A. E. NORRIS.

HOISTING OR CONVEYING APPARATUS.

APPLICATION FILED MAY 16, 1906.

939,294.

Patented Nov. 9, 1909.

3 SHEETS—SHEET 1.

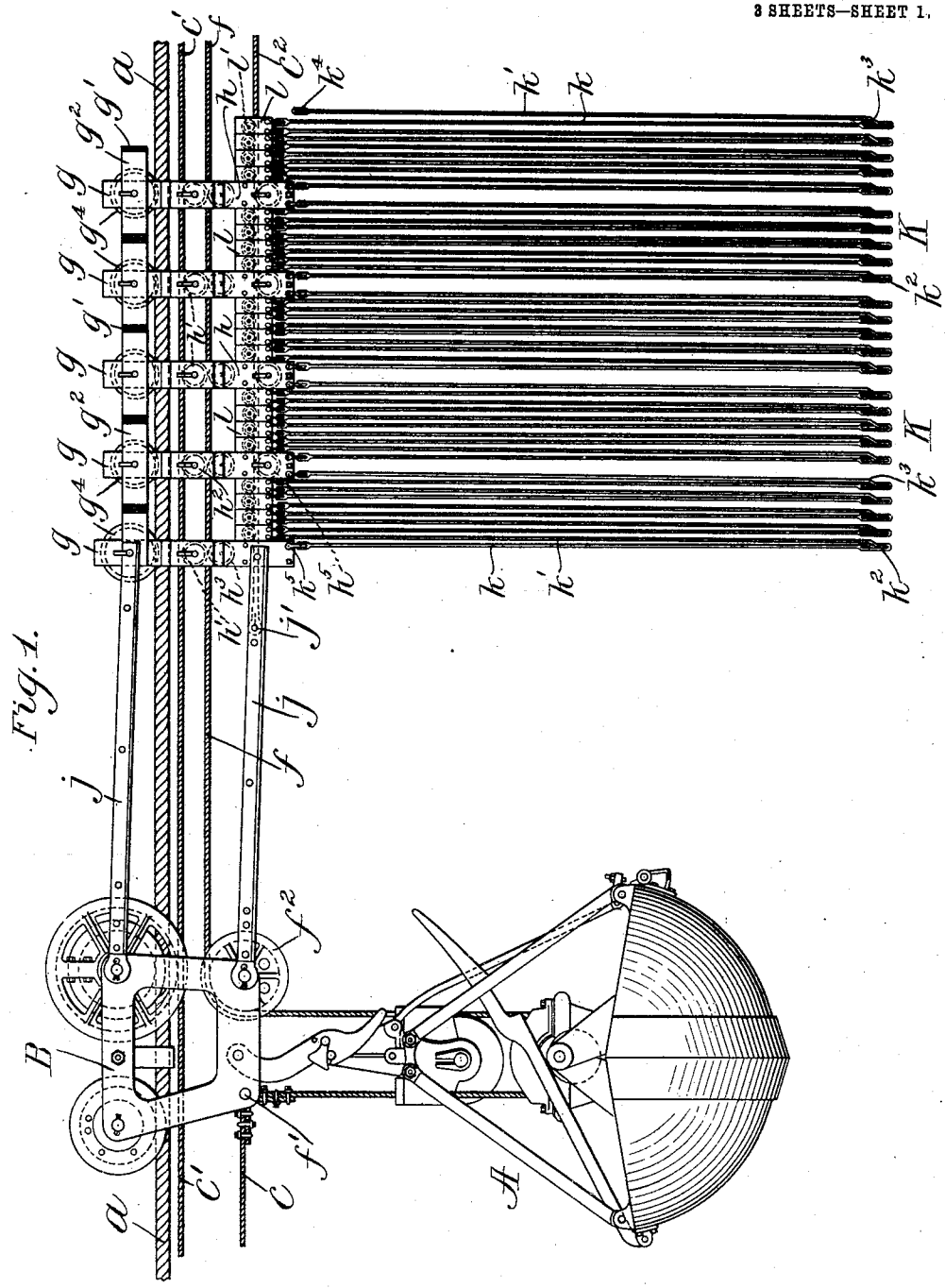

Fig. 1.

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Fig. 2.

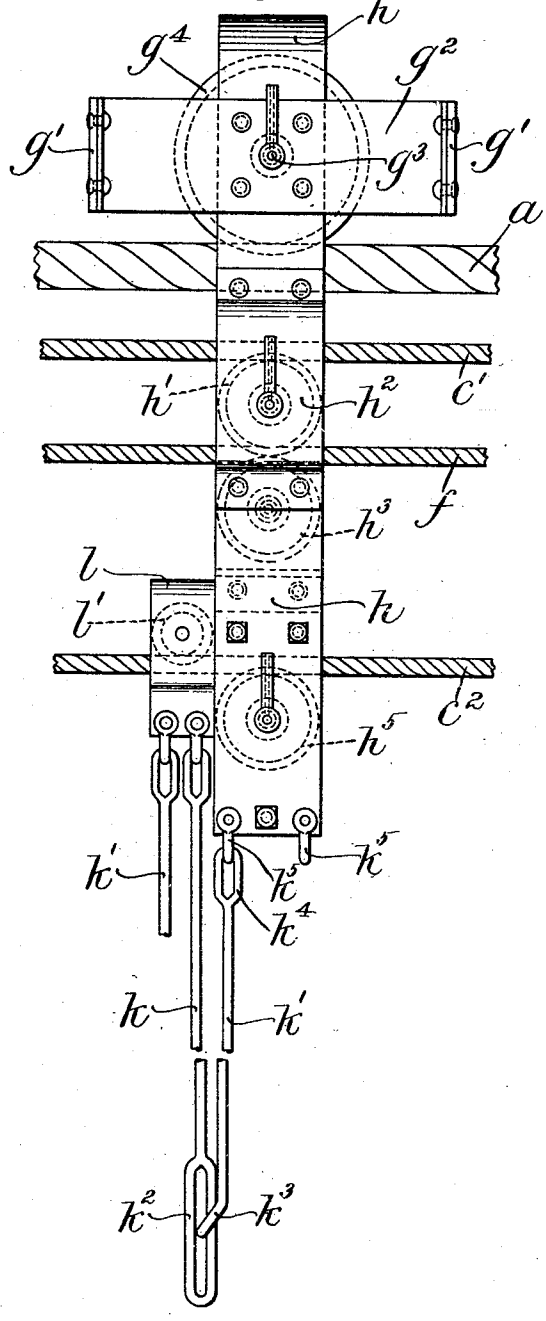
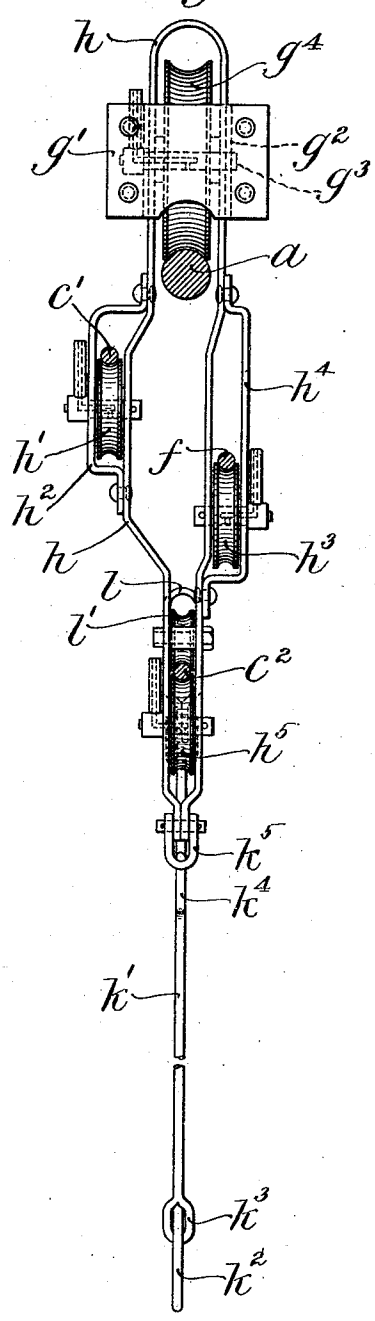


Fig. 3.



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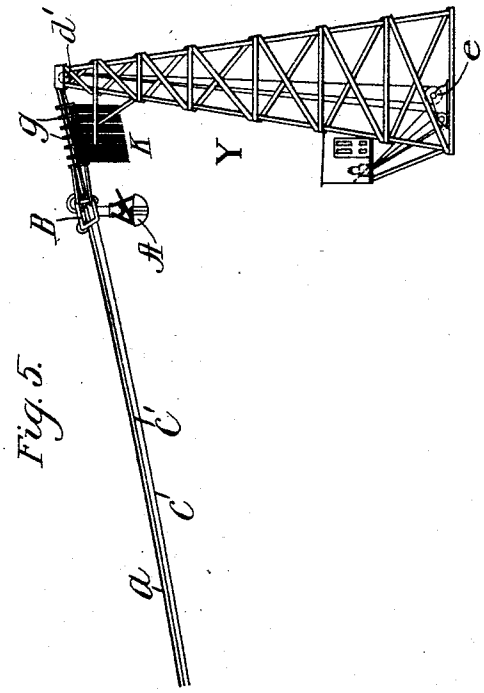


Fig. 5.

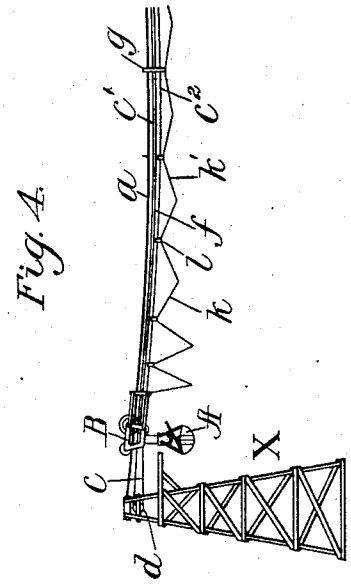


Fig. 4.

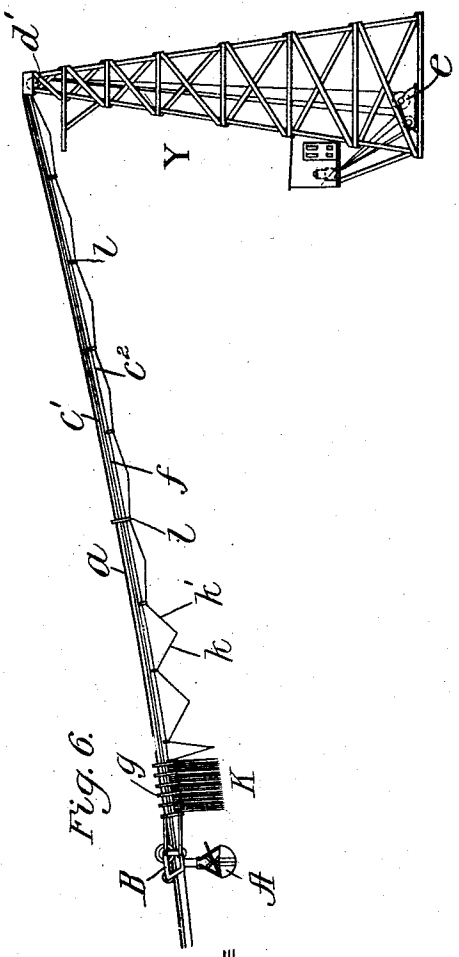
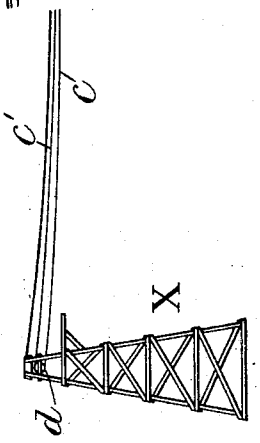


Fig. 6.



Witnesses:
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UNITED STATES PATENT OFFICE.

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HOISTING OR CONVEYING APPARATUS.

939,294. Specification of Letters Patent. Patented Nov. 9, 1909.

Application filed May 16, 1906. Serial No. 317,103.

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 and State of Massachusetts, have invented an Improvement in Hoisting or Conveying Apparatus, of which the following description, in connection with the accompanying drawings, is a specification, like characters on the drawings representing like parts.

My invention relates to hoisting or conveying apparatus, being more particularly though not exclusively concerned with cable-way apparatus and the provision of a new and improved system of fall rope carriers for such apparatus.

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

In the drawings,—Figure 1 shows the trolley carriage and an assemblage of the principal features of the fall rope carrier system in a hoisting and conveying cable-way apparatus embodying one form of my invention; Fig. 2 shows in side elevation an enlarged view of a main carrier trolley and carrier frame of the construction shown in Fig. 1, together with its relation to the several ropes of the system; Fig. 3 shows the same in front elevation, partially in section; Fig. 4 shows a portion of a cable-way with the trolley near the end of its travel and the carriers separated by their full distance; Fig. 5 shows the opposite end of the cable-way with the trolley carriage near its starting point of travel, and Fig. 6 shows the cable-way partially broken away with the trolley carriage at an intermediate point.

Referring to the drawings, I have shown my invention by way of illustration as embodied in a cable-way apparatus employing as the hoisting and conveying unit a grab hoist A, which is supported from and operated through the medium of an overhead trolley carriage B, the latter mounted to travel along the cable-way *a*. The specific construction of the grab hoist forms no essential part of my invention and the same is shown herein merely as a conventional representation of any trolley-supported unit, it being understood that my invention is applicable to various constructions of cable-way and other apparatus without reference to the hoisting unit employed.

The particular construction of the trolley and the number, arrangement or purpose of the various operating or other ropes employed is not essential to my invention, but in the illustrated embodiment thereof I have shown the trolley B, adapted for travel along the cable-way *a* under the control of an endless traversing rope *c*. As is usual in this class of apparatus, one end of the traversing rope *c* is attached to the trolley carriage B, and, after passing over a sheave *d* on the tower X at the farther end of the cable-way (Figs. 4 and 6) leads back in the return strand *c'* longitudinally through the trolley and to and over a sheave *d'* upon the tower Y at the opposite end of the cable-way and thence down to and about a suitably driven and controlled rope drum *e*. The other end c^2 of the traversing rope is attached to the opposite end of the trolley carriage and, after leading to the tower Y, passes over a suitable sheave down to the rope-winding drum *e*, the traversing rope thereby constituting in effect an endless rope controlling the travel of the trolley carriage according to the rotation of the rope-winding drum *e*.

In the present instance the grab hoist is controlled both for hoisting and for opening and closing by means of a single rope *f*. My invention is not limited to, nor essentially concerned with its application to systems employing but a single hoist-operating rope, but the illustrative embodiment thereof will sufficiently suggest its application to other systems and to those employing a plurality of ropes for controlling the hoisting unit. This hoist-controlling rope *f* is connected to the trolley carriage at *f'*, and, after passing downward to the hoist over and about suitable sheaves thereon, leads up to and over the guide sheave f^2 carried by the trolley, thence to a guide sheave upon the operating tower Y and down to and about a suitable rope-winding drum at the base thereof.

As is well understood in the art, the operating rope *f* requires distributed support through fall rope carriers or the like when the trolley is moved to a distance from the operating tower, and one of the objects of this invention is to provide such support in a simple but effective way and under such conditions that danger of entanglement or

interference between the various parts constituting the fall rope carrier system is reduced to a minimum.

Referring now more particularly to Figs. 1, 2 and 3, the operating rope f is given its additional and distributed support through the means of the separate main rope-carrying units or carriers g. These consist (Figs. 2 and 3) each of a carrier trolley frame comprising end plates g' riveted to the flanged side plates g^2, the latter carrying a bearing pin g^3, upon which is journaled the carrier trolley wheel g^4, adapted to travel along the cable-way a and to transmit thereto the weight sustained by the depending carrier. This carrier frame is riveted to an elongated upright frame h, which depends from the carrier trolley frame and furnishes journaled support for one or more sheaves which are suitably positioned and arranged to sustain or assist in sustaining the weight of one or more of the operating ropes. At one side of the frame the returning strand c' of the traversing rope engages with and is supported by a sheave h', the latter given suitable journaled support between the side of the frame h and the overlying plate h^2 riveted thereto. At the opposite side of the frame and somewhat below the level of the sheave h', is a second supporting sheave h^3 journaled upon a pin sustained by the frame h and a plate h^4 which is riveted to the frame. This sheave engages with and assists in sustaining the hoist-operating rope f. Still farther down near the lower part of the frame and journaled between the adjacent walls of the frame is a third sheave h^5, which underlies and assists in sustaining the other strand c^2 of the traversing rope. Thus it will be seen that each carrier, supported directly as it is upon the cable-way offers support not only to the hoist-operating rope f but to the two strands c' and c^2 of the traversing rope as well.

Referring now to Fig. 1, it will be seen that the foremost carrier unit g, or that next adjacent the main trolley carriage B, has rigid attachment thereto, being connected at either side (front and rear end Fig. 1) through a pair of angle irons j, which are each jointed or swiveled at one end to the trolley and at the opposite end to the carrier frame, so that the foremost carrier while permitted a certain flexibility of movement relative to the carriage as is necessary for use upon the cable-way is rigidly connected thereto so as to be pushed or pulled thereby at a fixed distance therefrom. As the trolley moves in one direction or the other the foremost carrier follows or precedes it, as the case may be, at a fixed distance predetermined by the rigid attaching frame. The end or transverse plates g' of each carrier trolley frame form abutting or striking plates, which, when the carriers close in on each other, contact each with the adjacent end plate of the next adjacent carrier, so that when the trolley is near the operating tower or its starting point, as represented in Fig. 5, each carrier frame abuts against its neighbor and the same are positively spaced near their upper portions by a distance equal to the length of the carrier trolley frame. As the trolley carriage is moved toward the operating tower Y from a distant position, where the carriers have been separated at intervals, as represented in Fig. 6, the carriers are overtaken one by one, each by its neighbor, as the latter itself is advanced by the foremost carrier and the intermediate abutting carriers, until they finally assume the closed-in position shown in Fig. 5. The strand c^2 of the traversing rope is connected with the carriage by being secured at j' to a transverse bar or member connecting the two lower members j of the rigid frame connection.

In order to distribute the supporting carriers uniformly as the trolley is moved toward the farther end of the cable-way, it is usual to provide some kind of distance or separating devices, those usually employed being some kind of unsupported flexible connections directly connecting the carriers themselves. Such connections, however, have usually been quite susceptible of entanglement, and to prevent the unsupported length of these flexible connections from being excessive, moreover, it has been necessary to reduce the interval between the carriers by increasing their number beyond what is actually necessary to afford effective support to the operating ropes. In the illustrated embodiment of my invention I have provided between the main carrying units, distancing means, which are free from danger of entanglement and act to separate or locate the carriers when extended at a predetermined distance interval. These are so arranged and constructed as to receive support between the main carrying units, permitting the selection of as great an interval between the extended carriers as may be desired. For this purpose any suitable means may be provided but there are here provided between the respective carrying units distance members consisting of spacing links K, K (Fig. 1) which may be constructed in any suitable fashion and formed of any suitable material, but which preferably are light metal rods of sufficient size and shape to afford a certain degree of stiffness in order to prevent entanglement. These separating links are formed in pairs, the individual members of which, k, k', respectively, differ principally in their mode of attachment at their lower ends. The link k is provided with an elongated flat eye k^2, and the link k' with a short but bent or inclined eye k^3 formed at right angles to the eye k^2, but

coupled therewith. This connection, as will be evident from the description to follow, permits a certain free endwise play between the two rods and, when the carriers separate, allows the rods to become partially opened or separated without that resistance which is interposed when one rod begins to lift the other. This connection practically eliminates the danger of the rods in any way entangling or fouling each other during separating or closing movement of the carriers.

Each link receives overhead support from a carrying element of some kind. Starting with the end link of each series, as for example the link k' shown in Fig. 2, the same is secured to the lower end of the main carrying unit, being provided for that purpose with an eye k^4, which is linked to a shackle k^5, the latter swiveled to swing about a lower corner of the carrier frame h. The next adjacent link k, to which it is coupled at its lower end, is jointed at its upper end through a similar shackle connection to a link-carrying trolley l, the latter consisting merely of a simple sheet metal frame of general upright rectangular outline, as viewed in side elevation, provided with the trolley wheel l' through which it is sustained upon the strand c^2 of the traversing rope. Each link or rod carrier has as its lower end a pair of shackles, to one of which is attached the link k, as already described, and to the other of which is attached a link k', the latter having a construction at its lower end adapted to mate or couple with an adjacent link k (Fig. 1), sustained by an adjacent link-carrying trolley. In this fashion there is provided a series of jointed separating linked pairs, the members of each pair being sustained upon adjacent link-carrying trolleys. This series of intermediate trolley supported links is jointed at each end to a main carrier by means of the main-carrier-supported link described, the latter differing from the other corresponding links of the series only by a slight difference in length. It will be obvious that when the carriers are separated these links are caused to separate or open by the separation of their trolley carriers, permitting a separation between the main carriers of approximately the aggregate length of the links, as will be clear from Figs. 4 and 6. When closed (Fig. 5) they hang freely and without interference, as shown in Fig. 1. The end link of the entire system may be attached or anchored to any stationary object, as the structure of the tower Y.

In the embodiment of my invention illustrated in the drawings, the cable-way is assumed to have a length of approximately 700 feet and with the number and length of separating links is sufficient to permit a span or interval between the carriers when fully separated of approximately 100 feet, the linked separating members, however, being adequately supported at intermediate intervals of approximately 20 feet. It will be understood that these figures are given merely as illustrative of advantages which follow from the use of this invention, the latter being in nowise limited to dimensional or constructional details or the number of spacing members employed.

The link-carrying trolleys when the carriers are separated are supported upon the strand c^2 of the traversing rope, but the latter receiving support from each carrier the weight of the links and connections is sustained directly upon the cable-way. This is a simple and convenient arrangement but it will be obvious that the intermediate support may be derived directly from the main cable a, as by mounting the link or carriers directly thereon or from other of the strands or cables than that shown. In either case, however, it will be noted that the intermediate trolley carriers receive their ultimate support, whether directly or indirectly from the main cable a.

In the closed position of the carriers, as shown in Fig. 1, the upright rectilinear ends of the link-carrying trolley frames come into abutting contact each with the other, the end members of the series similarly abutting with the corresponding and alining edges of the adjacent carrier frames h. The longitudinal dimensions of the link-carrying trolley frames are such that they act as spacers between the lower portions of the carrier frames, separating the latter along the traversing strand c^2 by substantially the same distance that they are separated along the cable-way a. This construction, it will be seen, tends to maintain the carriers in a substantially upright position when closed in on each other and firmly positions them relatively to each other in fixed relation, quite eliminating any tendency toward longitudinal rocking or displacement, leaving them in effect as separate but positively positioned and connected members of a supporting structure, and practically eliminating any possibility of interference or entanglement between their linked connections.

While I have used the term "rope" in referring to the cable and the various operating ropes of the system, it is to be understood that this term is used in a generic sense and to include other flexible power transmission devices, such as chains, wire cables, or the like, or other devices having like or equivalent functions.

While I have shown and described in detail one practical embodiment of my invention, it is to be understood that the latter is not limited either to the application thereof herein shown, or to the form, details or relative arrangement of parts herein employed, but that extensive deviations may be made

without departing from the spirit of the invention.

Claims—

1. A hoisting and conveying apparatus having a supporting cable, a trolley carriage mounted to travel along said cable, a hoisting and conveying device carried by said carriage, an endless traversing rope connected to said carriage and controlled by suitable rope winding devices, a hoist-operating rope for the hoisting and conveying device leading from the trolley carriage to said cable-way end, separate carrier trolleys mounted to travel upon said supporting cable, said trolleys being provided with depending frames and end abutting plates adapted to hold the upper ends of said frames separated by a fixed distance when the carriers are closed in upon each other, a rigid frame connecting the foremost carrier with the main trolley carriage, appropriately positioned sheaves upon each of said frames affording support respectively to the strands of said endless traversing rope and the said hoist operating rope, and distance connections between adjacent carriers comprising a plurality of sets of connecting rods and intermediate trolley carriers for said rods the latter mounted to travel upon a strand of the traversing rope, said rods having a jointed or linked connection each with the next adjacent one, the end members of said series being sustained by the said carrier frames and the intermediate members by the said rod carriers.

2. A hoisting and conveying apparatus having a cable, a trolley carriage mounted to travel upon said cable, a hoisting and conveying device carried by said carriage, a plurality of operating ropes leading to said carriage, separate trolley carriers mounted to travel upon said supporting cable and provided with appropriately positioned sheaves affording support to said operating ropes, a rigid frame connecting the foremost carrier with the main trolley or carriage, and separating means between the said carriers comprising a plurality of rods having jointed connection each with the next adjacent one, said rods receiving support intermediate the said carriers from one or more trolley carriers, the latter mounted to travel upon one of the said operating ropes.

3. A cable-way apparatus having a cable, a trolley carriage thereon, a plurality of operating ropes leading to the carriage, a plurality of fall rope carriers on said cable affording support to said operating ropes, separating or distance connections between adjacent carriers, and intermediate carriers mounted upon one of said operating ropes for affording intermediate support to said connections.

4. A cable-way apparatus having a cable, a trolley carriage, an operating rope leading to the carriage from one end of the cable-way, separate rope carriers mounted upon said cable provided each with means for affording support to said operating rope, separating or distance connections between said carriers, and means carried by said operating rope for affording support to said connections intermediate said carriers.

5. A cable-way apparatus having a cable rope, a trolley carriage therefor, an operating rope leading to said trolley carriage, a plurality of carrier devices adapted to traverse said cable and provided each with means for affording support to said operating rope, connecting means between said carriers for insuring their separation at a predetermined distance on the traverse of the trolley carriage toward the farther end of the cable-way, and means movable upon one of said ropes for supporting said connecting means intermediate the said carriers.

6. In an apparatus of the class described, a plurality of fall rope carriers having intermediate separating connections comprising stiff connecting members jointed each to the next adjacent one, and one or more trolley carriers supporting said connecting members at the alternate junctions thereof.

7. In an apparatus of the class described, a trolley carriage, a trackway support therefor, a fall rope, a plurality of fall rope carriers having separating or distance connections and intermediate supporting means for said separating connections, said supporting means receiving support from the trackway support.

8. In an apparatus of the class described, a cable, a trolley carriage mounted to travel thereon, a traversing rope for said carriage, an operating rope leading thereto, and a plurality of carrying devices supported by and adapted to travel on said cable, said devices affording support to said traversing rope, having pivoted rod connections one with another, said connections having independent supporting means.

9. A cable-way apparatus having a cable, a trolley carriage mounted to traverse thereon, an operating rope leading to said trolley carriage, a plurality of fall rope carriers therefor, the foremost carrier being rigidly attached to the said trolley carriage and a plurality of depending separating and distance connections between adjacent carriers.

10. A cable-way apparatus having a plurality of fall rope carriers comprising each a trolley adapted to travel along the main cable, a depending frame carrying one or more suitably positioned rope-supporting sheaves, means for maintaining the upper portions of said frames separated by a predetermined distance when the carriers are closed in one upon another, connections between said carriers for separating them a

predetermined distance when in an open or extended relation, and also for separating the lower portions of said frames when in a closed in relation.

11. An apparatus of the class described having a plurality of fall rope carriers comprising each a trolley supported frame mounted to travel upon the main cable, one or more rope-supporting sheaves, intermediate linked connections and intermediate trolley carriers receiving support from the main cable sustaining said linked connections.

12. A fall rope carrier system having a plurality of rope-supporting trolley carriers, separating connections and other intermediate connection-supporting trolley carriers, the latter limiting the approach of said rope-supporting carriers in their closed relation.

13. A fall rope carrier system having fall rope carriers, comprising each a rectangular frame having end abutting plates, a trolley wheel journaled thereon, and a depending frame secured thereto having one or more rope-supporting sheaves, depending separating or distance connections between said carriers, and means associated with the same for separating the lower portions of said frames when in closed relation.

14. A fall rope carrier system having separating connections for the successive carriers comprising pairs of rods having a jointed connection one to another.

15. A fall rope carrier system having separating connections for the successive carriers comprising pairs of rods, one member of each pair having an elongated eye and the other an eye formed in a bent or incline end of the rod and linked or coupled with the eye of said first rod.

16. An apparatus of the class described having a trolley carriage, a traversing rope, an operating rope, a plurality of fall rope carriers for said operating rope and separating connections for said carriers receiving intermediate support from said traversing rope.

17. A cable-way apparatus having a cable, an operating tower at one end, a supporting tower at the opposite end, an operating rope leading from the carriage to the operating tower, an endless rope passing between the two towers and connected to said carriage, a plurality of fall rope carriers supporting said operating rope, and connections between said carriers receiving intermediate support from said endless rope.

18. A fall rope carrier system comprising a plurality of trolley carriers having means for holding the upper portions of the same separated by a fixed distance when in their closed in relation, separating connections for said carriers, and intermediate trolley carriers for supporting said separating connections, said intermediate carriers abutting one against another and separating the lower portions of said main carriers by the same predetermined distance when said carriers are in their closed in relation.

19. A fall rope carrier system having a plurality of carriers, distance or separating connections between the same, intermediate carrying means intervening between and separating adjacent carriers for supporting the distance connections and means for maintaining said carriers in a substantially upright position when in their closed-in relation.

20. A fall rope carrier system having the carriers g and the rods k, k'.

21. A fall rope carrier system having the carriers g the rods k, k' and the rod carriers l.

22. A fall rope carrier system having the connected carriers g, the sheave h', the rope c', the sheave h^5, the rope c^2, and the connected carriers l.

23. A cable-way apparatus having a cable, the trolley B, the fall rope carriers g, the connecting frame j connecting a carrier with said trolley, and separable connecting members intermediate the said carriers receiving support from the said cable.

24. In an apparatus of the class described, the combination with a fall rope, of a plurality of fall rope carriers having separating or distance connections, and a plurality of intermediate supporting devices for said separating connections between each pair of adjacent carriers.

25. A cable-way apparatus having a cable rope, a trolley carriage therefor, an operating rope leading to said trolley carriage, a plurality of carrier devices adapted to traverse said cable and provided each with means for affording support to said operating rope, connecting means between said carriers for insuring their separation at a predetermined distance on the traverse of the trolley carriage toward the farther end of the cable-way, and a plurality of supporting devices for said connecting means intermediate each pair of adjacent carrier devices.

26. A cable-way apparatus having a cable rope, a trolley carriage therefor, one or more operating ropes leading to said trolley carriage, a plurality of carrier devices adapted to traverse said cable and provided each with means for affording support to an operating rope, connecting means between the carriers for insuring their separation at a predetermined distance on the traverse of the trolley carriage toward the farther end of the cable-way, and means receiving support from one of said above mentioned ropes and acting to support said connecting means intermediate the said carriers.

27. In an apparatus of the class described, a trolley carriage, a trackway along which the same is adapted to run, a fall rope, a plurality of fall rope carriers having interme-

diate separating or distance connections and intermediate supporting means for said separating connections for maintaining said connecting means in a plurality of depending lengths or loops when the carriers assume a closed relation.

28. The combination with a cable-way rope, of one or more operating ropes including a fall rope, fall rope carriers, intermediate connections and intermediate carriers for the said connections supported upon one of the aforesaid ropes.

29. In an apparatus of the class described, a trolley carriage, a trackway support, a traversing rope for the carriage, an operating rope leading thereto, a plurality of carrying devices supported by and adapted to travel on said cable, said devices affording support to said operating rope, and intermediate flexible connections between adjacent carrying devices, said connections having independent supporting means, the latter receiving support from said trackway support.

30. In an apparatus of the class described, a fall rope, a plurality of fall rope carriers having separating or distance connections, a trolley carriage, a rigid connection between the trolley carriage and the adjacent fall rope carrier, and supporting means for said separating connections between adjacent fall rope carriers.

31. In an apparatus of the class described, a trolley carriage, an operating rope leading to the trolley carriage, a plurality of fall rope carriers, the foremost carrier being rigidly attached to said trolley carriage, a plurality of depending separating or distance connections between adjacent carriers, and separate intermediate supporting means for said connections between the carriers.

32. A hoisting and conveying apparatus having a cable, a trolley carriage mounted to travel upon said cable, a hoisting and conveying device carried by said carriage, a plurality of operating ropes leading to said carriage, separate trolley carriers mounted to travel upon said supporting cable and provided with appropriately positioned sheaves affording support to said operating ropes, separating means between the said carriers comprising flexible or linked connections, said connections receiving support intermediate the said carriers for one or more trolley carriers, the latter mounted to travel upon one of the operating ropes.

33. A hoisting and conveying apparatus having a cable, a trolley carriage mounted to travel thereupon, one or more operating ropes leading to said carriage, separate trolley carriers mounted to travel upon said supporting cable and provided with appropriately positioned sheaves affording support to said operating ropes, and separating means between said carriers comprising flexible connections, said connections receiving support intermediate the said carriers upon one or more trolley carriers, the latter receiving support from said supporting cable.

34. A cable-way apparatus having a cable, a trolley carriage thereon, a plurality of operating ropes leading to said carriage, a plurality of fall rope carriers on said cable affording support to said operating ropes, separating or distance connections between adjacent carriers and intermediate carriers receiving support from said cable for affording themselves intermediate support to said connections.

35. A hoisting system having in combination with an elevated trackway a plurality of trolley carriers, having separating or distance connections, and intermediate supporting means for said connections.

36. A hoisting system having in combination the cableway a, carriers g, and connections k.

37. In a hoisting system, the combination with a cableway of the connections k.

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,
ANNIE E. CHESLEY.