Nov. 9, 1937. K. J. J. McGOWAN 2,098,831

RAILWAY SWITCH OPERATING APPARATUS

Filed March 29, 1935 4 Sheets-Sheet 1

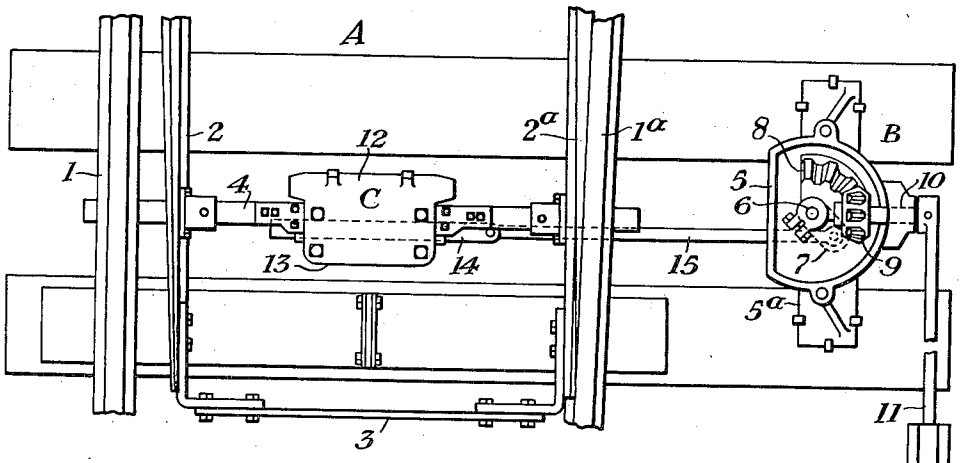


Fig. 1.

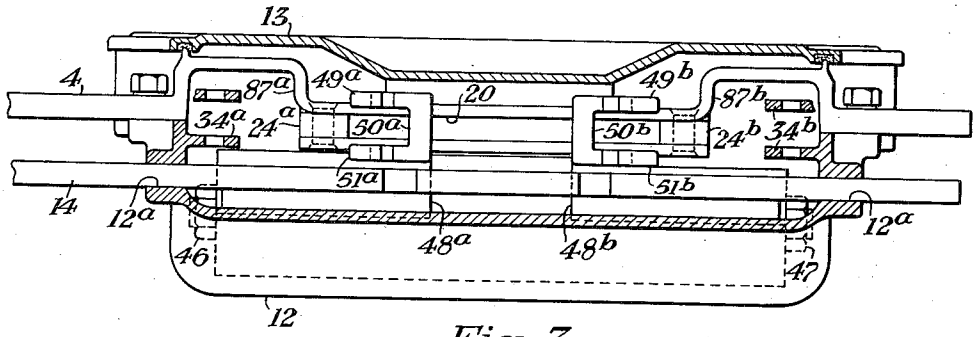


Fig. 3.

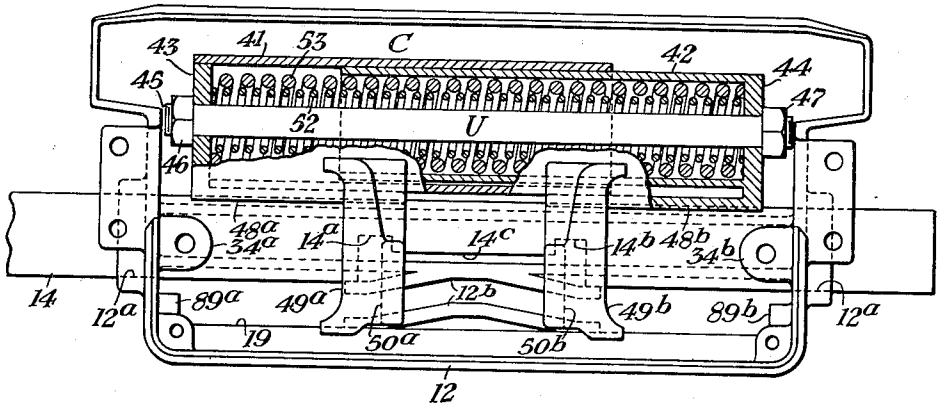


Fig. 5.

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RAILWAY SWITCH OPERATING APPARATUS

Filed March 29, 1935 4 Sheets-Sheet 2

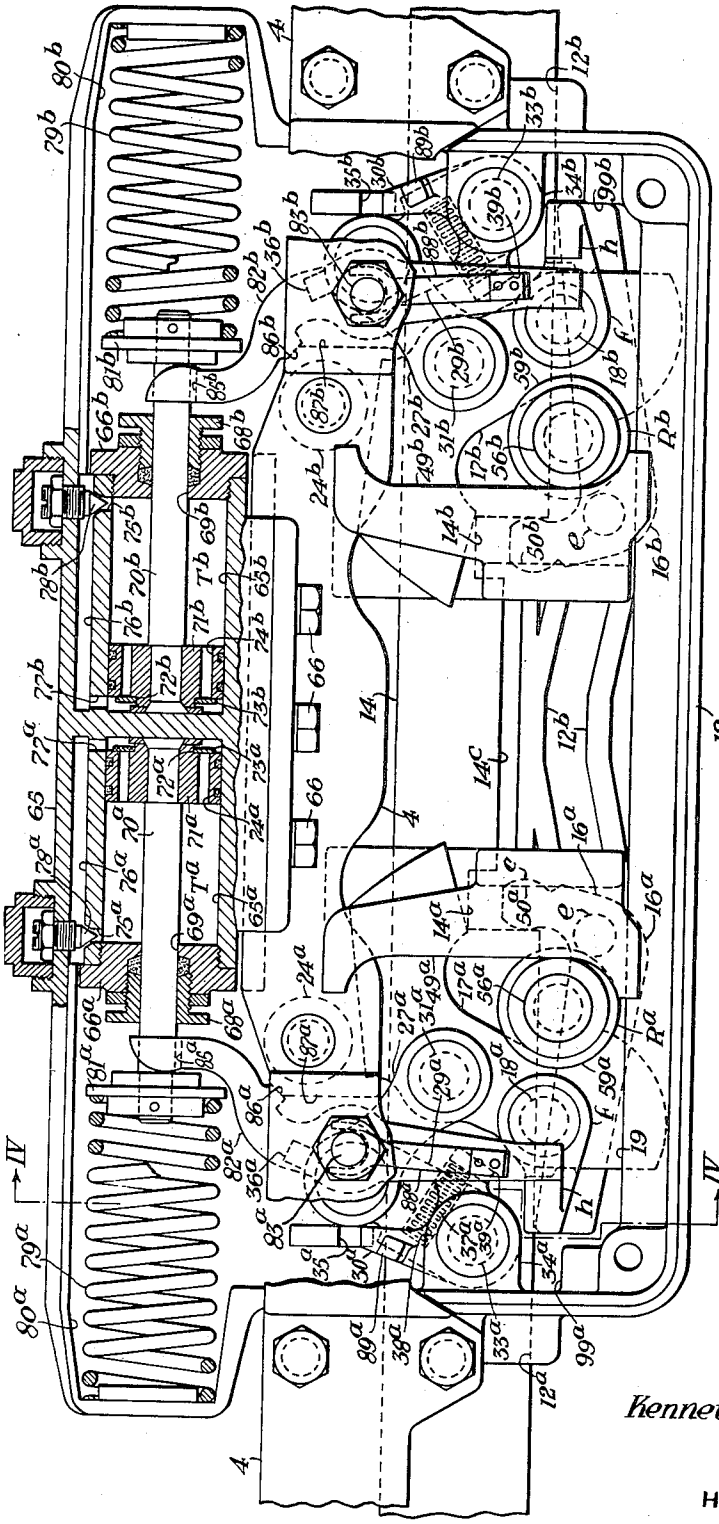


Fig. 2.

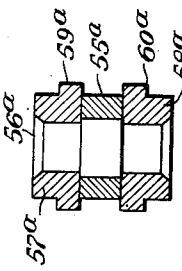


Fig. 10.

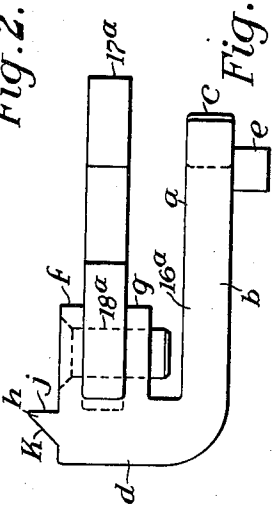


Fig. 9.

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RAILWAY SWITCH OPERATING APPARATUS

Filed March 29, 1935 4 Sheets-Sheet 3

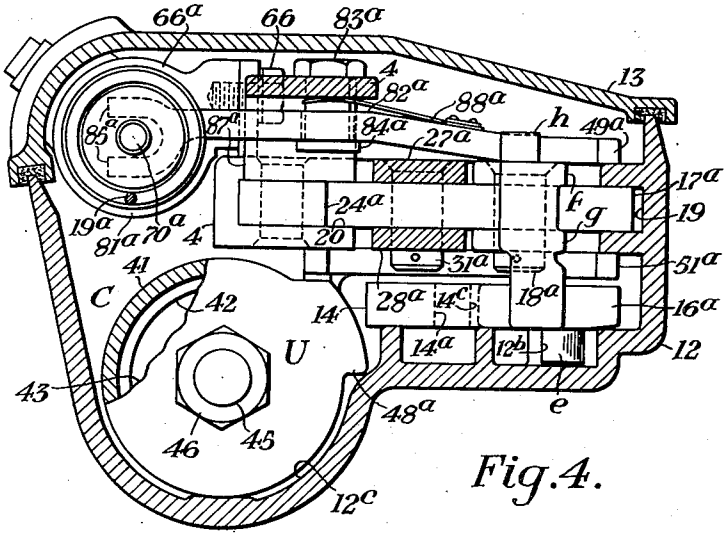


Fig.4.

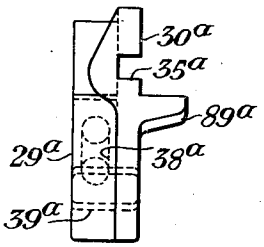


Fig.8.

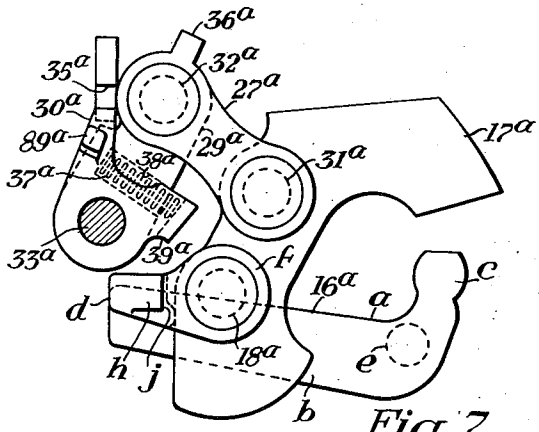


Fig.7.

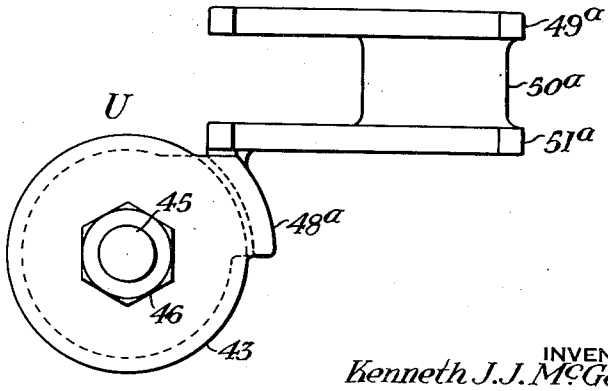


Fig.6.

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RAILWAY SWITCH OPERATING APPARATUS

Filed March 29, 1935 4 Sheets-Sheet 4

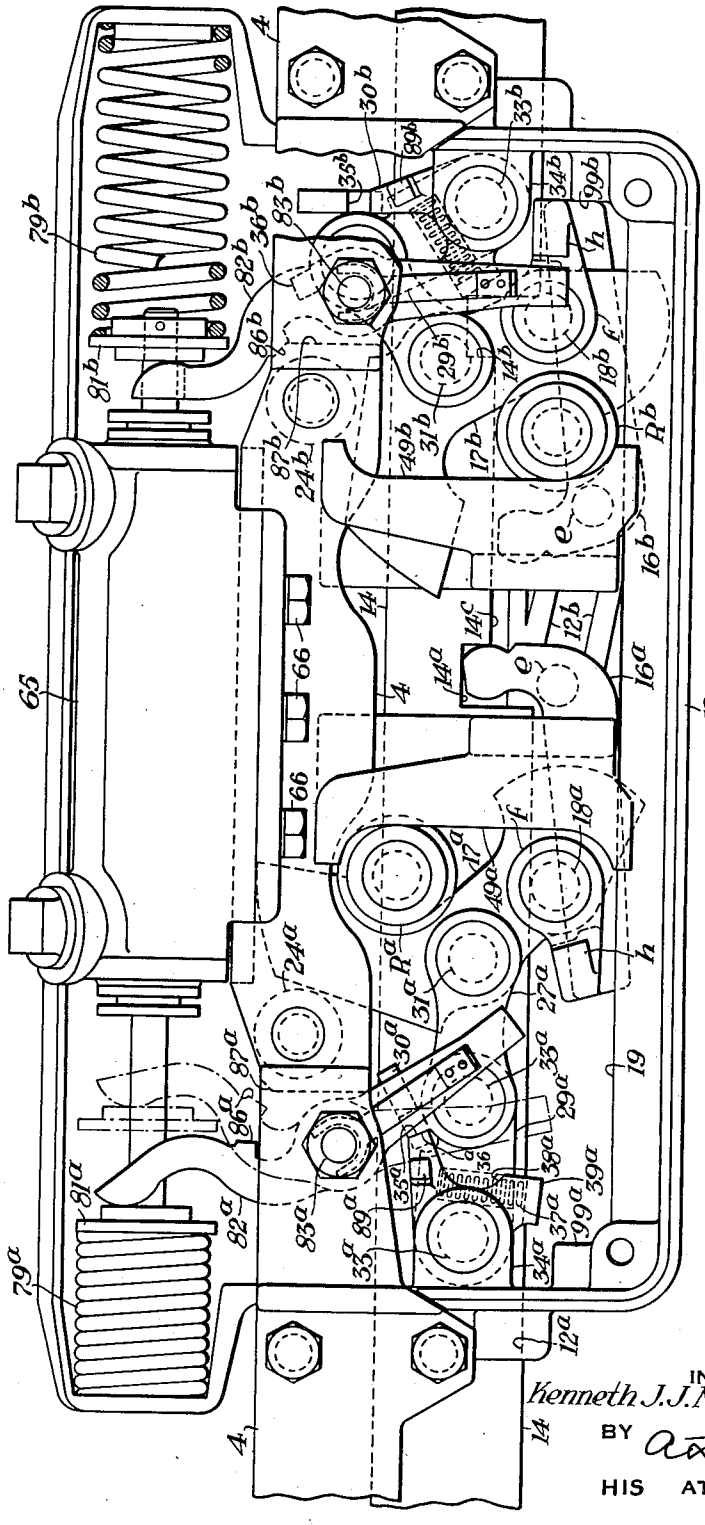


Fig. 11.

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Patented Nov. 9, 1937 2,098,831

UNITED STATES PATENT OFFICE

2,098,831

RAILWAY SWITCH OPERATING APPARATUS

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Application March 29, 1935, Serial No. 13,682

9 Claims. (Cl. 246—291)

My invention relates to railway switch operating apparatus.

One object of my invention is to provide means for biasing the movable rails of a switch to a selected extreme position in such manner that when a train trails the switch and displaces the movable rails from the selected extreme position, the biasing means will become effective to urge the movable rails to their opposite extreme position for a time interval which is preferably sufficiently long to permit the train to completely trail the switch, whereupon the biasing means will again become effective to bias the movable rails to their original positions.

Other objects of my invention will appear as the description proceeds.

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 railway switch A provided with one form of switch operating apparatus embodying my invention. Fig. 2 is an enlarged top plan view, with the cover removed, of the biasing mechanism C forming part of the apparatus illustrated in Fig. 1, the parts being shown in their normal positions. Fig. 3 is a vertical longitudinal sectional view of the device C shown in Fig. 2 with certain of the parts removed to better illustrate the construction of the remaining parts. Fig. 4 is a transverse sectional view of the mechanism) C shown in Fig. 2 taken substantially on the line IV—IV of Fig. 2. Fig. 5 is a top plan view of the mechanism shown in Fig. 2 with the cover and a number of the operating parts removed. Fig. 6 is an end view of the spring unit U forming part of the biasing mechanism shown in the preceding views. Fig. 7 is a top plan view showing certain of the parts of the mechanism C illustrated in Fig. 2 removed from the mechanism, these parts being in the relative positions in which they are shown in Fig. 2. Fig. 8 is a side view of the latch 30ª and link 29ª as they appear when viewed from the left in Fig. 7. Fig. 9 is a side view of the selector lever 16ª and floating lever 17ª as they appear when viewed from below in Fig. 2. Fig. 10 is a vertical sectional view of the roller assembly Rª forming part of the biasing mechanism C shown in Fig. 2. Fig. 11 is a view similar to Fig. 2, but showing the parts in the positions which they occupy when the switch is moved from its normal position to its reverse position by a trailing train.

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

Referring first to Fig. 1, the reference character A designates a railway switch comprising, as usual, two fixed rails 1 and 1ª and two movable rails or switch points 2 and 2ª, the switch points being connected together adjacent their tips by a front rod 3 and a composite head rod 4.

Associated with the switch A is a switch operating device B which may be of any suitable type, but which in the form here shown comprises a switch stand 5 having its base 5ª spiked or otherwise secured to the ties adjacent the switch A. A gear shaft 6 is journaled in the switch stand 5, and carries a crank 7 and a gear segment 8. The gear segment 8 meshes with a pinion gear 9 keyed to a pinion shaft 10. The pinion shaft 10 extends through the side of the switch stand 5, and has attached to its outer end the usual weighted switch-throwing lever 11.

Also associated with the switch A is a biasing mechanism C embodying my present invention. As here shown, this mechanism comprises a suitable casing 12 provided with a removable cover 13. The casing 12 is bolted to the head rod 4 to move therewith, and is provided at its opposite ends with aligned guideways 12ª which slidably receive an operating rod 14, one end of which is operatively connected with the previously mentioned crank 7 of the switch stand 5 by means of a connecting rod 15. Formed in one side of the operating rod within the casing 12 are two notches 14ª and 14ᵇ separated by a recess 14ᶜ. The notch 14ª cooperates with a selector lever 16ª (see Fig. 2), while the notch 14ᵇ cooperates with a selector lever 16ᵇ.

As best seen in Figs. 7 and 9, the selector lever 16ª is a casting or forging having a horizontally disposed substantially L-shaped lower portion *a* the long leg *b* of which terminates at the end opposite to the short leg *c* in an upright extension *d*. The lower portion *a* of the selector lever is provided at the junction of the long and short legs with a depending cam follower *e*, while the upright extension *d* is provided with two laterally projecting, vertically spaced, apertured lugs *f* and *g*, and with an upstanding lug *h* having a vertical forward surface *j* and a sloping rear surface k. The selector lever 16ᵇ is similar to the selector lever 16ª with the exception that the lever 16ᵇ is a right-hand lever, while the lever 16ª is a left-hand lever. The cam followers *e* of both levers 16ª and 16ᵇ ride in a camway 12ᵇ formed on the bottom of the casing 12.

The selector lever 16ª is pivotally attached to a floating lever 17ª, adjacent one end of the lever 17ª, by means of a pin 18ª which is mounted in

the lugs *f* and *g* of the lever 16[a], and the selector lever 16[b] is similarly pivotally attached to a floating lever 17[b]. The two floating levers 17[a] and 17[b] are each slidably mounted at the ends nearest the pins 18 in a channel-shaped guideway 19 (see Fig. 4) which extends longitudinally of the casing 12 at the right-hand side of the casing, as viewed in Fig. 4, while the other ends of the floating levers are each slidably mounted in a channel-shaped guideway 20 formed in the head rod 4. Disposed in the guideway 20 at one end of the guideway is a roller stop 24[a] which cooperates with the adjacent end of the floating lever 17[a] in a manner which will be described hereinafter, and disposed in the guideway 20 at the other end of the guideway is a roller stop 24[b] which cooperates with the adjacent end of the lever 17[b] in the same manner that the roller stop 24[a] cooperates with the adjacent end of the lever 17[a].

The floating levers are each operatively connected with the adjacent end of the casing 12 by means of similar toggle mechanisms, the corresponding parts of which are designated by the same reference characters with the distinguishing exponents *a* and *b*, respectively, affixed thereto. Referring particularly to the toggle mechanism for operatively connecting the lever 17[a] with the casing 12, this mechanism comprises three links 27[a], 28[a] and 29[a], and a latch 30[a]. The links 27[a] and 28[a] are each pivotally attached at one end to the floating lever 17[a] near the center of the lever by means of a pivot pin 31[a], while the link 29[a] is pivotally attached at one end, by means of a pivot pin 32[a], to the free ends of the links 27[a] and 28[a], and at the other end to the casing 12 by means of a pivot pin 33[a] mounted in a pair of spaced lugs 34[a]. The latch 30[a] is pivotally mounted on the pivot pin 33[a] above the link 29[a], and is provided adjacent its free end with a recess 35[a]. The recess 35[a] cooperates with a latch catch 36[a], provided on the link 27[a], in such manner that when the links 27[a], 28[a] and 29[a] are moved to substantially their dead center positions, the latch catch will enter the recess 35[a] and will thus hold the links in substantially their dead center positions until the latch is subsequently released by timing mechanism which I will describe hereinafter. The latch is constantly biased to its latching position with respect to the link 29[a] by means of a compressed coil spring 37[a], one end of which is disposed in a spring socket 38[a] formed in the side of the lever 29[a], and the other end of which engages a depending lug 39[a] which is formed on the latch 30[a]. Since, as was pointed out above, the toggle mechanism for operatively connecting the floating lever 17[b] with the casing 12 is similar to that for connecting the floating lever 17[a] with the casing, it is believed that the construction of this latter mechanism will be apparent from an inspection of the drawings and from the foregoing description without further detailed description.

The biasing mechanism C also includes a spring unit U. This unit is mounted in a longitudinally extending semicircular depression 12[c] which is formed in the bottom of the casing 12 adjacent the left-hand side of the casing, as viewed in Fig. 4, and in the form here shown, comprises two telescopically related tubular members 41 and 42 provided at their opposite ends with end plates 43 and 44. These end plates are each formed with an axially disposed hole through which a rod 45 passes with some clearance. The outer ends of the rod 45 are threaded to receive stop nuts 46 and 47, and surrounding the rod within the tubular members are two concentric compressed coil springs 52 and 53 which constantly bias the tubular members to the relative positions in which the end plates 43 and 44, respectively, engage the associated nuts 46 and 47. Formed integral with the end plates 43 and 44, respectively, at the side nearest the floating levers are members 48[a] and 48[b] which extend parallel to the associated tubular members, and provided on the free ends of the members 48[a] and 48[b] are laterally projecting arms 51[a] and 51[b], respectively. As shown in Figs. 3 and 6, the arm 51[a] is connected near its outer end by means of an upstanding web 50[a], with a similar arm 49[a] which extends parallel to the arm 51[a], and the arm 51[b] is similarly connected near its outer end by means of an upstanding web 50[b] with an arm 49[b] which is similar to, and which extends parallel to, the arm 51[b]. The left-hand ends of the arms 49[a] and 51[a], and 49[b] and 51[b], slidably cooperate with the opposite sides of the head rod 4, and the right-hand ends of these arms slidably cooperate with the outer faces of the members which form the guideway 19, in such manner that these arms are constrained to slide in a predetermined horizontal plane in the casing 12. The left-hand sides of the arms 49[a] and 51[a] and the right-hand sides of the arms 49[b] and 51[b], as viewed in Fig. 5, are curved as shown, for a purpose which will be made clear presently.

A roller assembly R[a] (see Fig. 10) comprising a roller 55[a] journaled on a pin 56[a] between two spaced circular members 57[a] and 58[a] which are riveted to the pin 56[a], is supported between the right-hand side of the floating lever 17[a] and the left-hand sides of the arms 49[a] and 51[a] of the spring unit U, as viewed in Fig. 1, in such manner that the spring unit U acts through the roller assembly to constantly exert a biasing force on the floating lever, but that the roller assembly can roll along the floating lever from a point on one side of the pivot pin 31[a] to a point on the other side of this pivot pin, and thus change the location at which the biasing force is applied to the lever. In a similar manner, a roller assembly R[b], similar to the roller assembly R[a], is supported between the left-hand side of the floating lever 17[b] and the right-hand sides of the arms 49[b] and 51[b] of the spring unit U, as viewed in Fig. 1, in such manner that the spring unit U acts through this latter roller assembly to constantly exert a biasing force on the floating lever, but that, this latter roller assembly can roll along the floating lever 17[b] from a point on one side of the pivot pin 31[b] to a point on the other side of this pivot pin, and thus change the location at which the biasing force is applied to the floating lever 17[b]. The roller assembly R[a] is held in the proper vertical position relative to the arms 49[a] and 51[a], and the floating lever 17[a], by means of annular flanges 59[a] and 60[a] formed on the end members 57[a] and 58[a], which flanges have larger diameters than the roller 55[a], and are so proportioned that they will just clear the opposite sides of the floating lever and will also fit between the two arms 49[a] and 51[a] with a small amount of clearance. The roller assembly R[b] is similarly held in the proper vertical position relative to the arms 49[b] and 51[b].

The parts are so proportioned that when no train is trailing the switch the roller assemblies R[a] and R[b] will engage the floating levers 17[a] and 17[b] in the relative positions in which they are shown engaging these levers in Fig. 2, and that, under these conditions, the spring unit U will

act through the roller assemblies R^a and R^b to bias the associated floating levers 17^a and 17^b toward the respective positions in which the selector lever 16^a engages a boss 99^a cast on the one end wall of the casing 12, and in which the selector lever 16^b engages a boss 99^b cast on the other end wall of the casing 12.

The timing mechanism referred to hereinbefore for releasing the latch 30^a after the links 27^a, 28^a and 29^a have been moved to substantially their dead center positions includes a timing device T^a comprising a cylinder 65^a formed in a casing 65 which is secured to the head rod 4 by means of bolts 66. The outer end of the cylinder 64^a is closed by a cylinder head 66^a, and extending into the cylinder through a stuffing box 68^a and through a hole 69^a provided in the cylinder head is a piston rod 70^a, the inner end of which is secured to a reciprocable piston 71^a. The cylinder 65^a is adapted to be filled with a suitable fluid, such as oil, and loosely mounted on a portion 72^a of reduced diameter formed on the right-hand end of the piston 71^a is an annular flapper valve 73^a which, when the piston 71^a is moved outwardly in the cylinder, opens and permits fluid to flow freely through a plurality of holes 74^a that extend through the piston, but which, when the piston 71^a is moved inwardly in the cylinder, closes and prevents the flow of fluid through the holes 74^a. The opposite ends of the cylinder are connected by a port 75^a, a passageway 76^a, and a port 77^a. An adjustable needle valve 78^a extends into the port 75^a and cooperates therewith to control the rate at which fluid can flow through the port 75^a, the passageway 76^a, and the port 77^a from one end of the cylinder to the other. The piston 71^a is constantly biased to the inner end of the cylinder by a spring 79^a, one end of which is disposed in a suitable socket 80^a formed in the casing 12, and the other end of which engages an annular spring support 81^a which is secured to the outer end of the piston rod 70^a.

The timing mechanism for releasing the latch 30^a after the links 27^a, 28^a and 29^a have been moved to substantially their dead center positions also comprises a trip lever 82^a which is pivoted intermediate its ends on a pivot pin 83^a which projects downwardly from the under side of the head rod 4, and which, as shown in Fig. 4, is provided at its lower end with an enlarged head 84^a. One end of the trip lever 82^a is provided with bifurcations 85^a which straddle the piston rod 70^a, and which cooperate with the spring support 81^a on the side opposite to that which is engaged by the spring 79^a, in such manner that the trip lever is biased to the position in which a stop 86^a provided on the trip lever engages a vertical portion 87^a of the head rod 4. The end portion of the trip lever opposite to the bifurcations 85^a slopes downwardly a slight amount and cooperates with the lug *h* on the selector lever 16^a and also with a lug 89^a on the latch 30^a of the trip mechanism. For reasons which will be made clear hereinafter, it is desirable that the trip lever should normally occupy the vertical position in which the end which cooperates with the lug *h* will be in a position to be engaged by the straight side *j* of the lug, but that, the lever may at times rotate slightly in a vertical direction about the piston rod 70^a as an axis to a position in which the end which cooperates with the lug *h* will clear the lug, and in order to permit this action of the lever, the distance between the head 84^a of the pivot pin 83^a and the under side of the head rod 4 is made longer than the vertical thickness of the trip lever 82^a, and the trip lever is biased by its own weight and by a spring 88^a to the vertical position in which the lever engages the head 84^a of the pin 83^a.

With the timing mechanism for tripping the latch 30^a constructed in the manner just described, it will be apparent that if the trip arm 82^a is rotated in a counter-clockwise direction in a horizontal plane about pin 83^a as an axis, the piston 71^a will be moved outwardly in the cylinder 65^a, and the spring 79^a will become compressed, so that if the force which rotated the lever in the counter-clockwise direction is then removed, the spring 79^a will tend to restore the piston 71^a and the trip lever 82^a to their original positions. It will also be apparent that during the outward movement of the piston 71^a, the flapper valve 73^a will open and permit fluid to flow freely through the holes 74^a in the piston 71^a, but that, as soon as the spring 79^a starts to restore the parts to their original positions, the flapper valve 73^a will close, and the piston 71^a will then be constrained to move at the relatively slow rate at which fluid can flow through the port 75^a past the needle valve 78^a, which rate can be controlled by adjusting the needle valve. It follows that when the parts of the timing mechanism have been moved away from their normal positions by the trip arm in the manner just described, the parts will not be restored to their full normal positions for a relatively long adjustable time interval.

The latch 30^b of the toggle mechanism which operatively connects the floating lever 17^b with the casing 12 has associated therewith timing mechanism for releasing this latch after the toggle levers 27^b, 28^b and 29^b have been moved to their dead center positions, which latter mechanism is similar to that just described, and the parts of which are designated by the same reference characters as the corresponding parts of that just described, but with the distinguishing exponent *b* added thereto. Since the timing mechanism for releasing the latch 30^b is similar to that for releasing the latch 30^a, it is believed to be unnecessary to describe this latter mechanism in detail.

The operation of the apparatus as a whole is as follows: When the movable rails 2 and 2^a of the switch A occupy their normal positions in which they are shown in Fig. 1, and the hand-throw lever 11 of the switch operating device B is rotated to its normal position in which it is shown in Fig. 1, the parts of the biasing mechanism C occupy the positions in which they are shown in Fig. 2. That is to say, the pistons 71^a and 71^b of the timing devices T^a and T^b are held at the inner ends of their strokes by the springs 79^a and 79^b, the trip levers 82^a and 82^b are held in the positions in which the associated stops 86^a and 86^b engage the vertical portions 87^a and 87^b, respectively, of the head rod 4, both toggle mechanisms are held in their collapsed positions, the rollers R^a and R^b engage the associated floating levers 17^a and 17^b adjacent the lower ends of these levers, and the floating lever 17^b is held by the force which is exerted on this lever by the spring unit U in the position in which the selector lever 16^b attached thereto engages the boss 99^b on the casing 12, while the floating lever 17^a is moved a short distance away from the position in which the selector lever 16^a attached thereto engages the boss 99^a, by engagement of the left-

hand side of the notch 14ª in the operating rod 14 with the short leg c of the L-shaped lower portion of the selector lever 16ª. With the parts of the biasing mechanism in the positions just described, due to the fact that the floating lever 17ª is held a slight distance away from the position in which the associated selector lever 16ª engages the boss 99ª on the casing 12, a force is transmitted from the operating rod 14 through the roller assembly Rª to the spring unit U, which force compresses the springs 52 and 53 of this unit beyond their initial compression so that the spring unit is accordingly effective to bias the movable rails to their normal positions, the biasing force being transmitted from the spring unit to the movable rails through the roller assembly Rᵇ, the floating lever 17ᵇ, selector lever 16ᵇ, boss 99ᵇ, casing 12, and head rod 4.

I will now assume that the parts are in the positions just described, and that it is desired to move the switch to its reverse position. To do this, the hand lever 11 of the switch operating device B is rotated from the extreme position in which it is shown in Fig. 1, through an angle of substantially 180° in a counter-clockwise direction, to its opposite extreme position. This rotation of the hand lever 11 will cause the operating rod 14 to move toward the left, as viewed in Fig. 1, and as soon as the operating rod starts to move, the left-hand edge of the notch 14ª in the operating rod will move out of engagement with the short leg c of the selector lever 16ª, thus permitting the compressed coil springs 52 and 53 of the spring unit to expand and move the floating lever 17ª to the position in which the selector lever 16ª engages the boss 99ª. As the operating rod continues to move, the right-hand side of the notch 14ᵇ in the operating rod will engage the short leg c of the selector lever 16ᵇ and will thus cause this lever, and hence the floating lever 17ᵇ to move toward the left with the operating rod. This movement of the floating lever, in turn, will exert a force on the roller assembly Rᵇ which force is transmitted through the spring unit U to the roller assembly Rª, and thence through the floating lever 17ª, selector lever 16ª, boss 99ª, casing 12 and head rod 4, to the movable rails 2 and 2ª of the switch, thus causing the movable rails to move with the operating rod until the rails reach their full reverse positions. When this happens, further movement of the movable rails is prevented, but the parts are so proportioned that the operating rod will continue to move for a short distance, and as a result, the springs 52 and 53 of the spring unit U will again become compressed beyond their initial compression, and will thus cause the spring unit to bias the movable rails to their reverse positions in a manner similar to that in which the movable rails are biased to their normal positions when the hand-throw lever 11 of the switch operating device B occupies its normal position.

When the switch A has been moved to its reverse position in the manner just described, and it is desired to restore the switch to its normal position, the hand-throw lever 11 is restored to its normal position. The operation of the apparatus under these conditions is exactly the reverse of that just described, and will be understood from the foregoing description and from an inspection of the drawing without further description.

I will now assume that the parts all occupy their normal positions in which they are shown in Figs. 1 and 2, and that a train trails the switch. Under these conditions, as the leading wheels of the train roll along the fixed rail 1ª and the movable rail 2, the movable rails will be forced toward their reverse positions by the wheels, and since the operating rod 14 is now held fixed by virtue of its connection with the switch operating device B, the casing 12 of the biasing mechanism C will move toward the left as viewed in Fig. 2, relative to the operating rod. As the casing 12 moves toward the left, the selector lever 16ᵇ, floating lever 17ᵇ, and associated parts will remain in the same relative positions with respect to the casing 12 in which they are shown in Fig. 2. The selector lever 16ª, however, will be prevented from moving with the casing due to the engagement of the left-hand side of the notch 14a in the operating rod 14 with the short leg c of the selector lever, and as a result, as the casing moves relative to this lever, the camway 12ᵇ will cooperate with the cam follower e on the selector lever to move the right-hand end of the selector lever, as viewed in Fig. 2, toward the operating rod to a position in which the short leg c fully enters the notch 14ª. Furthermore, as the casing 12 moves toward the left relative to the selector lever 16ª, a force will be exerted on the toggle links 27ª, 28ª and 29ª through the medium of the lugs 34ª and the pin 33ª, which force, due to the fact that the floating lever 17ª is secured to the selector lever 16ª by means of the pin 18ª and that the roller assembly Rª is biased into engagement with the lower end of the floating lever by the spring unit U, will cause the toggle links 27ª, 28ª and 29ª to move to their dead center positions and become latched in these positions, thus limiting further movement of the pivot pin 31ª relative to the casing 12 to rotation through an arc whose radius is equal to the distance from the center of the pin 31ª to the center of the pin 33ª. The casing 12 will continue to move toward the left after the toggle links have become latched in their dead center positions, and it will be apparent that this latter movement of the casing will cause a couple to be exerted on the floating lever through the medium of the toggle links and the pivot pin 18ª, which couple will cause the floating lever to rotate in a counter-clockwise direction about the pivot pin 18ª. During the first part of this rotation of the floating lever 17ª the roller assembly Rª will be held in substantially the relative position in which it is shown in Fig. 2, but the roller assembly Rᵇ will be constrained to move with the casing. As a result, the springs 52 and 53 of the spring unit U will become compressed a considerable amount beyond their initial compression, and as the floating lever 17ª continues to rotate, it will finally reach a position in which the surface against which the roller assembly Rª bears will slope upwardly toward the left instead of downwardly toward the left, as viewed in Fig. 2. When this happens, the roller assembly Rª will move, due to the force which is exerted on it by the spring unit U, from the relative position with respect to the lever 17ª, in which it is shown in Fig. 2, to the relative position in which it is shown in Fig. 11. As soon as the roller moves past the pivot pin 31ª, the biasing force exerted by the spring unit U, which force was previously effective to bias the movable rails to their normal positions, will then become effective to bias the movable rails to their reverse positions, thus causing the movable rails to complete their movement toward their reverse positions very quickly. The reason why the biasing force changes its effective direction in the manner just described is that as long as the roller

assembly R^a engages the floating lever at a point below the pivot pin 31^a, the force exerted by the biasing unit is transmitted to the movable rails in the manner previously described, but that, as soon as the roller R^a moves above the pivot pin 31^a, the floating lever 17^a then becomes a second-class lever whose fulcrum is the pivot pin 18^a, whose power arm is the portion between the point where the roller R^a engages the lever and the axis of the pivot pin, and whose load arm is the portion between the axis of the pins 31^a and 18^a; and the parts are so proportioned that under these conditions the resultant force which is then transmitted to the casing 12, and hence to the movable rails, will be in the opposite direction from that which was previously transmitted to the movable rails. The parts are further so proportioned that the floating lever 17^a will rotate to the position in which it becomes a second-class lever when the movable rails have been moved away from their normal positions a distance which is less than the smallest distance they would ever be moved by a train trailing the switch, and it follows that the movable rails will always become biased toward their reverse positions while a train is trailing the switch. The movement of the casing 12 toward the left relative to the operating rod also causes the left-hand side of the lower end of the trip lever 82^a to engage the straight side *j* of the lug *h* on the selector lever 16^a in such manner that the trip lever will be rotated in a counter-clockwise direction until the trip lever reaches the extreme position in which it is shown in Fig. 11, at which time the selector lever 16^a, due to the previously described rotation of this lever caused by the cooperation of the cam follower *e* with the camway 12*b*, will have been rotated to a position in which the lug *h* will move completely out of engagement with the trip lever. This counter-clockwise rotation of the trip lever will, of course, cause spring 79^a to become compressed, and piston 71^a of timing device T^a to be moved to the outer end of the cylinder 65^a, and as a result, as soon as the lug *h* clears the trip lever, the springs 79^a will start to return the trip lever toward its original position at a rate which is controlled by the adjustment of the needle valve 78^a, in the previously described manner. When the trip lever has been returned to the position in which it is shown in dotted lines in Fig. 11, the trip lever will move into engagement with the lug 89^a on the latch 30^a, and as the trip lever continues its movement it will exert a force on the latch which will finally trip the latch, and which will also cause the toggle links 27^a, 28^a and 29^a to move away from their latched positions. As soon as the toggle links move away from their latched positions the pivot pin 31^a will be free to move toward the left, and the force exerted on the floating lever by the spring unit will then cause the upper end of the floating lever to move into engagement with the roller stop 24^a. This movement of the floating lever will change the floating lever from a second-class lever to a third-class lever whose fulcrum and power arms will be the same as when it was a second-class lever, but whose load arm will now be the portion between the point at which the roller 24 engages the lever and the axis of the pivot pin 31^a, and the parts are so proportioned that under these conditions the resultant force which is transmitted to the casing 12 by the biasing unit will now be in a direction to cause the movable rails to move toward their normal positions. The parts of the timing mechanism will usually be so adjusted that the trip lever will not be returned to the position in which it trips the latch until a predetermined time interval has elapsed which time interval is of sufficient duration to permit the trailing train when moving at a speed which is equal to or greater than a predetermined minimum speed to have completely passed the switch, and it will be apparent, therefore, that when the biasing force again becomes effective to bias the movable rails to their normal positions, these rails will usually immediately start to return to their normal positions. Until the rails have been returned to within a relatively short distance of their normal positions the camway 12^b will cooperate with the cam *e* on the selector lever 16^a to hold this lever in the position in which the short leg *c* is within the notch 14^a in the operating rod 14, and as long as the short leg *c* is within the notch 14^a, the pivot pin 18^a will be held in a fixed position relative to the trackway. The movement of the rails toward their normal positions will therefore cause the floating lever to rotate in a clockwise direction about the pivot pin 18^a, and as the lever rotates it will finally reach a position in which the surface against which the roller assembly R^a bears will become inclined downwardly toward the left instead of upwardly toward the left. As soon as the floating lever reaches this position, the force which is exerted on the roller assembly by the spring unit will cause the roller assembly to move from the position in which it engages the floating lever adjacent its upper end to the position in which it engages the lever adjacent its lower end, and when this happens, the spring unit will then become effective to bias the movable rails to their normal positions through the medium of the roller assembly R^b, floating lever 17^b, selector lever 16^b, boss 39^b, casing 12, and head rod 4, thus causing a rapid return of the movable rails to their normal positions. The return movement of the rails will also cause the lower end of the trip lever 82^a to move into engagement with the sloping surface *k* of the lug *h* on the selector lever, and since the trip lever is free to rotate in a vertical plane through a limited distance about the piston rod 79^a as a fulcrum, the lower end of the lever will slide over the lug, whereupon it will return to the position to which it is biased by its own weight and by the bias of the spring 83^a. Due to the relatively slow movement of the timing device T^a, the timing mechanism may not be restored to its full normal position as soon as the rails have been restored to their full normal position, but when the timing mechanism has been restored to its normal position and the rails have reached their normal positions, all parts will then be restored to their normal positions in which they are shown in the drawings.

It should be pointed out that if under the conditions just described the timing mechanism including the timing device T^a had been set to release the latch at the expiration of a shorter time interval than that required for the train to trail the switch, the first pair of wheels that passed through the switch after the timing device had tripped the latch would ordinarily again condition the apparatus so that the switch would become biased to its trailed position for another time interval equal to that for which the timing mechanism is adjusted.

When the switch has been moved to its reverse position by the switch operating device B and a

train trails the switch, the operation of the apparatus is similar to that just described with the exception that under these conditions the floating lever 17b and associated parts at the right-hand end of the biasing mechanism C would become operative. Inasmuch as this operation is similar to that just described it is believed that it will be fully understood from the foregoing description and from an inspection of the drawings without further description.

It will be seen that I have provided operating apparatus for a switch of the type which is adapted to be trailed, whereby the switch is normally biased to an extreme position corresponding to the position of the switch operating device B, but that, when a train trails the switch, the switch then becomes biased to the position opposite to that corresponding to the position of the operating device for a measured time interval, and that when this time interval has expired, the switch again becomes biased to its original position.

One advantage of apparatus embodying my invention is that it eliminates the extreme wear on the switch points which usually takes place in switches of the type which are adapted to be trailed.

Another advantage of apparatus embodying my invention is that it improves the riding qualities of a train while it is trailing the switch.

Although I have herein shown and described only one form of 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 combination, a railway switch the movable rails of which are connected together by a head rod, a biasing mechanism comprising a casing secured to said head rod, an operating device associated with said switch, an operating rod slidably mounted in said casing and operatively connected with said operating device, a floating lever slidably supported in said casing and operatively connected intermediate its ends with said casing by means of toggle mechanism including a latch for latching said toggle mechanism in substantially its dead center position when said toggle mechanism is moved to such position, means for operatively connecting said floating lever with said operating rod in such manner that when said operating device occupies one extreme position and said switch occupies a corresponding extreme position said toggle mechanism will be collapsed and said lever will be rotated to one extreme position but that when said operating device occupies said one extreme position and said switch is moved away from the extreme position corresponding to the position of said device said toggle mechanism will be moved to its latched position and said floating lever will be rotated to another extreme position, a spring unit, a roller assembly biased into engagement with said floating lever on the side opposite to said toggle mechanism by said spring unit in such manner that said roller assembly will engage said lever on one side of its connection with said toggle mechanism or the other according as said lever is rotated to its one extreme position or its other extreme position, timing mechanism set into operation when said toggle mechanism is moved to its latched position and effective at the expiration of a predetermined time interval for tripping said latch and moving said toggle mechanism away from its latched position, and a stop cooperating with said levers when said toggle mechanism is moved away from its latched position by said timing mechanism, the parts being so proportioned that when said toggle mechanism is collapsed and said lever is rotated to said one extreme position said spring unit will bias said switch to the extreme position corresponding to the extreme position of said device but that when said toggle mechanism occupies its latched position and said lever is rotated to its other position said spring unit will then be effective to bias said switch to the extreme position opposite to that corresponding to said one extreme position of said device, and that after said toggle mechanism is moved away from its latched position said lever will then cooperate with said stop in such manner that said spring unit will again become effective to bias said switch to the extreme position corresponding to said one extreme position of said device.

2. In combination, a railway switch movable between two extreme positions, means for normally biasing said switch to a selected extreme position, means effective when said switch is moved away from said selected extreme position by a trailing train for biasing said switch to its opposite extreme position, and timing means set into operation when said second mentioned biasing means is actuated for terminating the effect of said second mentioned biasing means and for restoring the effect of said first mentioned biasing means at the expiration of a measured time interval.

3. In combination, a railway switch movable between two extreme positions, means for normally biasing said switch to a selected extreme position, means effective when said switch is moved away from said selected extreme position by a trailing train for biasing said switch to its opposite extreme position, and timing means set into operation when said second mentioned biasing means is actuated for terminating the effect of said second mentioned biasing means and for restoring the effect of said first mentioned biasing means at the expiration of a measured time interval which is sufficiently long to permit the train to completely trail the switch provided the train remains in motion at a speed which is equal to or greater than a predetermined minimum speed.

4. In combination with a railway switch and an operating device movable between two positions to actuate the switch to corresponding positions, a spring unit connected with the switch and the operating device and normally effective to urge the switch to a position corresponding to the operating device, means responsive to the trailing movement of a vehicle wheel through the switch to cause said spring unit to urge the switch to a position of disagreement with said device, and means set into operation when said first mentioned means is actuated for terminating the operation of said first mentioned means at the expiration of a measured time interval.

5. In combination with a railway switch and an operating device movable between two positions to actuate the switch to corresponding positions, biasing mechanism connected with the switch and the operating device and normally effective to urge the switch to a position corresponding to the operating device, means included in said biasing mechanism and effective when a

train trails the switch to cause the biasing mechanism to urge the switch to a position of disagreement with said device, and timing means included in said biasing mechanism and set into operation whenever said first mentioned means is actuated for terminating the operation of said first mentioned means at the expiration of an adjustable time interval.

6. In combination with a railway switch and an operating device movable between two positions to actuate the switch to corresponding positions, biasing mechanism connected with the switch and the operating device and normally effective to urge the switch to a position corresponding to the operating device, means included in said biasing mechanism and effective when a train trails the switch to cause the biasing mechanism to urge the switch to a position of disagreement with said device, and timing means included in said biasing mechanism and set into operation whenever said first mentioned means is actuated for terminating the operation of said first mentioned means at the expiration of a time interval which is sufficiently long to permit the train to completely trail the switch provided the train remains in motion at a speed which is equal to or greater than a predetermined minimum speed.

7. In combination with a railway switch and an operating device movable between two positions to actuate the switch to corresponding positions, a biasing mechanism comprising a casing secured to the movable rails of said switch to move therewith, an operating rod slidably mounted in said casing and operatively connected with said operating device, a spring unit in said casing, means in said casing for operatively connecting said spring unit with said operating rod in such manner that said spring unit is normally effective to bias the switch to a position corresponding to the operating device, means effective when a train trails the switch for modifying the connection between said spring unit and said operating rod in such manner that said spring unit is then effective to bias the switch to a position of disagreement with the operating device, and means set into operation when said second mentioned means is actuated for terminating the effect of said second mentioned means and for restoring the effect of said first mentioned means at the expiration of a measured time interval.

8. In combination with a railway switch the movable rails of which are connected together by a head rod, a casing secured to said head rod to move with the movable rails, a switch operating device, an operating rod slidably mounted in said casing and operatively connected with said operating device, a floating lever slidably mounted in said casing, means in said casing including toggle mechanism for operatively connecting said lever with said casing, other means in said casing for operatively connecting said lever with said head rod when a train trails the switch, the parts being so proportioned that when said operating device occupies one extreme position and said switch occupies a corresponding extreme position said toggle mechanism will be collapsed and said lever will be rotated to one extreme position but that when said operating device occupies said one extreme position and said switch is moved away from the corresponding extreme position said toggle mechanism will be moved to its dead center position and said floating lever will be rotated to another extreme position, latch mechanism effective when said toggle mechanism is moved to its dead center position for latching it in its dead center position, a spring unit in said casing operatively connected with said lever and said casing in such manner that when said device occupies its one extreme position said switch will be biased to its one extreme position or its other extreme position by said spring unit according as said lever occupies its one extreme position or its other extreme position, and timing mechanism in said casing set into operation when said toggle mechanism is moved to its dead center position and effective at the expiration of a predetermined time interval for tripping said latch mechanism and moving said toggle mechanism away from its dead center position.

9. In combination with a railway switch the movable rails of which are connected together by a head rod, a casing secured to said head rod to move with the movable rails, a switch operating device, an operating rod slidably mounted in said casing and operatively connected with said operating device, a floating lever slidably mounted in said casing, means in said casing including toggle mechanism for operatively connecting said lever with said casing, other means in said casing for operatively connecting said lever with said head rod when a train trails the switch, the parts being so proportioned that when said operating device occupies one extreme position and said switch occupies a corresponding extreme position said toggle mechanism will be collapsed and said lever will be rotated to one extreme position but that when said operating device occupies said one extreme position and said switch is moved away from the corresponding extreme position said toggle mechanism will be moved to its dead center position and said floating lever will be rotated to another extreme position, latch mechanism effective when said toggle mechanism is moved to its dead center position for latching it in its dead center position, a spring unit in said casing operatively connected with said lever and said casing in such manner that when said device occupies its one extreme position said switch will be biased to its one extreme position or its other extreme position by said spring unit according as said lever occupies its one extreme position or its other extreme position, and timing mechanism in said casing set into operation when said toggle mechanism is moved to its dead center position and effective at the expiration of a predetermined time interval which is sufficiently long to permit the train to completely trail the switch provided the train remains in motion at a speed which is equal to or greater than a predetermined minimum speed for tripping said latch mechanism and moving said toggle mechanism away from its dead center position.

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