E. P. DAWLEY.

SAFETY APPLIANCE FOR CABLE RAILWAYS.

APPLICATION FILED DEC. 1, 1909.

986,807.

Patented Mar. 14, 1911.

3 SHEETS—SHEET 1.

FIG. 11.

FIG. 10.

FIG. 1.

FIG. 15.

FIG. 12.

FIG. 16.

FIG. 14.

FIG. 13.

FIG. 9.

FIG. 8.

WITNESSES:

C. F. Hannigan.

Calvin H. Brown

INVENTOR:

Edwin P. Dawley.

By Geo. A. Remington.

Atty.

E. P. DAWLEY.

SAFETY APPLIANCE FOR CABLE RAILWAYS.

APPLICATION FILED DEC. 1, 1909.

986,807.

Patented Mar. 14, 1911.

3 SHEETS—SHEET 2.

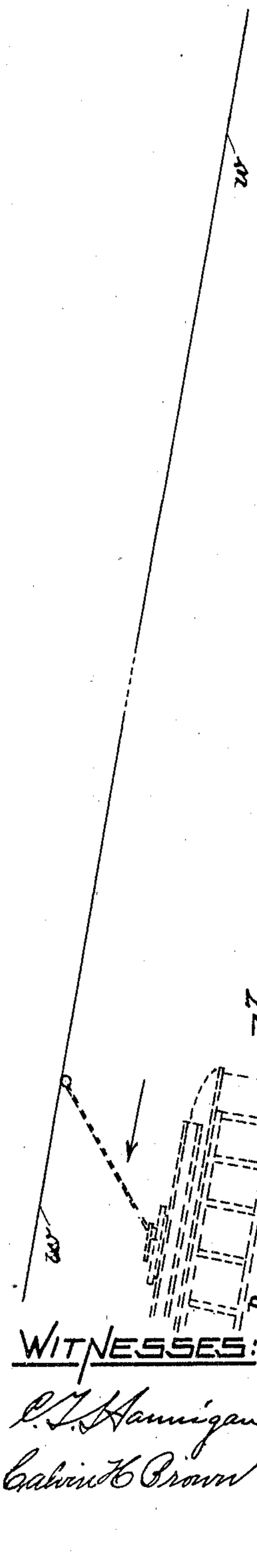

FIG. 12.

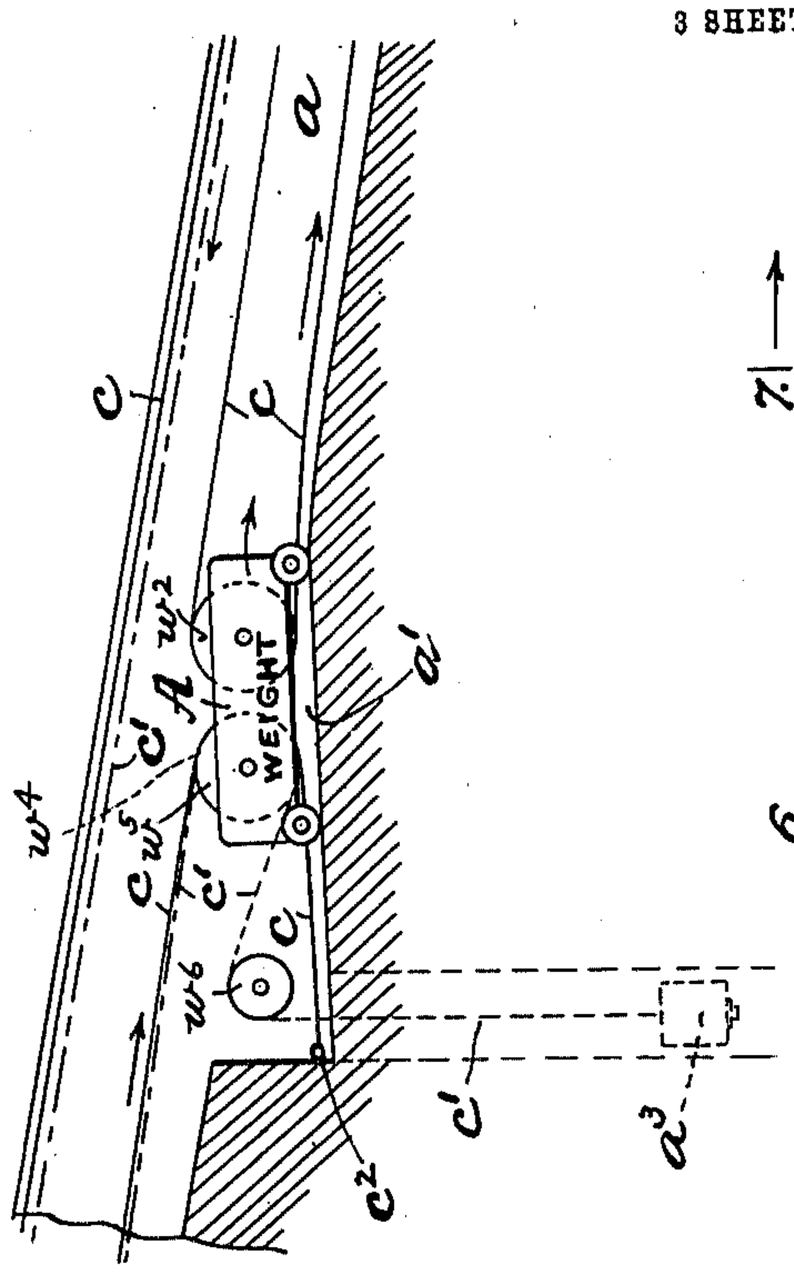

FIG. 7.

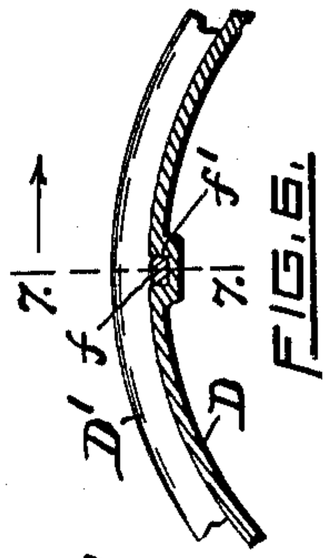

FIG. 6.

FIG. 2.

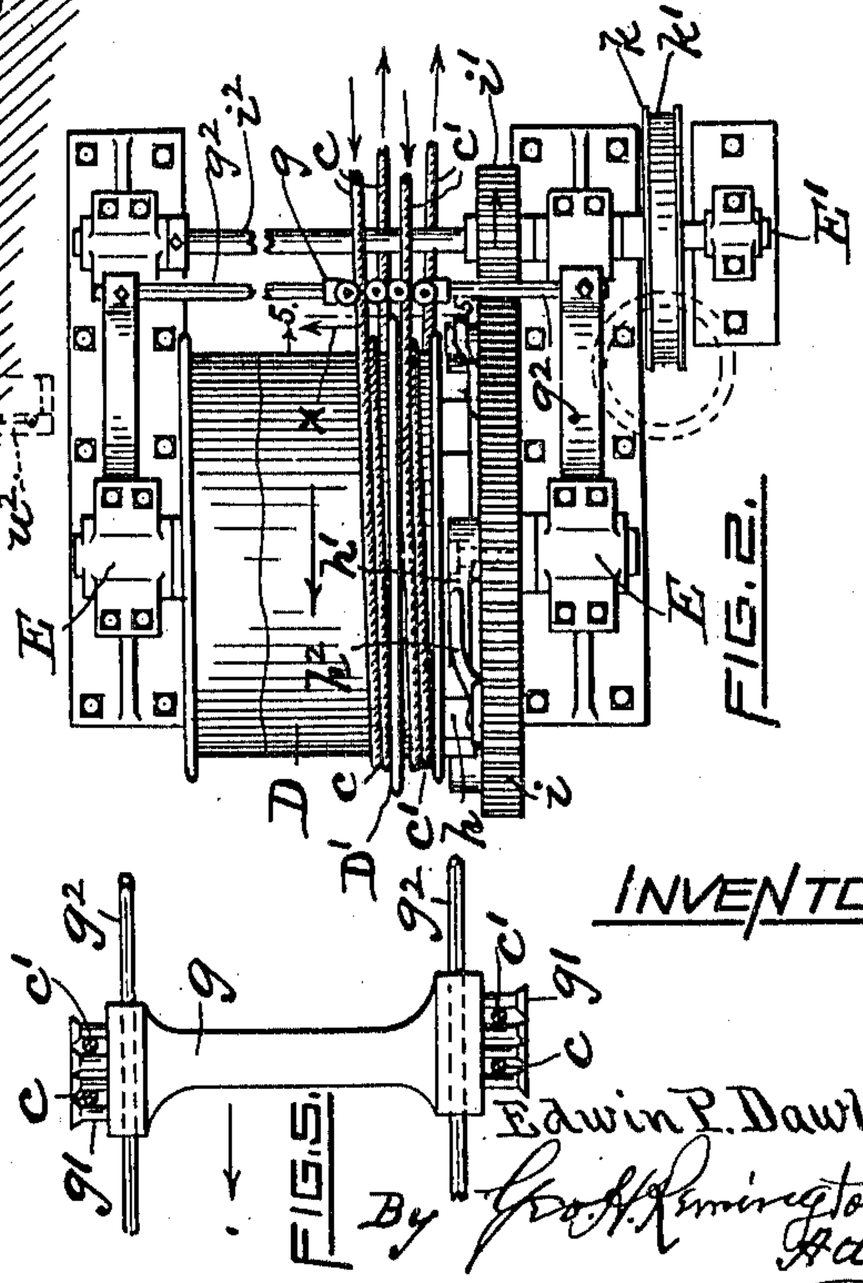

FIG. 5.

WITNESSES:

C. L. Hannigan.

Calvin K. Brown

INVENTOR:

Edwin P. Dawley.

By Geo. H. Remington.

Atty.

E. P. DAWLEY.

SAFETY APPLIANCE FOR CABLE RAILWAYS.

APPLICATION FILED DEC. 1, 1909.

986,807.

Patented Mar. 14, 1911.

3 SHEETS—SHEET 3.

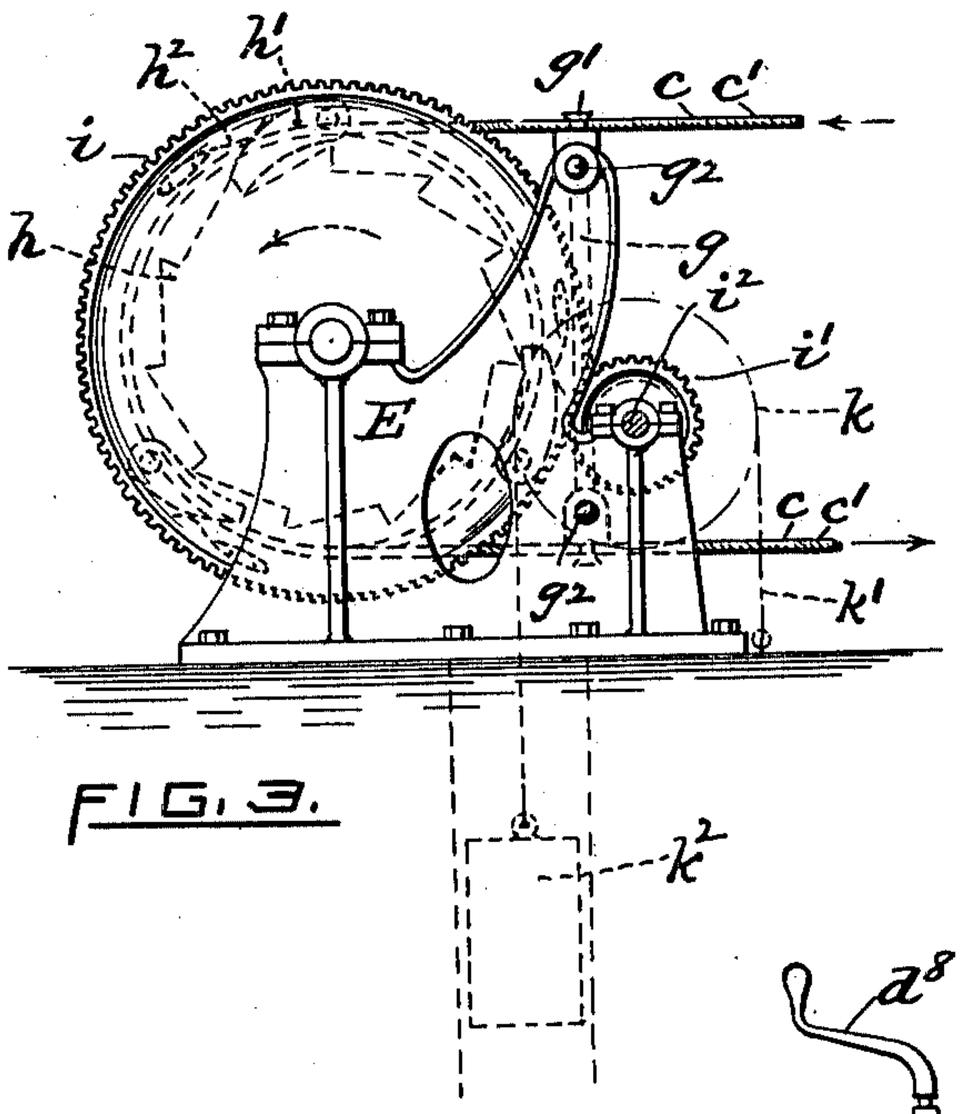

FIG. 3.

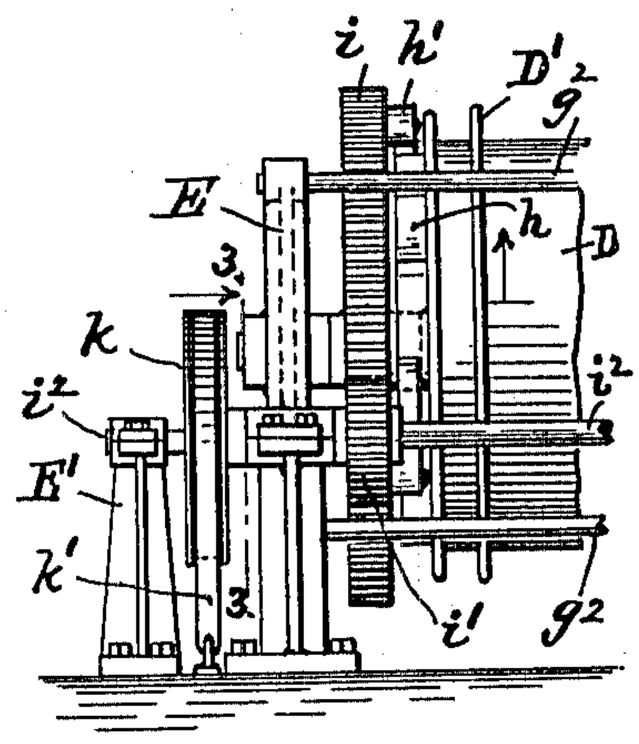

FIG. 4.

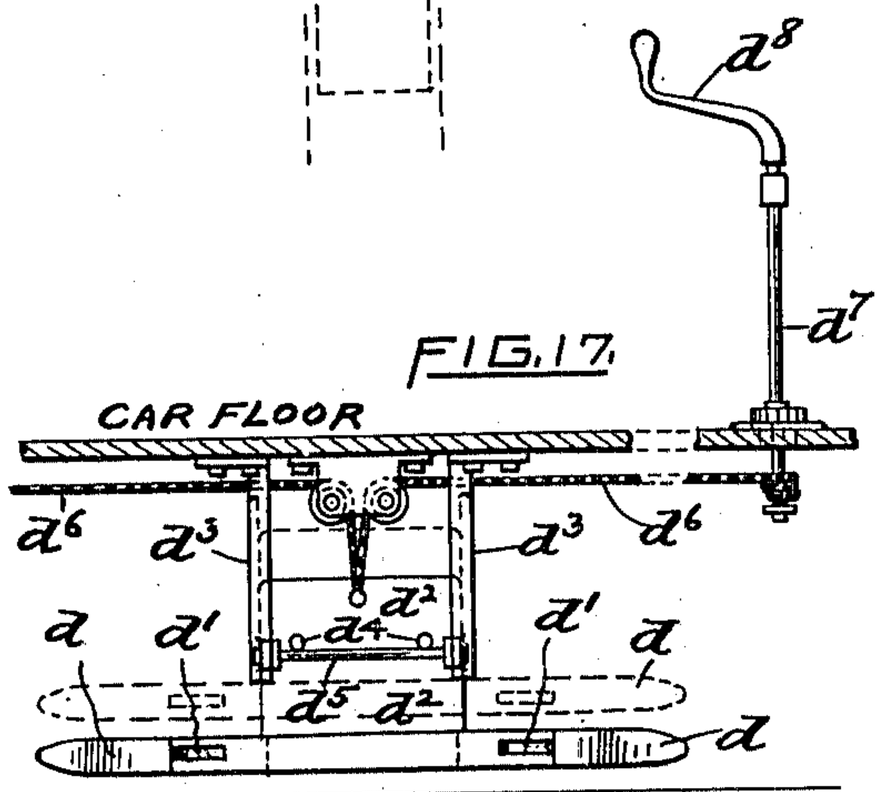

FIG. 17.

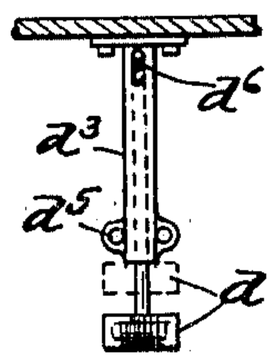

FIG. 18.

WITNESSES:

C. F. Hannigan.

Calvin H. Blinn

INVENTOR:

Edwin P. Dawley.

By Geo. H. Remington.

Atty.

UNITED STATES PATENT OFFICE.

EDWIN P. DAWLEY, OF PROVIDENCE, RHODE ISLAND.

SAFETY APPLIANCE FOR CABLE-RAILWAYS.

986,807. Specification of Letters Patent. Patented Mar. 14, 1911.

Application filed December 1, 1909. Serial No. 530,765.

To all whom it may concern:

Be it known that I, EDWIN P. DAWLEY, a citizen of the United States, residing at Providence, in the county of Providence and State of Rhode Island, have invented certain new and useful Improvements in Safety Appliances for Cable-Railways, of which the following is a specification.

This invention relates to improvements in safety appliances for cable railways, and it consists in the novel construction, arrangement and combination of devices, all as hereinafter set forth and claimed.

The invention forming the subject of this application for Letters Patent is, however, more especially adapted for use in connection with inclined railways employing a counterweight system wherein the cars are adapted to be indirectly connected temporarily to a weight-controlled cable, or cables, mounted in a slotted conduit containing the counterweight; the arrangement being such that the latter operates to assist the car up the hill or incline and also controls its descent.

In counterweight systems for inclined railways it has been usual heretofore to employ what are termed "grip"-cars adapted to be coupled to the passenger cars or "trailers". In such former systems each grip-car usually carries a "crew" of two persons—a motorman and an assistant, the latter's duties being to couple and uncouple the grip-cars to and from the passenger-cars at the termini and also to detachably connect the grip-car to the weight-propelled cable.

One of the objects sought to be attained by the present invention is to provide the weight-actuated cable of a counterweight system with clutch mechanism adapted, in coöperation with a companion member or connector permanently mounted beneath and carried by the car, to automatically interlock with said member when the parts are in juxtaposition at either terminal, and also adapted to automatically unlock or disengage the car from the cable-clutch when the car arrives at the opposite terminal. As thus devised, grip-cars *per se* and their crews are dispensed with, thereby materially reducing the cost of equipment and maintenance.

A further object is to provide the system with additional safeguards, whereby the liability of accidents is reduced to a minimum. These devices or appliances include the employment of an auxiliary of safety hauling-cable, mounted to wind around and unwind from a revoluble drum concurrently with the main hauling-cable, which is similarly mounted on the drum and connected to the counterweight.

A further object of the invention is to provide the system with a normally concealed, vertically movable safety "bumper" or obstruction located at or near the upper terminal of the incline, the bumper member being automatically elevated above the tracks a suitable distance immediately after the upwardly moving car has passed and at substantially the same time that the car is unlocked from the clutch. The said obstruction remains thus elevated until the next "down" car is positively locked to the then stationary clutch. The latter, now in its descent, trips and releases the bumper, which then drops to its limit, a cover at the same time automatically closing the opening. Obviously, the bumper is retracted before the car arrives at that point.

Another object of the invention is to provide means for relieving the strain or tension of the counterweight upon the cables while the clutch is at the lower terminal.

In the accompanying three sheets of drawings, illustrating my improved cable-railway system and safety appliances, Figures 1 and 1½ represent, in side elevation and longitudinal section, the invention as applied to an inclined railway; the counterweight, cables, &c., being shown in the normal position preparatory to hauling a car up to the other terminal. Fig. 1½ is a continuation of Fig. 1. Fig. 2 is a top plan view, in enlarged scale, of the cable-winding drum and its mechanism, located at the upper end of the cable conduit. Fig. 3 is a corresponding front end view of the drum, &c., the friction-brake device being omitted, the section corresponding with line 3 3 of Fig. 4. Fig. 4 is a partial side elevation of the drum, &c., the cables being omitted. Fig. 5 is a side view of the slidably supported cable-guide, as viewed from line 5 5 of Fig. 2. Fig. 6 is a partial transverse sectional view of the drum, in enlarged scale, taken on line 6 6 of Fig. 7, showing a modification of the slidable cable-separator. Fig. 7 is a corresponding longitudinal sectional view, taken on line 7 7 of Fig. 6. Fig. 8 represents a plan view of the counterweight, detached. Fig. 9 represents a plan view of the bumper connections, &c.,

corresponding with Fig. 1½. Fig. 10 is a side elevation, in partial section and enlarged scale, showing the connector member (carried by the car) locked to the clutch, the latter being firmly secured to the cables. Fig. 11 is a corresponding plan view, the sectional portion being taken on line 11 11 of Fig. 10. Fig. 12 is a transverse sectional view taken on line 12 12 of Fig. 10. Fig. 13 represents, in side elevation, the said interlocked members when advanced nearly to the upper terminal and also showing means for positioning a pair of hook-releasing pins. Fig. 14 is a partial plan and horizontal sectional view showing the hooks released from the connector member. Fig. 15 is a corresponding side elevation after the car with its attached connector has left the clutch, &c., at the end of the upper terminal; and Fig. 16 is a partial horizontal sectional view taken on line 16 16 of Fig. 15.

In the drawings, which represent the improvements forming the subject of this application for patent, *a* designates a suitable conduit in which the cables and coöperating mechanisms or devices are mounted. For the sake of clearness in the drawings some of the minor details, such, for example, as small guide-wheels for the cables, track supports, &c., are omitted from Figs. 1 and 1½.

It may be stated here that the main hauling-cable *c* has its upper end, c^2, fixed or immovable, the other or lower end being secured to a vertically movable weight, a^2; the latter being employed to compensate for any elongation of the cable; to keep it taut, and also prevent undue slackness. The weight movement, however, is comparatively short. The cable is supported on a wheel, w^1, located at the lower end of the inclined railway and conduit and extends upwardly to and around a wheel, w^2, mounted in and carried by the movable counterweight A, thence downward to and around a supporting wheel, w^3, and again upwardly in the conduit to and around the main winding-drum D, located at the upper end of the passage *a*, thence downward from the lower side of the drum to and around a wheel, w^4, mounted in the weight A, and terminates at the said fixed end part c^2. A clutch, adapted to have cars detachably connected thereto; is properly positioned on and rigidly secured to that portion of the cable which extends direct from the upper side of said lower supporting wheel, w^3, to the upper side of the winding-drum. The manner of thus mounting the cable and the connected counterweight is such that when in normal action the ratio of travel of the clutch-carrying portion of the cable is 100 per cent. greater than that of the counterweight, or, in other words, the clutch is moved two feet while the concurrently traveling weight member, actuating the cable, moves one foot: the direction of travel of said members being always opposed to each other.

The auxiliary or safety hauling-cable c^1 is indicated generally by the broken line. One end of it is rigidly secured to the clutch B and extends upwardly therefrom, substantially parallel with the corresponding portion of the main cable to and around the drum D, thence downward from the latter to and around a wheel or sheave, w^5, revolubly mounted in the counterweight A, then over a supporting wheel, w^6, the end of the cable being attached to the vertically movable weight a^3, the function of the latter being substantially the same as stated with respect to the weight a^2. The thickness, as well as the degree of flexibility, strength, &c., of the safety cable are the same as possessed by the main hauling-cable. The said counterweight A is supported on a carriage adapted to travel up and down the conduit, the length of such movement corresponding with the predetermined length of the clutch's travel. The conduit may be enlarged near its upper end so as to form a substantially level base, a^1 (Fig. 1½), on which the weight is adapted to rest when the system is temporarily inactive, the clutch then being stationary at the lower end of the runway. See also Fig. 1. When in this position, practically no tension whatever is imposed upon the cables by the weight A; the other or smaller weights and connections at the same time serving to keep the cables normally taut.

The drawings represent the improved inclined railway system as capable of being utilized in connection with cars as usually constructed and adapted to be normally propelled by electricity flowing from an overhead trolley-wire, *w*. The cars in this case are each simply additionally provided with a suitably located connector member, *d*, later described, positioned below the car floor and in alinement with the self-closing jaws of the clutch-head, with which latter the connector is adapted to interlock. Means, controlled by the motorman, are provided whereby, if desired, the connector may be raised a short distance above the normal working position after it is disconnected from the clutch. It may be added that generally throughout the drawings the arrows indicate the corresponding direction of movement or travel of the cables, counterweight, &c., when a car is clutched to the cables and beginning to move up the incline, the propelling forces then being the electric current combined with the pull of the counter-weight A.

The lower portion of the clutch member B extends downward through the center slot *s* formed between the slot-rails s^1 (Fig. 12), and is rigidly secured to the main hauling-cable *c* and, as drawn, to the safety-

cable c^1. If desired, the latter cable may be further secured by clamping its adjacent end to the cable c, as shown at c^3, Fig. 10. The head portion, b, of the clutch extends horizontally above the track; the same being comparatively long and hollow, and having a narrow longitudinal central slot, b^1, formed in its top flange. The ends of the slot are made quite flaring for guiding the connector into the head b. The latter is provided with two pairs of oppositely disposed, reversely arranged, swinging steel hooks or side jaws, m, each having the inner edge of its outer or free end beveled. The side walls of the head part are provided with slotted holes, b^2, to freely receive the hook part proper of the jaws; when normally closed the points of each pair of hooks are slightly separated,—see Fig. 11. Springs n serve to maintain the jaws in the thus closed position.

At each terminal of the clutch movement the slot s is provided with a pair of relatively long and narrow stationary guide members p^1; these extend above the track a short distance and form a support for the clutch, thereby positioning the latter so that its head part, b, will be in alinement with and adapted to freely receive therein and automatically interlock with the connector member d of the car upon its arrival, the cables and weight A then obviously being stationary.

A pair of laterally separated, vertically movable connector-releasing pins, p, are mounted at each terminal contiguous to said guide members p^1. See Figs. 13 to 16, which represent the pins of the upper terminal, and the relative positions of the clutch, &c. These pins are actuated by a pair of suitably bent swinging levers, e, each pivoted on a fixed fulcrum, e^1 (Fig. 13), arranged for the passage of the thin clutch part therebetween. The clutch carries two pairs of oppositely disposed rolls, r, the forward pair, when the clutch is in action, being adapted to engage the heel portion of the levers (shown in Fig. 13) and swing them upward a short distance, thereby correspondingly forcing the upper portion of the pins p through the bearings and positioning them in advance so as to be engaged by the beveled forward ends of the respective spring-pressed jaws m. The further continued movement of the clutch operates to force the forward jaws apart (Fig. 14), at which instant the clutch will cease moving, the connector d, attached to the car, meanwhile passing out of the clutch. Figs. 15 and 16 represent corresponding positions of the latter, &c. In order to keep the jaws open and also to provide means for holding the clutch in place until the next "down" car arrives, the clutch has a thickened end member, r^1, secured thereto, adapted to enter between the two fixed yielding side springs t; a suitable center spring, r^2, backed by a fixed abutment C, at the same time acting to absorb or resist the correspondingly slight impact force due to the engagement of said members—see Figs. 15 and 16. The said connector member d is, as drawn, somewhat longer than the clutch-head, is rectangular in form cross-sectionally, and has pointed ends. It is provided with oppositely disposed openings, d^1, conforming to and adapted, when in use, to receive therein and automatically interlock with the adjacent hook-shaped ends of the four swinging jaws m. These hooks, as well as the said openings, are devised so that the clutch and connector members are positively locked together when traveling in either direction, and cannot become accidentally unlocked. That is to say, the arrangement is such that the members remain locked together whether the car actuates the cables or vice versa, and also when working conjointly.

In some cases it may be deemed desirable to provide means for temporarily elevating the connector bodily, say from the lower or normal working position to the dotted line position, substantially as represented in Figs. 17 and 18. In such event, the central thin blade, d^2, may be vertically guided in fixed ways, d^3, secured to the car; stops d^4, in coöperation with stationary tie-bolts, d^5, serving to limit the connector's downward movement. In this case, the latter is under the control of the motorman through the medium of a crank, d^8, secured to a vertical rod, d^7, extending downward through the car's platform, and a flexible connection, d^6, attached to the blade and wound around the base of said rod, analogous to the well-known brake mechanism. The device may be controlled from both ends of the car, as indicated in Fig. 1.

In order to provide a further safeguard against accidents, I may employ a pair of laterally separated, vertically guided "bumper" members, H. When dropped to the normal position, the top ends then lie just below the track surface, and are protected by self-closing covers, H^1. To the forward side of each bumper is attached a suitably mounted flexible connection, u^2, fastened to a supported, wheeled clutch, u, constructed to be engaged and actuated by the cable-clutch B in its upward travel; the parts being so related that the bumpers will be fully elevated when the clutch arrives at the upper terminal; the corresponding position being indicated by dotted lines in Fig. $1\frac{1}{2}$. The return car, when connected to the waiting clutch, will in its descent release the said member r^1 from the holding spring t; the weight of the retreating bumpers at the same time maintaining the catch v in contact with the clutch until the catch is

arrested by the fixed stop-pins u^1 (see also Fig. 9), at which instant the bumpers and covers will have dropped to their normal positions; the clutch-locked car, &c., then continuing uninterruptedly until the lower terminal is reached.

The cable-winding drum D (see Figs. 2, 3, and 4) and its coöperating mechanism are located in the upper end of the conduit and beyond the clutch terminal. The drum is turned true and cylindrical and is secured to a shaft revolubly mounted in end bearings formed in the two vertical main frames E. The front end of the drum is provided with integral ratchet-shaped teeth h. A laterally slidable cable-separator member or flange, D^1, is mounted on the barrel of the drum; the function of said flange being to prevent the two hauling-cables c, c^1, from riding or crowding each other, and also to permit them to render freely while traveling along the barrel corresponding with the "lead" of the cables. The latter, as drawn, are properly positioned with respect to a car commencing to mount the inclined railway. The arrow x, Fig. 2, indicates the direction of lateral movement of the cables bodily while they are being simultaneously wound upon and unwound from the drum. In order to maintain a more uniform distance between the cables, I have represented a combined guide and separator, g, laterally slidable on the upper and lower supporting rods, g^2, located on the leading side, and secured in the said frames E. Each cable passes between a pair of suitable spools, g^1; the series of top spools being offset with relation to the lower spools, which latter guide the cables as they unwind from the drum—see Fig. 5. Between the said ratchet end of the drum and the front frame is located a large spur-gear, i, the same being freely revoluble on the drum's shaft. The frames E are provided with bearings carrying a revoluble shaft, i^2, to which is secured a pinion-gear, i^1, meshing into the gear i, all as clearly shown. The pinion-shaft is extended in front and is supported in the short standard E^1. A friction-brake wheel, k, carrying a flexible band, k^1, is secured to said shaft-extension; one end of the band is fixed, the other being attached to a suitable weight, as k^2. The gear i carries a plurality of swinging pawls. h^1, engageable with the said ratchet-teeth h. Springs, h^2, serve to maintain the pawls in continuous engagement with the teeth.

While the car is being hauled up the inclined way, the weight A at the same time descending in the conduit, the cables, drum and guides will move in the arrow directions indicated in Figs. 2 to 5, inclusive, the gears i and i^1 remaining stationary. Conversely, while the car clutched to the cables is descending the railway, the drum will rotate in a direction contrary to the arrows, the unwinding side of the cables then being at the top; in this case the drum will, through the medium of its teeth h and said pawls, automatically rotate the gears; the resistance of the suitably weighted brake-band, in connection with the resistance of the counterweight at the same time, being sufficient to hold the car stationary at any point on the inclined portion of the railway in case the power is cut off. That is to say, the motive power or electric current is also employed to propel the car down the incline, the weight, &c., operating, however, to retard its descent.

The flange or collar D^1 is movably mounted on the revolving drum's barrel; it is located between and separates the two cables c and c^1, and is adapted to slide bodily back and forth longitudinally of the drum by reason of and concurrently with the lateral movements of the cables, corresponding with the winding and unwinding process. The drum's periphery may be provided with a plurality of longitudinally extending guide-grooves, f^1, each having a short, key-like member f slidably fitted therein and secured to the inner diameter or bore of the flange; the outer face of the members f being flush or coincident with the drum's surface. See Figs. 6 and 7.

Assuming now the car, counterweight, &c., to be in the positions substantially as represented in Figs. 1, $1\frac{1}{2}$ and 2, the slowly moving car will, in advancing, introduce its connector d between the adjacent open jaws of the then supported stationary clutch, the connector immediately thereafter engaging and wedging apart the slightly separated ends of the spring-pressed jaws of the forward or opposite end of the clutch; at the instant the forward openings d^1 of the connector coincide or register with the hooks the latter spring into the openings, thus locking the member d to the car; the car in advancing forces the clutch ahead, thus releasing the rear jaws from the pins p, the hooks then springing into the adjacent rear openings of the clutch-head, thereby completing the locking operation; the pins p at the same time being automatically retracted. The continued movement of the car draws the cable-connected counterweight from the recess a^1 and, in coöperation with the motive power, propels the car uninterruptedly to the upper terminal, the clutch, &c., then positioning the upper pins p, which immediately thereafter are engaged by the forward jaws, thus opening the latter; the moving car next withdraws the connector from the rear hooks of the then stationary clutch and continues on its route. It may be explained that the beveled sides of the openings in the connector and the beveled edges of the adjacent hooks readily

permit the parts to become unlocked after the forward hooks have been opened or sufficiently separated. Just prior to reaching the upper terminal the clutch picks up the catch *a* connected to the bumpers H and elevates the latter to the predetermined height. These bumpers form a positive obstruction against the downward passage of a car unless it is first properly locked to the clutch, as hereinbefore stated. When the clutch is at the upper terminal, the counterweight will be at or near the bottom of the conduit, the cables then being at the rear end of the drum.

In the event that the motive power be suddenly cut off or stopped from any cause while the thus equipped and connected car is being hauled or propelled up the inclined track, no accident can result, because at the instant the car commences to descend, the movement of the drum is immediately reversed, thereby rendering the brake mechanism active, and automatically stops the car. Car-hauling mechanisms, as usually devised and constructed, are unprovided with means for automatically stopping a car in case the power is accidentally cut off while it is ascending an inclined track. In such event the motorman can only rely mainly upon the hand-braking means to check the car's descent.

While I have represented, described and claimed what I consider the most efficient and practical arrangement of the several devices which constitute my invention, I do not desire to thus limit the same, since constructional changes or modifications may be made therein without departing from the spirit and scope of the invention. For example, the travel ratio of the counterweight and clutch may be varied; the two cables may be secured together at a point immediately forward of the clutch, and the latter secured direct to the main cable only, the function and action of the cables and clutch obviously being the same in any case. I would further state that, while I have represented and described herein the clutch-head *b* and its jaws, the connector *d*, devised and constructed to coöperate with the clutch jaws, and the combined cable-guide and separator member *g*, as being well adapted to be employed in combination or association with my claimed invention, I disclaim as my invention the said clutch-head, jaws, connector and combined guide and separator elements.

What I claim is:

1. In an inclined cable-railway system provided with a mounted main hauling-cable, a movable counterweight connected thereto, and a revoluble drum on which the cable is wrapped, the combination therewith of an auxiliary or safety hauling-cable, disposed substantially parallel with portions of the main cable and adapted to coöperate and move in unison with it, also connected to said counterweight and wrapped around the drum, and a clutch member secured to the cable, said clutch member being devised and adapted to interlock with a car.

2. In a railway system of the character described, the combination of a plurality of mounted hauling-cables, means for effecting and controlling the movements of the cables, and a clutch member permanently connected to the cables, said clutch capable of being detachably secured to a car.

3. In a railway system of the character described, the combination of a hauling-cable, a revoluble drum having one or more turns of the cable wrapped thereon, a counterweight connected to the cable, a clutch member adapted to interlock with a car, positioned on and secured to the cable, and means for automatically guiding the said wrapped portions of the cable bodily and longitudinally of the drum's barrel while the cable is being wound upon and unwound from the drum.

4. In a railway system of the character described, provided with a plurality of suitable hauling-cables, a movable counterweight continuously connected therewith, and a conduit having said cables and counterweight mounted therein, a recess or chamber in direct open communication with the inclined portion of the conduit, having a substantially level base for supporting the counterweight thereon, thereby temporarily relieving the cables from the strain or pulling force of said weight.

5. In a railway system of the character described, provided with a weighted hauling-cable capable of being detachably connected to a car, the combination therewith of a revoluble drum having one or more turns of the cable wrapped around its barrel, a revoluble gear positioned with respect to the drum, means connecting the drum and gear members whereby one of them is capable of movement independently of the other, and a friction-brake device arranged to become automatically operative through the medium of said drum and gear for checking or retarding a car normally descending the inclined track and also capable of automatically stopping an ascending car in case the motive power is accidentally cut off.

6. In a railway system of the character described, the combination of a revoluble drum, a hauling cable mounted thereon, adapted to be connected to a car, and an annular flange slidably mounted on the barrel of the drum; said flange movement being produced by the lateral pressure of the cable thereagainst while the drum is in motion.

7. In a railway system of the character described, the combination of a revolubly mounted drum member, a pair of hauling ca-

bles wrapped thereon in a plane common to both cables, and an annular flange laterally movable on the drum's barrel, disposed between and separating the two cables, substantially as hereinbefore described and for the purpose set forth.

8. In a railway system of the character described, provided with a hauling-cable, the combination of a normally dropped bumper, means adapted to be actuated by the said cable for elevating the bumper above the surface of the track, and a self-dropping cover for closing and concealing the opening through which the bumper passes.

9. In a railway system of the character described, provided with a hauling-cable adapted to be detachably connected to a car, a movable bumper element, and means connected to the bumper operatively controlled by said cable to elevate the bumper immediately after the upwardly moving car has passed and to maintain said bumper in position until released.

10. In a railway system of the character described, a main hauling-cable, and a clutch secured thereto provided with self-closing, hook-shaped jaws, in combination with a suitably propelled car, a connector member secured to and carried by the car, adapted to enter said clutch and automatically interlock with its jaws, and manually controlled means mounted on the car and attached to the connector, whereby the latter is capable of being raised bodily above the normal working position to increase the distance between it and the track.

In testimony whereof, I have affixed my signature in presence of two witnesses.

EDWIN P. DAWLEY.

Witnesses:
GEO. H. REMINGTON,
CHARLES C. REMINGTON.