(No Model.) 4 Sheets—Sheet 1.

M. H. BRONSDON.

INCLINED RAILWAY.

No. 566,373. Patented Aug. 25. 1896.

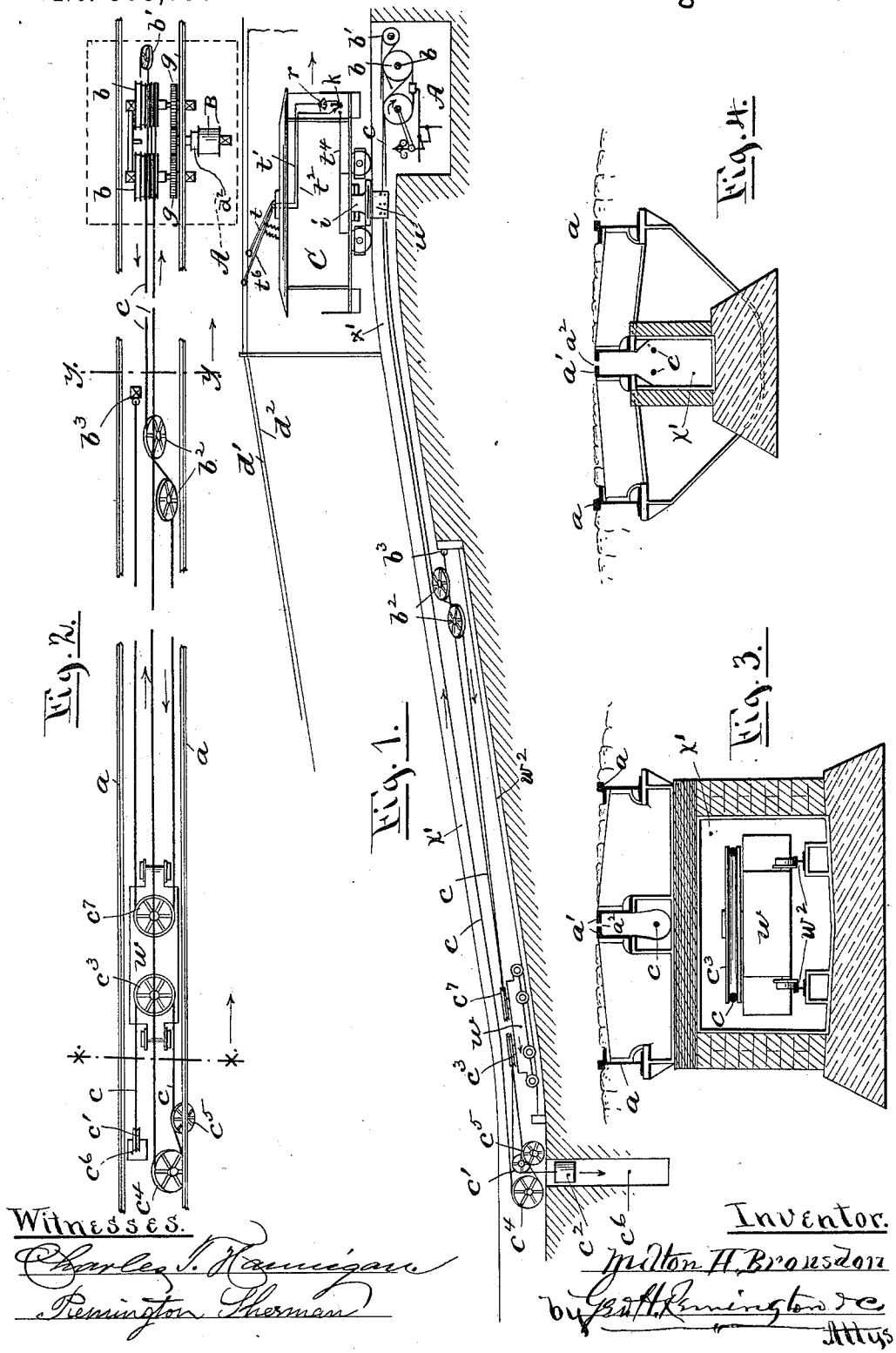

Fig. 1.

Fig. 4.

Fig. 2.

Fig. 3.

Witnesses.
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Inventor.
Milton H. Bronsdon
by Gratt Remington & Co
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(No Model.) 4 Sheets—Sheet 2.

M. H. BRONSDON.

INCLINED RAILWAY.

No. 566,373. Patented Aug. 25, 1896.

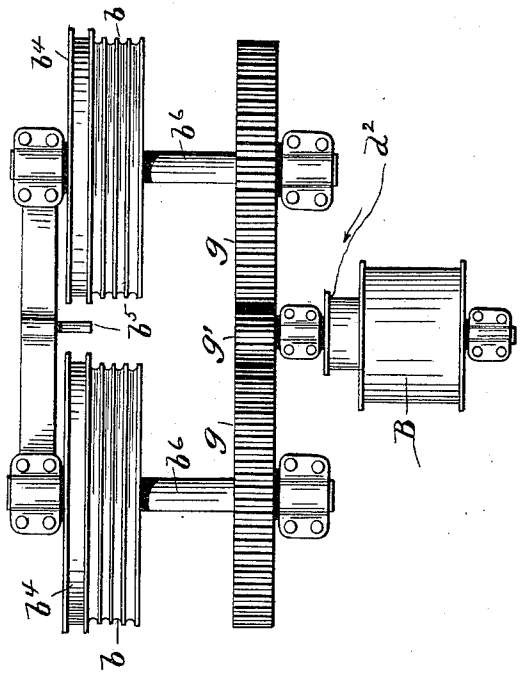

Fig. 6.

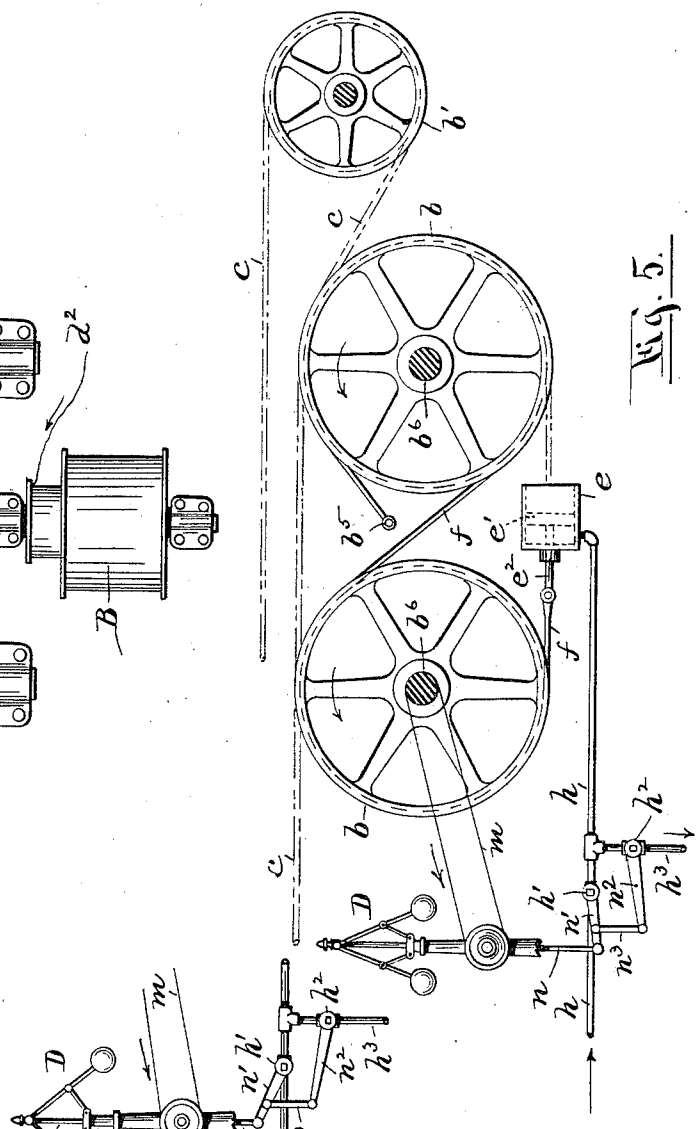

Fig. 5.

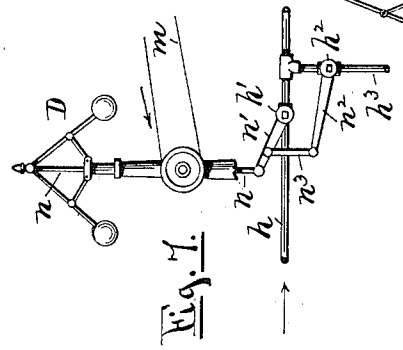

Fig. 7.

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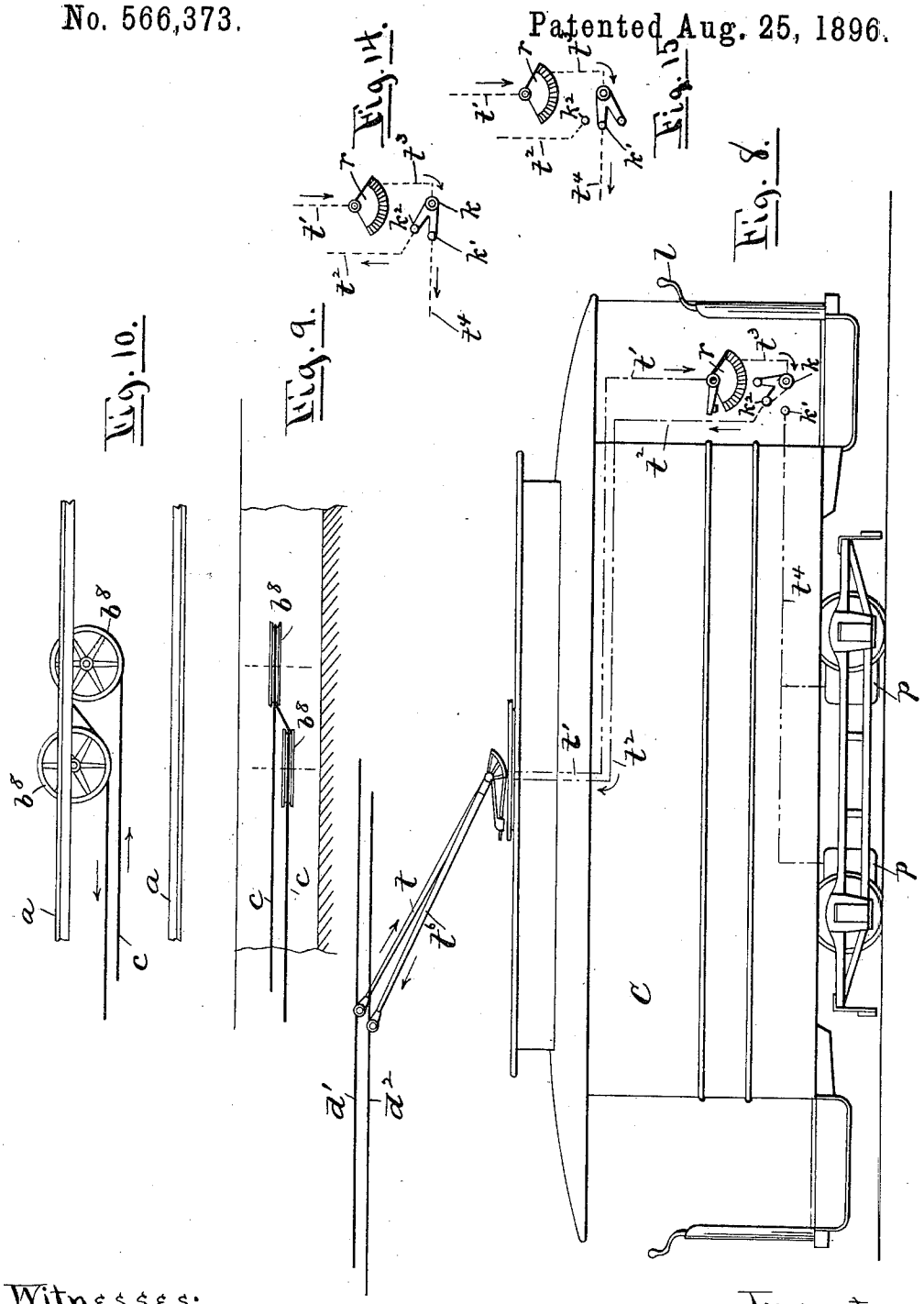
(No Model.) 4 Sheets—Sheet 3.

M. H. BRONSDON.

INCLINED RAILWAY.

No. 566,373. Patented Aug. 25, 1896.



Witnesses:

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(No Model.)

4 Sheets—Sheet 4

M. H. BRONSDON.

INCLINED RAILWAY.

No. 566,373. Patented Aug. 25, 1896

Fig. 12.

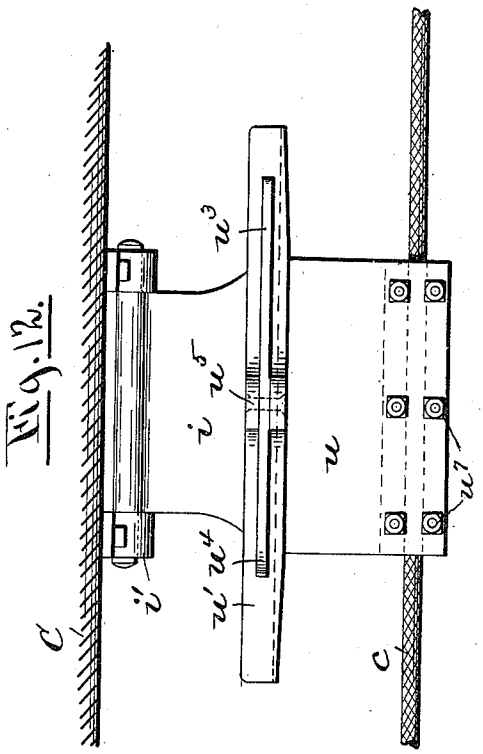


Fig. 13.

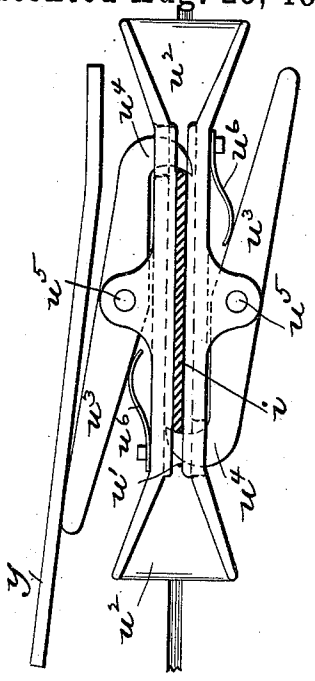
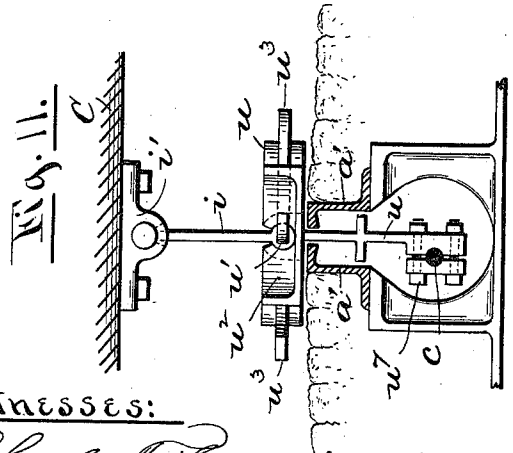
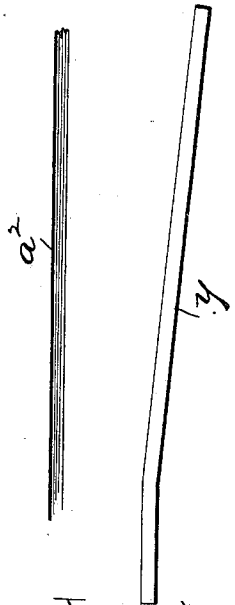


Fig. 11.





Witnesses:

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Remington Sherman

Inventor:

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Attys

UNITED STATES PATENT OFFICE.

MILTON H. BRONSDON, OF PROVIDENCE, RHODE ISLAND.

INCLINED RAILWAY.

SPECIFICATION forming part of Letters Patent No. 566,373, dated August 25, 1896.

Application filed June 29, 1896. Serial No. 597,347. (No model.)

To all whom it may concern:

Be it known that I, MILTON H. BRONSDON, 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 Inclined Railways; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters of reference marked thereon, which form a part of this specification.

My present invention relates to improvements in inclined railways, or rather to means for controlling the movements of street or tramway cars in ascending and descending gradients and forming part of a tramway system.

In inclined railways communicating, say, at either end with and forming a continuous part or continuation of the more level portions of the railway it has been usual heretofore to provide such inclined ways with conduits having movable endless ropes or cables mounted therein combined with counterweights connected with the cables and means for detachably securing the latter to the car.

The object I have in view is to provide inclined railways with an improved system for increasing the efficiency and safety of such railways, the invention being more particularly applicable to roads where traction alone is not to be depended upon to move the cars up and down the incline.

In my invention I employ the electric or trolley system of propulsion so arranged that the weight of a descending car gripped to a cable operates to elevate a heavy counterweight rigidly secured to the cable, the latter being mounted in a conduit parallel with the tracks or rails. The power of the electric current combined with said elevated counterweight operates to elevate or haul the car up the incline, an automatically-operating tripping device being employed to detach or ungrip the car from the cable.

My invention further consists in providing the incline portion of the railway with an auxiliary conductor or trolley and an electric motor mounted in the conduit capable of actuating said cable and counterweight, combined with a suitable multipolar switch and connecting means mounted on the car, whereby the electric current may be readily diverted from the main conductor to said auxiliary conductor through the medium of the switch to said motor, or, if desired, the current may be utilized for operating the car-motor and cable-motor conjointly by simply changing the poles of the switch. Another feature of my invention resides in providing the cable with an automatic power braking device for controlling the speed of the car, both in ascending and descending, all as will be more fully hereinafter set forth and claimed.

In the four accompanying sheets of drawings, illustrating my invention, Figure 1 is a side elevation showing the position and relation of the parts when the car has arrived at or near the top of the grade and is still attached to the cable, the conduit being in section. Fig. 2 is practically a plan view of the cable mechanism, the car being omitted. Fig. 3 is a transverse section taken on line $x\ x$ of Fig. 2. Fig. 4 is a similar section taken on line $y\ y$ of Fig. 2. Fig. 5 is a side view, in enlarged scale, showing the cable-winding drums and automatic controlling mechanism or power-brake, the gearing and cable-actuating motor being omitted. Fig. 6 is a plan view including the motor and gearing. Fig. 7 is a partial side view of the governor or controlling mechanism, showing a position of the parts when the brake is in action. Fig. 8 is a side elevation of a tramway or trolley car as provided with means by which the electric current may be shunted or diverted to an auxiliary motor arranged to actuate the winding-drums shown in Figs. 1 and 2. Fig. 9 is a side view showing a modified form of cable-pulleys adapted to be located at the upper end of the inclined railway in lieu of the winding-drums. Fig. 10 is a plan view of the same. Fig. 11 is a transverse section, taken through the car-base, slot-rails, and cable, showing the gripper or carrier clamped to the cable as in use. Fig. 12 is a corresponding side view of the parts. Fig. 13 is a plan view, the same also showing tripping or releasing means fixed at the upper and lower ends of the inclined railway.

Fig. 14 shows the position of the switch when set to divert the electric current to the car and cable motors simultaneously; and Fig. 15 shows the switch when conducting the current to the car-motor, the cable-motor then being cut out.

In the drawings, x', Fig. 1, indicates the conduit, located below the surface of the inclined railway, the conduit as drawn being arranged between the track-rails a a. (See Figs. 3 and 4.) The lower portion of the conduit is made larger than the upper part, so as to freely receive the counterweight w, the latter mounted on truck-wheels adapted to run up and down on suitable tracks w^2. The upper end of the conduit is enlarged to form a chamber A, containing the winding-drums b and their driving mechanism, soon to be described. The said winding drums or wheels b are grooved to receive a few wraps of the cable c. (See Figs. 5 and 6.) The drums are secured to horizontal shafts b^6, mounted in suitable bearings. They are adapted to be rotated simultaneously in either direction through the medium of the large spur-gears g, secured to said shafts, and the small driving or pinion gear g', intergearing therewith. B indicates an electric or other suitable motor having the said pinion-gear fixed to its axle. Thus it will be apparent that upon energizing the motor the drums and cable will be brought into action. The said cable c is not an endless cable. Its lower or free end passes over a guide-wheel c' and is attached to a comparatively small movable tension-weight c^2, adapted to work in the vertical hole or chamber c^6. The cable extends from said wheel c' upwardly along the conduit and around the lower horizontal wheel or sheave c^3 of the counterweight w, thence back and around the two fixed guide-wheels c^5 c^4, the latter deflecting the cable upwardly over the counterweight and along the conduit, its relation to the slot a^2, formed between the center or slot rails a', being such that it is readily accessible from the street-surface. (See Fig. 3.) The cable passes thence to and around the winding-drums b, and from the latter to the fixed forward guide-wheel b', Figs. 1 and 2, thence downwardly therefrom along the conduit to the two fixed deflector-wheels b^2 and around the forward horizontal guide-wheel c^7 of the weight w, and finally from the latter upwardly in the conduit to a point b^3, where it is made fast. The tension-weight c^2, Fig. 1, is employed for the purpose of taking up the slackness of the cable, thereby keeping the latter taut at all times.

To the central or main working portion of the cable is secured a "carrier" u, the same being clamped to the cable by bolts u^7. (See Fig. 11.) The web portion of the carrier extends upwardly through the slot a^2 and is surmounted by an elongated head having a longitudinal slot u' therein, the entrance or guideway at each end of the slot being made divergent or flaring, as shown at u^2, to allow the gripper-arm i free entrance to the slot. The opposite sides of the said head part are provided with ears in which are pivoted the grip or hook levers u^3, the hook portion u^4 thereof passing through lateral openings communicating with the ends of the slot and adapted to engage the corresponding ends of the gripper-arm i. By means of this arrangement the parts are locked together, springs u^6 being employed to keep the levers normally closed, as shown in Fig. 13. The said gripper-arm i is mounted in bearings or supports i', rigidly secured to the under side of the car C. Therefore when the gripper is locked to the carrier u it is clear that the car will travel in unison with the moving cable as long as the parts are thus locked together.

In order to automatically release the car from the cable, I provide a tripping device at each end of the inclined railway. As drawn said device consists simply of a short rail or bar y, located at one side of and at an angle with the slot a^2 of the center rail. It is also located in the path of the grip-lever, the arrangement being such that the carrier in its forward movement causes the free end of the grip-lever to engage the bar y, thereby automatically withdrawing the corresponding hook portion u^4 away from the gripper-arm and uncovering the forward end of the slot u', thus releasing the car from the cable. Upon the arrival of another car from the opposite direction the gripper-arm thereof enters the slot u' and engages the forward hook-lever, thereby giving an initial movement to the carrier and cable, at which instant the rear hook-lever, being then forced from the bar y, swings into position, thus securely locking the car to the cable. The force or power employed then operates to propel the car ahead to the opposite end of the inclined way, followed by automatically releasing the car from the carrier by means of the tripping device or bar y, located at that end of the way, the operation being substantially as before described.

In lieu of using the counterweight system alone for propelling the car up the inclined railway, the cable may be actuated by electromotive force—that is to say, assuming the line to be equipped under the trolley system and provided with the main conductor d', &c., as usual. In such case the cable may be driven by a pair of drums b, worked by an electric motor B, suitably mounted in the chamber A, located at the upper end of the conduit x', as before described. In such event the said main conductor may be paralleled along the inclined way by a conductor d^2, insulated from the main d'. The motor or trolley car C itself may be provided with the usual yielding trolley-pole t, rheostat or controller r, motors p, and suitable wires for conducting the electric current from the main line d' to the motors. In addition thereto the car is provided with means whereby the motorman on the car can readily switch or divert the current from the main conductor to the said cable-driving

motor B. The car, as drawn, (see Fig. 8,) is further provided with an auxiliary trolley-pole t^6, arranged to receive current from the conductor d^2, also a bipolar switch k and conductor t^3, connecting said switch and rheostat. A conductor t' unites the pole t and rheostat, a similar conductor t^2 uniting the pole t^6 and terminal k^2. A suitable conductor t^4 connects the car-motors p with the other terminal k'; or, in other words, the usual conductor leading from the rheostat to the motors p is cut and provided with an interposed switch k, the latter being combined with the auxiliary conductor d^2, pole t^6, and connecting-wire t^2, all as clearly shown.

From the foregoing it is obvious that the motorman can readily switch the current from the main d' to the insulated branch main d^2, communicating directly with the cable-motor B, by simply manipulating the rheostat and switch. As shown in Fig. 8, the current passes from the main d' to branch d^2, via pole t, wire t', rheostat r, switch k, wire t^2, and pole t^6. If desired, the current may be utilized simultaneously in said motors p and B by simply swinging the switch k to the central or mid position, (see Fig. 14,) and by swinging the switch to the lowest position the motor B is cut out altogether, the current then passing to and energizing the motors p. (See Fig. 15.)

As just stated, my invention embodies means whereby the same current used for propelling the car at grade may also be utilized for elevating the car up an inclined railway. It also consists in means for automatically controlling the passage of the car down said inclined way, the device being more particularly adapted to be brought into action when the cars are well laden.

In Figs. 5 and 6 the two winding or cable-driving drums b are represented as grooved or turned at b^4 to receive a brake strap or band f. One end of the band is attached to a fixed stud b^5, the other end, after passing the band round the two drums, being secured to a piston-rod e^2, having a piston e', working in a suitable cylinder e. (See Fig. 5.) Water or other medium under pressure is introduced into the cylinder by means of a pipe h, its inlet being located between the front head and piston. As drawn, D indicates portions of a well-known form of fly-ball governor capable of being driven by a belt m, leading from one of the drum-shafts b^6. The vertical governor-rod n is jointed at its lower end to a lever n', connected with a suitable stop-cock or valve h', located in the pipe h. A similar cock or valve h^2 is located in the branch or discharge pipe h^3, leading from pipe h. To the stem of the last-named valve is attached an operating-lever n^2, the latter being jointed to the lever n' by a short link n^3.

I would state that the relation of the two valves to each other is such that when the governor is stationary or even revolving at a normal rate of speed, as shown in Fig. 5, the inlet-valve h' remains closed, the outlet-valve h^2 then being open; but upon accelerating the speed of the governor beyond the normal limit, due to an increasing speed of the winding-drums b, the action of the governor elevates the rod n, thereby opening the inlet-valve h' and at substantially the same time closing the outlet-valve h^2, thus admitting water under pressure against the piston e' and causing the brake-strap to more snugly engage the drums b, the result being to reduce or check their rotation. The governor-rod meanwhile in falling closes inlet-valve h' and opens valve h^2, as before described.

In lieu of the winding-drums b the cable c may be passed around guide-pulleys b^8, mounted at the upper end of the conduit, substantially as shown in Figs. 9 and 10, the gripping device in such case working practically the same as hereinbefore described.

I claim as my invention—

1. In an inclined railway, the combination with a suitably-mounted cable and a counterweight attached thereto, of winding-drums for operating said cable, a stationary motor adapted to rotate the winding-drums, a car arranged to be detachably connected to the cable, and means mounted on and actuated from the car for controlling the action of said stationary motor, substantially as described and for the purpose set forth.

2. In an inclined railway, forming part of a trolley system, the combination with a weight-carrying cable mounted in a conduit and a stationary electric motor for operating said cable, of an electrically-propelled car, a gripping device for detachably connecting the car to the cable automatically, and a switch and intermediary means capable of being actuated from the car for energizing said electric motor at will, substantially as described and for the purpose hereinbefore set forth.

3. In an electric-railway system provided with a main conductor or feed-wire d' charged with electricity from any suitable generator or source of supply, the combination with a suitably-mounted cable, a stationary electric motor for actuating said cable, and a branch feed-wire d^2 insulated from said main conductor and connected to said motor, of an electric car in normal engagement with said main conductor and propelled by electricity therefrom, a gripping device arranged to detachably connect the car to said cable automatically, and a multipolar switch mounted on the car adapted to be manipulated so as to divert the current from the main conductor to the branch conductor d^2 and the cable-actuating motor, for the purpose hereinbefore set forth.

4. In an electric-railway system, the combination with a motor-driven cable c having a counterweight attached thereto, of a main conductor through which the electric current passes, a branch conductor insulated from the main conductor capable of energizing said cable-actuating motor, a car provided with

an electric motor, and a controller communicating with said main conductor, terminals communicating with said motor and with the said branch conductor, and a switch arranged to contact with said terminals, whereby the current may be switched from the main conductor to the branch conductor to energize the cable-motor, or from the main conductor to the car-motor, substantially as described.

5. In an inclined railway, the combination with a cable *c* mounted in a conduit and arranged to be gripped to a car, and wheels or drums over which the cable passes, of means for propelling the cable, a brake band or strap connected with said drums, a governor driven and controlled by the drums, a suitably-mounted piston connected with an end of the brake-band, and valves actuated by the governor for admitting water or other medium under pressure against the piston and exhausting it therefrom, substantially as described.

6. In an inclined railway, the combination with a suitably-mounted counterweight-carrying cable provided with a gripping device whereby it can be detachably secured to a car, of an automatically-operative braking device controlled by said cable, said braking means comprising a friction-band, a water-cylinder having a piston connected with said band, suitably-arranged water-piping and valves communicating with the cylinder, and a governor connected with and controlling the action of said valves, substantially as hereinbefore described and for the purpose set forth.

7. In an inclined railway, the combination with a cable *c* provided with a counterbalance-weight arranged in a conduit, of the carrier member clamped to said cable having a slotted head portion extending above the track's surface arranged to receive the gripper-arm *i* of a car, self-locking arms or levers mounted at the ends of the said head for holding the gripper-arm in place, and suitably-located fixed tripping-bars adapted to coact with the locking-levers for releasing the gripper, substantially as described.

8. In an inclined-railway system, the combination of a cable *c* and counterweight located in a conduit below the track-rails, the cable being mounted as follows—one end of the cable is fixed and passes down the conduit and around the upper sheave mounted in said counterweight, thence back over deflecting-sheaves to the top of the incline, then around fixed sheaves or drums located thereat and downwardly along the center of the conduit to the bottom of the incline, thence around guide-sheaves and upwardly and around the lower counterweight-sheave, and finally back to a tension-weight having free movement, substantially as hereinbefore set forth.

9. In a railway system provided with a cable mounted in a slotted conduit, the combination with the carrier clamped to the said cable, and a longitudinally-extending head integral with said carrier, of a laterally-movable gripper-arm secured to a car forming part of the railway system and interlocking with the head portion of said carrier, and fixed tripping members located at the ends of said conduit arranged to coact with the carrier to release the car therefrom automatically, substantially as described.

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

MILTON H. BRONSDON.

Witnesses:
GEO. H. REMINGTON,
REMINGTON SHERMAN.