No. 826,199.

PATENTED JULY 17, 1906.

A. E. STEVENSON.

SWITCH OPERATING MECHANISM.

APPLICATION FILED OCT. 12, 1905.

4 SHEETS—SHEET 1.

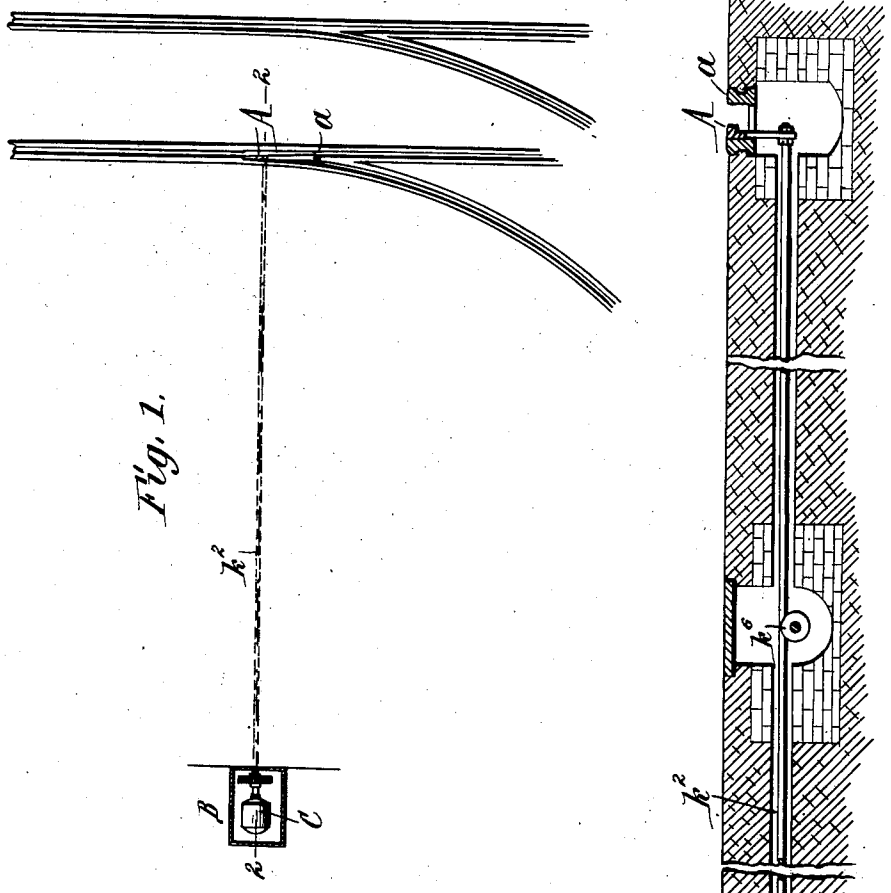

Fig. 1.

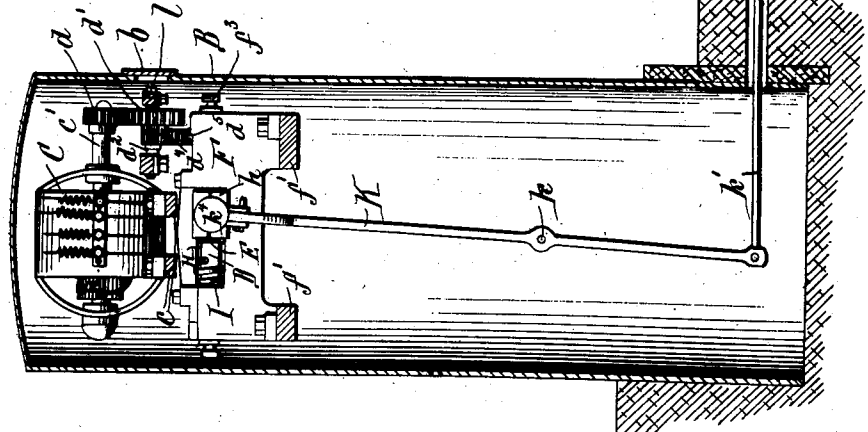

Fig. 2.

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4 SHEETS—SHEET 2.

Fig. 3.

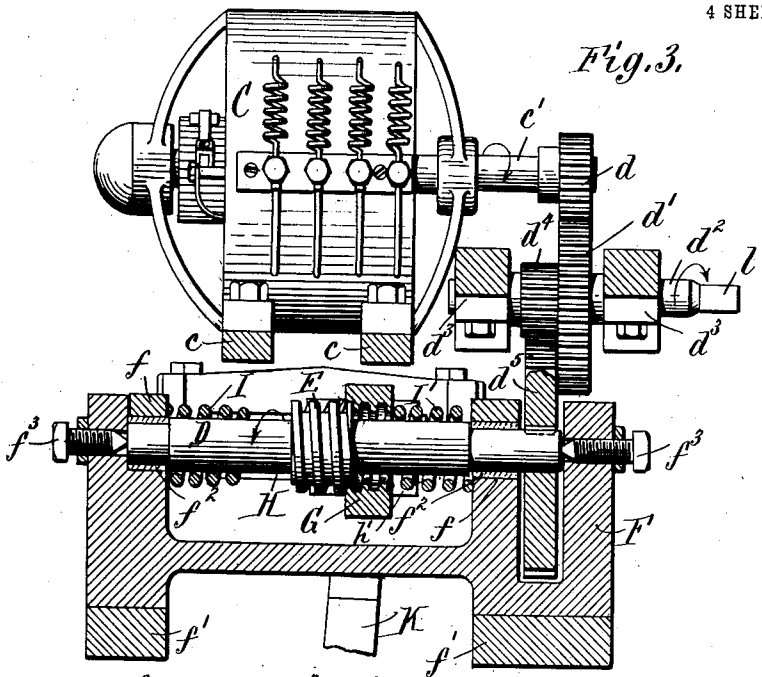


Fig. 4.

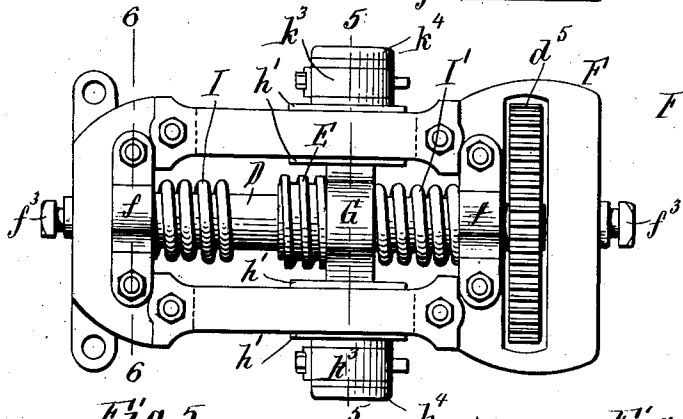


Fig. 5.

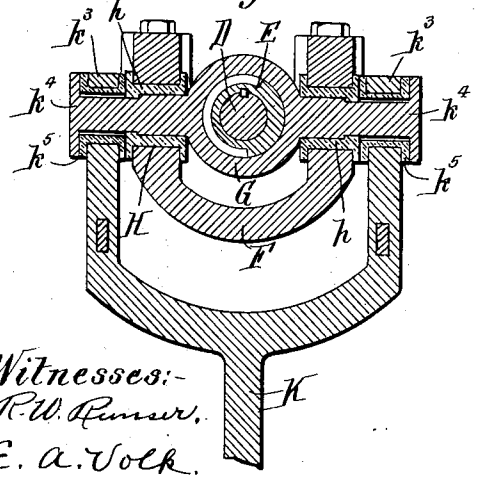
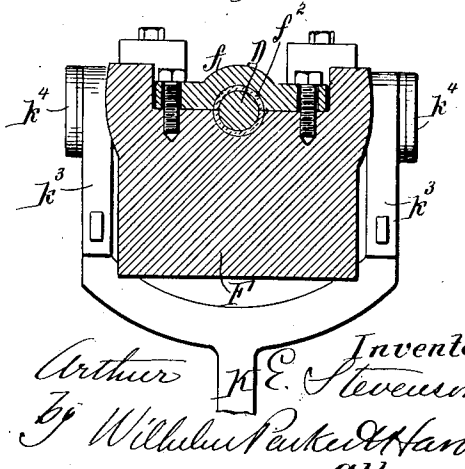


Fig. 6.



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No. 826,199

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4 SHEETS—SHEET 3.

Fig. 7.

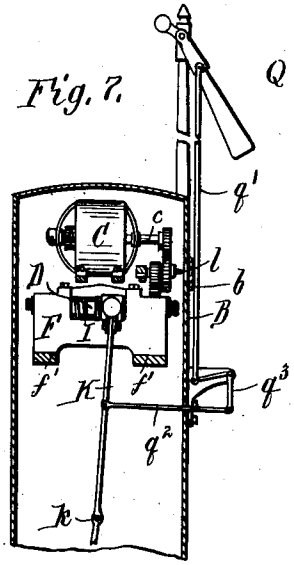
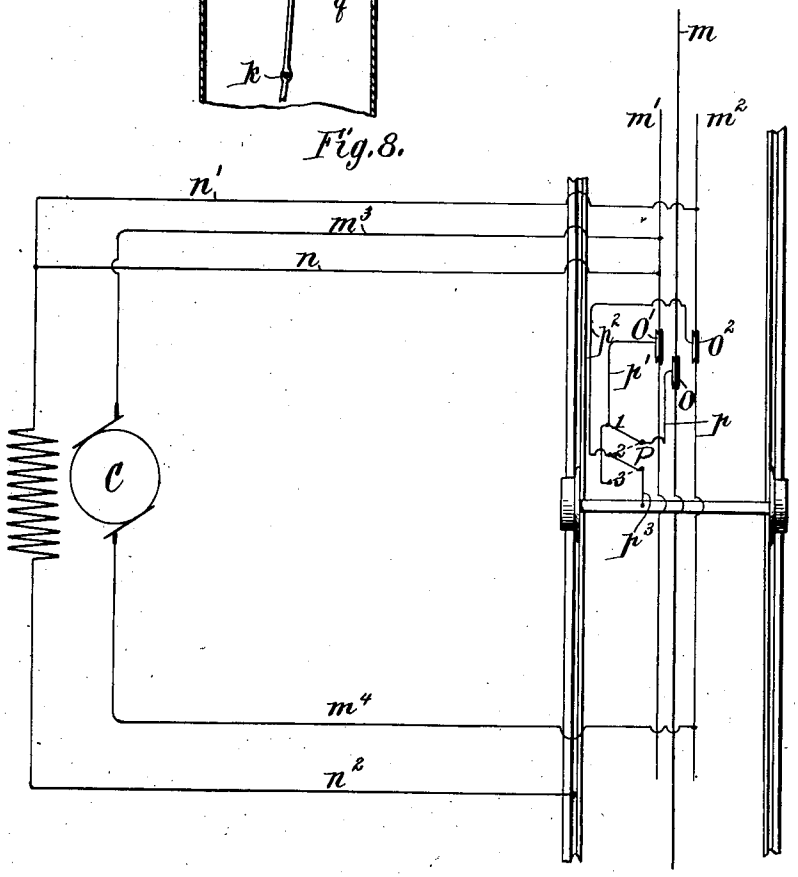


Fig. 8.



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APPLICATION FILED OCT. 12, 1905.

4 SHEETS—SHEET 4.

Fig. 9.

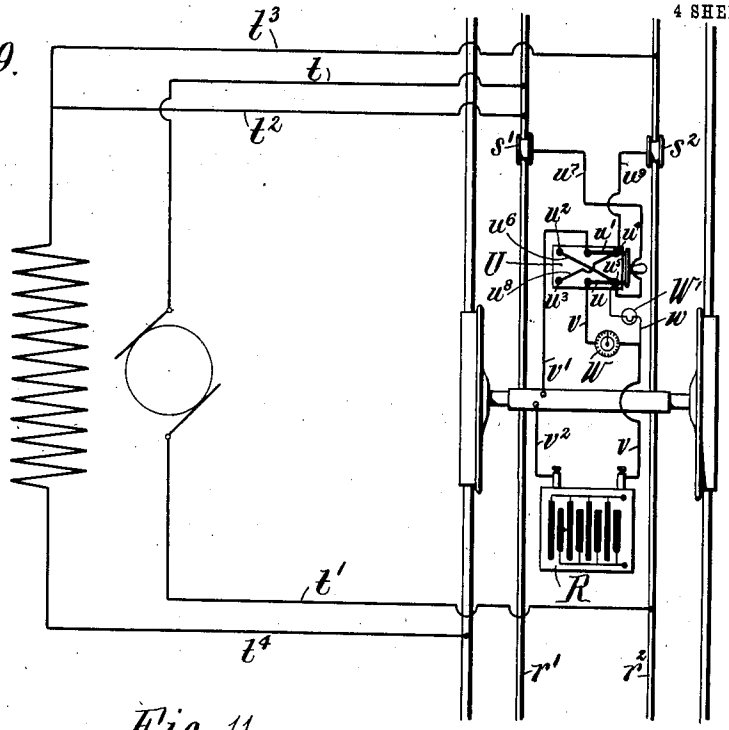


Fig. 11.

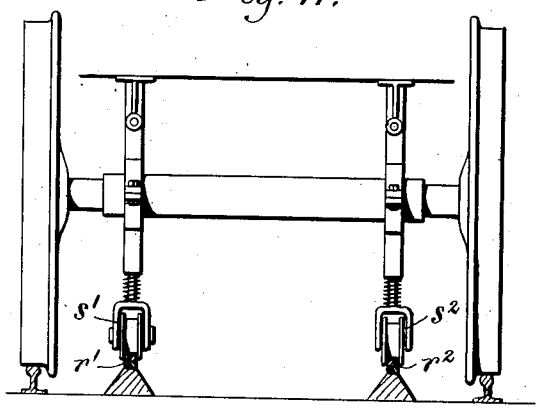


Fig. 10.

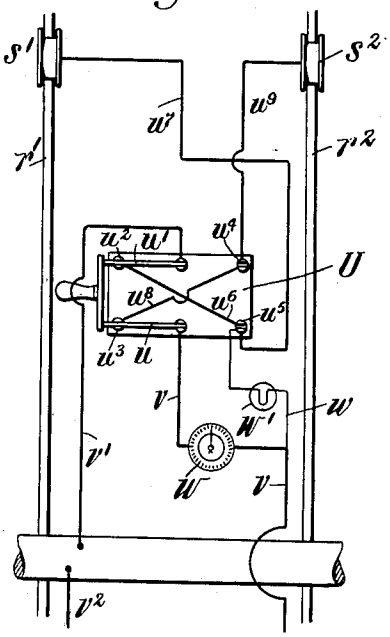
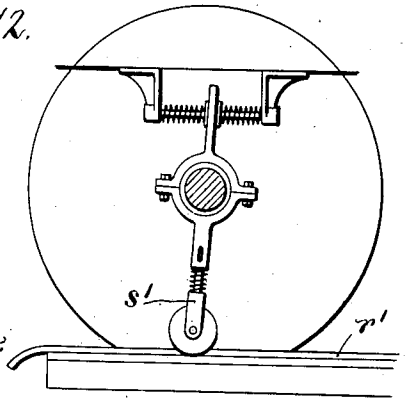


Fig. 12.



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UNITED STATES PATENT OFFICE.

ARTHUR E. STEVENSON, OF BUFFALO, NEW YORK.

SWITCH-OPERATING MECHANISM.

No. 826,199. Specification of Letters Patent. Patented July 17, 1906.

Application filed October 12, 1905. Serial No. 282,442.

To all whom it may concern:

Be it known that I, ARTHUR E. STEVENSON, a citizen of the United States, residing at Buffalo, in the county of Erie and State of New York, have invented a new and useful Improvement in Switch-Operating Mechanisms, of which the following is a specification.

This invention relates to switch mechanisms for railways, and more particularly to switch-operating mechanisms actuated by an electric motor which is controlled by suitable means, whether located on the moving car or engine under the control of the motorman or engineer or elsewhere.

The objects of the invention are to produce an efficient and practical switch-operating mechanism of simple and durable construction which will positively move the switch-tongue in opposite directions and positively lock it in the position to which it is moved; to so construct the mechanism that the switch-actuating device will come to rest when the switch is thrown and locked regardless of the continued movement of the operating-motor, thereby preventing the straining or breaking of any part of the mechanism; to effect a gradual or slow movement of the switch-tongue, so as to avoid injury to the apparatus and prevent the foot of a person or animal from being caught and held by the switch-tongue in the event of the foot being placed accidentally in the switch when the latter is being moved; to prevent the switch from being operated by any but an authorized person, and to improve switch-operating mechanisms in the respects hereinafter specified, and set forth in the claims.

In the accompanying drawings, consisting of four sheets, Figure 1 is a plan view of a portion of a railroad-track provided with a switch and switch-operating mechanism embodying the invention. Fig. 2 is a sectional elevation thereof, on an enlarged scale, in line 2 2, Fig. 1. Fig. 3 is a fragmentary longitudinal sectional elevation, on an enlarged scale, of the switch-operating mechanism, the inclosing casing being omitted. Fig. 4 is a plan view thereof, the motor and part of the drive-gear being omitted. Fig. 5 is a transverse section thereof in line 5 5, Fig. 4. Fig. 6 is a transverse sectional elevation thereof in line 6 6, Fig. 4. Fig. 7 is a sectional elevation of the switch-operating mechanism equipped with a signaling device to indicate the position of the switch. Fig. 8 is a diagram of electrical circuits and contact means for controlling the switch-operating mechanism from a moving car. Fig. 9 is a diagram of electrical circuits for operating the switch-motor from the locomotive on a steam or non-electric railway. Fig. 10 is a fragmentary diagram thereof, showing a different position of the electric switch. Figs. 11 and 12 are respectively a front and side sectional elevation of the contact-rails and devices employed for a non-electric railway.

Like characters of reference refer to like parts in the several figures.

A, Figs. 1 and 2, represents the movable switch tongue or rail of a steam, electric, or other railway switch *a*. The construction of the switch and switch tongue or rail is immaterial, as the switch-operating mechanism to be described is adapted to throw a switch or other analogous movable part in opposite directions and lock it in either position to which it is moved. The switch-operating mechanism is inclosed in a box or casing B of any suitable construction, preferably located above ground at the side of the street or road in the vicinity of the switch, and having a door *b*, provided with a suitable lock to prevent any but an authorized person from gaining access to the switch mechanism.

The switch mechanism, which is inclosed and protected by the casing B, is preferably constructed as follows:

C represents a reversible electric motor of any known or suitable construction for driving the switch mechanism. The motor is mounted in the casing B on cross-supports *c* or in any other desired way and is controlled by electrical circuits of any known or suitable arrangement from the moving cars or engines, from the switch-house, or other point. The armature-shaft *c'* of the motor is connected to and drives a screw-shaft D by speed-reducing gear consisting, for instance, as shown in the drawings, of a pinion *d* on the armature-shaft meshing with a gear-wheel *d'* on a counter-shaft d^2, which is journaled in suitably-supported bearings d^3 in the casing and is provided with a pinion d^4, meshing with a gear-wheel d^5 on the screw-shaft. The screw-shaft D is provided, preferably between its ends, with an enlarged screw-threaded portion E and is journaled at its opposite ends in bearings *f* on the opposite end portions of a frame or casting F, which is supported in the casing B on cross-supports *f'* or

in any other suitable way. The bearings f are preferably provided with bushings f^2 for the reduced journals of the screw-shaft and with end-thrust screws f^3, which are screwed into threaded holes in the ends of the frame F and bear against the ends of the screw-shaft to prevent endwise movement of the screw-shaft.

G represents a nut, block, or cross-head having a hole through which the screw-shaft passes and which is threaded for the engagement of the thread of the screw-shaft. The nut or cross-head is slidably mounted on the frame F to move longitudinally of the screw-shaft, for which purpose the nut or cross-head is preferably provided with opposite side arms resting in guides or ways H, formed at the opposite sides of the frame F. In the construction shown the arms of the cross-head are shouldered and bear in two-part slides or boxes h, having flanges h' embracing the sides of the guides or ways, whereby the boxes and cross-head are held from lateral play in the guides. Surrounding the screw-shaft and bearing at their outer ends against the ends of the frame are coil-springs I I'. When the screw-shaft is rotated in one direction, its thread working in the thread of the nut will cause the nut or cross-head to move in one direction—for instance, toward the right in Figs. 3 and 4—until it engages the spring I' and passes off of the thread of the shaft. The opposite rotation of the screw-shaft will in like manner move the nut or cross-head in the opposite direction, or to the left in Figs. 3 and 4, until it engages the other spring I and passes off of the shaft-thread. The springs are of such length as to be compressed somewhat by the nut or cross-head in moving off of the shaft-thread and to press the nut or cross-head against the shaft-thread so as to cause the proper engagement of the threads of the shaft and nut or cross-head when the shaft is turned in the proper direction.

The nut or cross-head G is connected by some suitable means to the switch tongue or rail and throws the same to one side or the other, according to the direction of movement of the screw-shaft and cross-head. These means preferably consist of a lever K, fulcrumed at k in the casing B and connected at its upper end with the nut or cross-head and at its lower end with the switch tongue or rail by a rod k', preferably passing through an underground conduit or pipe k^2. The upper end of the lever K is preferably forked and the fork-arms are attached by straps k^3 to headed studs or wrist-pins k^4, projecting from the outer ends of the arms of the nut or cross-head, suitable bushings k^5 being sleeved on the wrist-pins. The switch-rod k' is supported between its ends on a grooved antifriction-wheel k^6, journaled in a suitable pit in the street or road.

The operation of the switch mechanism is as follows: Assuming the switch-tongue A to be in the closed position shown in Figs. 1 and 2, giving a straight track, and it is desired to open the switch-track, the motor is caused by the proper operation of its controlling means to rotate in a right-hand direction, thereby driving the screw-shaft in the same direction. In this position of the switch-tongue the nut or cross-head G will be at the right-hand side of the thread of the screw-shaft, being pressed against said thread by the spring I'. In the rotation of the screw-shaft to the right its thread will enter the thread of the nut or cross-head and cause the latter to move to the left, thereby swinging the lever K and throwing the switch-rod and switch-tongue over to open position. The switch-tongue is left in the open position until the motor is caused to rotate in the opposite direction and produce the opposite movement of the nut or cross-head, lever, and switch-tongue. The length of the thread of the screw-shaft is just sufficient to give the switch-tongue the proper throw, and as soon as the switch-tongue reaches the limit of its movement in either direction the nut or cross-head will pass off of the thread of the screw-shaft and come to rest against one of the springs I I'. The continued operation of the motor cannot cause a further movement of the nut or cross-head, and there is therefore no undue strain on the parts of the mechanism. The springs serve to cushion the movements of the nut or cross-head and prevent shock to the apparatus which would result from a sudden positive stopping of the nut or cross-head. The thread of the screw-shaft constitutes a positive stop to the movement of the switch-lever and the switch-tongue connected thereto, and the switch tongue or lever cannot be moved except by the rotation of the screw-shaft, and as this, with the other parts of the operating mechanism, are inclosed in the lock-box the switch cannot be thrown except by the operation of the motor-controlling device or by gaining access to the casing and turning the screw-shaft.

To enable the switch to be operated manually when for any reason this is necessary, the end portion l of the counter-shaft d^2 is preferably suitably shaped for the engagement of a special tool or handle, which may be the motorman's controller-lever, by which said shaft can be turned, thereby turning the screw-shaft and operating the switch. The switch cannot, however, be thus operated by hand by any one except an authorized person provided with a proper key to open the casing.

In the switch mechanism hereinbefore described the screw-shaft is rotated and the nut held from rotation and reciprocated by the shaft. A manifest reversal of this arrange-

ment would be to reciprocate a non-rotary screw-shaft by rotating a nut thereon which is held from axial movement. Such an arrangement being a mere reversal of that shown in the drawings, it is not believed necessary to illustrate the same by drawings. While coil-springs I I′ are shown for pressing the nut or cross-head against the thread of the screw-shaft to cause the thread to enter the nut when turned in the proper direction, the invention is not limited to the use of such springs, but any other suitable sort of pressure device or devices could be employed in place thereof.

The electric motor C can be controlled by suitable means of known construction for causing it to rotate at will in one or the other direction, accordingly as it is desired to open or close the switch, and such controlling means can be located at a fixed point, such as in a switch-tower or on the cars or engines under the control of the motorman or engineer.

Fig. 8 illustrates diagrammatically one arrangement of circuits for operating the motor from a moving car of an electric trolley railroad. In said figure, m represents the trolley-wire or conductor for the current which operates the cars, and m' m^2 two conductors arranged parallel with the trolley-wire and insulated therefrom and from each other. The insulated conductors m' m^2, which are normally dead, are connected by conductors m^3 m^4 with the armature-circuit of the motor C. The field of the motor is connected across the car-operating circuit by conductors n n' n^2, leading to the conductors m' m^2 and to one of the track-rails.

O O′ O² represent three trolley-wheels or contact devices carried by the car and adapted to contact, respectively, with the trolley-wire m and parallel conductors m' m^2. The contact-wheels are insulated from each other. P represents an electrical switch having three contact-points 1, 2, and 3 and two insulated switch-arms. The contact-points 1 and 2 are connected by conductors p' p^2 to the contact-wheels O′ O², respectively, and the points 1 and 3 are connected to each other. One switch-arm is connected by a conductor p to the trolley-wheel O, and the other arm is connected by conductor p^3 to the car-wheels and through these to the track-rails. When the arms of the switch are not in engagement with the contact-points thereof, no current can pass through the motor in either direction and the motor will remain at rest, leaving the switch-tongue undisturbed. If the switch-arms are moved against the contact-points 1 and 2, as indicated in Fig. 8, the current will flow from the trolley-wire m through the trolley O, conductor p, switch-arm, contact-point 1, conductor p', trolley O′, conductors m' m^3, motor-armature, conductors m^4 m^2, trolley O², conductor p^2, switch-post 2, other switch-arm, conductor p^3, and wheels to the track, thus completing the circuit through the motor-armature in one direction and causing the motor to run in one direction. The current is caused to pass through the motor-armature in the opposite direction by moving the arms of the electric switch P against the other contact-points 2 and 3, in which case the current will flow from the trolley-wire m through the trolley O, conductor p, one switch-arm, contact-point 2, conductor p^2, trolley O², conductors m^2 m^4, motor-armature, conductors m^3 m', trolley O′, conductor p', switch-post 3, other switch-arm, conductor p^3, and the car-wheels to the track. The current will flow through the motor-field by conductors n n^2 in one position of the switch and by conductors n' n^2 in the other direction of the switch, thus always passing through the field in the same direction in both positions of the switch.

Any other known or suitable electrical connections whereby the motor can be controlled and caused to rotate in opposite directions from the car could be used, the above-mentioned connections being only described to indicate one way of operating the motor. The electrical switch can be set at any time, either before or upon reaching the parallel conductors m' m^2, for the desired movement of the switch-tongue, and the motor can be stopped or reversed at any time while the trolley-wheels are in contact with the conductors m' m^2 by the proper operation of the electrical switch P. The conductors m' m^2 extend a sufficient distance from the track-switch for the switch to be thrown in ample time, regardless of the speed of the car. If the electrical switch is set either for a clear track or to open the switch-track and the switch-tongue has already been thrown to the desired position, the operation of the motor will have no effect, as the rotation of the screw-shaft by the motor cannot move the nut and switch-lever on account of the thread of the screw-shaft not turning in the required direction.

The switch-motor can be operated from the moving locomotive on steam or other non-electric railroads by the means illustrated in Figs. 9 to 12. In said figures, R represents a battery or other source of electric current carried on the locomotive or train, and r' r^2 represent conductor-rails extending parallel with the track and suitably supported above the railroad-ties and insulated therefrom. s' s^2 are contact-arms depending from the locomotive-axle or other suitable support, from which they are insulated and carrying at their lower ends spring-pressed wheels or shoes adapted to contact with the rails r' r^2. The wheels are normally retained at such height as to clear the ties, cross and switch rails, and the like, and the ends of the conductor-rails r' r^2 are inclined downwardly,

so that the wheels will engage the same and ride up on the rails. t t' are wires connecting the motor-armature with the rails r' r^2, and t^2 t^3 t^4 are wires connecting the motor-field with the conductor and track rails. U is an electric switch having two contact-arms u u' insulated from each other and four insulated contact-posts u^2 u^3 u^4 u^5, with which the arms of the switch are adapted to contact. The switch-posts u^2 and u^5 are connected to each other by a wire u^6 and to the contact-arm s' by a wire u^7, and the switch-posts u^3 and u^4 are connected together by a wire u^8 and to the contact-arm s^2 by a wire u^9. The pivot for the switch-arm u is connected to one terminal of the battery by a wire v, and the pivot for the other switch-arm is connected by a wire v' to the locomotive-axle, which in turn is connected to the other terminal of the battery by a wire v^2.

When the wheels of the contact-arms are in contact with the conductor-rails and the switch U is in the position shown in Fig. 9, the current will flow from the battery through wire v, switch-arm u, post u^5, wire u^7, contact-wheel s', rail r', part passing through the motor-field by wires t^2 t^4, track-rail, locomotive wheel and axle, and wire v^2 to the battery. Current will also flow from the contact-rail r' through wire t, motor-armature, wire t', rail r^2, contact s^2, wire u^9, switch-post u^4, switch-arm u', wire v', axle and wire v^2 to the battery. The motor will then turn in the proper direction to move the track-switch one way. When it is desired to move the track-switch in the opposite direction, the electric switch U is moved to the position shown in Fig. 10, when the current will flow from the battery through wire v, switch-arm u, post u^3, wire u^8, post u^4, wire u^9, contact s^2, to contact-rail r^2, where it will divide, part going by wire t^3 through the motor-field by the same path and in the same direction as before. The other part of the current will pass from the contact-rail r^2 through wire t', motor-armature, wire t, rail r', contact s', wire u^7, switch-post u^5, wire u^6, post u^2, switch-arm u', wire v', locomotive-axle, and wire v^2 to the battery, thus passing through the motor-armature in the opposite direction and causing the opposite rotation of the armature and movement of the track-switch.

W represents an ammeter connected in the conductor v between the battery and the electrical switch U. The current passes through this conductor v in either position of the switch, and when the locomotive reaches the conductor-rails r' r^2 the engineer can tell by the position of the ammeter-index whether the switch-motor is operating or not, thus being notified in time to stop his train in the event that the motor fails to operate. To notify the engineer when he is approaching the switch and direct his attention to the ammeter, an electric lamp W′ is provided in proximity to the ammeter. This lamp is connected in a shunt w between the wires v and u^7 and will always light up as soon as the contacts s' s^2 engage the contact-rails r' r^2, regardless of the position of the electric switch U. A signal is thus given to the engineer in his cab that he is approaching a switch, and the ammeter is illuminated, so that he can readily ascertain whether or not the switch-motor is working.

It is not necessary to describe the means for controlling the switch-operating motor from a fixed point. Any known or suitable connections for this purpose can be employed.

A semaphore or other signal can be connected to and operated by the switch-lever K for indicating to the motorman or engineer the position of the switch-tongue. Fig. 7 shows a semaphore Q connected to the switch-lever by rods q' q^2 and an interposed bell-crank lever q^3. By this arrangement movement of the switch-lever to open the switch will raise the semaphore, while the opposite movement of the switch-lever will lower the semaphore. Any other suitable operating connections could be employed. The semaphore is preferably counterweighted, whereby its tendency to rise acts to push the switch-lever in a direction to press the nut G against the thread of the screw-shaft, so that the thread will enter the nut upon the rotation of the shaft in the proper direction. Thus a proper arrangement of semaphores or other weighted devices would serve the purpose of the springs I I′ for pressing the nut against the thread of the screw-shaft.

I claim as my invention—

1. The combination of a screw and a nut having a screw-threaded engagement, electrically-controlled means for rotating one of said parts to cause axial movement of the other part, and a switch member or the like connected to and operated by said axially-movable part, substantially as set forth.

2. The combination of a screw and a nut having a screw-threaded engagement, one of said parts being movable axially into and out of threaded engagement with the other part, means for pressing one part toward the thread of the other part, means for rotating one of said parts to cause the axial movement of the other part, and a switch member or the like connected to and operated by said axially-movable part, substantially as set forth.

3. The combination of a screw-shaft having a threaded portion and an unthreaded portion, a nut having a thread for engagement with the thread of said shaft and movable axially into and out of engagement with the thread of said shaft, means for pressing said nut axially against the thread of said shaft, means for rotating said shaft, and a switch member or the like connected to and operated by said nut, substantially as set forth.

4. The combination of a screw-shaft having a threaded portion and unthreaded portions at opposite sides of said threaded portion, a nut having a thread for engagement with the thread of said screw-shaft and movable axially into and out of engagement with the thread of said screw-shaft, yielding means for arresting the movement of said nut and pressing the same against the thread of said screw-shaft, means for rotating said screw-shaft, and a switch member or the like connected to and operated by said nut, substantially as set forth.

5. The combination of a screw and a nut having a screw-threaded engagement, one of said parts being movable axially into and out of threaded engagement with the other part, means for pressing one part toward the thread of the other part, a reversible electrical motor for rotating one of said parts in opposite directions to cause the axial movement of the other part, and a switch member or the like connected to and operated by said axially-movable part, substantially as set forth.

6. The combination of a screw-shaft having a threaded portion and unthreaded portions at opposite sides of said threaded portion, a nut having a thread for engagement with the thread of said screw-shaft and movable axially into and out of engagement with the thread of said screw-shaft, coil-springs surrounding said screw-shaft at opposite sides of its threaded portion for arresting the movement of said nut and pressing the same against the thread of said screw-shaft, means for rotating said screw-shaft, and a switch member or the like connected to and operated by said nut, substantially as set forth.

7. The combination of a screw-shaft having a threaded portion and unthreaded portions at opposite sides of said threaded portion, a nut having a thread for engagement with the thread of said screw-shaft and movable axially into and out of engagement with the thread of said screw-shaft, yielding means for arresting the movement of said nut and pressing the same against the thread of said screw-shaft, means for rotating said screw-shaft, a switch-lever connected to said nut, a switch member, and a rod connecting said switch-lever and switch member, substantially as set forth.

8. The combination of a screw and a nut having a screw-threaded engagement, an electric motor for rotating one of said parts to cause axial movement of the other part, means for controlling said motor from a moving car or engine, and a switch member or the like connected to and operated by said axially-movable part, substantially as set forth.

9. The combination of a screw and a nut having a screw-threaded engagement, a reversible electric motor for rotating one of said parts to cause axial movement of the other part, electrical controlling means on a moving car or engine and connections for driving said motor in opposite directions, and a switch member or the like connected to and operated by said axially-movable part, substantially as set forth.

10. The combination of a track-switch, an electric motor for operating the same, electrical means for controlling said motor from a moving car or engine, and an indicator on the car or engine electrically connected with said motor-controlling means and constructed to indicate a variation of resistance in the motor-circuit, whereby the engineer is informed whether or not the motor is in operation, substantially as set forth.

11. The combination of a track-switch, an electric motor for operating the same, electrical means for controlling said motor from a moving car or engine, and an indicator on the car or engine electrically connected with said motor-controlling means and constructed to indicate a variation of resistance in the motor-circuit, and an electric lamp on the car or engine also connected with said controlling means, whereby the engineer is informed whether or not the motor is in operation, and also has his attention drawn to the indicator, substantially as set forth.

Witness my hand this 7th day of October, 1905.

ARTHUR E. STEVENSON.

Witnesses:

EDWARD C. HARD,

CHARLES W. PARKER.