No. 829,968. PATENTED SEPT. 4, 1906.

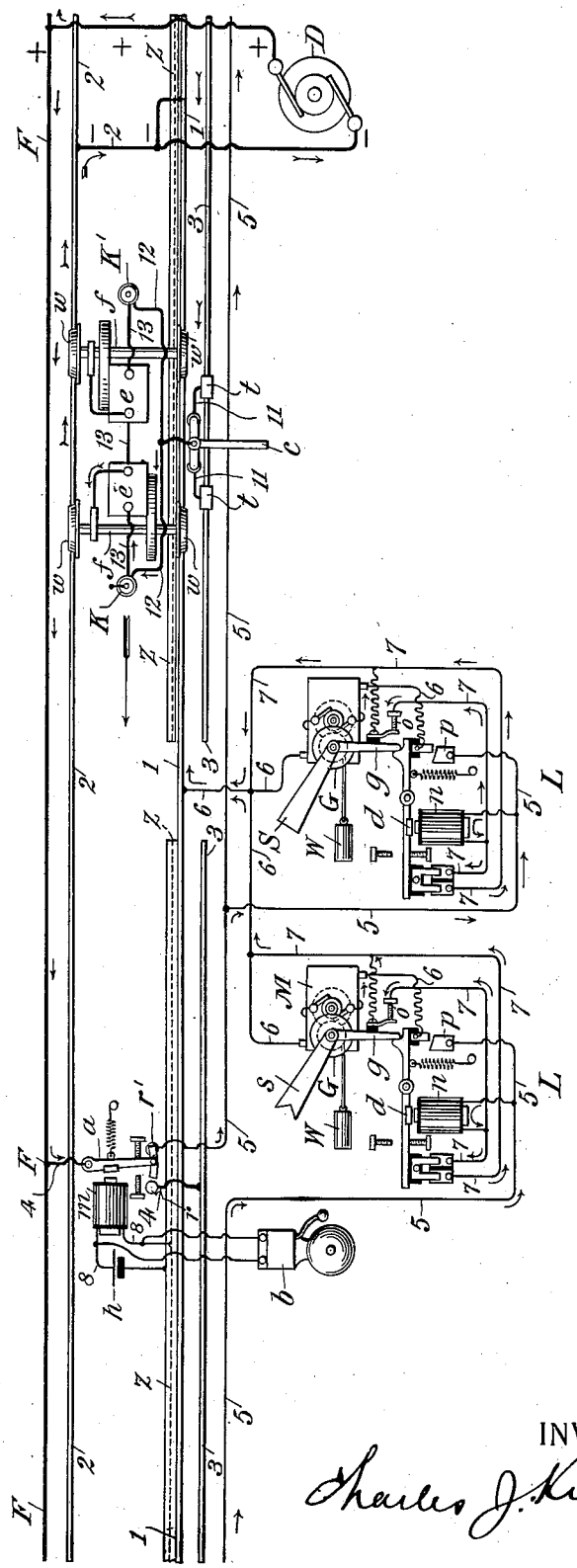
C. J. KINTNER.

RAILWAY SIGNAL AND SAFETY APPLIANCE.

APPLICATION FILED JUNE 6, 1904. RENEWED DEC. 28, 1905.

5 SHEETS—SHEET 1.

Fig. 1.



WITNESSES:

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5 SHEETS—SHEET 2.

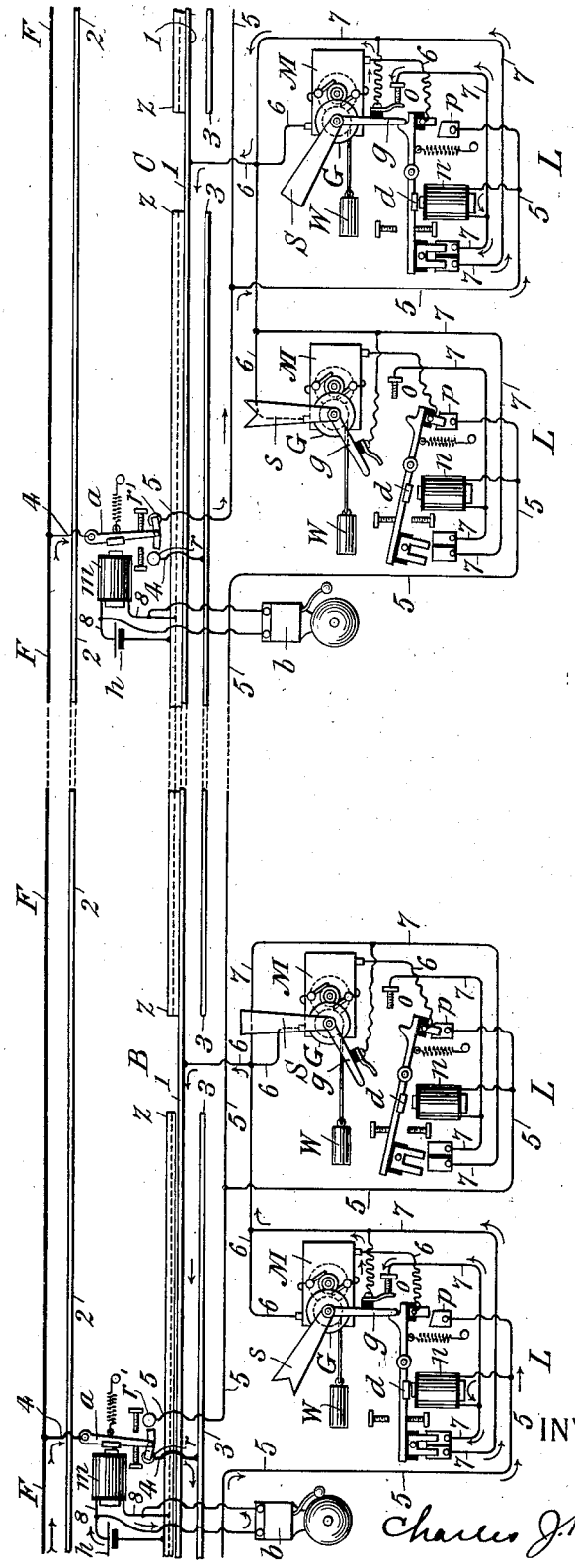

Fig. 2.

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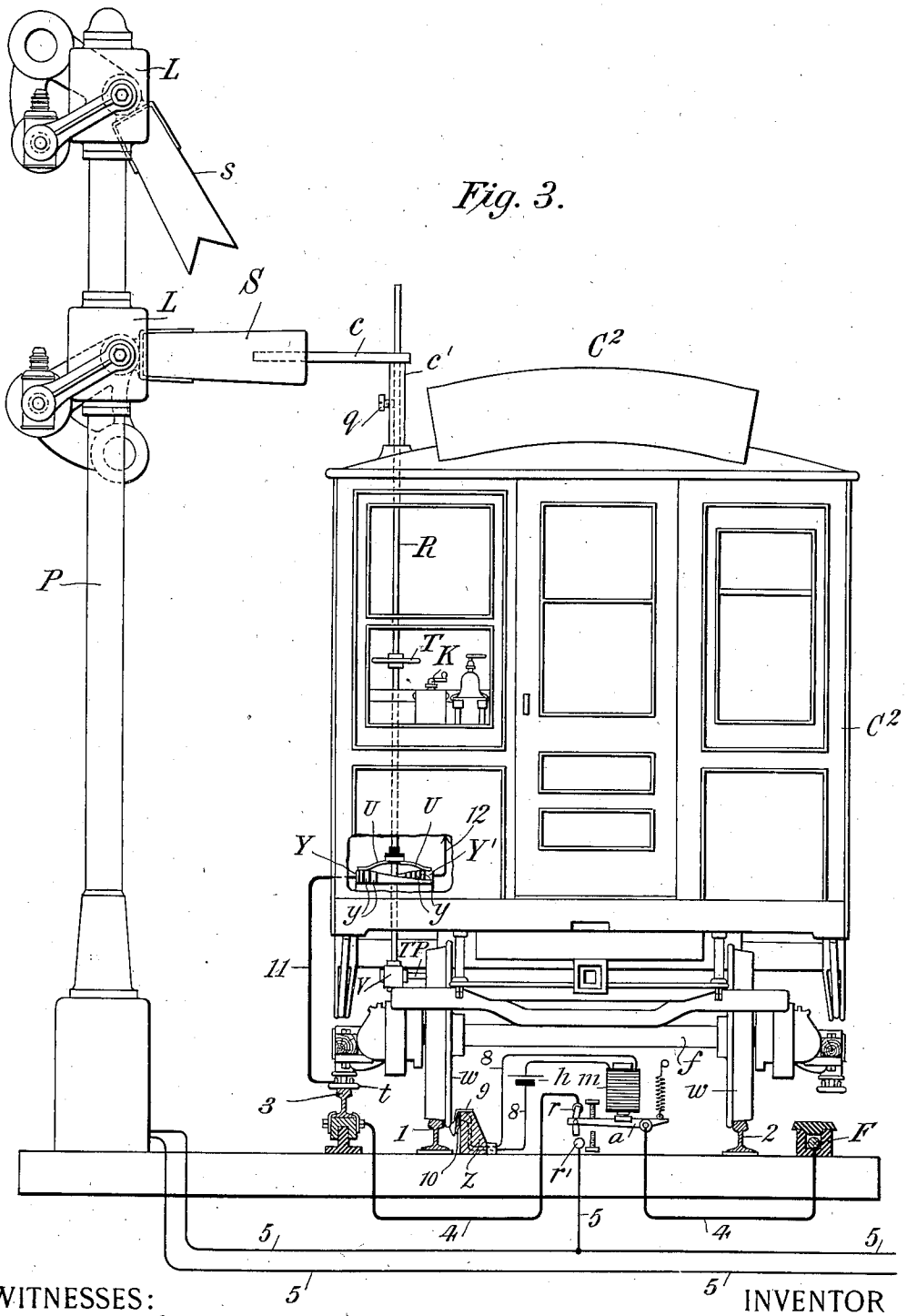
5 SHEETS—SHEET 3.

Fig. 3.



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5 SHEETS—SHEET 4.

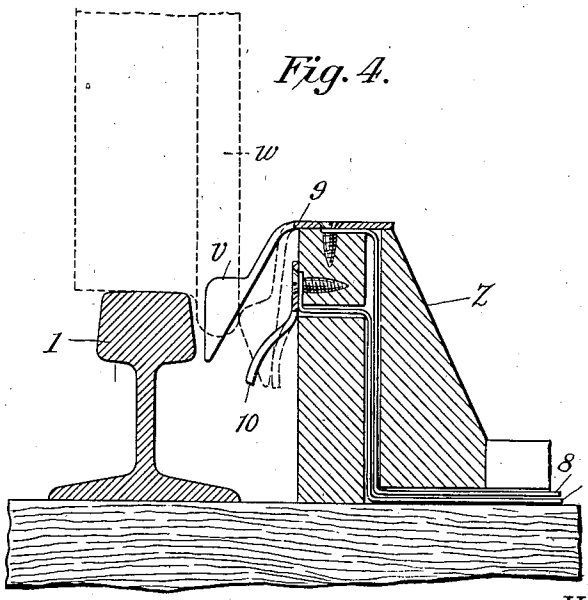

Fig. 4.

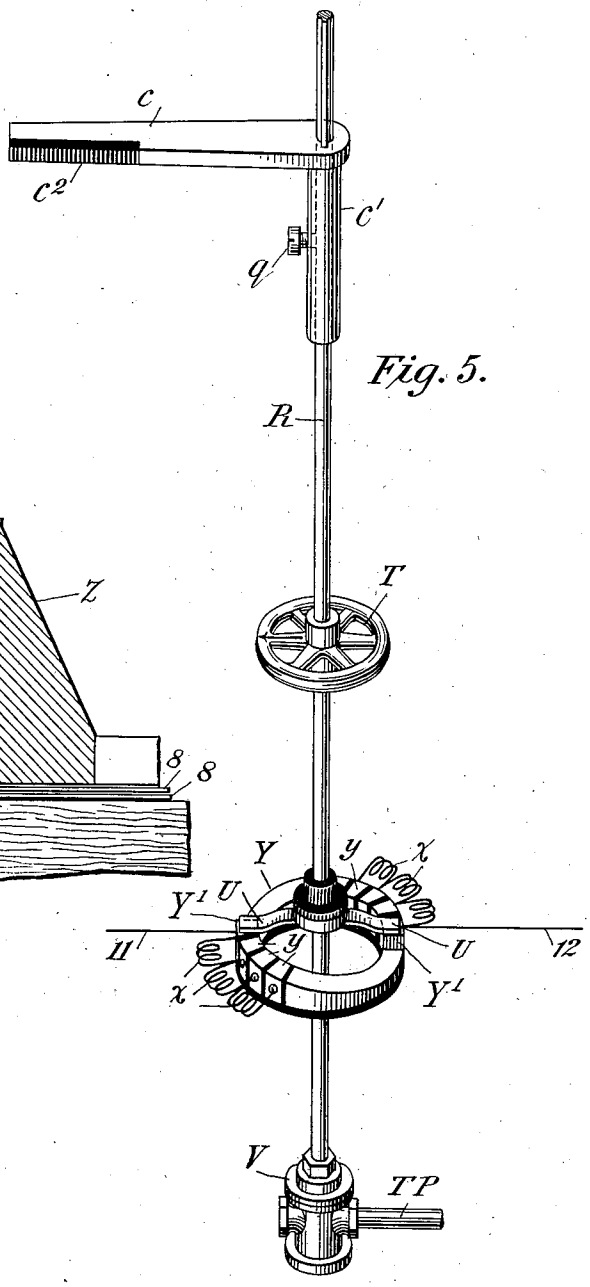

Fig. 5.

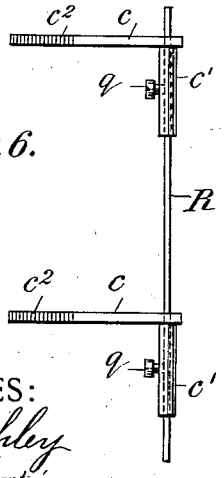

Fig. 6.

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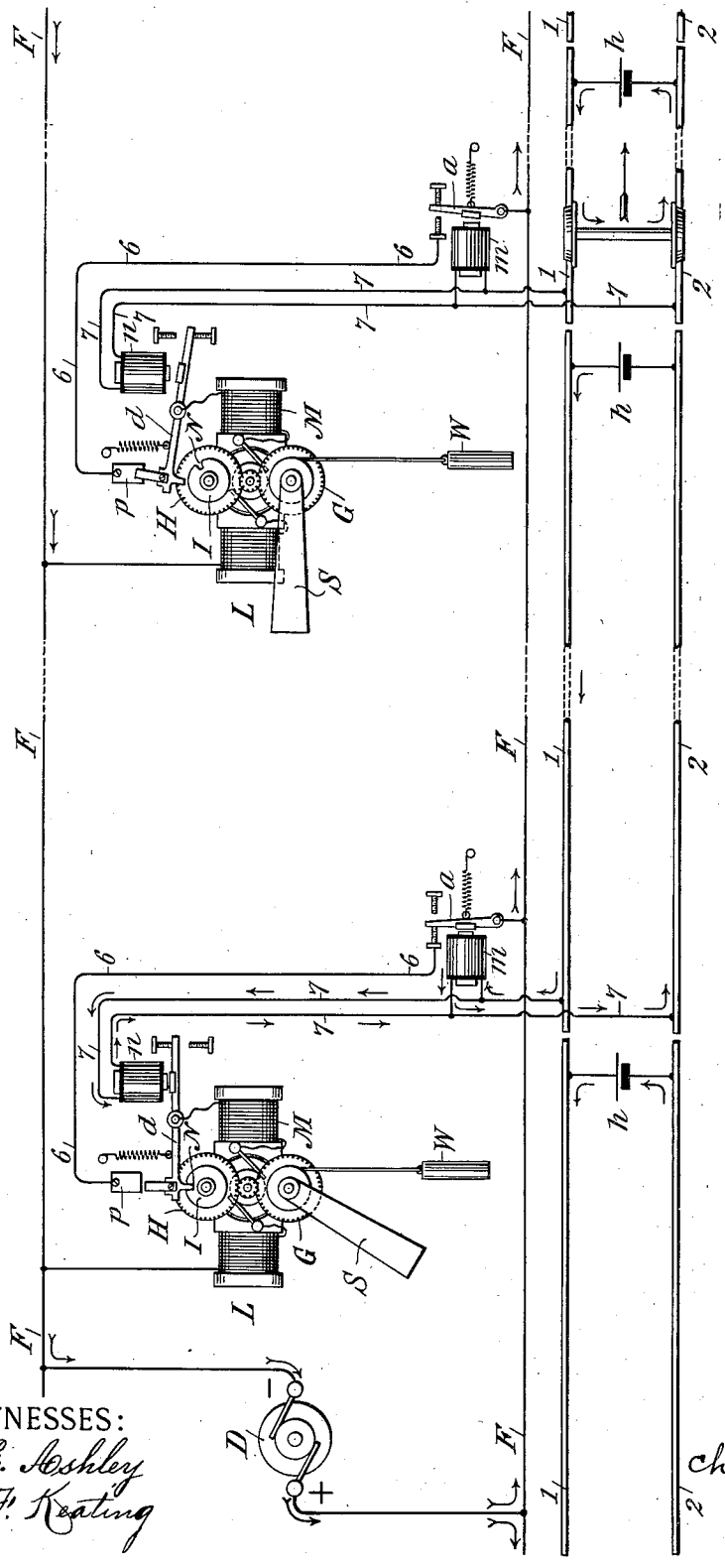
5 SHEETS—SHEET 5.

Fig. 7.



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UNITED STATES PATENT OFFICE.

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RAILWAY SIGNAL AND SAFETY APPLIANCE.

No. 829,968. Specification of Letters Patent. Patented Sept. 4, 1906.

Application filed June 6, 1904. Renewed December 28, 1905. Serial No. 293,552.

To all whom it may concern:

Be it known that I, CHARLES J. KINTNER, a citizen of the United States, residing at New York, borough of Manhattan, county and State of New York, have made a new and useful Invention in Railway Signals and Safety Appliances, of which the following is a specification.

My invention is directed particularly to improvements in railway systems where electric power is used both for the operation of the cars and the signals.

For a full and clear understanding of the invention, such as will enable others skilled in the art to construct and use the same, reference is had to the accompanying drawings, the essential points of novelty being particularly pointed out in the claims at the end of this specification.

Figures 1 and 2 of the drawings are diagrammatic views illustrating my invention complete and a plan view of a car on Fig. 1 traveling from right to left, the drawings being placed end to end with Fig. 1 upon the left. Fig. 3 is an enlarged sectional view taken through the road-bed, illustrating a car in end elevational view and a signal-post and a home and distant signal carried thereby, together with my novel appliance for automatically effecting the stoppage of a car or train when one of the signals, in this instance the danger-signal, is set, the circuit relations being shown in diagrammatic view. Fig. 4 is an enlarged detail sectional view taken through one of the tram-rails and the insulating-stringer which supports the circuit-controlling track conductors or rails of the system, a part of a car-wheel being shown in dotted lines, the closed relation of the controlling track conductors or rails being also illustrated in dotted lines and the open relation thereof in full lines. Fig. 5 is an enlarged perspective view of that part of the safety appliance carried by a car. Fig. 6 is a detail side elevational view of the upper portion of that part of the apparatus illustrated in Fig. 5, illustrating in this instance how the safety appliance may be operated by either a home or distant signal. Fig. 7 is a diagrammatic view illustrating that part of my invention relative to the control or operation of the signals through the agency of rotary electric motors as applied to existing types of steam-railways where both lines of tram-rails are divided into sections insulated at their adjoining ends.

My invention contemplates the utilization of a power-house dynamo having one of its poles connected directly to an insulated current-feeder extending over the route, the other pole thereof being connected to both of the tram-rails in a well-known manner, said tram-rails being bonded together throughout their length as is usual, and the combination of a series of sectional track-controlling conductors or rails parallel therewith, together with semaphores or signals controlled in their operation in one direction by the application of rotary electric motors and in a reverse direction by the application of a constantly-acting force, such as gravity or a spring, the arrangement being such that the signals are held locked at "safety" against the influence of the constantly-acting force and with the source of electrical energy normally disconnected therefrom.

It also comprehends the combination of such a system of signals with sectional third rails, local sources of electrical energy therefor, and switching devices connected in circuit with the sectional track-controlling conductors or rails in such manner that when any sectional third rail is made alive the corresponding signal or signals is or are displayed at "danger" or "caution" through the agency of the constantly-acting force.

It also comprehends the combination of such a system with a safety appliance carried by a car and so devised that when any signal is set either at "caution" or "danger" the car will be automatically stopped and the brakes applied if the motorman fails to stop his car before reaching such signal, the arrangement being such that a motorman is at liberty to pass any signal by operating the safety appliance, but always in such manner that either the car or train will be brought to a dead-stop, or in any event slowed down, owing to the variation or disruption of the current flowing through the motor or motors and the application of the brakes.

My invention contemplates also the application of my novel arrangement of signals controlled by rotary electric motors and a constantly-acting force in opposite directions with any system of railways whether the same be adapted for the use of electric, steam, or any well-known equivalent source of energy as a source of motive power.

Referring now to the drawings in detail, and first to Figs. 1 and 2, said figures being placed end to end, as before stated, with Fig.

1 upon the left, F represents a current-feeder extending over the route and insulated preferably in a conduit, as shown in Fig. 3, said feeder being connected to one pole of a power-house dynamo D, the other pole thereof being connected directly in the usual way to the tram-rails 1 2, the rails being bonded together in a manner well understood.

3 3 3 3 represent sectional third-rails or conductors supported upon insulators carried by the ties in the usual way and *z z z z* represent a series of stringers, preferably of wood treated with insulating material, so as to give them the best insulating effect, said stringers being located closely adjacent to the inner edge of one of the tram-rails, as 1, and wherever curves occur preferably on the inside of the outer rail for the purpose of preventing undue wear upon the same.

4 4 4 are normally open branch feeders connected on one side directly to the current-feeder F and on the other directly to the insulated sectional third rails 3 3 3, *a a a* being switching-armatures constituting the movable parts of switching devices for connecting the current-feeder to the sectional third rails in sequence as a car passes over the route in either direction, said armatures being provided at their free ends with yielding contact-springs adapted to make good sliding contact on the front side with contacts *r r r* and on their rear side with contacts *r' r' r'*, retractile springs being provided for normally holding the switching-armatures on their back contacts.

9 10 9 10 9 10 are pairs of sectional track-controlling conductors or rails secured directly to the insulating-stringers *z z z z*, said conductors or rails being made, preferably, of thin flexible steel, the outer or upper rail being provided with an enlargement or bead *v* and their normal relations to the tram-rail that shown in Fig. 4, so that their free edges are fully out of electrical contact with each other.

m m m are switching-electromagnets and *h h h* are local sources of electrical energy, preferably storage-batteries, said magnets and batteries being included in circuits 8 8 with the corresponding pairs of sectional track-controlling conductors or rails 9 10, as clearly illustrated in Fig. 3.

b b are electromagnetic tap-bells located in multiple-arc relation with the switching-magnets *m m m*, their function being to give audible indication of the fact when any switch is closed and the corresponding sectional third rail connected to the feeder and also of the condition of the battery, it being a well-known fact that as a battery loses its electrical energy a magneto tap-bell in circuit therewith will give a proportionately slow rate of operation.

w w represent the wheels and *f f* the axles of a car, *e e* the usual propelling electric motors geared to the axles thereof, and K K' the controllers on the cars.

12 12 13 13 are the conductors to and from the controllers to the motors and connected to the wheels and axles in the usual manner.

t t represent current-collectors or trolley-shoes located, preferably, between the inner pairs of truck-wheels *w w* and closely adjacent thereto.

11 11 are the conductors running from the current-collectors or trolley-shoes *t t* to the operative parts of the safety appliance illustrated in detail in Figs. 3 and 5, said safety appliance consisting of a vertically-disposed rod R, supported by journal-bearings in the front end of the car and in the cab of the motorman, T being a hand-wheel or manually-operative device closely accessible to the motorman and in close proximity to the controller K.

TP represent the train-pipe, which controls the operation of the brakes, and V the exhaust-valve therefor, said parts being of well-known construction—such, for instance, as is found in the Westinghouse system of air-brakes.

U is a yielding switch-bar connected directly to the rod R with its ends resting upon contact-plates *y y*, the same being insulated from each other and provided with a series of resistances *x x* connected thereto, their function being to cut resistance into the circuit when the safety appliance is rotated in a definite direction. These contact-plates *y y* are arranged with their upper surfaces in two inclined planes, as shown, so that when the switch-bar U is connected directly to the conductors 11 and 12 and all of the resistance cut out the ends of the spring will be under strong stress and such that if the safety appliance be rotated from left to right in the direction of the hands of a watch they will suddenly snap down past the ledges Y' Y', thereby instantaneously interrupting the motor-circuit at two points.

c is an operating-arm attached to a hub *c'*, the upper end of the rod R being provided with a spline and the hub with a corresponding groove for adjusting the arm *c* vertically, *q* being a set-screw for securing it in position.

c^2 is a rubber buffer located at the outer end of the arm *c*, the function of this arm being to automatically operate the safety appliance when a signal is set at "danger" and the motorman fails to observe the same.

Referring now to the means located beside the track for operating the safety appliances carried by the cars, S S S represent semaphore-arms for danger-signals, and *s s s* corresponding semaphore-arms for cautionary signals, the same being located in the usual manner in pairs upon semaphore-posts P. (See Fig. 3.)

M M M M M M are rotary electric motors, preferably of the series-wound type, there

being one of these motors in each of the motor-boxes L L at the top of the semaphore-post P.

W W W W W W are weights secured to cords running over pulleys carried by the shaft which controls the movement of each semaphore, the function of said weights being to move their corresponding signals to "danger" when released. These weights W might be carried directly on an extension of the semaphore-arm, as is the usual practice.

g g g g g g are locking-arms for the semaphores. *n n n n* are locking electromagnets, and *d d d d d d* are locking armature-levers therefor, each of said levers being provided with a locking-lug at its free end adapted to lock the outer or free end of its corresponding locking-arm *g*.

5 5 5 are signal-circuits running to back contacts *p p p* in each motor-box and also to the locking electromagnets *n n n*.

6 6 6 are motor-circuits running from movable contacts carried by the locking armature-levers *d d d* to and through the motors M M and to one of the tram-rails 1.

7 7 7 are shunt-circuits running from stationary operating-contacts around the motor M M M M M M to earth or tram-rail 1, their function being to shunt the motors out of circuit after said motors have restored the signals to "safety" against the influence of the normally acting force of gravity due to the weights W W W.

o o o are stationary contacts adapted to contact with yielding contacts carried by the locking-arms *g g* when the signals are set at "safety."

The rotary armatures of the motors M are geared each through a small pinion directly with a large gear-wheel G, carried by the same shaft which supports the semaphore S or *s* and the locking-arm *g*, and the arrangement is such that when a motor is connected in circuit with the power-house dynamo it rotates the semaphore to "safety" against the influence of the weight W and ultimately locks it in safety position with the motor cut out of circuit and the weight W tending to restore it to "danger" or "caution."

The complete operation is as follows: Suppose a car to be traveling from right to left in the direction of the large-tailed arrow, as shown in Fig. 1. In this position the flanges of the car-wheels *w w* close the circuit to the battery *h* for the section over which said car is at that time moving, thereby causing the switching-armature *a* at the extreme left of Fig. 2 to be drawn into its forward position, so that working current is now flowing from the plus pole of the power-house dynamo D in the direction of the tailed arrows upward and to the right through the feeder F, thence through the branch feeder 4, switching-armature *a*, yielding contact carried thereby, front stationary contact *r*, branch feeder 4, sectional third rail 3 to the left, through the current-collectors or trolley-shoes *t t*, thence by way of conductors 11 11 to the yielding switching-bar U of the safety appliance on board the car, (see Figs. 3 and 5,) through the conductors 12, front controller K, conductors 13, motors *e e*, through the axles *f f*, and both sets of wheels *w w* to the tram-rails 1 2, and thence to the negative pole of the power-house dynamo. It will be noted that in this position of the safety appliance on board the car the operating-arm *c* extends outward into the path of any exposed semaphore S which may be raised to its danger position. As the circuit from the current-feeder F was interrupted at the back contact *r'* when the car entered the section upon which it is now standing, the locking armature-lever *d* of the "danger" semaphore S was released, and for like reason the locking armature-lever *d* of the cautionary signal *s* at the end of the next section to the right was released, so that said signals were turned, the first to "danger" and the second to "caution," by reason of the action of their weights W. This will be apparent on tracing the circuit from the back contact *r'*, Fig. 2, by way of the multiple-branch signal-circuit 5, magnets *n n*, shunt-circuits 7, and ground or return circuit through the tram-rail 1. As soon as the car leaves the section upon which it is now standing in passing from right to left the switching-magnet *m* will be demagnetized by reason of the yielding action of the sectional track-controlling conductors or rails 9 10, it being apparent on inspection of Figs. 3 and 4 that when the flanges of the wheels *w* release the outer or protecting track-controlling conductor or rail 9 it will by reason of its elasticity assume the position shown in full lines in Fig. 4, so that no current will flow from the switching-battery *h* of that section. Consequently circuit is closed to the operating-motor M of the next danger-semaphore S in the rear from the current-feeder F by way of the branch feeder 4, switching-armature *a*, back contact *r'*, signal-circuit 5, stationary contact *p*, movable contact at the right-hand end of the locking-armature-lever *d*, motor-circuit 6 through the motor M, to the tram-rail 1, and thence to the negative pole of the dynamo, as indicated by the tailless arrows. A similar multiple-arc branch circuit is closed through the like circuit connections and conductors through the motor M, which operates the cautionary semaphore *s* at the right of Fig. 2, so that both of these motors are set in operation against the action of their corresponding weights W, thereby rotating the semaphores S and *s* and the corresponding locking-arms *g g* to their safety positions, at which time the movable contacts carried by the locking-arms *g g* are brought into electrical contact with the stationary contacts *o o*, so that a

branch circuit is now closed in each instance through the corresponding locking-magnet *n*, shunt-circuit 7, stationary contact *o*, movable contact carried by the arm *g*, shunt-circuit 7 to the tram-rail 1. An instant before the movable contact in each instance leaves the stationary contact *p* an additional shunt-circuit is closed through a bridging contact at the other end of the locking armature-lever and two stationary contacts, as shown, by way of a branch of the shunt-circuit 7, thus continuing the movement of the armature-lever *d* after the motor-circuit is broken between the corresponding movable contacts and stationary contacts *p* and maintaining the armature in each instance in its forward position, thus locking the signals (safety and cautionary) so long as the current flows from the back contact *r'*. The locking-lugs on the right-hand end of the armature-levers *d* will in each instance come into the path of the corresponding free ends of the locking-arms *g*, so that when the motor-circuits are broken at the stationary contacts *p* the weights W will rotate the signals backward a slight distance until they are locked in the manner shown for both signals at the extreme left-hand side of Fig. 1. It is apparent, therefore, that the working current which operates the semaphores and restores them to "safety" against the influence of a constant source of power, as gravity, attributable to the weights W, will only be required for the brief space of time necessary to effect the rotation referred to, so that by this arrangement such working current is only utilized for a limited time, the resistance of the locking-magnets being such as to necessitate only a small flow of current therethrough. This resistance may be either in the windings or coils of the magnets themselves or the usual resistance in the nature of choke-coils in circuit with the magnets for cutting down the current-flow therethrough, as will be fully understood by those versed in the art. So long as the car stands upon a section, as illustrated in Fig. 1, the corresponding tap-bell *b* for that section will continue to ring, thus giving audible evidence of the presence of the car on that section. The rapidity of movement of the bell-clapper will also give an audible indication of the condition of the battery. The distance between the adjoining ends of the stringers *z z* and the corresponding pairs of sectional track-controlling conductors or rails 9 10 and also of the corresponding sectional third rails 3 3 should preferably be slightly less than the distance between the pairs of truck-wheels *w w* and the corresponding pairs of current-collectors or trolley-shoes *t t* for each car, so that the circuit will be closed for the next succeeding sectional switching-magnet *m* in advance before it is interrupted for the section upon which the car is traveling, no matter in which direction it may be moving, this arrangement making it possible to obtain the best results at crossings of other tracks, at frogs, switches, and sidings, owing to the excellent insulating results which accrue from such a structural system.

Referring now to the safety appliance carried by the car and adapted to be actuated by the semaphores when displayed at "caution" and "danger," it will be apparent that should the motorman fail to observe the position of the semaphore as indicated in Fig. 3 and the car proceed on its way the free end of the arm *c* with its yielding rubber buffer c^2 will ultimately strike the end of the semaphore, which acts as a tripping device, thus causing the rod R to be rotated through a sufficient distance to rupture the circuit between the two ends of the yielding switching-bar U and the corresponding contact-plates *y y* as they snap downward, passing the ledges Y' Y', so as to effectually interrupt the circuit flowing to the motors. The same movement of the rod R will also turn the exhaust-valve V in the train-pipe TP to its full limit, thus suddenly applying the brakes, so that the car or train will be stopped. Where two operating-arms *c* are utilized, one for the danger-semaphore S and the other for the cautionary semaphore *s*, as shown in Fig. 6, the motorman may run by the cautionary signal by taking hold of the hand-wheel T and rotating the same from right to left in the reverse direction of the hands of a watch a sufficient distance so that the outer end of the arm *c* shall effectually clear the outer end of the exposed cautionary semaphore *s*. In the act of doing this, however, it will be apparent that he will cut resistance *x x* successively into circuit sufficient to lower the speed of the train and for like reason will gradually apply the brakes, it being understood that the port or opening in the valve V is such that it will wholly open and wholly close the train-pipe TP twice for each complete revolution in either direction of the rod R. In like manner the motorman may pass the danger-semaphore S if he be so instructed. The hand-wheel T is provided with an index or pointer to indicate the position of the operating-arms *c c*, and the same may be operated in such manner, if desired, as to reverse the position of the yielding switching-bar U, with the operating-arms *c* extending in a reverse direction, so that, if desired, the automatic operation may be dispensed with. The usual controlling apparatus for regulating the admission of air to the brake apparatus and the application of the brakes in the ordinary manner by the motorman is shown at the right of the controller K in Fig. 3 of the drawings, it being understood that the air-valve therefor is in a multiple branch of the train-pipe and that the manual operation of

the same is identically like that found in the Westinghouse or similar systems of air-brakes, my improved safety appliance being both manual and automatic and entirely independent of the motorman's or engineer's usual main air-controlling apparatus for regulating the application of the brakes and of the controller K for regulating the application of the current to the motors. This arrangement of safety appliances makes it possible for motormen to concentrate trains upon one or more sections where the service requires such concentration—in such systems, for instance, as the elevated roads in the cities of New York, Boston, and Chicago, where it is often an absolute necessity that the trains shall be congested. It also prevents any possibility of a motorman passing an exposed signal, either of the cautionary or danger type, without first cutting off the current and simultaneously applying the brakes, provided, of course, the safety appliance has been set in the manner indicated, or, if preferred, it enables any motorman or any number of motormen to run by all danger-signals continuously, the rules and regulations of the management of course governing in such matters.

In Fig. 7 of the drawings I have illustrated how my novel method of controlling the operation of semaphores with rotary electric motors may be effected in connection with existing systems of steam-railways or other railways than those utilizing electric power—such, for instance, as are now in general use. In this figure I have shown the tram-rails 1 2 divided into sections of the desired length and insulated from each other at their adjoining ends, the track-battery *h* in each instance being located at one end of each section and the signal-controlling magnet *m* included normally in circuit therewith at the other end thereof, this arrangement being similar to that now in general use. F represents the current-feeder, as before, and D the dynamo designed to furnish current for the signal-controlling motors M, the armatures of which are geared in each instance to a main gear-wheel G, as before, on the shaft which supports the semaphore, W being the weight for returning the semaphore to "danger." Said armatures are also geared to a train of gear-wheels, one or more, (here represented as H,) on an independent shaft. I is a locking-disk on the same shaft, provided with a locking-notch N for a locking-detent at the outer end of the locking armature-lever *d*, which carries a yielding contact adapted to make contact with the stationary contact *p* in the motor-circuit 6. It will be understood, of course, that the train of gearing H may be continued successively for the purpose of minimizing the amount of "pull" upon that shaft which supports the locking-disk I, so that the retractile spring of the locking armature-lever *d* will under all conditions release the detent and unlock the signal when the locking-magnet *n* is demagnetized.

The operation of this form of the invention is as follows: A pair of wheels and axles representing a car is shown at the extreme right-hand side of the drawings and the local battery *h* of that section is short-circuited. Consequently the signal-controlling magnet *m* is demagnetized, as is also the locking-magnet *n* in the circuit 7 7. Hence the retractile springs of both armatures withdraw the same, so that the detent at the extreme outer end of the locking armature-lever *d* is released from the notch N, thereby allowing the weight W to set the semaphore S at "danger," as shown. When the car left the next section in the rear the semaphore for that section was standing at "danger" and the respective parts of the apparatus in the position shown on the right of the drawings, except that circuit was then closed from the battery *h* through the tram-rails and both of the magnets *m n* in the manner shown by the tailless arrows. Consequently the motor-circuit was closed from the dynamo D by the switching-armature *a*, motor-circuit 6, stationary contact *p*, yielding contact carried by the armature-lever *d*, motor M, to the negative feeder, back to the dynamo D. The tendency of the magnet *n* at that time, however, was to break the circuit between the yielding contact carried at the free end of its armature-lever and the stationary contact *p*; but this could not be effected for the reason that the detent was held against the cylindrical surface of the disk I during the time that the semaphore was being turned to safety position. When it reached this position, however, the detent was forced into the notch N by the action of the magnet *n*, thereby rupturing the motor-circuit 6 between the yielding contact carried by the armature-lever *d* and the stationary contact *p*. Consequently the locking armature-lever *d* and its detent will hold the semaphore at safety position until released in the manner shown at the right of the drawings. At the same time it will be noted that the motor M is cut out of circuit at that point between the yielding contact carried at the free end of the locking armature-lever *d* and the stationary contact *p*.

It is to be noted that with both of the modified forms of the invention, in so far as the same relate to the operation of the signal-controlling motors M, the motor-circuit 6 is provided with means for breaking the same at two independent points, one controlled by the switching-armature *a* and the other by the locking-lever *d*, and that the arrangement of circuits, circuit connections, and

locking devices is such that the motors are always cut out of circuit when the signals are at safety position and are only cut into circuit when a car or train has passed out of the section over which it is for the time being moving and no matter in which direction.

I am aware that it is not broadly new with me to control the operation of rotary electric motors in a reverse direction by an independent source of power, as a weight, and to cut the motor out of circuit with a local source of electrical energy, as a battery, after the signal has been restored to safety position and in such manner that when released it will be set at "danger" by the action of the weight, and I make no claim hereinafter broad enough to include such a combination.

I do not limit my invention to the numerous details of construction and arrangement of circuits illustrated in the accompanying drawings, as many of the same may be materially departed from and still come within the scope of my claims hereinafter made.

By the expression "sectional track-controlling conductors or rails" (illustrated in the drawings by the numerals 9 10) I wish to be understood as meaning, generically, any conductor or rail which is brought into either mechanical or electrical contact with the tram-wheels of the trucks or the flanges thereof and acted upon in such manner as to continuously close the circuit to the switching-magnets *m* through local sources of electrical energy so long as a car or train shall be passing over or standing upon that particular section.

I make no claim, broadly, in the present application to a train-control appliance carried by a car and operatively connected to the source or sources of power which move the car and operate the brakes when combined with an electrically-controlled stop device beside the track and held normally out of action with such train-control appliance, together with means for manually operating said train-control appliance, nor to such a train-control appliance operatively connected with the source of power and the brakes and provided with means for manually operating it when combined with a second manual train-control device, such train-control devices being mechanically disconnected from each other so that each may be manually operated independently, thereby affording two absolutely independent means for manually controlling the movement of a train, which means are accessible to the motorman, as these features are fully disclosed in a copending prior application filed in the United States Patent Office by me on the 14th of April, 1903, Serial No. 152,494, and constitute a part of the invention embodied in said application.

Having thus described my invention, what I claim, and desire to secure by Letters Patent of the United States, is—

1. In a railway system a source of electrical energy connected to current-feeders extending over the route; a series of signals and a series of rotary electric motors having their armatures connected to the signals; in combination with circuits and circuit connections for connecting any motor in a multiple branch circuit with the source of electrical energy a sufficient time to set the signal connected thereto; together with means for automatically disconnecting the same from the source of electrical energy after the signal has been set, substantially as described.

2. In a railway system a source of electrical energy connected to current-feeders extending over the route; a series of signals and a series of rotary electric motors having their armatures connected to the signals; in combination with additional sources of energy adapted to act upon the signals in opposition to the motors; together with circuits, circuit connections, and locking devices whereby any signal may be set in a definite position through the agency of its motor and the latter automatically disconnected from the circuit when the signal is set and locked, substantially as described.

3. In a railway system a source of electrical energy connected to current-feeders extending over the route; a series of rotary electric motors located in multiple circuit with the feeders and a series of signals operatively connected to the armatures of the motors; in combination with additional sources of energy, one for each signal adapted to oppose the application of power from the motors; together with circuits, circuit connections and locking devices or each signal whereby its corresponding motor may be cut out of circuit when the signal has been set and locked and the opposing source of power left in action to display the signal in a different position when released, substantially as described.

4. In a railway system a source of electrical energy connected to current-feeders extending over the route; home and distant signals operatively connected with rotary electric motors; together with circuits and circuit connections whereby the signals may be set and the motors cut out of circuit until said signals are released, substantially as described.

5. In a railway system a source of electrical energy connected to current-feeders extending over the route; home and distant signals operatively connected with rotary electric motors; additional sources of energy, as weights, for opposing the action of the motors; in combination with circuits, circuit connections and locking devices whereby the signals may be set and locked against the influence of the opposing forces and the motors cut out of circuit, substantially as described.

6. In a railway system a source of electrical energy connected to current-feeders extending over the route; a series of home and distant signals operatively connected to rotary electric motors; additional sources of energy, as weights, for opposing the action of the motors; circuits, circuit connections, locking devices and sectional track-controlling conductors or rails all so arranged that normally the signals are held or locked in definite position against the opposing sources of energy with the motors out of circuit, the arrangement being such that the presence of a car upon any section will display a home signal at danger and its companion distant signal at caution, substantially as described.

7. In a railway system a series of home and distant signals; a series of rotary electric motors one for each signal having its armature connected thereto; a common source of electrical energy for furnishing current directly to any or all of said motors; sectional track-controlling conductors or rails for each pair of such signals, and local sources of electrical energy connected to the same; together with local electromagnets connected in circuit therewith; circuits and circuit connections whereby each motor will set its signal to a definite position and be automatically cut out of circuit, substantially as described.

8. In an electric-railway system a current feeder or main operatively connected to a source of electrical energy; a series of sectional third rails or conductors; a series of electromagnetic switching devices included in circuit with sectional track-controlling conductors or rails made operative by the presence of the wheels of a car; a series of signals one for each section operatively connected with electromotive devices, the armatures of the electromagnetic switching devices being connected on one side to the current feeder or main and adapted to be connected at their free ends either to the sectional third rails or to the signal devices, the arrangement being such that when a car is standing upon or passing over any section the corresponding sectional third rail is electrically connected to the current-feeder and the motive device which controls the operation of the companion signal is disconnected therefrom, substantially as described.

9. In an electric-railway system a source of electrical energy having one pole thereof operatively connected to a current feeder or main extending over the route; the other pole thereof being connected to the tram-rails; a series of sectional third rails; a series of sectional track-controlling conductors or rails corresponding thereto; local sources of electrical energy and switching electromagnets included in circuit therewith; the armatures of said switching-magnets being located in normally open branch feeders connected to the current feeder or main, said armatures being adapted to close the circuit on one side to the sectional third rails and on the other to signaling devices operatively connected with electric motors, the arrangement being such that when any sectional third rail is connected to the current-feeder the corresponding signal-circuit is broken and the signal displayed at danger, substantially as described.

10. In a sectional third-rail system of electric railways a source of electrical energy operatively connected to a current-feeder extending over the route; a series of sectional third rails and a series of electromagnetic switching devices; together with sectional track-controlling conductors or rails made operative by the presence of a car upon any section; in combination with home and distant signals for each section controlled by electromotive devices operatively so connected with the switching devices that when any sectional third rail is made alive the corresponding home and distant signals are displayed respectively at danger and caution, substantially as described.

11. In a sectional third-rail system of electric railways a series of switching devices provided with switching-electromagnets and track-circuit connections for operating the same; in combination with a signal for each section controlled by an electromotive device, the armature-levers of the switching-magnets being permanently connected on one side to the current-feeder and having front and back contacts on the other side connected respectively to the sectional third rails and the electromotive devices which control the signals, the arrangement being such that the working current is utilized for displaying the signals at safety when the sectional third rails are dead and that the absence of the working current through the motive or controlling devices of the signals will display the same at danger, substantially as described.

12. In a railway system a current-feeder extending over the route; a series of signals operatively connected to electromotive devices for controlling their movements and included in signaling-circuits normally connected to the current-feeder; in combination with sectional track-controlling conductors or rails; switching-electromagnets and local sources of electrical energy included in circuit therewith, the armature-levers of said switching devices being normally included in the signaling-circuits; together with additional electromagnetic means for interrupting the signaling-circuits in such manner as to cut out the electromotive devices for the signals when the latter are set, substantially as described.

13. An electric-railway system embracing a source of electrical energy; a current feeder or main; a series of sectional third rails or conductors normally disconnected there-

from; a series of sectional track-controlling conductors or rails; electromagnetic switching devices and local sources of electrical energy connected to said sectional track-controlling conductors or rails; in combination with audible electromagnetic signaling devices included in circuit therewith and electromagnetically-controlled visual signals included in signaling-circuits, the switching-armatures of the electromagnetic switching devices being connected on one side to the current-feeder and adapted to be connected at their free ends alternately to the sectional third rails and the signaling-circuits, substantially as described.

14. A safety appliance for an electrically-propelled railway-car provided with a rotary switch capable of assuming two open and two closed positions; in combination with means for automatically rotating it, and additional means for manually rotating it, substantially as described.

15. A safety appliance for an electrically-propelled railway-car provided with a rotary switch capable of assuming two open and two closed positions; a valve connected thereto and located in the train-pipe capable also of assuming two open and two closed positions for a complete revolution; in combination with means for automatically rotating said appliance, and additional means for manually rotating it, substantially as described.

16. A safety appliance for an electrically-propelled railway-car embodying a rotary switch having two contacting arms and a series of contacts connected together by resistance-coils; in combination with an operating-rod operatively connected with a valve for applying the brakes; together with means for automatically rotating said safety appliance, and additional means for manually rotating it, substantially as described.

17. A switch for an electrically-propelled car embracing a series of contacts disposed in inclined planes in circular relation and interconnected with resistance-coils; in combination with a yielding contact-arm adapted to bear on both of said sets of contacts simultaneously; together with means for manually rotating said yielding arm, and additional means operatively connected thereto for applying the brakes, the arrangement being such that when the switch is operated in one direction the current will be abruptly interrupted at two points and the brakes applied, and when operated in the reverse direction the current will be gradually cut down and the brakes similarly applied, substantially as described.

18. A safety appliance for a railway-car embracing a rod journaled in a car and operatively connected to means for applying the brakes; in combination with two operating-arms connected thereto and adapted to come into contact with independent tripping means located beside the track; together with means for manually operating said appliance in either direction, substantially as described.

19. In a railway system a series of semaphore-arms located beside the track and provided with means for automatically displaying them at danger; in combination with a safety appliance carried by a car consisting of a journaled rod operatively connected with means for disconnecting the motive power from the motive device which propels the car; together with means connected thereto for automatically applying the brakes; additional means operatively connected to the rod and adapted to extend into the path of a semaphore when exposed; and further means for manually rotating said safety appliance, the structural arrangement being such that the safety appliance may be placed in either of two positions when the car is moving; namely, in such position that the operating-arm will be in the path of any exposed semaphore, or in a diametrically opposite position so that the exposed semaphore-arm will not actuate it, substantially as described.

20. In a railway system a series of semaphore-posts supporting danger and cautionary semaphore-arms and motive devices which normally hold the same at safety; in combination with means for automatically displaying the same at danger or caution; together with a safety appliance carried by a car and provided with means adapted to be acted upon by either the danger or the cautionary signal, and additional means for manually operating it, said safety appliance being operatively connected to the source of power which controls the movement of the car and the source of power which applies the brakes, and the arrangement such that a motorman may pass any exposed signal by manually operating the appliance, but in so doing he will slow down or stop the train as desired, substantially as described.

21. A track-circuit-controlling conductor yieldingly supported upon a longitudinal stringer closely adjacent to one of the tram-rails and provided with an enlargement or bead adapted to make good contact with the flanges of the tram-wheels, substantially as described.

22. A pair of track-circuit-controlling conductors of yielding material both supported by a longitudinal stringer closely adjacent to one of the tram-rails, the upper of said conductors being provided with an enlargement or bead adapted to make good contact with the flanges of the tram-wheels, substantially as described.

23. In a railway system a series of sets of flexible sectional track-rails sustained by insulating stringers closely adjacent to one of the tram-rails, the distance between the ad-

jacent ends of the sectional track-rails approximating the distance between the inner pairs of truck-wheels on each car, substantially as described.

24. In a railway system pairs of flexible sectional track-rails sustained by insulating stringers, the outer sets of said rails being located closely adjacent to one of the tram-rails and the adjacent ends of said pairs of rails approximating the distance between the inner pairs of truck-wheels on each car, substantially as described.

25. A sectional third-rail system provided with an insulated current feeder or main and a series of sectional third rails normally disconnected therefrom; in combination with sectional track-controlling conductors or rails and sectional supporting-stringers therefor; together with switching-electromagnets and local sources of electrical energy included in circuit with the sectional track-rails and the magnets, and electromagnetic tap-bells included also in circuit therewith, the distance between the adjoining ends of the sectional track-controlling rails and the sectional third rails approximating the distance between the inner pairs of truck-wheels on each car, substantially as described.

26. A safety appliance for an electrically-propelled car embracing a switch combined with means located beside the track for causing it to automatically rupture the power-circuit and additional means for manually causing it to rupture said circuit; together with means controlled by the switch for applying the brakes; the arrangement being such that when actuated automatically in one direction the circuit is suddenly interrupted and the brakes instantly applied, and when actuated manually in reverse direction the current-flow is varied or interrupted and the brakes gradually applied, substantially as described.

27. A safety appliance for an electrically-propelled car embracing a switch rotatable in either of two directions and operatively connected to brake-controlling means, said switch being provided with an operating-arm located outside the car and manual operating means located at a point accessible to the motorman and adapted, when automatically operated, to suddenly stop the car and when manually operated to gradually stop it, substantially as described.

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

CHARLES J. KINTNER.

Witnesses:
M. TURNER,
M. F. KEATING.