(No Model.) 5 Sheets—Sheet 1.

J. H. PENDLETON.

CABLE RAILWAY.

No. 479,920. Patented Aug. 2, 1892.

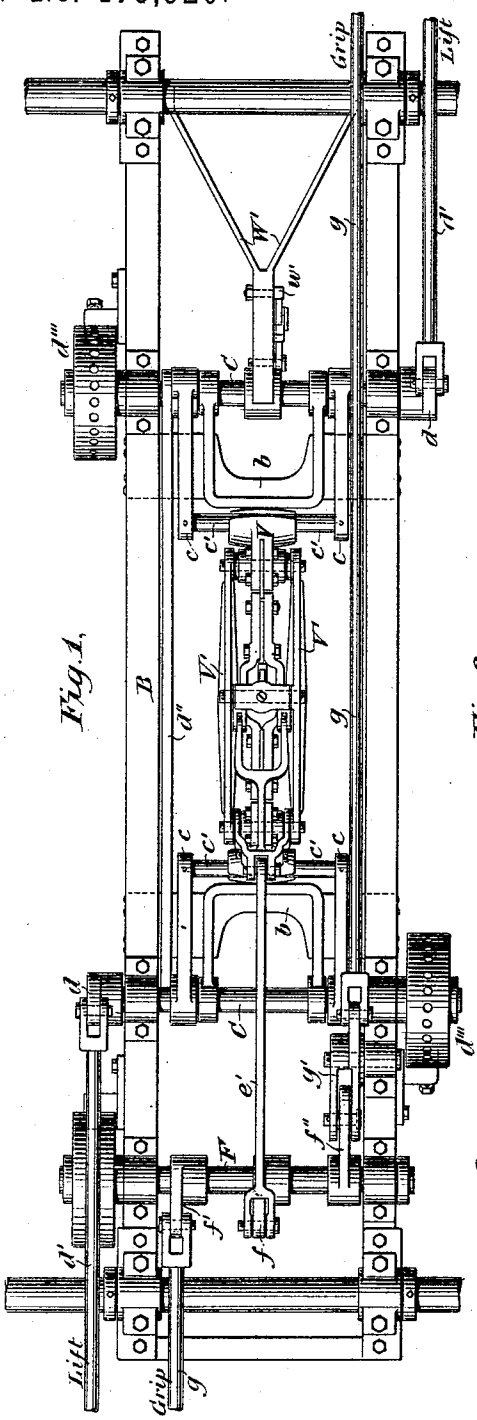

Fig. 1.

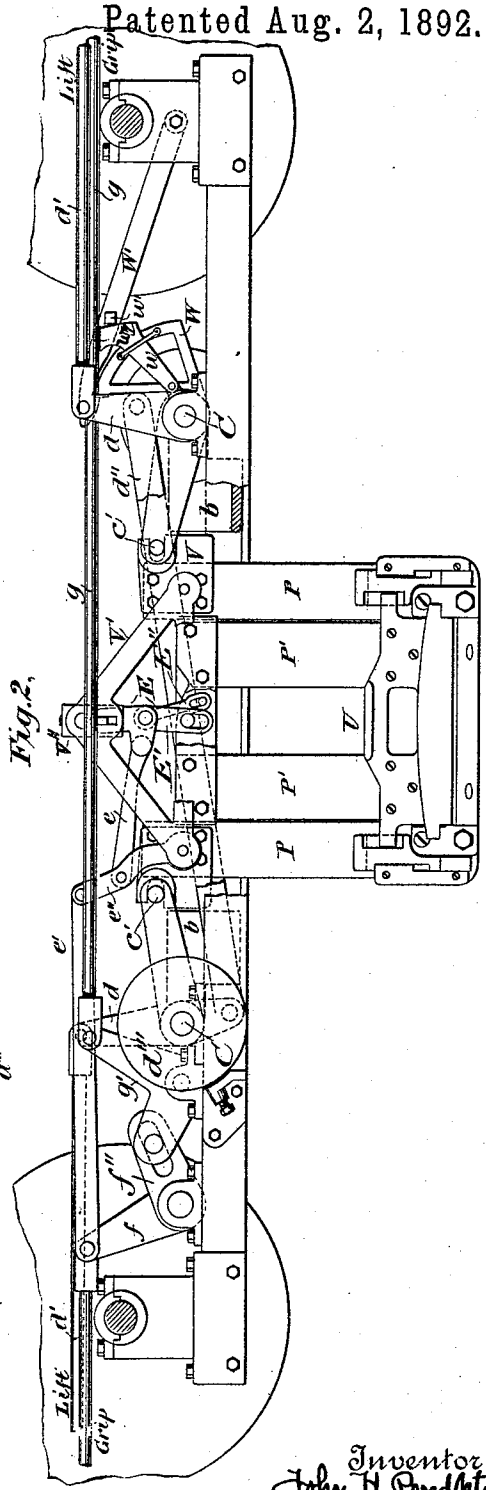

Fig. 2.

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(No Model.) 5 Sheets—Sheet 2.

J. H. PENDLETON.

CABLE RAILWAY.

No. 479,920. Patented Aug. 2, 1892.

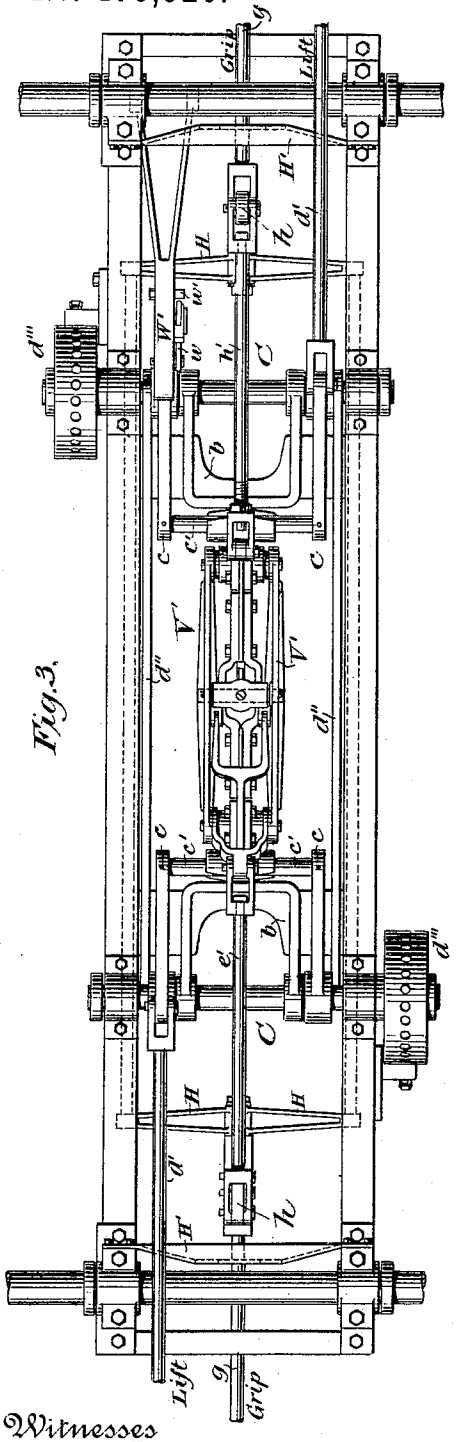

Fig. 3.

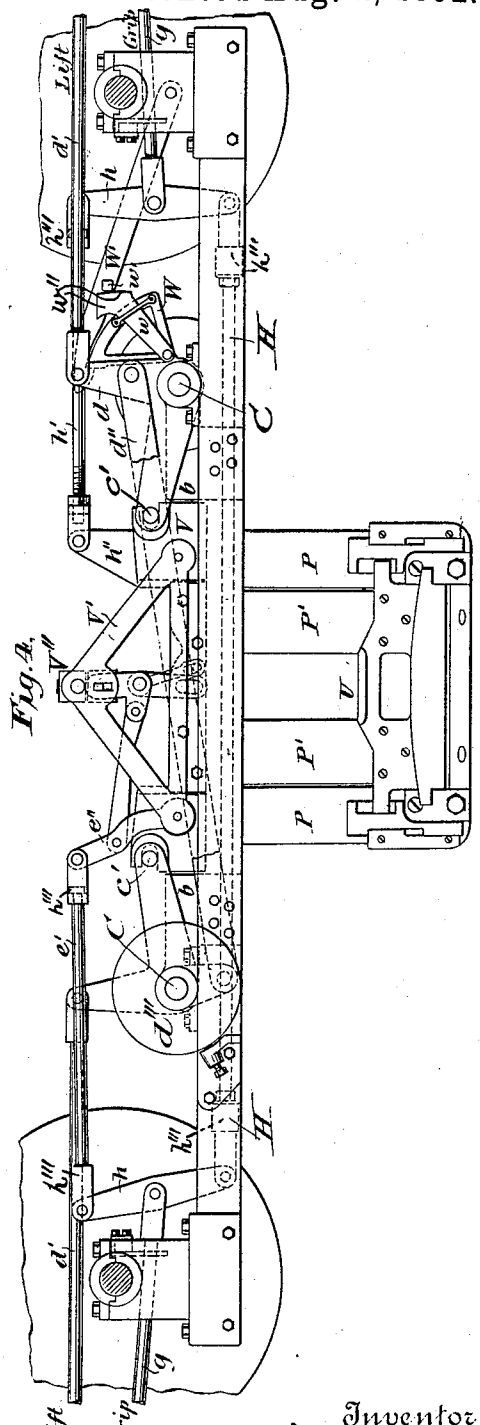

Fig. 4.

Witnesses
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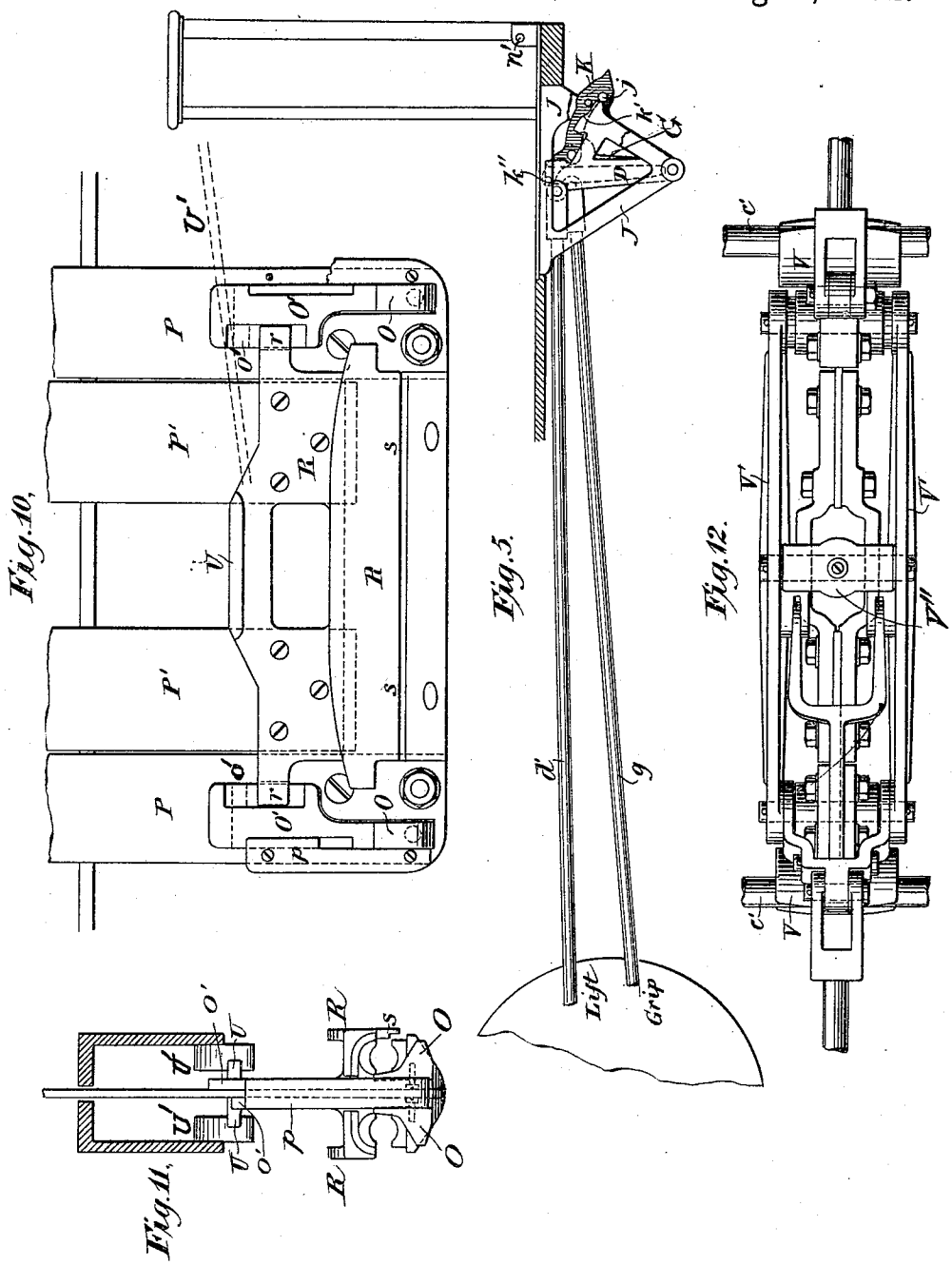
(No Model.) 5 Sheets—Sheet 3.

J. H. PENDLETON.

CABLE RAILWAY.

No. 479,920. Patented Aug. 2, 1892.



Witnesses
Edward Thorpe.
Harold P. Mann

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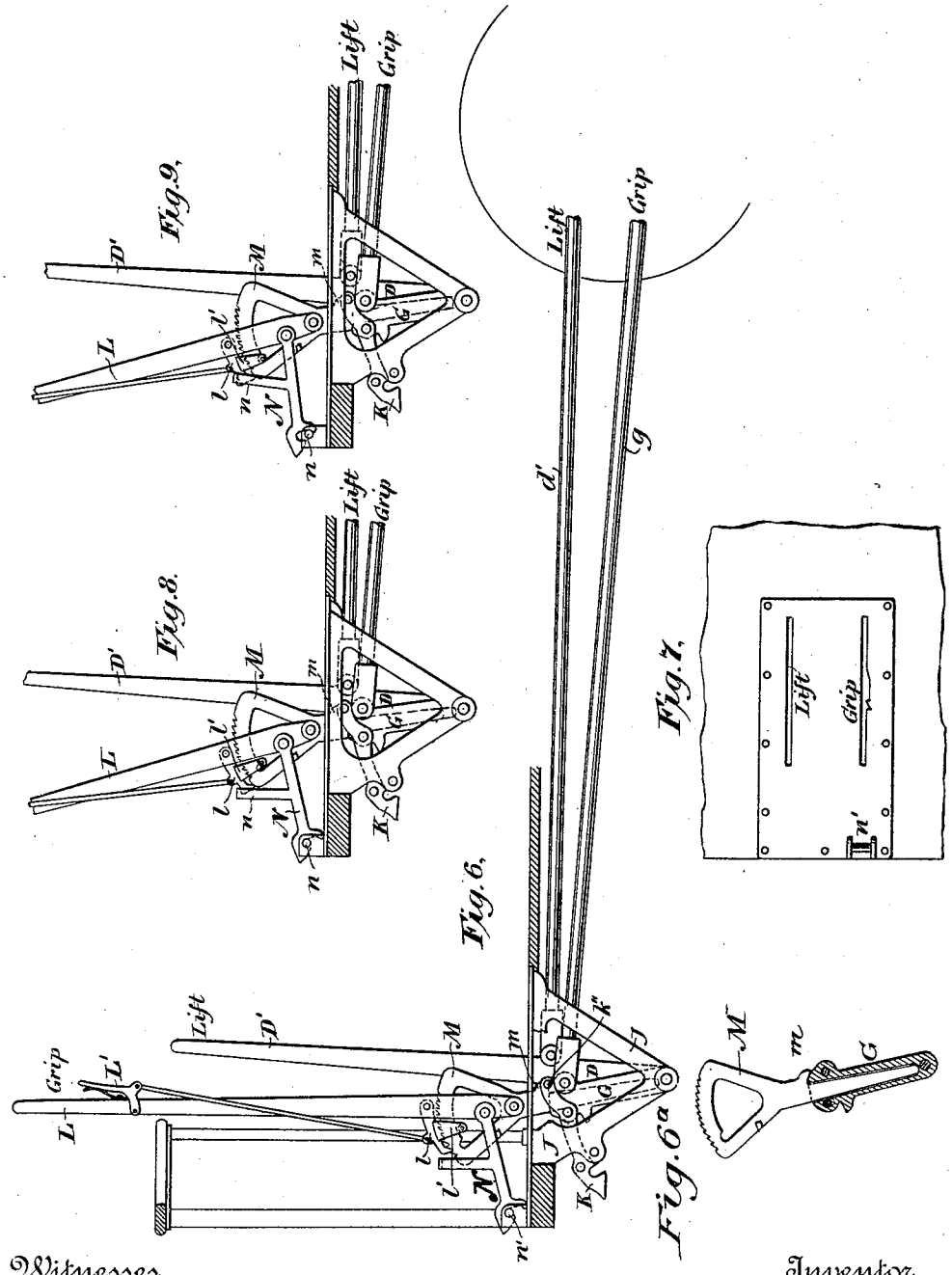
[illegible]

(No Model.) 5 Sheets—Sheet 4.

J. H. PENDLETON.

CABLE RAILWAY.

No. 479,920. Patented Aug. 2, 1892.



Witnesses
Edward Thorpe.
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(No Model.) 5 Sheets—Sheet 5.

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CABLE RAILWAY.

No. 479,920. Patented Aug. 2, 1892.

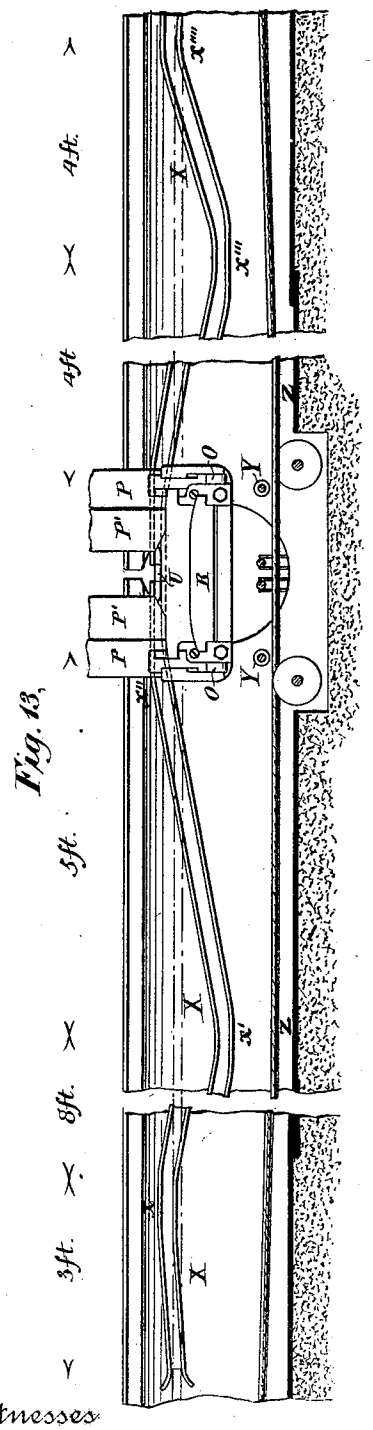

Fig. 13.

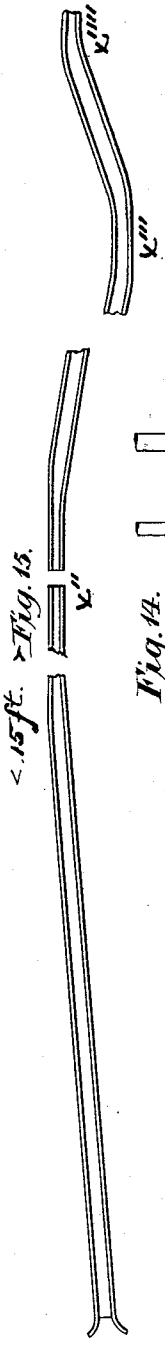

Fig. 15.

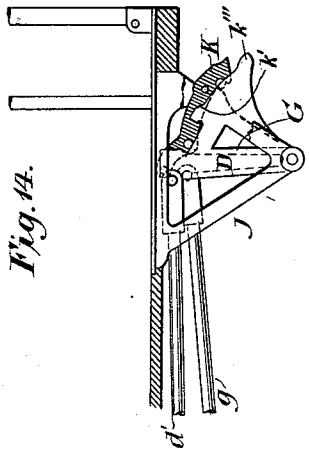

Fig. 14.

Witnesses
Edward Thorpe.
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Wm. Wallace Mitchell

UNITED STATES PATENT OFFICE.

JOHN H. PENDLETON, OF BROOKLYN, ASSIGNOR TO THE RAPID TRANSIT CABLE COMPANY, OF NEW YORK, N. Y.

CABLE RAILWAY.

SPECIFICATION forming part of Letters Patent No. 479,920, dated August 2, 1892.

Application filed June 13, 1892. Serial No. 436,482. (No model.)

To all whom it may concern:

Be it known that I, JOHN H. PENDLETON, of Brooklyn, New York, have invented new and useful Apparatus for Cable Railways, of which the following is a description, reference being taken to the accompanying drawings which form part of this specification

My invention relates particularly to a double gripper and actuating mechanism therefor for use in cable railways that employ two cables, and its purpose is to enable me to pick up either cable at will, to drop either or both cables when desired, to operate the gripper, for these purposes, and for gripping the cable from either platform of the car and secure positive operation, together with great simplification of parts. Besides this my invention contemplates an automatic safety device for dropping the cables, a system for crossing cable-lines, and simple means for deriving the greatest pressure upon the jaws of the grip at the moment of gripping, while giving as much motion as may be needed to the movable jaw during the greater part of its travel.

To these and certain incidental ends my invention is embodied in the apparatus and its several parts constructed, arranged, combined, and operated substantially in the manner hereinafter described, illustrated, and claimed.

In the accompanying drawings, Figure 1 is a plan, and Fig. 2 a side elevation, of my gripper associated with the raising and lowering and with the actuating mechanisms so far as they appear upon the supporting-frame. Figs. 3 and 4 are corresponding views of a more improved form of my invention. Figs. 5 and 6 are views showing the hand-levers with their attachments for operating the above-named mechanisms, the said figures being mere parts and continuations of Fig. 4 to the right and to the left, respectively. The car-body and certain other immaterial features are omitted. Fig. 6ª is a view showing the gripping-lever socket in section and the lower lever or link of my compound gripping-lever inserted therein but dissociated from its attachments. Fig. 7 is a plan view of the platform-plate through the slots of which the controlling hand-levers project. Figs. 8 and 9 are views of my gripping-lever and its attachments in positions differing from that shown in Fig. 6. Fig. 10 is a side elevation, Fig. 11 an end elevation, and Fig. 12 a plan, of my gripper. Fig. 13 shows my system of controlling cable-crossings. Fig. 14 is a detail of the raising and lowering lever attachments as arranged for the system shown in Fig. 13, and Fig. 15 is a modification of the system for crossings which obviates the need of the special form of device shown in Fig. 14.

In the figures like letters of reference indicate like parts.

In an application (Case A) filed by me on the 10th day of March, 1892, serially numbered 424,375 and patented herewith, I have set forth *in extenso* and claimed, broadly, a complete set of apparatus for carrying out many of the objects and purposes hereinbefore named. In this present application I desire to secure to myself certain details of construction of apparatus similar to that set forth in the said foregoing specification and certain modifications, improvements, and additions in and to such construction. I will not, therefore, repeat in full the description of parts not directly material to the claims of this present application, but will, so far as may be, limit myself to a description of the differences and to the features which are more directly the subject of these claims.

In another application (Case D) filed by me jointly with Andrew Bryson, of New York, on the 28th day of May, 1892, serially numbered 434,754 and patented herewith, I set forth another form of apparatus in which certain alternative features replace some of those herein described and claimed. In many respects, however, the apparatus described in that application and in this application are so similar as not to be the subject of the claims of both cases.

The difference in the gripper proper between this present invention and that set forth in the former of the above-named cases (Case A) are very slight. In that case I described and illustrated in full simple means by which, by opening to a certain extent the jaws and by lowering and raising the gripper, I was enabled to pick up either cable at will or to drop out the one that was in the

gripper. To effect this, I employed sliding shoes provided with deflecting-faces for shielding the lower jaws of the gripper, and thereby preventing the entrance of the cable within such jaws and for dropping the cables out of such jaws when already within them. These shoes were so secured by lost-motion connections to both sets of jaws that when the jaws were closed the shoes on both sides of the gripper lay inactive below the faces of the gripper-dies. By making the opening between the jaws on one side somewhat greater than on the other the jaws could be opened to receive the cable on one side only. When somewhat more open, both cables could pass between the jaws as the gripper was lowered between the cables; but the shoes on the side having the wider jaw-opening were so far raised that as the gripper rose the cable on that side came against the deflecting shielding faces of the shoes and slipped out of the jaws and free of the gripper. When the jaws were still further opened, the shoes upon both sides were brought into operation, permitting both cables to fall out. By these means either cable could be picked up at will, the opening of the jaws determining which should remain in the jaws. To effect these operations, I employed mechanism for opening and closing the jaws to the extent required and mechanism for raising and lowering the gripper without disturbing the adjustment of the jaws. I moreover set forth means by which when the gripper was raised above its normal position the jaws were automatically caused to fly open and drop the cable. This present invention contemplates these features with certain changes, additions, and improvements. As the two cases named are now public records of public information, I will refer to them for further explanation of the general purposes and operation of the broad invention common to both cases and restrict myself herein as much as possible consistent with clearness to those features which distinguishes this case from the former cases.

In addition to the mechanisms above named I have provided my gripper apparatus with an automatic release for the raising and lowering mechanism. The gripper is retained in its normal or raised position by a catch-hook which engages with a cam or a suitable part of the raising and lowering mechanism and holds the gripper. When the gripper is raised, however, either automatically or by hand, to about an inch above the normal, a detaching-block is thrown in position to interfere with the catch and to allow the gripper to be freely lowered.

It is principally in the gripping mechanism and its controlling hand-lever that the distinguishing features of the present invention occur. In the former application (Case A) the lost motion of the shoes was obtained by a pin-and-slot connection between the gripper-jaws and the sliding deflecting-shoes and by stops on the lower jaws to limit the downward travel of the shoes. I now provide each deflecting-shoe with guideways or channels at either side and of limited length, within which channels run guides moving with the upper and the lower jaws, respectively. By these means the travel is restricted relatively to each jaw, yet great freedom is allowed between such limits. The sliding connections with the gripping hand-lever is now replaced by a compound lever, which enables the operator to exert great power on the jaws of the gripper when the jaws are closed. When the jaws are to be opened, the compound lever may be reduced to a simple lever by simultaneously locking the hand-lever of the compound lever to its lower link or lever and releasing a hook that forms the fulcrum of the hand-lever. When so locked, the levers act as a simple lever to which is connected the operating-rod from the gripper-toggles. When the jaws are brought together by this lever, the said hook, which I term my "fulcrum-hook" and which is pivotally secured to the hand-lever of the compound levers, is brought into position to catch a suitable stud or staple upon the platform or dash-board of the car. A finger-lever upon the hand-lever enables the operator to unlock the compounded levers, and by simultaneously catching the fulcrum-hook upon its stud or staple to obtain a secondary fulcrum. The hand-lever is pivoted to the lower link of the lever below this secondary fulcrum, and, therefore, by the reverse motion of the hand-lever the lower lever or link may be farther advanced, drawing upon the toggles with great power. A rack upon this lower link engaged by a pawl upon the hand-lever completes the apparatus. This pawl may be controlled by the same finger-lever that operates the fulcrum-hook and locks and unlocks the levers.

The compound lever, instead of being secured directly to the operating-rod of the toggles, is made with a slightly-tapering tongue on the lower link, which fits into a socket to which the operating-rod is pivoted. The socket forms the permanent fulcrum for the compound lever and is pivotally supported in a suitable frame beneath the platform of the car, there being one such socket and frame at each platform. When the car is to be run in the opposite direction, the levers may be transferred to the socket at the other end of the car. Preferably the operating-rods do not connect directly with the toggles, but with an equalizer, which converts the otherwise direct pull into equal and opposing forces, between which the gripper is balanced, allowing it to play transversely and relieving it from unnecessary pressure against the butting-heads. This equalizer is described in a prior patent granted to me September 9, 1890, No. 436,105. With such an equalizer it is readily apparent that when the hand-lever is applied at one end of the car the operating-rod at the other platform should be fixed.

This I accomplish by providing a catch-hook upon the lever-socket, which engages with the stationary frame. When, however, the lever is inserted in the socket, a shoulder on the lever strikes the catch-hook and disengages it, leaving it free to be turned by the hand-lever. The raising and lowering lever also fits at each platform sockets similar to the gripping-lever sockets. To them are directly pivoted the operating-rods for raising and lowering the gripper, the sockets at each end turning with the rise and fall of the gripper. I provide inclined faces or cam-surfaces upon these sockets or upon the rods so formed that when the gripper is raised above its normal position by the automatic rails (which rails will be presently described) these inclines run under the catch-hooks of the gripping-lever sockets and disconnect the hooks from the frames. Of course when the gripping-lever is in one of its sockets the corresponding catch-hook is already raised and disconnected by the shoulder described, and therefore the other socket only will be released, freeing the jaws and allowing them to fly open and drop the cable from the deflecting-shoes. The rise of the gripper, to effect the automatic release of the catch-hook, and consequent dropping of the cables, is preferably about three inches above the normal.

For the crossings of intersecting cable roads I have improved and modified the system described in Patent No. 436,104, granted to me September 9, 1890. The cables of one line are slightly depressed to pass under the others, and elevating and depressing rails are arranged to cause the automatic release of the cable as the car approaches the crossing cables, to support the gripper clear of the cables, to then depress the gripper to pick up the cable once more, and finally to raise the gripper to its normal position, where it may be retained by the catch-hook and cam on the raising and lowering mechanism. In one form I depress the gripper to release the cables. To accomplish this, I provide a second cam-face on the raising and lowering lever-socket, which when the lever is enough depressed disengages the catch-hook of the gripping-socket and allow the cable to free itself from the gripper-jaws as the gripper again rises. I form a pocket or slight lowering in the bottom of the trench at the necessary point to allow this depressing of the gripper.

I have now described the general features of the present invention without specific reference to the embodiments of them shown in the accompanying drawings. There are, however, certain parts of considerable importance which I have omitted from this preceding general description, because they are better understood in connection with the separate mechanisms and movements to which they belong. From this general description I shall now turn to the several mechanisms shown in the drawings, which, combined together, constitute the apparatus as a whole, and shall describe each separately in turn.

In Figs. 1 and 2 I show my gripper apparatus without the equalizer. The levers upon the end of the car do not appear in these figures, and the operating-rods which connect with them are shown broken off. The frame B of the apparatus is secured to the axles of the car and is provided with butting-heads *b* for the gripper-head to press against in drawing the car. Upon this frame are mounted a pair of transverse rock-shafts C. From each shaft a double crank extends toward the center of the frame B, its crank-pin *c'* forming a supporting-shaft arranged to lie in a horizontal channel in the head of the gripper, as shown, and thereby support it. Upon the ends of the shafts C are cranks *d*, to which are pinned the operating-rods *d'*, by which the cranks are turned and the supporting-shafts *c'* raised and lowered, carrying with them the suspended gripper. To insure the equal and simultaneous rise and fall of the supporting-shafts, I connect them together by a pair of connecting-links *d''*, pivoted to the short cranks upon the shafts C at proper angles to cause equal and opposite rotation of the two shafts C. Upon one or both shafts C I place Baldwin or other torsion springs inclosed in suitable casings *d'''*. These springs are arranged to be adjusted "or set up" from time to time, as may be needed to either partially or wholly counterbalance the weight of the gripper. The rods *d'*, with their cranks *d*, are placed upon the outside of the frame in order that the hand-levers for operating them, which are preferably on the right-hand sides of the car-platforms, may be more conveniently connected to them. The mechanism for opening and closing the jaws of the gripper, which primarily consists of the toggles and lifting-link E, described in my former application, (Case A,) is connected by a pair of links *e e'* and an intermediate lever *e''* to a crank *f* upon the shaft F, mounted on the frame B. To another crank *f'* on the shaft F is pinned the operating-rod *g*, connecting with the gripping-lever under one platform of the car. To connect with the operating-rod for the other end of the car, I provide a slotted crank *f''* upon the shaft F and connect the operating-rod to one arm of a bell-crank *g'*, the other arm of which is provided with a crank-pin traveling in the slot in the crank *f''*. Of course other means may be employed for connecting this second operating-rod with the shaft F. A torsion-spring and casing, similar to those above described, may, if desired, be placed upon the shaft F to counterbalance wholly or in part the weight of the upper jaws of the gripper.

In Figs. 3 and 4 of the drawings I have shown the opening and closing mechanism provided with an equalizer by which the gripping force applied to the connecting-link *e'*, instead of drawing the gripper against the

butting-head b, is counterbalanced by an equal and opposite force applied to the gripper in line with the connecting-link e'. To the head of the gripper opposite to the intermediate lever e'' is pivoted a connecting-link h', similar to and in line with the link e'. The links e' and h' are pivoted to the upper end of a pair of rocking levers h, to the centers of which the operating-rods are pinned and to the lower ends of which is secured a connecting-frame H, divided, as shown, to pass around the gripper mechanism without interference therewith. It will now be seen that when the power is applied to the rods g, or when power is applied to one of the rods and the other is held stationary, the rocking levers h are drawn apart, exerting an equal and opposite pull upon the rods e' and h', thereby actuating the toggles of the gripper, while leaving the gripper free to move in any direction. The operating-rods extend through supporting-plates H′ upon the frame B, which serve to suspend the equalizer when tension is released and act as guides for the rods when put in compression to open the jaws of the gripper. As the gripper must be free to rise and fall, to twist in passing the curves, and to travel transversely upon the supporting shafts c', I place swivels h''' between the rocking levers and the frame H and upon the links e' h' and rods g. I also, in order to take up wear and to readily adjust the equalizer, place a screw-thread and jam-nut, as shown, upon one of the connecting-links e' or h'.

In Fig. 5 are shown the continuations and attachments of the operating-rods d' and g, the operating-levers being withdrawn from their respective sockets. The socket G for the gripping-lever is shown fixed in position in the frame J, to which it is fulcrumed by means of the catch-hook K, which engages the stud or bolt j on the frame. This catch-hook is pivoted to the socket G, as more clearly seen in Figs. 6, 8, and 9. In these latter figures it is shown unhooked from the frame, leaving the rod g, which is pivoted to the socket, free to be operated by the hand-lever L. When the catch-hook K engages the frame J, the end of the operating-rod g becomes fixed in the frame, allowing the equalizer and the toggles to be operated from the other end of the car. The operating-rod d' is pivoted to a socket D, fulcrumed in the frame J coaxially with the socket G. The hand-lever D′ for turning the socket may be inserted directly into the socket, as in Fig. 6 and 6^a. In the figures the raising and lowering lever D′ is in position corresponding to the normal position of the gripper. The socket D is provided with a face k', inclined to its travel and so arranged that normally it is clear of the catch-hook K; but when the gripper is raised above its normal position, and the socket thereby thrust toward the right, as seen in Fig. 5, the inclined face k' will be forced under a stud or lug upon the hook K, disengaging it from the frame, and thereby releasing the gripping-lever socket G and allowing the rod g to be drawn back and the jaws of the gripper opened to throw out the cable.

Figs. 6, 6^a, 8, and 9 show the compound lever for opening and closing and for gripping the jaws of the gripper. The lower lever or link M of this compound lever is provided with a tongue which may be fitted into the socket G. The hand-lever L is pivoted to the link M at a point just above the car-platform. The link is provided with shoulder m, as shown, which strikes against the projection k'' of the hook K when the lever is inserted and raises the hook from the frame J, leaving the socket free to turn with the lever. The hand-lever is provided with a pawl l and a detent l', formed by a projection from the said pawl. On the link M is a toothed rack for the pawl and a notch for the detent. The pawl is pivoted to the lever L in position to engage with the rack, and thereby retain the lever L in position relatively to the link M. The pawl may be withdrawn from the rack by the usual finger-lever L′ and connecting-rod. As the hand-lever L is thrown toward the dash-board of the car the detent strikes against the link M, forming a stop for the movement. In this position the detent is opposite the notch, as in Fig. 8, and by depressing the finger-lever L′ may be thrown into it, as shown in Fig. 9, locking the hand-lever to the link M and reducing the compound levers to a simple lever by which the socket G may be turned to open and close the jaws of the gripper. Pivoted to the hand-lever L, a few inches above the pivot of the link M, is my fulcrum-hook N. When the hand-lever L is in the position shown in Figs. 8 and 9, the tip of the pawl extends under the projecting arm m of the hook. Upon the platform or dash-board of the car I place a stud or staple n' or other catch with which the fulcrum-hook may engage when the pawl is not raised. If, however, the pawl be raised to draw the detent into its notch, the tip of the pawl engages the arm m and raises and holds the hook out of engagement with the catch, leaving the locked levers free to turn together. When the pawl is depressed and the levers thereby unlocked, the fulcrum-hook engages the catch and forms a secondary fulcrum for the hand-lever M. The operation of these levers is as follows: When the link M has been inserted in its socket G and the catch-hook K thereby disengaged from the frame J, the levers may be brought to the position shown in Fig. 9. After this the detent may be released and the fulcrum-hook simultaneously dropped onto its stud or staple n'. The lever L may then be drawn away from the dash-board to grip the cable, turning upon the pivot of the fulcrum-hook N as a fulcrum and forcing the link M toward the dash-board, thereby drawing upon the rod d' and exerting greatly-increased power upon the jaws of the gripper. The pawl engages with its rack and retains the hand-lever at any desired po-

sition, holding the jaws gripped until released by the finger-lever L′. This operation presupposes that the catch-hook K at the other end of the car is caught upon its frame J, for if that hook has been released it is of course impossible to grip the cable until the hook again engages with the frame. The hook may, however, be readily caught by merely opening the jaws to their full extent, for the upper jaws by their weight thrust upon the operating-rod, forcing the hook toward its engaging-stud and allowing it to catch thereon. To open the jaws, the hand-lever is thrown toward the dash-board, the fulcrum-hook released, and the detent thrown into the notch, reducing the system to a simple lever by which the operating-rod may be forced back, raising the upper jaws.

In Fig. 7 is shown the platform-plate containing the slots through which the gripping and the raising and lowering levers project from the sockets beneath. The gripping-lever slot contains notches upon one side into which the lever may be pressed to hold it in place against the weight of the upper jaw and in order to indicate to the operator the two positions for picking up the right or the left hand cable. The other slot is without notches.

Figs. 10 and 11 show the jaws and jaw-shanks of my gripper with my sliding deflecting-shoes O, mounted to slide upon the shank-plates P of the lower jaws. These shoes consist of the shoes proper or toe-pieces O and the sliding plates O′, to which the toe-pieces are screwed. This construction enables me readily to renew the toe-pieces when they become worn. The plates O′ contain channels *o o′*, as shown, for guide lugs or fingers *r* upon the upper jaws R of the gripper and guides *p* upon the shank-plates P. These channels or guideways are of such length that when the gripper is closed the shoes will have traveled downward until the guides *p* reach the upper limit of their guideways O. In this position the deflecting-surfaces of the toes of the shoes lie about three-eighths of an inch below the dies in the lower jaw, as clearly seen in Fig. 11. This is to allow for the wearing away of the dies. If the dies of both jaws are worn away three-eighths of an inch, the upper jaws must descend three-quarters of an inch farther to grip the cable, and I therefore extend the guideways *o′* three-quarters of an inch lower than would otherwise be necessary, giving them, as shown in Fig. 10, a clearance of three-quarters of an inch below the lugs *r* of the upper jaw. The guideways *o′* extend above the guide-lugs *r* one-half an inch and one inch and five-eighths, respectively, upon the two sides of the gripper, in order that the shoes upon one side may begin to rise when the upper jaw has risen one-half an inch and in order that the other shoes may rise one inch and one-eighth after and below the first. When the jaws have been opened out three-quarters of an inch, or, rather, when the upper jaw has been raised three-quarters of an inch, there will be an inch-and-one-half space between the tips of the jaws upon the side of the gripper having the deflecting-shoes constructed to be first raised. Those shoes will, of course, be raised one-quarter of an inch, which is insufficient to cause them to interfere with the entrance of the cables between the jaws when the gripper is pressed down between the cables. The upper jaw upon the other side of the gripper is, however, provided with a lip *s*, projecting downward and making the tip of the jaw an inch and an eighth longer than that of the other upper jaw. When, therefore, the upper jaw is so raised three-quarters of an inch, the opening between the jaws on this side is but one-half an inch, and the cable, which should be, to correspond with the dimensions given, one inch and three-eighths in diameter, cannot enter these jaws of the gripper. When, on the other hand, the upper jaw has been raised an inch and three-quarters, the cables can be admitted between the jaws on both sides, but the higher deflecting-shoes, have traveled up one inch and a quarter, just sufficient to completely shield the lower jaw and to allow the cable to slide outward free of the gripper as the gripper is raised. In this adjustment it will be seen that the lower shoes have traveled upward somewhat less than a quarter of an inch, and the cable on that side will therefore be retained in the jaws.

From the foregoing it will be seen that I am able to pick up either cable at will by merely adjusting the opening of the jaws. In order to drop both cables, the jaws are opened about an inch and a quarter farther, or three inches in all, raising the lower deflecting-shoes until they completely shield the corresponding jaw and merely carrying somewhat farther upward the shoes upon the other side. Both cables are then free to slide from the deflecting-shoes back onto the supporting-pulleys. In speaking of both cables in this manner it must not be understood that both cables can ever simultaneously be gripped by the gripper, for only when the gripper is depressed below the normal line of the cables can the cables both run temporarily between the jaws of the gripper, one or both of the deflecting-shoes being necessarily raised for such a condition, causing one or both cables to fall out as the gripper is raised.

The upper jaws of the gripper are secured to the jaw-shanks P′ by screws or bolts, as clearly shown in Fig. 10. Upon these shanks, and preferably integral with the jaws, are a pair of laterally-projecting lugs or ears U, arranged to meet the upper surfaces of inclined rails U′, arranged in the trench as shown. When the gripper thus meets these rails, it is lifted by means of the ears U, raising the gripper as a whole if the jaws are gripped, or, if not, merely raising the upper jaws. In the latter case the cables are immediately dropped by the rise of the deflecting-shoes. In the former case the rise of the lower jaw, together

with the upper jaw, acting through the raising and lowering mechanism, releases, in the manner heretofore described, one of the catch-hooks K. Upon the release of the hook the jaws are unlocked and the lower jaw by its own weight and that of the cable drops, thereby opening the gripper and permitting the cable to fall out.

The heads and the frames of my gripper, by which it is suspended from the supporting-shafts c', possess several novel features which give it lightness, strength, and ready adjustability. The plan view is shown in Fig. 12, the elevation in Fig. 2, in which latter view the side rails b of the supporting-frame B and some of the parts of the gripper apparatus are broken away in order to clearly show the construction. To the heads of the shank P are secured by bolts the shank-heads or head-blocks V, containing the supporting-channels for the shafts c', as already explained. To these head-blocks are bolted or pinned a pair of triangular or A frames V′, near the apexes of which is secured by a sliding connection the vertically-traveling cross-head, which forms the fulcrum for the upper link of the gripping-toggles E. The sliding cross-head is secured by a set-screw or other adjustable connection with the spreader-nut V″, pivoted in the apex of the frames V′. To the upper ends of the shank-plates P′ are bolted a pair of plates, which, as clearly shown in Fig. 2, form a cross-head, traveling vertically on the shank-plates P, with the rise and fall of the upper jaws of the gripper. To this cross-head the lower link E′ of the toggle and my supplemental lifting-link E″ (described in Case A) are attached by pin-and-slot connections. The elbow of the toggles is connected by the link e with the intermediate lever e'', which in turn connects by the connecting-link e' with the crank f, Fig. 2, or with one lever of the equalizer, Fig. 4. When the equalizer is used, its connecting-link h' is pinned to an upright arm h'' upon the head-block V, bringing the rods e' h' into alignment in order that the equalized forces may act in the same line.

Of the gripper mechanism proper there only remains unexplained the catch and automatic release by which I may retain the gripper in its raised position or release it by slightly elevating the gripper. In Figs. 2 and 4 this device is shown upon the right-hand raising and lowering shaft C in elevation, and in Figs. 1 and 3 is seen the plan. The rock-shaft C carries a cam W, not unlike the tumbler of a combination-lock. When the gripper is in its normal position, a hook or catch W′ engages the radial face formed at the end of the cam-surface and retains the gripper in position; but when the gripper is depressed the catch W′ rests upon the cylindrical face of the cam and allows the shaft to turn freely. Upon the cam W is pivotally secured a detaching-block or loose piece w, which is free to turn through a small angle between stops formed by a flattened staple or guide-iron, as shown. The detaching-block w is provided with a pair of oppositely-inclined faces w'' at its free end, which enable it to pass beneath a lug or projection w' upon the hook W′, raising the hook thereby. As the gripper rises from its depressed to its normal position one of these faces is brought into loose contact with the lug w', but allows the hook to fall and catch the end of the cam-face, and thereby hold the gripper in place. This is the position the block w occupies in the figures. When, however, the gripper is raised one inch or more, either by hand or by the automatic elevating-rails, as described, the detaching-block w, resting as described, against one of its stops, is forced beneath the lug w' till its other inclined face w'' engages the lug. As the gripper returns to its normal position the detacher w turns and rests against its other stop, and thereby its rear incline, passing under the lug as the cam approaches the position for locking with the hook, raises the hook and allows the gripper to be freely lowered. On the rising movement the hook catches once more, as before described. It will now be seen that to lower the gripper by hand it is merely necessary to raise the gripper an inch in order to unlock it and then to lower. On again raising the catch will lock, and thereby retain the gripper. Such are the mechanisms by which I am enabled to carry out the numerous requirements of a cable car for a successful double-cable road, with the various necessary relations and mutual functions of the several mechanisms by which the complicated operations may be effected. I will now describe a few of these operations, leaving many of the incidental advantages and uses in which the mechanisms may be employed unmentioned.

In an application filed by me jointly with Cornelius Tiers, of New York city, on the 21st day of June, 1892, and serially numbered 437,512, we have set forth a hydraulic jack for storing our grippers in the cars and for replacing them in operative position when it is again desired to use them. Let us suppose, therefore, that the gripper has just been secured in operative position in the car, that the car is upon the main track, and that the operating-levers are upon the wrong or rear end of the car. The upper jaws of the gripper will rest lightly upon the lower jaws. The first thing to be done is to remove the levers from the rear to the front platform of the car. As the compound lever is inserted in its socket, the shoulder m upon its lower link M raises and retains the catch-hook K. The compound lever is locked and placed in the notch in the platform, which corresponds to the cable it is desired to grip. By doing this the catch-hook K at the other end of the car is made to engage the frame J, for the upper jaw tending to close thrusts upon the free operating-rod at that end of the car. The gripper is slightly raised to unlock the cam W and catch W′.

depressed between the cables, and then elevated to its normal position, the catch again locking with the cam, and thereby retaining it. The hand-lever L is then thrown toward the platform and the detent l' released, allowing the fulcrum-hook N to fall upon its pin or stud n'. The cable will now be within the jaws ready for gripping. The car-brakes being then released, the hand-lever L may be drawn toward the car-body and the jaws gripped upon the cable. The pawl and rack L retain the jaws gripped until released by the finger-lever L. The cable may be dropped at any time by merely locking the compound lever, and by then forcing back the rod g to open the jaws to their full extent. When the gripper meets an elevating-rail, the lug U, raising the gripper about three inches, forces the incline k' on the raising-socket D under the catch-hook K and releases the jaws of the gripper, letting the lower jaw fall to open the jaws. Should the jaw fail to descend, the cable in passing down upon the large pulleys at the ends of sections will draw open the lower jaw and release itself.

Turning now to Figs. 13, 14, and 15 I will describe the manner in which by my invention I am enabled to run my gripper across intersecting cable roads without the use of horse or other auxiliary power. Fig. 13 shows crossing double-cable railways, the cables of the one seen in side elevation passing somewhat beneath the others. The under or, as I shall term it, the "cross-town" line is provided with a pocket or slight deepening of the trench on the side of approach to the other or "uptown" line. This is to enable the gripper to descend and follow the dip of the cables to within a few feet of the crossing cables. Preferably the pockets occur in the cross-town trench on both sides of the uptown line, making it possible without renewing the trench to reverse the direction of running the cars. This deepening of the trench amounts to about one inch, that being found sufficient. The rail is made of a channel-iron, the upper flange of which extends above the ears U of the gripper and serves to depress the gripper, while the lower flange acts the part of an elevating-rail, as before described. As the car approaches the uptown cables the rail first raises the gripper one inch, as at x in Fig. 13, thereby unlatching the lowering mechanism. The rail then depresses the gripper ten inches, as at x', or seven below normal, in order to permit it to follow the dipping of the cable close to the uptown line before releasing the cable. When so depressed, the lowering lever-sockets D are drawn so far toward the center of the car that an incline, similar in action to the one k' already described, is drawn under the catch-hook K, releasing it, and thereby unlocking the jaws of the gripper. From this point x' of lowest depression the rail rises, carrying the gripper upward to clear the cables of the other line. It will be seen that the lugs U, being on the upper jaw, will raise the upper jaw first and the cable within, the gripper drawing downward will release itself by opening the lower jaw and slipping from the deflecting-faces of the gripper-shoes. Above the crossing cables the ears or lugs U are raised by the rails three inches above normal, as at x''. When the crossing has been passed, the rail at once dips down to six inches below normal, as at x''', to automatically pick up the cables, so that it is only necessary for the operator to put his gripping-lever in the desired notch to pick up the cable that is wanted. From this point x''' the gripper is raised above normal at x'''' enough to lock the cam W with its catch-hook W', and then allowed to pass free of the channel-rails. It is therefore not possible for the operator by carelessness to allow the gripper to remain depressed and perhaps strike against the next succeeding supporting-pulleys. Should the operator fail to properly place the gripping-levers in order to pick up the cable that is wanted, the car will merely run on until its impetus has been checked by friction and grade.

In Fig. 14 is shown the slight change needed upon the car to adapt it for the use just set forth. D, as before, is the socket of the raising and lowering lever. As before, also, it is provided with an inclined face k' to unlatch the catch-hook K when the gripper is raised. In addition, however, the socket is provided with a second inclined face k''', constructed to raise the catch-hook when the gripper is depressed seven inches, and thereby carry out the process already described. This change is not, however, essential, and in Fig. 15 I show a rail arranged to co-operate with a car not so provided with the second incline k''' on its sockets D. In this simpler form of my invention the deflecting-rail merely elevates the gripper about three inches and releases the cable. After passing the intersecting cable-line the channel-rail depresses and raises, as shown before in Fig. 14. With this form of rail the gripper being raised to drop the cable must release at some distance from the crossing, and therefore, though somewhat simpler, I very much prefer the other construction, which permits the car to run within a few feet of the crossing before releasing. On a downgrade the simpler form of the invention is very satisfactory in all respects, because the downgrade preserves the speed of the car and because no deepening of the trench is necessary.

To insure the proper dipping of the cables beneath the uptown line and to prevent the car from raising the cable as it approaches the crossing, I provide one or more rollers Y, Fig. 13, extending across and above the cross-town cables and preventing the rise of the lower cables into contact with the others. In a prior patent to me, No. 436,104, of September 9, 1890, I have indicated a somewhat simi-

lar method of crossing cable-lines, and this present invention is the improving and perfecting of the general scheme therein indicated.

I have now described my complete invention. I have made no mention of a multitude of small modifications, which may be made in the details and forms of the parts; but I desire to secure to myself by the following claims all modifications, due to mere mechanical requirements and skill, which may be made without departure from the principles of my invention. In certain claims I term the lower jaws the "stationary" jaws, although from the foregoing it is clear that they are practically only stationary when the gripper is stationary. I therefore use this term in its relative sense, as, indeed, I do several others. This will be apparent from the context of the claims in which they occur.

Having thus described my invention, I claim and desire to secure by Letters Patent the following:

1. In combination, in a gripper apparatus for cable railways, a frame therefor, a pair of cranks mounted upon the said frame and provided with supporting-shafts c', parallel with their axes, a gripper provided with channels for the said shafts, connections between the said cranks for causing them to turn equally and together, and one or more torsion-springs inclosed in suitable casings upon the axes of the said cranks, substantially as and for the purposes set forth.

2. In combination, in a gripper apparatus for cable railways, a frame therefor, a pair of cranks c, mounted upon the said frame and provided with supporting-shafts c', parallel to their axes, a gripper provided with channels for the said shafts, connections between the said cranks for causing them to turn equally and together, and one or more levers D' and connecting-rods d for operating the said cranks to raise and lower the gripper, substantially as and for the purposes set forth.

3. In combination, in a gripper apparatus for cable railways, a frame therefor, a pair of cranks c, mounted upon the said frame, a gripper independently suspended from each of the said cranks, and one or more connections between the said cranks for causing them to turn equally and together, substantially as and for the purposes set forth.

4. In combination, in a gripper apparatus for cable railways, a frame therefor, a pair of cranks c, independently mounted upon the said frame, a gripper suspended from the said cranks, and one or more springs upon the axes of the said cranks, substantially as and for the purposes set forth.

5. In combination, in a gripper apparatus for cable railways, a frame therefor, a pair of cranks c, mounted upon the said frame and provided with supporting-shafts c', parallel to their axes, a gripper provided with channels for the said shafts, connections between the said cranks for causing them to turn equally and together, one or more operating-rods for the said cranks, a cam W, turning with the said cranks, a catch W' for engaging the said cam when the gripper is in its normal position, and a detaching device for the said catch arranged to be adjusted by the rise of the gripper above normal to interfere with the said catch, substantially as and for the purposes set forth.

6. In combination with a raising and lowering mechanism for a cable-gripper, a shaft C, moving therewith and provided with a cam W, a hook or catch W', pivoted to the frame of the mechanism and arranged to engage the said cam when the gripper is in its normal position, a detaching-block w, pivoted to the said cam, stops to restrict its motion upon the said cam, and a stud or lug w' upon the said catch, substantially as and for the purposes set forth.

7. In combination with a raising and lowering mechanism for a cable-gripper, a catch for engaging the moving parts of the said mechanism and retaining the gripper in its raised position, a detaching-block therefor carried upon the said moving parts, and stops for the said detaching-block, between which it may be free to travel, the said block being so formed that when the gripper has been raised above a certain position the said detaching-block on the lowering of the gripper may interfere with said catch and prevent it from engaging the said moving parts, substantially as and for the purposes set forth.

8. In combination with a pair of upper and lower jaws of a cable-gripper and a shank P for the lower jaw, a cable-deflecting shoe O, constructed to slide upon the said shank and provided with guideways $o\,o'$ of limited length, a guide upon the said shank for one of the said guideways, and a guide moving with the upper jaw and traveling in another of the said guideways, whereby the said shoes may be allowed a limited travel relatively to each of the said jaws, substantially as and for the purposes set forth.

9. A cable-deflecting shoe O for the purposes set forth, provided with guideways $o\,o'$, terminating in stops for limiting travel within such guideways, substantially as set forth.

10. A cable-deflecting shoe O for the purposes set forth, consisting of a sliding plate provided with guideways $o\,o'$, and a toe-piece detachably secured to the said sliding plate.

11. In combination with a pair of upper and lower jaws of a cable-gripper apparatus and a shank P for the lower jaw, a cable-deflecting shoe O, constructed to slide upon the said shank and provided with guideways $o\,o'$ of limited length, a guide upon the said shank for one of the said guideways, and a guide moving with the upper jaw and traveling in another of the said guideways, whereby the said shoe may be allowed a limited travel

relatively to each of the said jaws, one or more lugs or ears U upon the upper jaw of the said gripper, and one or more rails U′, arranged to pass under the said lugs or ears, and thereby automatically raise the said upper jaw, substantially as and for the purposes set forth.

12. In combination with the stationary jaw or jaws and jaw-shanks of a cable apparatus and for the purposes set forth, a pair of head-blocks V, secured to the said shanks and provided with supporting-channels, and a pair of side frames V′, secured to the said heads, substantially as set forth.

13. In combination, in a cable-gripper apparatus, an equalizer for the gripping mechanism thereof, consisting of a pair of levers *h*, a pair of operating-rods *g*, extending from the centers of the said levers to the platforms of the car, a frame H, to which is pivotally secured one end of each said levers, and connecting-rods *e′ h′*, connecting the remaining ends of the said levers, respectively, with the gripper and gripper mechanism, sockets G for a hand-lever and to which the said operating-rods *g* are connected, and one or more catch-hooks K for locking the said sockets in position, substantially as and for the purposes set forth.

14. In combination, for the purposes described, a hand-lever socket G, a frame J, to which the said socket is fulcrumed, a catch-hook K, pivoted to the said socket and arranged to engage with the said frame, and an operating-rod *g*, pivotally secured to the said socket, substantially as set forth.

15. In combination, for the purposes described, a lever-socket G, a frame J, to which the said socket is fulcrumed, a catch-hook K, pivoted to the said socket and arranged to engage with the said frame, and a lever fitting the said socket, provided with a shoulder constructed to disengage the said catch-hook from the said frame when the said lever is placed in the said socket, substantially as set forth.

16. In combination with the operating-rods *d′* for the raising and lowering mechanism and the operating-rod *g* of the gripping mechanism, of a cable-gripper apparatus, a hand-lever socket G, to which is pivoted the said rod *g*, a frame J, to which the said socket is fulcrumed, a catch-hook for locking the said socket in position, and a hand-lever socket D, to which is pivoted the said rod *d′*, arranged to interfere with the said catch-hook in certain positions, and thereby disconnect it, substantially as and for the purposes set forth.

17. In combination with the operating-rods *d′* for the raising and lowering mechanism and the operating-rods *g* of the gripping mechanism, of a cable-gripper apparatus, a lever-socket G, to which is pivoted the said rod *g*, a catch-hook K, pivoted to the said socket, and a second hand-lever socket D, to which the said rod *d′* is pivoted, provided with one or more inclined faces formed to run under and disconnect the said catch-hook, substantially as and for the purposes set forth.

18. A compound lever for the purposes described, consisting of link M, provided with a rack, a hand-lever L, pivoted to the said link at the center of curvature of the said rack, a pawl pivoted upon the said hand-lever and provided with a detent formed to fit in a notch upon the said link, and a fulcrum-hook N, pivoted to the said hand-lever and engaging with the said pawl when the said detent is in the said notch, whereby the said fulcrum-hook may be disconnected and the said lever and said link operated as a simple lever, substantially as set forth.

19. A compound lever for the purposes described, consisting of a link M, a hand-lever L, pivoted to the said link M, a detent pivoted on the said lever and arranged to lock the link and said lever, a fulcrum-hook N, pivoted to the said lever, and means for controlling the said detent and the said fulcrum-hook, substantially as set forth.

20. A compound lever for the purposes described, consisting of a hand-lever L and a link or lower lever M and means for independently fulcruming the said hand-lever, substantially as set forth.

21. In combination with a pair of crossing cables, a cable-trench for the lower of said cables, provided with a deepened portion extending a sufficient distance from the crossing to permit the descent of the gripper thereinto to follow the dip of the cable as it approaches the crossing, substantially as set forth.

22. In combination with a pair of crossing cables, a cable-trench for the lower of said cables, provided with a deepened portion to permit the descent of the gripper thereinto, and one or more depressing-rails secured within the said trench, substantially as set forth.

23. In combination with a pair of crossing cables, a gripper for the lower of said cables, one or more lugs or ears U on the said gripper, and a rail adjacent to the crossing cables, constructed to co-operate with the said lugs or ears to depress the said gripper as it approaches the crossing and then to elevate the said gripper to clear the upper of the said cables, substantially as and for the purposes set forth.

24. The method of crossing the gripper-car of a cable railway over the overlying cables of a crossing cable railway, which consists of in first depressing the gripper to follow the descent of the cable under the crossing, releasing the cable therefrom, and then raising the gripper to pass clear of the said overlying cable, substantially as and for the purposes set forth.

25. The method of crossing the gripper-car of a cable railway over the overlying cable of

a crossing cable railway, which consists in automatically depressing the gripper and releasing the cable as the gripper approaches the crossing and then automatically elevating the said gripper to pass clear of the overlying cable, substantially as and for the purposes set forth.

In testimony whereof I have hereto set my hand this 12th day of June, 1892.

JOHN H. PENDLETON.

Witnesses:
WALDORF H. PHILLIPS,
HAROLD D. BENNER.