

May 27, 1952

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2,598,495

RAILWAY SWITCH OPERATING APPARATUS

Filed Sept. 10, 1948

2 SHEETS—SHEET 1

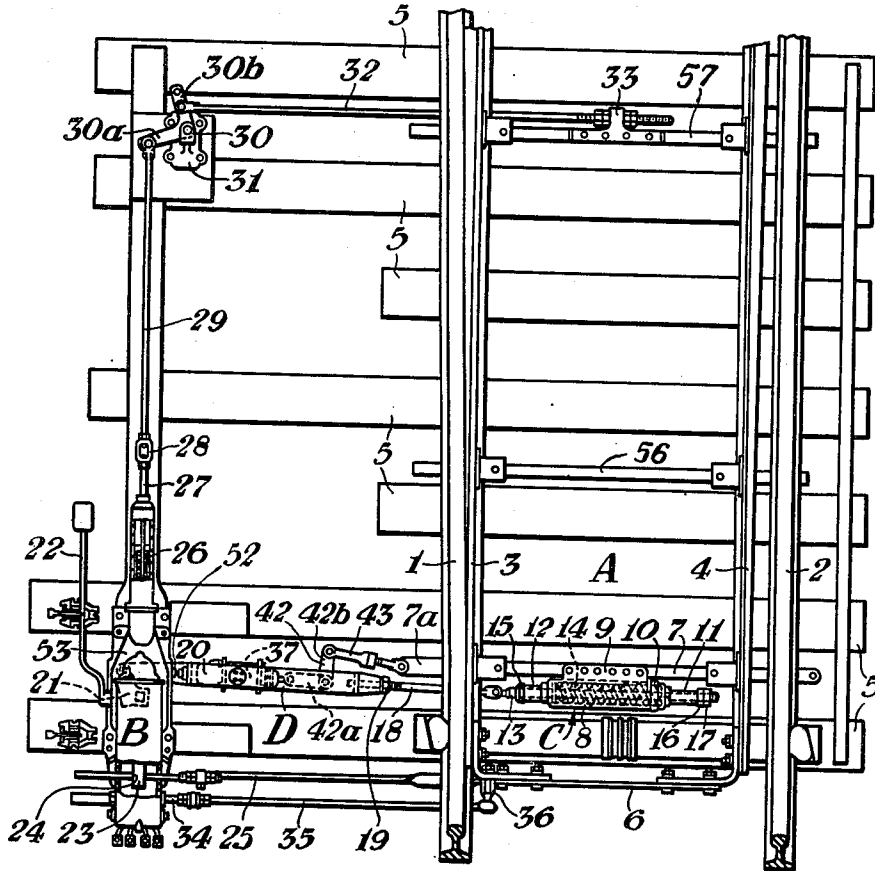


Fig. 1.



Fig. 4. 48 37



Fig. 5. 48 48a 37

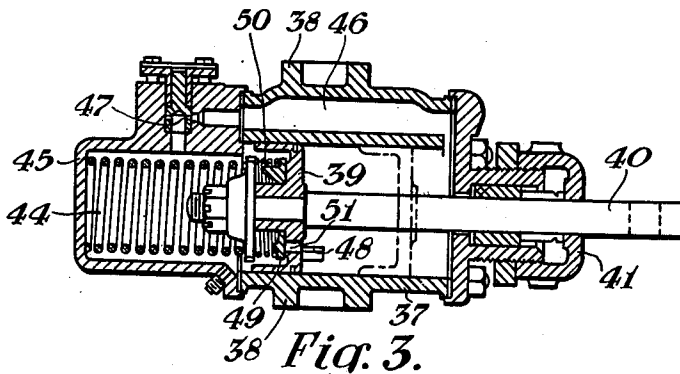


Fig. 3.

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2 SHEETS—SHEET 2

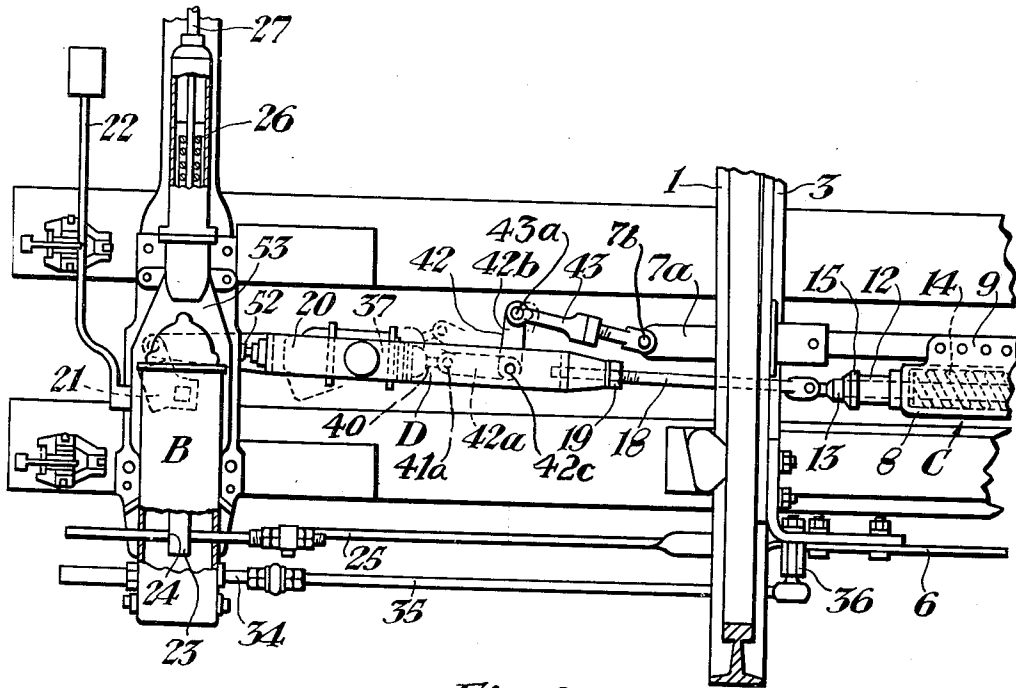


Fig. 6.

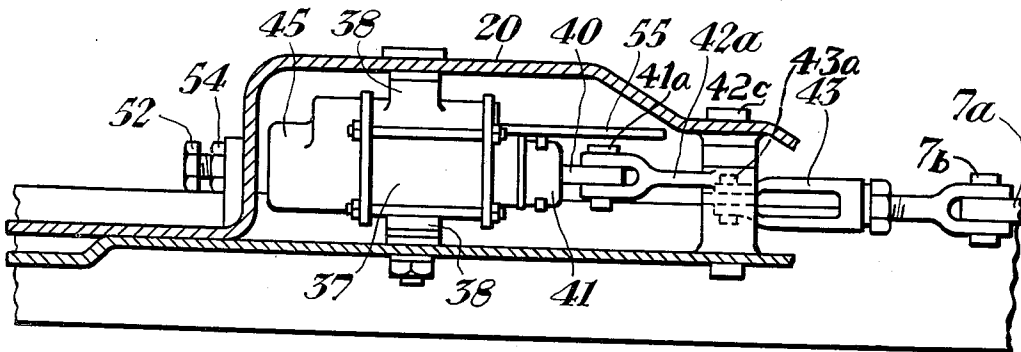


Fig. 2.

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RAILWAY SWITCH OPERATING APPARATUS

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17 Claims. (Cl. 246—291)

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Our invention relates to railway switch operating apparatus, and particularly to apparatus for operating switches which are adapted to be trailed.

All trailable switches are commonly provided with a manual switch operating device by which the switch points may be shifted between normal and reverse positions. Such switches are also provided with biasing means which yieldably holds the switch points in the position selected by the switch operating device, but which permits the switch points to move to their opposite positions when the switch is trailed by a train. It is common to provide, in connection with such switch biasing means, a suitable buffering mechanism to delay the return of the switch points to the position selected by the switch operating device, and thereby prevent repeated impacts on the switch points during passage of a trailing train.

Our invention is directed to improvement of the biasing and buffering mechanisms of the switch operating apparatus. While the utility of our improved biasing and buffering mechanisms is not so limited, we have illustrated it herein in connection with a manual switch operating device including a facing point lock of the type shown in Letters Patent of the United States No. 2,235,031, granted to Kenneth J. J. McGowan on March 18, 1941, for Railway Switch Operating Apparatus.

An object of our invention is to provide improved switch biasing and buffering means which will reduce wear between the switch points and the wheels of a trailing train.

Another object is to provide improved buffering mechanism which will give a better buffering action by increasing the ratio of movement of the buffering piston per unit movement of the switch point.

Another object is to provide improved buffering mechanism of general utility.

A further object is to provide improved buffering mechanism for switch operating apparatus, which buffering mechanism is removable as a unit without affecting the operability of the switch operating device or its biasing mechanism.

We accomplish these objects by connecting a yoke between the switch actuating device and the spring basket, pivotally mounting a buffer cylinder in this yoke and connecting the buffer piston to the switch points through a toggle linkage. The buffer cylinder and piston themselves form one link of the toggle. The toggle linkage is effective to increase the mechanical

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advantage of the buffer over the switch points. A spring acting on the buffer piston is ineffective as long as the toggle is in its normal dead center position, but becomes increasingly effective to oppose the main switch spring as the toggle moves away from dead center. The mounting of the buffer in the yoke permits its ready removal without disturbing the essential operating elements of the switch.

Other objects of our invention will become apparent as the description proceeds.

We shall describe one form of switch operating apparatus embodying our invention, and shall then point out the novel features thereof in claims.

In the accompanying drawings, Fig. 1 is a plan view of a railway switch and switch operating apparatus embodying our invention. Fig. 2 is an elevational view of the buffering mechanism in the switch operating apparatus of Fig. 1. Fig. 3 is a cross sectional view, on an enlarged scale, of the buffering cylinder and piston assembly. Fig. 4 is a fragmentary cross sectional view of the assembly shown in Fig. 3, illustrating the quick return leak groove. Fig. 5 is a view similar to Fig. 4, illustrating a modified form of leak groove. Fig. 6 is a top plan view on an enlarged scale of the buffering cylinder and its connections to form a toggle mechanism.

Referring to the drawings, there is shown a railway switch A comprising two fixed rails 1 and 2 two movable rails or switch points 3 and 4. The fixed rails 1 and 2 are secured to cross-ties 5 in the usual manner. The movable rails 3 and 4 are fastened together by a front rod 6, a head rod 7, and switch rods 56 and 57.

The movable rails are arranged to be moved between normal and reverse positions by means of a switch operating mechanism B, through the medium of a spring connecting rod C secured to the head rod 7.

The spring connecting rod C may have any suitable form. The construction shown is illustrated and described more completely in Letters Patent of the United States No. 2,061,752, issued to Herbert L. Bone on November 24, 1936. Briefly, this connecting rod comprises a cylindrical housing 8 having a lateral extension 9 fastened to the head rod 7. The right-hand end of the housing is threaded to receive a cap 10 having an end similar to the opposite end of housing 8. Slidably mounted in an opening in the cap 10 is a sleeve 11 provided with an annular flange (not shown) located within the housing 8, and similarly mounted in the opening

in the opposite end of housing 8 is a sleeve 12 provided with an annular flange within the housing 8. A spring rod 13 extends through both sleeves 11 and 12 with sufficient clearance to permit the rod to slide freely into place, and this rod is surrounded by a coil compression spring 14 which engages the annular flanges on the sleeves and urges the sleeves toward the positions in which the outer faces of the flanges engage shoulders formed on the inside of the cap 10 and the housing 8, respectively. The spring rod 13 is provided with an annular shoulder 15 for at times engaging the outer end of the sleeve 12, and with a nut 16 for at times engaging the outer end of the sleeve 11. A lock nut 17 is provided for locking the nut 16 in any adjusted position. The left end of the spring rod 13 is pivotally connected to a rigid link 18 which is threadedly attached at its opposite end to a yoke 20 and locked thereto by means of a nut 19. The opposite end of yoke 20 is connected to the switch operating crank 21 in the switch operating mechanism B.

The switch operating mechanism B is attached by a suitable mounting structure to the ties adjacent the outer side of the rail 1, and in the form here shown is similar to the mechanism described and claimed in the aforementioned Letters Patent of the United States No. 2,235,031. For purposes of our present disclosure it is sufficient to point out that this mechanism includes, in addition to the operating crank 21 referred to, a hand-throw lever 22 which is connected with the operating crank 21 by suitable operating mechanism, not shown. When the hand lever is in the position shown, the operating crank occupies the normal extreme position shown. When the hand lever is rotated through an angle of 180° to its reverse position, then the operating crank 21 is moved in a clockwise direction to a reverse extreme position.

This mechanism also includes a locking plunger 23 which cooperates with a notch 24 provided in a lock rod 25 to lock the switch in its normal position for facing point moves over the switch. When the hand-throw lever 22 occupies the position shown, the locking plunger is yieldably held by a spring 26 in a locking position in which it is disposed within the notch 24, and under these conditions the switch is locked. When the hand-throw lever is rotated from the position shown toward its opposite extreme position, the locking plunger is withdrawn from the notch to unlock the switch before any movement of the switch operating crank 21 takes place.

The lock rod 25 is detachably mounted in a transverse guideway formed in the casing of the mechanism B and is adjustably secured at one end to the front rod 6 of the switch A. The notch 24 is so disposed that it will align with the locking plunger 23 only when the switch A occupies the extreme position in which it is shown in the drawings and the movable rail 3 is in proper engagement with the fixed rail 1.

The parts of the mechanism are so proportioned that when the hand-throw lever 22 occupies the normal position shown, the spring means which moves the locking plunger to its locking position will tend to drive the locking plunger to an extreme position beyond the desired locking position. The locking plunger is prevented from moving beyond the desired locking position under these conditions, however, by a linkage connected with the switch rod 57. This linkage as here shown includes a plunger bolt

27 which is adjustably connected at its outer end by means of a turnbuckle 28 with one end of a link 29, the opposite end of which is pivotally connected with the long arm 30a of a bell crank lever 30. The bell crank lever 30 is pivotally supported in a crank stand 31, and has its short arm 30b pivotally connected with one end of an operating rod 32. The other end of the operating rod 32 is connected with the previously mentioned switch rod 57 by means of a standard switch basket 33. The switch rod 57 may be located at any suitable location, but will be preferably located approximately midway between the heel and the point of the switch. The plunger bolt 27, turnbuckle 28, link 29, lever 30, operating rod 32, and switch basket 33 constitute means for effecting the unlocking of the switch during a trailing move over the switch, as will be described presently.

The switch operating apparatus may include a suitable circuit controller, not shown, which is operated partly by the locking plunger 23 and partly by a point detector rod 34. This circuit controller may, for example, be similar to that described and claimed in Letters Patent of the United States No. 2,184,870, granted to Herbert L. Bone and Kenneth J. J. McGowan on December 26, 1939, for Railway Switch Operating Mechanism. The point detector rod 34 is slidably mounted in the casing of the mechanism B and is attached by means of a link 35 and a bolt member 36 to the movable rail 3 of the switch A in the usual and well-known manner.

Our improved buffing mechanism which slows the movement of the switch points 3 and 4 under the influence of the spring 14 is illustrated generally in Fig. 1 and in greater detail in Figs. 2, 3 and 6. This mechanism includes a cylinder 37 provided on its opposite sides with trunnions 38, by which it is pivotally mounted in the yoke 20. The cylinder is filled with oil or other suitable hydraulic fluid. A piston 39 moves within the cylinder 37, and is attached to a piston rod 40, which extends through a suitable packing gland 41, and is pivotally attached at its outer end by a pin 41a to an arm 42a of a bell crank lever 42. The bell crank lever 42 is likewise pivotally mounted on a pin 42c between the arms of the yoke 20. The other arm 42b of the bell crank lever 42 is pivotally connected by a pin 43a to one end of an adjustable link 43. The other end of link 43 is pivoted on an extension 7a of the head rod 7 by a pin 7b.

A spring 44 is retained in compression between the piston 39 and a cover 45, which closes one end of the cylinder 37.

Restricted communication between the opposite ends of the cylinder 37 is provided through a passage 46 and a restricted orifice 47. A quick return leak groove 48 is provided in the wall of cylinder 37 to permit rapid leftward movement of piston 39 after its right-hand surface clears the end of the leak groove.

A disk valve 49, biased closed by a light spring 50, closes a port 51 extending through the piston 39. Several such ports are usually provided, but only one is shown. The valve 49 is opened by the difference of fluid pressures acting on it when the piston 39 moves to the right, as it appears in Fig. 3, so that the piston may always move freely in that direction.

Operation

The manual operation of the switch from normal to reverse position will first be described.

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The switch is shown in the drawings in its normal position. When it desired to manually reverse the position of the switch, the hand-throw lever 22 is rotated through 180° to its diametrically opposite position. This produces a clockwise rotation of switch crank arm 21, which shifts the yoke 20, link 13 and spring rod C to the right. The spring connecting rod C carries the head rod 7 to the right, thereby reversing the position of the switch points. The movement of extension 7a of the head rod 7 is substantially equal to the movement of the yoke 20. Bell crank lever 42 and link 43 are therefore moved bodily, so that no relative motion takes place between the parts of the buffing mechanism. The buffing mechanism moves as a unit with the spring connecting rod C and the switch points, and hence offers no resistance to operation of the switch by the hand-throw lever.

The movement of the switch by the hand-throw lever from reverse position back to normal is accomplished in a similar manner. It will be readily understood that during movement of the switch points by the hand-throw lever the switch point lock is released, as previously mentioned in the discussion of the switch point lock mechanism.

It will now be assumed that the switch is in the normal position as shown in the drawings, and that a train trails the switch. As the trucks of the train pass the switch rod 57, that rod is moved to the right, and this movement is transmitted through link 32, bell crank lever 30, and link 29, to release the switch point lock. The switch points may then move to the right, their movement being opposed only by the spring 14 in the spring connecting rod C. During this trailing movement of the switch points, the yoke 20, link 13, and spring rod 13 remain in the positions established for them by the switch operating mechanism B. However, the head rod 7 moves to the right with the switch points, thereby pulling the link 43 to the right, rotating the bell crank lever 42 in a clockwise direction (as viewed in Fig. 6) and rotating the buffer cylinder and piston assembly in a counterclockwise direction about its trunnions 38 as shown in the dashed line position of Fig. 6. During this movement of the buffer assembly, the piston rod 40 is partly withdrawn from the cylinder 37, thereby causing piston 39 to move to the right in the cylinder, as viewed in Fig. 3. As previously mentioned in connection with the description of the buffer assembly, the valve 49 opens during such a movement of the piston, so that the movement of the piston is not opposed. The switch points 3 and 4 are therefore free to be moved to their reverse positions by a trailing train without opposition from the buffer assembly.

Attention is especially directed to the action of buffer spring 44. When the parts are in their normal positions, the spring 44 applies a force through the bell crank lever 42 to its bearing in the yoke 20. An equal and opposite thrust is transmitted through the trunnions on which cylinder 37 is mounted to the yoke 20. The buffer spring is therefore substantially ineffective to apply any biasing force to the switch points 3 and 4. However, when the switch is trailed by a train, the buffer and cylinder are rotated away from their normal position as shown in Fig. 6. The buffer spring 44 then no longer acts along a line passing through the axis of the bell crank lever 42, but on the contrary applies a torque to that lever which acts through the link 43 on the

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head rod 7 in opposition to the spring 14 in the spring connecting rod C. The buffer spring 44 is therefore then effective to reduce the total spring force acting to hold the switch points 3 and 4 against the wheels of the trailing train. This provides a substantial reduction in wear at the switch points. It should also be noted that the spring 44 takes up lost motion in the pins connecting the bell crank lever 42, the link 43, and the other elements of the buffer mechanism. Wear at the pins due to vibration is therefore reduced, as will be readily understood. Furthermore, if there is any lost motion at the pins, the spring 44 pushes the piston 39 farther toward its extreme buffing position, and thereby increases the buffing action, as explained hereinafter.

After a trailing train passes the switch, the switch points 3 and 4 start to return to their normal positions under the influence of the spring 14 in the spring connecting rod C. The buffer mechanism delays the return of the switch points so that they will not return to their normal positions between each passing truck of a trailing train. Referring to Fig. 3, it may be seen that in order for piston 39 to return from its dotted line position to its full line position, the fluid with which the cylinder 37 is filled, must pass through the small restriction 47 and passage 48 in order to escape from the left end of the cylinder and thus allow the return movement of the piston. During the first part of the return stroke of the piston, the piston movement is thus delayed. After the right edge of piston 39 passes the end of leak groove 48, however, relatively free communication is provided between the ends of the cylinder, and the fluid in the cylinder then passes through the leak groove, allowing the buffer piston to complete its return stroke quickly. This quick return at the end of the stroke is of advantage in insuring that the switch points return completely to their normal positions. The quick return allows the switch points to move rapidly and to strike any obstruction, for example, a lump of coal, with sufficient impact to crush it and effectively remove it as an obstruction.

In the modification illustrated in Fig. 5, the leak groove 48 is provided with a smaller extension 48a. This extension permits the piston 39 to move more rapidly in that phase of its return movement where the edge of the piston uncovers the extension, without permitting the extremely rapid movement obtained when the groove 48 is uncovered. When extension 48a is used, a smaller restriction 47 may be used, thereby increasing the buffing action when the piston is at the extreme buffing end of its stroke, without increasing the overall return stroke time. It is possible to obtain a decrease in the total return stroke time in this manner, if desired.

It should be noted that in our construction, the buffer piston travel is greater than the switch point travel, so that the buffing action is thereby increased. It should also be noted that the ratio of buffer piston travel per unit switch point travel is greatest during the first part of the return stroke of the piston, where the principal buffing action takes place, and where the need for increased buffing action is greatest. It should further be noted that the increase in the buffing action at the extreme buffing position cooperates with the action of spring 43, whose effectiveness in reducing the total spring force acting on the switch points is likewise greatest at the extreme buffing position.

If the switch is manually operated by the hand-

throw lever 22 to its reverse position, and the switch is then trailed, the buffer mechanism is still effective. Under such conditions, the switch points are moved to the left, as they appear in Fig. 1, by the trailing train, and the bell crank lever 42 is therefore rotated counterclockwise and the cylinder 37 is rotated clockwise on its trunnions 38.

The arm 42a of the bell crank lever 42 comprises one arm of a toggle mechanism. The piston rod 40, the piston 39, and cylinder 37 comprise the other arm of the toggle. This toggle mechanism is normally in its dead center position, wherein the arm 42a of the bell crank lever 42 and piston rod 40 are aligned, and is "broken" or moved away from its dead center position, only when the switch is trailed.

Our buffer mechanism may therefore be said to be double-acting in that a single buffer piston and cylinder is effective to buff the operation of the switch when it is trailed from either normal or reverse position. It should be noted that, except when the switch is being trailed, the buffer piston is at its innermost extreme position. This construction avoids the necessity for a cam operated valve to control fluid communication between the opposite ends of the buffer and cylinder, which has been necessary in some buffer mechanisms of the prior art. Since the piston rod 40 is normally within the fluid-filled cylinder, our construction reduces the liability of the piston rod 40 to corrosion, particularly at that portion of the piston rod which must pass through the packing gland, and which might wear out the packing if it became corroded. Another advantage of this invention is that the packing around the piston rod is never subjected to the buffing pressure in the buffer cylinder.

Attention is directed to the fact that our improved buffer mechanism is very compact, and that it can be quickly removed as a unit from the switch operating mechanism for purposes of inspection or repair, without affecting the operativeness of the switch operating mechanism. The buffer assembly may be removed by removing the pin which connects the piston rod to the bell crank lever 42 and by removing the supporting stub shaft which carries one of the trunnions 38 of cylinder 37.

It sometimes happens that when a train is trailing the switch, it becomes necessary to stop the train and back it up. Before the train may be backed up, the switch must be reversed so that it will not be split by the train. If a truck of the train happens to be in the switch, deflecting it from its normal position, then the spring 14 of the spring connecting rod C is effective to apply a strong biasing force to the switch points and to the switch operating mechanism. If the hand-throw lever is then operated to reverse the switch, this biasing force is applied to the lever as soon as it is raised a short distance out of its latch stand. However, our improved buffing mechanism is effective at such times to slow the movement of the hand operating lever and insure that it moves or is moved slowly from one position to the other.

When the modified form of leak groove shown in Fig. 5 is used under the conditions described in the preceding paragraph, the buffing action is reduced in successive steps. This reduction in the buffing action corresponds roughly to the reduction in the biasing force of the spring 14 as the manual lever 22 moves into correspondence with the position of the switch points. The

switchman is thus relieved of the necessity of waiting for a slow buffing stroke of the piston, while at the same time the spring load on the lever 22 is not increased sufficiently to cause the switchman to lose control of it.

The use of our buffing mechanism reduces the wear on the switch point lock, which might otherwise be locked and unlocked between every truck of the trailing train.

The buffer mechanism such as that disclosed herein is inherently incapable of providing any buffing action until the switch points start to move. Therefore, when a train is trailing the switch, as each truck passes it, the force of spring 14 is suddenly applied through the head rod 7 and the spring rod 13 to the switch operating mechanism. The buffer mechanism cannot relieve this impact because of the inertia of the parts. In order to prevent the transmission of such impact forces to the switch operating mechanism B, we have provided a stop bolt 52 threaded into a suitable portion of the yoke 20, by which such impacts are transmitted to the casing 53 of the switch operating mechanism B, rather than through the functional parts of the mechanism. The bolt 52 is threaded so that it may be adjusted to just touch the casing 53 when the yoke 20 is in its normal position. A lock nut 54 is provided to hold the bolt 52 in its adjusted position.

In order to assist in preventing corrosion of the piston rod 40, a cover 55 may be provided, as shown in Fig. 2. The cover 55 is attached by suitable means to the cylinder 37 and extends above the rod 40 so as to protect it from the elements.

Although we have herein shown and described only one form of switch operating apparatus embodying our 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 our invention.

Having thus described our invention, what we claim is:

1. Railway switching apparatus, comprising a railway switch movable between two extreme positions, an operating device movable between two positions to actuate the switch to its corresponding positions, means connecting the operating device to the switch including a rigid rod structure adjacent the device and spring means between the rod structure and the switch, said spring means being effective to permit movement of the switch by a trailing train away from the position selected by the operating device, buffer means for delaying the return movement of the switch by the spring means after passage of a trailing train including a buffer cylinder mounted on the rigid rod structure, a buffer piston movable in the cylinder, and a toggle linkage connecting said buffer piston to the switch, said toggle linkage being in its dead center position when the switch position corresponds to the position of the operating device, and being moved away from said dead center position as the switch moves away from the position selected by the operating device.

2. Railway switching apparatus as in claim 1, including a buffer spring biasing the piston in a direction away from the dead center position of the toggle linkage, said spring being effective to oppose the spring means when said linkage is out of its dead center position during a trailing train movement through said switch, and thereby to

reduce the force with which the switch points are held against the train wheels.

3. Railway switching apparatus as in claim 1, in which the ratio of buffer piston travel per unit of switch travel increases continuously as the deflection of the switch from the position selected by the operating device increases.

4. Railway switching apparatus as in claim 1, in which said rigid rod structure includes a yoke, and in which said cylinder is pivotally mounted in the bight of the yoke.

5. Railway switching apparatus, comprising a railway switch movable between two extreme positions, a rigid structure, spring means connecting the structure and the switch, said spring means biasing the switch to one extreme position and being effective to permit movement of the switch by a trailing train away from said one position, buffer means for delaying the return movement of the switch by the spring means after passage of a trailing train including buffer cylinder and piston elements, means supporting one of said elements on said rigid structure, and a toggle linkage connecting the other of said elements to said switch, said toggle linkage being in its dead center position when the switch is in said one position and being moved away from said dead center position as the switch moves away from said one position, thereby increasing the ratio of piston travel to switch travel.

6. Railway switching apparatus, comprising a railway switch movable between two extreme positions, an operating device movable between two positions to actuate the switch to corresponding positions, means connecting the operating device to the switch including a rigid rod structure adjacent the device and spring means between the rod structure and the switch, said spring means being effective to permit movement of the switch by a trailing train away from the position selected by the operating device, and means for delaying the return movement of the switch by the spring means after passage of a trailing train including a buffer mounted on the rigid rod structure and a toggle linkage connecting said buffer to the switch.

7. Railway switching apparatus as in claim 1, in which said cylinder is pivotally mounted on the rigid rod structure, and in which one arm of said toggle linkage includes the cylinder, the piston and a rod moved by the piston, and the other arm of the toggle linkage is one arm of a bell crank lever pivotally mounted on said rigid rod structure, the second arm of said bell crank lever being connected to the switch.

8. Railway switching apparatus as in claim 7, in which said rigid rod structure includes a yoke, and in which the cylinder and the bell crank lever are pivotally mounted in the bight of the yoke.

9. Control apparatus, comprising a control device movable between two extreme positions, a rigid structure, spring means connecting the structure and the control device, said spring means biasing the control device to one extreme position and being effective to permit movement of the control device away from said one position by a force applied thereto, buffer means for delaying the return movement of the control device by the spring means after removal of said force therefrom, said buffer means including a pair of expansible chambers separated by a movable wall, means providing restricted fluid communication between said chambers, and

means connecting said buffer means between said control device and said rigid structure so that movement of said control device relative to said structure causes concurrent movement of said wall relative to said chambers, said connecting means including a toggle linkage arranged to continuously increase the ratio of wall travel to control device travel as said control device moves away from said one position.

10. Control apparatus as in claim 9, including a spring acting on said movable wall in a direction to oppose said spring means, said spring becoming more effective as the travel of the control device from said one position increases because of the increased ratio of wall travel to control device travel.

11. Railway switching apparatus, comprising a railway switch movable between two extreme positions, an operating device movable between two positions to actuate the switch to corresponding positions, means connecting the operating device to the switch including a rigid rod structure adjacent the device and spring means between the rod structure and the switch, said spring means being effective to permit movement of the switch by a trailing train away from the position selected by the operating device, buffer means for delaying the return movement of the switch by the spring means after passage of a trailing train including a buffer cylinder, a buffer piston movable in the cylinder, means effective to provide free fluid communication between the ends of said cylinder during a piston stroke in a direction corresponding to switch movement away from the position selected by the operating device, means providing restricted communication between the ends of said cylinder during the first part of a return piston stroke and less restricted communication during the last part, and a toggle linkage connecting the buffer piston to the switch, said toggle linkage being in its dead center position when the switch position corresponds to the operating device position, and being effective when said switch is moved away from that position to increase the ratio of piston travel to switch travel so that said ratio is a maximum during said first part of the return piston stroke.

12. Railway switching apparatus, comprising a railway switch movable between two extreme positions, an operating device movable between two positions to actuate the switch to corresponding positions, means connecting the operating device to the switch including a rigid rod structure adjacent the device and spring means between the rod structure and the switch, said spring means being effective to permit movement of the switch by a trailing train away from the position selected by the operating device, means for locking said switch in one of said extreme positions, means responsive to deflection of the rails adjacent the heel of the switch by a trailing train to unlock said locking means and permit movement of the switch by said train, buffer means for delaying the return movement of the switch means after passage of a train truck to avoid successive operations of said locking and unlocking means as successive trucks pass said switch, said buffer means including a buffer cylinder mounted on the rigid rod structure, a buffer piston movable in the cylinder, and a toggle linkage connecting said buffer piston to the switch, said toggle linkage being in its dead center position when the switch position corre-

sponds to the position of the operating device, and being moved away from said dead center position as the switch moves away from the position selected by the operating device.

13. Buffer apparatus for regulating the speed of movement of a device movable between two positions, comprising a cylinder, a piston movable in the cylinder, means effective to provide free fluid communication between the ends of said cylinder during a forward piston stroke, means providing restricted communication between the ends of the cylinder during the first part of a return piston stroke, means providing less restricted communication between the cylinder ends during the last part of a return stroke, and a toggle linkage connecting said piston and said device including two arms arranged to be in their dead center positions when said device is in one of said two positions, and effective as the device is moved away from that position to continuously increase the ratio of piston travel to device travel, so that said ratio is a maximum during said first part of the return stroke.

14. Buffer apparatus for regulating the speed of movement of a device movable between two positions, comprising a cylinder, a piston movable in the cylinder, and a toggle linkage connecting said piston and said device including two arms arranged to be in their dead center positions when said device is in one of said two positions, and effective as the device is moved away from that position to continuously increase the ratio of piston travel to device travel.

15. Buffer apparatus for regulating the speed of movement of a device movable between two positions, comprising spring means biasing said device to one of said two positions, a cylinder, a piston movable in the cylinder, a toggle linkage connecting said piston and said device including two arms arranged to be in their dead center positions when said device is in one of said two positions, and effective when the device is moved away from that position to continuously increase the ratio of piston travel to device travel, and a toggle spring acting on the piston in a direction to oppose said spring means, said toggle

spring becoming increasingly effective as said ratio increases.

16. Railway switching apparatus as in claim 1, in which said cylinder is removably mounted on said rod structure and said piston is removably connected to said switch, so that said buffer means may be removed as a unit without affecting the operability of the operating device and the spring means.

17. Railway switching apparatus, comprising a railway switch movable between two extreme positions, an operating device movable between two positions to actuate the switch to corresponding positions, means connecting the operating device to the switch including spring means to permit movement of the switch by a trailing train away from the position selected by the operating device, and double-acting buffer means for delaying the return movement of the switch by the spring means after passage of a trailing train, said buffer means including a toggle linkage connecting said buffer means and said switch and arranged to be in its dead center position when the switch position corresponds to the position of the operating device, said linkage being deflected from its dead center position in one direction when said switch is trailed from its normal position and deflected in the opposite direction when said switch is trailed from its reverse position.

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