No. 862,159. PATENTED AUG. 6, 1907.

A. HILL.

TROLLEY.

APPLICATION FILED MAR. 2, 1907.

3 SHEETS—SHEET 1.

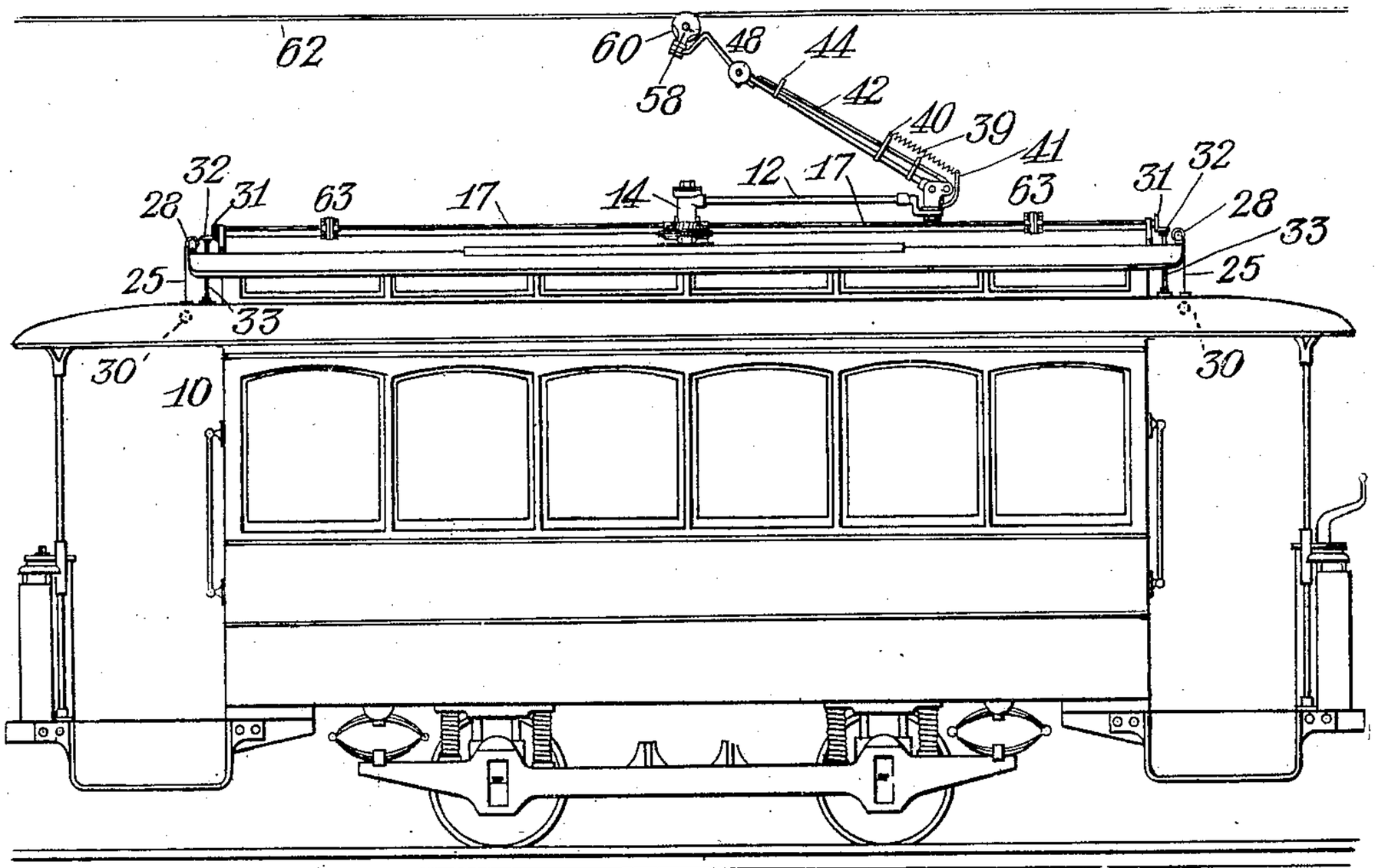

Fig. 1.

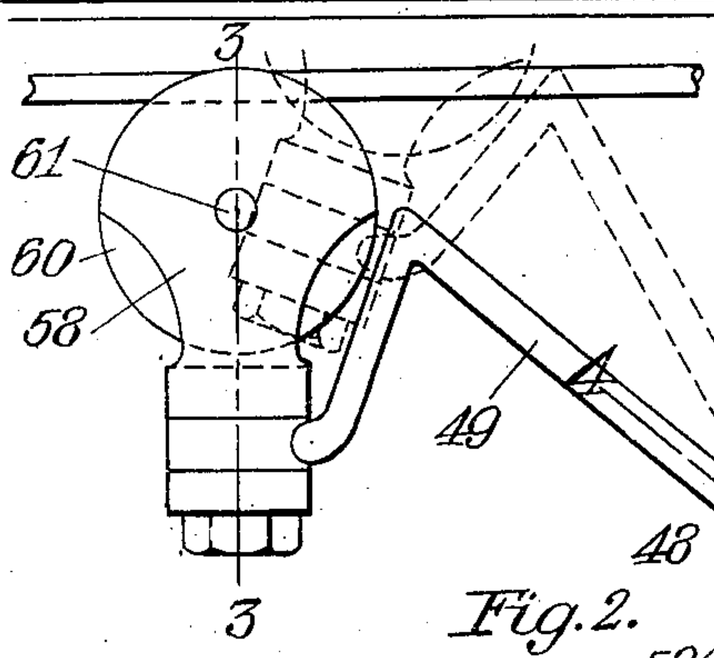

Fig. 2.

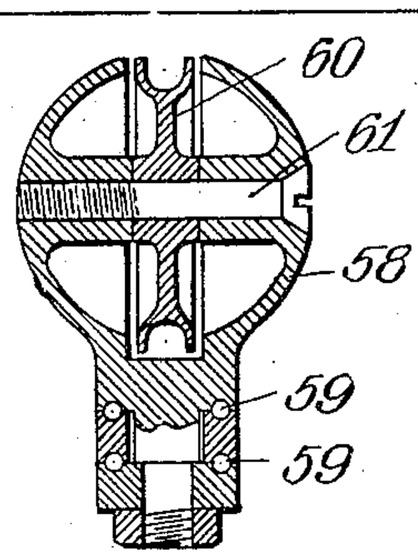

Fig. 3.

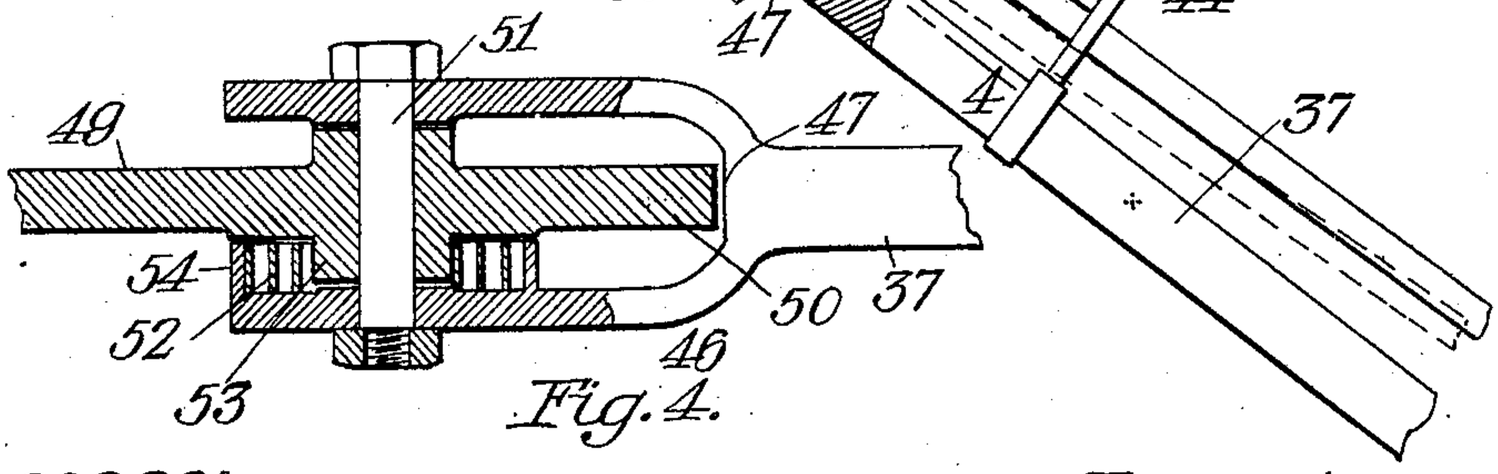

Fig. 4.

Witnesses:
Walter L. Owen
Sydney C. Taft.

Inventor:
Aaron Hill
by his attorney Charles J. Gooding.

No. 862,159. PATENTED AUG. 6, 1907.

A. HILL.

TROLLEY.

APPLICATION FILED MAR. 2, 1907.

3 SHEETS—SHEET 2.

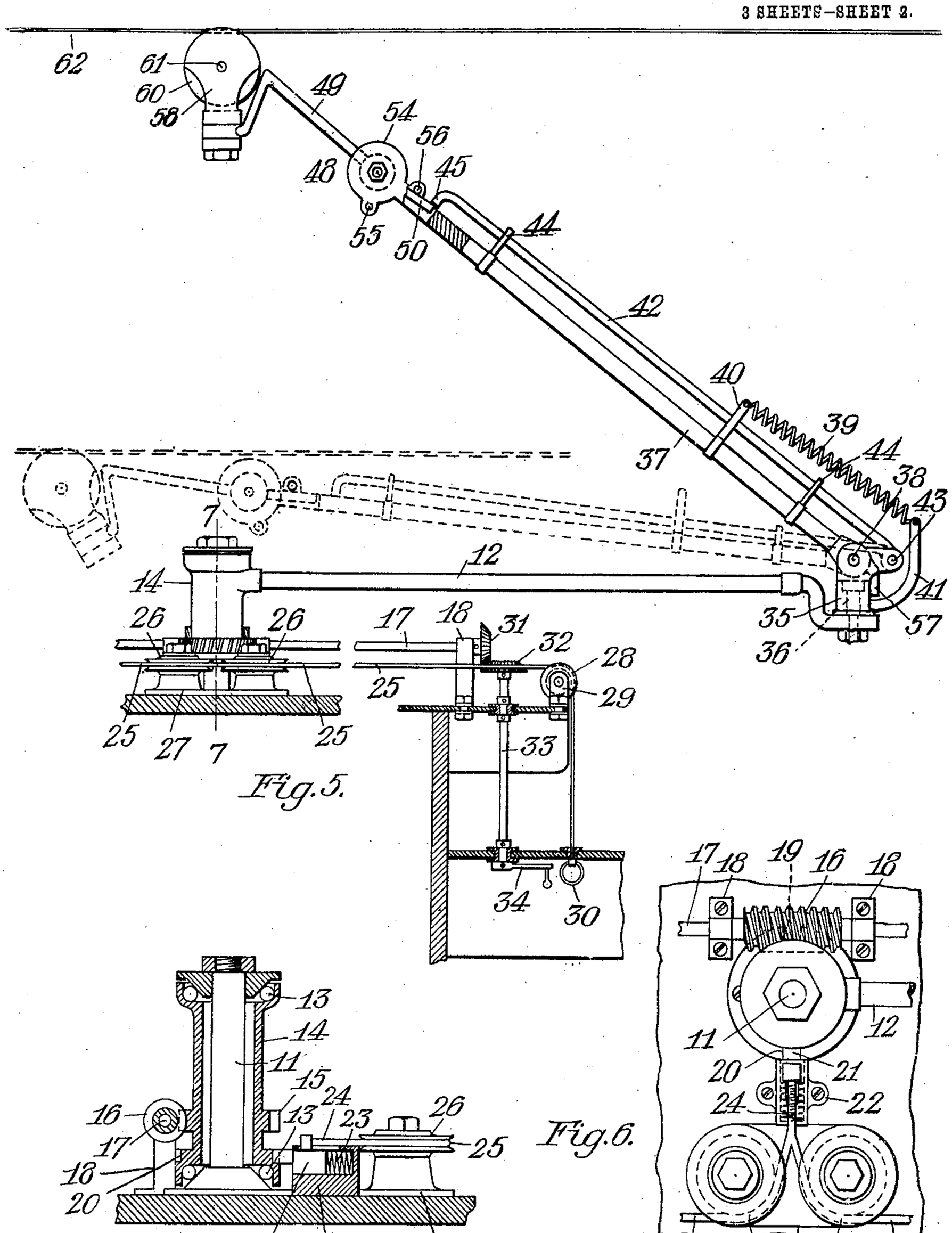

Fig. 5.

Fig. 7.

Fig. 6.

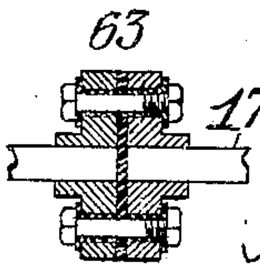

Fig. 8.

Witnesses:
Walter L. Green
Sydney C. Taft.

Inventor:
Harry Hill
by his attorney
Charles V. Gooding.

No. 862,159. PATENTED AUG. 6, 1907.

A. HILL.

TROLLEY.

APPLICATION FILED MAR. 2, 1907.

3 SHEETS—SHEET 3.

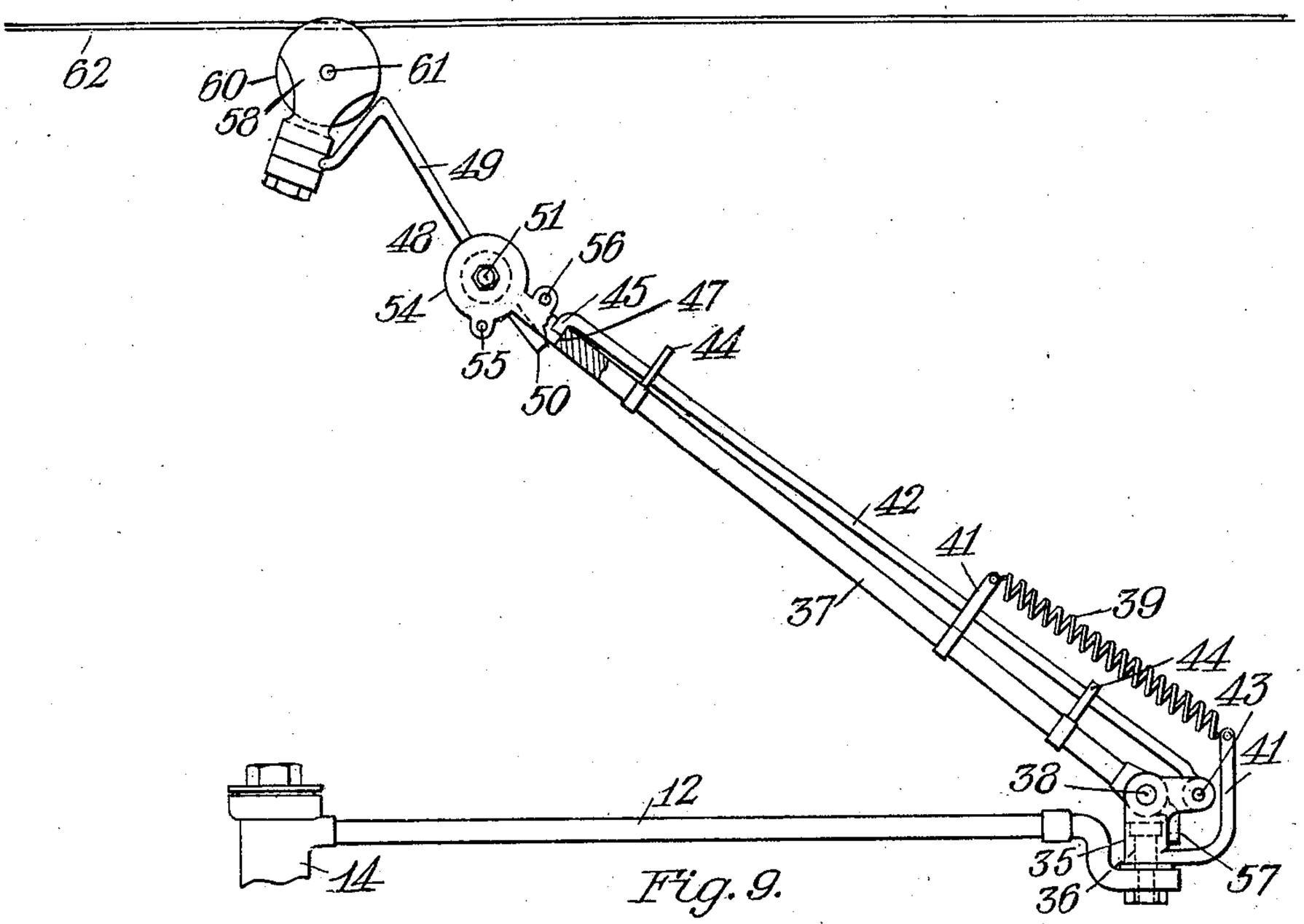

Fig. 9.

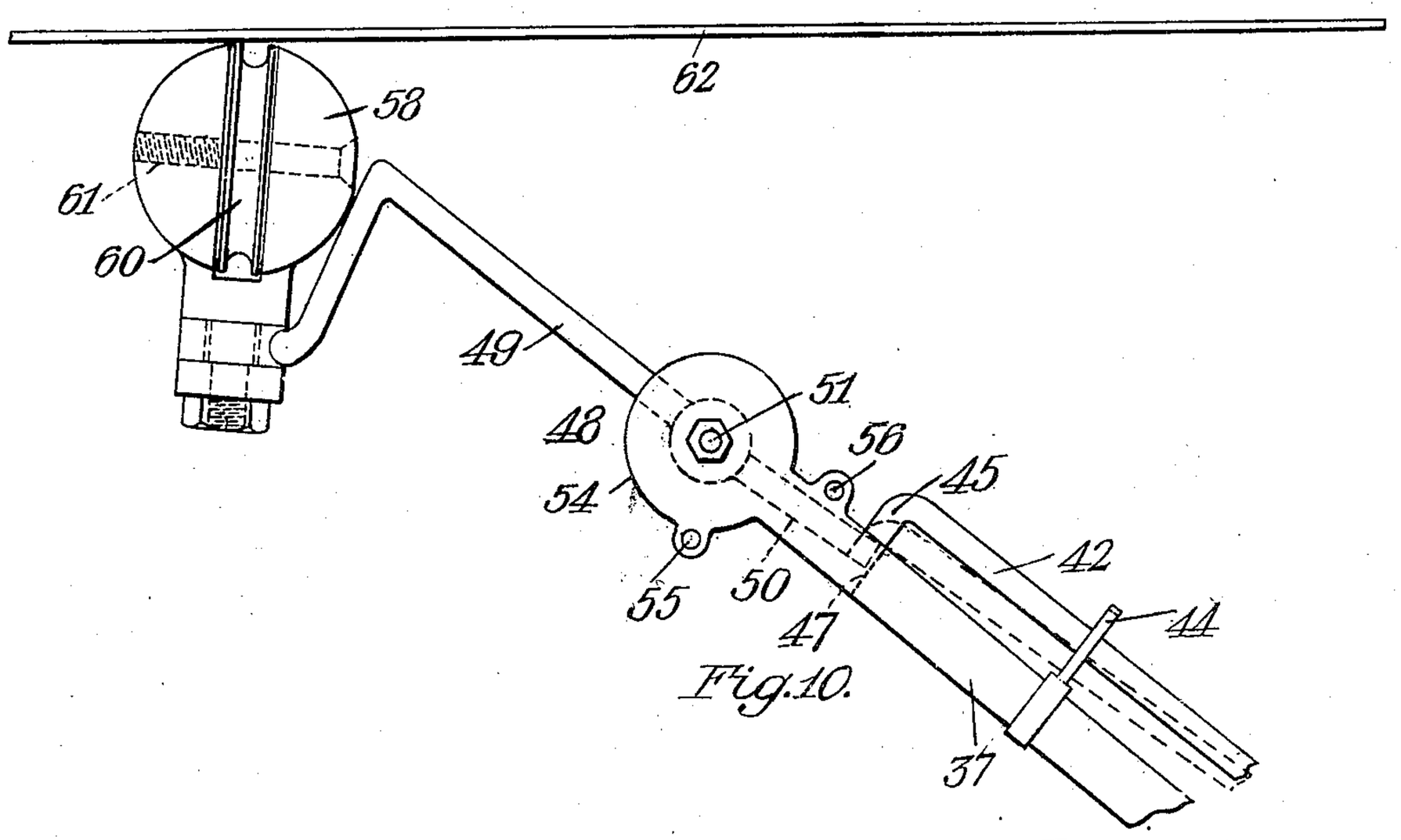

Fig. 10.

Witnesses:
Watson L. Pierce
Sydney E. Taft.

Inventor:
Aaron Hill
by his attorney. Charles J. Fooding.

UNITED STATES PATENT OFFICE.

AARON HILL, OF LYNN, MASSACHUSETTS.

TROLLEY.

No. 862,159. Specification of Letters Patent. Patented Aug. 6, 1907.

Application filed March 2, 1907. Serial No. 360,135.

To all whom it may concern:

Be it known that I, AARON HILL, a subject of King Edward VII, residing at Lynn, in the county of Essex and State of Massachusetts, have invented new and useful Improvements in Trolleys, of which the following is a specification.

This invention relates to improvements in trolleys for electric cars.

In trolleys now in use while cars are passing around curves the trolley wheels are very apt to jump off of the trolley wire owing to misalinement of the groove of the wheel with relation to the wire, and again in passing cross wires and turnouts the wheel is very apt to jump off of the wire owing to sluggish movement of the arm which carries the wheel.

The object of this invention is to overcome such difficulties above mentioned and to effect general improvements whereby the operation of reversing the trolley is more readily accomplished particularly in cramped quarters.

Other objects and advantages will appear more fully hereinafter.

The invention consists in the combination and arrangement of parts set forth in the following specification and particularly pointed out in the appended claims.

Referring to the drawings: Figure 1 is a side elevation of an electric car showing my improved trolley attached thereto. Fig. 2 is an enlarged side elevation, partly in section, of the upper portion of Fig. 1. Fig. 3 is a section, partly in elevation, taken on line 3—3 of Fig. 2. Fig. 4 is an enlarged detail section, partly in elevation, taken on line 4—4 of Fig. 2. Fig. 5 is an enlarged detail side elevation, partly in section, of a portion of the mechanism disclosed in Fig. 1. Fig. 6 is an enlarged detail plan view of a portion of Fig. 5 showing the worm for rotating the supporting arm and the latch for locking said supporting arm. Fig. 7 is an enlarged detail section, partly in elevation, taken on line 7—7 of Fig. 5. Fig. 8 is an enlarged detail sectional elevation of one of the insulating couplings. Fig. 9 is an elevation, partly in section, similar to Fig. 5 and partly broken away, in which the trolley wire is higher than in Fig. 5. Fig. 10 is an enlarged detail side elevation of the upper portion of the trolley illustrating the manner of returning the wheel to the wire.

Like numerals refer to like parts throughout the several views of the drawings.

In the drawings, 10 is an electric car to the roof or superstructure of which is rigidly secured a vertical post 11, there being an arm 12 journaled on said post. Suitable ball bearings 13, 13 are provided to insure an easy swinging movement of said arm on said post. The hub 14 of the arm 12 is provided with a worm gear 15 which may be formed integral therewith, said worm gear meshing into a worm 16. The worm 16 is fast to a shaft 17 journaled in suitable bearings 18 supported on the roof of the car 10. The hub 14 is provided with two diametrically opposite notches 19 and 20, there being a latch or bolt 21 adapted to enter either of said notches, whereby the arm 12 is locked against rotation. The bolt 21 is slidably arranged in a casing 22, there being a spring 23 adapted to normally hold said bolt in engagement with one of said notches. A cord 24 is connected at one end to the bolt 21, the other end of said cord being connected to two cords 25, 25 which pass partway around two grooved wheels 26, 26, respectively.

The wheels 26, 26 are rotatably mounted on a plate 27 fast to the car 10. The cords 25, 25 pass partway around pulleys 28, 28 located at opposite ends, respectively, of the car 10, said pulleys being rotatably mounted on brackets 29, 29. Each of the cords 25 leads downwardly from its pulley 28 and passing through the roof of the car has a ring 30 fast thereto by means of which said cord may be pulled in order to withdraw the bolt 21 from engagement with the notch 20 or 19, as the case may be.

Two bevel gears 31, 31 fast to opposite ends, respectively, of the shaft 17 mesh into bevel gears 32, 32, said bevel gears 32 being fast to vertical shafts 33, 33, respectively. The shafts 33, 33 are journaled in suitable bearings provided on the car 10, there being a crank 34 fast to each of said shafts, respectively. A standard 35 is rotatably mounted on a stud 36 fast to the arm 12, while an arm 37 is pivoted at 38 to the standard 35. A spring 39 connected at one end to a bracket 40 fast to the arm 37 is connected at its other end to a rigid arm 41 forming a part of the standard 35. An arm 42 is pivoted at 43 to the standard 35, the pivot 43 being arranged parallel to the pivot 38. The arm 42 is loosely guided in guides 44, 44 fast to the arm 37, said arm 42 being provided with a projection 45. The arm 37 terminates in a fork 46, there being a shoulder 47 formed on said arm between the two sides of said fork. A lever 48 consisting of two arms 49 and 50 is pivoted at 51 to the fork 46.

A spiral spring 52 is fast at one end to a hub 53 formed on the lever 48, the other end of said spring being fast to a casing 54 formed on the fork 46, said spring being adapted to normally move the lever 48 toward an upright position. Two stops 55 and 56 fast to the fork 46 are adapted to limit the movement of the lever 48 in opposite directions, respectively. A stop or lug 57 formed on the arm 37 is adapted to engage the standard 35 and thereby limit the upward movement of said arm. A wheel-support 58 is rotatably mounted on the lever 48 and is adapted to rotate about a substantially upright axis, there being suitable ball bearings 59, 59 provided to eliminate friction. A grooved wheel 60 is rotatably mounted on a screw 61 fast to the wheel-

support 58, said wheel-support being preferably formed substantially spherical. A trolley wire 62 is located in the grooved wheel 60. Two insulating couplings 63, 63 are interposed in the shaft 17 between the worm 16 and the bevel gears 31, respectively, whereby the cranks 34 are insulated from said worm which is charged with electricity.

The general operation of the apparatus hereinbefore specifically described is as follows: Trolley wires vary in height from the top of cars all the way from several inches to several feet. In subways and under culverts and bridges the trolley wires are often only a few inches above the tops of cars, whereas, in the streets the normal height of the wire is several feet above the top of the car. In Figs. 1, 2, and 5, the height of the wire 62 is shown slightly less than the average height of wires for ordinary street use, while in Fig. 9 the wire 62 is at very nearly the average height of street wires. Assuming the car 10 to be moving toward the right (Figs. 1, 2, 5 and 9) should the trolley wire 62 be low as indicated in dotted lines (Fig. 5) the arm 37 and the lever 48 occupy the position shown in dotted lines in said figure and at this time the arm 50 of the lever 48 is in contact with the stop 56 and, therefore, the lever 48 and the arm 37 constitute in effect a single rigid arm. At this time the spring 39 acts to hold the wheel 60 in contact with the wire 62, therefore, as the height of the wire 62 increases the wheel 60 remains in contact therewith. It will be noted that in the dotted position shown in Fig. 5 the projection 45 is in contact with the upper surface of the arm 37 and owing to the location of the pivot 43 with relation to the pivot 38, as the wire 62 increases in height the projection 45 moves toward the shoulder 47 formed on the arm 37 and finally occupies the position shown in full lines (Fig. 5). As the wire 62 increases still further in height the arm 50 which as shown in Fig. 5 prevents the projection 45 from engaging the shoulder 47, moves away from the stop 56 and in moving toward the position shown in Fig. 5 allows the projection 45 to move into engagement with the shoulder 47, and as the wire 62 increases still further in height, the arm 50 under the influence of the spring 52 moves entirely out of engagement with the projection 45, as shown in Fig. 9. It will be seen that at this time owing to the relation of the pivot 43 to the pivot 38 and owing to the presence of the stop 57, the arms 37 and 42 constitute in effect a single rigid arm. It will be understood that the stop 57 prevents upward movement of the arm and the projection 45 prevents downward movement of the arm.

During any ordinary variations in height of the wire 62, the lever 49 rocks on its pivot 51 and the spring 52 holds the wheel 60 in contact with said wire. In passing cross-overs and turnouts it will be understood that owing to the fact that the arm 49 of the lever 48 is so short that the action of said lever is very quick and, therefore, the wheel 60 remains in contact with the wire 62 with more certainty than if said wheel were mounted on a single rigid arm pivoted at 38. As the car 10 passes around curves it will be understood that the arm 37 swings toward one side or the other according to the relation of the wire to the median line of the car and the wheel standard 58 being free to turn on the arm 49 the groove of the wheel 60 remains at all times in alinement with the wire 62. In going into a subway or under a culvert the reverse of the foregoing takes place. The arm 50 strikes the projection 45 and as the wire continues to diminish in height, moves said projection out of contact with the shoulder 48 and when said arm strikes the stop 56 the lever 48 and the arm 37 constitute in effect a single rigid arm pivoted at 38. As the wire 62 continues to diminish to the height shown in dotted lines Fig. 5, the stop 57 moves away from the standard 35 and the projection 45 moves downwardly toward the right along the upper surface of the arm 37. When it is desired that the car 10 shall travel toward the left, Fig. 1, the operator by placing his finger through one of the rings 30 and pulling on the cord 25 releases the bolt 21 from engagement with the notch 20. He then rotates the crank 34, thereby through the worm 16 and worm gear 15 swings the arm 12 through an angle of 180°, it being understood that during said movement the trolley wheel 60 remains in contact with the wire 62. The bolt 21 when released is moved into the notch 19 by the spring 23. Should the wheel 60 become disengaged from the wire 62 either accidentally or intentionally, it may be returned to its place in the following manner. Assuming the groove of the wheel 60 to be at an angle to the wire 62, the arm 49 may be moved beneath the wire 62 by any suitable means. The periphery of the wheel 60 is permitted to contact with the wire 62 as the arm 49 is being moved into alinement with said wire, as shown in Fig. 10. It will be seen that but one flange of the wheel 60 touches the wire 62 and, therefore, owing to the inclination of the axis of the wheel-support 58 continued movement of the arm 49 toward a vertical plane containing the wire 62 causes said wheel-support to be rotated on its axis, thereby bringing the groove of the wheel 60 into alinement with said wire, as shown in Figs. 1, 3, 5 and 9. If when the wheel 60 is off of the wire 62 the groove in said wheel is substantially parallel to said wire, it will be obviously an easy matter to return said wheel to its proper position on said wire. The arm 49 is so formed and so related to the wheel 60 and wheel-support 58 that said wheel-support is thus prevented from catching on any cross-wires in case the wheel 60 should jump off of the wire 62. The spherical form of the wheel-support 58 prevents wires getting caught between said wheel-support and that portion of the arm 49 which is immediately adjacent thereto.

Having thus described my invention what I claim and desire by Letters Patent to secure is:

1. In combination a car, a standard supported on said car to swing about a vertical axis, an arm pivoted to said standard with its axis horizontal, a lever pivoted to said arm with its axis horizontal, a grooved wheel journaled on said lever with its axis horizontal, a spring adapted to normally raise said arm toward an upright position, a second spring adapted to normally raise said lever toward an upright position, and means for automatically locking said arm in an oblique position, said lever constructed when rocked upon its pivot to engage said means and release said arm held thereby.

2. In combination a car, an arm mounted on said car to swing about a vertical axis, a standard mounted on said arm to swing about a vertical axis, a second arm pivoted to said standard with it axis horizontal, a lever pivoted to said second arm with its axis horizontal, a grooved wheel journaled on said lever with its axis horizontal, a spring adapted to normally raise said second arm toward an upright position, a second spring adapted to raise said

lever toward an upright position, and means for automatically locking said second arm in an oblique position, said lever constructed when rocked upon its pivot to engage said means and release said second arm held thereby.

3. In combination a car, an arm mounted on said car to swing about a vertical axis, means for rotating said arm about said axis, a standard mounted on said arm to swing about a vertical axis a second arm pivoted to said standard with its axis horizontal, a lever pivoted to said second arm with its axis horizontal, a grooved wheel journaled on said lever with its axis horizontal, a spring adapted to normally raise said second arm toward an upright position, a second spring adapted to normally raise said lever toward an upright position, and means for automatically locking said second arm in an oblique position, said lever constructed when rocked upon its pivot to engage said means and release said second arm held thereby.

4. In combination a car, an arm mounted on said car to swing about a vertical axis, means for rotating said arm about said axis, means for locking said arm in a predetermined position, a standard mounted on said arm to swing about a vertical axis, a second arm pivoted to said standard with its axis horizontal, a lever pivoted to said second arm with its axis horizontal, a grooved wheel journaled on said lever with its axis horizontal, a spring adapted to normally raise said second arm toward an upright position, a second spring adapted to normally raise said lever toward an upright position, and means for automatically locking said second arm in an oblique position, said lever constructed when rocked upon its pivot to engage said means and release said second arm held thereby.

5. In combination a car, a post mounted vertically on said car, an arm journaled on said post to swing about the axis of said post, a worm gear fast to said arm concentric with said axis, a worm meshing into said worm gear, a horizontal shaft to which said worm is fast, bearings in which said shaft is journaled, means for rotating said shaft, a standard mounted on said arm to swing about a vertical axis, a second arm pivoted to said standard with its axis horizontal, a lever pivoted to said second arm with its axis horizontal, a grooved wheel journaled on said lever with its axis horizontal, a spring adapted to normally raise said second arm toward an upright position, a second spring adapted to normally raise said lever toward an upright position, and means for automatically locking said second arm in an oblique position, said lever constructed when rocked upon its pivot to engage said means and release said second arm held thereby.

6. In combination a car, a standard supported on said car to swing about a vertical axis, an arm pivoted to said standard with its axis horizontal, a lever pivoted to said arm with its axis horizontal, a wheel-support mounted on said lever to swing about a substantially upright axis, a grooved wheel journaled on said wheel-support with its axis horizontal, a spring adapted to normally raise said first arm toward an upright position, a second spring adapted to normally raise said lever toward an upright position, and means for automatically locking said arm in an oblique position, said lever constructed when rocked upon its pivot to engage said means and release said arm held thereby.

7. In combination a car, a standard supported on said car to swing about a vertical axis, an arm pivoted to said standard with its axis horizontal, a lever pivoted to said arm with its axis horizontal, a wheel-support mounted on said lever to swing about a substantially upright axis, a grooved wheel journaled on said wheel-support with its axis horizontal, a spring adapted to normally raise said first arm toward an upright position, a second spring adapted to normally raise said lever toward an upright position, and means for automatically locking said arm in an oblique position, said lever constructed when rocked upon its pivot to engage said means and release said arm held thereby.

8. In combination a car, a standard supported on said car to swing about a vertical axis, an arm pivoted to said standard with its axis horizontal, a lever pivoted to said arm with its axis horizontal, a wheel-support mounted on said lever to swing about a substantially upright axis, a grooved wheel journaled on said wheel-support with its axis horizontal, a spring adapted to normally raise said arm toward an upright position, a second spring adapted to normally raise said lever toward an upright position, and means for automatically locking said first arm in an oblique position, said lever constructed when rocked upon its pivot to engage said means and release said arm held thereby.

9. In combination a car, a standard supported on said car to swing about a vertical axis, an arm pivoted to said standard with its axis horizontal, a lever pivoted to said arm with its axis horizontal, a grooved wheel rotatably supported on said lever with its axis horizontal, a spring adapted to normally raise said arm toward an upright position, a stop adapted to limit the upward movement of said arm, and a second arm pivoted to said standard with its axis parallel to the axis of said first arm, said second arm provided with a projection adapted to engage a shoulder formed on said first arm, whereby said first arm is locked in an oblique position, one arm of said lever being adapted to disengage said projection from said shoulder.

10. In combination a car, a post mounted vertically on said car, an arm journaled on said post to swing about the axis of said post, means for rotating said arm about said axis, means for locking said arm in a predetermined position, a standard mounted on said arm to swing about a vertical axis, a second arm pivoted to said standard with its axis horizontal, a lever pivoted to said second arm with its axis horizontal, a spring adapted to normally raise said second arm toward an upright position, a second spring adapted to raise said lever toward an upright position, a stop adapted to limit the upward movement of said second arm, stops adapted to limit the movement of said lever in opposite directions, respectively, a wheel-support mounted on said lever to swing about a substantially upright axis, a wheel journaled on said wheel-support with its axis horizontal, and a third arm pivotally mounted on said standard with its axis parallel to the axis of said second arm, said third arm provided with a projection adapted to engage a shoulder formed on said second arm, whereby said second arm is locked in an oblique position, one arm of said lever being adapted to disengage said projection from said shoulder.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

AARON HILL.

Witnesses:
LOUIS A. JONES,
SADIE V. MCCARTHY.