

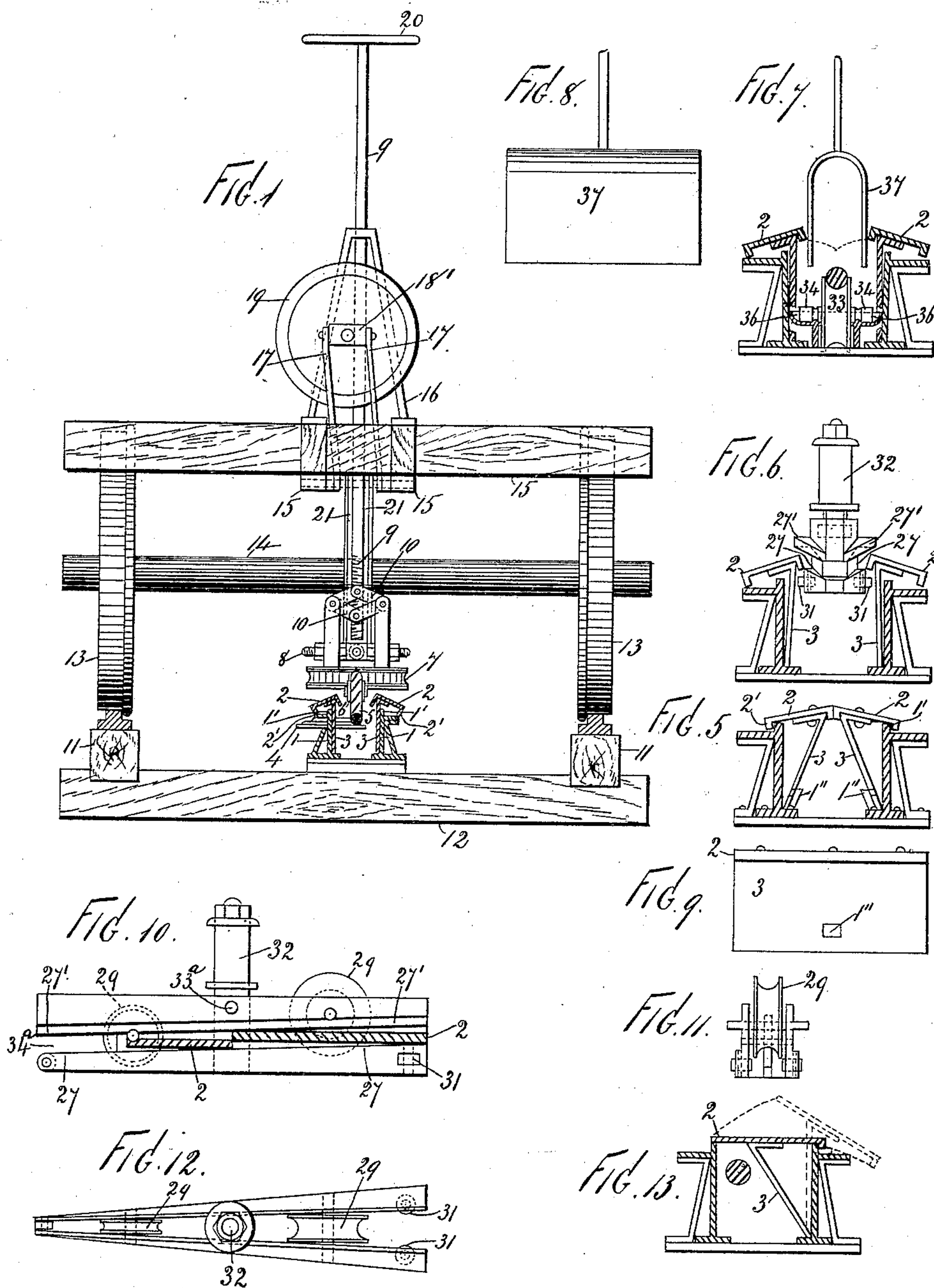
(No Model.)

3 Sheets—Sheet 1.

A. H. MATHESIUS.
CABLE RAILWAY.

No. 432,757.

Patented July 22, 1890.



Witnesses:
John Buckler,
L. H. Ogden

Alexander Hugo Mathesius
Inventor.
By North Ogden
Attorney.

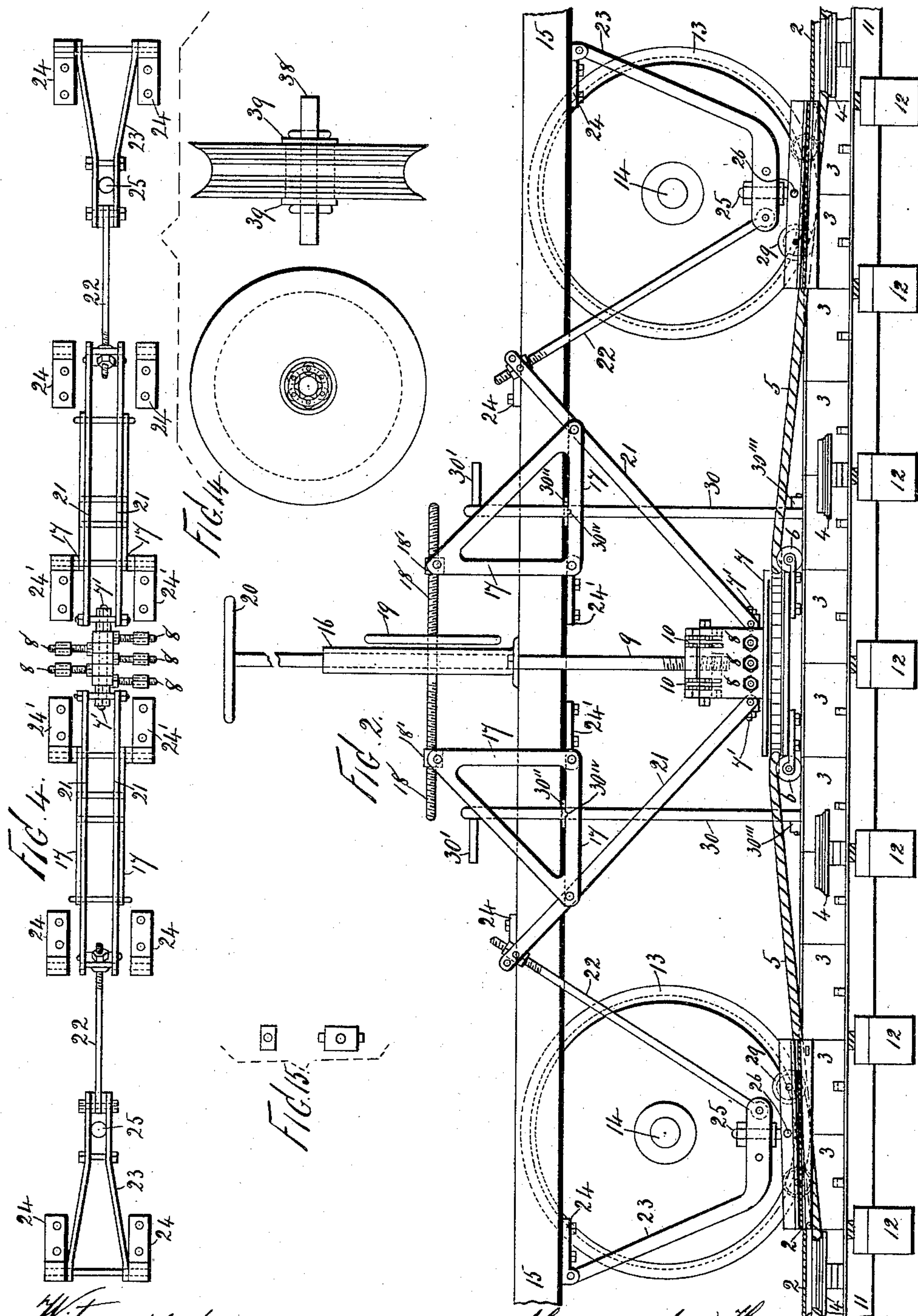
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3 Sheets—Sheet 2.

A. H. MATHESIUS.
CABLE RAILWAY.

No. 432,757.

Patented July 22, 1890.



Witnesses:
John Buckle,
L. H. Osgood,

Alexander Hugo Mathesius,
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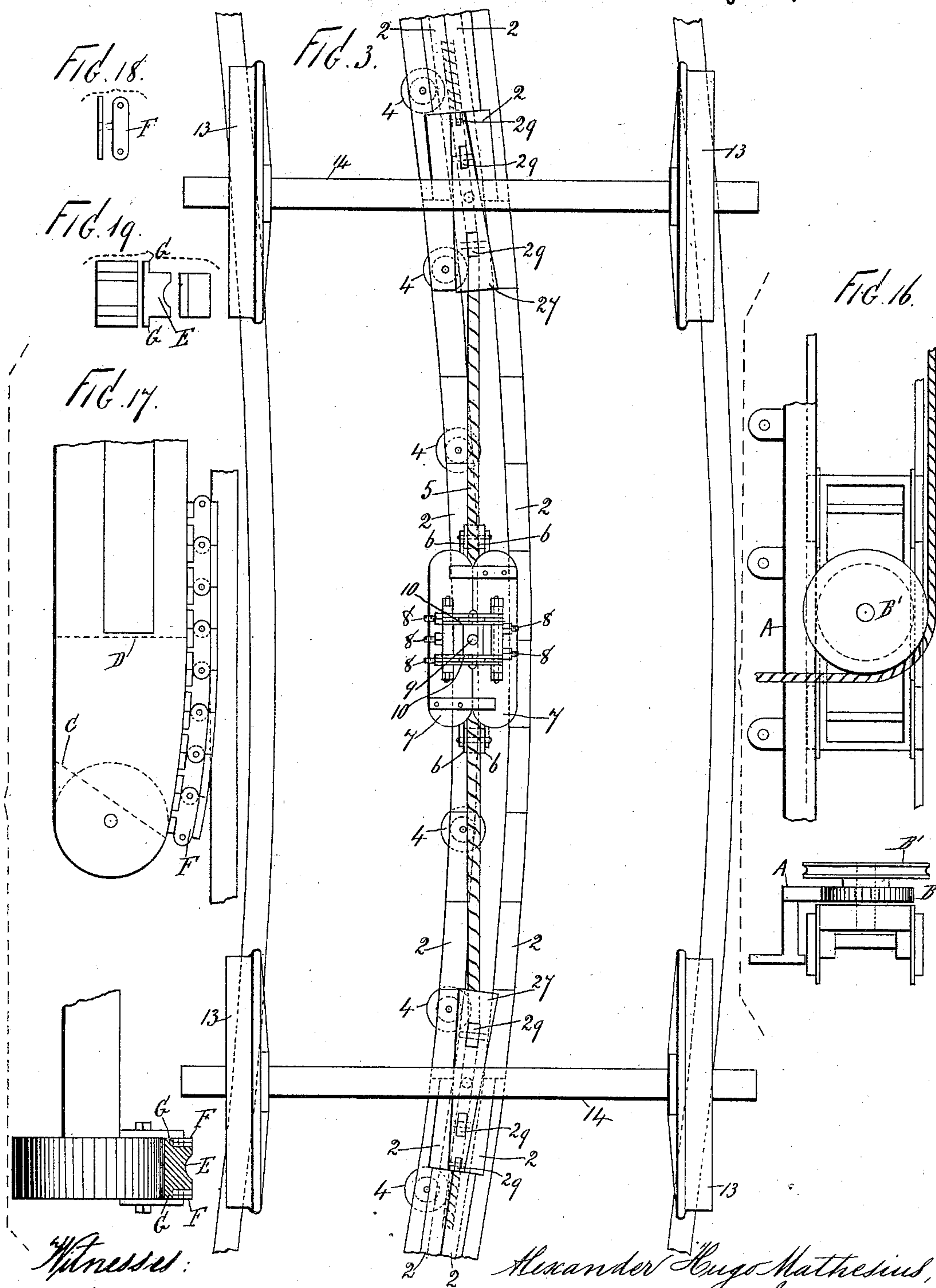
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3 Sheets—Sheet 3.

A. H. MATHESIUS.
CABLE RAILWAY.

No. 432,757.

Patented July 22, 1890.



Witnesses:

John Buckles,

L. H. Osgood

Alexander Hugo Mathesius,

Inventor:

By North Osgood
Attorney.

UNITED STATES PATENT OFFICE.

ALEXANDER H. MATHESIUS, OF BROOKLYN, NEW YORK.

CABLE RAILWAY.

SPECIFICATION forming part of Letters Patent No. 432,757, dated July 22, 1890.

Application filed May 7, 1885. Serial No. 164,628. (No model.)

To all whom it may concern:

Be it known that I, ALEXANDER HUGO MATHESIUS, of Brooklyn, county of Kings, and State of New York, have invented certain new and useful Improvements in Cable Railways, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon.

My invention has relation to means for propelling cars through the medium of an endless rope or cable which is supported on rollers in a covered tube and connected with the car by means of a cable-grip which is located outside of the tube, and it (the invention) also relates to certain apparatus or certain appliances to be used in connection with the endless-railway system.

Among the objects of my invention are the provision of simple and effective means for connecting the car with the cable, for keeping the tube closed before and after the car, for operating the various attachments or adjuncts, and especially the adaptation of the system for ready application upon a road-bed or railway already laid out or constructed, as well as for securing other advantages, as will hereinafter appear. To accomplish these objects my improvements involve certain novel and useful arrangements or combinations of parts, peculiarities of construction, and principles of operation, all of which will be herein first fully described, and then pointed out in the claims.

In the accompanying drawings, forming part of this specification, Figure 1 is an end view showing the tube open, with the grip holding the cable in elevated position and illustrating part of the connections. Fig. 2 is a side view showing the interior of the tube and the grip with all its connections. Fig. 3 is a plan view showing car on a curve, with grip, depressing-rollers, and cover opener and closer in position. Fig. 4 is a plan view showing connections for grip, depressing-rollers, and cover-opener. Fig. 5 is an end view showing covered tube on a larger scale than in previous figures. Fig. 6 is an end view showing the inclined planes of the pyramids of the cover-opener in position in an open tube. Fig. 7 is an end view of open tube, with ver-

tical guide-sheave and guard or apron in position. Fig. 8 is a side view of the apron. Fig. 9 is a side view showing section of cover and brace with a hole to receive cover-fastener, which is secured to the base or side of the tube. Fig. 10 is a side view showing cover opener and closer and depressing-rollers in position in their frame. Fig. 11 is an end view of depressing-rollers, cover-opener, and cover-closer from end opposite Fig. 6. Fig. 12 is a plan view of depressing-roller, cover opener and closer, and frame. Fig. 13 is an end view of tube, showing the cover made in one piece instead of in two sections. Fig. 14 represents a side and end view of a combination guide-sheave. Fig. 15 represents an end and plan view of a swivel-nut. Fig. 16 represents a plan and end view of guide and guide-sheave for tension-car. Fig. 17 represents a plan and end view of a portion of the grip. Fig. 18 represents a plan and side view of a link of the chain used in connection with the grip. Fig. 19 represents an end, side, and plan view of one of the grip-dies as used with the chain-guide.

In all these figures like letters and numbers of reference indicate corresponding parts wherever they occur.

Connection is made with the rope or cable by a cable-grip located outside of the tube wherein the cable moves. I provide the tube with a cover, which swings on the lower end of its brace, the cover being opened and closed by inclined planes, of which the lowermost are faces of pyramids, which are secured to a frame fastened upon the lower ends of arms suspended from the bottom of the car. A space is left between the inclined planes to accommodate rollers, which depress the rope or cable to such level as to keep it from contact with the tube-cover, which is closed outside of each arm. To prevent snow or any foreign matters from drifting in at the uncovered space between the arms, and also to prevent the cover from closing in that space, and also to retain the cable at its proper relation with respect to the tube when going around a curve, I suspend an apron from suitable points of the lifting device, which apron is made of a suitable form to allow the rope or cable to be lifted to the grip. The

grip shown herein is in some respects an improvement on that covered by my patent, No. 287,451, dated October 30, 1883. Each end of the improved grip is provided with suitable
 5 rollers or guides to resist the downward tension of the rope. Diagonal braces serve to hold the grip in its proper position, the lower ends of said braces being fitted to the grip and secured by intermediate bolts to one end
 10 each of right-angled cranks or levers, which are operated by a right and left handed screw.

To the upper ends of the diagonal braces adjusting-screws are applied, which have their
 15 opposite ends jointed to the lower ends of the arms which carry the frame for the depressing-rollers, and the inclined planes for opening and closing the tube-cover. By turning the hand-wheel which is attached to the hori-
 20 zontal right and left handed screw the grip, apron, depressing-rollers, and inclined planes are lowered or elevated to the position desired, and, if desired, the rope may be picked up by the grip in places upon the roadway
 25 which may be provided for that purpose, or all the attachments may be lifted high enough to entirely clear the tube and track. Two rods with rollers attached to their lower ends are suspended from the right-angled cranks
 30 in a proper position to be lowered into the tube and lift the rope to the grip; but this is only an auxiliary lift and intended to be used when the rope has to be dropped from the grip for any cause whatsoever, the tube being altogether too narrow to admit the grip
 35 to the level of the rope within the tube. These lifts are brought into requisition by placing pins or bolts into holes provided for that purpose in the upper ends of the diago-
 40 nal braces which correspond with holes in lugs secured to the bottom of the car and located so as to retain the grip and the other attachments at its proper level. The diagonal braces being thus secured and the bolts
 45 which connect them to the right-angled cranks being removed, the auxiliary lifts are free to be lowered without affecting the position of the grip. A quarter turn made by the handles locates the roller under the rope, and the
 50 rope may be then lifted by turning the hand-wheel of the horizontal right and left handed screw, bringing the rope to the proper level of the grip. The grip is opened and closed by a combination of toggle-joints and a right
 55 and left handed screw.

To secure the easy moving of the grip-dies by the traveling rope, I make the faces of the jaws which press the dies together tangent to compound curves. The smaller curve may be
 60 part of a roller which carries the dies around the ends, or the ends may be left solid and the dies compelled to slide around. The advantage which I obtain by this compound curve is that it enables me to make the grip
 65 more compact than in previous forms and consequently adapted for use in a smaller space. The wear of the dies is taken up by

screws and nuts of or on the eyebolts which hold the jaws together.

I make the guide-sheaves of several revolving
 70 plates in such manner that when the circumference is fitted to suit the rope each plate is free to move with a velocity corresponding to its radius, thereby obviating the slipping of the rope, as occurs on the solid sheave,
 75 which slipping is due to the fact that the diameters of various parts of the concave curve are of different lengths. The smaller sizes of these sheaves I mount on friction-rollers, but the larger sizes may be fitted loosely to a shaft
 80 which revolves in journal-boxes; or constructed by mounting loose rings upon the spider of an ordinary sheave. In cases where the rope is to be deflected from a straight
 85 line several of these small sheaves are placed on the circumference of a frame in such a way that the angle they make with each other is a minimum. In cases where the shaft revolves in journal-boxes, I recess the shaft and fit on the lower side of the journal-box a cor-
 90 responding projection. The outside ends of the journal-boxes are then closed and fitted as oil-reservoirs. Where the tracks are a considerable distance apart at the return or loop
 95 of the rope, I place a tension-wheel mounted on a car under one or each of the tracks and take up the side strain by a guide parallel to the rails upon which the tension-car is placed. A projection on the car may be made to slide
 100 against the guide-rail, or guide-wheels may be mounted upon suitable points of the tension-car.

Referring now to the parts specially delineated in Fig. 1, 1 1 is the tube, made of any material and of any suitable shape. This tube
 105 may be placed upon the cross-ties of any ordinary horse-railway or other railway and the intermediate spaces fitted as may be desired. The tube shown herein is intended to be made of rolled flanged iron, of which the
 110 sides may be secured by cross and diagonal braces. It may have a solid bottom, if desired. The upper faces have shoulders 1', which serve as stops to cover 2. The cover is provided on the under side with flanges, as
 115 2', which engage with stops 1' when the tube is closed. The cover swings on lower ends of braces 3, which are arranged at the interior of the tube. It will be observed that these
 120 braces alone could be made to serve as a cover; but the spaces between them and the sides of the tube would become filled with dirt, snow, or ice, &c., and would become inoperative. The cover could be hinged and the brace left free to swing, but I prefer the
 125 general arrangement shown. 4 represents a horizontal sheave of any approved pattern, which guides the rope around a curve. 5 is the rope raised out of the tube to suit the position of the grip. 6 are vertical guide-
 130 rollers, which resist part of the vertical strain of the rope. They may be mounted in vertical, inclined, or horizontal position. If vertical, they are made in halves to enable the

cable to be connected with the grip. I may use for this purpose movable dies similar to those employed in the grip and mounted in a suitable frame to travel in a vertical plane, or I may use the improved sheave, which will be referred to farther on. 7 is the grip of my improved pattern. 7' is the draw-bolt, which serves the double purpose of connecting the grip-jaws together by passing through the eyebolts, and also of connecting the gripping device to the bar by means of the diagonal braces. 8 are eyebolts with screws, which hold the grip-jaws together and by which the wear of the dies is adjusted. 10 are links which connect the upper ends of the grip together. Between the middle joints are right and left handed screw-nuts, (shown in detail in Fig. 15,) which are fitted to the lower ends of rods 9. By turning the hand-wheel the links will approach or recede from each other, and thereby open or close the grip. The links, as shown, form a double toggle-joint, and their advantage over a single toggle-joint is that the pressure which is by them applied to the grip is not transmitted to any outside attachments, and the attachments may therefore be made lighter and cheaper. The friction is also less than in the case of a single toggle, whereby the grip may be operated easier and quicker, as will be readily understood. 11 are stringers upon which the rails are secured, 12 the cross-ties which serve as a foundation for the tube, 13 the car-wheels, and 14 their axles. 15 are the floor-sills of the car, to which the grip attachments are secured. 16 is a standard, by which rod 9 is held in a vertical position. 17 are the bent or right-angled levers, which are operated through the medium of the right and left handed screw 18 and nuts 18' and hand-wheel 19.

In Fig. 2, 21 21 are diagonal braces attached at their lower ends to grip 7 by draw-bolt 7' and connected to the right-angled levers 17 by suitable pins or bolts. 22 are adjusting-screws for the frame of the depressing-rollers, the upper ends of which screws are provided with screw-nuts secured to the diagonals by a swivel, (like that shown in Fig. 15,) the lower ends being secured to the arms 23, which are suspended from lugs 24. All these connections are held in their proper position or moved up or down by the right and left handed screw 18, which is operated by hand-wheel 19. 30 30 are auxiliary lifts, made of rods provided with handles 30', stops 30'', and rollers 30'''. When not in service, they may be removed or turned to a position so that the rollers shall clear the rope; but when intended to be used and lowered to the level of the rope, handles 30' are turned a quarter turn, which locates stops 30'' in the recesses 30'''. In this position of the lifts the rope can be raised to the proper level for the grip by first disconnecting 21 from 17.

In Fig. 3 are shown the frames which hold

or carry the depressing-rollers 29 and inclined planes of cover opener and closer 27 under the center of the axles of the car-wheels. These parts are shown more in detail in Figs 10, 11, 70 and 12.

It is evident that when the rope is guided or held in position under the center of the car-axles the car may pass around or along a curve without disturbing the relative positions of the axis of the tube and the rope, and it is immaterial whether the tube is located midway between the tracks or on one side of the middle line. On railroads without curves the depressing-rollers and attachments are located nearer the ends of the car for the purpose of reducing the vertical strain on the depressing-rollers and the grip. It will be understood that this strain would be equalized were it not for the weight of the rope, and it has no effect on the traction of the car.

In Fig. 4, 7' is the draw-bolt, which connects the grip-jaws, and 8 8 are the adjusting-screws. The ends of bolt 7' are threaded, and screw-nuts secure the swivel-fittings, (see Fig. 15,) to which the diagonal braces 21 are connected.

In Fig. 5 the tube is shown as closed. 1'' are cover-fasteners, which are secured to the base of the tube. A hole is provided in brace 3, which receives a shoulder on the fastener, and the arrangement is such, as indicated, as will prevent the cover from being lifted from the outside.

In Fig. 6, 27 are the inclined planes for opening, and 27' those for closing, the cover. The frame is provided with rollers 31 and a pin 32, which is secured to the frame by trunnions for the purpose of accommodating itself to the angle or bend of the rope when raised to the grip. The upper end of pin 32 is fitted to arm 23 (see Figs. 2, 3, and 4) and free to move in a horizontal plane, which it is forced to do by the tension of the rope when going around a curve.

In Fig. 7 is shown an end view of an open tube with vertical guide-sheave 33 in position. The sheave is provided with shaft 34, that has its journal recessed around its circumference, and into this recess is fitted a projection, which forms part of a journal-box bearing. By closing the outside of this journal-box and allowing a space between the end of the shaft and the box a reservoir 36 is formed, which may be partially filled with a lubricant. The projection, which is fitted in the recess of the journal, prevents anything below its level from flowing out. 37 is a guard or apron made of sheet-iron and suspended by suitable connections from any convenient part of the lifting apparatus, its office being to prevent the cover from closing under the car between the depressing-rollers and to prevent snow, &c., from drifting into the tube.

In Fig. 8 the apron or shield is shown in side elevation.

In Fig. 9 the cover and its brace are shown detached from the tube and in side elevation,

the perforation being for the reception of the projection on the cover-fastener 1".

In Fig. 10 the cover opener and closer is shown in side view, the pin 32 being secured to it by trunnions 33^a. Guide-sheaves 29 are placed between the parts of the frame and secured by proper pins. In the front part of the frame is a recess 34^a, which enables the elevating-incline 27 and depressing-incline 27' to project a certain distance over and under the closed cover in order that the cover may be opened sufficiently to allow the center part of the frame to ride clear of it. Between the inclines are shown sections of cover 2, which are in position to be opened or closed, as the case may be.

In Fig. 11 is shown the cover-opener and the construction of the frame and position of one of the guide-sheaves 29 therein, and in Fig. 12 the same parts are represented in plan.

In Fig. 13 the brace 3 is made to sustain a single cover 2, adapted to protect the upper mouth of the tube and resting on both margins thereof. In this form the brace is used to strengthen the cover, and it may swing about the lower end of the brace or be hinged to one side of the tube. In the latter case the brace is not required to reach to the base of the tube.

In Fig. 14 the guide-sheave is shown as made of separate plates and the whole connected by shaft 38 and flanges 39. The side view shows the sheave mounted on friction-rollers; but, as before stated, in some cases the spider of an ordinary sheave may be used and rings fitted to the circumference thereof, which construction will be the equivalent of that specially illustrated.

In Fig. 15 the swivel-connection is shown in detail. I use this form to connect the links and screws, as right and left handed screw 18 with right-angled levers 17, or diagonal braces 21 with adjusting-screws 22.

In Fig. 16 the tension-car is provided with a guide-roller B, which moves against a guide or way A, placed parallel to the track upon which the tension-car moves. The cable passes around the large sheave B', and any strain thereon tending to force the car sideways is transmitted to the guide A through roller B, and thus the car is firmly held to its proper position on the tracks.

In Fig. 17 C and D are radii of portions of the compound curve before alluded to, which curve is made up of several short curves tangent one to the other. The dies E are independent of each other and are prevented from leading the jaws by chains F F, which embrace the shoulders G G of the dies. This method of holding the dies in place has this advantage—that the wear is removed from the chains entirely, and consequently the only expense for repairs of the grip will be the refurnishing or recutting of the independent dies; also, by using the chains, one on each side of the dies, the dies can be made consid-

erably lighter than otherwise, and this is of special advantage, because it diminishes the inertia of the dies and consequently the wear on the dies as well as on the cable.

In Figs. 18 and 19 the links and dies are shown in detail.

Having now fully described my invention, what I claim as new herein, and desire to secure by Letters Patent, is—

1. The combination of a cable-tube, movable covers for the same, a cable located in said tube, and a cable-grip supported on the car outside of the tube and formed of jaws which are applied to the cable above the tube, substantially as set forth.

2. The combination of a cable-tube, movable covers for the same, a cable located in said tube, a cable-grip supported on the car outside of the tube and formed of jaws which are applied to the cable above the tube, and a cover-opener attached to the car in front of the grip for opening the covers to permit the passage of the cable from the tube to the grip, substantially as set forth.

3. The means of propelling cars around curves, the same consisting of the endless rope or cable, the grip secured to the car, and means for holding or guiding the cable in the plane passing through the centers of the car-axes.

4. The combination of the diagonal braces, with a tube placed on the cross-ties of a street-railway for the purpose of retaining the sides of the tube in their proper positions.

5. The stops or shoulders combined with the tube, for the purpose of securing the closed covers in their proper positions, the covers being arranged to swing around axes located within the tube.

6. In a cable railway, the outside horizontal flange combined with the cable-tube, for the purpose of strengthening the tube and permitting easy removal of foreign matters by the opening of the tube-cover.

7. The interior braces combined with the cover of the tube, said tube being located on top of the cross-ties of a street or surface railway.

8. The combination, with the tube having the movable covers, of the interior braces, substantially as shown and described.

9. The combination of the tube, the movable covers, and the interior braces, the covers being arranged to swing around the lower ends of the braces.

10. The shoulders or stops combined with the tube and movable covers, for the purpose of securing the covers in proper position when closed.

11. The combination, with a cable-tube, of tube-covers having downwardly-extending shoulders projecting over the top edge of the tube, substantially as set forth.

12. The pyramids for opening the tube-covers, the same being constructed and arranged substantially as shown.

13. The inclined surfaces located parallel with the upper sides of the pyramids, for the purpose of closing the tube-cover.

14. The frame containing the depressing-rollers, the pyramids, and inclined planes attached to said frame, and all combined substantially as shown.

15. The pin combined with the trunnions which connect the pending arms with the frames, to permit horizontal and vertical movement of the frame and its fittings.

16. The adjustable pending arms combined with the frame, for the purpose of allowing a vertical adjustment of the depressing-rollers, pyramids, and inclined planes.

17. The combination, with the cable-grip, of the right and left handed screw arranged to raise and lower said grip, substantially as explained.

18. The combination, with the cable-grip, of the right and left handed screw and the bent levers, for the purposes explained.

19. The combination, with the cable-grip, of the bent levers and the diagonal braces, for the purposes explained.

20. The combination, with the cable-grip, of the bent levers, right and left handed screw, and diagonal braces, for the purposes explained.

21. The combination, with the auxiliary lift, of the right and left handed screw for raising and lowering said lift.

22. The combination, with the auxiliary lift, of the right and left handed screw and the bent levers, for the purposes explained.

23. The right and left handed screw combined with the cover openers and closers, for the purpose of raising and lowering the same.

24. The combination, with the depressing-rollers, of the right and left handed screw for the purpose of raising and lowering the same.

25. The combination, with the depressing-rollers, of the right and left handed screw and the bent levers, for the purposes explained.

26. The combination, with the grip, of the right and left handed screw and double toggle-joint for opening and closing the grip.

27. The combination, with the grip, of the double toggle-joint, for the purpose explained.

28. The chains embracing the movable dies of the grip and combined therewith, for the purposes set forth.

29. In a cable-grip composed of two parts, each having movable dies, the combination, with said parts and dies, of the two independent chains holding the dies together.

30. In combination with a cable-grip having movable dies and chains, a concave guide-roller composed of plates arranged to move as described, so that each plate travels with a velocity in proportion to the radius of the plate for the purpose of relieving the dies or chain of vertical pressure, as set forth.

31. The guide-sheave, made up of plates or

rings, arranged, as explained, so that each plate may move independently of the others, for the purposes explained.

32. In combination with the guide-sheaves, made of plates or rings, friction-rollers mounted upon the shaft and arranged to operate, as set forth.

33. In combination with the endless cable of a cable railway, sheaves or wheels for supporting said cable having their journals grooved, and the boxes for supporting the journals being provided with elevations for retaining the lubricant.

34. In combination with the endless cable of a cable road and the tension-car, the guide to retain said car upon its track, arranged substantially as shown and described.

35. In a cable railway employing an endless cable running in a covered tube, the combination, with the main grip, of the auxiliary lift arranged substantially as explained and adapted to enter the covered tube and to elevate the cable to the main grip, substantially as and for the purposes set forth.

36. The tube-opener provided with depressing-rollers for taking up the vertical and horizontal strain of the cable when the car moves around a curve, substantially as set forth.

37. The combination, with a cable-tube, of a laterally-movable cover and a diagonal brace attached to said cover and adapted to swing on its lower edge within the tube, substantially as set forth.

38. The combination, with a cable-tube, of two laterally-movable half-covers and diagonal braces attached to the under side of the said half-covers and adapted to swing on their lower edge within the tube, substantially as set forth.

39. The combination of a cable-grip having a die-seat which is formed of straight parallel sides, rounded-off ends, and compound curves having radii of different lengths located intermediately between the sides and ends, with movable dies guided in said seat, substantially as set forth.

40. The combination, with the sheaves which support the cable of a cable railway, of journal-boxes and oil-reservoirs which are formed by extensions of the lower halves of the journal-boxes, substantially as set forth.

41. The combination, with the cable-grip, of eyebolts for holding the grip-jaws together and for adjusting said jaws to the dies, substantially as set forth.

42. The combination, with a cable-grip, of a draw-bolt passing through the eyebolts of the grip, substantially as set forth.

In testimony that I claim the foregoing I have hereunto set my hand in the presence of two witnesses.

ALEXANDER H. MATHESIUS.

Witnesses:

JOHN BUCKLER,

WORTH OSGOOD.

It is hereby certified that in Letters Patent No. 432,757, granted July 22, 1890, upon the application of Alexander H. Mathesius, of Brooklyn, New York, for an improvement in "Cable Railways," an error appears in the printed specification requiring the following correction, viz: In line 95, page 4, the word "plane" should read *planes*; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed, countersigned, and sealed this 19th day of August, A. D. 1890.

[SEAL.]

CYRUS BUSSEY,
Assistant Secretary of the Interior.

Countersigned:

ROBERT J. FISHER,
Acting Commissioner of Patents.