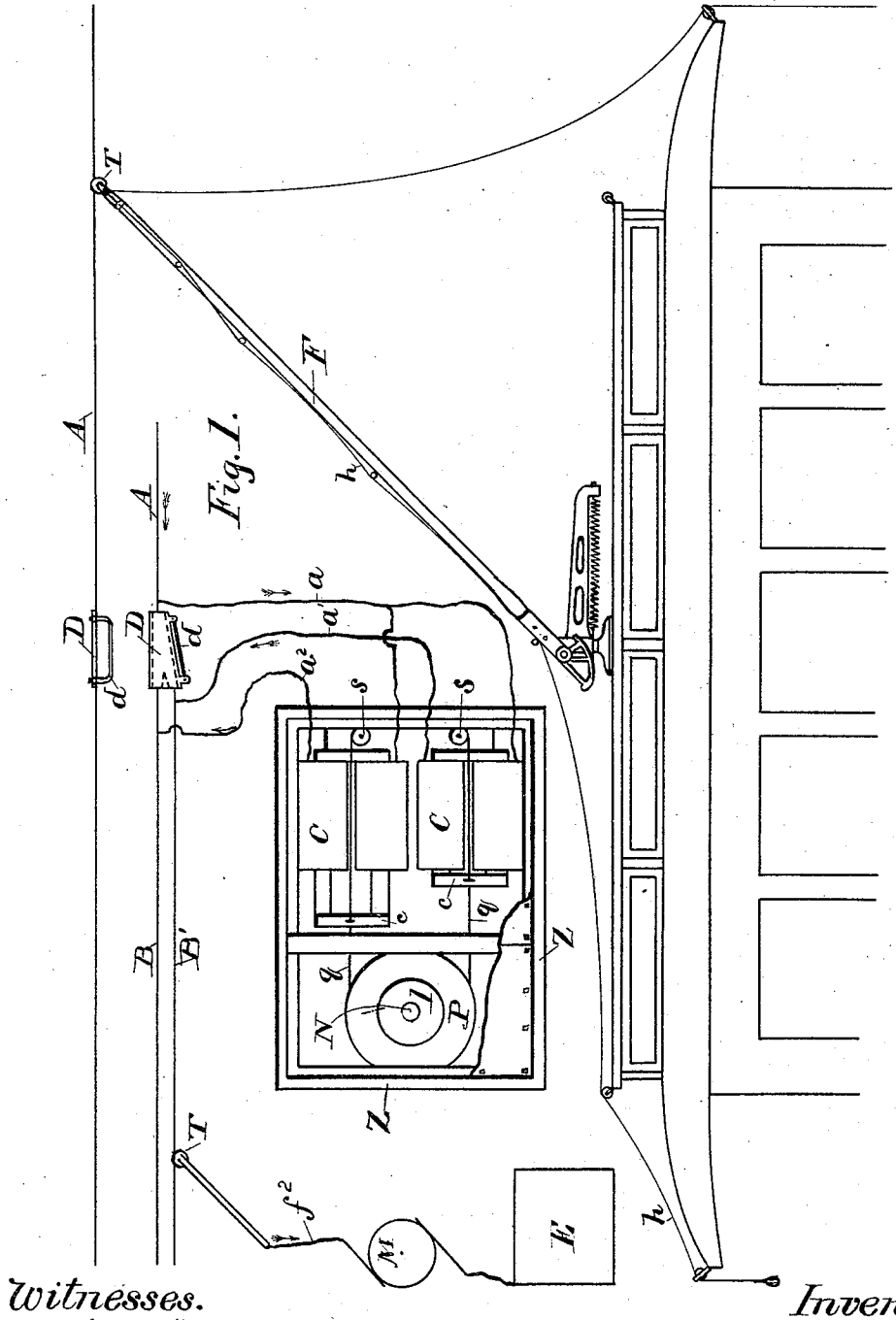
(No Model.) 4 Sheets—Sheet 1.

# C. A. STONE & E. S. WEBSTER.

## ELECTRICALLY OPERATED RAILWAY SWITCH.

No. 484,123. Patented Oct. 11, 1892.




Witnesses.
E. Webster
H. L. Rogers.

Inventors.
Charles A. Stone
Edwin S. Webster

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(No Model.) 4 Sheets—Sheet 2.

# C. A. STONE & E. S. WEBSTER.

## ELECTRICALLY OPERATED RAILWAY SWITCH.

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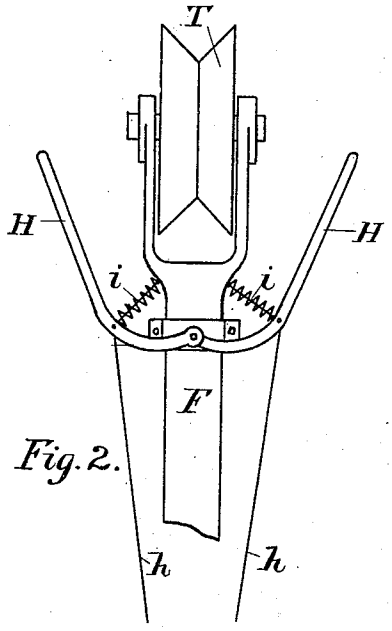


Fig. 2.

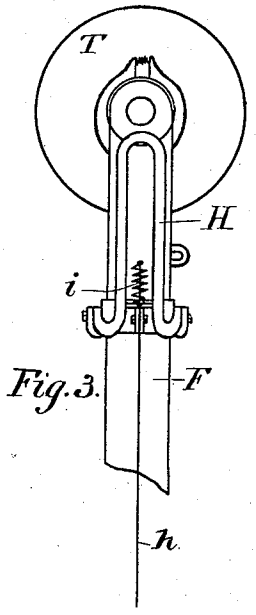


Fig. 3.

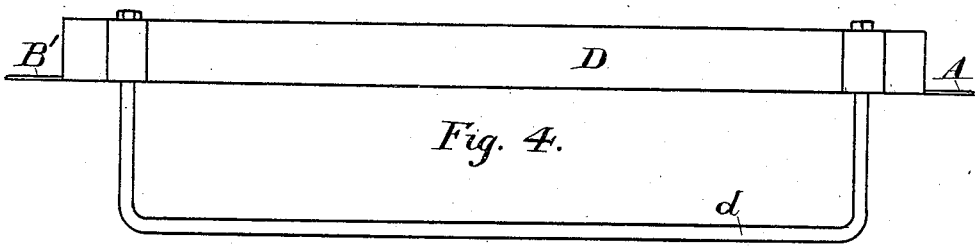


Fig. 4.

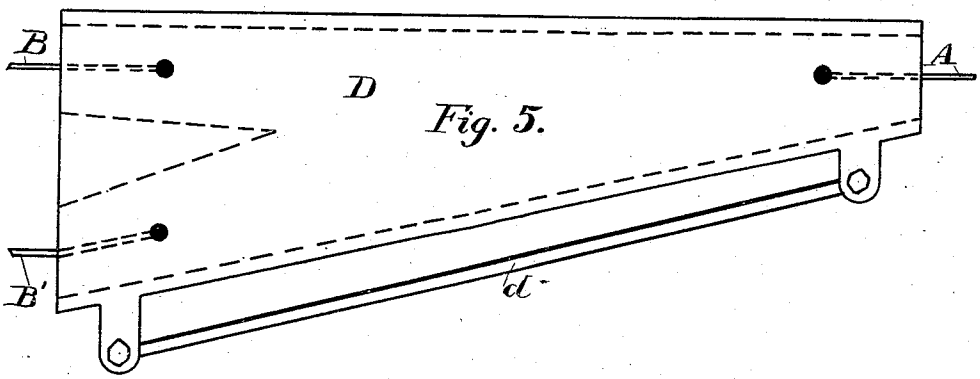


Fig. 5.

Witnesses.
B. Gurbster.
H. L. Rogers.

Inventors.
Charles A. Stone
Edwin S. Webster

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(No Model.) 4 Sheets—Sheet 3.

# C. A. STONE & E. S. WEBSTER.

## ELECTRICALLY OPERATED RAILWAY SWITCH.

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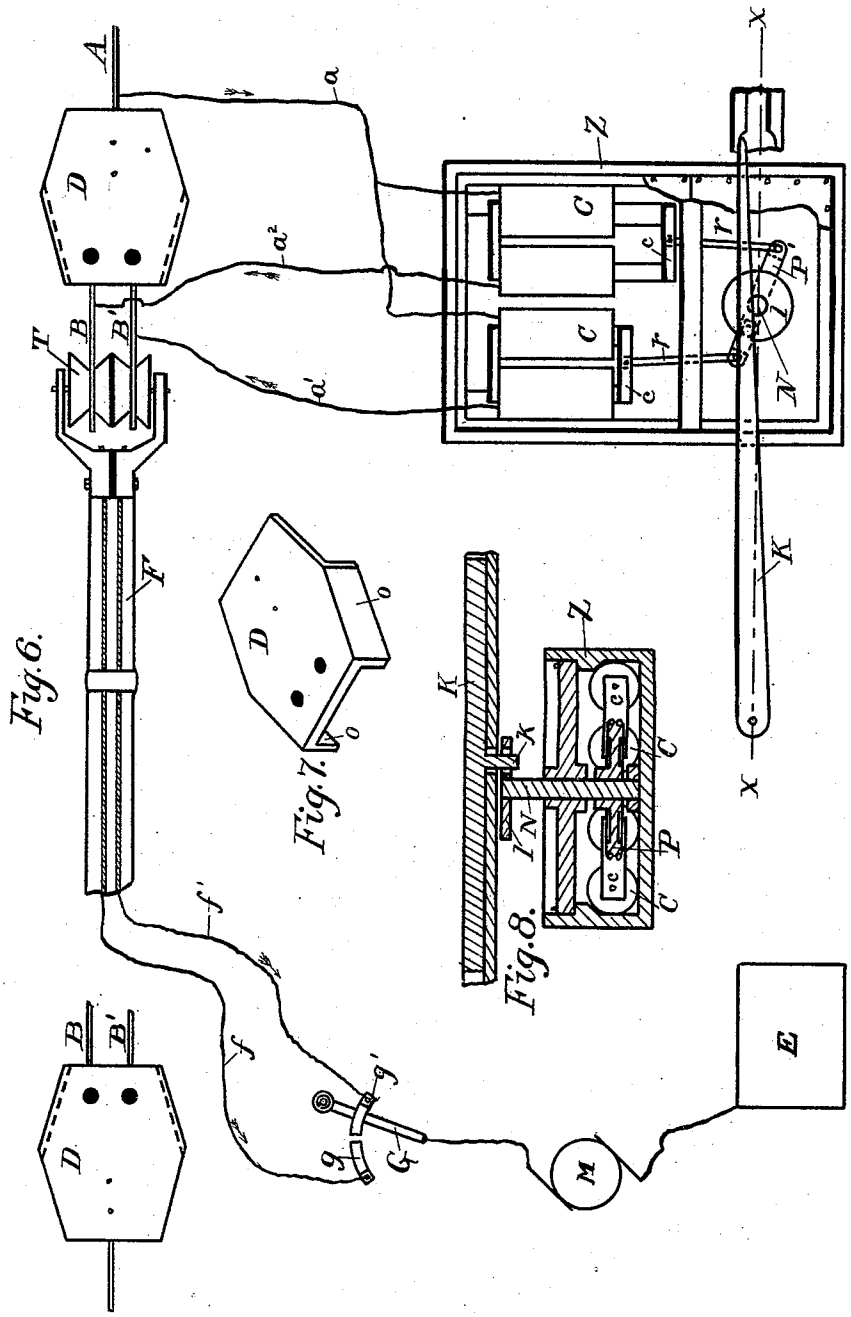


Witnesses.
A. J. Webster.
H. L. Rogers.

Inventors.
Charles A. Stone
Edwin S. Webster

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(No Model.) 4 Sheets—Sheet 4.

# C. A. STONE & E. S. WEBSTER.

## ELECTRICALLY OPERATED RAILWAY SWITCH.

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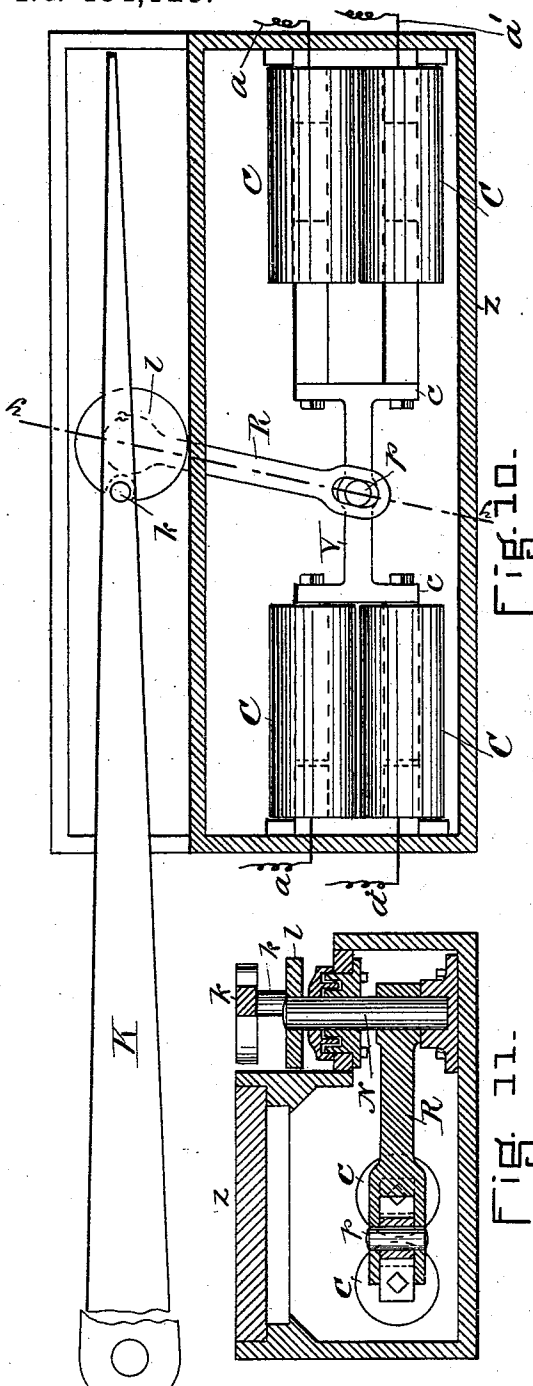


Fig. 10.

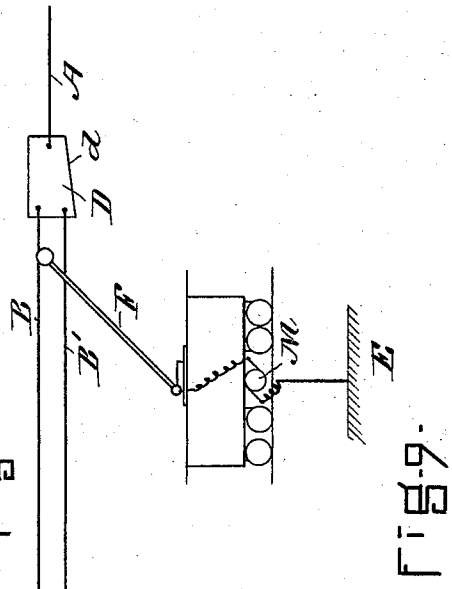
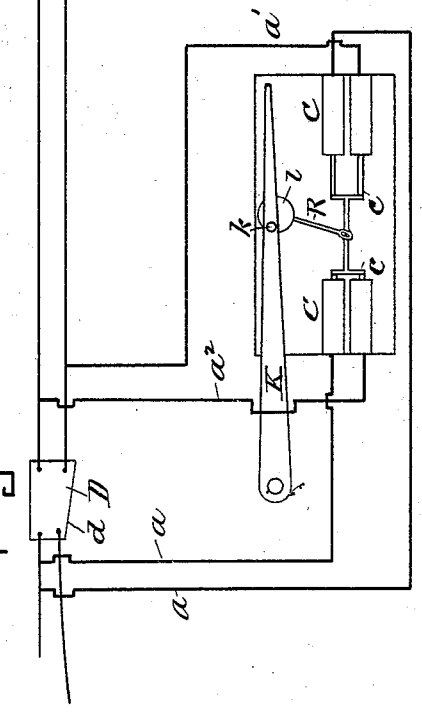


Fig. 9.



Fig. 11.



WITNESSES.

H. B. Rogers.

F. G. Fleming.

INVENTORS

Charles A. Stone

Edwin S. Webster

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

# UNITED STATES PATENT OFFICE.

CHARLES A. STONE, OF NEWTON, AND EDWIN S. WEBSTER, OF BOSTON, MASSACHUSETTS.

## ELECTRICALLY-OPERATED RAILWAY-SWITCH.

SPECIFICATION forming part of Letters Patent No. 484,123, dated October 11, 1892.

Application filed September 25, 1891. Serial No. 406,872. (No model.)

*To all whom it may concern:*

Be it known that we, CHARLES A. STONE, of Newton, in the county of Middlesex, and EDWIN S. WEBSTER, of Boston, in the county of Suffolk, in the Commonwealth of Massachusetts, have invented certain new and useful Improvements in Electrically-Operated Railway-Switches, of which the following description, in connection with the accompanying drawings, is a specification.

Our improvements relate to that class of railway-switches which are operated by the action of electro-magnets upon their armatures or solenoid-coils upon their cores, the electric current for which is supplied from the same source as that from which the car-motor derives its power; and our invention primarily consists in providing near the location of each switch insulated sections of conductors through which current is supplied to the motor, which we will designate as "switch-sections." These switch-sections are insulated from direct electrical connection with the main electric conductor, but are indirectly connected in circuit therewith through a magnet by the action of which the railway-switch tongue is operated. By this means when the contact-brush, trolley, or other electrical collector supported upon the car moves onto either of these switch-section conductors the electric current will be drawn through the coils of the said railway-switch magnet, and thereby cause it to operate the railway-switch automatically and without effort on the part of the driver or conductor of the car, except to see that the contact-brush or trolley is directed onto the switch-section conductor by means, for example, such as hereinafter described. When but one magnet is used, which will pull the railway-switch tongue in one direction only, a spring may be used to return it to its normal position as soon as the car has passed beyond the switch-section. We prefer, however, generally to operate the railway-switch tongue in both directions by the action of a magnet, and therefore provide a pair of electric conductors in each switch-section and a pair of electro-magnets placed in opposed relation to one another or so that their action shall be in opposite directions within a closed chamber beneath the railway-switch and connect each of the said switch-section conductors with the main electric conductor through the coils of one of said switch-magnets. The respective armatures of these magnets may be pivotally connected (by a link) to one end of an arm or yoke secured to the switch-operating shaft or by a flexible band or chain which passes around a pulley or sheave upon said shaft. Instead of using a single contact-brush or trolley, we may employ a double one with an insulating-division or two placed side by side upon the same support, but insulated from each other and respectively electrically connected with separate contacts of a hand-switch connected with the motor-circuit and placed upon the car convenient to the driver. When using such a double trolley, we place the switch-section conductors the same distance apart that the grooves of the trolleys are and provide a guiding-plate at the point where the switch-section conductors are insulated from the main conductor, so that the trolley will be caused to run upon the switch-section with a conductor in each of its grooves, and, as heretofore stated, each switch-section conductor being independently connected with the main electric conductor through one of the railway-switch magnets, all that is needed for the driver to do is to move the said hand-switch upon its right-hand or left-hand contact, according to the direction in which he desires to go, and the railway-switch will be correspondingly turned.

When using a single trolley or contact brush, as in the arrangement first hereinabove described, and it is desired to turn the car onto a shunt-track, the trolley may be guided to the switch-section conductor, through which the railway-switch will be properly set for that purpose by means of an arm which may be thrown into position beside the trolley, where it will bear upon a guide-rod attached to the trolley-switch plate and placed at an angle with the main trolley-wire, or the trolley may be guided by the usual trolley-rope.

Referring to the drawings, which form part of this specification, Figure 1 is an elevation of the top of a car with a trolley-support and trolley thereon and a trolley-wire or main elec-

tric conductor, with a diagrammatic view of the switch-section conductors, railway-switch magnets, and the connection between the main and switch-section conductors through said magnets, and also a trolley upon the switch-section conductor and its connection through the motor to ground. Fig. 2 is a front elevation of a single trolley with the switching-arms in position. Fig. 3 is a side elevation of the same. Fig. 4 is a side elevation of the trolley-switch plate with the switching-guide rod attached thereto. Fig. 5 is a plan view of the same parts. Fig. 6 is a plan view of a portion of the main and switch-section conductors with the trolley-guiding plates joining them, the double trolley, the railway-switch magnets, and switch-tongue, and their connections, and the electric connections between the several parts shown diagrammatically. Fig. 7 is a perspective view of the trolley-guide plate. Fig. 8 is a vertical section of the railway-switch tongue and the parts beneath by which it is operated, shown in Fig. 6, when the switch-tongue is at a central position in the arc of its movement. Fig. 9 is a diagrammatic view of the main and switch-section conductors and their electrical connection with the railway-switch magnets and the motor of the car through the trolley and with the said magnets placed with their cores substantially in a straight line. Fig. 10 is an enlarged plan of the switch-magnets placed as shown in Fig. 9 and the railway-switch tongue and the connection between them with the top plate of the magnet-box removed; Fig. 11, a sectional elevation on line *y y* of Fig. 10.

The several parts of the various devices are indicated by the same letter or figure wherever shown.

A is the main electrical conductor, which we have represented as an overhead trolley-wire; but it will readily be seen that our improvements are equally as applicable and advantageous in a system having the main conductor below the car, and we intend them to be so employed, and also with a double-trolley or metallic-circuit system.

B B′ are the switch-section conductors.

C are the railway-switch magnets, contained in a water-tight box Z beneath the switch. Two coils upon each side, as illustrated in the drawings, may be used to give greater power.

*a a′ a²* are the electrical connections between the main and switch-section conductors through the coils of the magnets C.

D are metal plates to which the main and switch-section conductors are attached, the switch-section conductors having insulating connections therewith. In Figs. 1, 2, 3, and 6 the trolley serves both as the main and switch trolleys.

F is the trolley-support, Fig. 6.

G is the hand or current switch upon the car, connected with the motor-circuit, and *g g′* separate metal contacts of said switch.

*f f′* are electrical conductors between the trolleys and the contacts *g* of the hand-switch.

M is the motor, and E the earth connection of the motor. In the double-trolley or metallic-circuit overhead system the motor will be connected with the return-circuit wire instead of to earth.

In Figs. 1, 4, and 5, *d* is the trolley-guide rod, held below the plate D and against which an arm H bears when pulled out into the position shown in Fig. 2 by a cord or wire *h*, Fig. 1. When the cord is released, the arms H are drawn up against the trolley-bearings by springs *i*.

K is the railway-switch tongue, provided with a lug or finger *k*, projecting down through the plate upon which the tongue rests and into a slot in a disk or crank-arm *l* upon the crank-shaft N, which shaft projects down into the magnet-box Z and has bearings therein.

P is a disk, or it may be an arm P′, as in Fig. 6, attached to the shaft N within the box Z. The armatures *c* of the magnets C are connected with the arm or yoke P′ by links or rods *r*, one end of each being pivoted to one of the armatures *c* and the other end to one end of the arm P′, Fig. 6, or with the disk P by a band or chain *q*, passing around the disk, as shown in Fig. 1.

In Figs. 9, 10, and 11 we have illustrated a modification in the arrangement of the switch-magnets, using the solenoid type, with a single rod V extending from one to the other and serving to connect the armatures of each, and then by means of a pin *p* in this rod V, working in a slot in an arm or link R, rigidly attached to the crank-shaft N, the switch-tongue K will be moved one way or the other, according as the rod V is drawn one way or the other by the coils C. When using a band *q*, as shown in Fig. 1, we find it best not only to attach it to each armature, but also to extend the band to the rear end of the box and pass it around pulleys *s*, so that the band will always be held taut without regard to the magnetization of the coils of the magnets.

We prefer to use the solenoid form of magnets for the purpose of operating the railway-switch, and in order to obtain greater energy, double coils may be used, as illustrated in Figs. 1, 6, and 10.

In Fig. 7, *o* are the trolley-guiding lips of the plate D.

To illustrate the operation of our improved construction first, as shown in Fig. 1, holding the sheet with the conductor A at the top and assuming that the electric current is coming over that conductor from the right, in order to reach the switch-section conductors the current must pass down the conductor *a*, through the coils of the magnets C, and thence up the conductors *a′ a²*. As soon as the car approaches the switch-section the driver pulls upon the cord *h*, thus drawing the arms H into the position shown in Fig. 2, and when the trolley arrives at the plate D the arm H,

bearing upon the guide-rod *d*, will direct the trolley onto the lower or left-hand switch-section conductor. Immediately the current will flow down the conductor *a*, through the coils of the lower magnet C, up the conductor *a'* to B', and thence by the trolley and the conductor connecting it with the motor, through the motor, to earth. The passage of the current through the lower magnet C will magnetize it and cause its core to be drawn in, and thus through its connection with the crank-shaft N will turn that and move the switch-tongue when properly arranged with reference to the slot in the disk *l*, so that the car will be guided upon a shunt-track at the left or downward in relation to the sheet of drawings. If it is desired to continue the car upon the straight or main track, the arms H are allowed to remain against the trolley-bearing, and the trolley will then move straight across the plate D onto the conductor B, and thus, drawing the current through the other magnet C, turn the switch-tongue so as to direct the car upon the main track.

In the arrangement shown in Fig. 6 it is immaterial in which groove of the double trolley T the main conductor runs; but the current or hand-switch G must be placed upon the contact connected with that side of the trolley which bears upon the main conductor. When the trolley arrives at the plate D, its projecting lips *o* will guide the trolley so that each of the switch-section conductors will run in one of the grooves and the driver can turn the railway-switch to the right or left by placing the switch G upon the right or left hand contact *g*. In Fig. 6 the switch G is turned to the left and the current for the motor is drawn through the conductors *a'* B' *f'*, and the switch-tongue is turned so as to direct the car to the left.

In Fig. 9 the operation is the same as in Fig. 1, excepting that the trolley is upon the upper or right-hand switch-section conductor.

We claim—

1. In an electric railway, the combination of a main electric conductor provided with switch-sections insulated from direct connection therewith, connecting-conductors between the main conductor and each of said switch-sections, a railway-switch magnet in the circuit of each connecting conductor, an electric collector supported upon the car to make contact with the said switch-section conductors, and a current-conductor from the said collector to the car-motor, whereby the motor and railway-switch magnet will be automatically placed in series whenever the said collector is upon a switch-section, for the purpose specified.

2. The combination of devices for operating railway-switches electrically, consisting of a pair of switch-section conductors each connected through a magnet of the railway-switch with the main electrical conductor, a trolley or collector supported upon the car and adapted to make contact with either switch-section conductor, as desired, and a current-conductor from the collector to the car-motor, substantially as described.

3. In an electric railway, a main conductor provided with switch-sections insulated from direct connection therewith, a connecting-conductor for each of said sections, which has a railway-switch magnet in circuit, electric collectors supported upon the car to make contact with said switch-section conductors, a current-switch upon the car, connected with the motor-circuit, and a conductor from each of said collectors to a contact of said current-switch, whereby when the collectors are upon a switch-section the motor and a magnet of the railway-switch will be in series and its switch operated when the current-switch is placed upon either of its said contacts, substantially as described.

4. In combination with the main conductor of an electric railway, a pair of switch-section conductors connected therewith through the magnets of the railway-switch, contact-makers supported upon the car for said switch-section conductors, a hand-switch upon the car, connected with the motor-circuit, and current-conductors from said hand-switch to the respective contact-makers, whereby the motor and one of said railway-switch magnets will be placed in series when the contact-maker is upon a switch-section, substantially as described, and for the purpose specified.

5. The combination of devices for operating railway-switches electrically, consisting of a pair of switch-section conductors respectively connected through one of the magnets of the railway-switch with the main conductor, a collector or contact-maker supported upon the car for each switch-section conductor, a guide to direct the contact-makers to the said conductors, a hand-switch upon the car in the motor-circuit, and a connecting-conductor between each collector, and a separate contact of said hand-switch, substantially as described.

6. In an electric railway, the combination, with the main electrical conductor, of a pair of switch-section conductors each electrically connected therewith through a magnet of the railway-switch, a pair of collectors upon the trolley-support, adapted by their contact with the said switch-section conductors to place the motor and one of the railway-switch magnets in a series circuit, a current-switch upon the car, connected with the motor-circuit, and electrical connections between separate contacts of said current-switch and the said collectors, respectively, substantially as described.

7. In an electrically-operated switch for a railway, a pair of electro-magnets arranged beneath the switch to act in opposition to one another and separately connected with a source of electrical supply, a shaft pivoted beneath the switch-tongue, a finger upon said tongue which engages with a slotted lever on said shaft, and connecting devices between

the respective armatures of the magnets and the said pivoted shaft, whereby the attraction of either armature by its magnet will turn the said shaft and move the switch-tongue, substantially as described.

8. In an electrical railway, a pair of switch-operating magnets respectively in separate circuits, connecting the main electrical conductor and a switch-section conductor, a pivoted shaft beneath the switch-tongue, operative connection between the armature of each magnet and said shaft, and a projecting lug upon the switch-tongue to engage with a slotted arm upon said shaft, substantially as described, and for the purpose specified.

9. In combination with an electrically-operated railway-switch, a switch-section electric conductor connected with an electro-magnet of the railway-switch through an independent circuit, which circuit is adapted to be interposed in the main circuit between the motor and the source of electrical supply, substantially as described, and for the purpose specified.

10. In combination with a railway-switch, a pair of electro-magnets connected with the main conductor in parallel circuits and arranged beneath the switch with their cores substantially in a straight line, a connection between the armatures of the respective magnets, a railway-switch-operating shaft, an arm or link rigidly attached to said shaft and flexibly to said armature connection, and switching mechanism upon the car, by which the current from the main conductor may be drawn through either of the electro-magnets, as desired, substantially as described.

11. In combination with a main conductor of an electric railway, a pair of switch-section conductors respectively connected therewith through one of the magnets of the railway-switch, a contact-maker supported upon the car and connected through the motor with the return-circuit, and switching mechanism by which the motor and a magnet of the railway-switch may be connected in series through either of said switch-section conductors, as desired, substantially as described.

CHARLES A. STONE.
EDWIN S. WEBSTER.

Witnesses:
A. J. BURROW,
T. J. CUNNINGHAM.