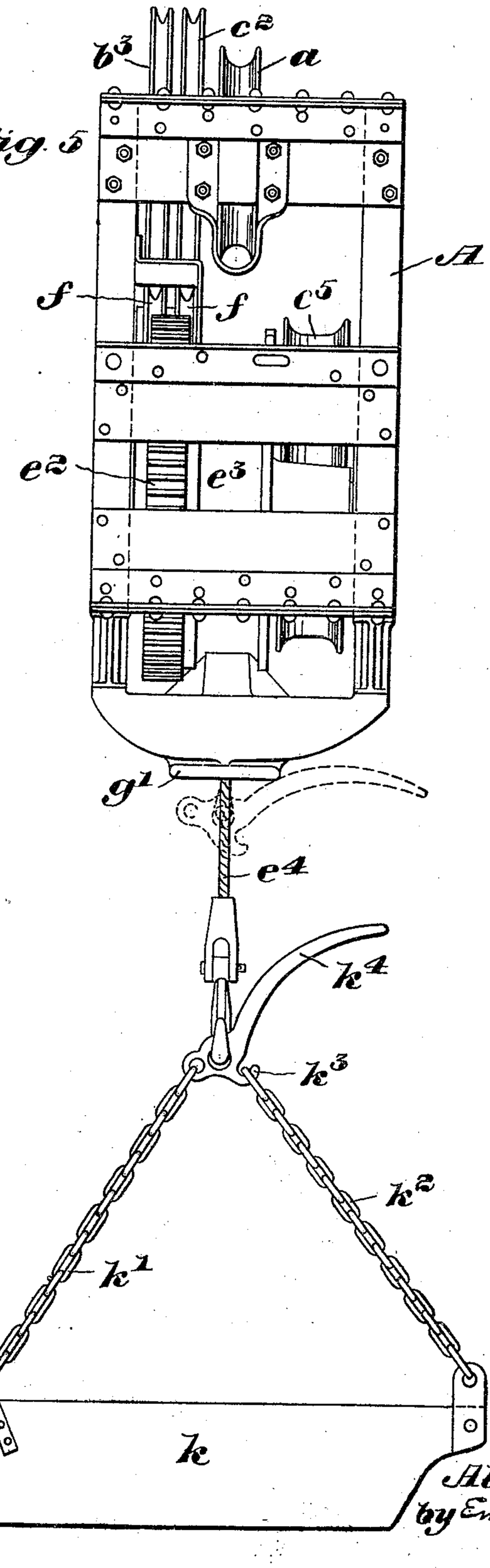
APPLICATION FILED DEC. 3, 1904.

956,150.

Patented Apr. 26, 1910.

4 SHEETS—SHEET 3.

Fig. 5



Witnesses:
Horace A. Crossman.
Everett S. Emery.

Inventor.
Almon E. Norris,
by Emery, Booth & Powell
Attys.

A. E. NORRIS.

CABLEWAY APPARATUS.

APPLICATION FILED DEC. 3, 1904.

956,150.

Patented Apr. 26, 1910.

4 SHEETS—SHEET 4.

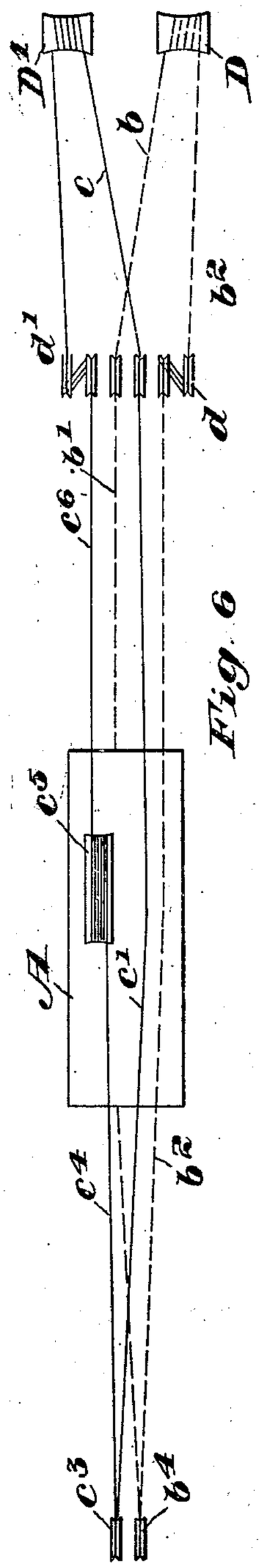


Fig. 6.

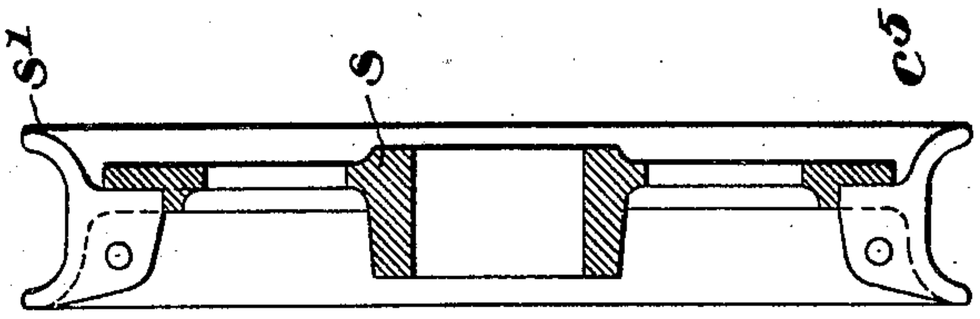


Fig. 8

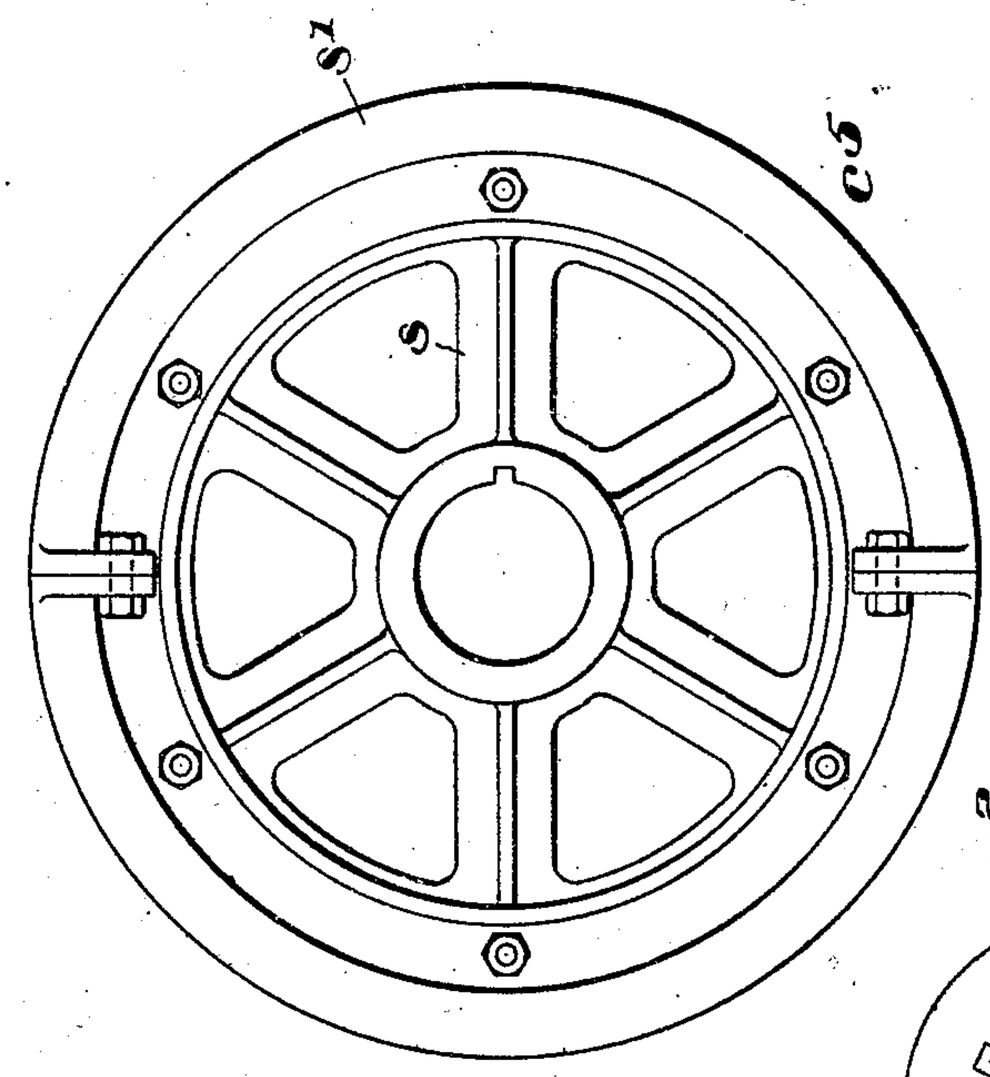


Fig. 7

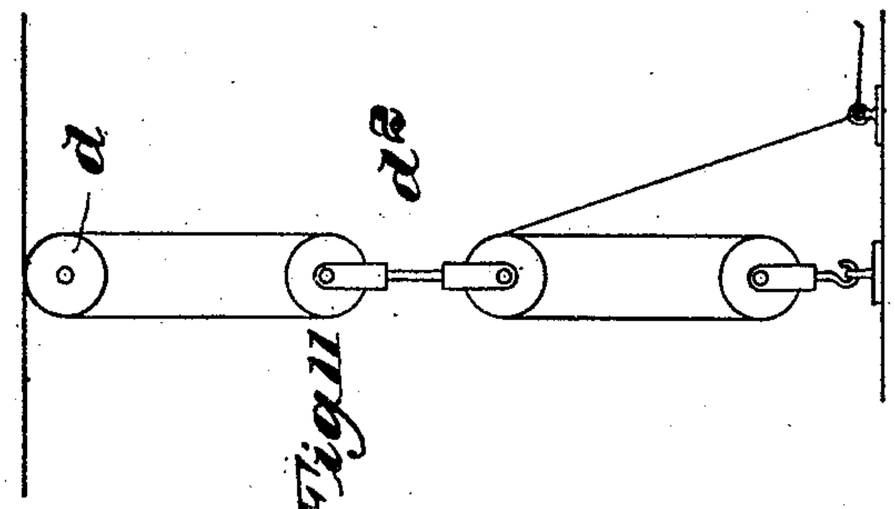


Fig. 11

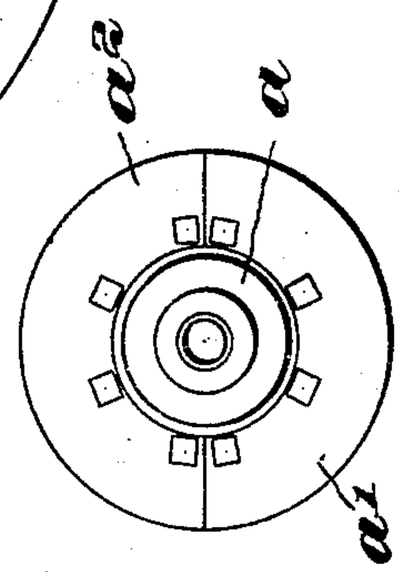


Fig. 10

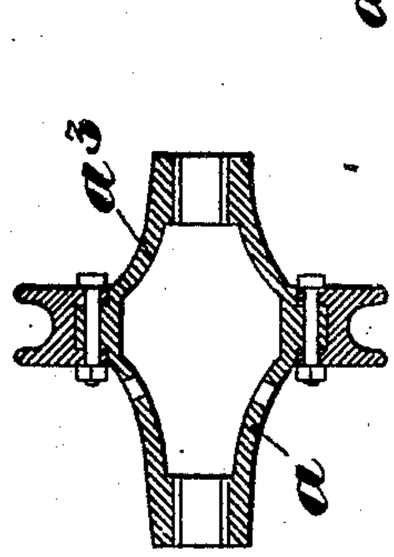


Fig. 9

Witnesses:
Horace A. Crossman.
Everett S. Emery.

Inventor:
Almon E. Norris.
by Emery, Booth, Powell
Attys.

UNITED STATES PATENT OFFICE.

ALMON E. NORRIS, OF CAMBRIDGE, MASSACHUSETTS.

CABLEWAY APPARATUS.

956,150. Specification of Letters Patent. Patented Apr. 26, 1910.

Application filed December 3, 1904. Serial No. 235,308.

To all whom it may concern:

Be it known that I, ALMON E. NORRIS, a citizen of the United States, residing at Cambridge, in the county of Middlesex, Commonwealth of Massachusetts, have invented an Improvement in Cableway Apparatus, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

My invention consists in improvements in hoisting and conveying apparatus, and, although capable in some features of more general application, is more particularly concerned with cable-way apparatus employing a trolley carriage propelled along a cable or other track-way by a traverse rope and load lifting devices upon the carriage operated by a suitable hoisting rope.

My invention will be best understood by reference to the following description taken in connection with the accompanying illustration of one specific embodiment thereof submitted for illustrative purposes, while its scope will be more particularly pointed out in the appended claims.

In the drawings,—Figure 1 is a side elevation of one construction of trolley carriage showing certain features of my invention embodied therein; Fig. 2 is a section on line 2—2 in Fig. 1; Fig. 3 is a plan view of the carriage shown in Fig. 1 looking from the top; Fig. 4 is a view of the same carriage looking from the bottom; Fig. 5 is an end elevation of the carriage shown in Fig. 1, this view also showing a depending skip attached to the hoisting rope; Fig. 6 is a diagrammatic view of the relative arrangement of the operating ropes or cables used in connection with the trolley carriage; Fig. 7 is a side elevation of the hoisting winch; Fig. 8, a sectional elevation of the same; Fig. 9, a sectional elevation of the trolley wheel illustrated in Fig. 1; Fig. 10, a side elevation of the same; Fig. 11, a diagrammatic illustration of the adjustable take-up; and Fig. 12 is a modified form of the support for the guiding sheave.

I have herein illustrated my invention as embodied in a cable-way apparatus and more particularly in the trolley carriage illustrated in Figs. 1 to 5, inclusive, adapted to be propelled lengthwise the cable-way or other track-way used, and provided with suitable load lifting devices, the movement of the trolley carriage and the load lifting device being herein controlled from the end of the cable-way by means of endless operating ropes or cables.

Referring to the particular form of trolley carriage illustrated (Figs. 1 to 5), the same is provided with a suitably shaped box-like skeleton frame A in which are journaled in suitable manner the trolley or carriage wheels *a*, *a* shown as three in number and having grooved peripheries to fit and travel freely upon the track cable B, the middle wheel being shown as somewhat depressed to adapt it to the natural curve or depression in the cable B.

The arrangement of operating cables for the apparatus herein shown is substantially similar to that disclosed in my copending application, Se. No. 86,497, filed December 19, 1901. This arrangement comprises an endless traverse or trolley cable *b* and an endless hoisting cable *c*. The former, (Figs. 3 and 6), is attached to the opposite ends of the carriage A, from which the strand b' passes from the one side over suitable guiding sheaves to and about the stationary traversing winch D, located at the end of the cable-way. From the winch D the slack strand b^2 passes about suitable slack adjusting or take-up devices *d*, thence to the trolley carriage beneath the sheave b^3 and to the opposite end of the cable-way over a guiding sheave b^4, and thence back again to the trolley carriage through the strand b^5. Thus the traverse rope in effect constitutes an endless cable which is moved by rotation of the winch D to produce the desired traversing movement of the trolley carriage.

Referring to Figs. 3 and 6, the strand c' of the hoisting rope *c* passes from the stationary hoisting winch D′, adjacent the winch D, to the trolley carriage and beneath the sheave c^2, thence to the opposite end of the cable-way about the guiding pulley c^3, thence through the strand c^4 to the hoisting winch c^5, about which it is wound with any desired number of turns. From the winch c^5 the strand c^6 of the hoisting rope leads through the adjustable take-up d', back again to the hoisting drum D′.

The hoisting winch together with the pinion e' is fixed on a sleeve, e^x, the latter loose

upon the shaft e. The pinion e' engages with and drives the gear e^2, the latter being secured to the hoisting drums e^3, about which is wound the load hoisting rope e^4, which is directly attached to the load to be raised or lowered. Thus the load can be raised or lowered by rotation of the hoisting winch c^5, through movement of the hoisting rope c, relatively to the trolley carriage, the rope movement being under the command of the operator controlling the stationary winches D and D'. The winches D and D' are employed to coöperate each with the other, as is well understood in this class of apparatus, to effect all necessary movements of the traversing and hoisting ropes in raising and lowering the load upon the carriage and effecting its transference from any one point in the cable-way to another.

As in my prior application the idle strands of the endless controlling ropes, or those not necessarily engaging the trolley carriage or its parts, namely, the strand b^2 of the traversing rope and the strand c' of the hoisting rope, are caused to pass beneath the sheaves b^3 and c^2, respectively, thereby to assist in sustaining the weight of the carriage. In my present form of carriage, however, I have located the load sustaining sheaves b^3 and c^2 lengthwise the carriage in a substantially central position, to effect a better balancing of the carriage. The strands b^2 and c' of the traversing and hoisting ropes are maintained in engagement with the load sustaining sheaves b^3 and c^2 by means of the small sheaves or rolls f, which are arranged on either side of the load sustaining sheaves and adjacent thereto to prevent the strands b^2 and c' from disengaging from the load sustaining sheaves.

In practice, where hoisting drums have been placed upon trolley carriages employed in cable-way systems difficulty has been found in compelling the rope to wind up evenly on the drum surface. Unless the balance of the carriage is excellent, there is a tendency for the oncoming strand of the rope to climb upon the preceding convolution. This is particuraly the case when the rope is under strain and the oncoming strand meets the rope drum when near one end thereof and off the center of the carriage. Under such circumstances, the downward pull of the rope itself tips the carriage and so augments the climbing tendency as to make it practically impossible to overcome the same.

In the present instance I have provided an arrangement which maintains the balance of the carriage while permitting the uniform and even winding of the rope upon the drum.

More specifically in the illustrated embodiment of my invention, instead of permitting the hoisting rope to depend directly from the hoisting drum, I cause the same to pass over suitable rope-guiding means and to be delivered from the trolley in substantially one and the same vertical line of travel. By this means there is no unbalancing or tipping of the carriage as the rope travels from one end to the other of the drum in winding or unwinding.

The hoisting rope e^4 passes to and from the trolley through (Fig. 4) an eye g in the throat g' the latter secured to and depending from the lower part of the trolley frame, the said eye being in line with the edge of the receiving sheave h, which receives the rope from the drum and delivers or pays it out to the load below.

In order to adapt the rope which travels over the receiving sheave h, to the varying point of contact thereof with the hoisting drum and to guide the rope and positively cause the same to wind evenly upon the drum, I cause the hoisting rope e^4, before passing to the hoisting drum, first to pass from the sheave h, to the opposite end of the trolley carriage and about the guiding sheave j, the latter being mounted to tilt and adapt itself to the varying line of contact between the rope and the winding drum. The sheave j (Figs. 1, 2 and 4) is rotatively mounted in a frame j', which is mounted to oscillate at one end about a pivotal support in a fixed cross piece j^2 and at the opposite end in the cross yoke j^3. The yoke j^3 is fixedly secured to the brackets j^4 and j^5, riveted to the side of the frame. Referring to Fig. 4, it will be observed that the axis of oscillation of the frame j' and the guiding sheave j is in the same plane with the sheave h and is substantially tangential to the periphery of the sheave at the pitch line of the hoisting rope e^4. During the winding and unwinding of the hoisting rope about the hoisting drum, the point of contact between the rope and the drum will travel from one to the other end thereof, and the line of travel of the rope will swing from one side to the other, but for each change in the line of rope travel, the guiding sheave j will tilt about its axis to adapt itself to the new line of rope travel. This it readily does, for the tilting axis of the guiding sheave j lying in the plane of and being tangential to the sheave h at the pitch line of the hoisting rope, the length of the latter between the sheaves h and j is unchanged during tilting movement of the sheave j, within whatever limits it be carried. The sheave j is therefore perfectly free to assume any position which is necessary to adapt the oncoming rope strand to its varying line of travel. To maintain the hoisting rope in contact with the sheave j under all conditions, a suitable rope guide j^6 is provided, attached to and movable with the frame j'.

In Fig. 12 I have shown a modified form of the tilting sheave, wherein instead of a

tilting frame, fixed frames j^7, rigidly braced to the sides of the trolley carriage, are provided. To these frames are fixedly secured the pin j^8, having the spherical bearing portion j^9 upon which is seated the tilting sheave j^{10}, adapted both to rotate and oscillate upon the spherical bearing pin.

Referring more particularly to Fig. 5, I have there shown means for controlling a load carrying device, herein shown as a skip k, by the elevation of the main hoisting rope, e^4, thus avoiding the necessity of additional controlling ropes. The skip k is carried herein by the chains k' and k^2, the end of the latter being secured to the hook k^3 to hold the skip in a horizontal position suited for hoisting and conveying material. When it is desired to dump the material, the hoisting rope e^4 may be raised to bring the trip k^4 into engagement with the bottom g' of the depending throat to depress the point of the hook k^3 and release the chain k^2, thereby to drop one end of the skip and dump the contents thereof.

In the operation of cable-way systems employing trolleys such as the one here illustrated, the trolley wheels are subjected to considerable wear and soon become worn, making frequent renewals necessary. Since it is often desirable to effect these renewals without the withdrawal of the carriage from the cable-way, I have provided the trolley wheels (Figs. 9 and 10) with split removable rims composed of the sections a' and a^2, which are securely but separately bolted to the hubs a^3. Through the employment of trolley wheels of this construction renewal of the wearing surfaces of any or all of the wheels may be quickly and easily accomplished; for it is only necessary to move the carriage until a half section of one wheel is out of engagement with the cable, when it may be removed and replaced by a new half section and the wheel then reversed for the repetition of the same operation with the remaining half.

By reference to Fig. 1 it will be seen that the supporting sheaves b^3 and c^2 are also split diametrically so that these may be renewed or repaired in the same manner as the trolley wheels without the necessity of the withdrawal of the carriage from the cable.

In Figs. 7 and 8, I have shown the details of the hoisting winch c^5; herein the same consists of the spider s having a peripheral flange to which are bolted the split half sections of the rim or cable-engaging portion s'. This construction permits the rim to be removed, either partially or wholly, for the purpose of repairs without requiring the removal of the winch from the carriage.

In Fig. 11, I have shown diagrammatically one form of my adjustable slack take-up. In those cable-way systems employing automatic take-up devices for the operating cables, such cables are continually under the maximum tension for which they are designed. This tension continues whether the carriage be loaded or not and the cables are therefore necessarily strained for a greater part of the time. In the present instance I have provided an adjustable take-up whereby the tension upon the operating cables may be relieved when necessary, so that the tension placed upon the cables by the slack take-up means will be best suited to the varying conditions of operation. Referring to Fig. 11, the sheave d, about which the strand b^2 of the hoisting cable passes, is secured to a block and tackle d^2, the position of which may be adjusted at will, thereby positively to lengthen or shorten the loop which is formed by the said cable in passing about the said sheave d. The slack take-up device for the traversing rope or cable is similar to that described. By this means any desired tension may be placed upon either of the operating cables at any time.

I have herein described for illustrative purposes one embodiment of my invention, but it is to be understood that the details herein set forth are in no sense material to my invention, but that they may be modified within wide limits without departing from the spirit thereof.

Claims—

1. In an apparatus of the class described, the combination with a trolley carriage, of a drum, a rope adapted to be wound upon and unwound from said drum, and means including a laterally tilting sheave from which said rope passes to said drum for maintaining the rope in substantially the same vertical line of pull irrespective of the varying point of contact with the drum.

2. In an apparatus of the class described, the combination with a drum, a rope adapted to be wound thereon, means to receive said rope from said drum and a sheave between said receiving means and said drum, said sheave having its plane of rotation adjustable about an axis passing through its axis of rotation to adapt the rope to its varying point of contact with the drum.

3. In an apparatus of the class described, the combination with a trolley carriage, of a rope-winding drum, a load-carrying device and a rope-winding member, the latter being movable laterally to tilt the plane of the on-coming and out-going rope strands to adapt the rope to a varying point of contact with the drum, such movement leaving substantially unchanged the rope length between the guiding member and the load-carrying member.

4. In an apparatus of the class described, the combination with a trolley carriage of a hoisting drum upon the same, a rope adapted to be wound upon and unwound from said drum, a receiving sheave with which said

rope engages in passing to and from the carriage, and means between said sheave and said drum to adapt the rope to its varying point of contact with the drum.

5. In an apparatus of the class described, the combination with a trolley carriage of a hoisting drum upon the same, a rope adapted to be wound upon and unwound from said drum, a receiving sheave with which said rope engages in passing to and from the carriage, and a guiding sheave about which said rope passes between said receiving sheave and drum, said sheave being laterally movable relative to the length of said rope.

6. In an apparatus of the class described, the combination with a trolley carriage of a hoisting drum upon the same, a rope adapted to be wound upon and unwound from said drum, a receiving sheave with which said rope engages in passing to and from the carriage, and a guiding sheave about which said rope passes between said receiving sheave and drum, said guiding sheave being adapted to rock about an axial line lying in the plane of said receiving sheave and substantially tangential to its periphery.

7. In an apparatus of the class described, the combination with a trolley carriage of a hoisting drum thereon, a hoisting rope adapted to be wound upon and unwound therefrom, a receiving sheave with which said rope engages in passing to and from said carriage, and rotary rope-guiding means between said drum and said sheave, said means being movable transversely relative to the length of said rope.

8. The combination with a rope-receiving member, of a rotary rope-guiding member coöperating therewith, the latter being supported to permit rocking adjustment of its plane of rotation about an axial line substantially intersecting its axis of rotation and lying in the plane of said receiving member and substantially tangential to its periphery.

9. The combination with a rope-receiving member, of a rope guiding member coöperating therewith, the latter being supported to permit rocking adjustment of its plane of rotation about an axial line substantially intersecting its axis of rotation and lying in the plane of said receiving member and substantially tangential to its periphery at or about the point where the rope passing from the guiding member to the receiving member meets the latter.

10. In an apparatus of the class described, the combination with a flexible cableway, of a trolley carriage thereon, the latter having a hoisting drum and hoisting rope depending centrally from said carriage, and guiding means therefor adjustable to correspond to the varying point of contact of the rope with the drum.

11. In an apparatus of the class described, the combination with a trolley carriage, of a flexible cableway, a rope-winding drum on the carriage, a depending rope, and a load-sustaining device carried thereby, the said carriage, drum, rope and cableway being related to laterally preserve equilibrium of the carriage irrespective of the varying point of contact of the rope-winding drum.

12. In a cableway system, the combination with a trolley carriage, of a rope-winding drum, a rope depending from said drum, and means apart from the drum to cause even lateral distribution of successive rope convolutions over the drum surface, while maintaining substantially the same vertical line of downward pull upon the depending rope.

13. In a cable-way system, the combination with a supporting cable-way, of a trolley carriage suspended thereon, a hoisting drum, a hoisting rope adapted to be wound upon said drum with a varying resultant line of pull relatively to the center of carriage support, and means automatically adjustable in response to the varying line of pull to prevent the unbalancing of the carriage by the winding of the rope thereon.

14. In an apparatus of the class described, the combination with a cable-way, of a trolley, a hoisting rope, a hoisting drum upon which said rope is adapted to be wound, and means for maintaining said hoisting rope in substantially the same vertical line of pull in passing to and from the trolley.

15. In an apparatus of the class described, the combination with a trolley of a hoisting rope, rope delivery means upon said trolley, a hoisting drum on one side of said rope delivery means, and rope-guiding means maintained on the other side thereof about which said rope passes in traveling from said drum to said delivery means.

16. In a cable-way system, a trolley carriage, a hoisting drum, an endless hoisting rope having one strand thereof operatively related to said drum, and means mid-way the length of said carriage for causing the other strand thereof to assist in supporting the trolley weight, said supporting means and said hoisting drum being on opposite sides of the longitudinal central plane of said carriage.

17. In an apparatus of the class described, the combination with a supporting cable, of a trolley carriage mounted thereon, a hoisting drum arranged transversely said carriage, a fall rope adapted to be wound thereon, means to receive said rope from said drum, and a sheave between said receiving means and said drum, said sheave having its plane of rotation adjustable to adapt the rope to its varying point of contact with the drum.

18. In an apparatus of the class described, the combination with a suitable track-way,

of a trolley carriage, a hoisting drum arranged transversely said carriage near one end thereof, a fall rope a receiving sheave arranged to permit of the substantially central downward travel of the fall rope with reference to the center of carriage support, and a tilting sheave at the opposite end of the carriage from the drum about which said rope passes in leading from the receiving sheave to the drum.

19. In an apparatus of the class described, the combination with a trolley carriage, of a hoisting drum upon the same, a single fall rope adapted to be wound upon and unwound from said drum, a receiving sheave with which said rope engages in passing to and from the carriage, and a guiding sheave about which said rope passes between said receiving sheave and drum having means to permit of its adjustment to adapt itself to the movement of said fall rope in winding or unwinding upon said drum.

20. In an apparatus of the class described, the combination with a trolley carriage having the hoisting drum e^3, receiving sheave h and guiding sheave j, the latter being held at a substantially fixed distance at one side of the said drum.

21. In an apparatus of the class described, the combination with a supporting cable, of a trolley carriage suspended thereon, a hoisting drum arranged transversely said carriage, a fall rope adapted to be wound upon and unwound from said drum, and laterally movable guiding means for guiding said rope to and from said drum.

22. In an apparatus of the class described, the combination with a supporting cable, of a centrally supported balanced trolley carriage, a transversely arranged hoisting drum upon said carriage, a single fall rope adapted to be wound upon and unwound from said trolley and means for preventing the unbalancing of said carriage during the winding or unwinding of said rope.

23. In an apparatus of the class described, the combination with a flexible cableway, of a trolley carriage, a hoisting drum thereon, a single fall rope, a receiving sheave arranged for the vertical travel of said fall rope, and means for the substantially horizontal delivery of the fall rope to the winding drum.

24. In an apparatus of the class described, the combination with a trolley carriage, of a hoisting drum thereon, a fall rope, means comprising a receiving sheave to effect a substantially central and vertical travel of the fall rope from the carriage with reference to the center of carriage support, and means for delivering the fall rope to the drum in a substantially horizontal direction.

25. In an apparatus of the class described, the combination with a supporting cable, of a trolley carriage having a balanced support thereon, a hoisting drum arranged transversely on said carriage, a single fall rope adapted to be wound and unwound thereon, and means for balancing the effect of said rope upon said drum.

26. In an apparatus of the class described, the combination with a trolley carriage, of a hoisting drum arranged transversely thereon and near one end thereof, a fall rope, a receiving sheave arranged to receive said fall rope and to effect a substantially central and vertical travel of the fall rope in passing to and from the carriage, and a guiding sheave near the opposite end of the carriage from the drum, said sheave being mounted to tilt laterally about an axis substantially tangential to the periphery of the receiving sheave.

27. In an apparatus of the class described, the combination with a supporting cable, of a trolley carriage, one or more trolley wheels supporting said carriage upon said cable, a hoisting drum arranged transversely said carriage, a fall rope, and receiving means for said fall rope to limit the travel of said fall rope to and from the carriage to substantially the same vertical plane with the supporting trolley wheel or wheels.

28. In a hoisting apparatus, the combination with a trolley carriage, a hoisting rope, a skip, connections suspending opposite ends of said skip, a sustaining device for joining said connections to said fall rope having a hook member for holding one of said connections, and means for oscillating said member for releasing its hooked connection on the rise of the fall rope.

29. In an apparatus of the class described, a trolley carriage, a fall rope, a trip having a hook member and pivotally secured to the fall rope, a skip, flexible connections supporting opposite ends of the skip upon said trip, one of said connections having releasable connection with said hook member; and means permitting engagement between the trip and the carriage on the elevation of the fall rope to release the said connection from said hook member.

30. In an apparatus of the class described, a trolley carriage, a hoisting drum thereon, a depending fall rope adapted to be wound upon and unwound from said drum, a skip having connections attached to the opposite ends of said skip and to said fall rope, and lever means carried by said fall rope having an arm adapted to engage with the trolley carriage for releasing one of said connections and dumping the skip on the elevation of the rope.

31. The combination in a cable way system, of a cable, a trolley carriage having a plurality of trolley wheels therefor and arranged longitudinally and medially on said carriage, and a hoisting winch and one or more supporting sheaves carried by said car-

riage and arranged on opposite sides of the plane containing said wheels, for balancing said carriage both longitudinally and laterally relative to said cable.

32. In a hoisting apparatus, the combination of a hoisting drum, a fall rope adapted to be laterally wound and unwound thereon, with a movable following and guide sheave operatively mounted with relation to said drum for receiving the rope therefrom and having connected devices for retaining said rope thereon.

33. In an apparatus of the class described, the combination with a trolley carriage, a flexible cableway from which the same is suspended, a rope-winding drum upon the carriage, a single fall rope adapted to be wound on and unwound from said drum, and a load sustaining member carried by the rope, the said carriage, drum, rope and cableway being related to preserve the lateral equilibrium of the carriage irrespective of the varying point of contact with the drum.

34. In an apparatus of the class described, the combination with a trolley carriage, of a rope-winding drum thereon, rope-guiding means to cause the latter to depend from the carriage at a substantially central point transversely the same, thereby to preserve the equilibrium of the carriage, and means for maintaining the rope length intervening between the guiding means and the drum of substantially the same length irrespective of the varying point of contact with the drum surface.

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.

ALMON E. NORRIS.

Witnesses:

THOMAS B. BOOTH,

EDITH E. CHAPMAN.