

(No Model.)

6 Sheets—Sheet 1.

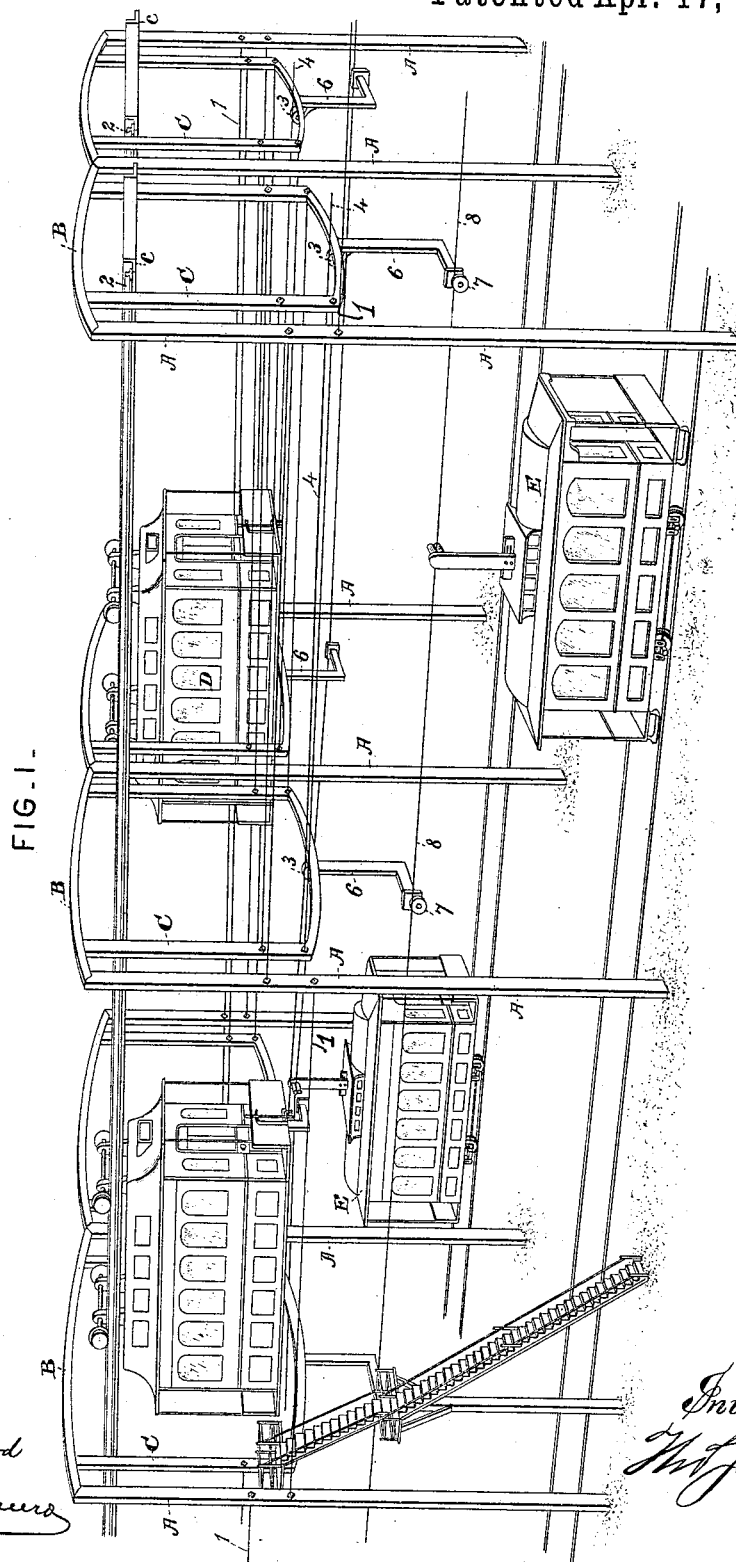
T. J. MAYALL, Dec'd.

L. A. MAYALL, Executrix.

COMBINED ELEVATED AND SURFACE RAILWAY.

No. 381,405.

Patented Apr. 17, 1888.



attest:  
Geo. T. Smallwood  
Philip Mauro

Inventor:  
Wm L Mayall

(No Model.)

6 Sheets—Sheet 2.

T. J. MAYALL, Dec'd.

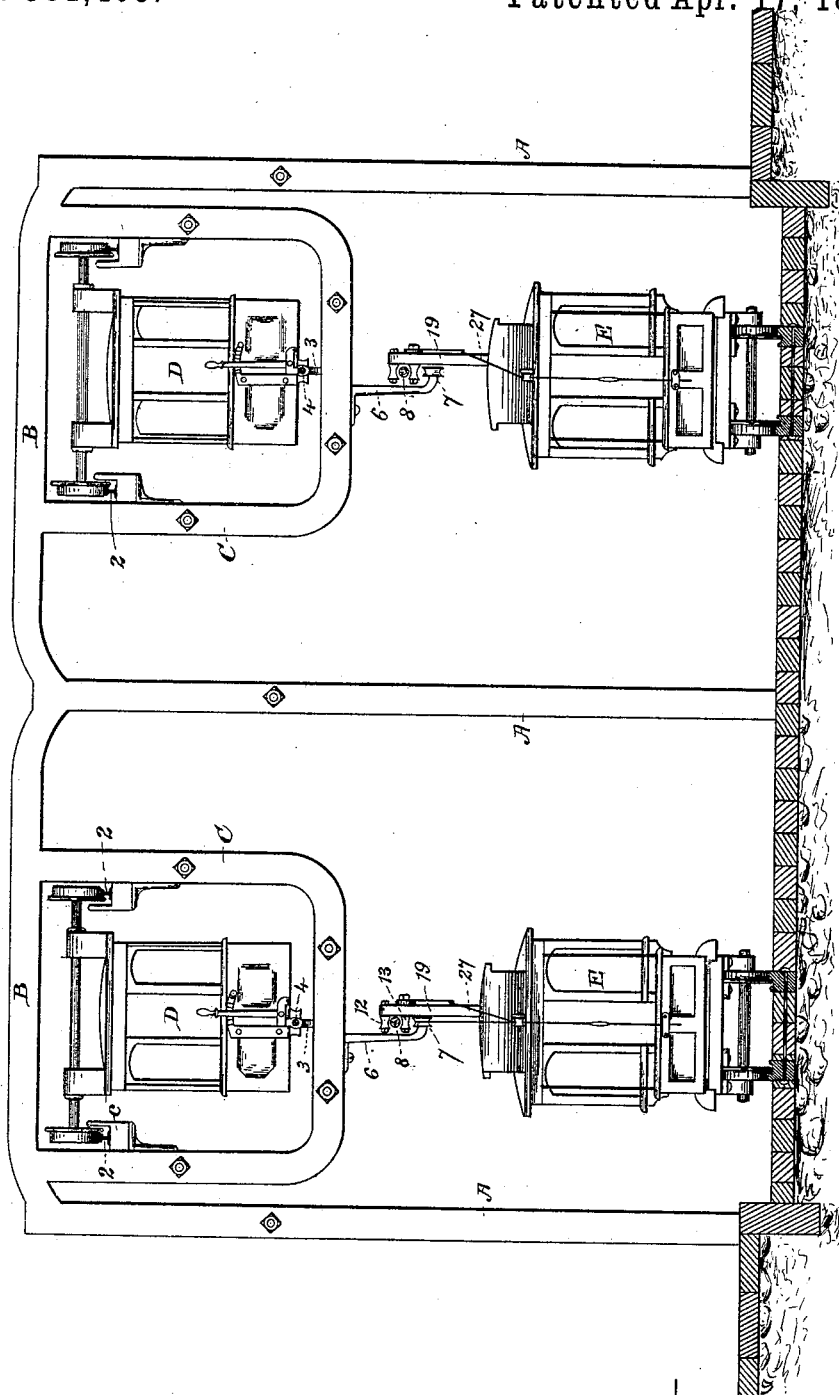
L. A. MAYALL, Executrix.

COMBINED ELEVATED AND SURFACE RAILWAY.

No. 381,405.

Patented Apr. 17, 1888.

FIG. II.



WITNESSES:

Geo. T. Smallwood.

Philipbauer

INVENTOR:

T. J. Mayall.

(No Model.)

6 Sheets—Sheet 3.

T. J. MAYALL, Dec'd.

L. A. MAYALL, Executrix.

COMBINED ELEVATED AND SURFACE RAILWAY.

No. 381,405.

Patented Apr. 17, 1888.

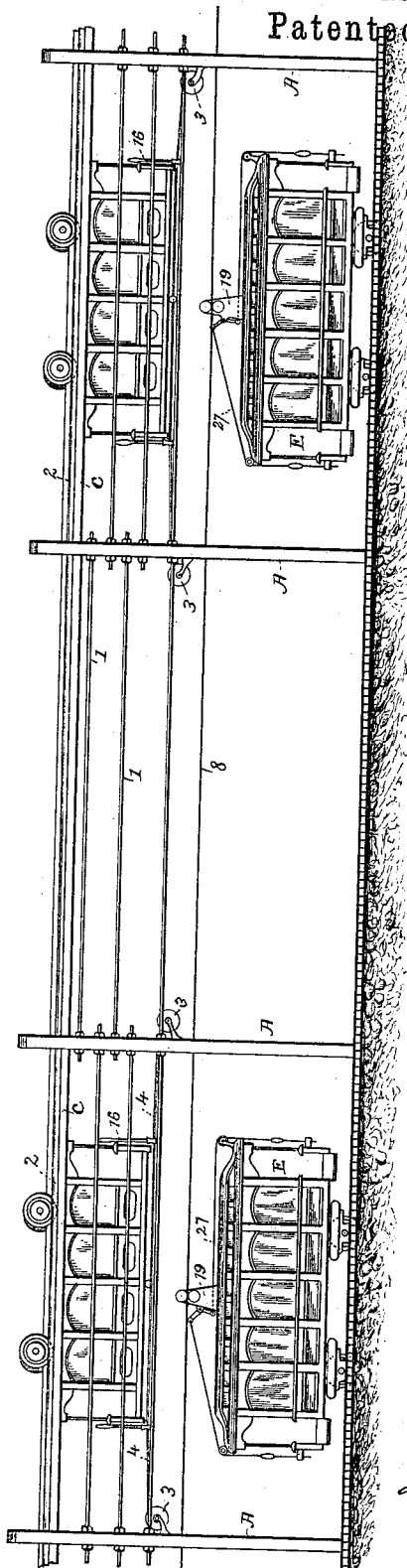


Fig. III.

WITNESSES:

Geo. T. Smallwood  
Philip H. H. H.

INVENTOR:

T. J. Mayall

(No Model.)

6 Sheets—Sheet 4.

T. J. MAYALL, Dec'd.

L. A. MAYALL, Executrix.

COMBINED ELEVATED AND SURFACE RAILWAY.

No. 381,405.

Patented Apr. 17, 1888.

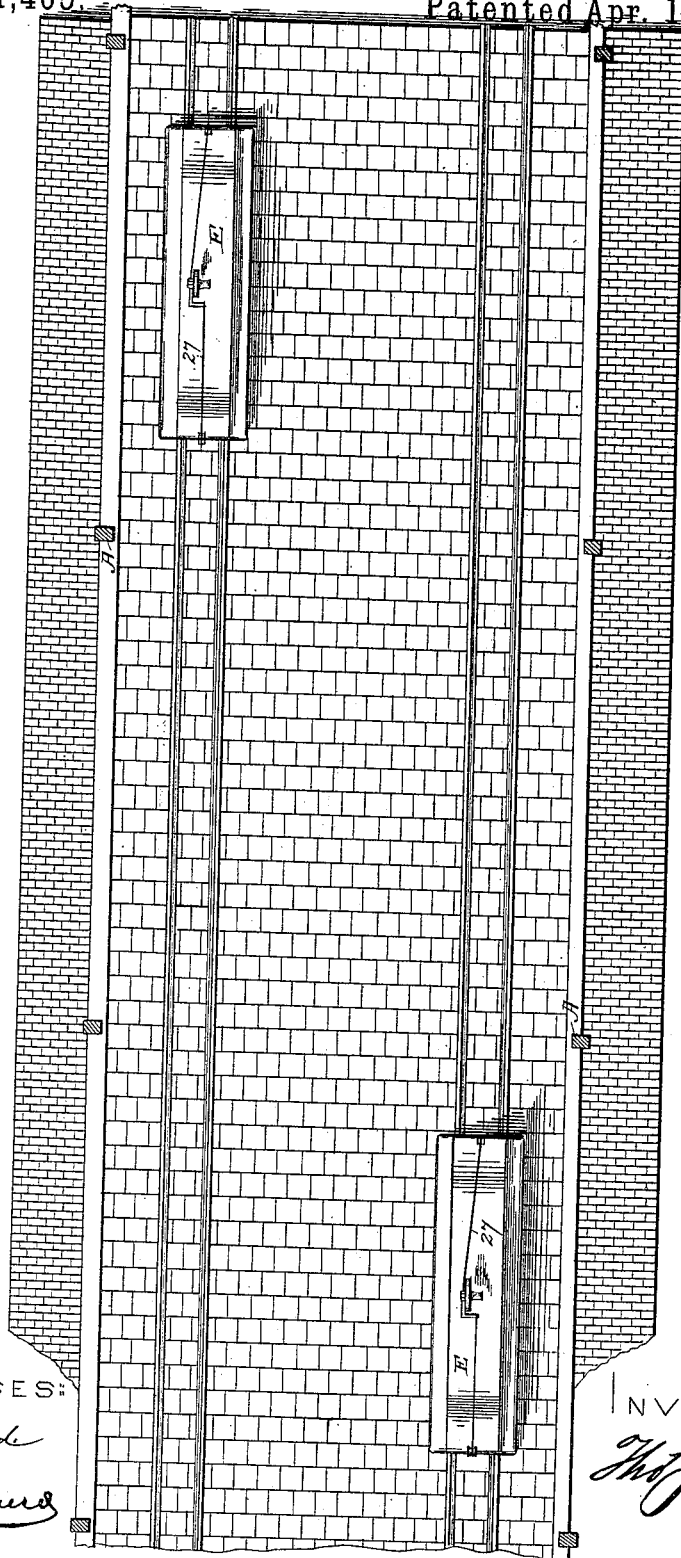


Fig. IV

WITNESSES:

*Geo. T. Smallwood*  
*Philip H. H. H.*

INVENTOR:

*Thos. J. Mayall*

(No Model.)

6 Sheets—Sheet 5.

T. J. MAYALL, Dec'd.

L. A. MAYALL, Executrix.

COMBINED ELEVATED AND SURFACE RAILWAY.

No. 381,405.

Patented Apr. 17, 1888.

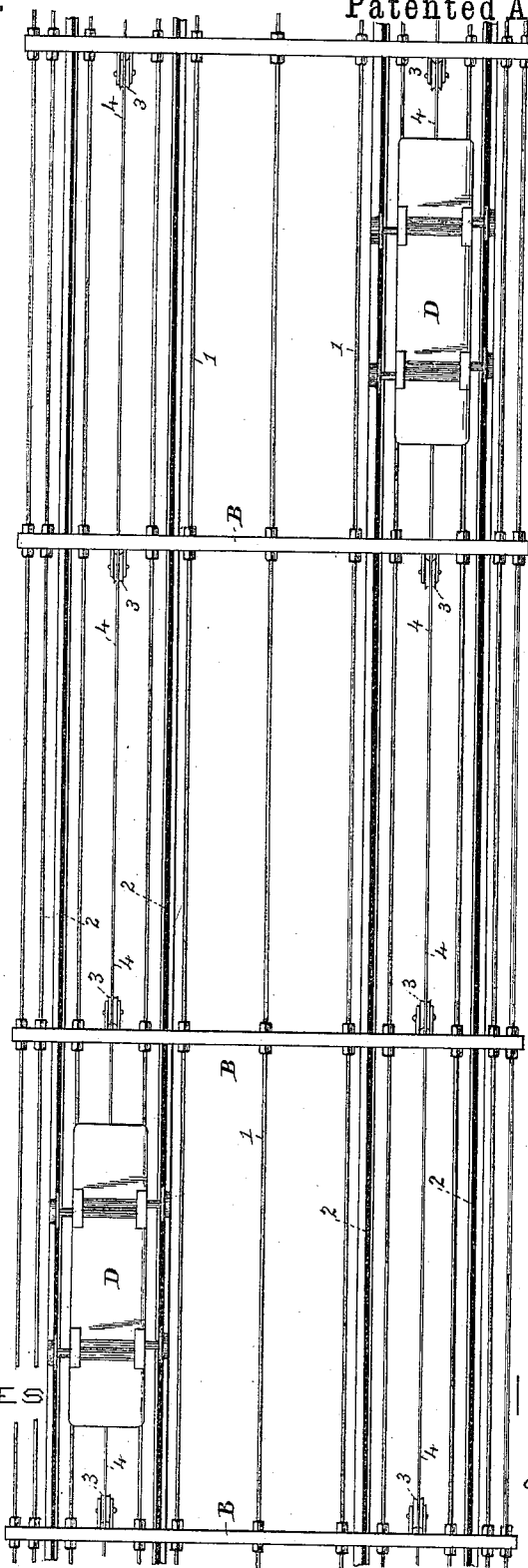


Fig. V

WITNESSES

*Geo. T. Smallwood*

*Philip Beauregard*

INVENTOR:

*T. J. Mayall*

(No Model.)

6 Sheets—Sheet 6.

T. J. MAYALL, Dec'd.

L. A. MAYALL, Executrix.

COMBINED ELEVATED AND SURFACE RAILWAY.

No. 381,405.

Patented Apr. 17, 1888.

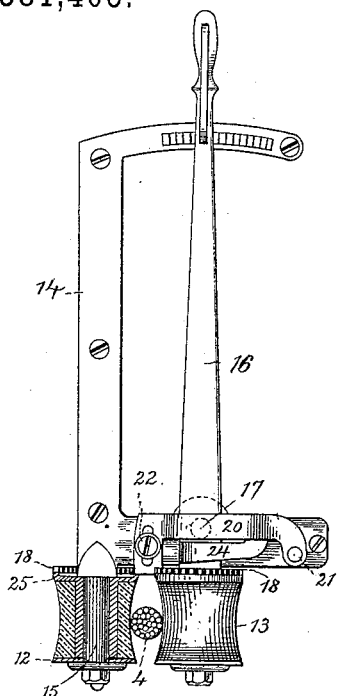


Fig VI

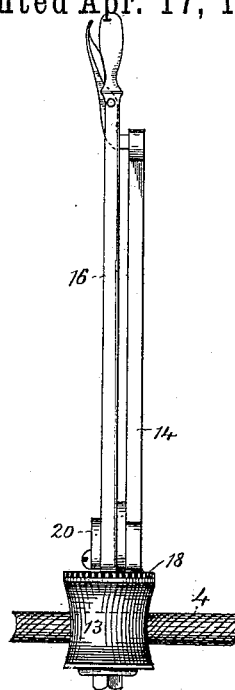


Fig VII

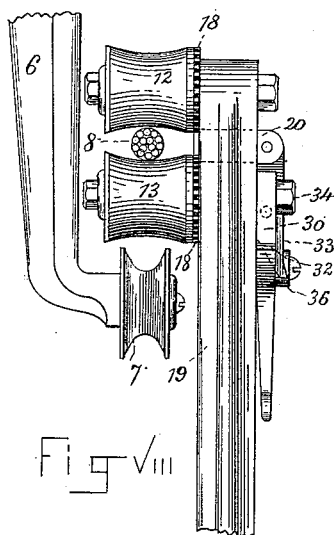


Fig VIII

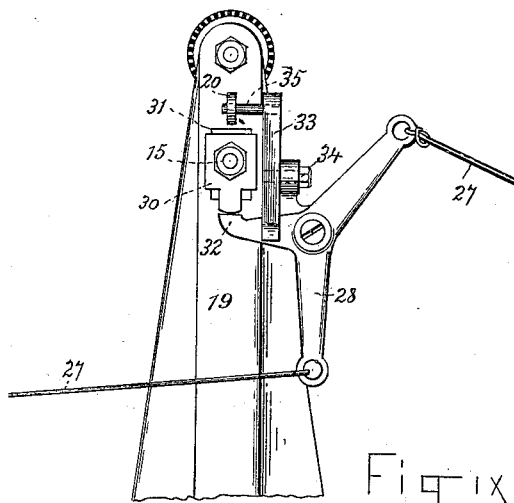


Fig IX

WITNESSES:

Geo. T. Smallwood  
Philip H. H. H.

INVENTOR:

Thomas J. Mayall  
by A. H. H.  
his attorney.

# UNITED STATES PATENT OFFICE.

THOMAS J. MAYALL, OF READING, MASSACHUSETTS; LUCY A. MAYALL  
EXECUTRIX OF SAID THOMAS J. MAYALL, DECEASED.

## COMBINED ELEVATED AND SURFACE RAILWAY.

SPECIFICATION forming part of Letters Patent No. 381,405, dated April 17, 1888.

Application filed June 21, 1887. Serial No. 242,036. (No model.)

*To all whom it may concern:*

Be it known that I, THOMAS J. MAYALL, of Reading, in the county of Middlesex and State of Massachusetts, have invented a new and useful Improvement in Combined Elevated and Surface Railways, which improvement is fully set forth in the following specification.

This invention relates to the construction and operation of street-railways to be operated by cable, pneumatic tubes, electric motors, or other means.

The invention is designed to secure rapid locomotion, safety to passengers, a minimum cost of construction, and smaller running expenses than attend the operation of the so-called "rapid-transit" systems now in vogue. As a matter of safety to the community, it is necessary that street-railway cars running at high speed should be either above or below the level of the street, and of the two plans the elevated road is preferred for obvious reasons. Several such systems are in operation, employing steam as the motive-power. The objections to such systems are the necessity of strong, cumbersome, and unsightly frame-work to support the road-bed, owing to the weight of the engine, the liability of accident to persons on the cars, as well as on the street below, and the smoke, noise, and other attendant annoyances. To obviate these serious objections I propose to dispense with the steam-engine and employ other means, preferably a grip-cable, to draw the cars, as hereinafter more fully described. This enables me to use a light frame-work that would be entirely unobjectionable on the score of appearances or obstruction to travel on the street below, and further avoid the annoyances and to a great extent the dangers attending elevated steam-railways. This frame-work is preferably composed of metal uprights connected by tie-bars and cross-pieces, from which depend frames of approximately rectangular form, which carry the rails, and through which the cars pass.

The elevated cars are of course designed to make few stops, and are principally useful for traveling long distances. To accommodate another class of travelers the same grip-cable is used to draw cars upon the surface of the street, so that the present invention includes

a combined elevated and surface road. The grip-cable for the surface-cars runs over rollers carried by bent arms depending from the frames before referred to, and the grip on the car below lifts the cable off the rollers as it successively passes the supporting arms.

The system requires two elevated tracks and two surface-tracks, and the cars on the surface run in opposite directions to those immediately overhead. The same structure thus serves to support the road-bed of the elevated road and the propelling means (in this case a cable) for both the surface and elevated roads, which is a matter of considerable economy. One obvious advantage of the system is that it avoids the necessity as well as the expense of tearing up the streets to lay a conduit for the grip-cable, (or electric wires or pneumatic tube, as the case may be.) The cable being overhead is at all times readily accessible for repairs, and any defect in the working of the system can be instantly located and remedied.

The invention includes certain details which are useful in the practical carrying out of the system, and which will be hereinafter described.

Referring now to the accompanying drawings, which illustrate one manner in which the invention may be carried into effect, Figure I is a perspective view of the tracks, showing cars in transit. Fig. II is a cross section of the same. Fig. III is a side view; Fig. IV, a plan showing the surface-road and cars; Fig. V, a similar view showing the elevated road, and Figs. VI to IX details of grippers for the cars.

The frame-work or structure that supports the elevated road-bed comprises the pillars A, connected by the rods 1, the cross-pieces B, and the hanging frames C, all of which may be made of wrought-iron, plate, steel, or other suitable material combining lightness with strength. The hanging frames C have brackets c, upon which run the rails 2 for the cars D of the elevated road. The frames C also carry grooved rollers 3, upon which runs the cable 4, for drawing the upper cars. The bent arms 6, hanging from the frame C, carry grooved rollers 7 for the return-cable 8, whereby the surface-cars are drawn in the opposite

direction to cars D. The arms 6 are bent at right angles near their lower ends, and the grip mechanism of the car E is also provided with an offset in the opposite direction, so that it can keep hold on the cable without coming into contact with the arms 6. The grippers for both sets of cars are so placed relatively to the rollers 3 and 7 that they lift the cable as they pass each roller, the cable then resuming its normal position. The grip mechanism for the elevated cars is illustrated in Figs. VI and VII, and that for the lower cars in Figs. VIII and IX.

Referring to Figs. VI and VII, which are views at right angles to each other, rollers 12 13 are supported at the bottom of a casting, 14, and turn on studs 15. The stud of roller 12 is fixed directly to the frame 14, and that of roller 13 is fixed to the end of a lever, 16, pivoted at 17 to the frame 14, so that by moving the lever 16 to the right, Fig. VI, the roller 13 is moved toward roller 12 and the cable 4 gripped between them. At the ends of the rollers 12 13 are disks 18, having notches around their peripheries. A locking-arm, 20, is pivoted at 21 to the frame 14. At its other end it is held by a screw, 22, passing through a slot in said arm, so that the locking end thereof can move into or out of engagement with the notches in disks 18, thereby locking the rollers 12 13 or releasing them. Lever 16 has near its lower end a projecting finger, 24, which is connected with the locking-arm 20, so that when lever 16 is moved to the right, Fig. VI, the locking-arm is raised and releases the notched disks 18. When the lever 16 is moved to the left, causing the rollers to grip the cable, the locking-arm is again thrown into engagement with the notched disks and holds the rollers stationary. This form of grip mechanism being substantially the same as that described and claimed in my application for improvement in elevated railways, filed June 14, 1887, No. 241,252, is not claimed herein. I prefer to make the grip-rollers in the manner described in my application filed June 16, 1887, No. 241,511. I find that grip-rollers made in this way are very desirable, and they take firm hold of the cable without producing appreciable wear thereon.

The grip mechanism illustrated in Figs. VIII and IX is similar in most respects to that just described, being modified only sufficiently to adapt it to the surface-cars and to be worked by a cord instead of by a hand-lever. It is

designed to be applied to the middle of a car, and the operating-lever has two arms, 28, from which run cords 27 to both platforms of the car, so that it can be worked from either. In this case the stud 15 of roller 13 is carried by a sliding block, 30, working in a slot, 31, in the standard 19, which block can be raised by the arm 32 to grip the cable 8 between the rollers. The locking-arm 20 is actuated by a lever, 33, pivoted at 34 and connected with said arm by a stud, 35. The lower end of lever 33 has an incline or cam face, 36, (see Fig. VIII,) which makes contact with the arm 32 of lever 28. Consequently, when the arm 28 is raised to bring together the grip-rollers, the lower end of lever 33 is moved out and locking-arm 20 is thrown into engagement with the notched disks 18 on the ends of rollers 12 13. The rollers 12 and 13 in this case are placed at the sides of the standards 19, and the arm 6, carrying roller 7, upon which the cable runs, is bent in the opposite direction, so that the rollers 12 13 may follow the cable without striking arm 6. The height of standard 19 on the surface-cars is such that the rollers 12 13 will pass above the rollers 7, lifting the cable off each successively as the car passes.

Having now fully described my said invention, what I claim, and desire to secure by Letters Patent, is—

1. In an elevated street-railway system, the combination of the upright posts on opposite sides of the roadway, the top cross-pieces, the hanging frames of approximately rectangular form, the overhead tracks, the rollers for the cable drawing the overhead cars, and the depending arms having rollers for the return-cable, substantially as described.

2. A grip mechanism for cable-railway cars, comprising a pair of rollers having notched disks, a three-arm lever for moving one of said rollers toward and away from the other, and a locking device operated by said lever for engagement with the notches in said disks, and a cord, one leading from two of the arms of said lever, substantially as described.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

THOS. J. MAYALL.

Witnesses:

PHILIP MAURO,  
C. J. HEDRICK.