(No Model.)

4 Sheets—Sheet 1.

J. H. ROBERTSON.

CABLE RAILWAY GRIP.

No. 377,499. Patented Feb. 7, 1888.

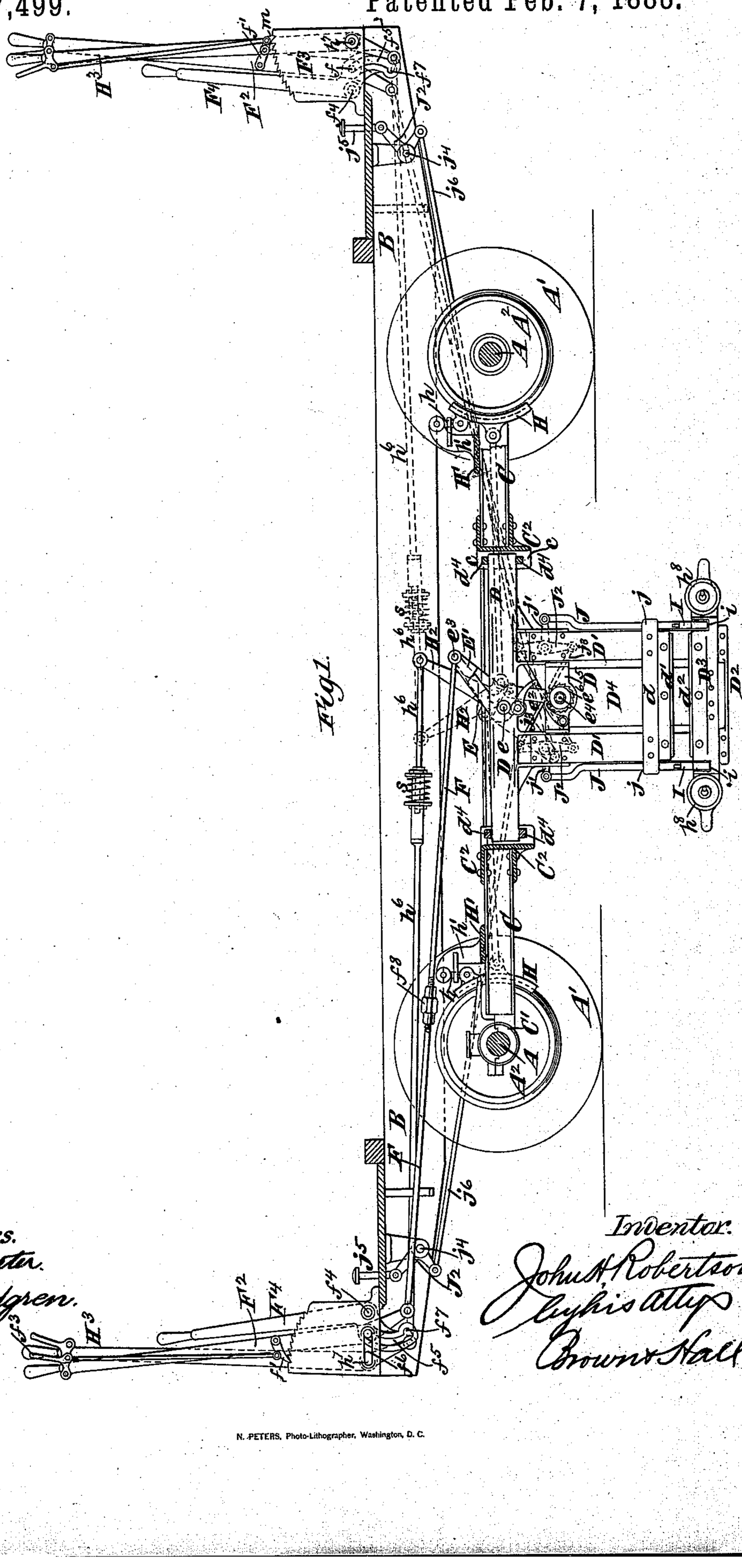


Fig. 1.

Witnesses.
Emil Koster.
C. L. Sundgren.

Inventor.
John H. Robertson
by his attys
Brown & Hall.

(No Model.) 4 Sheets—Sheet 2.

J. H. ROBERTSON.

CABLE RAILWAY GRIP.

No. 377,499. Patented Feb. 7, 1888.

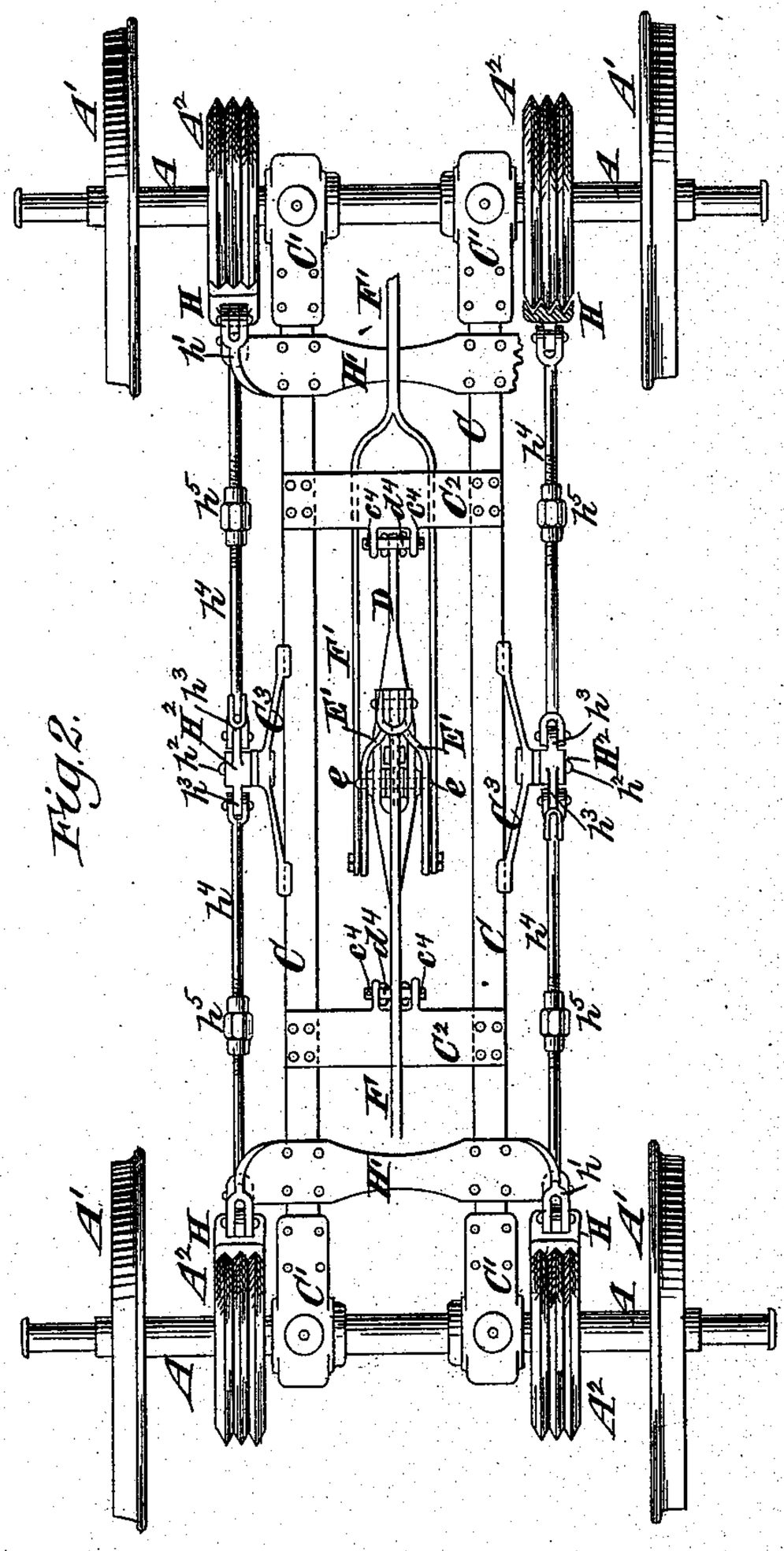


Fig. 2.

Witnesses
Emil Herter.
C. L. Sundgren.

Inventor:
John H. Robertson
by his attys
Brown & Hall.

(No Model.) 4 Sheets—Sheet 3.

J. H. ROBERTSON.

CABLE RAILWAY GRIP.

No. 377,499. Patented Feb. 7, 1888.

Fig. 4.

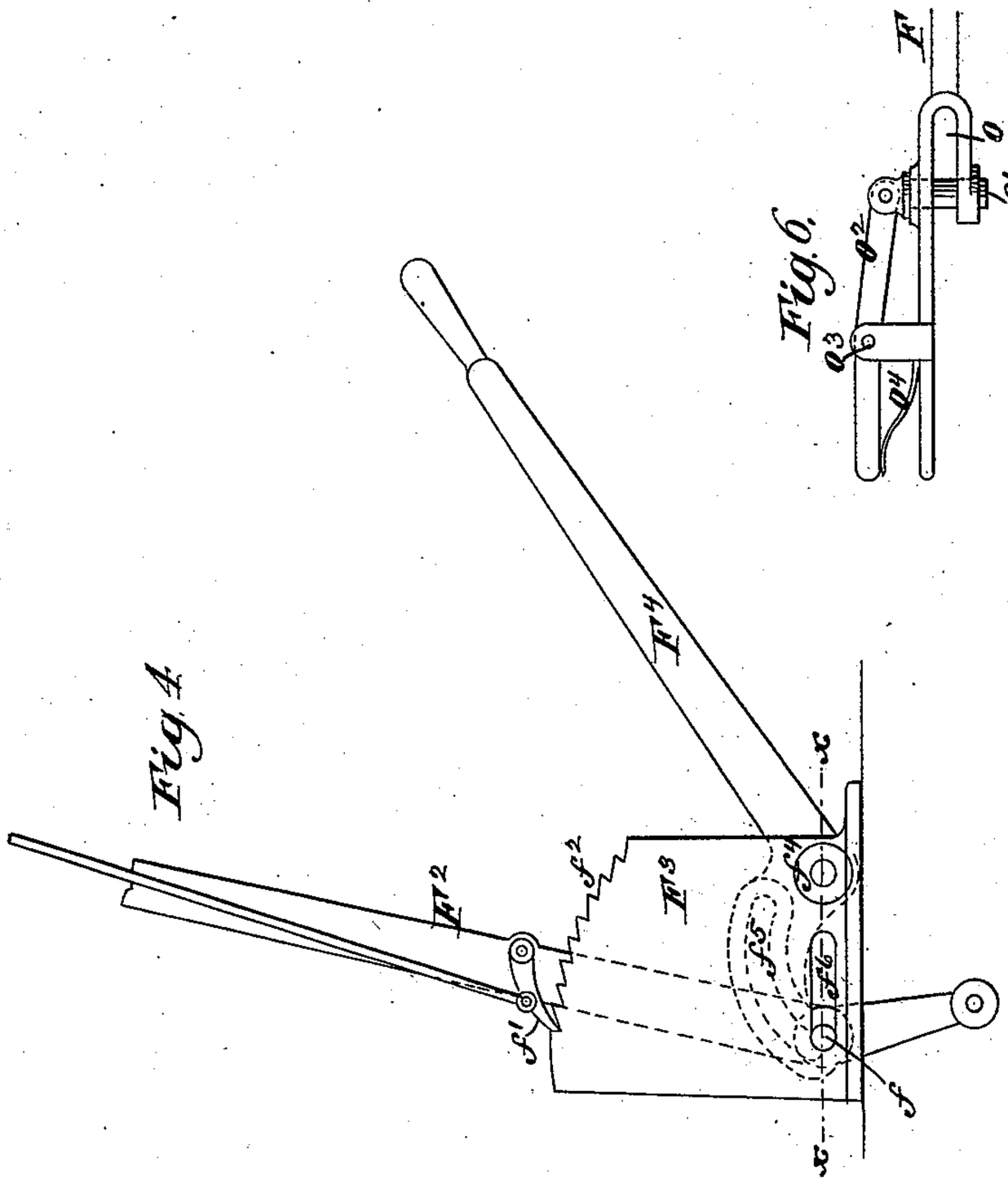


Fig. 6.

Fig. 5.

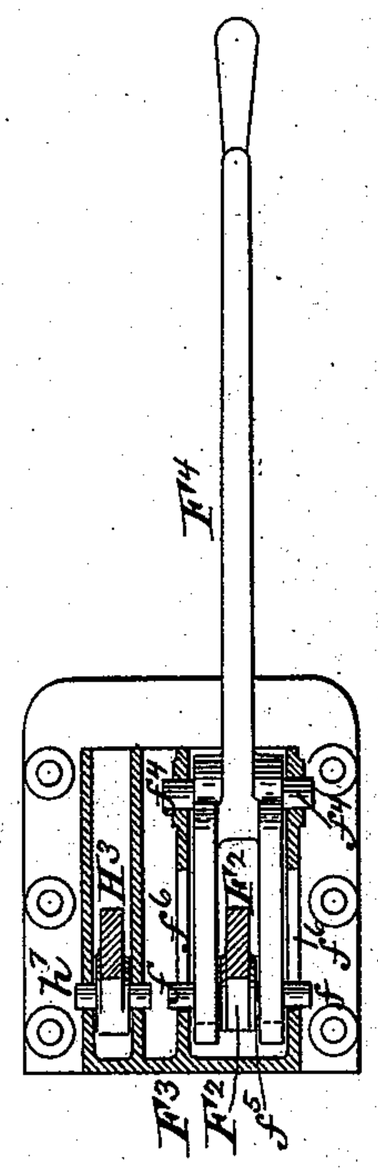
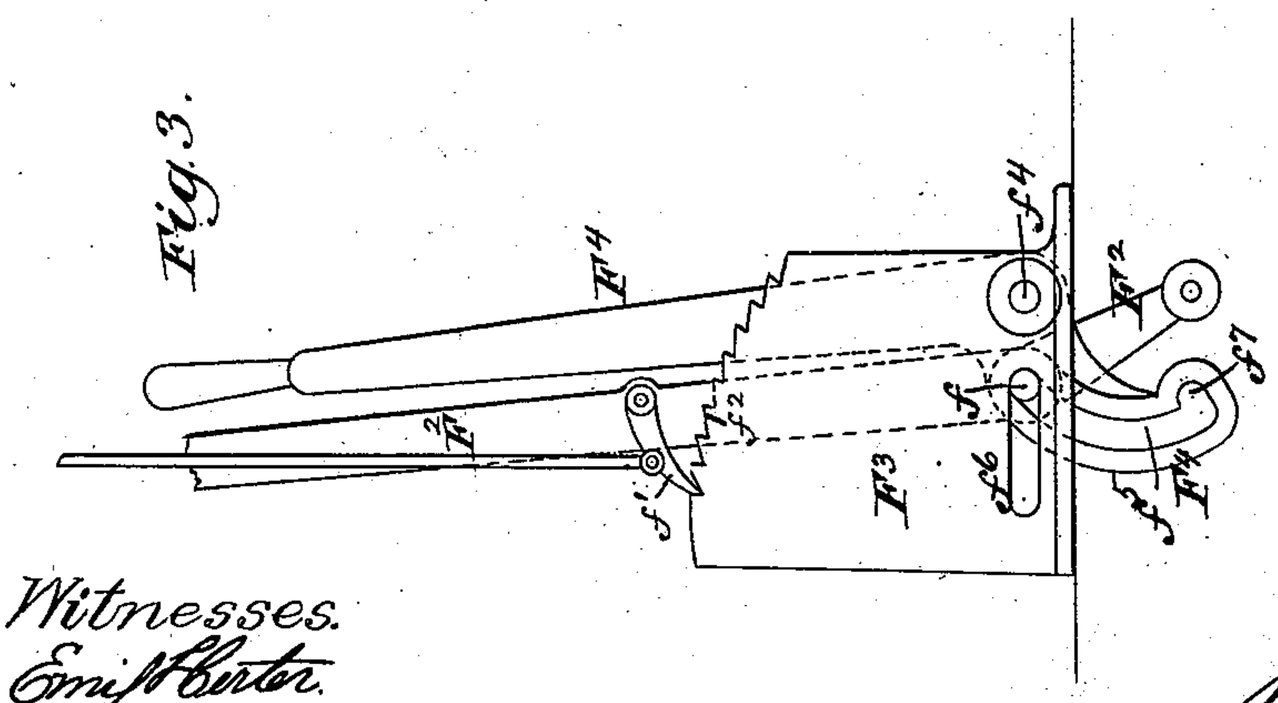


Fig. 3.



Witnesses.
Emil Berter.
C. L. Sundgren.

Inventor.
John H. Robertson
by his Attys
Brown & Hall

(No Model.)

4 Sheets—Sheet 4.

J. H. ROBERTSON.

CABLE RAILWAY GRIP.

No. 377,499. Patented Feb. 7, 1888.

Fig. 10.

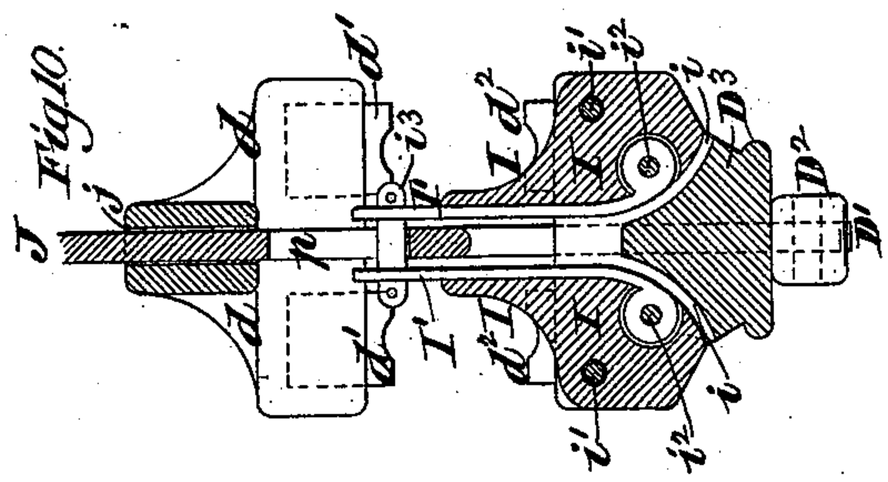


Fig. 11.

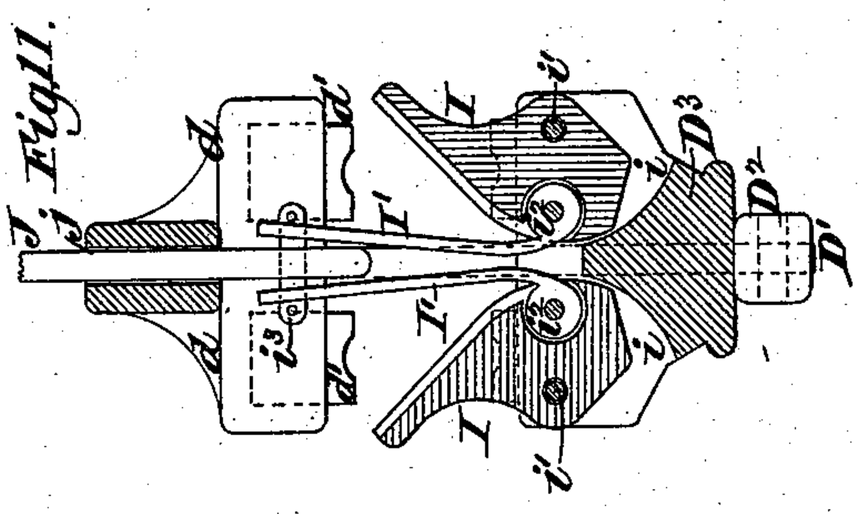


Fig. 9.

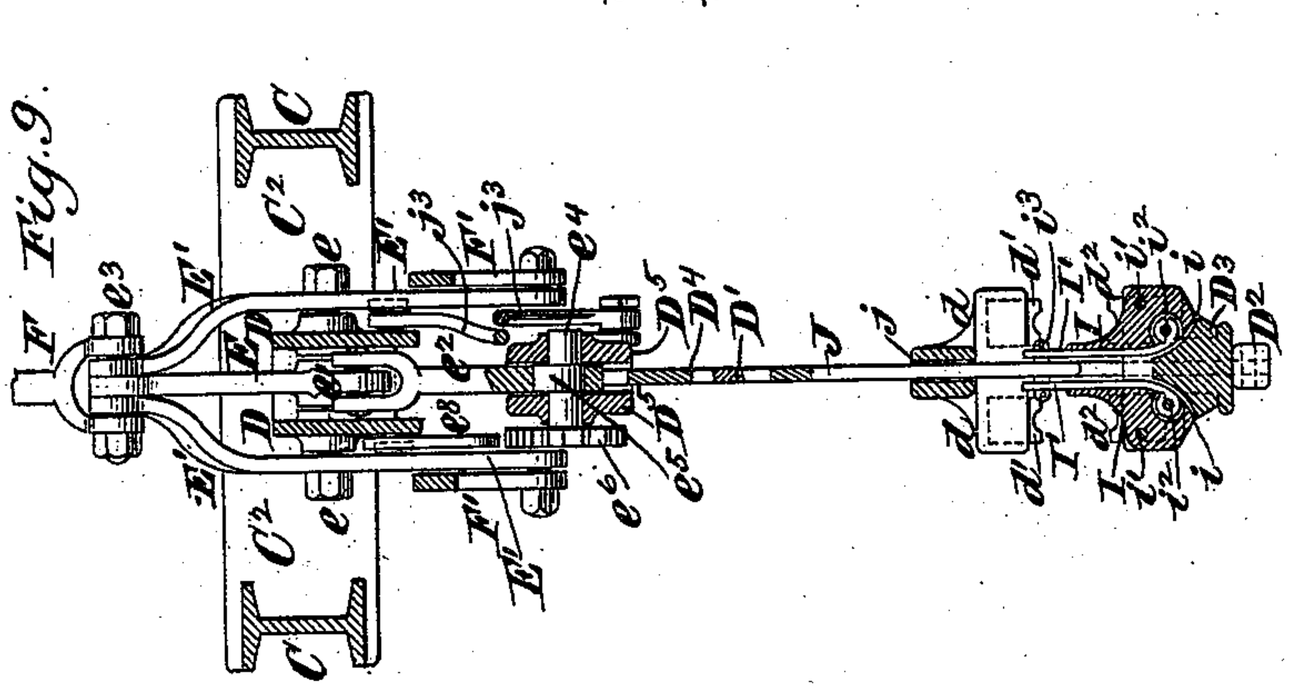


Fig. 7.

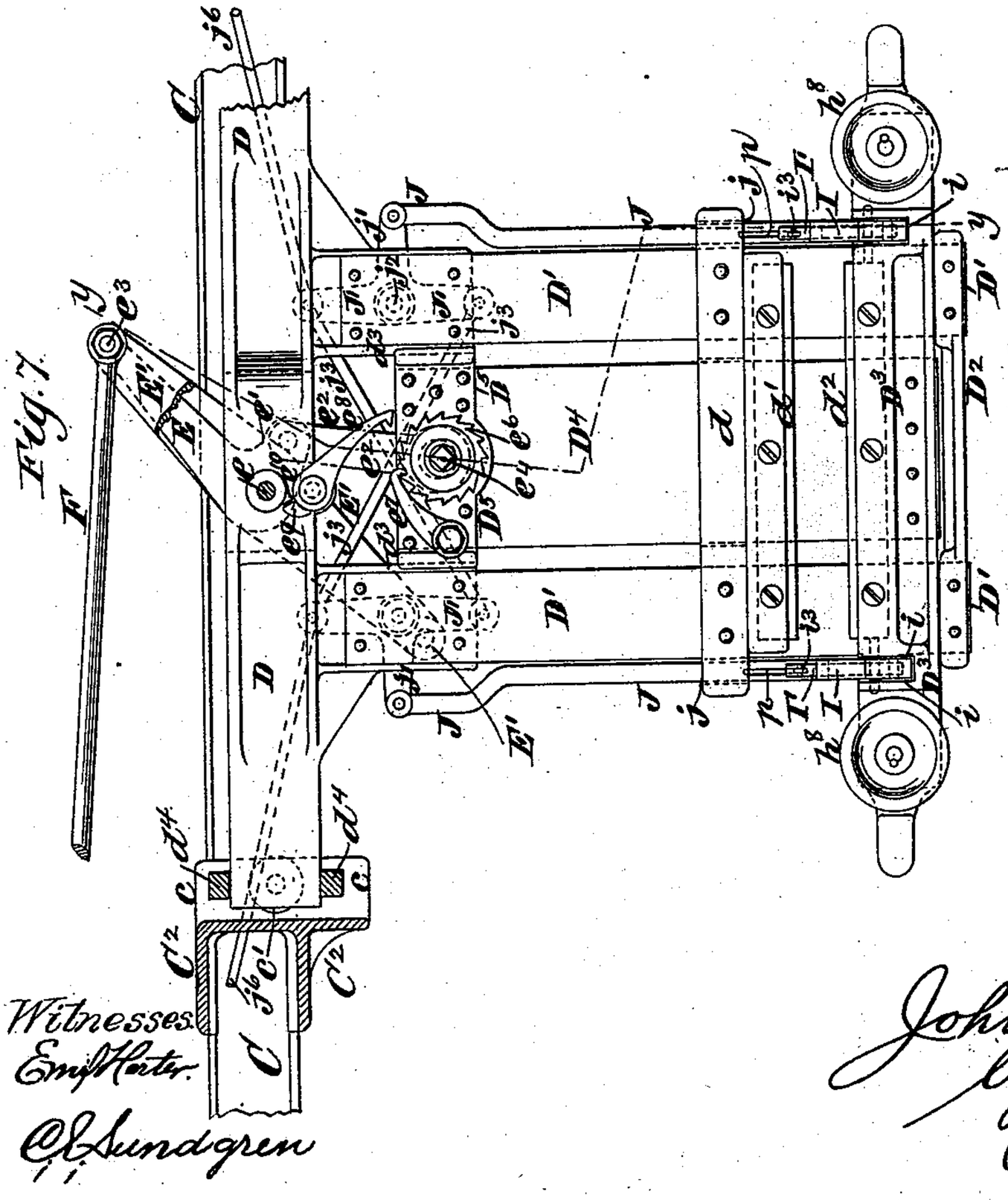
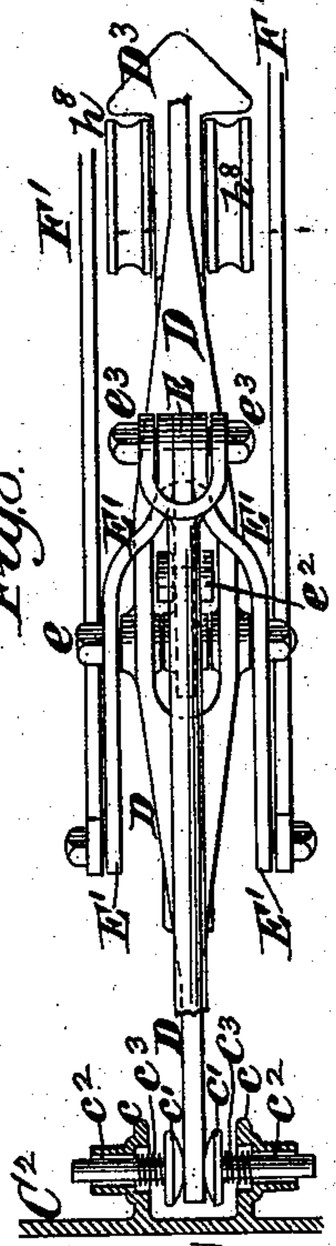


Fig. 8.



Witnesses.
Emil Hester.
C. L. Sundgren

Inventor:
John H. Robertson,
by his Attys
Brown & Hall.

UNITED STATES PATENT OFFICE.

JOHN H. ROBERTSON, OF NEW YORK, N. Y.

CABLE-RAILWAY GRIP.

SPECIFICATION forming part of Letters Patent No. 377,499, dated February 7, 1888.

Application filed April 20, 1887. Serial No. 235,462. (No model.)

To all whom it may concern:

Be it known that I, JOHN H. ROBERTSON, of the city and county of New York, in the State of New York, have invented a new and useful Improvement in Cable-Railway Cars, of which the following is a specification.

My invention relates more particularly to the construction of the grip mechanism which is provided upon cable-railway cars.

My invention is applicable to cable-grips which comprise a fixed jaw secured upon a grip-frame depending from the car and a movable jaw carried by a head which slides upon said frame and is raised and lowered to grip and release the cable. Commonly these grips are made double, or with jaws upon opposite sides, so as to engage either desired one of two cables.

In the operation of grips of this character the movable jaw is raised or lowered slightly to apply it to the cable with gripping force and to release it therefrom very frequently in a trip, and whenever it is desired to stop the car to take on or let off a passenger, and such movable jaw has its maximum length of movement given to it only occasionally—as, for example, when it is desired to pick up a cable at the terminus of the line or elsewhere. A common means of operating the movable jaw consists of a lever upon the car-platform connected by suitable mechanism with the sliding frame to which the movable jaw is attached, and in order to secure the maximum movement of the sliding jaw a comparatively wide range of movement of the operating-lever is necessary. A long lever is necessary in order to obtain a sufficient leverage to apply the movable jaw with a strong gripping action to the cable, and such long lever, if it were necessary to operate it through a range of movement sufficient to perform the entire movement of the movable jaw, would require more space than there is upon the platform of an ordinary car for its manipulation.

An important object of my invention is to provide for the employment of a long lever having comparatively great leverage for applying the movable jaw with gripping force to the cable, and at the same time to reduce the range of movement necessary for such lever. To this end I combine with the fixed and movable jaws of the cable-grip a lever and connections for operating the movable jaw and a movable fulcrum-support for the lever, whereby the lever and movable jaw may be moved by the fulcrum-support to bring the jaw into gripping relation with the cable before the jaw is operated to grip the cable by said lever. The grip-lever may have a ratchet-and-pawl lock, whereby it engages with a frame or housing in which it is mounted, and the pawl acts as a fulcrum when the normal fulcrum-support of the lever is moved to perform the maximum portion of the movement of the gripping-jaw. The movable fulcrum-support for the grip-lever may advantageously consist of a second lever, which is forked to embrace the grip-lever and constructed with cam-shaped slots receiving the fulcrum of the grip-lever, and the fulcrum-pin of the grip-lever may slide within a horizontal slot in the frame or housing wherein the levers are arranged. When the grip is operated from either end of the car, it is usual to disconnect the grip-connections from the lever at the opposite end of the car, and this may be accomplished by constructing the rod through which the lever operates directly with a fork receiving the end of the lever and having a spring-actuated joint-pin, whereby provision is afforded for disconnecting the lever from the movable jaw.

The invention also consists in novel details of construction and combination of parts through which power is transmitted from the grip-lever to the rising and falling frame which carries the movable jaw.

The invention also consists in a novel construction and combination of parts whereby the stationary grip-frame is held in central position widthwise of the car by devices which permit it to yield or move laterally in rounding curves.

The invention further consists in a novel combination of parts whereby wear in the lower movable jaw of the grip is compensated for or taken up automatically.

The invention also consists in a novel combination of parts connected with the grip and by which either cable, when it is desired to no longer use it, may be thrown laterally out of range of the gripping-jaws.

In the accompanying drawings, Figure 1

represents a longitudinal section of such portions of a car and its grip as are necessary to illustrate my invention. Fig. 2 is a plan of the two axles and the frame supported in fixed relation to them and to which the grip mechanism and the brake mechanism are secured. Fig. 3 is an elevation, upon a larger scale than Fig. 1, of one grip-lever and its movable support, illustrating such parts in the position which they occupy when the movable jaw is in an inoperative position or is farthest removed from the fixed jaw. Fig. 4 is a similar view of the parts shown in Fig. 3, but illustrating them in the position which they occupy when the movable fulcrum-support of the grip-lever has been shifted to bring the movable jaw of the grip into gripping relation to its cable. Fig. 5 is a horizontal section upon about the plane of the dotted line *x x*, Fig. 4. Fig. 6 is a plan of a portion of the rod through which the grip-lever transmits its motion, and illustrating the construction whereby provision is afforded for disconnecting such rod from the grip-lever. Fig. 7 is a sectional elevation, upon a larger scale than Fig. 1, of the grip mechanism, also showing a portion of its supporting-frame. Fig. 8 is a plan of the parts shown in Fig. 7. Fig. 9 is a vertical section upon about the plane of the dotted line *y y*, Fig. 7; and Figs. 10 and 11 are views of the grip-jaws and appurtenances similar to Fig. 9, but upon a larger scale, and showing the throw-off devices which are employed. In Fig. 10 these throw-off devices are represented in their inoperative position, and in Fig. 11 they are represented in the position which they occupy when in action.

Similar letters of reference designate corresponding parts in all the figures.

A designates the axles of the car, on which are the supporting-wheels A′, and B designates the main frame or platform of the car, which may be supported from the axles by any suitable system of springs.

I have not shown the springs or axle-boxes, as their construction will be well understood by mechanics familiar with the subject, and my invention in no way relates to them.

From the axles is supported a frame which is maintained in fixed relation to them, and from which the grip and also the brake mechanism is supported. As here represented, this frame consists of I-beams C, which are parallel with each other, as best shown in Fig. 2, and which are secured at the end in castings C′, constructed with boxes to fit the axles A, and this fixed frame also comprises cross portions or castings C^2, which are best shown in Figs. 1, 2, and 7. These cross pieces or castings C^2 serve to maintain the beams C at proper distances apart, and also serve to directly support the grip-frame, as I shall now proceed to describe.

What I term the "fixed" frame of the grip comprises a head-piece, D, (best shown in Figs. 7 and 8,) and two plates or thin uprights, D′, rigidly secured to and depending from this head and connected at their lower ends by a cross piece or brace, D^2. To the plates or thin uprights D′ is fixed a jaw-holder, *d*, in which is removably secured a fixed jaw or die, *d′*, and opposite to this fixed jaw or die, but below it, is a movable jaw or die, d^2, secured in position within the jaw-holder D^3. This jaw-holder D^3 is mortised, so as to slide upon the upright plates D′, and is itself secured to a central plate, D^4, which is termed a "lifting-plate," and which has at the upper end a cross-head, D^5, fitted to slide upon suitable guides, d^3, formed upon the fixed frame D D′. I have here represented the fixed plates D′ as having fixed jaw-holders *d* secured upon their opposite sides, and the lifting-plate D^4 as having its sliding head D^3 provided with movable jaws on its opposite sides, so that the grip is adapted for receiving and to operate in connection with either one of two parallel cables.

It will be understood that the several plates D′ D^4 travel in a narrow slot through which the cable-tunnel beneath the street communicates with the surface, each slot being, for example, only about three-quarters of an inch in width. It will therefore be necessary in rounding curves that the entire grip mechanism shall be free to move transversely to the length of the car. In some constructions such lateral movement is provided for by pivoting the fixed frame of the grip at its upper end; but in a preferable construction the frame of the grip is so supported at its upper end that it may move bodily in a lateral direction, and so that, notwithstanding its lateral movement, the plates D′ D^4 will always maintain their vertical position. In this example of my invention the ends of the frame-head D are supported by and are fitted to slide laterally between cross pieces or bearers d^4, which may be rectangular, as shown best in Fig. 7, and which extend across between ears or lugs *c*, with which the cross-pieces C^2 of the fixed frame supported by the axles are provided.

The ears or lugs *c* are at such distance apart as to permit the lateral movement of the frame-head D between them, and in the ears or lugs are mounted buffers *c′*, which slide in suitable sockets, c^2, provided for them, and to which are applied springs c^3. These buffers *c′* normally hold the frame-head D in central position widthwise of the car, and yet they will yield to permit the frame to move laterally from such position, and will return it to such central position after lateral movement. The bearers or pins d^4 are removably fitted in the lugs or ears, so that they may, one or both of them, be removed when the grip-frame is to be detached from the frame C C^2, and such pins or bearers are held against accidental displacement by cross-pins c^4, as shown in Fig. 2, or by other suitable means. The frame-head D of the fixed grip-frame is forked or yoked at the center, as best shown in Figs. 8 and 9, and through this fork or yoke extends a pin or bolt, *e*. Within the yoke of the frame-head D,

and upon the bolt or pin *e*, is fulcrumed a lever E, which has a shorter arm, *e'*, connected by a rod or link, e^2, with the cross-head D^5 of the grip.

E' designates other levers, which are fulcrumed upon a pin or pivot, *e*, and which extend on opposite sides thereof. These levers E' straddle the frame-head D, and their lower ends are separated considerably, as shown best in Fig. 9, while their upper ends are deflected inward, so as to lie close to and on opposite sides of the lever E. The pin or bolt *e* may be considered as a rock-shaft, upon which the levers E' are secured, and the lever E, with its short arm *e'*, may be considered as arms projecting from this rock-shaft. A pin or bolt, e^3, connects the upper ends of the levers E E' together, and with these ends and by this common pin a forked grip-operating rod, F, is connected. With the opposite or lower ends of the levers E' is connected a rod, F', which is forked for a considerable distance, as shown in Figs. 2 and 8, so as to straddle the grip. A draft upon either of the rods F F' will tend to lift the arm *e'*, and through the rod or link e^2 will raise the lifting-plate D^4 and the movable jaw-holder D^3.

It is obvious that as the movable and fixed jaws of the grip wear by use the lifting-plate D^4 and the movable jaw-holder D^3 must be raised a greater distance to bring the movable jaw into gripping action upon the cable. To compensate for such wear, I provide in the mechanism through which the lifting-frame of the grip is operated an automatic take up device, which is best shown in Figs. 7 and 9. The rod or link e^2, which enters the cross-head D^5, is fitted upon a pin or short shaft, e^4, having an eccentric portion, e^5, which is received in the eye of the rod, and upon this pin or short shaft is a ratchet-wheel, e^6, with which engages a stop-pawl, e^7.

Upon the frame-head D of the grip I have represented a pawl, e^8, which, by a toe, e^9, upon its upper end engaging a projection, e^{10}, upon the frame-head D, is held in about the position represented in Fig. 7. When wear upon the jaws of the grip has taken place to such an extent that in the lifting movement of the cross-head D^5 the teeth of the ratchet-wheel e^6 are brought into engagement with the pawl e^8, it is obvious that the pawl will, when the grip is released and permitted to descend, turn the wheel e^6 the space of a tooth, and by such turning movement the eccentric portion e^5 of the pin or short shaft e^4 will be rotated within the eye of the rod e^2, and will have the effect of lowering the pivotal center of said rod in the cross-head, thus compensating automatically for the wear to which the dies or jaws are subjected.

As best shown in Fig. 1, the rods F F', through which the grip is operated from opposite ends of the car, are connected with the lower ends of grip-levers F^2, and the description of one lever and appurtenances applies clearly to both. The lever F^2 is supported in a frame or housing, F^3, and has a pawl, *f'*, which engages a series of ratchet-teeth, f^2, in the top of the frame and constitutes a locking device for holding the lever after it has been moved to apply the grip. This pawl may be lifted to unlock the lever by means of a hand-piece or spoon, f^3, applied to the upper end of the lever.

The lifting-frame of the grip, which carries the movable jaw, has to be raised and lowered to a slight extent very frequently from time to time as the car is to be stopped or started; but it is necessary only occasionally to move and raise the movable jaw throughout its whole range of movement.

It is of course necessary to provide a grip-lever F^2 of considerable length, in order to obtain sufficient power to apply the movable jaw with such pressure to the cable as to prevent its slipping, and upon the platform of the car there is no room for the operation of such long lever through a sufficient range to perform the maximum lifting and lowering movement of the movable jaw. In order that this excessive motion of the long grip-lever shall not be necessary, I provide a movable fulcrum-support for the grip-lever F^2, which may be first operated to raise the movable jaw into gripping relation to the cable, and then by a comparatively slight movement of the lever F^2 the jaw may be applied with gripping force to the cable. The construction of this fulcrum-support for the grip-lever F^2 will be best understood from Figs. 3, 4, and 5. As here represented, the movable fulcrum-support consists of a lever, F^4, which is fulcrumed at f^4 in the frame or housing F^3, and which has its portion below the fulcrum f^4 forked, so as to embrace the grip-lever F^2. The forked portion of the lever F^4 is constructed with cam-shaped or eccentric slots f^5, which receive through them the fulcrum-pin *f* of the grip-lever F^2, and such fulcrum or pin *f* is free to slide horizontally in slots f^6, formed in the frame or housing F^3.

The cam-shaped slots f^5 of the lever F^4 have at the lower end concave depressions or seats f^7, which are of such size that the fulcrum *f* of the grip-lever may work in them, and it will be obvious that when the lever F^4 is swung upon its fulcrum f^4 the cam-shaped or eccentric slots f^5 will, by their action upon the fulcrum *f* of the grip-lever F^2, move that fulcrum laterally or horizontally in the slots f^6, and when the lever F^4 is moved to the position shown in Fig. 4 the seats or depressions f^7 are brought into the same horizontal plane with the slots f^6, and the fulcrum *f*, by dropping back into these seats or depressions, will hold the lever F^4 in the position to which it is moved without any additional locking devices.

The rod F or F', being connected with the lower end of the grip-lever F^2, constitutes the resistance to be overcome when the lever F^4 is moved from the position shown in Fig. 3 to the position shown in Fig. 4, and the lever F^4 serves to move the lever F^2 and to raise the

movable jaw of the grip into gripping relation to the cable, the pawl f' meanwhile serving as a fulcrum upon which the lever F^2 is moved. After the movable jaw has thus been raised into gripping relation to the cable, the jaw may be applied with gripping force to the cable by the operation of the lever F^2, and inasmuch as but a comparatively slight movement of the jaw is necessary to grip the cable the movement of the grip-lever F^2 will not be excessive. When the grip is controlled by the lever F^2 at one end of the car, it is necessary to disconnect the rod F or F′ from the other lever F^2. To provide for this, I may make the rod with a fork, *o*, as shown in Fig. 6, and fit the pin o' to slide by a hand-lever, o^2, fulcrumed at o^3, and having a spring, o^4, applied to it.

The rods F F′ may have in them turn-buckles, as shown at f^8 in Fig. 1, in order to properly adjust their length.

I will now describe the brakes and brake-applying mechanism, which will be best understood from Figs. 1 and 2. Upon the axles A are secured brake-drums A^2, which are independent of the supporting-wheels A′, and, as here represented, have circumferentially-grooved faces. Two brake-drums are provided on each axle, one upon each side of the central line of the car, and brake-shoes H are arranged in operative relation to these drums. The brake-shoes may be held in place by links or rods *h*, pivoted upon brackets or posts h', rising from cross pieces or bars H′, secured upon the beams C of the frame, which is supported by the axles. Upon each of the beams C, as best shown in Fig. 2, is secured a bracket, C^3, to which is pivoted a lever, H^2, as shown. The lever H^2 is pivoted at h^2 and has short arms h^3, extending in opposite directions, and which are connected by rods h^4 with the brake-shoes H. In these rods are turn-buckles h^5, for adjusting them to proper length, and from the long arm of the lever H^2 extends a rod, h^6, for operating such lever to apply or remove the brakes. The rods h^6 extend from the levers H^2, which are on opposite sides of the car, toward opposite ends thereof, and are connected with brake-applying levers H^3 at opposite ends of the car. Each brake-applying lever may be fulcrumed at h^7 in the frame or housing F^3, which supports the grip and fulcrum levers F^2 F^4. When the car is moving in one direction, the driver operates the brake-lever H^3 at the end of the car at which he may be, and thus applies the brake-shoes H to the brake-drums A^2, which are on both axles at one side of the car, and when he is at the other end of the car, and the car is moving in a reverse direction, he applies to the brake-drums A^2 on both axles the brake-shoes H, which are on the opposite side of the car.

I do not here claim the mechanism shown for operating the brakes, as it is made the subject of my application for Letters Patent Serial No. 256,622, filed December 1, 1887.

When it is desired to transfer the grip from one cable to another, the cable before in use is thrown off laterally, and I will now describe, with particular reference to Figs. 9, 10, and 11, the mechanism which I employ for accomplishing this result. Upon the lower sliding head, D^3, of the vertically-movable frame of the grip which carries the jaw d^2 are cable-supporting sheaves h^8, and just inward of these sheaves, and lying close to the upright plates D′ of the fixed grip-frame, are throw-off levers I, which are best shown in Figs. 10 and 11. These levers I are arranged in pairs, and one at each end of each of the movable jaws d^2 on opposite sides of the grip. They are arranged in notches *i*, formed in the sliding head or jaw-holder D^3, and are fulcrumed at i' beyond the concaved upper surface of the movable jaw d^2. Operating rods or connections I′ are pivoted one to each of the throw-off levers I at the points i^2, and are so shaped as to conform nearly to the contour of the throw-off levers fitting in the notches *i* in the jaw-holder D^3. When the operating rods or connections I′ are raised, the throw-off levers I are not lifted bodily, because the pivots i', on which they are fulcrumed, retain their fixed position on the sliding head D^3; but by the lifting of the connections I′ the levers I are swung outward directly on their pivots, and thus they throw off the cables without having to lift the weight of the cables, which are meantime supported upon the lower jaws. Each pair of the rods or connections I′ is connected by a cross-pin, i^3, with a vertically-movable rod or bar, J, lying in the same plane with the plates D′ D^4, but close to the edge of the latter. These rods J, one in advance of and one behind the grip, are fitted to suitable guides, *j*, in the fixed jaw-holder *d*, as clearly shown in Fig. 7, and the rods or bars J are connected at their upper ends with the laterally-extending arms j' of three-armed levers J′. These levers are fulcrumed at j^2 in the fixed frame of the grip, and through arms which extend upward and downward from their fulcrums are connected with each other by cross-connections j^3, as shown in Fig. 7, the upper end of the lever J′ on one side of the grip being by the rod or connection j^3 joined to the lower end of the lever J′ on the opposite side of the grip. Consequently it will be seen that motion transmitted to either of the levers J′ will, through the cross-connections j^3, be imparted to the opposite lever. When the cable is to be thrown off, the rods J are lifted, and through the lower pairs of rods or connections I′ thereof the levers I are swung upon their pivots i' in a plane transverse to the line of movement of the cable, and as represented in Fig. 11. Such movement of the throw-off levers I will throw either cable out of range of the grip. Any suitable connections may be employed for operating the rods J from the ends of the car. The means here shown in Fig. 1 at each end of the car consists of a bell-crank lever, J^2, fulcrumed at j^4 and having connected with one arm a push-pin, j^5, which extends through the car-plat-

form. The other arm of this bell-crank lever is connected by a rod, j^6, with the upper arm of one of the three-armed levers J′, and when pressure is exerted upon the push-pin j^5 the laterally-extending arms j' of the levers J′ will be lifted, and through the rods J and I′ will produce the operation of the throw-off levers I and throw off the cable.

In the foregoing description I have referred to the frame D D′ *d* as the fixed frame of the grip to distinguish it from the vertically-movable or lifting frame D^3 D^4 D^5, and notwithstanding the fact that such "fixed" frame, as I term it, is free to move to a limited degree laterally as the car may round curves.

To enable the lower grip-jaws to be raised without interfering with the throw-off devices carried by the movable jaw-holder, I slot the rods J, as shown at *p* in Fig. 7.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The combination, with the fixed and movable jaws of a cable-grip, of a lever and connections for operating the movable jaw, and a movable fulcrum-support for the lever, whereby the lever and movable jaw may be moved by the fulcrum-support to bring the said jaw into gripping relation to the cable before the jaw is applied by the operation of said lever to grip the cable, substantially as herein described.

2. The combination, with the fixed and movable jaws of a cable-grip, of a lever and connections for operating the movable jaw, a movable fulcrum-support for said lever, and a ratchet-and-pawl lock for said lever, whereby the lever will be held to prevent its swinging on its fulcrum when the fulcrum-support is moved, substantially as herein described.

3. The combination, with the fixed and movable jaws of a cable-grip, of a grip-lever and connections for operating the movable jaw, and a second lever having a cam-shaped slot receiving the fulcrum of the grip-lever and which by its movement serves to shift the grip-lever and move the grip-jaw into gripping relation to the cable, substantially as herein described.

4. The combination, with the fixed and movable jaws of a cable-grip, of a grip-lever and connections for operating the movable jaw, the frame F^3, having slots f^6, in which the fulcrum *f* of said lever may slide, the lever F^4, having cam-shaped slots f^5, also receiving the grip-lever fulcrum, and a lock whereby the grip-lever may be fixed in the frame at a point above its fulcrum, substantially as herein described.

5. The combination, with a movable grip-jaw and its operating-lever, of the rod F or F′, through which said jaw is moved by the lever, the said rod being forked at *o*, and having the spring-actuated joint-pin *o′*, whereby provision is afforded for disconnecting the lever from the movable jaw, substantially as herein described.

6. The combination, with the head D of the grip-frame and the movable grip-jaw, of the lever E, pivoted in said frame-head and having an arm, *e′*, connected by a rod, e^2, for moving said jaw, the levers E′, straddling the frame-head and connected at one end with the lever E, the rods F F′, extending, respectively, from the common joint of the levers E E′ and from the opposite ends of the levers E′, and grip-levers at opposite ends of the car, and with which the rods F F′ are connected, substantially as herein described.

7. The combination, with the axles of a car and a frame supported in fixed relation thereto and provided with the removable horizontal guides d^4, of a grip-frame depending from and movable laterally between said guides, and the buffers *c′*, for holding said grip-frame in central position, substantially as herein described.

8. The combination, with a main grip-frame carrying a fixed jaw, of a movable jaw and the lifting-plate and cross-head through which it is operated, and a rod or link connected with the cross-head and having an automatic take-up device for compensating for wear in the jaws, substantially as herein described.

9. The combination, with the movable jaw of a cable-grip and the lifting-plate and cross-head for operating said jaw, of a link or rod for operating the cross-head, an eccentric-pin whereby said link or rod is connected with the cross-head, and which carries a ratchet-wheel, and a pawl upon the grip-frame, which serves, when the cross-head is raised sufficiently, to engage the ratchet, substantially as herein described.

10. The combination, with the fixed and movable jaws of a cable-grip and a head, D^3, carrying the lower jaw, of a throw-off lever pivoted in said head to swing in a vertical plane transverse to the line of cable, and the lifting-connection attached to the said throw-off lever at a point inward of the pivot connecting it with the head, and by which the said lever may be swung upon its pivot, said pivot remaining in fixed position on the head, substantially as herein described.

11. The combination, in a double cable-grip, of a head carrying the lower jaw, the throw-off levers I, movable in said head, and the rods I′, whereby said throw-off levers are operated, substantially as herein described.

12. The combination, in a cable-grip, of a head carrying the lower jaw, throw-off levers pivoted in said head at opposite ends of the jaw to swing in vertical planes transverse to the line of cable, the three-armed levers J′, having cross-connections j^3, and connected by rods J I′ with the throw-off levers, and connections from opposite ends of the car to said three-armed levers, substantially as herein described.

JOHN H. ROBERTSON.

Witnesses:
FREDK. HAYNES,
HENRY J. MCBRIDE.