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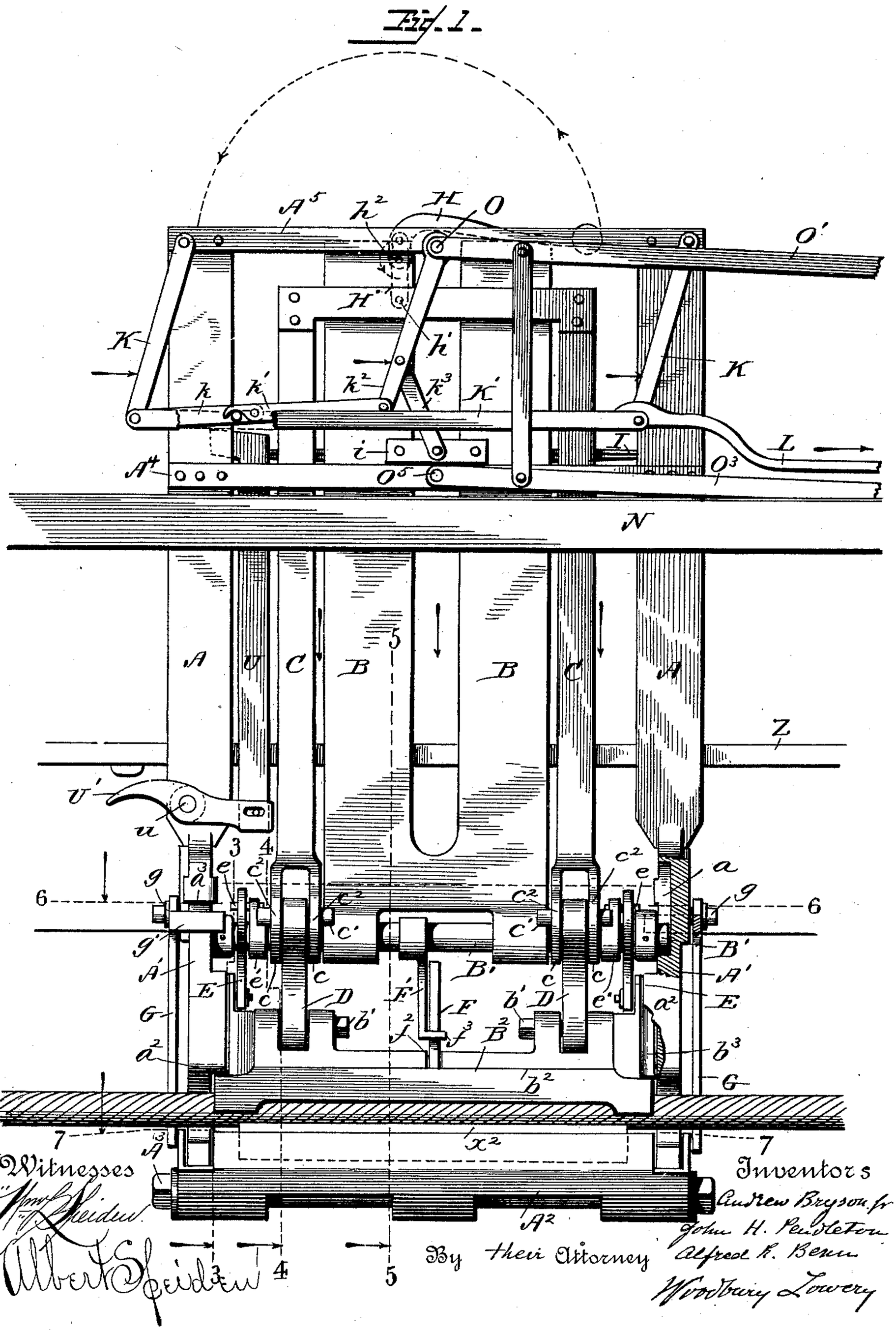
A. BRYSON, Jr., J. H. PENDLETON & A. R. BENN.

GRIP MECHANISM FOR DUPLEX CABLES.

No. 475,846. Patented May 31, 1892.

Fig. 1.



Witnesses

Wm. F. Leidersdorf

Albert Speidel

Inventors

Andrew Bryson, Jr.

John H. Pendleton

Alfred R. Benn

By their Attorney

Woodbury Lowery

(No Model.) 5 Sheets—Sheet 2.

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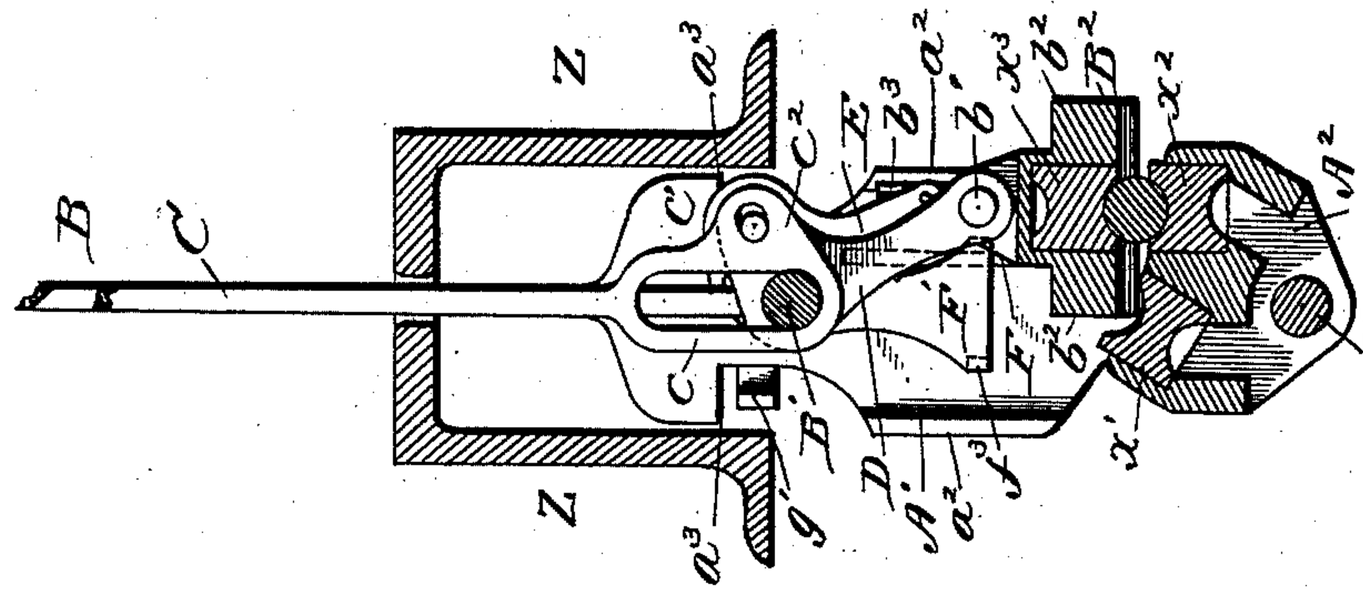

Fig. 4.

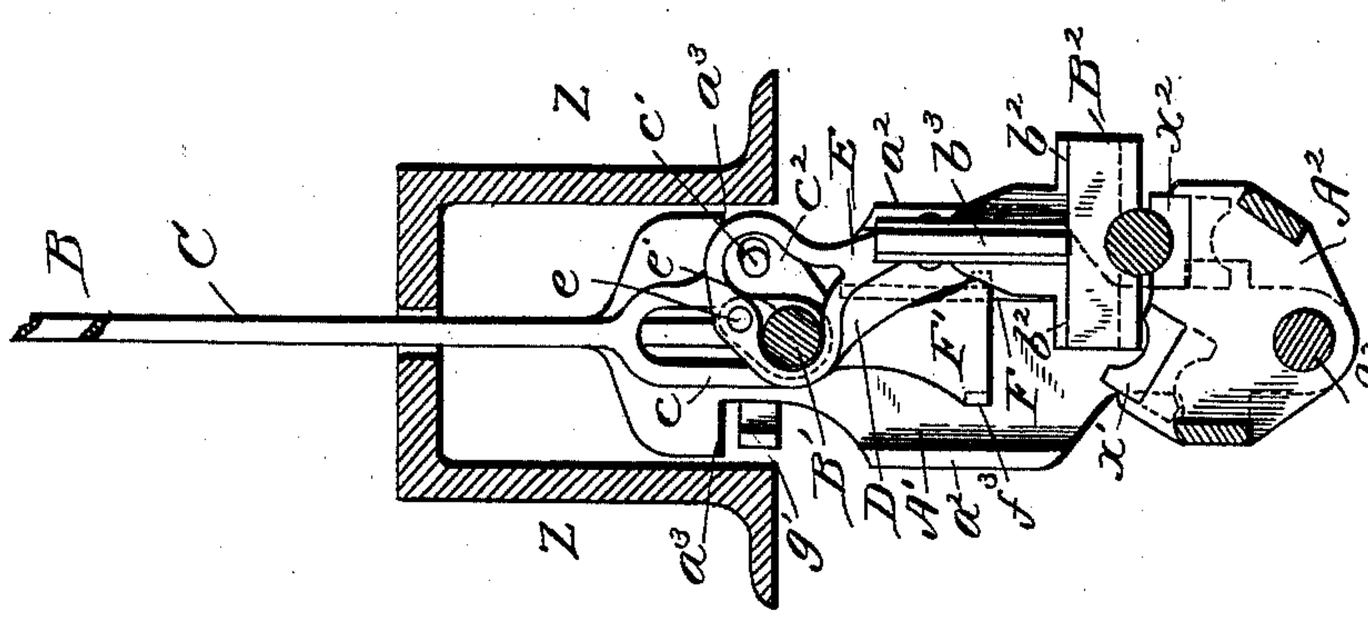

Fig. 3.

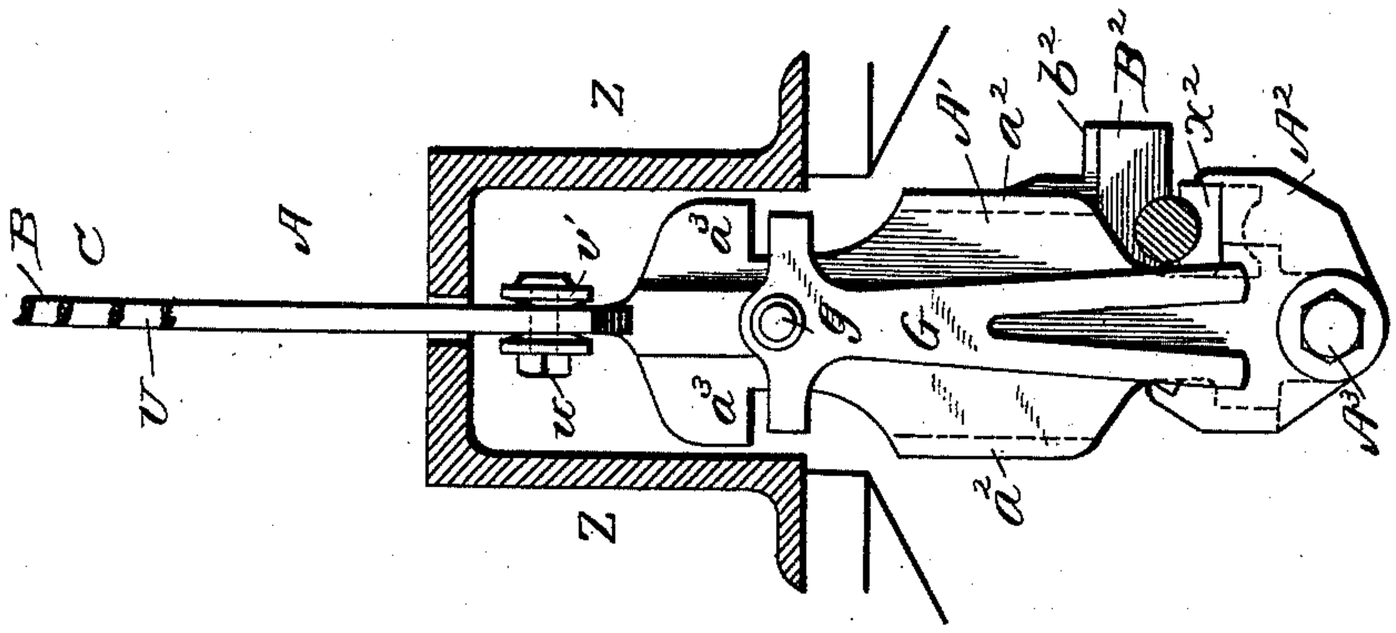

Fig. 2.

Witnesses
Wm. F. Speidel.
Albert Speidel

Inventors
Andrew Bryson Jr.
John H. Pendleton
Alfred R. Benn
By Their Attorney Woodbury & Lowery

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A. BRYSON, Jr., J. H. PENDLETON & A. R. BENN.

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Fig. 5.

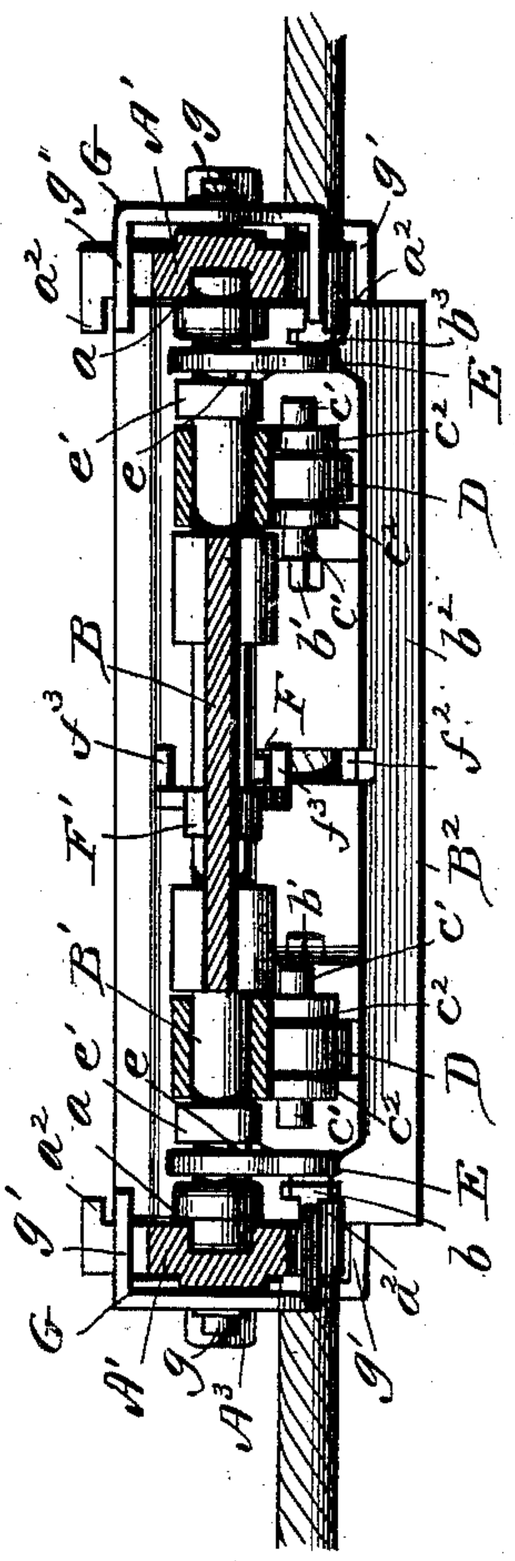


Fig. 7.

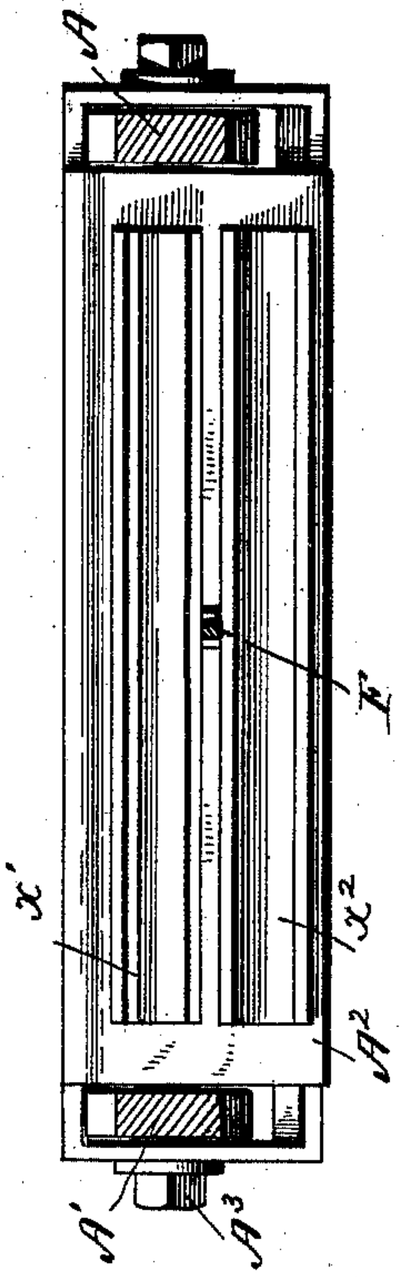
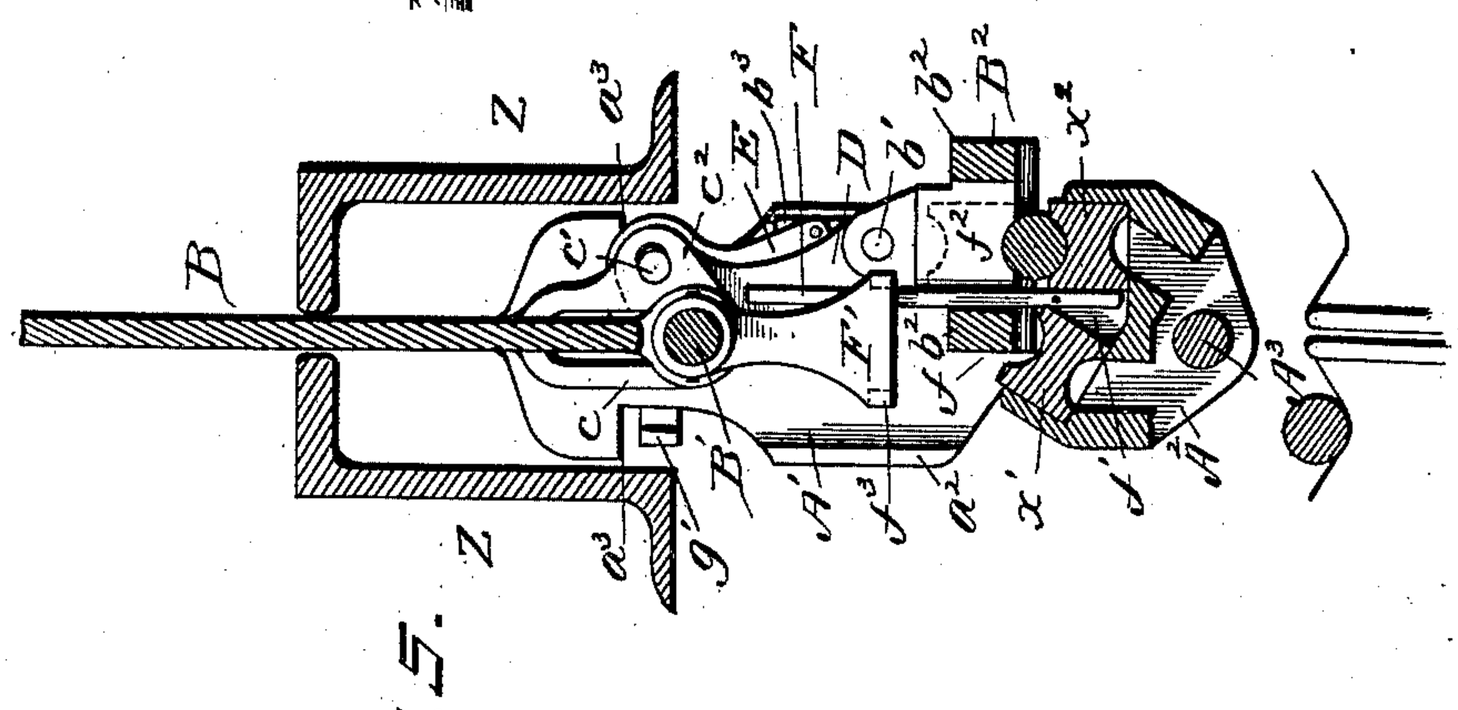


Fig. 6.



Witnesses
W. J. Speidel.
Albert Speidel.

Inventor
Andrew Bryson Jr.
John H. Pendleton
Alfred R. Benn
By their Attorney
Woodbury & Lowery

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A. BRYSON, Jr., J. H. PENDLETON & A. R. BENN.

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Fig. 8.

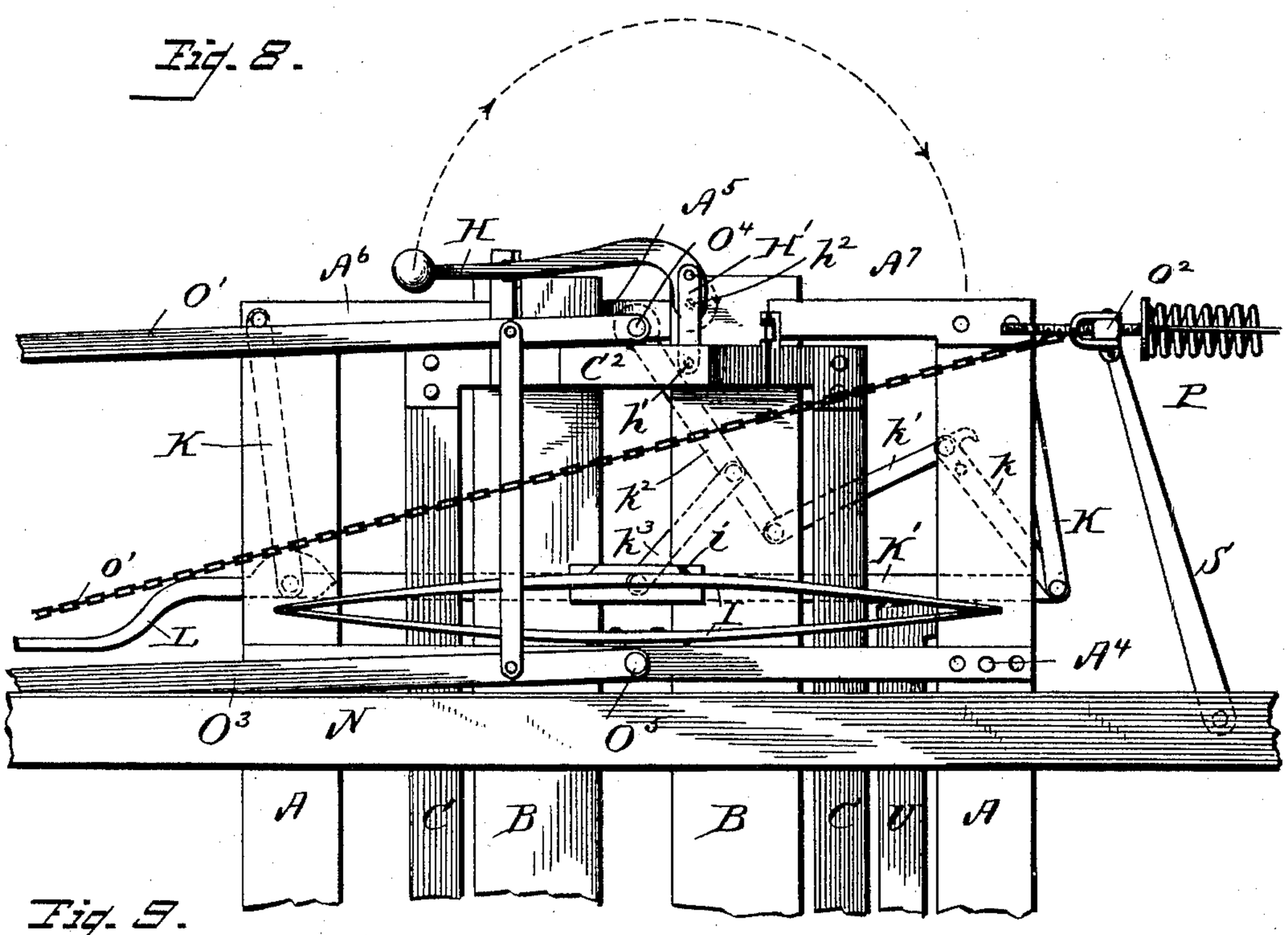
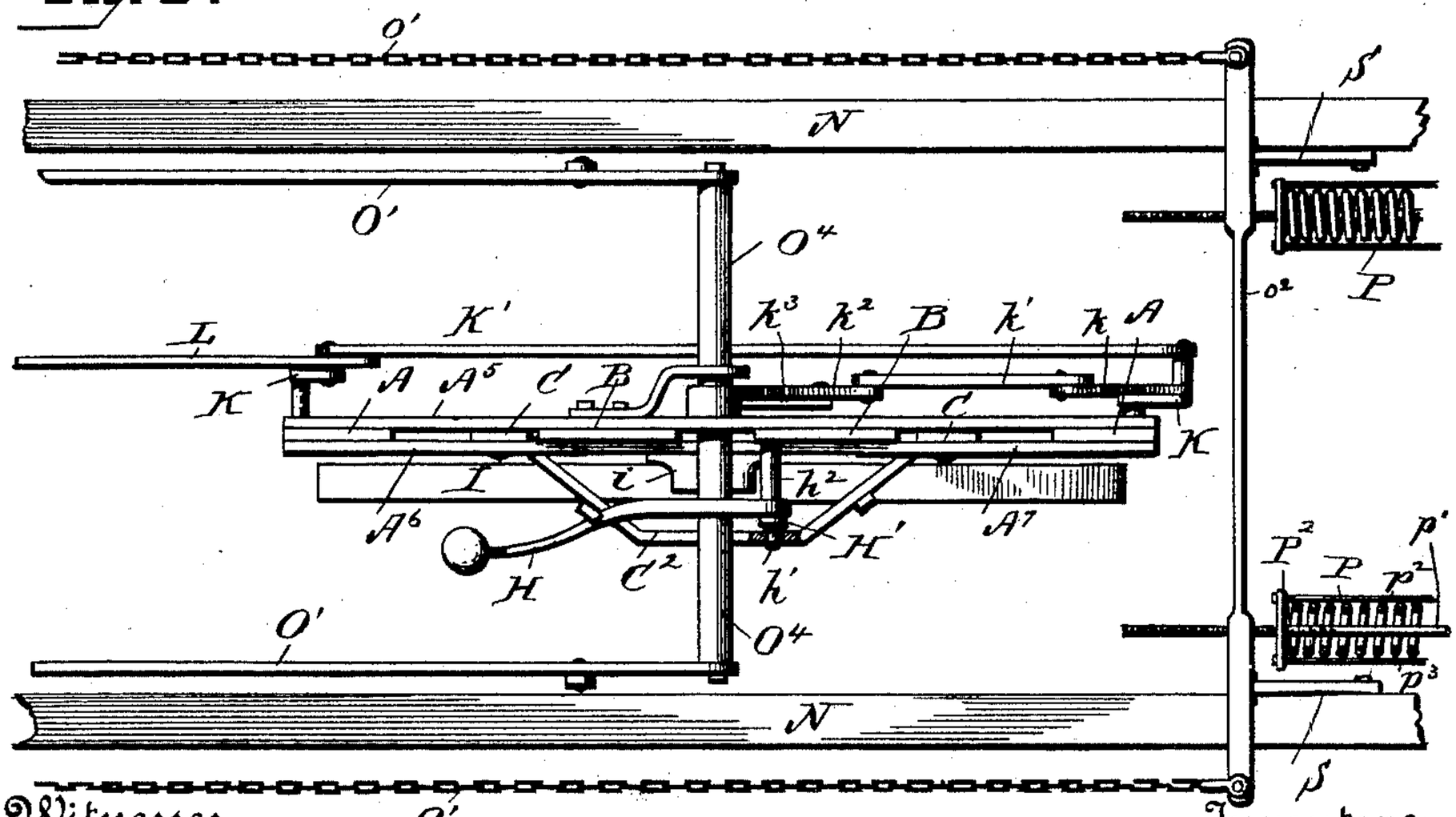


Fig. 9.



Witnesses
Albert Speiden.

Inventors
Andrew Bryson Jr.
John H. Pendleton
Alfred R. Benn
By Their Attorney Woodbury Lowery

(No Model.) 5 Sheets—Sheet 5.

A. BRYSON, Jr., J. H. PENDLETON & A. R. BENN.

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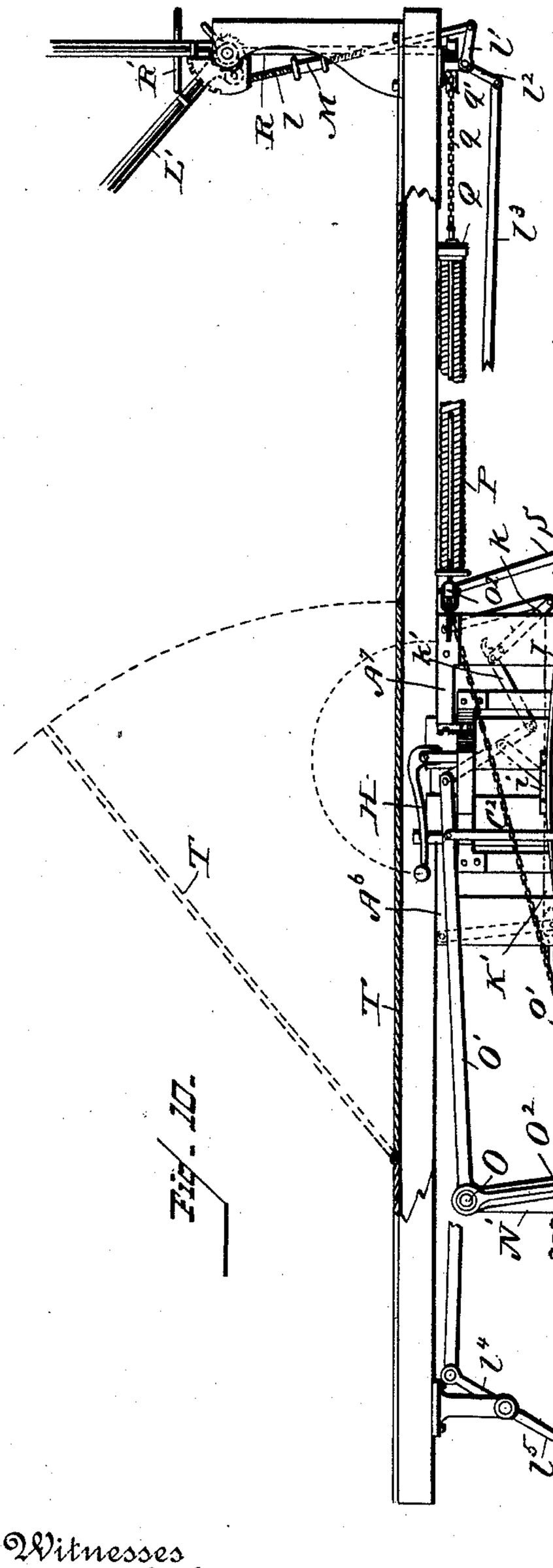

Fig. 10.

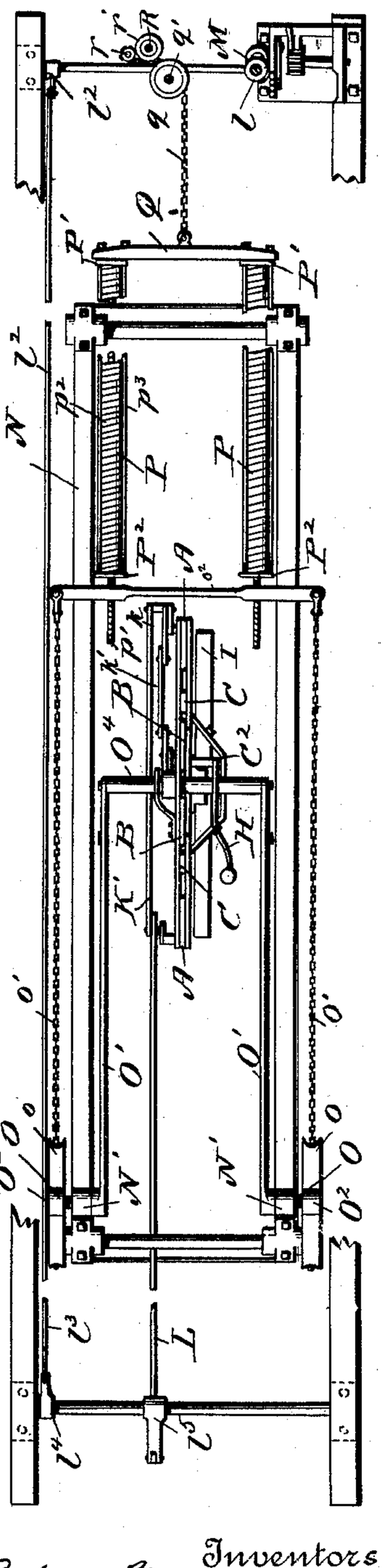

Fig. 11.

Witnesses
Wm. C. Speidel.
Albert Speidel.

Inventors
Andrew Bryson, Jr.
John H. Pendleton
Alfred R. Benn
By their Attorney Woodbury Lowery

UNITED STATES PATENT OFFICE.

ANDREW BRYSON, JR., OF NEW YORK, AND JOHN H. PENDLETON AND ALFRED R. BENN, OF BROOKLYN, ASSIGNORS TO THE RAPID TRANSIT CABLE COMPANY, OF NEW YÓRK, N. Y.

GRIP MECHANISM FOR DUPLEX CABLES.

SPECIFICATION forming part of Letters Patent No. 475,846, dated May 31, 1892.

Application filed May 11, 1891. Serial No. 392,395. (No model.)

To all whom it may concern:

Be it known that we, ANDREW BRYSON, Jr., of the city, county, and State of New York, and JOHN H. PENDLETON and ALFRED R. BENN, of Brooklyn, county of Kings, State of New York, citizens of the United States, have invented new and useful Improvements in Grip Mechanism for Duplex Cables, of which the following is a specification.

The object of our invention is to provide in a duplicate-cable system a grip capable of operation from the car-platform to drop and pick up at the will of the gripman either of the cables; to automatically release the grip from the main cable either in case of derailment or at any fixed point on the line, such as at the ends of the cable sections or crossings; to enable the grip to be lifted into the car, so as to facilitate the transfer from track to track of the cars and grip without the necessity of trenches or conduits for the same; to maintain the grip centrally in the tunnel, and to so reduce the size of the grip by the simplification and adjustment of its parts, while retaining the maximum strength and efficiency, as to admit of a corresponding reduction in the size and consequent expense of the construction of the tunnel and its appurtenances; and our object is, more particularly, to provide a grip capable of grasping either cable without the use of the device described in Letters Patent No. 440,001, granted to Bryson, Pendleton, and Moss November 4, 1890, in which independent mechanism is used for presenting the particular cable to be grasped to the grip.

Our invention relates to a grip mechanism having a lower fixed and an upper movable gripping-block; and it consists in a grip having projecting shoulders to maintain it in a central position in respect to the trench or tunnel, having a movable upper jaw or gripping-block, with a single die swung transversely through a downward arc by mechanism actuated by the gripman to engage with either cable, and a lower fixed jaw or grip-block having two parallel sets of dies to engage with their respective cables and rocked transversely through an upward arc into position beneath the cable to be seized by the lateral swing of the upper jaw.

It consists, further, in the mechanism by which the position of the upper jaw in respect both to the cable to be gripped and to the lower jaw is permanently locked; in the suspension of the entire grip mechanism on springs and the mechanism actuated from the car-platform, by which it can be entirely raised or depressed; in an automatic trip secured to the grip below the slot of the trench, by which the grip can be released; in providing the upper jaw of the grip with shoulders or ledges on both sides of the gripping-die, whereby it can engage with an elevating or depressing rail located at fixed points on the line to raise or lower the grip, as may be desired, and in various other details hereinafter more fully set forth.

In the accompanying drawings, which illustrate our invention, Figure 1 is a side elevation of the grip mechanism, showing the grip partly closed. Fig. 2 is an end view of the grip-jaws, showing the pendulum-ejector. Figs. 3, 4, and 5 are cross-sections of the grip-jaws on the lines 3 3, 4 4, and 5 5 of Fig. 1. Fig. 6 is a plan view, partly in relief, on the line 6 6 of Fig. 1. Fig. 7 is a plan view of the lower jaw on the line 7 7 of Fig. 1. Fig. 8 is an enlarged side elevation of the grip supporting and actuating mechanism on the side opposite to that given in Fig. 1 and showing the position of the mechanism when the grip is entirely open, and Fig. 9 is a plan view of part of the grip supporting and actuating mechanism. Fig. 10 is a side elevation, and Fig. 11 is a plan view, showing all the connections of the grip supporting and actuating mechanism.

In all of the figures the relative position of the pressure and reversing standards, as hereinafter described, is that assumed by them when the grip-jaw is swung to that side of the grip illustrated in Figs. 2 to 5.

We will now proceed to describe that portion of the grip mechanism which is located below the slot in the trench shown in Figs. 1 to 7, and which consists of the gripping-jaws and their connections with each other below the trench.

A A are the vertical tension-standards, which, after passing through the slot between the vertical slot-rails Z Z are widened trans-

versely into the end plates A′ A′, of the shape best shown in Figs. 2 to 5. A bolt A^3 connects together the lower ends of the end plates A′ A′ and also carries the lower gripping-jaw A^2, mounted loosely thereon and capable of being rocked transversely on the bolt A^3 to either side of the trench by means of the mechanism to be hereinafter described. The lower jaw A^2 is V-shaped, which allows it to pass down between the cables, spreading them out, and has secured to its shanks or edges by suitable and well-known means two double reversible and interchangeable gripping-dies X′ X^2. The lower jaw A^2 together with the end plates A′ and the tension-standards A form the fixed part of the grip against which the cable is gripped by the vertical downward motion imparted to the upper jaw and maintain a constant level in the trench except when the entire grip mechanism is raised or depressed by the deflecting-rail within the trench or by the gripman upon the car-platform, as hereinafter described.

From the shaft B′, which plays vertically in slots or recesses *a* in the end plates A′, is suspended the upper jaw B^2 by means of two sets of links D D and E E. The bell-crank links D D are pivoted at one end to the upper jaw B^2 by bolts *b′ b′*, and at the other to the shaft B′ between the forked ends *c c* of the reversing standard C, and by a third pivot *c′* to the ears c^2 on the forked ends *c c* of the reversing standard C. The ends *c c* of the reversing standard C are slotted where they are secured to the shaft B′, so as to admit of a certain predetermined vertical play to the standard, which raising or lowering of the reversing standard C the length of its slot in respect to the fixed position of the pressure-standard B serves to swing the upper jaw transversely from one side of the grip to the other. In Fig. 3 the upper jaw B^2 is shown in position gripping one of the cables by means of the pressure applied through the pressure-standard B. To hold the jaw on this side in position over this cable the reversing standard C is elevated in respect to the fixed position of the pressure-standard B, with the bottom of the slot in its forked ends *c c* bearing against the shaft B′ and the bell-cranks D in their highest position. The upper jaw B^2 is now swung to the other side of the grip by first raising the pressure-standard B, which lifts the upper jaw B^2 and releases the cable, and then standard C, which carries down that part of the bell-crank levers D pivoted to the ears c^2, swings them on the shaft B′, and carries the suspended jaw B^2 over to the other side of the grip. The reversing standard C is then locked, as hereinafter described, in its down position in respect to pressure-standard B and the pressure applied through the latter to grip the cable.

In order to maintain a parallel transverse motion in swinging the upper jaw, the second set of links E E is provided. These are slotted transversely to allow of a transverse swing where the shaft B′ passes through them and are secured to the latter by being pivoted at *e* to a lug *e′*, keyed transversely on the shaft B′ and projecting upward to one side of the center of said shaft and at their lower ends to the swinging upper jaw B^2.

In swinging the upper jaw B^2 from one side of the grip to the other the lower jaw A^2 is rocked on its shaft A^3 and locked in position under the cable to be gripped by the following mechanism, which also serves to prevent the displacement of the lower jaw by the side pressure of the cable as the grip-jaw passes below it: A vertical arm F, pivoted to the lower jaw A^2 at *f* in such wise as to swing transversely in the conical guide-slot *f′*, rises vertically through a transverse slot f^2 in the upper jaw B^2 and passes between the side lugs f^3 f^3 on the sector F′, keyed to the shaft B′. It follows that when the upper jaw B^2 is swung from one side to the other of the grip (see Fig. 5) the end of the slot f^2 brings up against the arm F, pushes it forward until the arm F abuts against the opposite lug f^3 on sector F′, when the pressure on the arm causes the lower jaw A^2 to rock on its shaft A^3, bringing the lower end of the arm F up against the other end of the transverse slot *f′* and locking the lower jaw in place. The upper jaw B^2 is provided with but a single gripping-die x^3, secured in a well-known way, and has shoulders b^2 b^2, projecting beyond the vertical side of the grip, adapted to engage with a deflecting-rail for automatically raising or lowering the grip, such as shown in Letters Patent No. 436,104, granted to J. H. Pendleton September 9, 1890. In order to take up the horizontal component of the pressure transmitted to the upper jaw B^2 through the links D D, it is further provided with an upward extension or shoulder b^3, which bears against the lugs a^2 a^2 on end plates A′ when the pressure is applied. In order to throw out the cable from its place in the lower dies x' x^2, the ejecting-pendulum G is freely pivoted at its upper end *g* to the exterior of the end plates A′ A′. It has rearwardly-extending arms *g′*, one or the other of which engages with the top of the shoulder b^3 on the upper jaw B^2 when the latter is lifted and rocks G on its pivot *g*, whereupon the lower arm of G forces the cable from between the dies. The further throw of the pendulum G is limited by the projections a^3 on the end plates A′.

We have thus far described that part of the grip mechanism which is located below the trench. We will now proceed to describe the connections between the pressure-standard B and the reversing standards C, whereby the raising or lowering of the reversing standards C in respect to the fixed position of the pressure-standard B swings the upper jaw B^2 from one side to the other of the grip. The tension-standards A A are secured together by the lower cross-bars A^4, which also serve as guides for the two vertically-moving standards B and C, and by the bars A^5 A^6 A^7, which form top

guides for the standards C. The reversing standards C C are also connected by the cross-brace C^2, between which the vertically-slotted pressure-standard B is free to move. The reversing-lever H is connected by a link H′, pivoted at h' to the cross-piece C^2 of the reversing standards, and is itself pivoted at h^2 to the pressure-standard B, forming a link-and-toggle joint between the standards B and C. The length of the link H′ is sufficient to allow it to be pivoted to the reversing-lever H at such a height above the pivotal connection of the latter with the cross-brace C^2 when the reversing standards C are raised that on throwing the lever H in the direction of the arrow, Figs. 1 and 8, through an arc of more than one hundred and eighty degrees, the reversing standard C is dropped the length of the slot in its forked ends *c c* in respect to standard B, the upper jaw B^2 swung to the opposite side of the grip, as already described, and the standards locked in their new relation, in order to move as a unit when the pressure is applied to the upper jaw. It follows that the reversal of lever H reverses the position of the standard C and restores the upper jaw to its first position, as shown in Figs. 1 and 8. The upper jaw B^2, having been swung to the cable which it is desired to grip and in its passage having rocked and locked the lower jaw A^2 into position, is now prepared to receive the gripping pressure from the standard B, which is applied in the following way: At or near the central point of the lower cross-piece A^4, connecting the tension-standards A A, (see Fig. 8,) is secured one leaf of the spring I, the top leaf of which is fastened to the pressure-standard B by the spring-seat *i*. The spring I, which is of sufficient strength to overcome the weight of the pressure-standard B, the upper jaw B^2, and its appurtenances and to operate the cable-ejectors G, stands normally "wide open," holding the jaws apart. Simultaneously with the raising of the upper jaw B^2 its shoulder b^3 engages with one or the other of the rearwardly-extending arms g' on the ejector G and rocks the latter to one side, in which position it is maintained so long as the jaws remain apart. The spring I is compressed and the pressure applied by means of the device consisting of the bars K K, pendent from the top of the tension-standards A A and connected by the bar K′, which constantly maintains a horizontal plane. At one extremity of the bar K′ the rod L, actuating the pressure device, is hooked, and at the other extremity one end of the toggle-joint k k', which connects with the lower arm of the lever-rod k^2, forming with link k^3 a single link-joint k^2 k^3 between the cross-pieces A^5 of the tension-standard A and the compression-standard B, to which the other ends of the lever-rod k^2 and the link k^3 are respectively connected. (Shown in Figs. 1 and 8.) It follows that when the rod L is thrust to the right by a simple downward push on the actuating-lever L′ on the car-platform through rod *l*, bell-crank l' l^2, rod l^3, and lever l^4 l^5 the toggle-joint k k' falls by gravity into the horizontal position shown in Fig. 1 and is immediately locked, and that following this a reverse motion of the rod L by a forward motion of the lever L′ on the car-platform applies a pressure on the lower end of the lever k^2 through the now horizontal and unyielding links k k' tends to straighten the joint k^2 k^3, forcing down the pressure-standard B against the spring I, which is compressed, and closing the grip. On releasing the push against the joint k^2 k^3 the spring I automatically lifts the pressure-standard B and raises the upper jaw B^2. The rod *l*, through which the pressure is applied, is formed of two pieces, Fig. 10, connected together by a sleeve-nut M, having right and left hand screw-threads, so that by turning the nut the rod is shortened or lengthened, thus taking up the wear of the gripping-dies at the convenience of the gripman.

In order to suspend the grip from the car and at the same time to secure a yielding connection and means for raising and depressing the grip, we provide a frame N N, (see Fig. 10,) carried on the car-axles and having two standards N′ N′, erected at one end of the frame. To the shafts O O, passing through the top of each standard N′, the arms O′ O′ are securely keyed and are pivoted at their extremities to the ends of a shaft O^4, from which the entire grip is suspended by the guides A^5, through which said shaft passes. (See Figs. 8, 9, 10, and 11.) The arms O^2 O^2, extending downward and at right angles to the grip-supporting arms, are likewise keyed to the shaft O, forming thus, with the arms O′ O′, a bell-crank lever, so that a pull on the lower end of the arms O^2 O^2 raises the outer ends of arms O′ O′ and lifts the grip, while a contrary motion lowers it. In order to maintain a parallel motion, so that the grip shall always rise and fall vertically, the arms O^3 are pivoted to the frame N and to the shaft O^5, passing through the lower cross-piece A^4 on the tension-standards A. These arms O^3 also take the horizontal thrust or pull of the cable. The arms O^2 O^2, which are expanded into segments *o o* at their lower extremities, so that the leverage shall remain constant, are rocked by the chains or cables o' o', connected to the cross-piece o^2, which is in turn connected by the springs P, maintained, consequently, in compression to the cross-head Q. A chain or cable *q* connects the cross-head Q to the sprocket-wheel *r* after passing around the horizontal pulley q'. The chain *q* is wound and unwound about the sprocket-wheel *r* by means of the cog-wheel r' and its vertical shaft R, having the horizontal hand-wheel R′, operated by the gripman. The springs P are kept in tension by the compression-plates P′ P^2, connected, respectively, by the rods p', p^2, and p^3 to cross-pieces o^2 and Q, Figs. 9 and 11. The bars S S, pivoted to the frame N N, support the springs in a horizontal position. In

order that the grip may have side motion to any extent required, facilitating the passing of corners and reducing the wear of shanks and slot-rails, the shafts O^4 and O^5, from which the grip is immediately suspended, are made long enough to give the requisite lateral play to the grip. It is thus seen that the entire grip mechanism is constantly suspended at any desired height by a horizontally as well as vertically yielding connection, not even broken when the grip-jaws are closed or opened or when the entire gripping mechanism is raised or lowered. If it is desired to lower the grip in order to pick up the cable, the wheel R′ is turned so as to unwind the cable *q*, the arms O′ O′ and O^2 O^2 fall correspondingly, the grip descends vertically to the bottom of the trench or conduit, and the cable takes its proper position between the grip-jaws. To raise the grip after the cable is in position, the wheel R′ is turned in the opposite direction, winding up the chain *q*, and lifting the grip through the reverse operation of the mechanism described.

When it is desired to shift the car from one track to another or when at the end of a trip the car is taken to the car-house, the trap T in the floor of the car is opened, the rod L is unhooked, and the hand-wheel R′ turned, winding up the chain *q* until the grip is lifted out of the trench and raised clear of the surface, its supporting-arms O′ O^3 standing at a steep vertical angle; but we do not confine ourselves to the particular details of the suspension mechanism shown, as it is evident that the springs P may be placed along the sides of the frame N N and may be connected in several ways to the hand-wheel R′ without in any way varying their operation.

In addition to the releasing device, which we have already described, we also provide an automatic grip-releasing mechanism, which consists of the tripping-shank U, Figs. 1, 8, and 10, the upper end of which abuts immediately beneath the joint of the links *k k′* when in their horizontal position, so that when the grip is closed and the spring I compressed an upward push of the shank U breaks the toggle-joint and allows the spring to release the upper grip-jaw B^2 automatically. This upward push of shank U is accomplished by means of the trip-lever U′, located below the trench and pivoted at *u* to one of the end plates A′. One arm of the trip-lever is pivoted to the lower end of the shank U, while the other arm is free.

In case of the derailment of the car or of the striking of an obstacle which will raise the car from the track or when the car reaches the end of cable sections or crossings, the instant release of the grip is secured by the short arm of the lever U′, pressing upward against the under sides of the slot-rail heads, (or a projecting piece secured to the slot-rail heads at the desired points,) raising the shank U, breaking the toggle-joint *k k′*, and allowing the spring I to open the grip and throw out the cable, as described. Should the car rise any higher, the hub surrounding the pin by which the trip-lever U′ is pivoted to the end plate A′ bears against the under side of the slot-rail heads and the yielding attachment of the grip to the car, hereinbefore described, allows the car to rise, but without taking the grip any higher, so that in no case can the grip strike the yokes.

It is evident that in the absence of the trip-lever U′ and its enlarged hub *u* a stop may be placed on the standard A to prevent further rising of the grip.

In Figs. 2 to 5 it is seen that the shoulders or projections a^3 of the end plates A′ are swelled out, so as to prevent undue oscillation of the grip. The clearance between them and the slot-rail web is slightly greater than that between the grip-shanks and the slot-rail heads, but not enough to allow too much lateral swing of the grip, so that when the upper jaw B^2 is at its highest point to release and throw out the cable these projecting shoulders a^3 will clear the inside of the yokes. Fig. 2 also shows that the shoulders a^3 extend sufficiently over the shoulders b^2 on the upper grip-jaw B^2 to protect the latter from any obstruction other than the deflecting-rails with which it is to engage. It is thus seen that we provide a grip having the capacity of seizing the cable on either side, while presenting an unobstructed vertical side to the cable not in use, its lower jaw traveling at a constant level in the trench, while rocking transversely through an upward arc, its upper jaw swinging transversely through a downward arc and alone receiving the vertical motion by which the gripping-pressure is applied or released.

Having thus described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. In a cable-grip, the combination of a grip-frame, a fixed lower jaw adapted to rock transversely through an upward arc, an upper jaw adapted to swing transversely through a downward arc, and means for rocking the lower and swinging the upper jaws, substantially as described.

2. In a cable-grip, the combination of a grip-frame, a fixed lower jaw adapted to rock transversely through an upward arc, an upper jaw adapted to swing transversely through a downward arc, means actuated by the upper jaw for rocking the lower jaw, and means for swinging the upper jaw, substantially as described.

3. In a cable-grip, the combination of a grip-frame, a vertically-fixed lower jaw having two gripping edges, an upper jaw adapted to swing transversely over either edge of the lower jaw, means for swinging the upper jaw, and means for imparting a vertical motion to the upper jaw, substantially as described.

4. In a cable-grip, the combination of a grip-frame, a vertically-fixed lower jaw having two gripping edges, an upper jaw adapted to swing

transversely over either gripping edge of the lower jaw, means for swinging the upper jaw, and means for locking the upper jaw in a fixed relation to the under jaw, as described.

5. In a cable-grip, the combination of a grip-frame, a vertically-fixed lower jaw having two gripping edges, an upper jaw adapted to swing transversely over either gripping edge of the lower jaw, means for swinging the upper jaw, means for locking the upper jaw in a fixed relation to the under jaw, and means for imparting a vertical motion to the upper jaw, as described.

6. In a cable-grip, the combination of a grip-frame, a fixed lower jaw adapted to rock transversely through an upward arc, an upper jaw adapted to swing transversely through a downward arc, means actuated by the upper jaw to rock and lock the lower jaw in position, means for swinging the upper jaw, and means for locking the upper jaw in a fixed relation to the lower jaw, substantially as described.

7. In a cable-grip, the combination of a grip-frame, a fixed lower jaw adapted to rock transversely through an upward arc, an upper jaw adapted to swing transversely through a downward arc, means actuated by the upper jaw to rock and lock the lower jaw in position, means for swinging the upper jaw, means for locking the upper jaw in a fixed relation to the under jaw, and means for imparting a vertical motion to the upper jaw, substantially as described.

8. In a cable-grip, the combination of a grip-frame, a vertically-fixed lower jaw, a transversely-swinging upper jaw, means for swinging the upper jaw, and means for maintaining a parallel transverse motion in swinging said upper jaw, substantially as described.

9. In a cable-grip, the combination of a grip-frame, a vertically-fixed lower jaw having two parallel sets of gripping-dies, an upper jaw adapted to swing transversely and having a single gripping-die, and means for bringing the single gripping-die on the upper jaw and either of the gripping-dies on the lower jaw into the same vertical plane, substantially as described.

10. The combination, with a cable-grip having a vertically-moving upper jaw, of a cable-ejector pivoted to the frame of the grip and adapted to be swung transversely by the upward movement of said jaw to eject the cable, substantially as described.

11. The combination, with a bell-crank lever pivoted to the car-frame, of the grip suspended from the horizontal arm of the lever and an intermediate spring connection between the vertical arm of the car, substantially as described.

12. The combination, with a bell-crank lever pivoted to the car-frame, of the grip suspended from the horizontal arm of the lever, an intermediate spring connection between the vertical arm and the car, and means for rocking the bell-crank, substantially as described.

13. The combination, with a bell-crank lever pivoted to the car-frame, of the grip suspended from the horizontal arm of the lever, an intermediate spring connection in constant compression between the vertical arm and the car, and a connecting device between said spring and the car to compress or release the spring, whereby the bell-crank is rocked, substantially as described.

14. The combination, with a bell-crank lever pivoted to the car-frame, of the grip suspended from one arm of the lever, an intermediate spring connection between the other arm and the car, and a stop on the grip-frame in the trench below the slot-irons, adapted to engage with the slot-rail heads, substantially as described.

15. The combination of the tension-standards A, recessed at a, the lower jaw A^2, its shaft A^3, the upper jaw B^2, its shaft B', means for suspending it from said shaft, and pressure-standards B, substantially as described.

16. The combination of the tension-standards A, recessed at a, the lower jaw A^2, its shaft A^3, the upper jaw B^2, its shaft B', the bell-crank D, pivoted at b' and c', and the reversing standard C, having the forked and slotted ends c, with the ears c^2, substantially as described.

17. The combination of the tension-standards A, recessed at a, the lower jaw A^2, its shaft A^3, the upper jaw B^2, its shaft B', the bell-crank D, pivoted as described, the reversing standard C, and the links E, having transverse slots for the passage of the shaft B' and pivoted at one end to the jaw B^2 and at e to the lug e', projecting from and keyed to shaft B', substantially as described.

18. The combination of the tension-standards A, recessed at a, the lower jaw A^2, having the guide-slot f', the arm F, pivoted therein, the shaft A^3, the upper jaw B^2, having the transverse slot f^2, its shaft B', the bell-crank D, pivoted as described, the reversing standard C, the links E, having the transverse slots and pivoted as described, the lug e', and the sector F', having the side lugs f^3 and keyed to the shaft B', substantially as described.

19. The combination of the tension-standards A, recessed at a, the lower jaw A^2, having the guide-slot f', the arm F, pivoted therein, the shaft A^3, the upper jaw B^2, having the transverse slot f^2, its shaft B', the bell-crank D, the reversing standard C, the links E, the lug e', the sector F', and the pressure-standard B, substantially as described.

20. In a cable-grip, the combination of the shaft B', the upper jaw B^2, suspended therefrom, the reversing standard C, adapted to move vertically on shaft B', and the link connection between the standard C, the jaw B^2, and the shaft B', whereby when standard C is raised or depressed the jaw B^2 is swung from one side to the other.

21. In a cable-grip, the combination of the shaft B', the pressure-standard B, secured

thereto, the upper jaw B^2, suspended therefrom, the reversing standard C, adapted to move vertically on the shaft B′, the link connection between the standard C, the jaw B^2, and the shaft B′, and means for lifting and lowering the standard C in respect to the standard B and locking it in such position, substantially as described.

22. In a cable-grip, the combination of the shaft B′, the pressure-standard B, secured thereto, the upper jaw B^2, suspended therefrom, the reversing standard C, adapted to move vertically on the shaft B′, the link connection between the standard C, the jaw B^2, and the shaft B′, and the reversing-lever H, pivoted to the pressure-standard B and through the link H′ and suitable connections to the reversing standards C, substantially as described.

23. The combination of the tension-standards A, recessed at *a*, the lower jaw A^2, its shaft A^3, the shaft B′, the pressure-standard B, secured thereto, the upper jaw B^2, suspended therefrom, the reversing standard C, adapted to move vertically on the shaft B′, the link connection between the standard C, the jaw B^2, and the shaft B′, and the reversing-lever H, pivoted to the pressure-standard B and through the link H′ and suitable connections to the reversing standards C, substantially as described.

24. The combination of the tension-standards A A, having a fixed lower jaw, the pressure-standard B, having a vertically-moving upper jaw, and the spring I, having one leaf secured to the grip-frame and the other to the pressure-standard, substantially as described.

25. The combination of the tension-standards A A, having a fixed lower jaw, the pressure-standard B, having a vertically-moving upper jaw, the spring I, secured as described, and means for depressing the pressure-standard against the stress of the spring, substantially as described.

26. The combination of the tension-standards A A, having a fixed lower jaw, the pressure-standard B, having a vertically-moving upper jaw, the spring I, secured as described, the links k^2 k^3, pivoted, respectively, to the tension-standards A, the pressure-standard B, and to each other, and suitable connections to the short arm of the link k^2, substantially as described.

27. The combination of the tension-standards A A, having a fixed lower jaw, the pressure-standard B, having a vertically-moving upper jaw, the spring I, secured as described, the links k^2 k^3, pivoted, respectively, to the tension-standards A, the pressure-standard B, and to each other, the toggle-joints k k', pivoted to the short arm of the link k^2, and means for first straightening and then pushing on the toggle-joint, substantially as described.

28. The combination of the tension-standards A A, having a fixed lower jaw, the pressure-standard B, having a vertically-moving upper jaw, the spring I, secured as described, the link connections k k' k^2 k^3, means for straightening the link connection k' k^2, and the automatic trip consisting of the trip-lever U′, pivoted at *u* to the standard A in the trench below the slot-irons, and the trip-shaft U, pivoted to one arm of the lever and projecting up under the toggle-joint, substantially as described.

29. The combination of the tension-standards A, their enlarged ends or plates A′, recessed at *a* and having the shoulders a^3 a^3, a fixed lower jaw, the vertically-moving shaft B′, the upper jaw B^2, suspended therefrom and having the shoulder b^3, and the cable-ejecting pendulum G, pivoted to the plate A′ at *g* and having the inwardly-extending arms *g*′, adapted to engage with shoulder b^3 of the upper jaw and with shoulders a^3 of plate A′, as described.

30. The combination of the tension-standards A, their enlarged ends or plates A′, recessed at *a*, having the shoulders a^2 a^2, a fixed lower jaw, the vertically-moving shaft B′, the upper jaw B^2, suspended therefrom and having the shoulder b^3, the pressure-standard B, and the bell-cranks D and links E and their connections, substantially as described.

31. The combination of the tension-standards A, their enlarged ends or plates A′, recessed at *a*, having the shoulders a^2 a^3, a fixed lower jaw, the shaft B′, the upper jaw B^2, suspended therefrom and having the shoulders b^2 b^3, the pressure-standard B, the bell-cranks D and links E and their connections, and the reversing standards C, substantially as set forth.

32. The combination of the bell-crank levers O O′ O^2, pivoted to the car-frame at N, the grip suspended from the arm O′, the springs P, connected to the segmental end of arm O^2, head-plates P′ P^2, rods p' p^2 p^3, cross-head Q, cable *q*, and means for winding and unwinding the cable, substantially as described.

In testimony whereof we have hereunto set our hands in the presence of two subscribing witnesses.

ANDREW BRYSON, JR.
JOHN H. PENDLETON.
ALFRED R. BENN.

Witnesses to signature of Andrew Bryson, Jr.:

ALEX. H. TIERS,
J. H. PENDLETON.

Witnesses to signature of John H. Pendleton:

ALEX. H. TIERS,
A. BRYSON, Jr.

Witnesses to signature of Alfred R. Benn:

CHRISTOPHER CLARKE,
A. BRYSON, Jr.