June 4, 1935. W. C. McWHIRTER 2,003,382

RAILWAY SWITCH OPERATING APPARATUS

Original Filed March 23, 1932 5 Sheets-Sheet 1

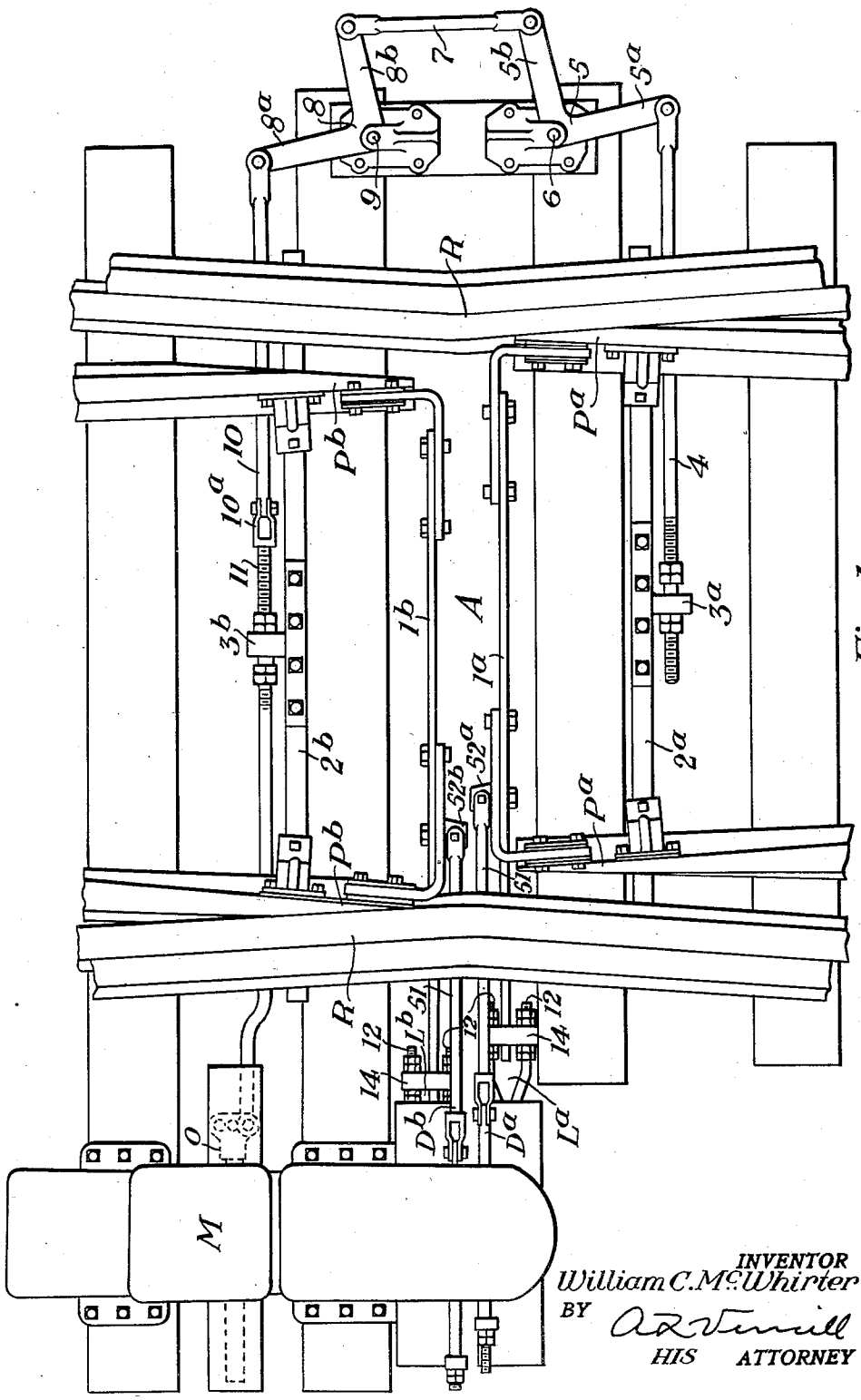


Fig. 1.

INVENTOR
William C. McWhirter
BY
HIS ATTORNEY

June 4, 1935. W. C. McWHIRTER 2,003,382

RAILWAY SWITCH OPERATING APPARATUS

Original Filed March 23, 1932 5 Sheets-Sheet 2

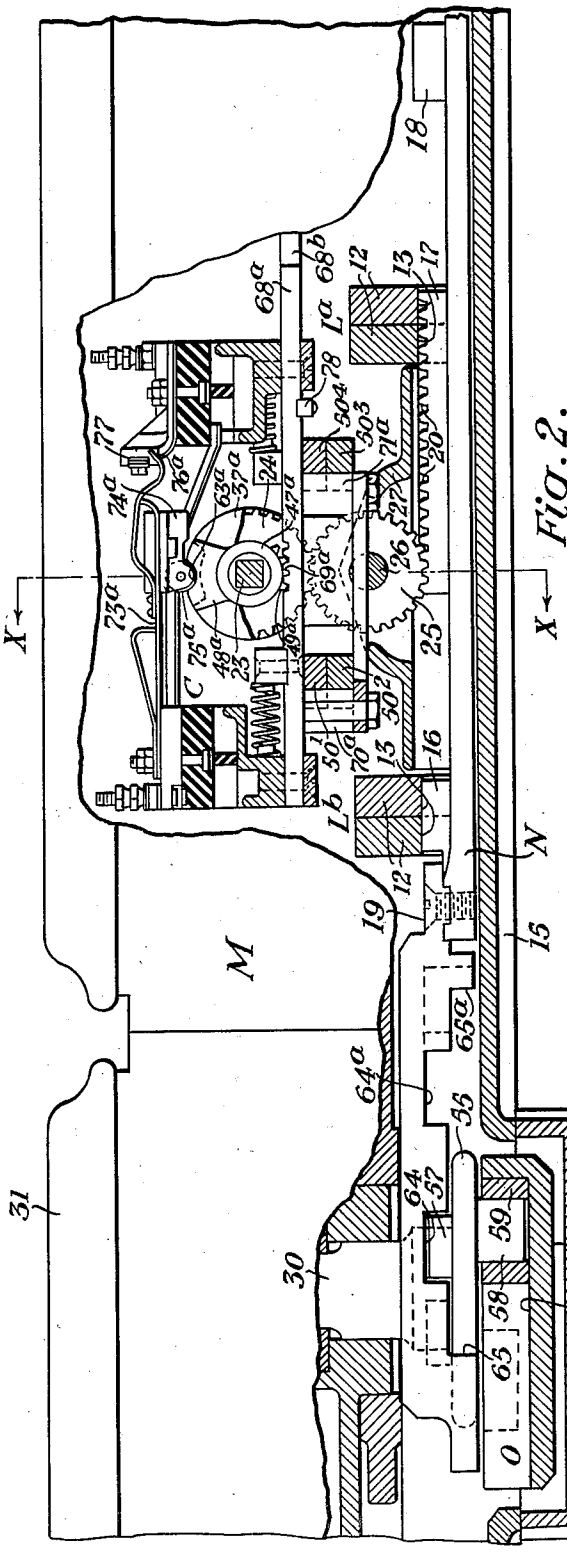


Fig. 2.

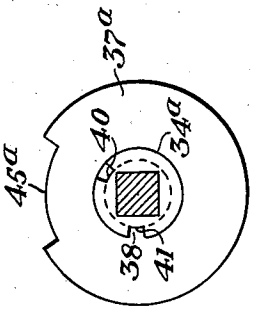


Fig. 12.

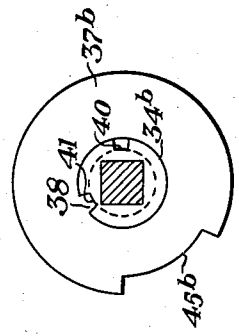


Fig. 13.

INVENTOR
William C. McWhirter
BY
HIS ATTORNEY

June 4, 1935. W. C. McWHIRTER 2,003,382

RAILWAY SWITCH OPERATING APPARATUS

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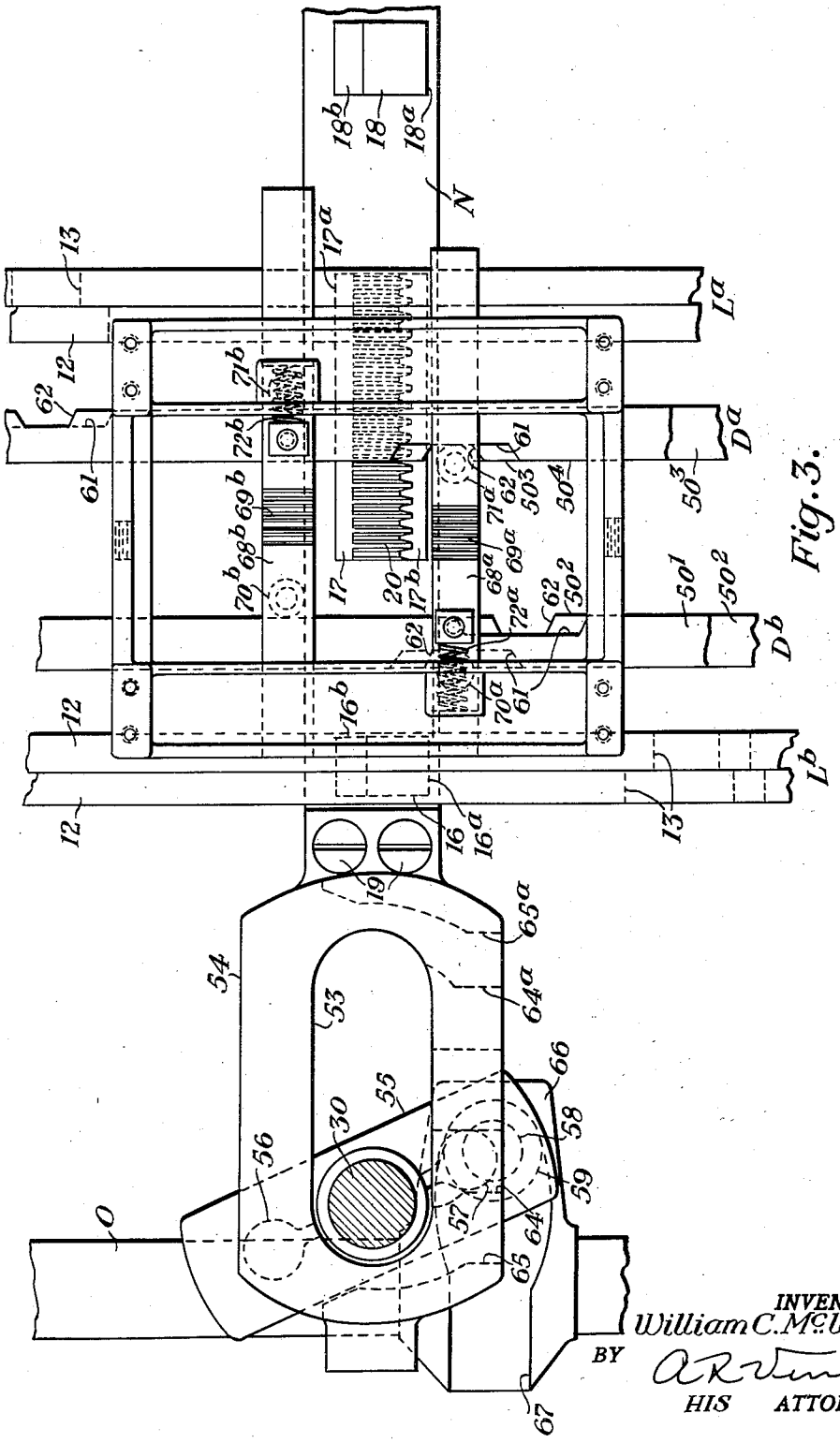


Fig. 3.

INVENTOR
William C. McWhirter
BY
HIS ATTORNEY

June 4, 1935. W. C. McWHIRTER 2,003,382

RAILWAY SWITCH OPERATING APPARATUS

Original Filed March 23, 1932 5 Sheets-Sheet 4

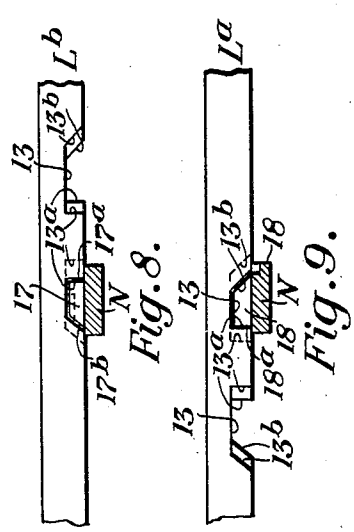


Fig. 8.

Fig. 9.

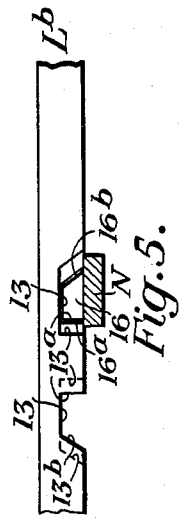


Fig. 5.

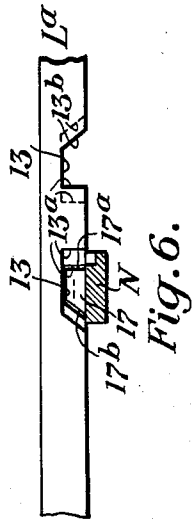


Fig. 6.

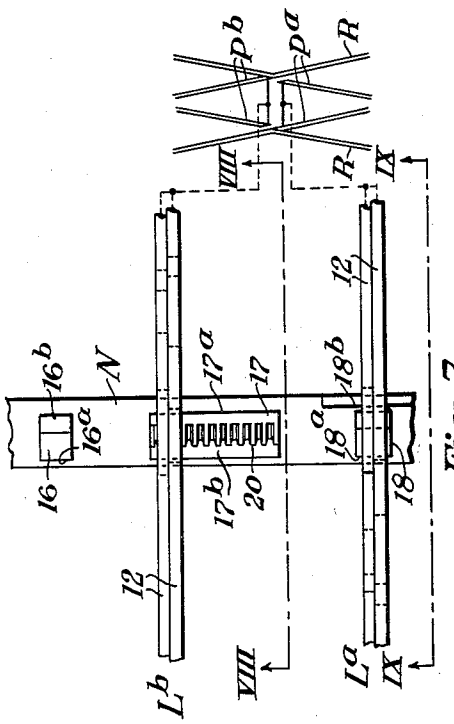


Fig. 7.

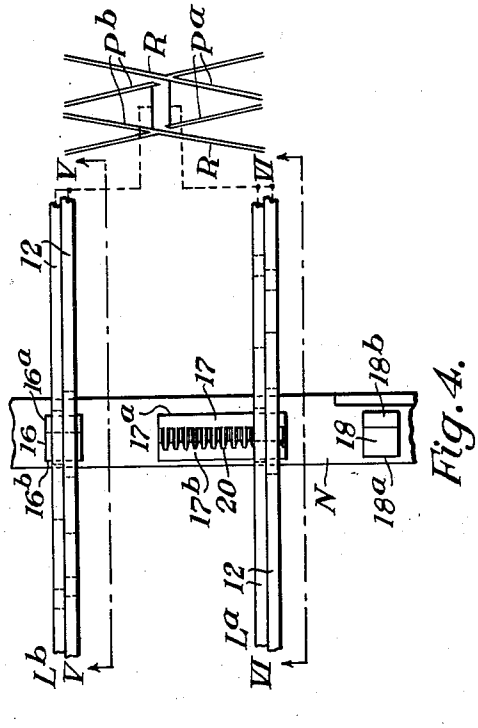


Fig. 4.

INVENTOR
William C. McWhirter
BY
HIS ATTORNEY

June 4, 1935. W. C. McWHIRTER 2,003,382

RAILWAY SWITCH OPERATING APPARATUS

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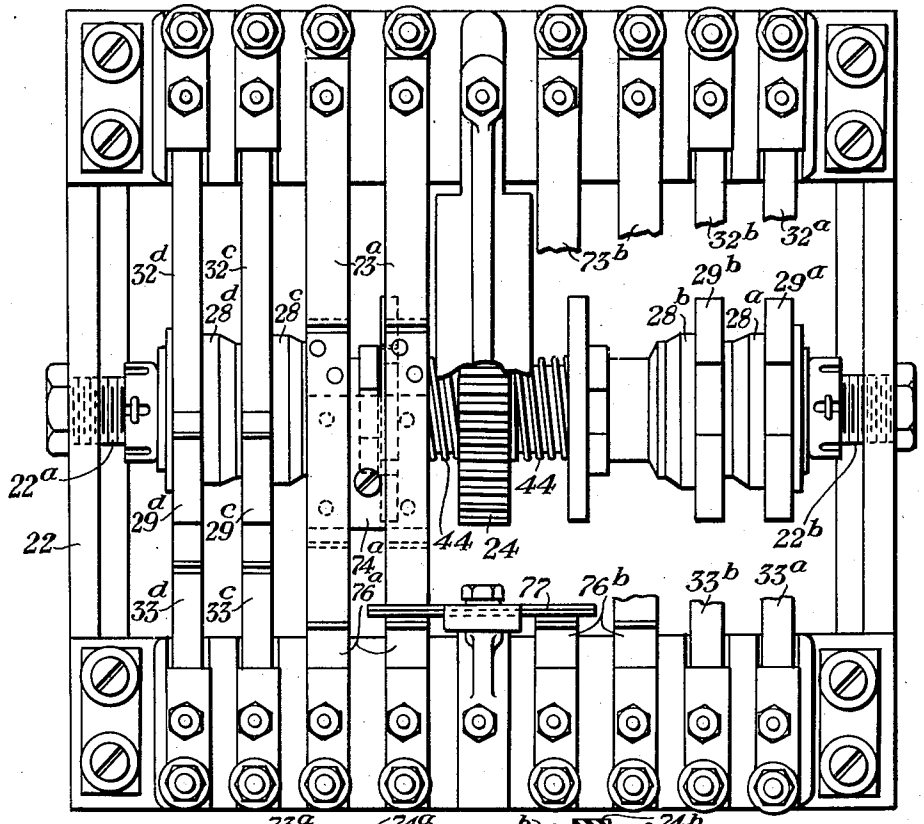


Fig. 11.

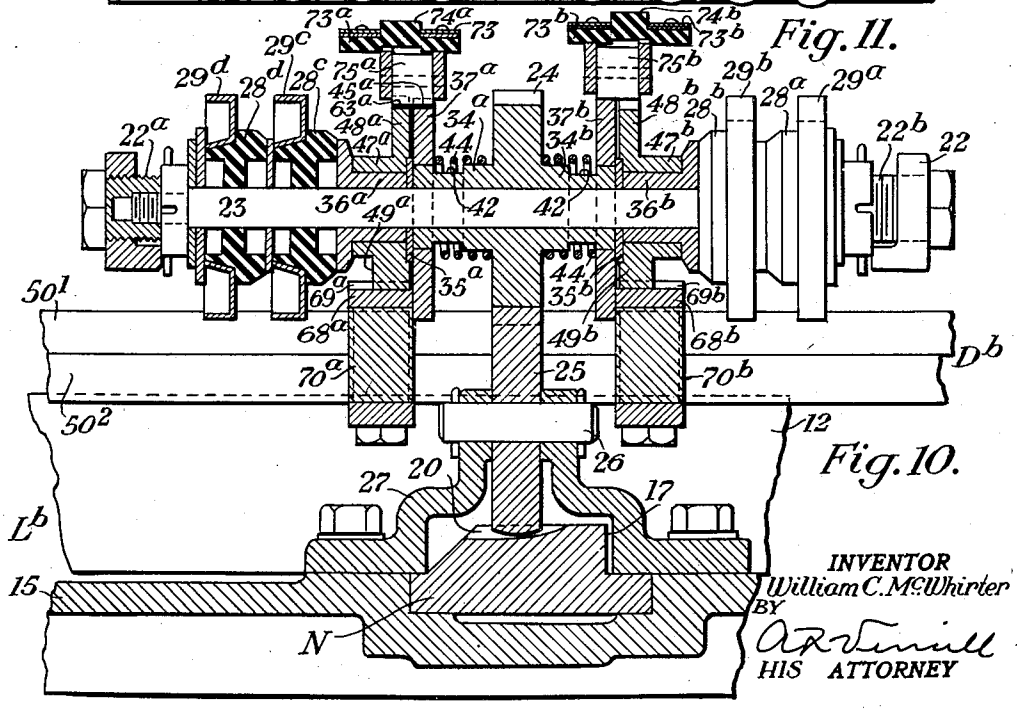


Fig. 10.

INVENTOR
William C. McWhirter
BY
HIS ATTORNEY

Patented June 4, 1935 2,003,382

UNITED STATES PATENT OFFICE

2,003,382

RAILWAY SWITCH OPERATING APPARATUS

William C. McWhirter, Wilkinsburg, Pa., assignor to The Union Switch & Signal Company, Swissvale, Pa., a corporation of Pennsylvania

Original application March 23, 1932, Serial No. 600,601, now Patent No. 1,972,663, dated September 4, 1934. Divided and this application April 3, 1934, Serial No. 718,764

10 Claims. (Cl. 246—240)

My invention relates to railway switch operating apparatus.

One feature of my invention is the provision of novel and improved means for locking the movable points of a railway switch in either extreme position of the switch.

Another feature of my invention is the provision of novel and improved mechanism for detecting any failure of the switch points to occupy their proper positions relative to the stock rails in either extreme position of the switch.

The present application is a division of my copending application Serial No. 600,601, filed March 23, 1932, now Patent Number 1,972,663, issued Sept. 4, 1934, for Railway switch operating apparatus.

I will describe one form of apparatus embodying my invention, and will then point out the novel features thereof in claims.

In the accompanying drawings Fig. 1 is a top plan view showing a frog layout A operated by a switch machine M embodying one form of switch locking and point detecting apparatus embodying my invention. Fig. 2 is a left-hand side view of a portion of the switch machine M shown in Fig. 1, drawn on a somewhat larger scale, and having some of the parts broken away or removed to better illustrate the construction thereof. Fig. 3 is a top plan view of a portion of the apparatus shown in Fig. 2. Fig. 4 is a diagrammatic view of a portion of the apparatus shown in Figs. 2 and 3. Figs. 5 and 6 are sectional views taken on the lines V—V and VI—VI, respectively, of Fig. 4. Fig. 7 is a view similar to Fig. 4, but showing the parts in a different position. Figs. 8 and 9 are sectional views taken on the lines VIII—VIII and IX—IX, respectively, of Fig. 7. Fig. 10 is a sectional view taken on the line X—X of Fig. 2. Fig. 11 is a top plan view showing on an enlarged scale a portion of the circuit controller forming part of the point detector mechanism of the switch machine M illustrated in Figs. 1 and 2. Fig. 12 is a view of the cam 37^a forming part of the circuit controller shown in Figs. 2, 10 and 11, as it appears when viewed from the left in Fig. 11. Fig. 13 is a view of the cam 37^b forming part of the circuit controller shown in Figs. 2, 10 and 11, as it appears when viewed from the right in Fig. 11.

Similar reference characters refer to similar parts in each of the several views.

Referring first to Fig. 1, I have here shown a movable point frog layout A operated by a switch machine M into which may invention has been incorporated. The frog layout A is of standard construction, and comprises the usual stock rails R, R between which are movably mounted two pairs of switch points P^a, P^a and P^b, P^b, respectively, such pairs being disposed in opposed relation and having their confronting ends connected by front rods 1^a and 1^b, respectively. The switch points P^a, P^a are also connected together by the usual head rod 2^a, and the switch points P^b, P^b are similarly connected together by the usual head rod 2^b. The head rod 2^a, in turn, is connected through the usual lost motion connection 3^a with one end of a throw rod 4, the other end of which is pivotally connected to one arm 5^a of a bell crank lever 5. The bell crank lever 5 is pivotally supported in the trackway at 6, and the other arm 5^b thereof is connected, by means of a connecting link 7, with the corresponding arm 8^b of a similar bell crank lever 8 which is pivotally supported in the trackway at 9. The remaining arm 8^a of the bell crank lever 8 is connected, by means of a connecting rod 10 and screw jaw 10^a, with a throw rod 11 which, in turn, is connected with the head rod 2^b by means of a lost motion connection 3^b similar to the lost motion connection 3^a. The throw rod 11 extends underneath one stock rail R and one switch point P^b, and is connected at its free end with the longitudinally movable operating rod O of the switch machine M. It will be apparent, therefore, from an inspection of the drawings that, when the operating rod O is actuated by the switch machine, the switch points P^a, P^a and P^b, P^b will be simultaneously reversed.

Operatively connected with the front rods 1^a and 1^b are two lock rods L^a and L^b, respectively, which project into the switch machine M, and each of which comprises two bars 12 arranged side by side, as best seen in Fig. 2. The bars 12 have notches 13 in their lower edges (see Figs. 5, 6, 8 and 9) constructed and arranged in accordance with my present invention as will be described presently, and each lock rod is provided with a suitable device 14 of standard construction for adjusting the bars 12 longitudinally relative to each other according to the degree of movement of the track switch. Each of the bars 12 has a long notch 13 and a short notch 13 spaced a short distance apart, as clearly shown in Figs. 5, 6, 8 and 9, the long notch of the one bar being arranged opposite the short notch of the other contiguous bar. It will be noted that, as here shown, the adjacent sides 13^a of the two notches 13 in each bar 12 are perpendicular to the longitudinal axis of the bar while the remaining side 13^b of each notch 13

in each bar is beveled at an angle of approximately 45° with the longitudinal axis of the bar. It should be distinctly understood, however, that this particular shape of notches is not essential to my invention, the only essential requirement being that the short notches in the two bars shall have different shapes, and that the long notches be of such size and shape that a dog of the same configuration as the short notches can enter the long notches with sufficient clearance to permit the desired adjustment between the bars

Referring now particularly to Figs 2 and 3, the switch machine M, in the form illustrated, comprises a suitable casing 15 provided with guides to receive the operating rod O and the lock rods L^a and L^b. Slidably mounted within the casing 15 directly above the operating rod O and directly below the lock rods L^a and L^b, and intersecting the operating rod O and the lock rods L^a and L^b at right angles, is a slide bar N. As here shown, the slide bar N is made in two sections secured together by means of screws 19, but it will be readily understood that this bar may, if desired, be constructed of a single piece of material suitably machined. Attached to, or formed integral with the upper side of the slide bar N near its right-hand end, as viewed in Figs. 2 and 3 are three spaced locking dogs 16, 17 and 18, the middle one of which, 17, is somewhat longer than the two outer dogs 16 and 18. The locking dogs 16, 17 and 18 are adapted to selectively enter certain ones of the notches 13 in the lock rods L to lock the switch points in their extreme positions in a manner which will be described hereinafter, and each dog is constructed to have a shape which matches the shape of the notch which such dog is adapted to enter. As best seen in Figs 4–9, inclusive, each dog is formed with a vertical side designated by the same reference character as the associated dog with the exponent *a*, and with a beveled side, designated by the same reference character as the associated dog with the exponent *b*, the beveled side 17^b of the middle dog 17 being located at the opposite side of the slide bar N from the beveled sides 16^b and 18^b of the other dogs 16 and 18, respectively. The dogs 16, 17 and 18 are so arranged that when the dogs are within the cooperating notches 13 in the lock rods L, their vertical sides will cooperate with the adjacent sides of the notches to securely hold the proper ones of the switch points against the adjacent stock rail for either the normal or the reverse position of the switch in the same well-known manner as in all similar switch locking devices. The tapered sides of the dogs are provided for the purpose of preventing the dogs from entering an improper one of the notches, as will be explained more fully hereinafter. The upper side of the middle dog 17 is formed with rack teeth 20 which operate an indication circuit controller C (see Fig. 2) as will be described hereinafter.

The slide bar N and the operating rod O may be actuated by any suitable form of operating mechanism. As here shown, this mechanism is similar in all respects to that shown and described in Letters Patent of the United States No. 1,293,290 granted to William Zabel on February 4, 1919 for Railway traffic controlling apparatus, and all parts of this mechanism herein referred to are designated by the same reference characters as the corresponding parts are designated by in the said Zabel patent. Referring particularly to Figs. 2 and 3, this operating mechanism comprises a vertical shaft 30 which projects into the casing 15 from a transmission housing 31 which is secured to the upper side of the casing. The axis of the shaft 30 is disposed at one side of the point of intersection of the operating rod O and slide bar N, while its lower end extends through a slot 53 formed in a cam 54 on the bar N and is provided with a horizontally disposed crank 55. The crank 55 is of substantially rectangular formation, and is rigidly connected to the shaft 30 at its medial portion, its upper side being formed with projections 56 and 57 arranged on opposite sides of the shaft while its lower side is provided with a pin 58 carrying a roller 59, such pin being disposed at one side of the projection 57. The cam 54 is relatively thick and wide with respect to the main part of the slide bar N, as will be apparent from an inspection of the drawings. The under side of the cam 54 is formed with spaced recesses 64 and 64^a adjacent one side edge thereof to receive the projections 56 and 57 when the crank is rotated, while the opposite ends of the cam are provided with flanges 65 and 65^a. The confronting sides of the flanges 65 and 65^a are curved inwardly at their medial portion to receive the curved ends of the crank 55 while the opposite ends of the flanges are made flat to engage the sides of the crank as will be more fully described hereinafter. The operating rod O is formed with a cross arm 66 having a longitudinally extending groove 67 formed in the upper side thereof in which works the roller 59 of the crank 55. One end of the groove 67 is open while the side walls of the groove are arranged parallel to each other from the open end to its medial portion whereupon they curve outwardly to describe an arc, as shown in Fig. 3.

The operation, as a whole, of the apparatus thus far described is as follows: When the operating rod O and the slide bar N are in their normal positions in which positions they are shown in Figs. 2 and 3, and the switch points are in their corresponding positions in which they are shown in Fig. 1, the locking dogs 16, 17 and 18, and the lock rods L^a and L^b occupy the relative positions in which they are shown in Figs. 2, 3, 4, 5 and 6. That is to say, the locking dog 16 is within the right-hand pair of notches 13 in the lock rod L^b, as viewed in Fig. 4, and the locking dog 17 is within the left-hand pair of notches 13 in the lock rod L^a, as viewed in Fig. 4. It will be readily understood that under these conditions, any thrust on the switch points tending to move them away from their normal positions, such for example as a thrust due to an improper trailing move, will be resisted by the straight side 16^a or 17^a of the dog 16 or 17, as the case may be, and it follows, therefore, that the switch points are securely locked in their normal positions by the dogs 16 and 17.

When it is desired to reverse the switch points, the shaft 30 is rotated in a clockwise direction to rotate the crank 55 in the same direction. This rotation of the crank causes the pin 57 to engage the left-hand wall of the recess 64, whereby the slide bar N is moved to the left as viewed in Figs. 2 and 3, or upwardly as viewed in Fig. 4, far enough to withdraw the dog 16 from the notches 13 which it previously occupied in the lock rod L^b; the dog 17 being simultaneously withdrawn from the notches 13 which it previously occupied in the lock rod L^a, thus unlocking the switch points P^a, P^a and P^b, P^b. During this

movement of the crank, the roller 59 whose initial position was at the closed end of the groove 67 is moved to the medial portion of the groove or at the intersection of the curved and straight walls thereof, but due to the shape of the groove this movement of the roller does not cause the operating rod O to be moved. It will be seen, therefore, that during the first part of the movement of the crank the slide bar is moved to unlock the switch points, but the operating rod O, and hence the switch points, remain at rest. However, in the continued movement of the crank, the roller 59 engages the upper straight side of the groove 67 and imparts sufficient movement to the operating rod O in the general direction in which the crank is moved to completely reverse the switch points. During the greater part of this portion of the movement of the crank, the curved ends thereof engage the curved sides of the flanges 65 and 65^a so that the crank then serves as a locking means for the slide bar N to prevent longitudinal movements thereof. The movement of the switch points to their reverse positions moves the lock rods L^a and L^b from the relative positions in which they are shown in Fig. 4 to the relative positions in which they are shown in Fig. 7, so that the left-hand pair of notches 13 in the lock rod L^b is then in alignment with the locking dog 17 and the right-hand pair of notches in the lock rod L^a is in alignment with the locking dog 18. Upon further continued movement of the crank 55, pin 56 enters recess 64^a and imparts a second movement to the slide bar in the same direction as the first movement, this latter movement being sufficient to cause the locking dog 17 to enter the left-hand pair of notches 13 in the lock rod L^b and the dog 18 to enter the right-hand pair of notches 13 in the lock rod L^a, as shown in Figs. 7, 8 and 9, thus locking the switch points in their reverse positions. It should be pointed out that when the switch points are locked in their reverse positions any thrust tending to open the points is then taken by the straight side 17^a or 18^a of the dog 17 or 18, as the case may be, thus insuring an effective locking of the points under these conditions. It will be noted from the foregoing that the movement of the operating rod which reverses the switch points is subsequent to the initial movement of the slide bar which unlocks the switch points but is in advance of the final movement which locks the switch points in their reverse positions.

In order to restore the switch points to their normal positions after they have been reversed as above described, the shaft 30 is rotated in a counter-clockwise direction to rotate the crank 55 in this direction. The subsequent movements of the operating rod and slide bar above described are maintained under these conditions but the directions of the movements are reversed.

The means for rotating the shaft 30 forms no part of my present invention and is therefore not shown in the drawings.

It should be pointed out that while the dog 17 can enter the left-hand pair of notches 13 in the lock rod L^b, it cannot, due to its shape, enter the other pair of notches in this bar. It will be seen, therefore, that if the lock rod L^b should become broken or disconnected from the switch points P^b, P^b for any reason when the switch points are in the relative positions in which they are shown in Fig. 4, and the switch machine is subsequently operated to reverse the switch points, the switch points would move to their reverse positions in the manner previously described, but the lock rod L^b would fail to move, and as a result, when the slide bar N has moved to the position in which the dog 17 would normally start to enter the left-hand pair of notches in the lock rod L^b to lock the switch points in their reverse positions, this dog would engage the lock rod adjacent the right-hand pair of notches, which would prevent the slide bar from completing its movement. When this happens, an indication of the improper operation of the slide bar would be given by the usual indication circuits controlled by the circuit controller C referred to hereinbefore, and it follows, therefore, that the improper operation of the apparatus under the above conditions would be detected. Furthermore, if the lock rod L^b should become broken or disconnected from the switch points when the switch points are in the positions shown in Fig. 7, so that this lock rod failed to move when the switch points are subsequently reversed by the switch machine, the dog 16, due to its shape, could not enter the left-hand pair of notches in this lock rod, and the slide bar would therefore be prevented from moving to the extreme position corresponding to the position which the switch points then occupy, thus causing the broken rod to again be detected by the circuit controller. In a similar manner, if the lock rod L^a should become broken or disconnected from the switch points when the switch points occupy the positions in which they are shown in either Fig. 7 or Fig. 4, and the switch machine was subsequently operated to reverse the switch points, the dog 17 or 18, as the case may be, would prevent the slide bar from moving to the extreme position corresponding to the new position of the points, thus causing the improper operation to be detected under these conditions.

Referring now again to Fig. 2, the circuit controller C referred to hereinbefore is mounted in the left-hand end of the switch machine above the lock rods L^a and L^b and the slide bar N, and as best seen in Figs. 10 and 11, comprises a suitable supporting framework 22 provided with aligned bearings 22^a and 22^b in which a horizontal cam shaft 23 is journalled. The cam shaft 23, which is of rectangular cross section except for a rounded portion at each end which fits into the associated bearing, is adapted to be rotated or oscillated in response to the longitudinal movements of the slide bar N, and for this purpose, the shaft has fixed thereto a gear wheel 24 which meshes with an intermediate idler gear 25 driven by the rack teeth 20 in the upper face of the locking dog 17 of the slide bar N. The idler gear 25 is pivoted on a pin 26 mounted in a suitable casting 27 which is fastened to the bottom of the casing 15 of the switch machine M. The casting 27 in addition to supporting the pin 26 also serves to prevent vertical displacement of the slide bar N. Mounted on the cam shaft 23 on opposite sides of the gear wheel 24 are a plurality of driving collars of insulating material each designated by the reference character 28 with a suitable distinguishing exponent. Each driving collar 28 is provided with a square hole which has a sliding fit on the cam shaft 23, and as clearly shown in Fig. 10, each driving collar comprises a comparatively narrow web and a peripheral flange extending in each direction. A portion of the peripheral flange of each driving collar is tapered, and the tapered portion is provided with serrations or teeth (not shown) around its entire circumference. Each driving collar 28 car-

ries a contact segment of electroconductive material designated by the reference character 29 with the same distinguishing exponent as the associated driving collar. Each contact segment 29 is in the form of a ring, the bore of which is tapered to fit the tapered portion of the periphery of the associated insulating driving collar. The bore of each contact segment is also provided with serrations or teeth (not shown) which match the teeth on the periphery of the insulating driving collars. Each contact segment 29 cooperates at its periphery with two contact fingers designated by the reference characters 32 and 33, respectively, with the same distinguishing exponent as the reference character for the associated cam. For example, the contact segment 29^a cooperates with the contact fingers 32^a and 33^a to at times close a contact 32^a—29^a—33^a. The periphery of each contact segment may have any desired length and due to the mating teeth on the driving collar and the segment, may be turned to any desired position relative to the cam shaft 23. As here shown, the parts are so proportioned, and the contact segments are of such length and are so arranged, that the contacts 32^a—29^a—33^a and 32^b—29^b—33^b will be closed at all times except when the slide bar N is in the extreme position in which it locks the switch points in the positions in which they are shown in Fig. 1, and that the contacts 32^c—29^c—33^c and 32^d—29^d—33^d will be closed at all times except when slide bar N is in the extreme position in which it locks the switch points in the position reverse to that in which they are shown in Fig. 1. The contacts 32^a—29^a—33^a, 32^b—29^b—33^b, 32^c—29^c—33^c and 32^d—29^d—33^d may be used in a well known manner to control the circuits for a motor which operates the shaft 30 previously described, or for any other desired purpose.

As best seen in Fig. 10, the gear wheel 24 which drives the cam shaft 23 is formed with oppositely disposed hubs 34^a and 34^b and mounted on the cam shaft 23 between the hub 34^a and the driving collar 28^b is a washer 35^a and a bushing 36^a. A washer 35^b, similar to the washer 35^a, and a bushing 36^b similar to the bushing 36^a, are likewise mounted on the cam shaft 23 between the hub 34^b and the driving collar 28^b. The hubs 34^a and 34^b carry two cams 37^a and 37^b, respectively, which are connected to the hubs to rotate therewith by suitable means which I will describe presently. The cam 37^a is provided in its periphery with an arcuate notch 45^a (see Fig. 12), and is adapted, when rotated, to actuate a pair of contact fingers 73^a which are connected together for simultaneous movement by an insulating bridge 74^a. The cam 37^b is likewise provided in its periphery with an arcuate notch 45^b (see Fig. 13), and is adapted, when rotated, to actuate a pair of contact fingers 73^b which are connected together for simultaneous movement by an insulating bridge 74^b. The insulating bridges 74^a and 74^b are provided with rollers 75^a and 75^b, respectively, which coact with the corresponding cams 37^a and 37^b and serve as an actuating medium for the contact fingers when the associated cams are rotated. The fingers 73^a and 73^b, when the notches 45^a and 45^b in the cams 37^a and 37^b are opposite the rollers 75^a and 75^b, at times assume an inclined position in which they engage lower stationary contact fingers 76^a, 76^a and 76^b, 76^b, as will be described more fully hereinafter, but when the notches 45^a and 45^b are not opposite the rollers 75^a and 75^b these fingers are lifted to cause the inner finger of each pair to engage an upper stationary contact 77. The cams 37^a and 37^b are so arranged, and the notches 45^a and 45^b are of such length that all of the contact fingers 73 will be lifted when the slide bar N is in transit, but that, one pair of fingers will normally be permitted to assume their lower positions when the slide bar N is at one extreme end of its movement, and the other pair of fingers will normally be permitted to assume their lower positions when the slide bar N is at the other extreme end of its movement, as will be described more fully hereinafter.

The means referred to hereinbefore for operatively connecting the cams 37^a and 37^b with the associated hubs 34^a and 34^b comprises, in the form here shown, a feather key 38 on each cam (see Figs. 12 and 13) which is adapted to fit into either one or the other of two angularly spaced longitudinally extending keyways 40 and 41 formed in the periphery of the associated hub. The spacing between the keyways 40 and 41 in each hub is such, and the parts are so proportioned, that when the feather key 38 on a cam is within the keyway 40 in the associated hub, the notch 45 in such cam will align with the roller 75 carried by the associated contact fingers 73 when and only when the slide bar N is at the extreme end of its movement corresponding to the positions of the switch points shown in Fig. 1, and that, when the feather key on a cam is in the keyway 41, the notch 45 in such cam will align with the roller 75 carried by the associated contact fingers 73, when and only when the slide bar N is at the extreme end of its movement corresponding to the extreme position of the switch points opposite to that in which they are shown in Fig. 1.

In order to enable the switch machine to be used in either a right-hand or a left-hand installation, it is desirable to be able to change the position of a cam 37 relative to the associated hub from that in which the feather key 38 thereon fits in one keyway to that in which the feather key fits into the other keyway with a minimum amount of effort, and for this purpose, each hub 34 is provided with an annular groove 42 which is somewhat wider than the length of the keys 33, and which communicates with the inner ends of the grooves 40 and 41 in the hub. With this arrangement, it will be seen that when it is desired to change a cam from the relative position on the associated hub in which the key 38 thereon engages the one keyway to the position in which it engages the other keyway, it is only necessary to slide the cam inwardly on the hub until the cam is in alignment with the annular groove 42, rotate the cam until the key is in alignment with the desired keyway, and then move the cam outwardly on the hub to the position in which the key is within the desired keyway. The cams 37 are held in the positions in which the associated key 38 is within one or the other of the keyways 40 or 41 by means of coil springs 44 one of which surrounds each hub 34 between the gear wheel 24 and the associated cam. As here illustrated, the cam 37^a occupies the relative position on the hub 34 in which the key 38 thereon is within the keyway 40 in this hub, while the cam 37^b occupies the relative position on the hub 34^b in which the key 38 thereon is within the keyway 41 on this hub. It will be seen, therefore, that with this arrangement, in so far as the control of the contact fingers 73 by cams 37^a and 37^b is concerned, the contact fingers 73^a will be held in the positions in which the contact 73^a—77 is

closed, and the contact 73a—76a are open, except when the slide bar N occupies the extreme position corresponding to the position of the switch points shown in Fig. 1, and that the contact fingers 73b will be held in the positions in which the contact 73b—77 is closed and the contacts 73b—76b are open, except when the slide bar N occupies the extreme position corresponding to the extreme position of the switch points opposite to that in which they are shown in Fig. 1.

The contact fingers 73a and 73b are further controlled in accordance with the positions of the switch points by means of point detector mechanism also embodying my invention, which mechanism I will now describe. This mechanism in the form here shown, comprises two crossbars 68a and 68b (see Figs. 2, 3 and 10) which are slidably mounted in the supporting framework 22 directly below the sleeves 36a and 36b on the cam shaft 23 and which extend at right angles to the cam shaft 23 in parallel spaced relation. The crossbar 68a is biased toward the right as viewed in Fig. 3 by means of a spring 72a and is provided with two spaced rollers 70a and 71a. In similar manner, the crossbar 68b is biased toward the left as viewed in Fig. 3 by means of a spring 72b, and is provided with two spaced rollers 70b and 71b. The rollers 70a and 70b cooperate with the opposite edges of a pair of detector bars 50¹ and 50² which are slidably mounted in the main casing 15 of the switch machine for movements in directions parallel to the operating rod O, and the rollers 71a and 71b likewise cooperate with the opposite edges of a pair of detector bars 50³ and 50⁴ which are slidably mounted in the casing 15 in the manner similar to the bars 50¹ and 50². The detector bars 50¹ and 50² form part of a detector rod Db which, in the form here shown, comprises, in addition to the bars 50¹ and 50², a connecting rod 51, and suitable means for securing the bars to one end of the connecting rod in such manner that longitudinal movements of the bars relative to each other and to the rod may be made for purposes of adjustment. The detector bars 50³ and 50⁴ likewise form part of a detector rod Da which is similar to the detector rod Db. The free end of the connecting rod 51 of the detector rod Da is connected with the front rod 1a by means of a lug 52a, while the free end of the connecting rod 51 of the detector rod Db is connected with the front rod 1b by means of a lug 52b. It will be apparent, therefore, that any movement of the switch points will cause corresponding longitudinal movements of the detector rods. Each detector bar 50 is provided in one edge with a long notch 61 and in the opposite edge with a short notch 62 which is in vertical alignment with the long notch 61 in the other bar of the same connecting rod. The notches are so located and the parts are so proportioned that, with the detector bars properly adjusted, the short notch 62 in the bar 50¹ of the detector rod Db will align with the roller 70a on the crossbar 68a, and the short notch 62 in the bar 50³ of the detector rod Da will align with the roller 71a on the crossbar 68a, when and only when the switch points occupy their normal positions in which they are shown in Fig. 1; and that, the short notch 62 in the bar 50² of the detector rod Db will align with the roller 70b in the crossbar 68b, and the short notch 62 in the detector bar 50⁴ of the detector rod Da will align with the roller 71b on the crossbar 68b, when and only when the switch points occupy the extreme position opposite to that in which they are shown in Fig. 1.

It is obvious that when the short notches 62 in the bars 50¹ and 50³ of the detector rods Db and Da align with the rollers 70a and 71a on the crossbars 68a, the spring 72a will urge this crossbar to the position in which the rollers 70a and 71a enter the aligned notches, and that, when the short notches in the bars 50² and 50⁴ of the detector rods Db and Da align with the rollers 70b and 71b on the crossbar 68b, the spring 72b will urge this crossbar to the position in which these rollers will enter the aligned notches. The extreme positions to which the crossbars can be moved by the springs 72a and 72b in the event of the removal of the detector bars 50 from the switch machine are limited by suitable stops 78.

The upper sides of the crossbars 68a and 68b are provided with rack teeth 69a and 69b, respectively, which mesh with gear segments 49a and 49b formed on cam members 47a and 47b. The cam members 47a and 47b are journalled on the bushings 36a and 36b previously described, longitudinal displacement of the cam members on the bushings being prevented by an annular flange formed on one end of each bushing, and by the washer 35a or 35b which abuts against the opposite end of the bushing. The cam member 47a is provided, in addition to the gear segment 49a with an upwardly extending cam segment 48a (see Fig. 10) which is adapted to cooperate with the roller 75a carried by the contact fingers 73a, and the cam member 47b is likewise provided with a similar cam segment 48b which is adapted to cooperate with the roller 75b carried by the contact fingers 73b. The upper portions of the cam segments 48a and 48b as here shown are curved and are provided with notches 63a or 63b, respectively. The parts are so proportioned that the notch 63a will align with the rollers 75a when and only when the crossbar 68a is moved to the position in which the rollers 70a and 71a thereon are within the short notches 62 in the detector bars 50¹ and 50³ of the detector rods Db and Da, and that the notch 63b will align with the roller 75b when and only when the crossbar 68b is moved to the position in which the rollers 70b and 71b thereon are within the short notches 62 in the detector bars 50² and 50⁴ of the detector rods Db and Da.

It will be seen, therefore, from the foregoing that when the switch points are in their full normal positions in which they are shown in Fig. 1, and are locked in these positions by the slide bar N, the notch 63a in the cam segment 48a and the notch 45a in the cam 37a will both be opposite the roller 75a carried by the contact fingers 73a, and under these conditions, the contact fingers 73a will assume their lowermost positions in which the contact 73a—77 is open and the contacts 73a—76a are closed. Likewise, when the switch points are in their full reverse positions, and are locked in these positions by the slide bar N, the notch 63b in the cam segment 48b and notch 45b in the cam 37b will both be in alignment with the roller 75b carried by the contact fingers 73b, and under these conditions, the contact fingers 73b will assume their lowermost positions in which the contact 73b—77 is open and the contacts 73b—76b are closed. When, however, the switch points are in their intermediate positions, the notch 63a in the cam segment 48a and the notch 45a in the cam 37a will be out of alignment with roller 75a, and the notch 63b in the cam segment 48b and the notch 45b in the cam 37b will both be out of alignment with the roller 75b, and under these

conditions, both sets of contact fingers 73[a] and 73[b] will be held in their uppermost positions so that the contacts 73[a]—77 and 73[b]—77 will both be closed while the contacts 73[a]—76[a] and 73[b]—76[b] will all be open.

It will also be seen from the foregoing that if, when the switch points are locked in either their normal or their reverse positions, a train trails through either pair of switch points and displaces such pair of switch points from their locked positions, the resultant movement of the point detector rod which is connected to the displaced points will force the crossbar 68 whose roller 70 previously occupied a pair of notches in this detector rod out of such notches, thus operating one set or the other of the contact fingers 73 depending upon which position the switch points are in when they are trailed and which pair of points is trailed. For example, I will assume that a train trails through the switch points P[a], P[a] when the switch points are locked in the positions in which they are shown in Fig. 1, thus forcibly moving these switch points toward the left. This movement of the switch points P[a], P[a] will move the detector rod D[a] downwardly as viewed in Fig. 3 thus forcing the roller 71[a] on the crossbar 68[a] out of the vertical aligned notches 60 and 61 in the left-hand sides of the point detector bars 50 of the detector rod D[a]. As a result, the cam member 47[a] which previously occupied the position in which the notch 63[a] in the cam segment 48[a] was in alignment with the roller 75[a] will be rotated to a position in which the roller 75[a] is forced to ride up on the periphery of the cam segment 48[a], thus causing the contacts 73[a]—76[a] which were previously closed to become opened and the contacts 73[a]—77 which were previously open to become closed. The operation of the contacts by the detector bars, if a train trails through the switch points P[a], P[a] when they are locked in their reverse positions, or the switch points P[b], P[b] when these points are locked in either their normal or their reverse positions will be readily understood from the foregoing and from an inspection of the drawing without further description.

It should be particularly pointed out that while I have here shown the point detector mechanism as comprising two detector rods each consisting of two longitudinally adjustable detector bars jointly connected by a single connecting rod to a pair of switch points, in actual practice it may at times be desirable to provide the mechanism with four detector rods each consisting of a different one of the detector bars 50, and suitable means for separately connecting each point of the switch to a different one of the bars instead of connecting a combined pair of detector bars to the front rod as above described. Inasmuch as it would unnecessarily complicate the disclosure to show such an arrangement here, it has been omitted from the drawings.

It should also be pointed out that while I have illustrated my invention as applied to a movable point frog, it may equally well be utilized for controlling a single switch. In this event, either the lock rod L[a] and point detector rod D[a] or the lock rod L[b] and point detector rod D[b] may be omitted. It is thought that the operation of the apparatus when used in connection with a single switch will be readily understood from the foregoing without further description.

Although I have herein shown and described only one form of railway switch operating apparatus embodying my invention, it is understood that various changes and modifications may be made therein within the scope of the appended claims without departing from the spirit and scope of my invention.

Having thus described my invention, what I claim is:

1. In railway switch operating apparatus of the type in which a slide bar is moved to an intermediate position prior to the movement of the operating rod which reverses the switch points and to one or the other of two extreme positions after the completion of the movement of the operating rod depending upon the extreme position to which the switch points have been moved, the combination of two spaced locking dogs secured to the slide bar and located in the same horizontal plane, and a lock rod connected to the switch points to move therewith and provided with two spaced notches adapted to selectively receive said locking dogs to lock the switch points in their two extreme positions.

2. In railway switch operating apparatus of the type in which a slide bar is moved to an intermediate position prior to the movement of the operating rod which reverses the switch points and to one or the other of two extreme positions after the completion of the movement of the operating rod depending upon the extreme position to which the switch points have been moved, the combination of two differently shaped spaced locking dogs secured to the slide bar and located in the same horizontal plane, and a lock rod connected to the switch points to move therewith and provided with two spaced notches adapted to selectively receive said two dogs to lock the switch points in their two extreme positions.

3. In railway switch operating apparatus of the type in which a slide bar is moved to an intermediate position prior to the movement of the operating rod which reverses the switch points and to one or the other of two extreme positions after the completion of the movement of the operating rod depending upon the extreme position to which the switch points have been moved, the combination of two differently shaped spaced locking dogs secured to the slide bar and located in the same horizontal plane, and a lock rod connected to the switch points to move therewith and provided with two spaced notches having such shapes that each notch will receive a different one of said locking dogs only, the parts being so proportioned that the one dog will enter the correspondingly shaped notch when the switch points are moved to one extreme position and the slide bar is moved to the corresponding extreme position and that the other dog will enter the correspondingly shaped notch when the switch points are moved to the opposite extreme position and the slide bar is moved to the corresponding extreme position.

4. In railway switch operating apparatus of the type in which a slide bar is moved to an intermediate position prior to the movement of the operating rod which reverses the switch points and to one or the other of two extreme positions after the completion of the movement of the operating rod depending upon the extreme position to which the switch points have been moved, the combination of two spaced locking dogs secured to said slide bar in the same horizontal plane and each having a different edge beveled to provide the dogs with different shapes, and a lock rod secured to the switch points to move therewith and provided with two spaced notches so shaped

that the one notch will receive the one dog only and the other notch will receive the other dog only.

5. In railway switch operating apparatus of the type in which a slide bar is moved to an intermediate position prior to the movement of the operating rod which reverses the switch points and to one or the other of two extreme positions after the completion of the movement of the operating rod depending upon the extreme position to which the switch points have been moved, the combination of two spaced locking dogs secured to said slide bar in the same horizontal plane and each having a different edge beveled to provide the dogs with different shapes, and a lock rod secured to the switch points to move therewith and provided with two spaced notches so shaped and so positioned that the one notch will receive the one dog if and only if the lock rod has been moved by the switch points to one extreme position corresponding to one extreme position of the points when the slide bar is moved toward one of its extreme positions and that the other notch will receive the other dog if and only if the lock rod has been moved by the switch points to an opposite extreme position corresponding to the opposite extreme position of the points when the slide bar is moved toward the other of its extreme positions.

6. In combination, two pairs of movable switch points, means including an operating rod for reversing both pairs of switch points simultaneously, a slide bar, means for moving said slide bar to an intermediate position prior to the movement of said operating rod which reverses the switch points and to one or the other of two extreme positions upon the completion of the movement of the operating rod depending upon the extreme position to which the switch points have been moved, three spaced locking dogs secured to said slide bar in the same plane, and two lock rods one secured to each pair of switch points to move therewith, the one lock rod being provided with two spaced notches adapted to receive a first or a second one of said dogs respectively to lock the associated pair of switch points in their two extreme positions and the other lock rod being provided with two spaced notches adapted to receive said second and a third one of said dogs respectively to lock the associated pair of switch points in their two extreme positions.

7. In combination, two pairs of movable switch points, means including an operating rod for reversing both pairs of switch points simultaneously, a slide bar, means for moving said slide bar to an intermediate position prior to the movement of said operating rod which reverses the switch points and to one or the other of two extreme positions upon the completion of the movement of the operating rod depending upon the extreme position to which the switch points have been moved, three spaced locking dogs secured to said slide bar in the same plane the two outer dogs being shaped differently from the middle dog, and two lock rods one secured to each switch point to move therewith, the one lock rod being provided with two spaced notches adapted to selectively receive the middle dog and the one outer dog to lock the associated pair of switch points in their two extreme positions and the other lock rod being provided with two spaced notches adapted to selectively receive the middle dog and the other outer dog to lock the associated pair of switch points in their two extreme positions.

8. In combination, two pairs of movable switch points, means including an operating rod for reversing both pairs of switch points simultaneously, a slide bar, means for moving said slide bar to an intermediate position prior to the movement of said operating rod which reverses the switch points and to one or the other of two extreme positions upon the completion of the movement of the operating rod depending upon the extreme position to which the switch points have been moved, three spaced locking dogs secured to said slide bar in the same plane and having their alternate edges beveled, and two lock rods one secured to each switch point to move therewith, the one lock rod being provided with two spaced notches adapted to selectively receive the middle dog and the one outer dog to lock the one pair of switch points in their two extreme positions and the other lock rod being provided with two spaced notches adapted to selectively receive the middle dog and the other outer dog to lock the other pair of switch points in their two extreme positions.

9. In railway switch operating apparatus of the type in which a slide bar is moved to an intermediate position prior to the movement of the operating rod which reverses the switch points and to one or the other of two extreme positions after the completion of the movement of the operating rod depending upon the extreme position to which the switch points have been moved, the combination of a first cam, means for operating said first cam in response to movement of said slide bar, a detector rod connected with the switch points and provided with a notch, a second bar provided with a roller and biased to a position in which said roller will enter the notch in said detector rod in one position of the switch points, a second cam operatively connected with said second bar, and indication contacts controlled jointly by said two cams.

10. In railway switch operating apparatus of the type in which a slide bar is moved to an intermediate position prior to the movement of the operating rod which reverses the switch points and to one or the other of two extreme positions after the completion of the movement of the operating rod depending upon the extreme position to which the switch points have been moved, the combination of a rotatable cam shaft, a gear wheel secured to said cam shaft and operatively connected with said slide bar to rotate said shaft in response to movement of said slide bar, a first cam operatively connected with said cam shaft, a detector rod connected with the switch points and provided with a notch, a second bar provided with a roller and biased to a position in which said roller will enter the notch in said detector rod when the switch points occupy a predetermined position, a second cam rotatably mounted on said cam shaft and operatively connected with said second bar, and a contact controlled by said two cams.

WILLIAM C. McWHIRTER.