Nov. 5, 1957 N. C. L. BROWN 2,812,426

SWITCH MACHINE

Original Filed Dec. 24, 1949 5 Sheets-Sheet 1

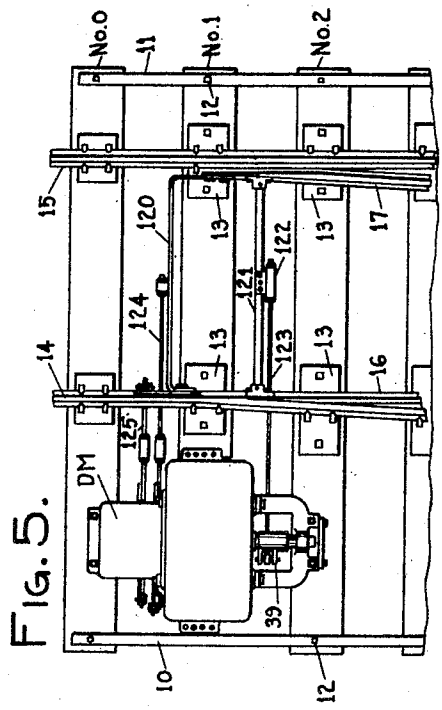



FIG. 5.

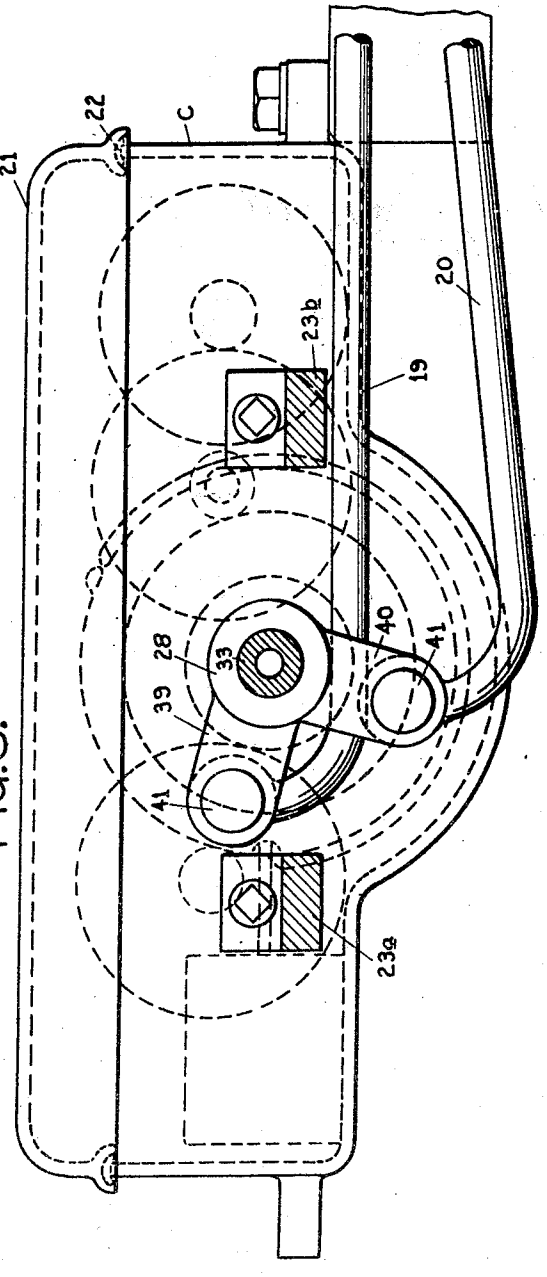



FIG. 3.

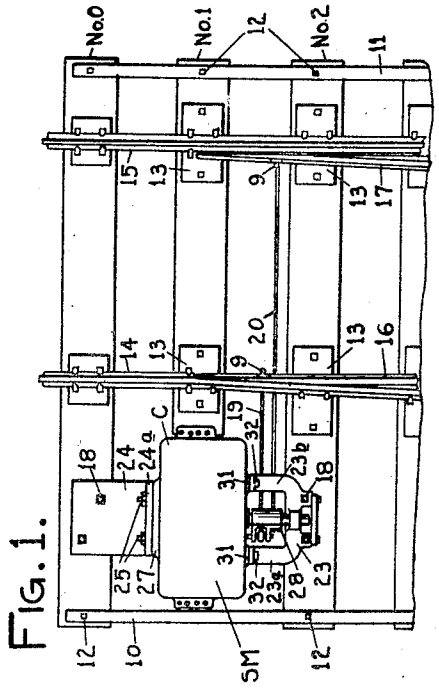



FIG. 1.

Inventor
N. C. L. Brown,
By Neil M. Preston,
his Attorney

Nov. 5, 1957 N. C. L. BROWN 2,812,426

SWITCH MACHINE

Original Filed Dec. 24, 1949 5 Sheets-Sheet 2

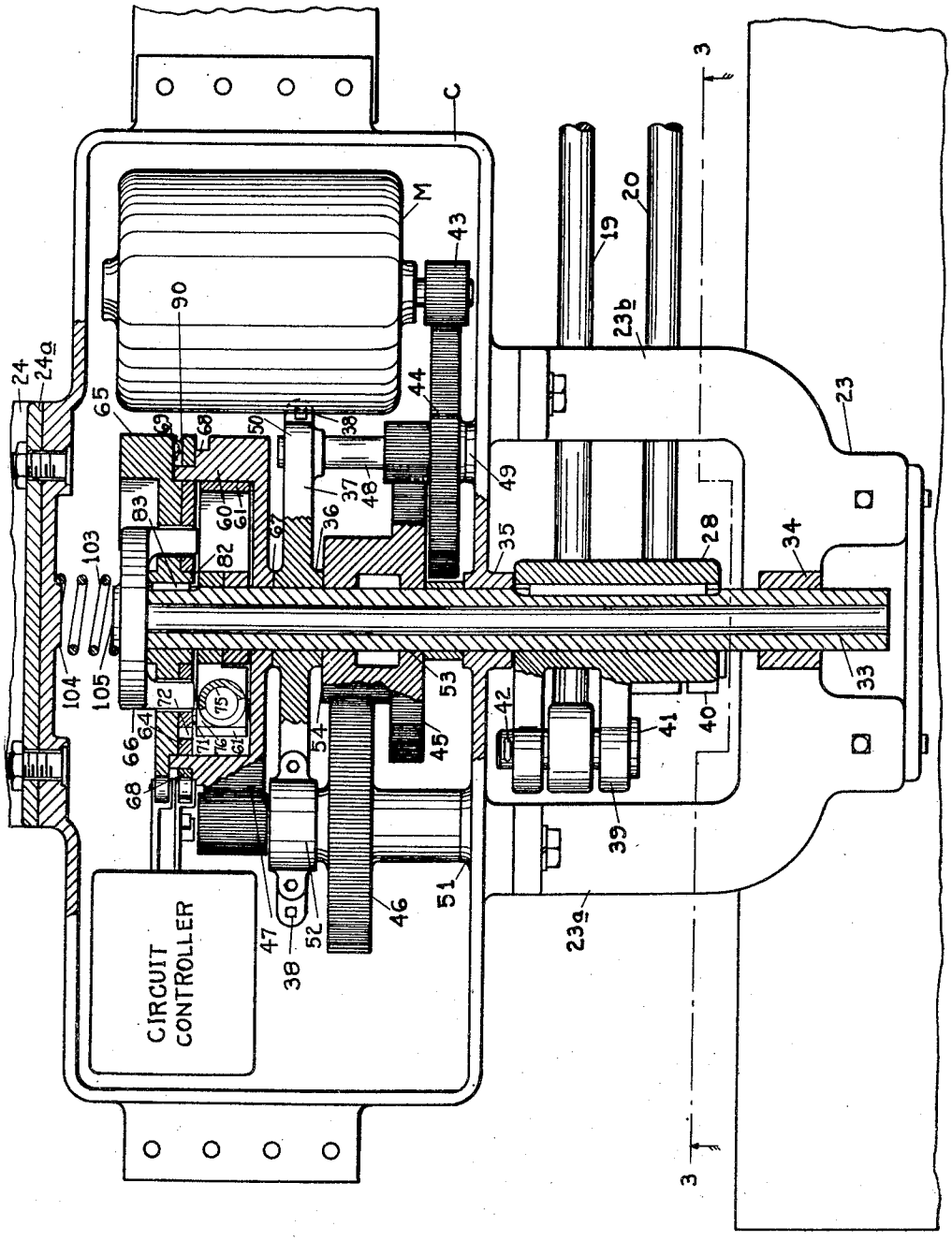


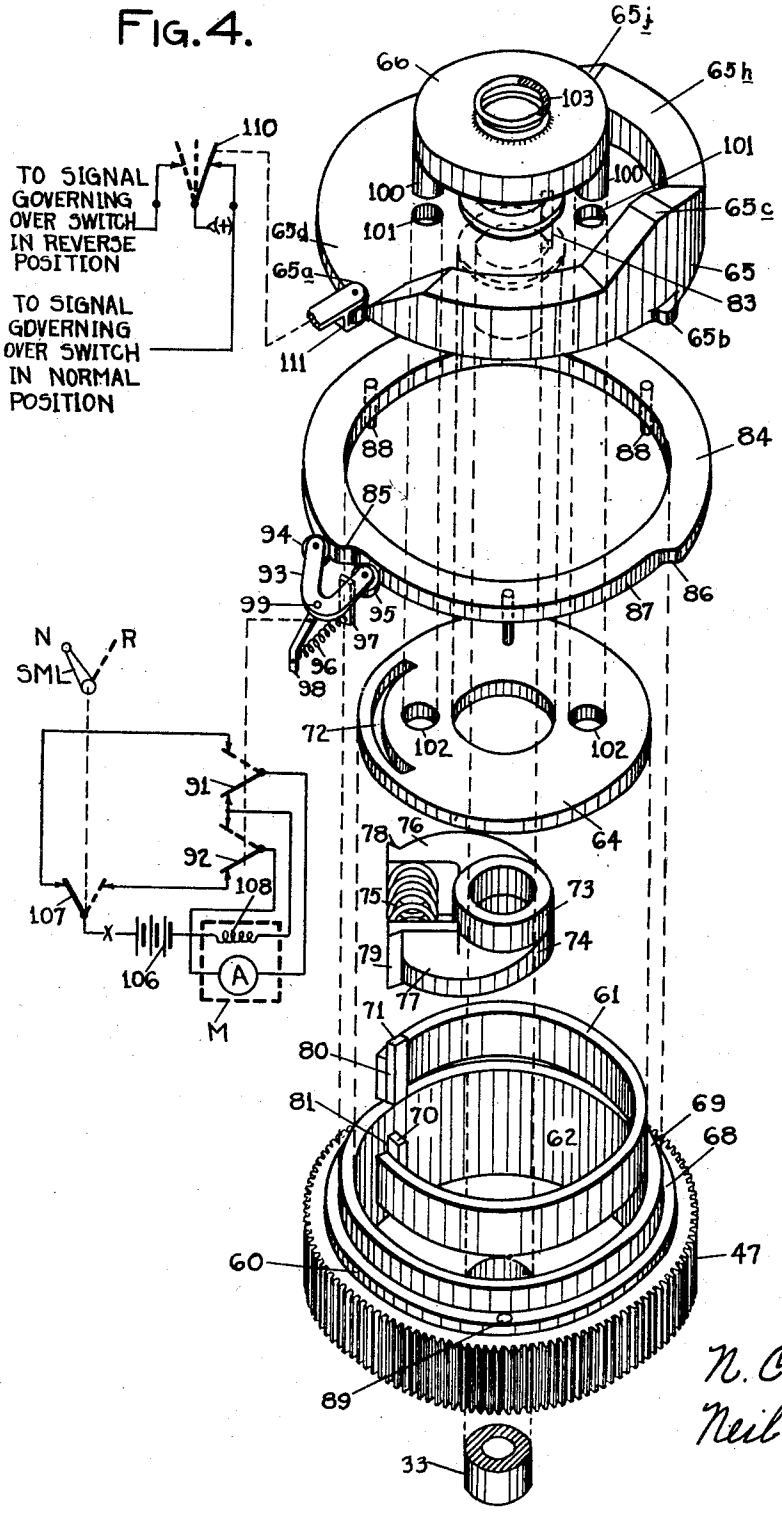

FIG. 2.

Inventor
N. C. L. Brown,
By Neil W. Preston,
his Attorney

SWITCH MACHINE

Original Filed Dec. 24, 1949 5 Sheets-Sheet 3

FIG. 4.




Inventor
N. C. L. Brown.
Neil W. Preston.
his Attorney

Nov. 5, 1957 N. C. L. BROWN 2,812,426

SWITCH MACHINE

Original Filed Dec. 24, 1949 5 Sheets-Sheet 4

FIG. 6.

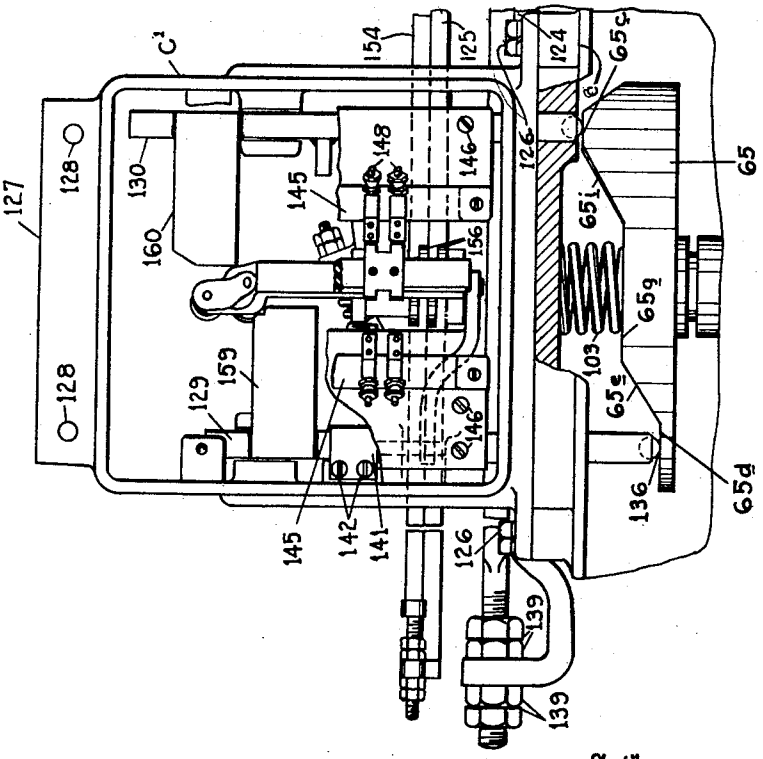
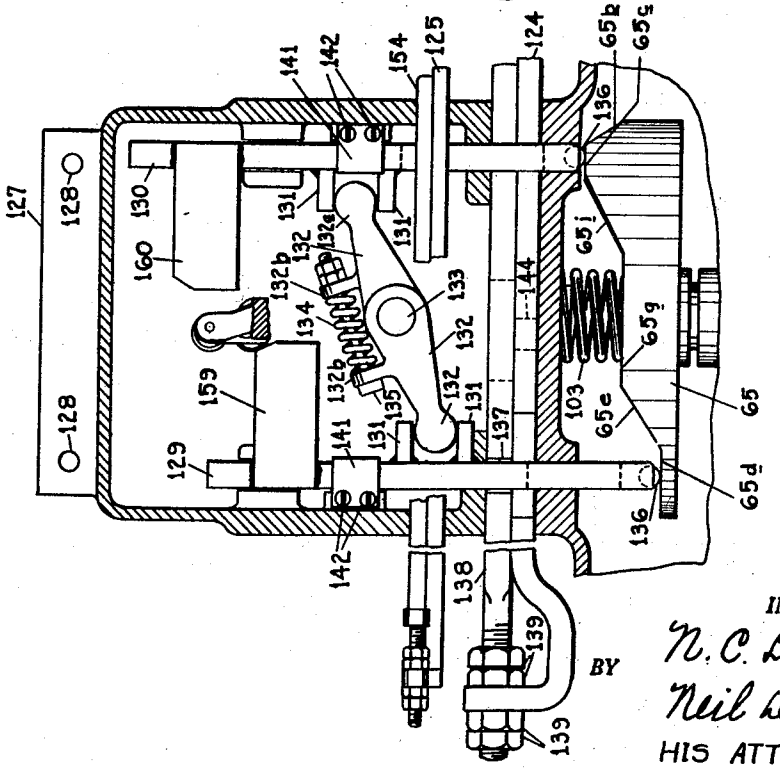



FIG. 9.




INVENTOR.
N. C. L. Brown.
BY Neil W. Benton.
HIS ATTORNEY

FIG. 8.

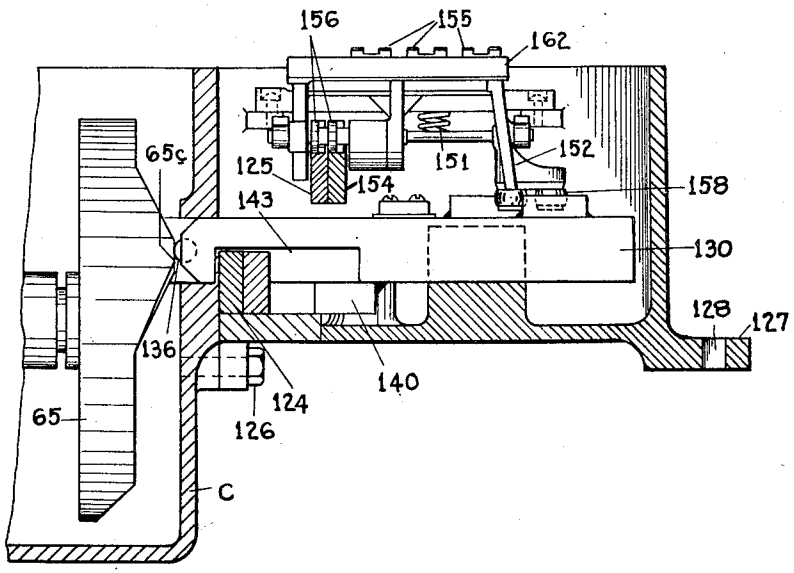
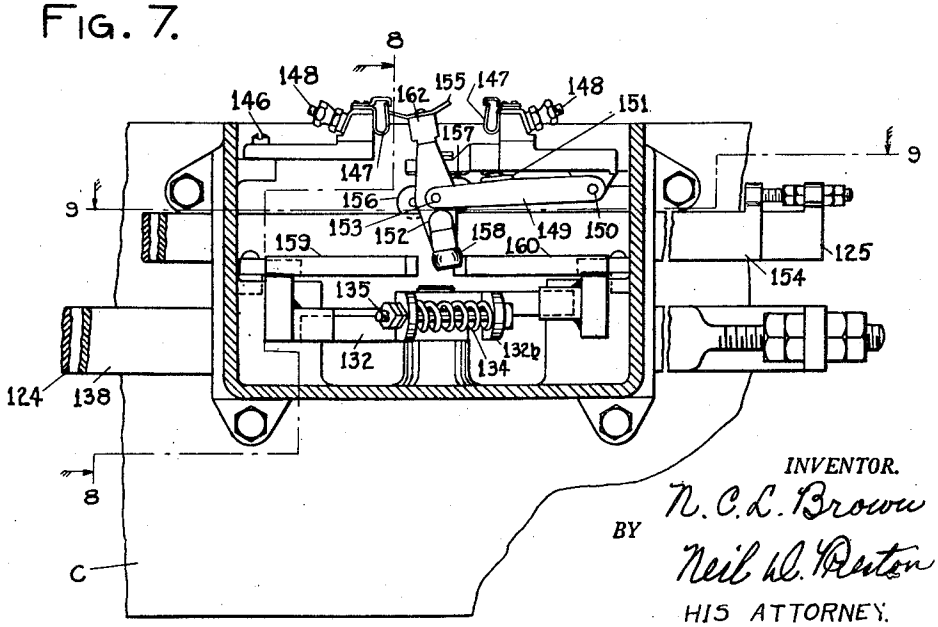



FIG. 7.




INVENTOR.
N. C. L. Brown
BY
Neil W. Reston
HIS ATTORNEY.

United States Patent Office 2,812,426 Patented Nov. 5, 1957



2,812,426

# SWITCH MACHINE

Ned C. L. Brown, Scottsville, N. Y., assignor to General Railway Signal Company, Rochester, N. Y.

Original application December 24, 1949, Serial No. 134,969, now Patent No. 2,659,812, dated November 17, 1953. Divided and this application August 11, 1953, Serial No. 373,473

7 Claims. (Cl. 246—240)

This invention relates to switch machines for railroads, and it more particularly pertains to improvements in electric switch machines and their connections to associated track switches.

This application is a division of my prior application Ser. No. 134,969, filed December 24, 1949, which has resulted in Pat. No. 2,659,812, granted November 17, 1953.

One of the problems encountered in railway practice involving the use of power switch machines for the operation of track switches is to lock facing switch points against the possibility of their being operated by extraneous means such, for example, as by vibration due to the passage of trains. Another problem encountered in switch yards and similar places where frequent switch movements are made is to prevent damage to the track switch and/or its associated switch machine in case the track switch is inadvertently trailed when in the wrong position for such trailing movement.

An object of the present invention is to provide an improved means for connecting a switch machine to a track switch whereby an attempt to spread a closed switch point by vibration or other forces applied to such switch point is resisted by a toggle-like locking connection of the switch point to the switch machine.

Another object of the present invention is to lock the closed point of a track switch through a novel means of connection of the respective switch points to the switch machine, and by use of separate throw rods for the respective switch points to provide means governed by the character of the connection of the switch to the switch machine for unlocking the closed point in response to the approach of a train trailing the track switch when such switch is in the wrong position for such train movement, and thereby prevent damage to the track switch and/or switch machine.

Another object of the present invention is to provide an improved operating mechanism for a switch machine wherein a variable torque friction clutch permits slippage in case of an obstruction of the switch points in mid-stroke to allow parts of the machine to operate through a predetermined complete cycle and pole change the switch machine motor to condition the machine for operation in the opposite direction.

Another object of the present invention is to provide an improved switch locking and point detector contact mechanism wherein yieldable locking dogs are employed to permit the switch machine to complete its operating cycle, even though the track switch lock rods may be out of alignment so that they cannot be locked.

Other objects, purposes and characteristic features of the present invention will be in part obvious from the accompanying drawings, and in part pointed out as the description progresses.

In describing the invention in detail, reference is made to the accompanying drawings in which similar reference characters are used to designate corresponding parts throughout the several views, and in which:



Fig. 1 is a plan view of a switch layout showing a single track switch and switch machine organization according to one embodiment of the present invention;

Fig. 2 is a plan view of the switch machine of Fig. 1 with its cover removed and certain parts shown in cross section;

Fig. 3 is an elevational sectional view of the switch machine as viewed along the line 3—3 of Fig. 2;

Fig. 4 is an expanded view in perspective of parts of the switch machine involving clutch and circuit controlling apparatus;

Fig. 5 is a plan view of a switch layout showing a modified form of single track switch machine organization;

Fig. 6 is a plan view of a circuit controller and locking mechanism employed in the switch machine as shown in Fig. 5;

Fig. 7 is an elevational view shown partially in cross section of the switch point detector and locking mechanism of the switch machine as shown in the switch layout of Fig. 5;

Fig. 8 is an elevational view of the point detector and locking mechanism as taken along the section line 8—8 of Fig. 7; and,

Fig. 9 is a plan view of the point detector and locking mechanism as taken along the section line 9—9 of Fig. 7.

With reference to Fig. 1, a switch layout is illustrated as one embodiment of the present invention wherein conventional long switch ties numbers 0 and 2 are provided for the mounting of the switch machine SM at its ends, and a shorter intermediate tie number 1 is employed as a support for the right-hand side of the switch machine SM as viewed in Fig. 1. The ties are held in proper spaced relationship by the tie straps 10 and 11 which are suitably secured near the ends of the ties as by the lag screws 12. Tie plates are preferably provided on the top of the switch ties extending throughout their entire lengths as a means for accurately maintaining the gauge of the rails at the track switch, and as a means for helping to maintain the switch machine SM a fixed distance from the switch points. Slide plates 13 are provided beneath the stock rails 14 and 15 and the movable switch points 16 and 17 respectively in the usual manner.

The switch machine SM of Fig. 1 is secured to numbers 0, 1 and 2 ties respectively by suitable bolts or lag screws 18, it being secured to the number 0 tie at its rear end as viewed in Fig. 1, to the number 2 tie at its front end, and to the number 1 tie at its right-hand side. If desired in practice, the number 2 tie can be a long and deeper tie with a portion hollowed out for clearance of the lower portion of the switch machine SM. Under such conditions, both sides of the switch machine SM are secured to the number 1 tie.

Connection of the switch machine SM of Fig. 1 to the respective switch points is accomplished by the respective throw rods 19 and 20, the throw rod 19 being effective to connect the near point 16 of the track switch to the switch machine SM, and the throw rod 20 being effective to connect the far point 17 of the track switch to the switch machine SM.

With reference to Figs. 1, 2 and 3, the major portion of the switch machine operating mechanism is housed in a suitable case C, preferably of cast iron, which is provided with a cover 21 having a suitable channel about the periphery of its edge for receiving cording 22 or other suitable packing material for insuring a tight fit of the cover to the case C. The cover is securely held in position by suitable hasps (not shown) and locked in accordance with the requirements of practice.

The front and back ends of the case C as viewed in

Fig. 1 have secured thereto suitable mounting brackets 23 and 24 respectively which in turn are secured to the respective switch ties Nos. 2 and 0. The bracket 24 is illustrative as being secured to the case C by the bolts 25 which secure an upright portion 24*a* of the mounting bracket 24 to a suitable boss 27 on the rear end of the case C. The front mounting bracket 23 is bifurcated in its portion extending to the case C so as to allow clearance for the respective crank arms of a throw crank 28 which has a structure and mode of operation to be hereinafter considered. The bifurcated portions 23*a* and 23*b* of the mounting bracket 23 are suitably secured to bosses 31 on the case C by the bolts 32. It is to be understood that other forms of supporting brackets may be employed, and that other means, such as welding can be employed for securing the mounting brackets to the case C in accordance with the requirements of practice.

A hollow throw shaft 33 (see Fig. 2) extends longitudinally through the switch machine substantially parallel to the stock rails. The shaft 33 is driven by the motor M through suitable reduction gearing and a variable torque clutch in a manner to be hereinafter more specifically described. The throw shaft 33 is suitably supported in the switch machine by three bearings, one of which is formed in the front portion of the mounting bracket 23 at the point 34, another of which is formed in the front end of the case C at the point 35, and another of which is formed at the point 36 in a bearing supporting bracket 37 which is suitably secured substantially at the center of the case C to the bottom of the case by the bolts 38. Although specifically these bearings are illustrated as being formed in the castings, it is to be understood that brass or bronze bushings may be employed, or ball or roller bearings in accordance with the requirements of practice.

The crank 28 is keyed to the throw shaft 33 in a position between the shaft bearings 34 and 35 and between the bifurcating portions 23*a* and 23*b* of the mounting bracket 23. This crank 28 has formed thereon the respective crank arms 39 and 40 which are displaced substantially 90° from each other as illustrated in Fig. 3. It is to these crank arms that the throw rods 19 and 20 for the respective switch points 16 and 17 are secured. The rods 19 and 20 are connected to the respective switch points 16 and 17 by suitable hinge switch clip fittings 9, and they are connected between the jaws of the respective crank arms 39 and 40 by the pins 41 and cotter pins 42 (see Figs. 2 and 3). A threaded portion of the ends of the rods 19 and 20 permits a fine adjustment of the closure of the switch points 16 and 17.

The drive motor M (see Fig. 2) is suitably secured within the case C at the right hand side of the case, and such motor M, when energized by a suitable circuit organization such as is shown in Fig. 4, drives with its pinion 43 the reduction spur gears 44, 45, and 46, the gear 46 in turn being effective to drive a ring gear 47 of the variable torque clutch. The gear 44 is pivoted on a shaft 48 which is journaled at one end in the boss 49 in the front end of the case C and at the other end by the bearing support 37 at the point 50. Similarly the gear 46 turns about a pivot shaft which is journaled at the point 51 in the front end of the case C and at the point 52 in the bearing support 37. The intermediate gear 45 coupling the gears 44 and 46 is pivoted on the throw shaft 33, but is not secured thereto, the gear 45 having front and back end bearing points 53 and 54 respectively.

The clutch organization as shown in Figs. 2 and 4 comprises in general a cylindrical drum 60 freely rotative about the shaft 33 and driven by the ring gear 47 which is cut on the outer circumference of the drum 60, or which may be a separate ring gear pressed or otherwise fitted onto the drum 60 according to the requirements of practice; a cylindrical clutch shoe 61 having frictional engagement with the inner cylindrical surface 62 of the



drum 60; two cranks 73 and 74 pivoted to rotate freely on the shaft 33 within the shoe 61 and biased away from each other by a spring 75 as a means for governing the application of pressure of the shoe against the inner cylindrical surface 62 of the drum 60; a circular bearing plate 64; an end plate 65 keyed to the shaft 33; and a spring biased coupling yoke 66 for normally coupling the end plate 65 and the bearing plate 64 as a means for normally driving the throw shaft 33 in accordance with the output of the clutch.

To consider the structure of the respective parts of the clutch more specifically, with reference to Fig. 2, the drum 60 has a lower bearing 67 which is freely rotative on the throw shaft 33. The upper edge of the drum 60 as viewed in Fig. 4 is stepped to a smaller outside diameter for providing a shoulder 68 for support of the pole changer ring spaced from the end plate 65 which bears against the upper edge 69 of the drum 60.

The clutch shoe 61 is preferably of resilient sheet metal with an outer friction lining as a suitable friction surface for bearing against the inner cylindrical surface 62 of the drum 60. The shoe 61 has its left-hand side open for approximately 30°, although the extent of the open portion is not at all critical, provided the other cooperating parts of the clutch are correspondingly constructed. Suitably secured to the open ends of the clutch shoe 61, and extending elevationally as viewed in Fig. 4, are respective normal and reverse clutch output driving detents 70 and 71 which extend upwardly within an annular slot 72 in the bearing plate 64.

The clutch shoe 61 is fitted within the drum 60, and it is expanded against the inner surface 62 of the drum 60 by action of cranks 73 and 74 which are biased apart by a compression spring 75. The cranks 73 and 74 are freely pivoted on the shaft 33, and their crank arms 76 and 77 have respective shoulders 78 and 79 formed at their ends to engage the outer edges 80 and 81 of the detents 71 and 70 so as to normally expand the clutch shoe 61 in accordance with the compression of the spring 75 which is suitably disposed between the respective inner faces of the crank arms 76 and 77. The bearing plate 64 fits within the upper edge of the drum 60 as viewed in Fig. 4, and thus serves as a bearing for the upper end of the drum 60. In this position, the detents 70 and 71 of the clutch shoe 61 extend upwardly through the annular slot 72 in the bearing plate 64 and thus cause rotation of the plate 64 relative to the rotation of the clutch shoe 61.

With reference to Fig. 2, the circular end plate 65 has its hub 82 keyed to the throw shaft 33 by the key 83, and the extension of the hub 82 of the end plate 65 downwardly as illustrated in Fig. 2 provides a pivot for the bearing plate 64, although it will be readily apparent that the bearing plate 64 can be pivoted directly on the throw shaft 33 if desired.

A pole changer ring 84 (see Fig. 4) is provided of a diameter to fit into the step of the drum 60 against the shoulder 68. The outer edge of the pole changer ring 84 (see Fig. 4) is recessed for a portion comparable to the number of degrees of rotation of the throw shaft 33, which is assumed for this embodiment of the present invention to be approximately 120°. Thus the respective ends 85 and 86 of the recess 87 define the respective ends of the stroke of the switch machine, the end 85 being associated with the normal position of the switch machine according to this embodiment of the present invention and the opposite end 86 being associated with the reversed position. As a means for rotatively coupling the pole changer ring 84 to the drum 60, location pins 88 are secured to the ring 84 and extend downwardly therefrom as viewed in Fig. 4 so as to engage holes 89 in the shoulder 68 of the drum 60. The pole changer ring is suitably biased against the shoulder 68 so as to maintain its pins 88 in engagement in their associated registration holes 89 by a suitable crimped spring washer

90 (see Fig. 2) which is maintained under compression between the upper surface of the pole changer ring 84 and the lower surface of the end plate 65.

Although it is to be understood that various forms of contact actuated mechanisms can be employed in the circuit controller, the pole changer contacts 91 and 92 are illustrated in Fig. 4 of this embodiment of the present invention as being actuated by a toggle rocker arm which comprises a U-shaped structure 93 carrying rollers 94 and 95 at the respective ends of the structure which are actuated by the recess ends 85 and 96 respectively of ring 84. The rollers 94 and 95 are actuated by the respective normal and reverse ends 85 and 86 of the recess 87, and the actuation of the toggle under either of these conditions deenergizes the switch machine motor M in a manner to be more apparent as the description progresses. A suitable toggle spring 96 connects a fixed point 97 with a toggle arm 98 extending beyond a pivot point 99 of the toggle structure and thus maintains the toggle structure, and the contacts 91 and 92 which are indicated as being actuated thereby, in their last actuated positions throughout the mid-stroke operation of the driving mechanism of the switch machine. The circuits governed by the pole changer contacts will be hereinafter considered along with a description of the mode of operation of the machine.

The periphery of the circular end plate 65 is used as a cam surface for actuation of a roller of a circuit controller operating arm which is illustrated in Fig. 4 diagrammatically as actuating circuit controller contacts which are closed only in the respective full normal and full reverse positions of the track switch. These contacts are generally used in signal control circuits for governing the signals either directly, or indirectly through the selecting of line circuits in accordance with the requirements of practice. The recess 65*a* in the outer edge of the end plate 65 receives the roller when the track switch is in its normal position as illustrated in Fig. 1. When the track switch is operated to its reversed position, the roller rides on to the detent 65*b* in the outer edge of the end plate 65 and thus actuates the associated contact to its left end position to close one or more circuits for governing signals over the track switch in its reverse position.

The yoke 66 has downwardly extending pins 100 normally engaging the end plates 65 and the bearing plate 64 by extending through registering holes 101 and 102 in these respective plates. It is therefore provided that rotation of the bearing plate 64 as provided by the output of the clutch is applied to the end plate 65 which is keyed to the throw shaft 33, and thus rotation of the bearing plate 64 causes rotation of the throw shaft 33. The connecting yoke 66 is biased in its engaging position by a spring 103 as shown in Fig. 2 which is maintained under compression between the case C and the yoke 66, such spring being maintained in longitudinal alignment by bosses 104 and 105 in the case and the yoke respectively. Because of the connecting yoke 66 extending across the end of the throw shaft 33 as is illustrated in Fig. 2, by use of a hollow shaft 33 as shown, it is possible to disengage the yoke 66 from the bearing plate 64 by applying end thrust to a shaft inserted within the hollow throw shaft 33 as a means for disengaging the power operation mechanism of the switch machine from the throw shaft 33 so as to permit actuation of the throw shaft manually by suitable manually operable means which may be provided in accordance with the requirements of practice.

With reference to Fig. 3 it will be noted that the respective throw rods 19 and 20 are formed with a substantially 90° hook near the point of connection of the rods to the respective crank arms 39 and 40. It is by this arrangement that the switch points when closed are locked against the possibility of their being opened by vibration, or by the application of a force tending to separate the switch points from their closed positions. With the switch machine and the track switch in their normal positions as illustrated in Fig. 1, the throw rod 19 which is connected to the crank arm 39 is so hooked about the throw shaft 33 that if a line were drawn from the center of the connecting pin 41 (connecting the rod 19) to the switch point 16 it would fall above the center of the throw shaft 33 and thus provide that any tension applied to actuate the throw rod 19 to the right would merely draw the hooked end of the rod 19 more tightly around the hub of the crank 28.

It is therefore desirable that the left-hand end of the switch rod 19 be curved substantially as is shown in Fig. 3 so that with the switch machine SM in its normal position as shown, the switch rod 19 is wrapped tightly about the lower portion of the periphery of the crank 28 to securely lock the normal switch point 16 in its closed position.

To consider the mode of operation of the switch machine organization, it will be assumed that the control switch SML (see Fig. 4) is actuated to its right-hand position for causing the track switch to be operated to its reverse position. By this actuation a circuit is closed for the energization of the switch machine motor M extending from the positive terminal of the battery 106 and including safety contact selections indicated by the letter X, contact 107 of the switch SML in its right-hand position, contact 92 of the pole changer circuit controller in its lower position, armature A of the motor M, contact 91 of the pole changer circuit controller in its lower position, and the series field winding 108 of the motor M to the negative terminal of the battery 106. In accordance with the energization of the motor M with the polarity as described, the motor M actuates its armature and pinion 43 (see Fig. 2) in a counter-clockwise direction which drives the gear 44 clockwise, the gear 45 counter-clockwise, the gear 46 clockwise and the gear 47 of the clutch counter-clockwise, as viewed from the throw rod connection end of the throw shaft 33 according to Fig. 2. The actuation of the drum 60 of the clutch in a counter-clockwise direction actuates the detent 71 (see Fig. 4) against the upper end of the annular slot 72 in the bearing plate 64 and through this engagement of the detent 71 with the bearing plate 64 drives the throw shaft 33 in a counter-clockwise direction. With reference to Fig. 3, the rotation of the shaft 33 in a counter-clockwise direction is effective to unhook the throw rod 19 from the back of the throw shaft 33 and to actuate the throw rod 20 to its right-hand position to start the closing of the switch point 17 against the stock rail 15.

The counter-clockwise rotation of the shaft 33 continues until the pole changer toggle 93 is actuated by the roller 95 (see Fig. 4) striking the end 86 of the recess in the pole changer ring 84, at which time the toggle 93 is actuated to its left-hand actuated position and thus the circuit just described for the motor armature A and the motor field F are opened at contacts 91 and 92 of the pole changing circuit controller. Thus the motor M is deenergized at the end of the stroke and the shifting of the pole changer contacts 91 and 92 to their upper positions conditions a circuit for the motor M so that upon subsequent actuation of the switch control lever SML to its left-hand position, energy can be applied to the motor M of a polarity to restore the switch machine to its normal position.

The stroke of operation of the track switch in its operation from its normal to its reverse position is assumed to be be such as to actuate pin 41 (see Fig. 3) connecting the throw rod 20 to the crank arm 40 to a position whereby it is slightly above a line that could be drawn from the center of that pin to the switch point 17 with the rod 20 hooked tightly under the portion 23*b* of the bracket 23 as the normal rod 19 is hooked around the crank 28 with the switch machine in its normal position. Thus a hook lock is provided for locking the switch point 17 against the stock rail 15 because any force exerted to urge the switch point 17 away from such stock rail is applied to urge the rod 20 to be more tightly hooked under the portion 23*b* of the bracket 23.

It is preferable that the switch rods be adjusted so that

the switch points are actuated tightly against their respective stock rails just prior to the rotation of the cranks to which they are connected to their full locking positions. With the switch point closed prior to the completion of rotation of the shaft **33** to its fully locked positions, the switch rod connecting the closed point is sprung slightly in a manner readily absorbed by the hook portion of the rod so that when operation of the switch machine has been completed to the point where the motor M is deenergized, the particular switch point that is closed is urged in that closed position by a spring tension that is stored within the associated switch rod.

With reference to Fig. 4, assuming that it is desired to actuate the track switch from its reverse to its normal position, the control switch SML is actuated to its left-hand position and thereby establishes a circuit for the motor M extending from the positive terminal of the battery **106** and including safety circuit contact selections as indicated by the letter X, contact **107** of the control switch SML in its left-hand position, contact **91** of the pole changer circuit controller in its upper position, armature A of the motor M, contact **92** of the pole changer switch controller in its upper position, and the field winding **108** of the motor M to the negative terminal of the battery **106**. It will be noted that the energization of the motor M by this last described circuit is of the opposite polarity for the armature A and the same polarity for the field **108** as compared to energization by the circuit formerly described for energization of the motor M in accordance with the designation of a reversed position for the track switch. It is thus provided that in response to the actuation of the control SML to its left-hand position, the motor M is energized with a polarity to turn its armature and pinion **43** in a clockwise direction and thus effect the clockwise rotation of the throw shaft **33** through the gear reduction and the clutch organization. This operation continues until the toggle roller **94** (see Fig. 4) hits the recess end **85** and actuates the contacts **91** and **92** to their lower position to open the normal operating circuit which has been described.

To consider the mode of operation when the track switch is split by a trailing train movement, it will be assumed that the track switch is locked in its normal position as illustrated in Fig. 1, and it will be further assumed that a train proceeds from the turnout track to pass through the track switch. When the train progresses to a point of narrow gage where the wheels of the train apply pressure against the switch point **17**, the reverse throw rod **20** which is connected to this switch point is actuated to the right and thus acts through the crank arm **40** which connects the switch rod **20** to the throw shaft **33** to rotate the throw shaft in a counter-clockwise direction as viewed in Fig. 3.

This rotation continues as the train progresses through the switch, and because of the counter-clockwise rotation of the throw shaft **33** the normally closed switch point **16** is unlocked from its hooked position around the hub of the crank **28**, and thus this switch point can also be crowded open as the train progresses through the track switch. It will be readily apparent that by both switch points being unlocked, the wheels of the train can crowd the switch points to a position to render free passage of the train between the switch point **16** and the stock rail **14**, and the switch point **17** will be crowded to a position where it will be closed against the stock rail **15**, corresponding to the full reverse position of the track switch. It will thus be seen that the track switch can be trailed without damage to the track switch or to the switch machine SM.

To consider the operation of the switch machine under the above described trailing condition it will be apparent that as the throw shaft **33** is rotated in its counter-clockwise direction by tension applied to the throw rod **20** the end plate **65** is rotated in a counter-clockwise direction as viewed from the throw rod end of the shaft **33**, and because of such plate being coupled by the yoke **66** to the bearing plate **64**, the bearing plate **64** is also rotated in the same direction. The rotation of the plate **64** applies pressure to the engagement of the ends of the slot **72** with the detent **71** of the brake shoe **61** so as to slip the clutch as the ratio of the reduction gearing of the switch machine is such as to substantially lock the clutch ring gear **47** against being driven by the throw shaft **33**. The nature of the clutch is such as to allow a freer slippage in response to a sudden shock so that if the throw shaft is quickly rotated, the spring **75** is compressed during the acceleration of the throw shaft **33** as compared to the slippage of the brake shoe **61** so that the brake shoe **61** slips more freely within the drum **60** under conditions where a more abrupt shock is applied to the throw shaft as by a train trailing the switch at a relatively high speed.

It will be noted that because of the slippage of the clutch throughout the entire stroke of the track switch as above described, the pole changer ring **84** has become out of correspondence with the end plate **65**, the end plate **65** being substantially in the reverse position and the pole changer ring **84** being maintained substantially in its normal position. The rotation of the end plate **65** under such conditions opens the circuits for signals closed through the contact **110** (see Fig. 4) in its right-hand position because of the roller **111** being forced out of the recess **65***a* in the end plate. In all probability the forcing of the switch points to their reverse positions by passage of the train is not sufficient to complete the rotation of the end plate **65** to a position to actuate the roller **111** by the detent **65***b* and thus close the circuits for controlling a signal governing traffic over the track switch in its reverse position. Under such conditions, if the operator of the power switch is remote from the track switch so as to not have been aware of the improper movement over the switch by a train, he will become aware that something is wrong when he can no longer clear a certain signal over a particular position of the switch. The normal procedure is to then inform a maintainer that something is wrong and that the switch should be inspected.

To restore the ring **84** to a position in correspondence with the end plate **65**, the operator of the track switch need only to actuate the switch control lever SML (see Fig. 4) to its reverse operating position (right-hand position) so as to cause the driving of the pole changer ring **84** to the full reverse position of the switch machine and thereby drive the switch point **17** to its fully locked position and to actuate the end plate **65** to its full reverse position so as to permit the closing of a signal control circuit through the switch circuit controller. After this completion of operation has been accomplished, the switch machine is conditioned for operation back to its normal position when operation to its normal position is called for because the pole changer contacts **91** and **92** are actuated to pole change the motor M and thus condition the motor for operation to its normal position when lever SML is actuated to its left-hand position in accordance with the usual mode of operation of the switch machine.

It will be noted that while driving the switch machine to its reverse position under the above assumed conditions, the switch points are already assumed to be nearly in their reverse positions, so there is little operation of the switch points as compared to full stroke operation of the switch machine SM. It is thus provided that the switch machine initially completes the operation of the switch points to their reverse positions, and when the points reach these positions, the throw shaft **33** is stopped in its rotation by the hooking of the switch rod **20** under the portion **23***b* of the bracket **23**. When the rotation of the throw shaft **33** is suddenly stopped in this manner, additional pressure is momentarily applied through the plate **64**, to the detent **71** (see Fig. 4) that is connected to the shoe **61** of the clutch and the compression

spring 75 that is disposed between the cranks 73 and 74 is compressed, thus removing a part of the expanding force that is normally applied to the clutch shoe 61 so as to permit the clutch to momentarily slip freer and to therefore soften the shock on the switch machine mechanism of the abrupt stopping of the rotation of the throw shaft 33.

By requiring the drive of the switch machine through the clutch to be through the spring 75, it is provided that the driving torque of the clutch is maintained substantially constant as regulated by the compression of the spring 75. When a higher torque tends to be developed by the clutch as the speed increases the spring 75 is further compressed and thus decreases the pressure of the shoe 61 against the inside surface of the drum 60.

To consider the mode of operation of the machine in case the switch points are obstructed so that full operation of the track switch cannot be accomplished, it will be apparent from the above description, that slippage of the clutch takes place similar to that which has been described, and that such slippage continues until the pole changer ring 84 has been driven to its full operated position to pole change the motor M and thus condition it for restoration of the switch machine to its former position when such position is designated by restoration of the switch control lever SML. In other words, in case an obstruction is encountered in the switch points, the clutch slips until full operation is accomplished to pole change the motor M, and the actuation of the lever SML back to its former position will cause the switch points to be restored. Because of there being only a partial stroke of restoration of the switch points under such conditions there is clutch slippage on the restoration stroke so as to actuate the pole changer ring 84 to its fully restored position and thus pole change the motor M. It will be therefore seen that under any condition where only a partial stroke is accomplished, a full stroke operation of the switch machine is accomplished by slippage of the clutch in order to condition the switch machine for reversal by the rotation of the pole changer ring 84.

There are conditions such as where high speed train movements are to be made through a track switch where it is more desirable to positively lock both switch points and tie them together rigidly with a front rod, than to provide for trailability of the track switch without damage.

To meet these requirements, the power switch layout may be provided as shown in Fig. 5 wherein a front rod 120 is illustrated as connecting the points 16 and 17 of the track switch, and a switch rod 121 is provided for connecting the switch points 16 and 17 together having a suitable connector basket 122 at its center point for connecting the single throw rod 123. The throw rod 123 in turn is connected to the crank arm 39 of the switch machine. The connecter basket 122 includes adjustable means whereby there may be free travel of the throw rod 123 to compensate for the difference in the stroke of the switch machine from the throw of the particular track switch with which the switch machine is associated.

For the power switch layout as shown in Fig. 5, the switch machine is modified from the machine as it has been described by the substitution of a lock and detector mechanism DM for the supporting bracket 24 of Fig. 1. This mechanism DM acts upon a lock rod 124 connecting the mechanism with the front rod 120 as shown in Fig. 5 to lock the track switch in its full normal and full reverse operated positions, and a detector rod 125 is provided for connecting the detector mechanism of the switch machine with the switch point 16, this rod 125 being secured to the switch point 16 by a suitable lug of the type normally employed in practice for this purpose.

With reference to Fig. 6, the lock and point detector mechanism DM is illustrated as comprising a case $C^1$ which is secured to the end of the switch machine case C by the bolts 126, the case $C^1$ being provided with a base flange 127 having holes 128 for securing of the case $C^1$ to the number 0 tie, and thus providing an end support for the switch machine SM with which the lock and detector mechanism DM is associated. The case $C^1$ has longitudinal channels formed therein along each side and near the bottom of the case for the passage of respective normal and reverse lock plungers 129 and 130 respectively which are actuated longitudinally by the cam surface of the end plate 65 of the switch machine which has been described as being driven in accordance with the rotation of the throw shaft.

Each of the lock plungers 129 and 130 has formed on the sides thereof lugs 131 (see Fig. 9) spaced for receiving a rounded end 132*a* of a crank 132 which is pivoted by the pin 133 midway between the normal and reverse lock plungers 129 and 130. The two cranks 132 are biased rotatably opposite to each other by a compression spring 134 which is disposed between lugs 132*b* of the respective cranks 132 and suitably secured by a bolt 135 extending through these lugs 132*b* and axially through the center of the spring 134. By this arrangement it is provided that each lock plunger 129 and 130 in turn is positively driven outwardly from the cam end plate 65 by the rotation of the end plate 65 for unlocking the associated track switch from its respective normal and reverse locked positions, but the locking of the switch is accomplished by the movement of a lock plunger inwardly toward the cam of the end plate 65 as driven through the cranks 132 and through the compression spring 134, thus permitting the rotation of the cam of the end plate 65 to be completed for each switch operation, even though, through faulty adjustment of the lock rod 124, or the associated track switch, the lock plunger may be sufficiently out of alignment so that it may not be driven to its full locking position. To facilitate smooth operation of the lock plungers in accordance with the rotation of the cam of the end plate 65, suitable rollers 136 are provided at the lower ends of the plungers 129 and 130 as viewed in Figs. 6 and 9 which bear against the cam of the end plate 65 and follow its contour as the switch machine is operated.

The condition of the lock plungers 129 and 130, and detector contact mechanism, as illustrated in Figs. 6 to 9 inclusive, is that which would be assumed with the associated track switch in its normal position in a track switch layout as is shown in Fig. 5, thus the normal lock plunger 129 has its locking dog as formed in the underside thereof as viewed in Fig. 9, actuated to a locking position within the normal locking notch 137 (see Fig. 9) which is provided within a short adjustment rod 138 which is longitudinally adjustable with respect to the lock rod 124 according to the usual practice in lock rod adjustment by the adjustment nuts 139 which are used in securing the adjustment rod 138 to the lock rod 124. When the track switch is in its full normal position as shown, the reverse lock plunger 130 bears against the highest portion 65*c* of the cam of the end plate 65, and is thus in a position where its locking dog 140 (see Fig 8) has been withdrawn from the lock rod 124 and in a position urging the normal lock plunger 129 through the coupling of the cranks 132 and compression spring 134, against the lowest portion 65*d* of the cam of the end plate 65. The locking dog 140 as shown in Fig. 8 as being welded to the lower side of the reverse lock plunger 130, but it is to be understood it could be otherwise secured, or it could be formed as integral with the plunger 130. The lock plungers 129 and 130 are maintained in their respective longitudinal channels by the top plates 141 which are secured to the case $C^1$ by the screws 142.

To consider the mode of operation of the locking mechanism that has been described, a typical operating condition will be assumed where the switch machine is driven to actuate its associated track switch from its normal to its reverse position. As has been described, the switch machine is illustrated as being in its normal locked po-

sition, and in this position the normal lock plunger **129** is retained in a position bearing against the end plate **65** at the lowest portion of the cam of the end plate so that the plunger **129** engages the locking notch **137** of the adjustment rod **138** which is associated with the lock rod **124**. The lock plunger **129** is biased against the end plate **65** by the compression spring **134** acting through the respective cranks **132** which have been actuated about their pivot point **133** by the longitudinal operation of the reverse lock plunger **130**. When the switch machine is in its normal position, the lock plunger **130** does not engage the lock rod **124** or the adjustment rod **138** in locking engagement because of the clearance slot **143** in the lower side of the lock plunger **130** as viewed in Fig. 8. It will be noted that this clearance slot is of sufficient length to permit the actuation of the reverse lock plunger **130** as required for the throw portion of the operating stroke so that this portion of the stroke is completed before the locking dog **140** of the lock plunger **130** starts to engage a locking notch in the lock rod **124**.

Assuming power to be applied to the switch machine for operation to its reverse position, the roller **136** of the normal lock plunger **129** rides along the inclined surface **65***e* of the cam of the end plate **65** and thus the lock plunger **129** is actuated out of engaging position with the normal locking notch **137** of the adjustment rod **138**. The lock plunger **129** is clear of locking engagement with the adjustment rod **138** when the roller **36** has been actuated to the top of the inclined portion **65***e* of the cam of the end plate **65**, and as the operation of the switch machine progresses from that point there is no further movement of the lock plungers **129** and **130** for the throw portion of the switch as the lock rod **124** is being actuated to the right and as the track switch moves from its normal to its reverse position.

Although the use of the compression spring **134** for coupling the cranks **132** would permit the disengaging of the lock plunger **129** from its locking position as has been described without relative opposing movement of the lock plunger **130**, it is preferably provided that for the unlocking portion of the stroke, the lock plunger **130** be permitted to ride downwardly on an inclined surface **65***f* which is the reverse of the inclined surface **65***e* which actuates the normal plunger **129**. Thus after the track switch has been unlocked under the above described conditions, the lock plungers **129** and **130** are both held in disengaging positions, the lock plunger **129** bearing against the portion **65***g* of the cam of the end plate **65**, and the lock plunger **130** bearing against the surface **65***h* (see Fig. 4) of this cam.

Upon the completion of the throw portion of the operating cycle under consideration, the roller **136** of the lock plunger **129** starts to ride up the inclined surface **65***i* of the cam of the end plate **65**, and the reverse lock plunger **130** is thus driven through the compression of spring **134** toward the end plate **65**, and it follows a reverse inclined surface **65***j* (see Fig. 4). Thus as the reverse locking portion of the cycle of operation of the switch machine is completed, the lock plunger **129** is actuated to its fullest extended position and bears against the cam surface **65***c* of the cam of the end plate **65**. At this time, the reverse lock plunger **130** has actuated its locking dog **140** within notch **144** of the lock rod **124** so as to lock the points of the associated track switch in their full reverse positions. The lock plunger **130** at this time bears against the lowest portion **65***d* of the cam of the end plate **65**. It will be noted that if, for some reason, the locking notch **144** of the lock rod **124** were not in proper alignment for the locking dog **140** to enter the notch **144**, the operation of the switch machine would be completed, and the lock plunger **129** would be actuated to its fully extended position, and the spring **134** would be further compressed because of the failure of the lock plunger **130** to complete its cycle of operation. Thus the operation of the track switch would be completed, but the point detector contacts would be held open as will be more readily apparent as the description progresses.

Having thus described specifically the mode of operation with respect to the locking of the lock rod **124** by the lock plungers **129** and **130** for the operation of the switch machine from its normal position to its reverse position, it is to be understood that the reverse of this mode of operation is accomplished when the switch machine is operated from its reverse to its normal position.

According to the embodiment of the invention illustrated in Fig. 5, a conventional detector rod **125** is provided for actuation of a detector contact mechanism, rather than having the detector contact mechanism actuated off of the end plate **65** as has been illustrated in Figs. 2 and 4. Thus for the embodiment according to Fig. 5, the circuit controller that is illustrated in Figs. 2 and 4 as being actuated by the end plate **65** is not required, and a detector mechanism as illustrated in Figs. 6 to 9 inclusive is substituted therefore.

With reference to Fig. 6, two stationary contact blocks **145** of insulating material are oppositely disposed within case C′ and suitably secured to the case by the screws **146**. These blocks **145** have secured thereto oppositely disposed contact springs **147** which have associated therewith respective terminal posts **148** for the connection of wires of signal control circuits, and the like.

Disposed beneath the left hand contact block as viewed in Fig. 7, is a bracket **149** pivoted by the pin **150**, and biased downwardly about this pivot point **150** by a compression spring **151**. This bracket **149** carries a cradle **152** which is pivoted by a pin **153** extending through the left hand end of the bracket **149** as viewed in Fig. 7 so as to locate the cradle **152** substantially at the center of the case $C^1$, and disposed between the oppositely disposed contact springs **147**. The cradle **152** has a block **162** of insulated material secured at the top thereof, and this block **154** of insulating material carries respective contact strips **155** which are adapted to selectively close respective electrical circuits between adjoining pairs of contact springs **147** which are secured to the stationary contact blocks **145**. Thus one of these contact strips **155**, as illustrated in Fig. 7, is arranged to engage adjoining contact springs **147** either at the left or at the right thereof as the cradle **152** is actuated counter clockwise and clockwise respectively about the pivot point **153**.

The detector rod **125** has an associated adjustment rod **154** provided for the purpose of obtaining adjustment in a manner comparable to that which has been described for the adjustment of the normal and reverse locking notches of the lock rod **124**, the upper sides of the detector and detector adjustment rods **125** and **154** respectively being notched to govern the rocking of the cradle **152** about its pivot point **153**, the cradle **152** being provided with rollers **156** and **157** which are biased against the upper surface of the detector rod **125** and the detector adjustment rod **154** so that they can enter the respective normal and reverse notches in the top of these rods when the switch points assume their respective normal and reverse positions.

It is provided that the detector cradle **152** is so actuated, as is the usual practice in switch machines of this character, by the lock plungers **129** and **130** that circuits through the respective adjoining pairs of contact springs **147** can be said to check the mechanism of the switch machine in correspondence with the switch points. This is accomplished by the rollers **158** (see Fig. 7) at the lower end of the cradle **152** which are actuated by respective normal and reverse dogs **159** and **160** which are suitably secured as by welding to the respective normal and reverse lock plungers **129** and **130**. These dogs **159** and **160** are so disposed that the cradle **152** of the circuit controller is maintained on center, with all contacts open during the

throw portion of the switch machine operating cycle, and is permitted to be actuated to its left or right contacting position only provided that the respective lock plungers **129** and **130** and the detector rods **125** and **154** assume their respective full operated positions. It will thus be seen according to Fig. 9 that the cradle **152** is actuated to its normal contact engaging position, and upon the driving of the lock plunger **129** to unlock the lock rod **124**, the cradle **152** is driven to its center position and the contacts are opened in accordance with the movement of the cradle engaging dog **159** as the lock plunger **129** is actuated outwardly by the roller **136** riding along the inclined surface **65***e* of the end plate **65**.

Having thus described one specific embodiment of the present invention, together with certain modifications, as applied to the control of specific track switches, it is desired to be understood that the form shown has been shown and described more for the purpose of illustrating the principles and mode of operation involved than for indicating the scope of the present invention, and it is to be further understood that various other modifications, adaptations and alterations may be applied to the specific form shown within the scope of the present invention, except as limited by the appending claims.

What I claim is:

1. In a power switch machine for actuating a railway track switch, a lock rod connecting the movable points of said track switch and extending transversely through said switch machine, a throw shaft extending longitudinally through said switch machine, a rotary cam plate secured to said throw shaft having an operating surface which varies axially in the same direction as the axis of said throw shaft, respective normal and reverse laterally spaced lock plungers bearing against said operating surface of said cam plate and traversing said lock rod, said lock plungers being operable axially upon rotation of said cam plate, and a spring biased linkage coupling said lock plungers so that the driving of one lock plunger axially in one direction by said cam drives the other lock plunger axially in the opposite direction through said spring linkage to lock said lock rod.

2. In a power switch machine for actuating the movable points of a railway track switch, a lock rod connecting the movable points of said track switch and extending transversely through said switch machine, respective normal and reverse laterally spaced lock plungers traversing said lock rod and operable axially, a rotary throw shaft operable to respective normal and reverse rotary positions, a rotary cam plate driven by said throw shaft having an operating surface which varies in the same direction axially as said throw shaft, said cam plate being disposed at the ends of said lock plungers so as to axially actuate said lock plungers by said operating surface selectively in engagement with said lock rod in accordance with the respective normal or reverse position to which said throw shaft is actuated.

3. A power switch machine for actuating the movable points of a railway track switch comprising in combination, a lock rod connected to the movable points of said track switch and extending transversely through said switch machine, respective normal and reverse laterally spaced lock plungers traversing said lock rod, said lock plungers being movable only axially, a rotary throw shaft operable to respective normal and reverse rotary positions, a rotary cam plate driven by said throw shaft, said cam plate being disposed at the ends of said lock plungers so as to actuate said lock plungers selectively in a given direction of axial movement, and reciprocating linkage including two cranks having a common pivot point and connecting said lock plungers for actuating each plunger axially in one direction to lock said lock rod in response to the actuation of the other lock plunger axially in the other direction by said cam plate.

4. In a power switch machine for actuating the movable points of a railway track switch, a lock rod extending transversely through said switch machine and connected at one end to the points of a track switch, laterally spaced normal and reverse lock plungers within said switch machine transversing said lock rod and carrying normal and reverse locking dogs respectively for engagement with said lock rod, said lock plungers being operable only axially, a power operated throw shaft carrying a cam plate for driving said lock plungers axially in one direction only, and reciprocating linkage including two cranks having a common pivot point and connecting said lock plungers for actuating each plunger axially in the opposite direction to lock said lock rod in response to the actuation of the other lock plunger in said one direction by said cam plate.

5. A power switch machine comprising in combination, a lock rod extending transversely through the switch machine and connected at one end to the movable points of a track switch, laterally spaced locking plungers transversing said lock rod and carrying locking dogs for selective engagement with said lock rod, said lock plungers being operable only axially, a power driven cam for selectively operating said lock plungers in one direction axially, and spring biased linkage coupling said lock plungers, said linkage including two cranks having a common pivot point whereby the driving of one lock plunger axially by said cam drives the other lock plunger axially in the opposite direction through said linkage to lock said lock rod.

6. A power switch machine of the character described comprising, a lock rod extending transversely through the switch machine, respective normal and reverse laterally spaced lock plungers transversing said lock rod, said lock plungers being operable only axially, and said normal and reverse lock plungers carrying normal and reverse locking dogs respectively for selectively engaging said lock rod, a power driven cam for operating said lock plunger axially in a direction to unlock said lock rod, and spring linkage means including two cranks having a common pivot point engaging the lock plungers respectively for operating said normal and reverse lock plungers to respective locking positions when the other lock plunger is operated in the opposite direction by said cam.

7. A power switch machine comprising, a lock rod extending transversely through the switch machine, respective normal and reverse laterally spaced lock plungers transversing said lock rod, said normal and reverse lock plungers carrying normal and reverse locking dogs for respectively engaging said lock rod, said lock plungers being operable only axially, a power driven cam for operating said lock plungers axially in the same direction selectively to unlock said lock rod, a pair of cranks operating about a common pivot point midway between said lock plungers, said cranks engaging said lock plungers respectively, and said cranks being oppositely biased about said pivot point by a compression spring whereby the driving of one lock plunger axially by said cam drives the other lock plunger in the opposite direction through said cranks and said compression spring to lock said lock rod.

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