(No Model.) 6 Sheets—Sheet 1.

C. I. EARLL.

CABLE RAILWAY.

No. 511,597. Patented Dec. 26, 1893.

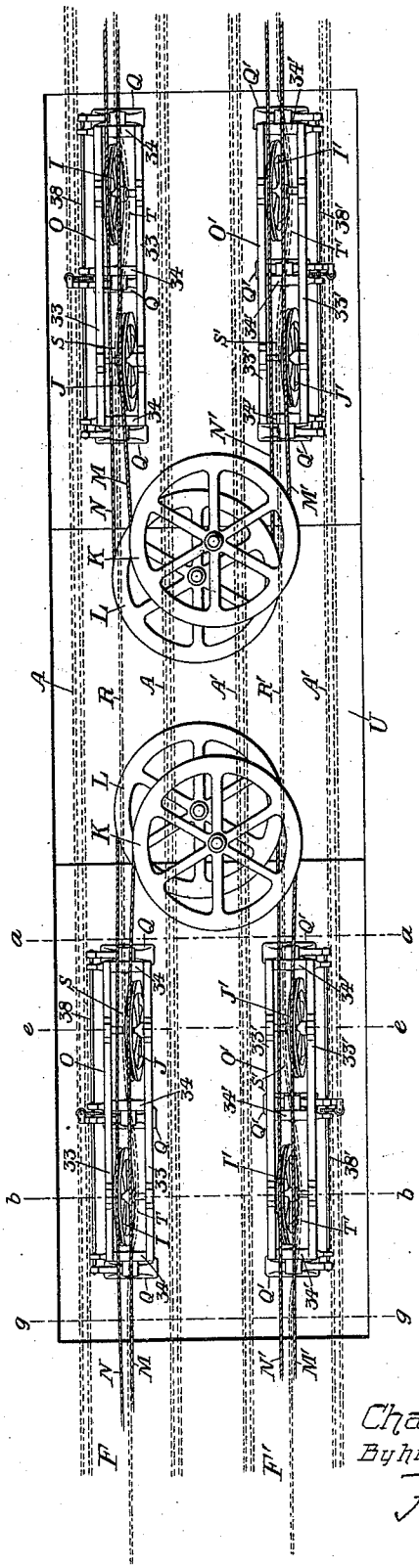

Fig. 1.

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Fig. 2.

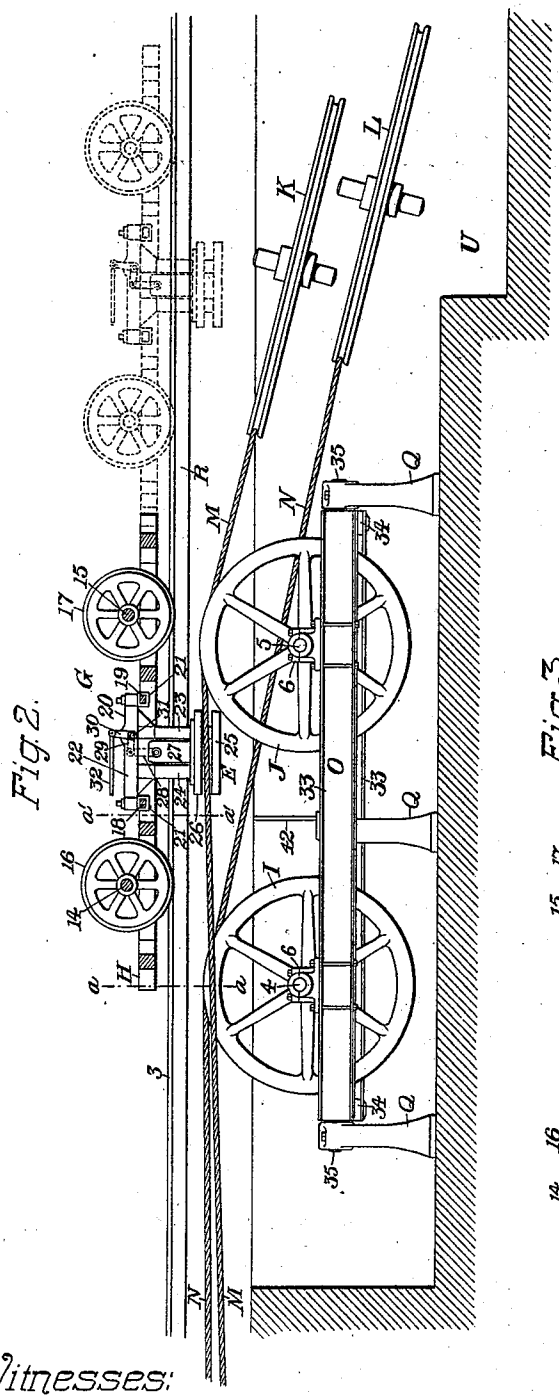
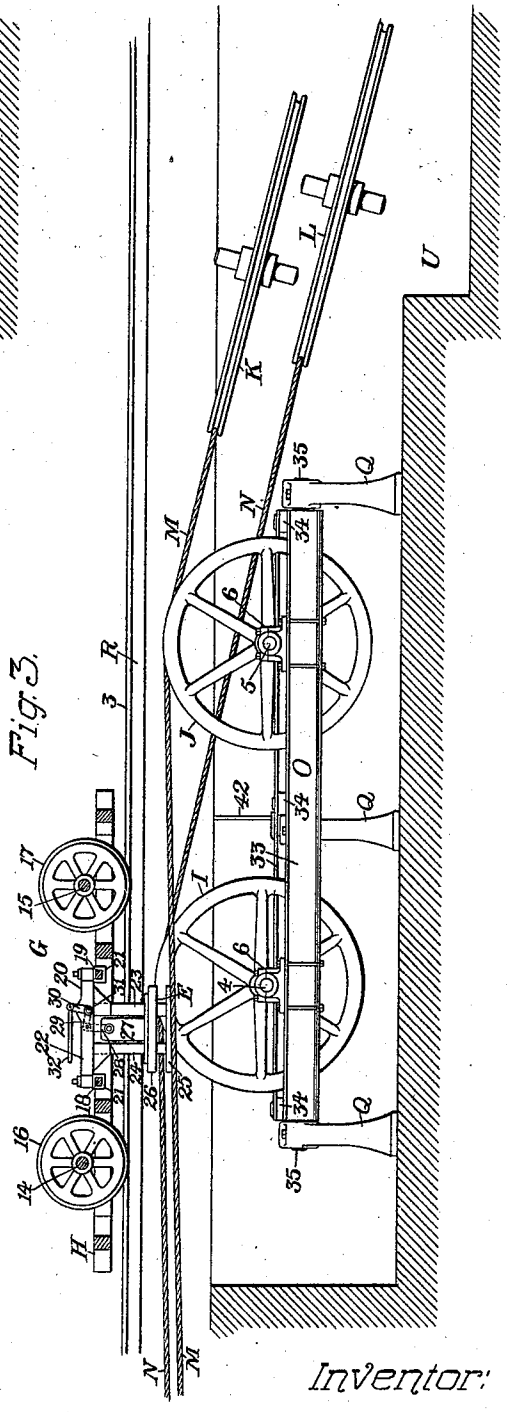


Fig. 3.



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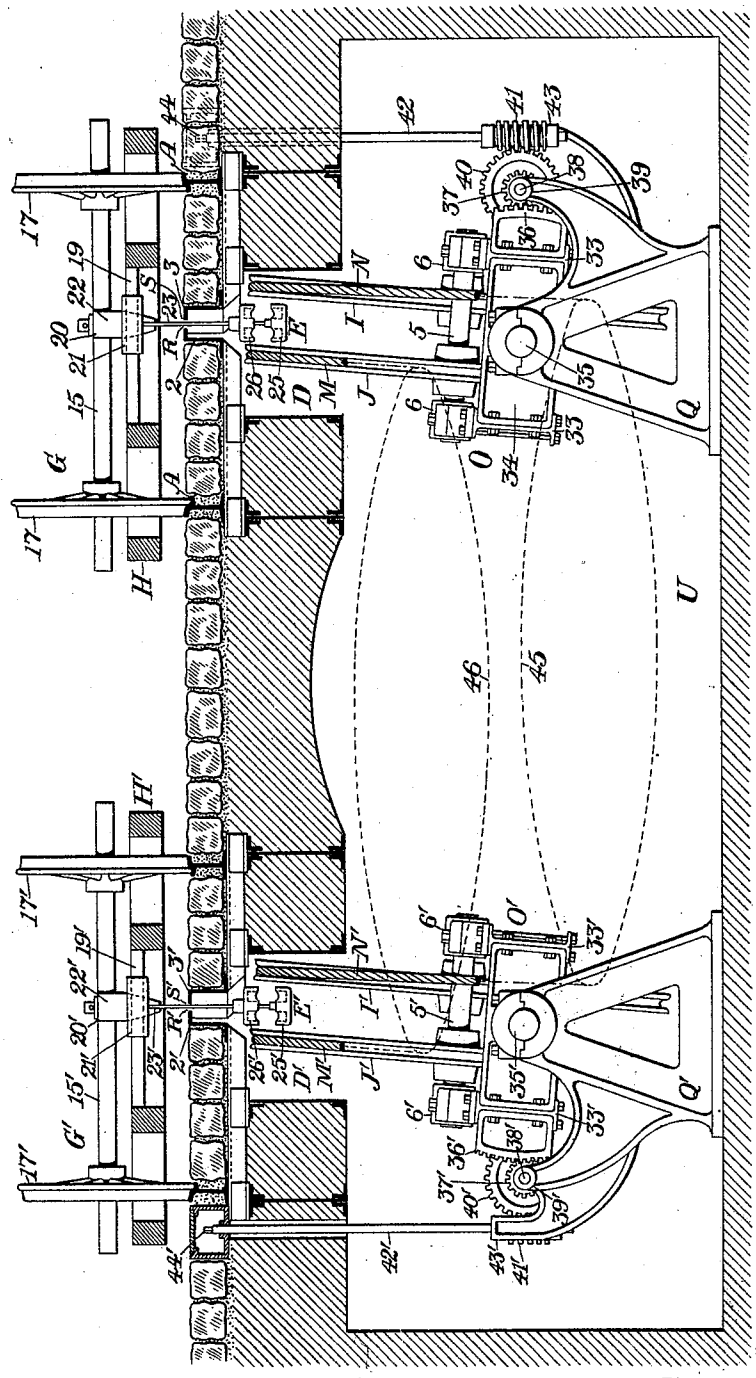

Fig. 4.

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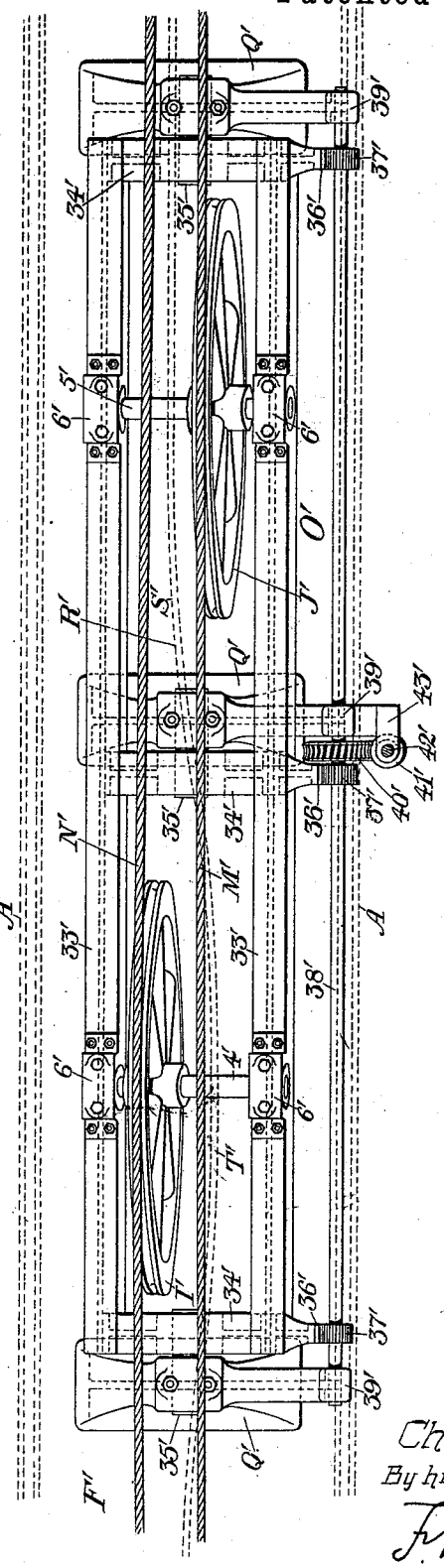

Fig. 5.

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CABLE RAILWAY.

No. 511,597. Patented Dec. 26, 1893.

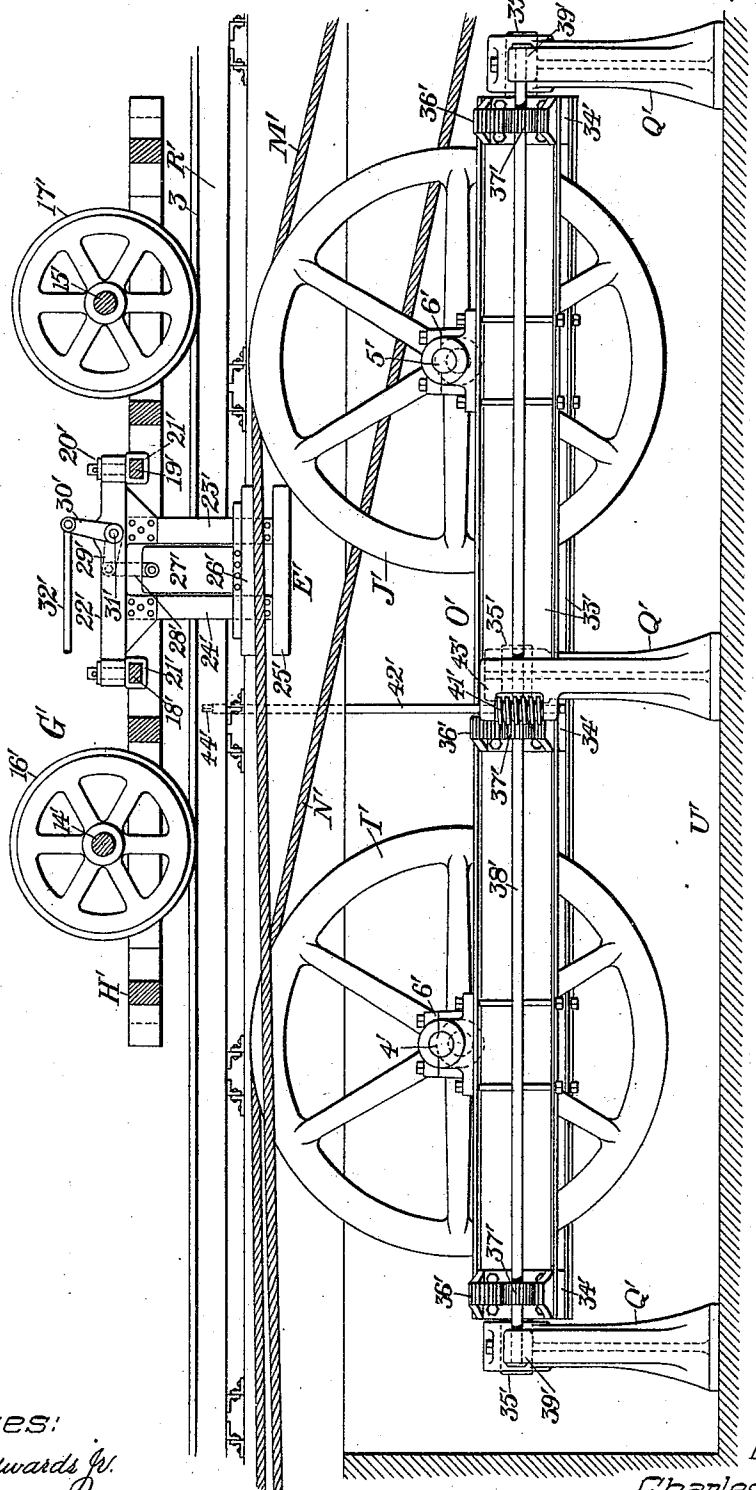

Fig. 6.

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Fig. 9.

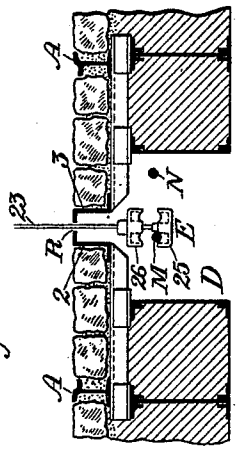


Fig. 12.

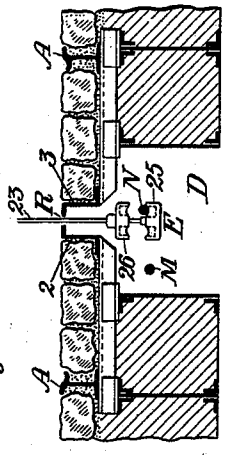


Fig. 8.

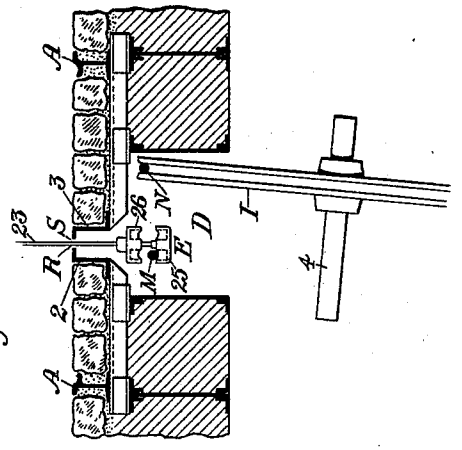


Fig. 11.

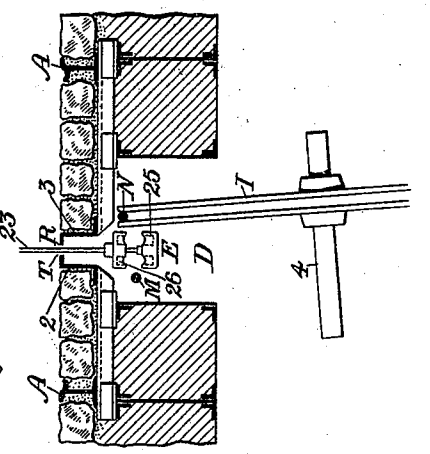


Fig. 7

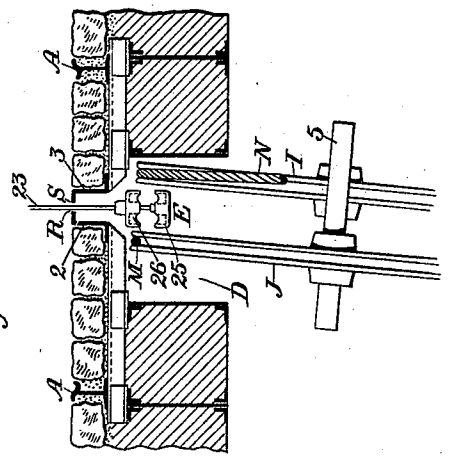
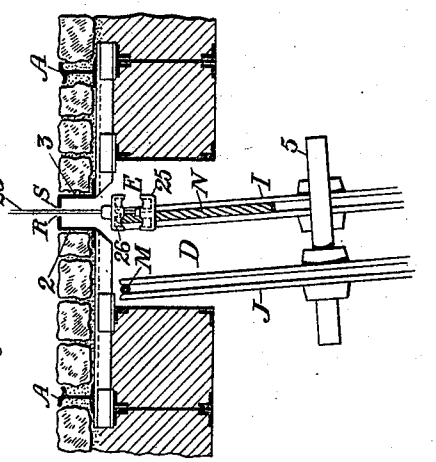


Fig. 10.



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UNITED STATES PATENT OFFICE.

CHARLES I. EARLL, OF NEW YORK, N. Y.

CABLE RAILWAY.

SPECIFICATION forming part of Letters Patent No. 511,597, dated December 26, 1893.

Application filed September 13, 1893. Serial No. 485,380. (No model.)

To all whom it may concern:

Be it known that I, CHARLES I. EARLL, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Cable Railways, of which the following is a specification.

This invention relates to cable-railways; the object being to provide an improved and effective mechanism, or apparatus, for use in connection with a pair of driving-cables, whereby the two cables may be shifted, one into position for use and the other into position for non-use, by means of a cable-shifting mechanism having its shifting-movement transversely of the railway, and whereby the cable being used may be placed in and removed from the grip of a cable-car.

The subject matter of this application is in the nature of a modification of the improvements which are described and particularly claimed in my prior application, Serial No. 469,894, filed April 11, 1893, in which my present improvements are also particularly claimed, the same being further and specifically claimed in this present application.

In the drawings accompanying and forming a part of this specification, Figure 1 is a plan view of a portion of a double-track railway furnished with my present improvements for placing the "live" cable in, and removing it from, the grip of the cable-car. Fig. 2 is a side elevation, as seen from below in Fig. 1, of the cable-road track, which is designated in a general way by F, in Fig. 1, this being the track on which the cars move toward the left hand; in this figure, the cable-car, designated in a general way by G, is shown in place on the track and with its grip-jaws opened ready to receive the "live" cable therein. Fig. 3 is a view, similar to Fig. 2, of the same track and mechanism, showing the cable M lowered, or "dead," and the other cable, N, raised into position for use, or "live;" also showing the cable-car with its grip-jaws open, ready to receive the "live" cable N. Fig. 4 is an enlarged cross-sectional view, in line *a—a*, Fig. 1, showing the double-track cable-road furnished with my present improvements, and with the cables shifted toward the right-hand, the cable M into position for use, and the cable N into position for non-use. Fig. 5 is an enlarged plan view of one of the cable-shifting mechanisms shown in the preceding figures. Fig. 6 is a side elevation, as seen from below in Fig. 5, of the cable-shifting mechanism, and showing a cable-car with its grip in position to receive the "live" cable. Fig. 7 is a sectional view of the track F, taken in line *e—e* of Fig. 1, showing the grip carried inwardly, ready for passing the sheave J before being carried into position for receiving the cable M. Fig. 8 is a sectional view similar to Fig. 7, and taken on the line *b—b*, Fig. 1, showing the grip carried toward the inner rail of the track and passing the outwardly-shifted sheave I, which is here shown carrying the "dead" cable N; the grip itself is shown carrying the "live" cable M. Fig. 9 is a similar sectional view, in line *g—g*, Fig. 1, showing the grip in that portion of the grip-slot which is central between the track-rails; the "live" cable M is here shown between the jaws on the left-hand side; while the "dead" cable N is shown at some distance away from the grip, at the right-hand thereof. Figs. 10, 11 and 12 are sectional views corresponding to Figs. 7, 8 and 9, respectively, and similarly illustrate the operation of the parts in connection with the other cable N, which is herein shown shifted into position for use.

Similar characters designate like parts in all the figures.

For clearness of illustration of the more essential features of my present improvements, the track-structure, with the exception of the track-rails and grip-slot, is omitted from Figs. 1, 2 and 3, and in some other views is only partially shown.

This invention provides means whereby one or the other of the two cables in a system of cable traction where the two cables are used in the same conduit, can be placed in the cable-car grip or removed therefrom automatically; the only operation required of the grip is that it shall be opened just previous to its passing the points where the cable is to be taken into or ejected from it. The grip may be any approved form of "side" grip; *i. e.*, a grip which takes the cable in at the side; preferably, one that is attached to the car in such a way that it may have a lateral movement relatively to the car.

The system of cable traction in which two cables are used in the same conduit, and which is the one to which this invention relates, will be referred to as the duplex system. In the duplex system, the cables are, in general, carried at a short distance apart and at the same level. One cable only is used by a grip at a time, the purpose of having the two cables being that in case of disablement of one, delay is avoided by having another ready for use. The cable which is being used will be referred to as the "live" cable, the other, which in general is kept at rest, will be referred to as the "dead" cable. The cable which when facing in the direction in which the cable moves is carried on the right-hand side of the grip, will be referred to as the right-hand cable, and that on the opposite side as the left-hand cable.

The track-structure shown in connection with my present improvements comprise the usual track rails A, which along the line of the road and except at the several pits, are supported upon the usual yokes, not shown. Midway of the width of the track it has the usual grip-slot, R, which, except as elsewhere herein described, is parallel with the track rails. The track structure also has the usual conduit, D, wherein the two cables M and N are supported along the line of the road by the ordinary supporting sheaves, not shown, placed and operated in the usual manner. Over the power station pit and over any intermediate pit or terminal pits, the track is supported by bridge-work, usually comprising plate-girders and masonry arches forming the roof of the pits, in the well known manner illustrated in a general way in the several cross-sectional views. The grip-slot R of the track is formed between the two slot-rails, 2 and 3, which at the cable-shifting apparatus are curved laterally of the track to form the curved portions as T and S, and T′ and S′, of the grip-slots R and R′, respectively. By means of these deflected portions of the grip-slots in connection with the cable-shifting apparatus hereinafter described and with the rails of the cable road, the grip of the cable car is, at the proper time, carried sidewise of the car and of the cable-road track a sufficient distance to carry said grip beyond the vertical plane of the cable and thus remove the cable from the grip.

For illustrating the construction and mode of operation of the novel features of my cable railway improvements, I have shown in some of the figures of drawings so much of the ordinary cable-car as seems essential to a proper understanding of my present invention, and the manner of using the same. Such car may consist, as herein shown, of a suitable horizontal frame designated in a general way by H, which frame is carried by a pair of axles 14 and 15 furnished respectively with the usual car-wheels 16 and 17, adapted for running on the track rails. The car-frame H is shown provided with the transverse parallel guide-bars 18 and 19, upon which guides the grip-frame, 20, is mounted and slides laterally of the car-frame. Said grip-frame may properly consist of the guide bearings 21, and the yoke, 22, supported at the ends thereof on the ends of said sliding bearings 21, and carrying the downwardly projecting shanks 23 and 24, for supporting the lower jaw 25, of the grip. The upper jaw, 26, is carried on the said shanks 23 and 24, being perforated therefor, and having between the said shanks a central shank, 27, whereby said upper jaw is operated through suitable connections (not all herein shown) with the grip-lever of the car. These connections as herein shown comprise the link, 28, connected at its lower end to the middle shank 27, and at its upper end to the arm 29, of an angle-lever, 30, which is pivotally supported at 31, on the yoke 22, and whose upper end connects with a rod, 32, that is supposed to extend to the usual grip-operating mechanism on the platform of the car. By actuating said angle-lever 30, this will, through the connections described, operate the middle shank 27 and thereby raise or lower the upper jaw 26 of the grip to release or seize the "live" cable, as may be required. In the several views in which the cable grip (or the lower portion thereof) is shown, the grip-jaws 25 and 26 are shown open, but the operation of this class of cable grips being well-known, it is not deemed necessary to show the grip-jaws in their closed position. The operation of this laterally movable cable-grip in passing through the curved portions of the grip-slot of the track is substantially the same as the operation of similar kinds of grips in passing through the curved grip-slots heretofore used in cable roads operated by a single cable, for carrying a cable-grip past a fixed sheave.

As herein before described the grip is shown in the drawings as opened and closed by a vertical movement of one of the jaws thereof, this being as herein shown the upper jaw of the grip, but obviously that kind of grip in which the lower jaw instead of the upper one is arranged to move vertically might be used in place of the one herein shown. The grip-jaws are opened and closed by the movement of one of those jaws, by a movement crosswise (vertically) of the plane (which is the plane of the surface of the road) of the curved portion of the grip-slot of the track.

In connection with a track structure having its track slot made with laterally deflected or curved portions, and in combination, also, with two independently operable driving cables in the conduit, I provide a cable-shifting apparatus having a cable-carrying sheave, for each of the cables, respectively, which sheaves are shiftable in a direction crosswise to the grip-slot of the track and shift the cables, one into position for use, and the other into position for non-use, and vice versa, as may be required. For the purpose of effecting the movement of said cable carrying sheaves,

these sheaves are shown mounted upon a suitable tilting frame, the construction and arrangement of which may be modified to suit the circumstances of any particular case. In the present instance, I have shown the shiftable sheave-carrying apparatus, arranged to have its shifting movement laterally of the tracks, by an oscillating motion.

The sheaves I and J, are shown supported at successive points longitudinally of the track upon a sidewise-tilting frame, O; which frame is composed, in the preferred form thereof herein shown, of two side-bars or beams, 33, connected at suitable points by the cross-bars, 34. Said cross-bars are shown provided with journals 35, which are supported in the three frames or pillow blocks, Q, these being fixed on the usual foundations. The sheaves I and J are carried upon the shafts 4 and 5, respectively, which are journaled in the bearings, 6, fixed on the sides of the tilting frame; and are set out of alignment by a distance equal to that required between the two cables, so that the sheaves appear side by side, when the cable-shifter is seen in end view, as in Fig. 4. As a means of tilting or shifting said sheave-carrying frame, this frame is shown provided with the tooth-segments, 36, fixed on one side thereof, and meshing with the pinions, 37, which are fixed on a shaft, 38, that is supported in the bearings, 39, of the aforesaid pillow blocks Q. Said shaft 38, is, or may be actuated by means of the worm-wheel, 40, fixed thereon, and the worm 41, meshing with the said worm-wheel and carried by the worm-shaft, 42; this shaft is journaled at its lower end, in the outer end of the frame-arm 43, and may have at its upper end the usual square nut or head, 44, for receiving a wrench or crank for operating the same. In practice the said worm-shaft 42 extends upward to the street surface and may terminate in a box or casing provided with a cover for protecting the same when not in use. By means of a wrench applied to said worm-shaft the operator through said shaft and the gearing described is enabled to tilt or shift the sheave-carrying frame O from the position thereof shown in Figs. 4 to 8 inclusive, to the position indicated (by the position of the sheaves) in Figs. 10 and 11, and vice versa.

The manner of setting the sheave-shifting frame, in order to shift one sheave into position for use and the other sheave into position for non-use of the cable carried thereby, determines which of the cables should be taken up by the cable cars passing that point on the cable road. At the end of the portion of the cable road which is operated by one pair of cables these are passed from one track to the opposite track over ordinary intermediate sheaves, as K and L, which are or may be supported by the usual U-frames fixed upon suitable foundations in the intermediate pit U, Figs. 2, 3 and 4. Said sheaves K and L are shown set some distance lower than the upper sides of the shiftable sheaves I and J, this being done primarily for the purpose of deflecting that portion of the cables intermediate to said sheaves K and L, away from the path of the grips of the cable cars as will be understood by comparison of Figs. 1, 2 and 3. In Fig. 4, the position of the sheaves K and L are indicated by dotted elliptical lines 45 and 46, respectively. The cable car, starting from the position shown by the dotted lines in Fig. 2, and traveling toward the left-hand, and the cable M being the "live" cable, as shown in said figure, and in Figs. 4, 5 and 6, the grip E is first carried away from the cable M by the curved portion S of the slot R, as indicated in Figs. 5 and 1, so as to pass the inner side of the sheave J; next the grip is carried in the opposite direction by the inward curvature of the portion S of the slot R, until the grip reaches about the position of the line a'—a', Fig. 2, at which time the jaws of the grip pass over and receive the cable; and on the further movement of the car along the track, the oppositely curved portion T of the slot R carries the grip still farther in the direction of the cable M, (primarily for the purpose of providing for the passage of the grip by the inner side of the other sheave I,) when this is raised (as in Fig. 11), thereby temporarily deflecting the cable sidewise by carrying this with the grip to the position indicated in Fig. 8 and corresponding to the line a—a, Fig. 2. On the further movement of the car along the track the curved portion T of the slot R brings the grip back to its normal running position central between the rails as shown in Fig. 9. After passing the point indicated by the line a'—a', if the car is to be continued running, the gripman closes the grip-jaws 25 and 26 onto the cable; but if the car is to be stopped, the grip-jaws are, of course, allowed to remain open. On the right side of the sheaves I and J, that is on the side toward the terminal sheaves, or toward the power house pit or a cable-crossing pit, as the case may be, the cables are deflected downward, preferably at about the inclination shown in Figs. 2 and 3, so as to immediately carry the cables, and of course bring the terminal sheaves K and L, below the path of the grip of the cable car. By this means the grip, when this approaches the cables, (as indicated by dotted lines near the right hand of Fig. 2,) does not interfere with the "live" cable and is not interfered with by either of the cables or their driving or elevating sheaves. The successive laterally curved portions T and S of the grip-slot are oppositely disposed, as illustrated in Fig. 1, for the purpose hereinbefore mentioned of carrying the grip first by one side of one of the sheaves, as J, and then by the opposite side of the other one of the sheaves, as I, which carry the two driving cables, N and M, respectively. In practice, however, it is not necessary that the slots R and R' should be carried back, as in Fig. 1, to a central position between the track rails along that portion of the track between the elevating mech-

anisms of the two adjacent driving systems; but said portions of the grip-slots may be continued at one side of central line, to join the next deflection thereof. The cable car running on the track F′, Fig. 1, when approaching the elevating sheaves, the jaws of the grip having been opened before the car reaches said sheaves, the grip is first carried outward by the curved portion T′ of the grip-slot R′, and then carried inwardly (toward space between the two tracks) by the curved portion S′ of the grip-slot. If during this time the run N′ of the cable is the one in use, the grip will of course be carried free of the cable when passing the sheave I′, this being elevated to the position of the sheave I, in Fig. 3. If however, the other cable is the one in use, the passage of the grip along the curved portion T′, of the grip-slot R′, first deflects the cable slightly out of its normal position (in the same manner as, but in the opposite direction to, that illustrated in Fig. 6) and afterward on passing the curved portion S′ of said grip-slot, carries the grip free of the cable in a manner corresponding to that in Fig. 5. The location of said lateral curves of the grip-slot longitudinally of the track and slot-rails, and relatively to the cable elevating sheaves, is such; and also the height of the elevating sheave relative to the track itself and to the grip of the cable car running on the track, that at the time the grip reaches the curved portion of the slot the cable will normally stand somewhat above the height of the grip. By this means, the jaws of the grip having been opened just previous to its arrival at the curved portion of the slot, the cable is raised free of the lower jaw of the grip, and this is carried sidewise free of the cable; the entire operation being accomplished smoothly and without shock and without any dragging of the cable on the jaws of the laterally moving grip.

By the terms "live" and "dead" as applied herein to the driving cables of the cable road, I do not refer to the movement merely of the cable, but to the use and disuse of the same. The cable which is shifted into position for use is referred to as the "live" cable and, vice versa, the cable which is shifted out of position for use is referred to as the "dead" cable. It will however be understood that when one cable, as for instance M, is shifted from its live position (shown in Fig. 2) to its "dead" position (shown in Fig. 3) and the other cable N reversely shifted from its "dead" to its "live" position, both cables must in practice be kept running until those cable cars which are being driven by the cable M shall have been all carried to the end of the portion of the track operated by that cable or to a point where the cable is diverted from the track. In practice it is also sometimes necessary to run the "dead" cable for the purpose of lubricating or inspecting the same.

The two sheaves I and J constitute separate cable-shifters, and are, as herein described, provided with means substantially as described for alternately elevating and lowering the same. Said cable-shifters being located along the line of the track at the lateral deflections or curves in the grip-slot of the track, the cable-car grip, this being laterally movable on the car, is carried past the cable-shifter by means of the deflected portions of the grip-slot, the track-rails continuing past the deflection in a straight line. When the first of the two cables is shifted crosswise of the grip-slot into position for use, the second cable is similarly shifted into position for non-use; and on the reverse movement of the cable-shifter (by which term I designate the cable-shifting sheaves and some suitable means for supporting and operating the same after the manner set forth) of course the first cable is shifted into position for non-use and the second cable into position for use; that is, into the path of the cable-grip, or out of said path.

The two cables being transferred, by means of the intermediate sheaves, from one track to the other, and those sheaves being located below the path of the cable-car grips, and the cable-shifters along each track, respectively, being independently operable, the same cable may be shifted into position for use or into position for non-use in either one of the tracks or in both of them, as may be required in any particular case.

The driving-cables are normally located in near proximity to each other, side by side in the conduit of the track-structure of the cable-road, and the successive oppositely-disposed curves or deflections of the grip-slot are extended sufficiently far laterally of the normal line of said slot, to carry the cable-car grip out of its normal path and out of engagement with the cable which is in position for use, and also far enough laterally of the track to freely pass the cable-elevating or shifting sheave, as I or J.

Having thus described my invention, I claim—

1. In a cable-railway, the combination with a track-structure having a grip-slot with successive deflections, substantially as described, and with a cable-car and its grip, of a pair of driving-cables located below the grip-slot, a laterally-movable cable-shifter in position at said deflections and having two sheaves set out of alignment as set forth, for carrying said cables respectively from and into the path of the grip, and means for actuating the cable-shifter to move the same and carry the cables transversely of the track, substantially as described.

2. In a cable-railway, the combination with a track-structure having a grip-slot with successive deflections, and with a cable-car and its grip, of a pair of driving-cables located below the grip-slot, and a rocking cable-shifter supported below the track at said deflections

and adapted for carrying the cables from and into the path of the grip, and means for supporting and rocking the cable-shifter upon an axis longitudinally of the track.

3. In a cable-railway, the combination with a track-structure having a grip-slot with successive deflections, and with a cable-car and its grip, of a pair of driving-cables located below the grip-slot, a sheave-carrying frame located longitudinally of the track and supported for a shiftable movement transversely of the track, substantially as described, and a pair of cable-carrying sheaves supported on said frame, one for each cable respectively, and located at successive deflections, respectively, of the grip-slot, substantially as described.

4. The herein-described cable-shifter for cable-railways, it comprising, in combination, a frame pivotally supported for rocking movement upon an axis longitudinally of the frame, a pair of cable-sheaves carried on the frame out of alignment with each other as set forth, and located one near each end of the frame, and frame-tilting means, substantially as described, for operating the cable-shifter.

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