April 19, 1932. C. W. PRESCOTT 1,854,602

TRAFFIC CONTROLLING SYSTEM

Filed April 16, 1925 4 Sheets-Sheet 1

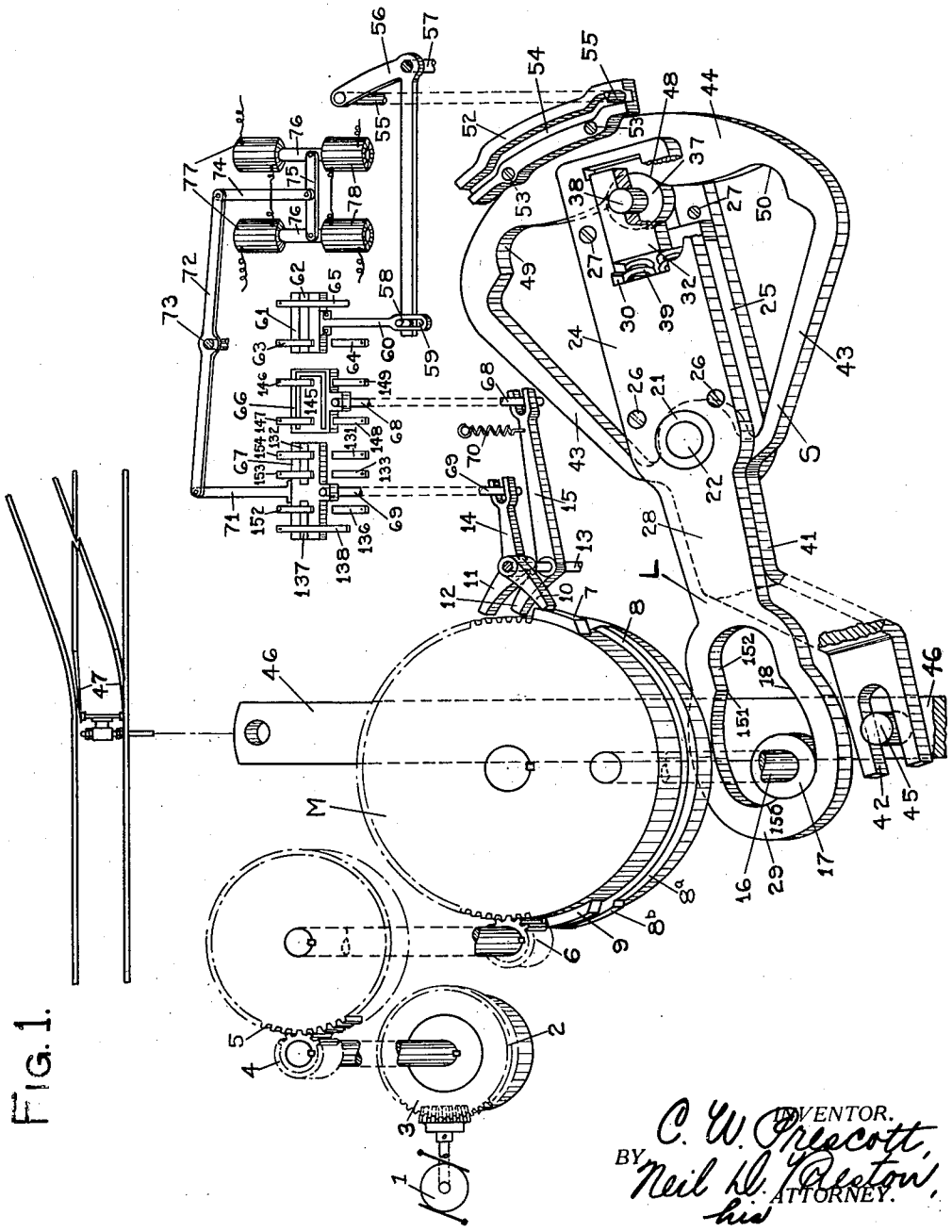


FIG. 1.

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FIG. 2.

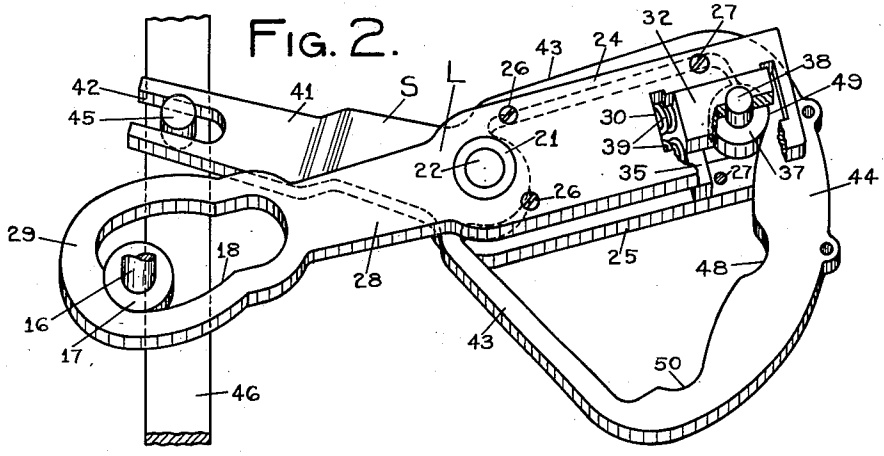


FIG. 3.

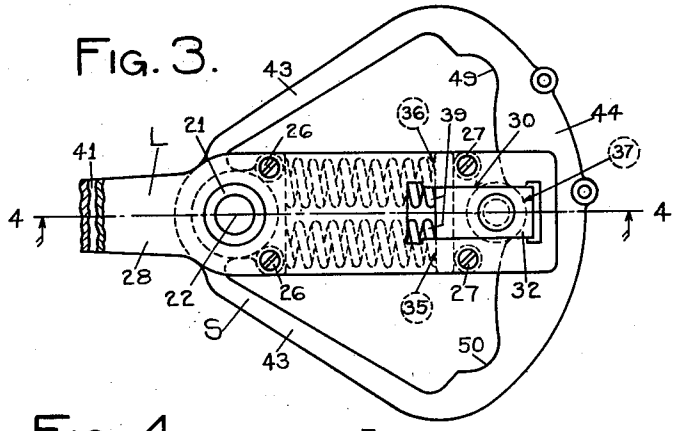


FIG. 4.

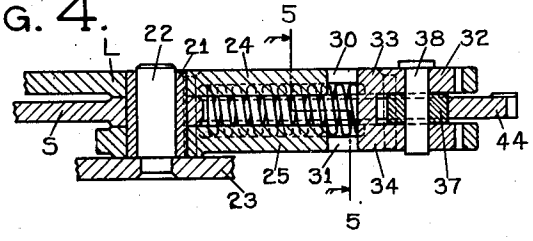
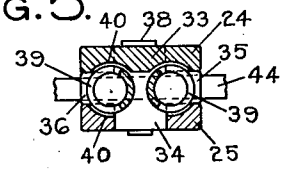


FIG. 5.



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TRAFFIC CONTROLLING SYSTEM

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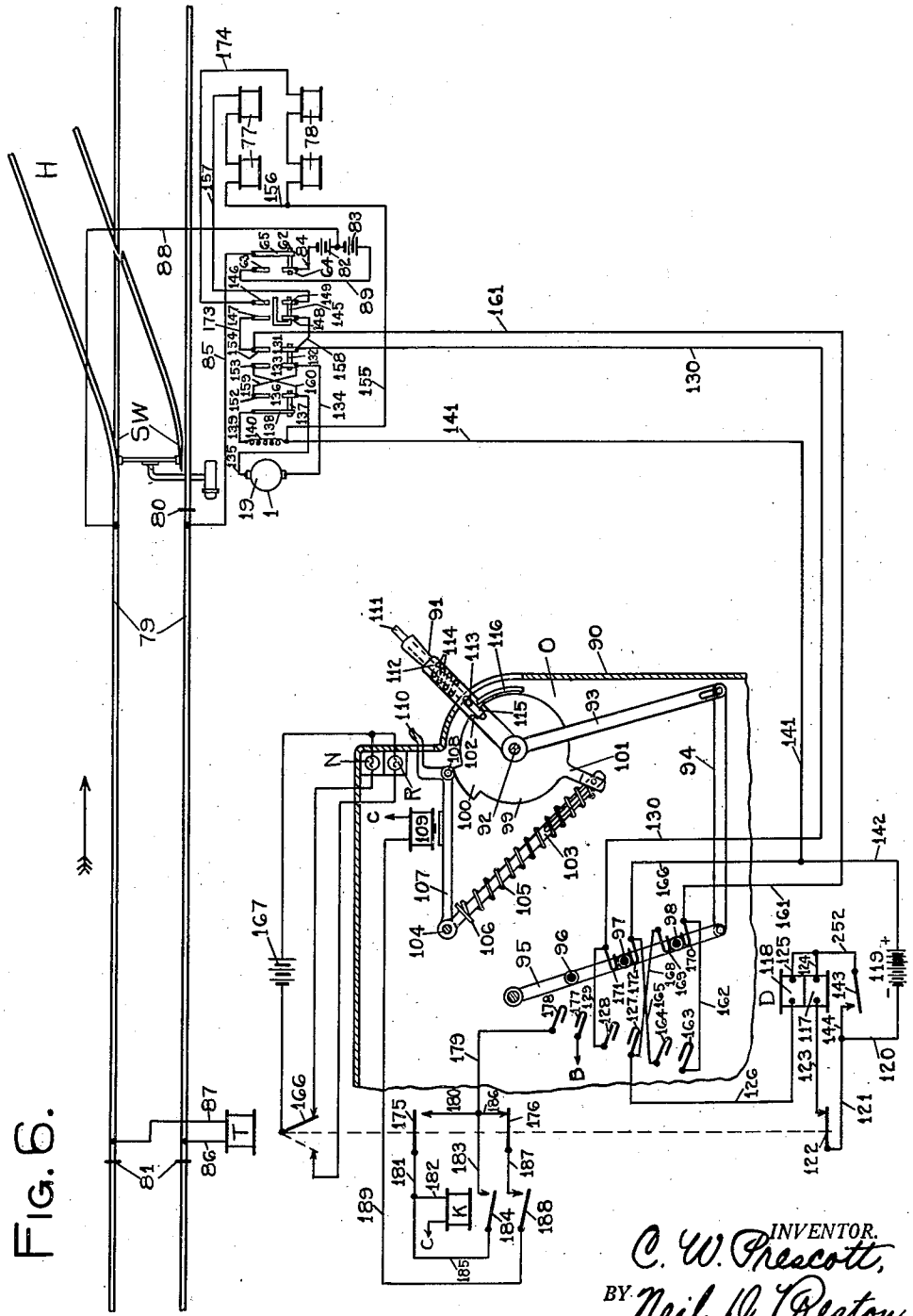


FIG. 6.

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TRAFFIC CONTROLLING SYSTEM

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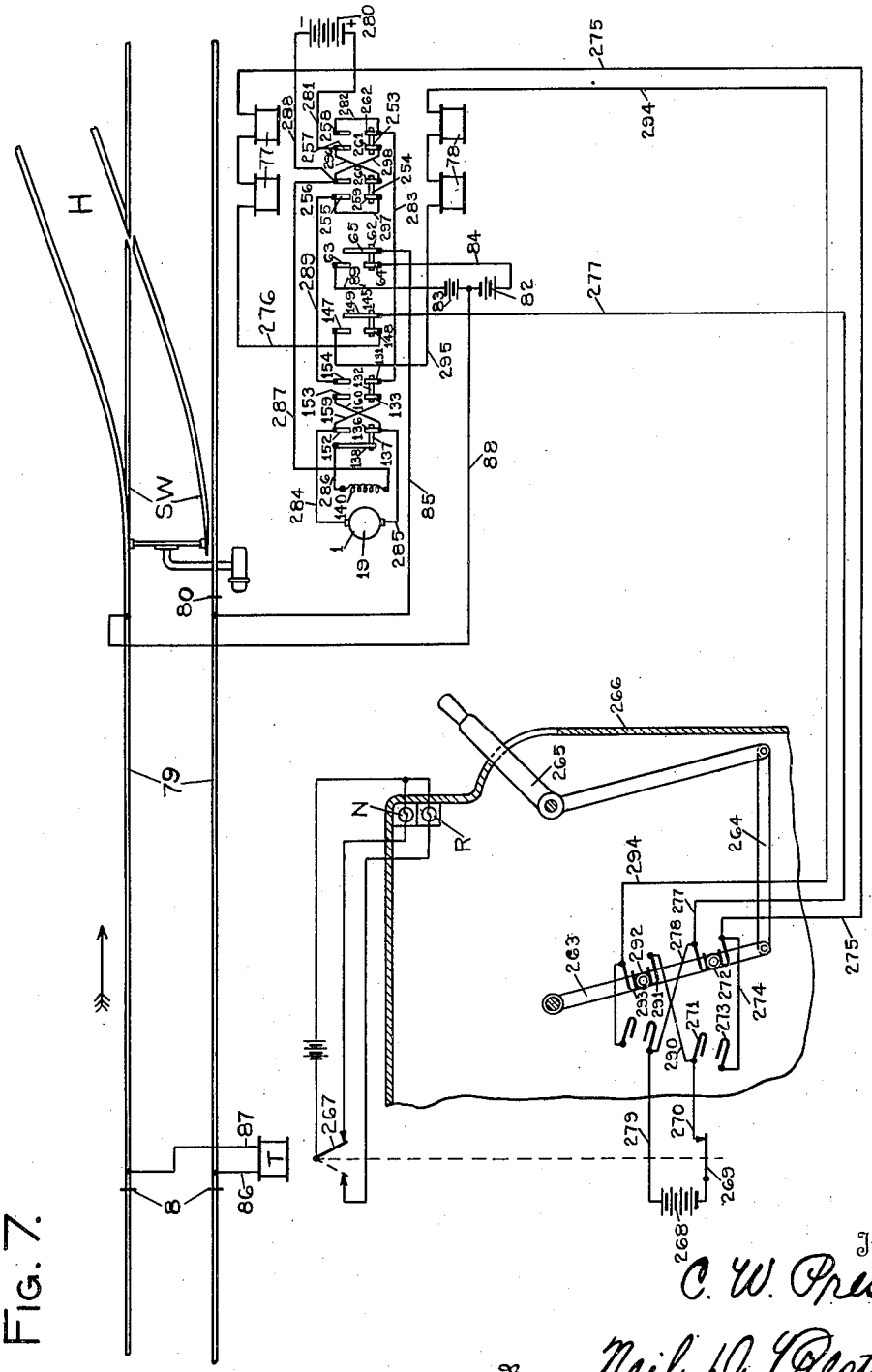


FIG. 7.

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Patented Apr. 19, 1932 1,854,602

UNITED STATES PATENT OFFICE

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TRAFFIC CONTROLLING SYSTEM

Application filed April 16, 1925. Serial No. 23,543.

This invention relates to power-operated switch machines for use on railroads and particularly in classification for "hump" yards, and to a system for controlling the operation of such machines.

In modern railway practice, it is customary in handling freight cars and in making up trains, to employ a special arrangement of tracks and switches, usually on a grade, which is commonly known as a "hump", gravity, or classification yard. In order to centralize the control of the switching operations and to minimize the number of switchmen or attendants needed, it is desirable to operate these switches by power and to control the operation from a central point.

It has been the practice to provide power-operated switch machines for use in "hump" yards which operate to permit the switch points to be trailed, that is, to be forced from one position to another by the wheels of a passing car, this feature being accomplished by permitting the switch points to operate the switch machine connections and gearing against the opposition set up by the inertia of these moving parts. It has been found that this rapid operation of the gearing and other parts of the switch machine causes excessive wear and breakage of parts, and subjects the switch points and operating rods and bars to excessive strains.

With the above and other consideration in mind it is proposed in accordance with the present invention to provide a simple and efficent switch machine for use in "hump" or classification yards as well as in flat switching yards and in interlocking plants which is quick-acting, is reversible at any point of its stroke, and incorporates means for permitting the switch points to be trailed without undue strain on the switch points or operating rods, and without the operation of any gear mechanism, which means will maintain the switch points in their normal position until trailed and in their trailed position until returned by the operator.

It is further proposed to provide a control system for a switch machine which is governed in accordance with the occupancy of the detector track circuit, so that the switch may be manually set for a turnout move and automatically returned to its normal position as soon as the car has passed the switch points.

It is still further proposed to provide means for indicating the position of the switch points and the occupancy of the detector track circuit so that the proper operation of the switch machine mechanism can be readily determined, these means being so designed as to minimize the number of control wires needed between the switch machine and the tower or other central control point.

Other objects, advantages and characteristic features of the present invention will become apparent as the description thereof progresses.

In describing the invention in detail, reference will be made to the accompanying drawings in which:—

Fig. 1 is a simplified view in perspective of the operating mechanism of the switch machine comprising the present invention, certain of the parts being broken away to show the structure;

Fig. 2 is a perspective view of the throw-bar operating mechanism in the position assumed when the switch is trailed;

Fig. 3 is a plan view of the structure shown in Fig. 2, certain of the parts being broken away;

Fig. 4 is a section taken along the line 4—4 of Fig. 3, viewed in the direction of the arrows;

Fig. 5 is a section along the line 5—5 of Fig. 4, viewed in the direction of the arrows;

Fig. 6 is a diagrammatic representation of the control devices and circuits for the switch machine of the present invention, together with a section of trackway provided with a track switch and with circuits and devices for its operation;

Fig. 7 is a diagrammatic representation of a modified system of control for the switch machine of the present invention, using a local source of energy controlled from a remote point.

Referring to Fig. 1, the switch machine of the present invention comprises a power supply means, circuit controlling means, and two throw-bar operating members which are nor-

mally relatively fixed, but are relatively movable when the switch points are trailed.

The power for operating the switch machine is supplied by a suitable electric motor, conventionally represented at 1, which drives a friction clutch 2 through the bevel gears 3 as shown. The clutch 2 may be of any suitable construction and is preferably adjustable to slip at different loads. The friction clutch 2 is connected through a gear train 4, 5, and 6 to the main gear M of the switch machine. The main gear M is of special construction, having gear teeth cut about a little more than one-half of its circumference, and carrying three vertically spaced cams 7, 8 and 9 on the remainder of its circumference. The cam 8 has two levels, a long lower portion 8^a and a short elevated end portion 8^b. Three cam followers 10, 11 and 12 are pivotally arranged on the rod 13 to engage the cams 7, 8 and 9 respectively, the followers 10 and 11 being made integral or otherwise rigidly connected at their pivot point, and operating a lever 14, while the follower 12 is shifted about the same rod 13 and operates a lever 15.

The main gear M is provided with a downwardly extending rod or pin 16 carrying a roller 17 on its lower end. This roller 17 engages the inner cam surface 18 of a sector operating lever L which is normally connected to a throw-bar operating sector S, the lever L and the sector S being pivoted substantially at their midpoints about the bushing 21 carried by the pin 22 which is secured to the base 23 of the switch machine housing as shown in Fig. 4. As most clearly shown in Figs. 2 through 5, the lever L consists of two members, an upper member 24 and a lower member 25, which members lie on either side of the sector S and are rigidly connected by the screw bolts 26 and 27. The upper member 24 of the lever L extends in a portion 28 which ends in a cam 29, while the lower member 25 extends only to the pivot pin 22 as most clearly shown in Fig. 4. The members 24 and 25 are provided with substantially rectangular aligned openings 30 and 31 near their free ends, and a movable block 32 is slidably carried between the members, having vertical extensions 33 and 34 which fit the openings 30 and 31, and horizontal extensions 35 and 36 which extend between the members 24 and 25 as most clearly shown in Fig. 5. The block 32 is bifurcated and carries a roller 37 rotatably mounted on a pin 38 which passes vertically through the block 32 as shown. Two heavy coiled springs 39 are carried by the members 24 and 25, fitting into the channels or grooves 40 therein and bearing against the block 32 in such a manner as to force this block outwardly away from the pin 22.

The throw-bar operating sector S consists of an operating arm 41 terminated in an open slot 42, and a hollow sector-like portion, comprising diverging legs 43 and a cam portion 44. The slot 42 engages a pin 45, secured to the throw bar 46, which is connected to the switch points 47, this connection being represented by a dot-and-dash line. The inner surface of the cam portion 44 is shaped in an irregular manner, having a comparatively deep central notch or depression 48, located at the axial center of the sector S and two other more shallow notches 49 and 50, located near the ends of the cam portion 44. The roller 37 of the lever L is forced against the inner surface of the cam 44 by the springs 39 and in this manner the throw-bar operating sector S and the sector operating lever L are rigidly connected to move as a single unit about the pin 22 under normal operating conditions. When a given force is exerted on the operating arm 41 of the sector S, the lever L being held stationary by the roller 17 bearing against the cam surface 18, the roller 37 is forced out of the notch 48 in the cam portion 44 and the lever L and sector S are thrown out of alignment, the roller 37 falling into one of the depressions 49 or 50 at one end of the cam portion 44 as shown in Fig. 2. The lever L and the sector S are now held in this relative position by the pressure of the springs 39 holding the roller 37 in one of the depressions 49 or 50.

Referring again to Fig. 1, a contact operating cam 52 is secured to the edge of the cam portion 44 of the sector S by means of the screws 53, and consists of a slotted metal block having the two extreme ends of its slot 54 arranged at different distances from the axis of rotation of the sector S, and the remaining central portion of this slot radially arranged with respect to said axis. A follower pin 55 engages the slot 54 and operates a bell crank lever 56 which is pivoted at the point 57 and carries a pin 58 at its free end. This pin 58 engages the slotted end 59 of a rod 60 which is connected to a movable insulated contact block 61 as shown. The slot in the rod 60 is of such a size that the initial movement of the sector S and the consequent initial movement of the bell crank lever 56 acts only to take up the lost motion between the pin 58 and the slot 59, while the final movement of the bell crank lever 56 as the sector S comes to its extreme position causes the contact block 61 to be moved to its opposite position. In place of the slotted rod 60, a snap or toggle mechanism may be used, such mechanism being preferably made adjustable as to the point of the stroke at which the block 61 is shifted. The contact block 61 carries a metallic contact strip 62 which engages the stationary contacts 63, 64 and 65 to control various circuits as hereinafter described.

Two other insulated contact blocks 66 and 67 are provided, being operated by the levers

15 and 14 through the rods 68 and 69 respectively as shown. The contact block 66 is returned to one of its extreme positions by means of the spring 70 connected to the lever 15. The contact block 67 has a second operating means comprising the rod 71 and the lever 72 which is pivoted at 73 and connected by links 74 and 75 to the armatures 76 of the pole-changing magnets 77 and 78.

Referring now to the trackway devices and operating circuits as shown in Fig. 6, a section of trackway comprising the rails 79 and having a track switch SW therein has been shown. A detector track circuit current flows in the track rails between the insulating joints 80 and 81, being supplied from the battery 82 or 83 through the following circuit:—from the battery 82 through wire 84, stationary contact 64, movable contact 62 and stationary contact 65, wire 85 to the track rail 79, wire 86, winding of the track relay T, wire 87, track rail 79 and wire 88 to the battery 82. It is obvious that if the movable contact member 62 is in its reverse or upper position, the polarity of the current supplied to the detector track circuit is reversed, being then supplied by the battery 83 through the wire 89, stationary contact 63, and the circuit just traced. The track relay T, which is connected across the track rails at the entrance end of the detector track circuit, may be of any suitable type, but in the embodiment shown is of the polarized direct current type.

The switch machine of the present invention may be operated by the usual control circuits and switches located in a tower or other convenient point, but in the particular embodiment shown, the control means takes the form of special apparatus for controlling the switch machine operation in part manually and in part automatically in accordance with the occupancy of the detector track circuit. This apparatus consists of a switch machine control O which is conveniently located in a tower or other suitable centralized control point and comprises a cabinet or casing 90 carrying an operating handle 91 which is pivotally mounted on the shaft 92. The operating handle 91 carries a downwardly extending lever 93 which is connected by the link 94 to the switch lever 95, carrying the insulated movable contacts 96, 97 and 98 which operate to open and close control circuits as hereinafter described. Although the switch lever 95 has been disclosed as directly connected to the operating handle 91, it should be understood that a snap toggle connection might be used, thus preventing the operator from leaving this lever in its midposition, a suitable arrangement of this type being shown and described in the application of W. K Howe, Ser. No. 653,220, filed July 23, 1923. A disc 99 is rotatably mounted on the shaft 92 adjacent to the operating handle 91, this disc being provided with a stop or extension 100, a crank or operating arm 101, and a notch 102 arranged as shown. The operating arm 101 is movably connected by a slotted link 103 to a fixed pivot 104, the link 103 being provided with a spring 105, the opposite ends of which bear against a stop 106, and the arm 101, respectively, the pressure of this spring 105 acting to hold the disc 99 in the position shown. A locking lever 107 is also secured to the fixed pivot 104, and is provided with a roller 108, adapted to engage the stop 100 of the disc 99 when this disc is turned to a given position, the operation of this locking lever 107 being controllable by the magnet 109 and the handle 110. The operating handle 91 is of hollow construction and is provided with a push button 111, connected by a rod 112 to a pin 113, this pin and push button being normally maintained in the position shown by means of the spring 114. The pin 113 extends outwardly through the opening 115 in the side of the handle 91, and when the push button 111 is depressed, the pin 113 engages the slot 102 in the disc 99. An arcuate stop member 116 is secured to the casing 90, lying concentric with respect to the disc 99 and serving to maintain the pin 113 in engagement with the slot 102 when the operating handle 91 is drawn downwardly. It is evident that when the push button 111 is depressed and the operating handle 91 down to its lower position, the disc 99 is turned, the spring 105 is compressed and the roller 108 of the locking lever 107 engages the stop or extension 100 on the disc, thus holding the disc 99 and the handle 91 in one extreme position until the locking lever 107 is lifted clear of the stop 100 by means of the magnet 109 or the handle 110; whereupon the spring 105 returns the disc 99 together with the operating handle 91 to the initial position shown.

For the purpose of indicating to the tower man or operator the position of the switch points controlled by a given operating handle 91, small indicator lamps R and N are provided, being suitably mounted in the casing 90 above or near the operating handle 91 with which they correspond. These indicators designate the position of the switch points by means of distinctive colors, letters or other suitable indicia.

A double current relay D of the type now common in interlocking and switch machine practice is provided in connection with the switch machine control and acts to prevent the switch points from being thrown under a car. This relay D is provided with two windings 117 and 118 of high and low resistance respectively. As this relay is fully disclosed and described in the application of W. K. Howe, Serial Number 653,220, filed July 25, 1923, a more detailed description of its construction and operation will not be given.

Operation (Figs. 1 to 6)

The switch machine and operating circuits have been shown in Fig. 6, the switch machine being conventionally represented, and its essential circuit controlling elements and current carrying devices being separately shown. The circuit controlling apparatus has been shown as located near the entrance end of the detector track circuit, but it is assumed that this apparatus may be located at any convenient point and that the control wires from the track relay T and the switch machine will lead to this point, so obtaining centralized control.

Referring now to the operation of the switch machine and its control system in switching a car from the main line trackway to a siding, assume that the controls and devices are in their normal positions as shown in Fig. 6, that is, with the switch points set for car travel along the main line trackway, and that a car is approaching the entrance end of the detector track circuit, being propelled by gravity as is customary in "hump" yard operation. The operator, wishing to transfer this car into the siding H, pulls down the operating handle 91 before the car reaches the detector track circuit, throwing the switch lever at 95 to the left, and the high resistance winding 117 of the double current relay D is energized through the following circuit:—from the negative terminal of the battery 119, through wires 120 and 121, contact finger 122, and front contact of the track relay T, wire 123, winding 117 of the double current relay D, wires 124 and 125, winding 118 of the double current relay D, wire 126, stationary contact 127, movable contact 97 and stationary contact 128 of the switch lever 95, wires 129 and 130, stationary contact 131, movable contact 132, and stationary contact 133 of the switch machine, wire 134, armature 19 of the switch machine operating motor 1, wire 135, stationary contact 136, movable contact 137 and stationary contact 138 of the switch machine, wire 139, field winding 140 of the switch machine operating motor, and wires 141 and 142 to the positive terminal of the battery 119. The current flowing through the high resistance winding 117 and the armature and field windings of the switch machine motor in the circuit just traced, is not sufficient to operate the motor, but acts to attract the contact finger 143 of the double current relay D, completing a circuit through this contact finger and the low resistance winding 118, which circuit may be traced as follows:—from the negative terminal of the battery 119, wires 120 and 144, front contact and contact finger 143 of the double current relay D, wires 252 and 125, low resistance winding 118 of the double current relay D, wire 126, stationary contact 127, movable contact 97 and stationary contact 128 of the switch lever 95, wires 128 and 130, stationary contact 131, movable contact 132 and stationary contact 133 of the switch machine, wire 134, armature winding 19 of the switch machine operating motor 1, wire 135, stationary contact 136, movable contact 137, stationary contact 138, wire 139, field winding 140 of the switch machine operating motor 1, and wires 141 and 142 to the positive terminal of the battery 119. The current flowing in the circuit through the low resistance winding 118, just traced, is of sufficient value to operate the motor 1 of the switch machine, which drives the main gear M through the friction clutch 2 and the gear train 4, 5 and 6, moving the roller 17 on the cam surface 18 of the sector operating lever L. Soon after the main gear M starts to rotate, the cam 8 on the surface of this gear allows the cam follower 12 to drop to the lower portion 8^a, being forced by the spring 70 connected to the arm 15 of this cam follower, thus bringing the movable contact block 66 with its U-shaped movable contact member 145 to its central position, in which it engages the stationary contacts 146, 147, 148 and 149 to thus permit reversal of the motor during its operation cycle, as explained below.

The pole changing magnets 77 are energized through the following circuit:—from the positive terminal of the battery 119, wires 142, 141, 155 and 156, the windings of the pole changing magnets 77, wire 157, stationary contact 149 movable contact 145 and stationary contact 148, wires 158, 130 and 129, stationary contact 128, movable contact 97 and stationary contact 127 of switch lever 95, wire 126, low resistance winding 118 of the double current relay D, wires 125 and 252, contact finger 143 and front contact of the relay D, and wires 144 and 120 to the negative terminal of the battery 119. This energization of the pole changing magnets 77 causes their armatures 76 to be held up, so holding the contact block 67 in its lower position and maintaining the motor operating circuits closed until the end of the stroke. As movement of the throw-bar operating sector S is initiated, the cam 52 moves the lever 56 through the follower 55, this initial motion serving to take up the lost motion between the bell crank lever 56 and the slotted arm 60. The initial movement of the operating sector S therefore has no effect on the contact block 61.

During the initial movement of the main gear M and the initial operation of the contact block 66 just described, the roller 17 of the main gear bears against that portion of the cam surface 18 which is concentric with respect to the main gear M, which portion lies between the points 150 and 151 of this cam surface 18. As the roller 17 traverses this concentric portion, the lever L is

not moved, consequently the motor 1 does no appreciable work and acquires a high speed, but when the roller 17 engages the slotted portion 152 of the cam surface 18, the lever L is moved, carrying the sector S, connected thereto by the engagement of the roller 37 in the notch 48, and so shifting the switch points through the throw bar 46 to the reverse or turnout position. After the stroke of the switch points is completed, the roller 17 again passes into the concentric portion of the cam surface 18, allowing the motor and gearing to run free. The cam follower 12 now disengages lower portion 8a of the cam 8 on the main gear M, and the lever 15 is moved by the spring 70, shifting the contact 145 to disengage the stationary contact 148 and 149 and to engage the stationary contacts 146 and 147, and so breaking the energizing circuit to the pole changing magnets 77, just traced above. Immediately after the cam follower 12 disengages the cam 8, the cam 7 engages the cam follower 10, moving the lever 14 and shifting the contact block 67 to its upper position, thus causing the movable contact members 132 and 137 to disengage the stationary contacts 131, 133 and 136 and to engage the stationary contacts 152, 153 and 154, breaking the energizing circuit for the windings 117 and 118 of the double current relay and for the armature 19 and field winding 140 of the motor 1, which circuits have been traced above.

In the operation of the switch points by the motor, the moving mechanism of the switch machine acquires considerable velocity which maintains these moving parts in motion during the free run of the roller 17 in the concentric portion of the cam surface 18 after the stroke of the switch points 47 is completed. This free run of the switch machine mechanism is likely to cause injurious slamming of the parts when the roller 17 engages the end of the cam surface 18, causing excessive wear and possibly breakage of the mechanism. In order to avoid this injurious slamming, the switch machine control circuits have been arranged to short-circuit the armature and field windings 19 and 140 of the motor 1 during this free run of the mechanism, thus causing a well-known dynamic braking effect in the motor. This snubbing or dynamic braking circuit is closed by the engagement of the movable contacts 132 and 137 of the movable contact block 67, with the stationary contacts 138, 152, 153 and 154, the contact block 67 being moved to its upper position after the completion of the stroke of the switch points, as described above. The snubbing circuit completed at the end of the switch operation from normal to reverse position may be traced as follows:—from the field winding 140, wire 139, stationary contact 138, movable contact 137 and stationary contact 152, wires 159 and 134, armature winding 19, wires 135 and 160, stationary contact 153, movable contact 132, and stationary contact 154, wires 161 and 162, stationary contact 163, movable contact 98 and stationary contact 164 of the switch lever 95, wires 165, 166, and 141 to the field winding 140 of the motor 1. If desired, the current generated by the free run of the motor may be used to energize indication lights, to operate a relay or to indicate in any other suitable manner that the switch machine has operated.

As the stroke of the switch points is completed, the cam 52 moves the bell crank lever 56 through the cam follower 55 to a position to move the movable contact block 61 to engage the stationary contacts 63 and 65. This reverses the polarity of the current applied to the track circuit, this current now being supplied from the battery 83 through the wires 89, 85 and 88 as clearly shown in the drawings. This reversal of the polarity of the detector track circuit current causes the track relay T to swing its movable contact finger 166 to the reverse position, energizing the reverse indication light R from the battery 167 through a circuit which is obvious from the drawings. The illumination of the reverse indication light R informs the switch operator that the switch points have completed their stroke to the reverse position.

With the switch points thus thrown, the car under consideration may pass into the siding H.

It should be noted that if the car has entered the detector track circuit before the switch lever 95 is thrown, the energizing circuits for the high resistance winding 117 of the double current relay D can not be completed because of the fact that the front contact 122 of the track relay T which contact is included in this circuit is opened by the de-energization of this track relay when a car shunts the track rails. Under these circumstances, the contact finger 143 of the double current relay D can not be attracted, and for this reason operating current can not be supplied to the motor and the switch points can not be moved. If, however, the operator throws the switch lever 95 with the detector track circuit clear, and a car enters the detector track circuit before the switch points 47 have completed their stroke, the motor 1 continues to operate and completes the stroke, the energy for the double current relay D and the motor 1 being supplied through the front contact of finger 143 of the double current relay and a circuit which has been traced above. In this manner the possibility of the switch points being left stationary in mid stroke under any circumstances is avoided.

After the car under consideration has passed into the siding H and has left, the op-

erator may again set the switch points to their normal position by raising the operating handle 91 to the normal position as shown in Fig. 6, thus moving the switch lever 95 to the right. If the track circuit is clear when the switch lever 95 is thrown, the high resistance winding 117 of the double current relay D is energized through the following circuit:—from the negative terminal of the battery 119, wires 120 and 121, contact finger 122 and front contact of the track relay T, wire 123, high resistance winding 117, wires 124 and 125, low resistance winding 118, wires 126 and 168, stationary contact 169, movable contact 98 and stationary contact 170 of the switch lever 95, wire 161, stationary contact 154, movable contact 132 and stationary contact 153 of the movable contact block 67, wires 160 and 135, armature 19 of the motor 1, wires 134 and 159, stationary contact 152, movable contact 137 and stationary contact 138 of the movable contact block 67, wire 139, field winding 140 of the motor 1, and wires 141 and 142 to the positive terminal of the battery 119. The double current relay D now attracts its contact finger 143, completing an energizing circuit for the motor 1 through this contact finger and the low resistance winding 118 of this relay, this circuit being traceable as follows:—from the negative terminal of the battery 119, wires 120 and 144, front contact and movable contact finger 143 of the double current relay D, wires 252 and 125, low resistance winding 118, wires 126 and 168, stationary contact 169, movable contact 98 and stationary contact 170 of the switch lever 95, wire 161, stationary contact 154, movable contact 132 and stationary contact 153, wires 160 and 135, armature winding 19 of the motor 1, wires 134 and 159, stationary contact 152, movable contact 137 and stationary contact 138, wire 139 field winding 140 of the motor 1, and wires 141 and 142 to the positive terminal of the battery 119. As the motor starts, the cams 8 and 52 move the cam followers 12 and 55 respectively, shifting the contact block 66 to its mid-position to energize pole changes 78 from battery 119, so as to hold contacts 132, 137 in their upper position, to maintain the motor circuit, and taking up the lost motion between the slotted bar 60 and the bell crank lever 56, as described in connection with the operation of the switch machine from normal to reverse. The roller 17 engages the slotted portion 152 of the cam surface 18 and moves the lever L, the sector S and the throw bar 46 and switch points 47 to the normal position. The contact blocks 61, 66 and 67 are shifted to their lower positions as the motor and other operating mechanism run free, to break the circuit through pole changer magnet 78, and the motor energizing circuit is broken as before and a snubbing circuit, short-circuiting the armature and field windings of the motor to produce a dynamic braking effect is completed, which circuit may be traced as follows:—from the field winding 140 of the motor 1, wire 139, stationary contact 138, movable contact 137 and stationary contact 136 of the movable contact block 67, wire 135, armature 19 of the motor 1, wire 134, stationary contact 133, movable contact 132 and stationary contact 131 of the block 67, wire 130, stationary contact 171, movable contact 97 and stationary contact 172 of the switch lever 95, wires 166 and 141 to the field winding 140 of the motor 1. The polarity of the detector track circuit current is reversed by the movable contact 62, causing the track relay T to swing its finger 166 to the normal position, and illuminating the normal indication light N through a circuit which is obvious from the drawings.

It should be noted that after the switch points have completed their stroke and roller 17 of the main gear M is bearing against the concentric portion of the cam surface 18, the sector operating lever L is locked in position to maintain the switch points 47 thrown by the relative positions of the roller 17 and the cam surface 18. This locking relation secures the switch points 47 in their thrown position and prevents the points from becoming jarred or otherwise moved to a mid-position.

In hump yard practice, it often happens that a lump of coal, a piece of ice or other obstruction becomes lodged between the switch points, preventing the completion of their stroke. In order to dislodge such obstruction and for various other reasons it sometimes becomes necessary for the switch operator to reverse the motion of the switch points in midstroke, providing the detector track circuit is unoccupied. Assume that the operator has initiated a switch movement from normal to reverse position, and that when such movement is partially completed he wishes to bring the switch points back to normal. The operating handle 91 is returned to its upper or normal position, moving the switch lever 95 to the right and a circuit is immediately completed energizing the pole changing coils 78, which circuit may be traced as follows:—from the negative terminal of the battery 119, wires 120 and 144, front contact and contact finger 143 of the relay D, wires 252 and 125, low resistance winding 118 of the relay D, wires 126 and 168, stationary contact 169, movable contact 98 and stationary contact 170 of the switch lever 95, wires 161 and 173, stationary contact 147, movable contact 145 and stationary contact 146 of the block 66, wire 174, pole changing magnets 78, wires 155, 141 and 142 to the positive terminal of the battery 119. It should be noted that this energization of the pole changing magnets 78 may be completed at any point of the stroke for the reason that the movable contact member 145 is in a position to engage the stationary contacts 146, 147, 148 and 149

at all intermediate positions of the switch points between the full normal and full reverse positions. With the pole changing magnets 78 energized, the armatures 76 are drawn into their lower position, moving the contact block 67 to its upper position and completing a circuit to the field and armature of the motor 1 which will cause the switch points 47 to be returned to their normal position, the motor energizing circuit having been traced above in connection with the usual return of the switch points to normal. When the switch machine is in its mid-stroke position, the cam followers 10 and 11 are entirely free from their cams 7 and 9, and for this reason the pole changing magnets may move the contact block 67 without opposition.

From the foregoing description it is evident that reversibility of the switch points is provided at any point in their operation, provided the detector track circuit is unoccupied, this feature being accomplished by means of the pole changer magnets 77 and 78. In certain installations, however, such a refined degree of reversibility is not thought necessary, and in such cases the pole changer magnets with their associated levers 71, 72, 74 and 77, and the contact block 66 with its operating mechanism may be omitted from the switch machine structure, a limited amount of reversibility being provided by the separable connection between the sector operating lever L and the throw-bar operating sector S. When the pole changer magnets are omitted, the friction clutch 2 is tightened or omitted altogether, so that the torque exerted by the main gear M on the lever L is sufficient to force the roller 37 out of the central notch 48 in the cam portion 44 of the sector S. When the switch points encounter an obstruction during their stroke, the roller 37 is forced out of the notch 48 and traverses the cam portion 44 in one direction or another, depending upon the direction in which the switch points are being thrown. The main gear M now completes its cycle of operation, and the movable contact block 67 is moved to its reverse position during the final movement of the main gear as described above. As the roller 37 passes the high point of the cam surface 44 and moves toward the end notch 49 or 50, the sector S is forced back to its original position by the presence of the springs 39 forcing the roller 37 into the end notch. The contact block 61 is not moved, as the motion of the lever 56 as the sector S is started and then returned to its initial position acts only to take up the lost motion between the pin 58 and the slotted arm 60. The operator is apprised of the fact that the switch points have not completed their stroke by reason of the inconsistency between the illumination of the indication lights N and R and the position of the operating handle 91, the normal indication lamp N remaining illuminated after handle 91 has been moved to the reverse position, or the reverse indication lamp R remaining illuminated after handle 91 has been moved to the normal position. The operator may now reverse the operating handle, completing the energizing circuits to reverse the motor through the contacts of the block 67 as described above, and moving the lever L back to its opposite position. When the roller 37 reaches the center of the cam portion 44 of the sector S, the springs 39 force this roller into the notch 48, and the lever L is thus secured to the sector S. As the return stroke of the lever L is completed, the movable contact block 67 is shifted by one of the cams 7 or 9, reversing the connections to the motor windings, and permitting the operator to initiate a second switch operation and so endeavor to remove the obstruction to the points.

In making up trains or classifying cars in humpyards, it is customary to start several separate cars down a main trunk trackway, these cars being propelled by gravity and moving with an interval of several car lengths between them. These cars are then switched onto the proper sidings, the car intended for a given siding being selected by the operator and the switch being returned to normal to allow the remainder of the cars to pass on along the main track as soon as the car under consideration has cleared the switch points. It is obvious that the switch operator must be very alert and quick in returning the switch points, in order to maintain the following cars on the main trackway. In order to facilitate this classification of cars, the present switch operating system provides a means for automatically returning the switch points to their normal position as soon as a given car has left the detector track circuit. If the operator desires the switch points to be returned to their normal position automatically, he depresses the push button 111 before drawing the operating handle 91 to its lower position in setting the switch under consideration for the turn-out move. If the push button 111 is depressed as the operating handle 91 is drawn down, the disc 99 is carried with the operating handle 91 by the engagement of the pin 113 in the slot 102, and the spring 105 is compressed. When the operating handle 91 has been fully drawn down the locking lever 107 drops to its lower position, placing the roller 108 behind the stop member 100, thus locking the disc 99 in the reverse position with the spring 105 compressed. The switch machine is then operated to move the switch points 47 to their reverse or turn-out position in the manner described above. The car intended for the siding H now enters the detector track circuit, shunting the track rails and de-energizing the track relay T. With the track re-

lay T de-energized, its contact fingers 175 and 176 are retracted and an energizing circuit for the stick relay K is completed, this circuit being traceable as follows:—from the battery terminal B, stationary contact 177, movable contact 96 and stationary contact 178 of the switch lever 95, wires 179 and 180, back contact and contact finger 175 of the track relay T, wires 181 and 182 and the winding of the stick relay K to the battery terminal C. Once energized and picked up, the stick relay K will be maintained in this energized condition through the following stick circuit:—from the battery terminal B, stationary contact 177, movable contact 96 and stationary contact 178 of the switch lever 95, wires 179 and 183, front contact and contact finger 184 of the stick relay K, wires 185 and 182 and the winding of the stick relay K to the battery terminal C. As soon as the car under consideration has passed the insulating joint 80 at the exit end of the detector track circuit, the track relay T will again be energized, attracting its contact fingers 175 and 176. An energizing circuit for the locking lever magnet 109 is now completed, which circuit may be traced as follows:—from the battery terminal B, stationary contact 177, movable contact 96 and stationary contact 178 of the switch lever 95, wires 179 and 186, front contact and contact finger 176 of the track relay T, wire 187, front contact and contact finger 188 of the stick relay K, wire 189 and the winding of the magnet 109 to the battery terminal C. The energizing of the magnet 109 lifts the locking lever 107, disengaging the roller 108 and the stop member 100 of the disc 99 and so permitting the spring 105 to return the disc 99 together with the operating handle 91 to the normal operating position. The switch machine and switch points are now returned to the normal position in the manner described above and the track is now ready to receive the following cars on the main line trackway. A manual control 110 is provided to release the roller 108 from the stop 100, this manual control being provided to permit the operator to return the switch points to normal before the car enters the track circuit after an error has been made in setting the switch points.

In the particular embodiment shown, the insulating joint 80 at the exit end of the detector track circuit is slightly in advance of the switch points, and for this reason, power might be applied to the switch machine to move the points while the car wheels were still between the points and opposing this motion. In order to prevent damage to the switch machine mechanism under these circumstances, as well as in a case where an obstruction becomes lodged between the switch points, the friction clutch 2, which is located between operating motor 1 and the main gear M is provided, and allows the motor to continue to run without excessive strain or rupture of the moving parts when the switch points become jammed or locked for the reasons described above.

In a switch machine in which the friction clutch is tightened or omitted, as described above in connection with a simplified manner of obtaining reversibility, if a car wheel is encountered by the switch points, the roller 37 will be forced out of the notch 48, and the operator will have to change the position of the operating handle 91, return the lever L and pick up the sector S before completing the interrupted stroke of the switch points.

In certain switching operations such as in bringing a car from a siding on the main trackway it becomes necessary to trail the switch points, that is, to force the switch points from one position to another by means of the car wheels, thus in effect throwing the switch by the motion of the car. This is accomplished in the present invention without excessive strain or slamming of the moving parts by means of the connection between the throw bar operating sector S and the sector operating lever L. With the switch points thrown to one extreme position, the sector operating lever L is locked against movement by the engagement of the roller 17 and the cam surface 18 of the lever L as described above. As the switch points 47 are forced over the car wheels, the throw bar operating sector S is moving relative to the sector operating lever L, the roller 37 being forced out of the notch 48, traversing the surface of the operating sector and engaging one of the notches 49 or 50 at the end of the sector, depending on the direction in which the switch is trailed. The relative positions of the throw bar operating sector S and the sector operating lever L are clearly shown in Fig. 2, this being the position assumed by these members when the switch is trailed. The engagement of the roller 37 with the notch 49 or 50 maintains a relatively secure connection between the sector S and the lever L, thus securing the switch points 47 in their thrown position against misplacement due to vibration or any other cause.

When the switch points are trailed, the cam 52 moves the bell crank lever 56 through the cam follower 55, thus shifting the contact block and movable contact members 61 and 62 to their reverse position. This reverses the polarity of the detector track circuit current, reversing the track relay T and illuminating the reverse indication light R as described above, thus informing the switch operator that the switch has been trailed. The fact that a given switch has been trailed may be readily determined by the fact that the indication light will indicate the reverse position from the position of the operating handle 91, that is, the reverse indication light R

will be illuminated when the operating handle 91 is in its normal position, or the normal indicating light N will be illuminated when the operating handle 91 is in its reverse position. After the switch has been trailed and the car or cars have cleared the points and the detector track circuit, the operator may reset the switch machine mechanism by reversing the position of the operating handle 91. The motor will now be energized through circuits which have been traced above and the sector operating lever L will be swung by the main gear M through the roller 17, forcing the roller 37 out of the notch 49 or 50, across the cam surface 44 of the sector S and into the notch 48. The relation between the throw bar operating sector S and the sector operating lever L is now normal as shown in Fig. 1, and the operator may move the switch to either position in the manner described above.

When the switch points are trailed, if the friction clutch 2 be set to slip before the levers L and S separate as described above, the motor armature does not rotate, but drum M is found to go through its cycle, and thus make up the contacts 137, 132 and 145 so that with switch arm 95 in its normal position, as shown in Fig. 6, the switch points will be automatically returned to main line position, by the motor 1, after the switch is cleared.

The switch machine of the present invention is readily adaptable for use in connection with a local source of energy and a remote control, this arrangement being particularly desirable in large classification yards or interlocking plants where some of the switches are located at a comparatively great distance from the control point, and where the voltage drop in the operating wires would be prohibitive if the source of energy were located at the control points.

In Fig. 7, an arrangement for obtaining remote control in connection with the switch machine of the present invention has been shown. In this arrangement, the switch machine shown in Figs. 1 to 5 is slightly modified by disconnecting the contact block 67, carrying the movable contacts 137 and 132, from the pole changer magnet armature, by changing the design of contact 145 to a straight bar form 145′ and by installing two additional insulated movable contacts 253 and 254 with cooperating stationary contacts 255, 256, 257, 258, 259, 260, 261 and 262; the movable contacts 253 and 254 being operated by the pole changer magnets 77 and 78. In this case, the friction clutch 2 is tightened or altogether omitted.

Any suitable switch may be used to control the operation of the switch machine, and in Fig. 7, a simplified operating switch comprising a movable contact lever 263 connected by a link 264 to an operating handle 265 has been shown. It should be understood that an operating handle incorporating the automatic return feature shown in Fig. 6 might be used in this system, and that the contact lever 263 might be operated by a toggle connection if desired. The casing 266 carrying the controlling mechanism has been shown equipped with the usual indication lights R and N, the energizing of which is controlled in accordance with the position of the contact finger 267 of the track relay T in the same manner as the indication control shown and described in connection with Fig. 6.

As the construction of the switch machine, the detector track circuit and its associated devices, and the operating switch shown in Fig. 7, is substantially the same as that of the equivalent devices described in connection with Fig. 6, and hence a further description of the constructional details of these elements will be dispensed with, and the operation of this modified system will be described.

With the track switch SW in the normal or main line position as shown, assume first that the operator wishes to throw the track switch to its reverse position, the detector track circuit being unoccupied. The operating handle 265 is drawn downward to its lowest position, moving the contact lever 263 to its left hand position, and a circuit is completed for energizing the pole changer magnets 77, which circuit may be traced as follows:—from the positive terminal of the battery 268, contact finger 269 and front contact of the track relay T, wire 270, stationary contact 271, movable contact 272, and stationary contact 273 of the contact lever 263, wires 274 and 275, pole changer magnet 77, wire 276, stationary contact 148, movable contact 145 and stationary contact 149, wires 277, 278 and 279 to the negative terminal of the battery 268. The energization of the pole changer magnet 77 immediately moves the contacts 253 and 254 to their opposite or upper positions, thus closing the reverse energizing circuit for the switch machine motor, which circuit may be traced as follows—from the positive terminal of the battery 280, wire 281, stationary contact 257, movable contact 253 and stationary contact 258, wires 282 and 283, stationary contact 131, movable contact 132 and stationary contact 133, wires 159 and 284, armature winding 19 of the switch machine motor, wire 285, stationary contact 136, movable contact 137 and stationary contact 138, wire 286, field winding 140 of the switch machine motor, and wire 287 and 288 to the negative terminal of the battery 280. The switch machine motor now operates in a direction to move the switch points to their reverse position, the final movement of the main gear M acting to shift the movable contacts 137, 132 and 145′ to their upper positions, and the cam slot on the sector S shifting the movable contact 62 to its upper position. A snubbing circuit for the

motor is now completed, which circuit may be traced as follows:—from the armature 19 of the switch machine motor, wire 284, stationary contact 152, movable contact 137 and stationary contact 138, wire 267, field winding 140 of the switch machine motor, wire 287, stationary contact 256, movable contact 254, and stationary contact 255, wire 289, stationary contact 154, movable contact 132 and stationary contact 153, wires 160 and 285 to the armature 19 of the switch machine motor. It should be noted that this snubbing circuit is localized in the switch machine, and that the resistance of this circuit is therefore not dependent upon the length of the control wires and is equally effective in all locations of the switch machines.

When the movable contact 62 shifts, the polarity of the track circuit current is reversed in the manner described in connection with Fig. 6, thus reversing the position of the contact finger 267 of the track relay T and energizing the reverse indication light R through an obvious circuit.

After the switching operation is completed, and the operator wishes to return the switch points to normal, the operating handle 265 is returned to its upper position, swinging the contact lever 263 to the right. An energizing circuit for the contact changer magnets 78 is now completed, which circuit may be traced as follows:—from the positive terminal of the battery 268, contact finger 269 and front contact of the track relay T, wires 270 and 290, stationary contact 291, movable contact 292 and stationary contact 293 of the contact lever 263, wire 294, pole changer magnets 78, wire 295, stationary contact 147, movable contact 145′ and stationary contact 149, wires 277, 278 and 279 to the negative terminal of the battery 268. When the pole changer magnets 78 are energized, the movable contacts 253 and 254 are moved to their lower positions and a normal energizing circuit for the switch machine motor is completed, causing the motor to run in a direction to return the switch points to normal. This normal energizing circuit may be traced as follows:—from the positive terminal of the battery 280, wires 281 and 296, stationary contact 260, movable contact 254 and stationary contact 259, wires 297 and 289, stationary contact 154, movable contact 132 and stationary contact 155, wires 160 and 285, armature winding 19 of the switch machine motor, wire 284, stationary contact 152, movable contact 137 and stationary contact 138, wire 268, field winding 140 of the switch machine motor and wires 287 and 288 to the negative terminal of the battery 280. Upon the completion of the return stroke of the switch points to normal, the movable contacts 137, 132, 145′ and 62 are shifted to their lower positions, the polarity of the track circuit current is reversed and the following snubbing circuit for the motor is completed:—from the armature 19 of the switch machine motor, wires 284 and 159, stationary contact 133 movable contact 132 and stationary contact 131, wire 283, stationary contact 262, movable contact 253 and stationary contact 261, wires 298 and 287, field winding 140 of the switch machine motor, wire 286, stationary contact 138, movable contact 137 and stationary contact 136 and wire 285 to the armature winding 19 of the switch machine motor.

In addition to the fact that an economy in wiring and in power consumed is effected by the use of the system shown in Fig. 7, this system has the further advantage of giving all the protection afforded by the use of the double current relay D, shown in Fig. 6, without the use of this relay. It will be observed that when the operator draws the operating handle 265 after a vehicle has entered the detector track circuit, the track relay T is de-energized, its contact finger 269 is retracted and no current is supplied to the pole changer magnets 77 or 78, and consequently the switch machine does not operate. If, however, the operator draws the handle 265 just before a vehicle enters the track circuit, and the track relay T drops before the switch points have completed their stroke, the switch machine will continue to operate until the stroke is completed, the motor operating circuit having been closed by the pole changer magnets, and the de-energization of the track relay T having no effect upon these circuits. In other words, if the track circuit is occupied, the pole changer magnets can not be energized, but once these magnets are energized and their contacts 253 and 254 are shifted, the switch machine motor will operate for a complete stroke regardless of the occupancy of the detector track circuit, and the possibility of the switch points being left in a mid position is avoided.

In the event of the switch points being trailed, the operation and the manipulation is the same as for the form shown in Fig. 6.

From the description given it can be seen that a simple and efficient system has been provided for operating by power from a central control point the switches of a classification or "hump" yard, which system incorporates means for permitting the switches to be rapidly controlled, for permitting the switch points to be trailed without injury to the operating mechanism, for operating the switches automatically in accordance with the energization of the track circuits and simplified means for indicating the position and operation of the switch points. Various signal and control means and devices, well known in the art, might be used in conjunction with the specific devices disclosed without departing from the spirit of the invention, the description and disclosure of

such means being omitted for the sake of simplicity. For instance, pot signals and various other signals might be used in conjunction with the switch machine and switches for indicating the position of the switch points to the engineers and train crews, such signals being controlled from the operating tower or from the switch machine proper, and many other features and refinements might be added. As the devices of the present invention have been described in a rather specific manner and in connection with a rather specific system, it should be clearly understood that various changes in the devices and in their organization in the system might be made without departing from the scope of the invention as defined by the appended claims.

What it is desired to secure by Letters Patent is:—

1. In a switch machine, a power operated lever, means operatively connected to the points of a track switch, and a separable connection between said lever and said means.

2. In a switch machine, two members pivotally mounted to move about a common axis, power operated means for moving one of said members, a switch throwing bar connected to the other of said members, and yieldable means for connecting said members to move as a unitary structure, said yieldable means permitting said members to move independently when a given force is applied to separate them.

3. In a switch machine, a lever pivoted near its mid-point, power supply means connected to one end of said lever, a sector pivotally mounted to move concentrically with said lever, one end of said sector being connected to a switch operating bar, and engaging means comprising a notched cam surface on said sector and a spring pressed member on said lever for operatively connecting said sector and said lever, whereby said switch operating bar may be operated by said power supply means and may be moved independently of said power supply means.

4. In a switch machine, a lever and a sector mounted to move about a common axis, a power operated member engaging a cam on one end of said lever, a concentric surface on said cam whereby the engagement between said cam and said member locks said lever against movement when said member and said lever are in their extreme positions, a switch point operating bar engaging one end of said sector and a separable connection between said lever and said sector whereby said sector and said operating bar may be moved while said power operated member remains stationary.

5. In a switch machine, a power operated lever and a switch point operating sector journaled to swing about a common axis, a cam surface on said sector having a plurality of depressions therein and a spring pressed member on said lever for engaging said cam surface, whereby said lever and said sector will be automatically biased to one of a plurality of definite relative angular positions and means for locking the lever in fixed positions.

6. In a switch machine, a lever and a sector pivoted to turn about a common axis, a throw bar connecting said sector to the points of a track switch, means for moving said lever to either one of two definite positions, and a biased roller on said lever engaging a notched surface on said sector, whereby when said lever is in either one of said definite positions said switch points will be in a definite position.

7. In a switch machine, a power operated lever comprising two rigidly connected members having a space therebetween, a sector pivotally supported between said members, and a biased roller slidably carried by said lever and bearing against a cam surface on said sector.

8. In a switch machine, a power operated lever and a sector journaled to turn about a common axis, means connecting said sector to the points of a track switch, means for locking said lever in certain definite positions, and a separable connection between said lever and said sector comprising, a roller mounted in a spring pressed block slidably carried by said lever and engaging a notched surface on said sector, whereby said lever and said sector may move as a single unit about said axis under ordinary conditions, but may be moved to various relative angular positions when a predetermined force is applied to said switch points when said lever is locked.

9. In a switch machine, a lever and a sector, power operated means for moving said lever, means connecting said sector to the points of a track switch, a separable connection between said lever and said sector, circuit closing means controlled by the movement of said power operated means, and further circuit controlling means operated by the movement of said sector, whereby the relative positions of said switch points and said lever may be determined by the energizing of circuits controlled by said circuit controlling means.

10. In a machine for operating track switches of railroads, a power operated gear carrying a roller, a pivoted lever having a cam portion engaging said roller, a sector pivoted about the same axis as said lever and engaging a switch point operating bar, means for establishing a separable connection between said power operated gear and said switch point operating bar comprising a roller carried by a spring pressed block slidably mounted on said lever and a surface on said sector having depressions therein, and means for controlling electrical circuits in accordance with the positions of said gear and said operating bar comprising contact

operating cams carried by said gear and by said sector.

11. In a control system for a power operated track switch, in combination with a switch machine, a manually operable switch machine control lever having a plurality of operating positions, a circuit controlling device connected to said lever, means for securing said lever in one of its operating positions, and means for automatically moving said lever to another of its operating positions when a car passes said track switch.

12. In a track switch control system, a section of trackway provided with a track switch, a switch machine for operating said switch, a circuit controller for controlling the operation of said switch machine, a manually operable lever connected with said circuit controller and means for moving said lever from one position to another when a vehicle moves out of one portion of said section of trackway.

13. In a track switch control system, a section of trackway provided with a track switch, a power operated switch machine for operating said track switch, a circuit controller for throwing said switch machine to its normal or reverse position, a manually operable lever connected to said circuit controller, means for locking said lever and said circuit controller when moved to operate said switch machine to its reverse position, and means for releasing said lever and said circuit controller and returning them to a position to operate said switch machine to its normal position when a car passes a given point in said section of trackway.

14. In a track switch control system, a section of trackway provided with a track switch, an electrically operated switch machine for operating said track switch, a two position circuit controller for completing circuits for operating said switch machine to its reverse and normal position, a manually operable lever connected to said circuit controller, a disc journaled on a common axis with said lever, means for mechanically connecting said disc and said lever to turn as a single unit, spring means for biasing said disc to its normal operating position, a locking means for holding said disc in its reverse operating position against the action of said spring means and means for releasing said locking means comprising a magnet energized only after a car has passed a given point in said section of trackway, whereby said switch machine circuit controller may be manually set into its reverse position and automatically returned to its normal position.

15. In a control system for a power operated track switch, a section of trackway provided with a track switch, a switch machine for operating said switch and a track circuit, a track relay connected in said track circuit, means for controlling the operation of said switch machine comprising a lever, a spring biased member for biasing said lever to its normal position, a locking device for retaining said lever and said member in their reverse positions, and means for releasing said locking device comprising a magnet energized through the front contact of a stick relay and a front contact of said track relay, said stick relay having a pick-up circuit which is energized only when said track relay is de-energized.

16. In combination with a section of trackway having a track circuit and a track relay, a track switch and an electrically operated switch machine for moving said track switch, a source of energy at the switch location for energizing said switch machine, movable circuit controlling means at said switch location for selectively completing normal and reverse energizing circuits from said source of energy to said switch machine, two opposed electro-magnetic devices for moving said circuit controlling means, and energizing circuits for said electro-magnetic devices including a manually operable switch and a front contact of said track relay.

17. A member and an element having a non-frangible break down connection restraining them from relative movement below a predetermined stress on the connection, a track switch connected to move with the element and drive means for the member.

18. A member and an element having a break down connection restraining them from relative movement below a predetermined stress on the connection, a track switch connected to move with the element, drive means for the member, and a switch position indicator operated in accordance with the position of the element.

19. A member and an element having a break down connection restraining them from relative movement below a predetermined stress on the connection, a track switch connected to move with the element, drive means for the member, and means controlling forward and reverse operation of the drive means operable in accordance with the position of the member.

20. A member and an element having a break down connection restraining them from relative movement below a predetermined stress on the connection, a track switch connected to move with the element, drive means for the member, and a switch position indicator operated in accordance with the position of the element, and means controlling forward and reverse operation of the drive means operable in accordance with the position of the member.

21. A member and an element having a break down connection restraining them from relative movement below a predetermined stress on the connection, a track

switch connected to move with the element, drive means for the member arranged to move the member during part of its operative cycle, and to run idle for the rest of its cycle while locking the member in fixed position, and means operable in accordance with the position of the member for controlling forward and reverse operation of the drive means.

22. A driving member, a driven member, a connection, releasable at a predetermined stress, normally restraining the members from relative movement, a track switch connected to move with the driven member, and means to re-establish the releasable connection between the members at points to either side of the place of the connection before its break down.

23. In combination with a power operated switch machine, manually actuable means for setting the switch machine in one position, and means for automatically returning the switch machine to the other position requiring the occupancy and the subsequent vacancy of a given section of trackway, and manually operable release means for permitting the automatic return of the switch machine to the other position regardless of occupancy and vacancy of the section of trackway.

24. In a traffic controlling system for railroads, the combination with a switch machine, and its control lever, of a detector track circuit and selector means governed by said detector track circuit for applying operating current to said switch machine during detector track circuit occupancy independently of said control lever to complete an operation initiated before detector track circuit occupancy.

25. In an interlocking system for railroads, a switch machine, a control lever governing operation of said switch machine, a detector track circuit, a two position selector normally governed by said detector track circuit and said control lever for controlling the operating supply of current to said switch machine, and means governed by said track circuit for causing operating current to be applied to said switch machine in accordance with said two position selector and independently of the position of said control lever during the occupancy of said detector track circuit.

26. In an electric interlocking system for railroads, a switch machine having normal and reverse operating circuits, a control lever for governing said normal and reverse operating circuits of said switch machine, a detector track circuit, a two position selector repeating the position of said control lever when said detector track circuit is unoccupied, said selector controlling the operating current of said switch machine over said normal and reverse operating circuits, and means preventing the operation of said selector during detector track circuit occupancy, said means allowing said operating current of said switch machine to flow over either said normal or said reverse operating circuits, regardless of detector track circuit occupancy, to complete the operation of said switch machine in accordance with the corresponding operation initiated before detector track circuit occupancy, although said two position lever is in the opposite one of its two positions out of correspondence with said selector.

27. A circuit controller for operating switch machines comprising, two electro-magnets for operating circuit controlling means in opposite directions upon alternate energization of said electro-magnets, circuit selecting means for connecting one or the other of said electro-magnets to a line wire, and means for controlling the energization of the connected electro-magnet through the medium of said line wire.

28. In combination with a section of trackway having a track circuit, a track switch and an electrically operated switch machine for moving said track switch, contacts associated with said switch machine and operated in accordance with the position of said track switch, magnetic means for selectively closing operating circuits for said switch machine, and control circuits for said magnetic means including said switch machine contacts and capable of being completed during the stroke of the switch, whereby said track switch can be reversed during its stroke.

29. In combination with a section of trackway having a track circuit, a track switch in said section and an electrically operated switch machine for moving said track switch, normal and reverse energizing circuits for said switch machine, contacts operated by the switch machine for governing the energization of said circuits, magnetic means for operating said contacts, and control circuits for said magnetic means, said control circuits including a manually operable switch, and a contact operated in accordance with the position of said track switch.

In testimony whereof I affix my signature.

CHARLES W. PRESCOTT.