

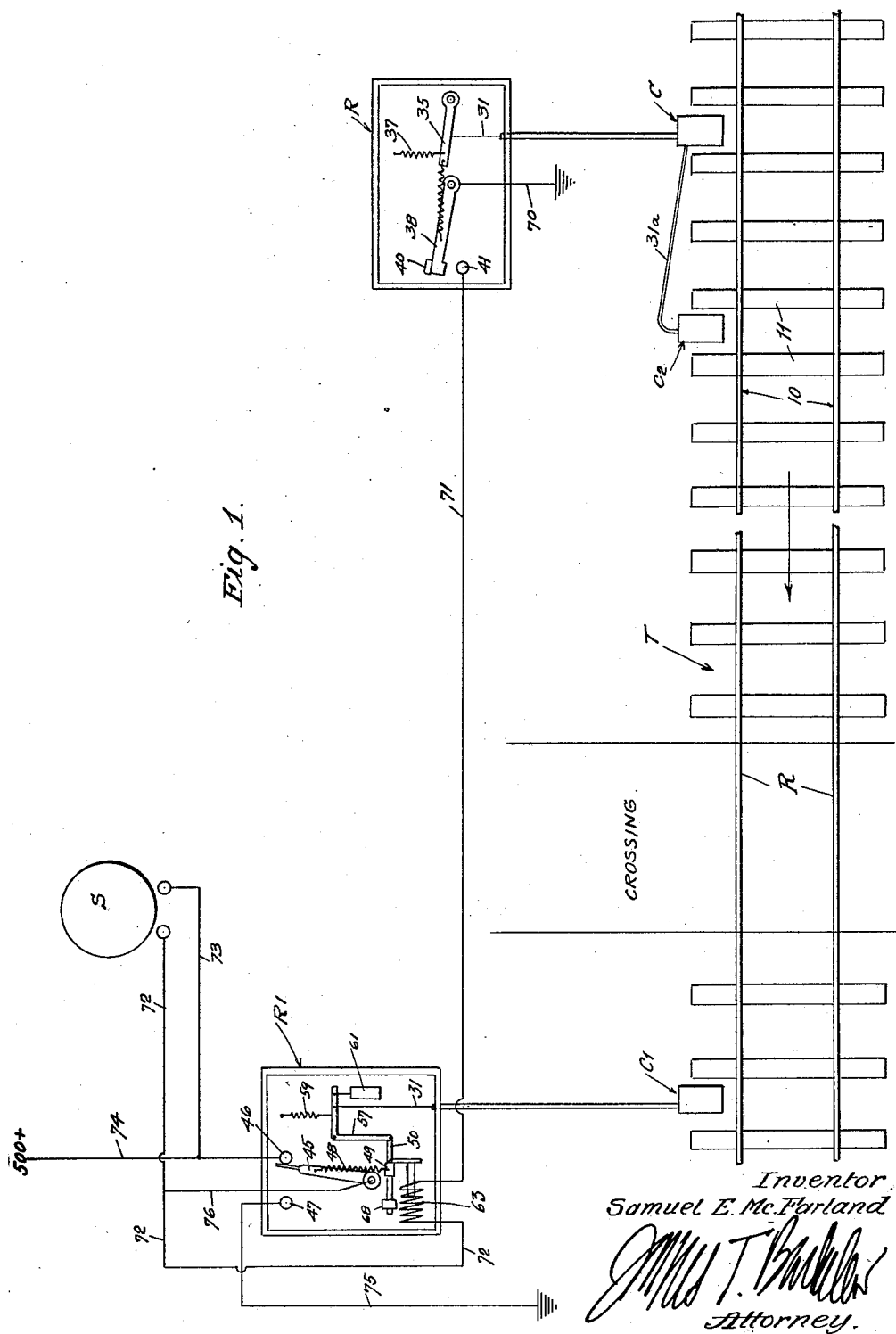
Jan. 6, 1931.

S. E. McFARLAND

1,787,752

RAILWAY SIGNAL SYSTEM

Original Filed Aug. 6, 1927 3 Sheets-Sheet 1



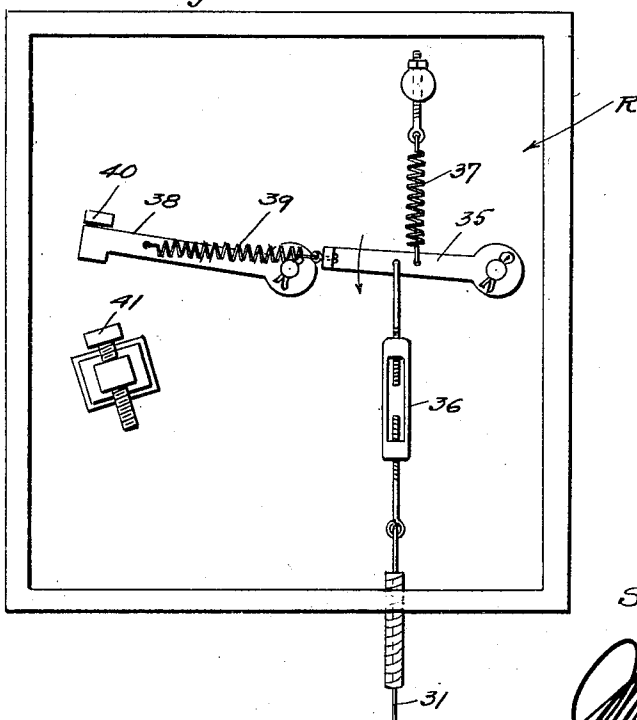
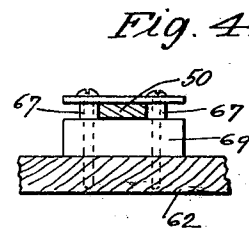
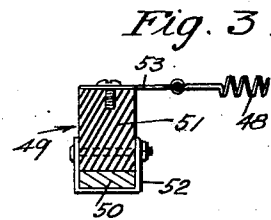
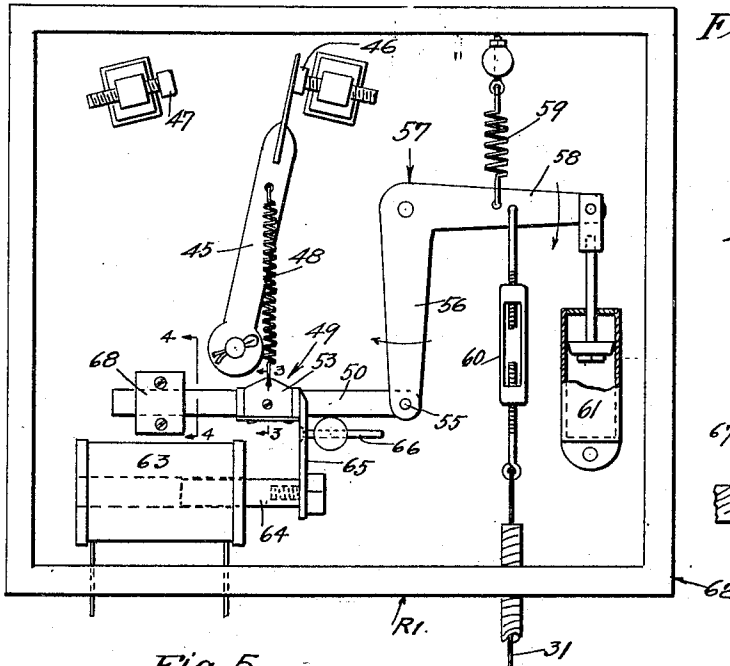
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1,787,752

RAILWAY SIGNAL SYSTEM

Original Filed Aug. 6, 1927 3 Sheets-Sheet 2



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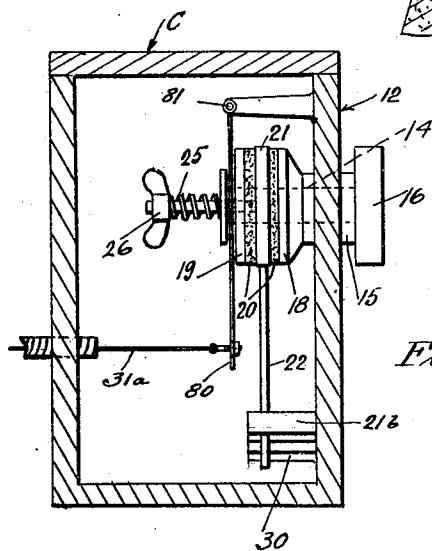
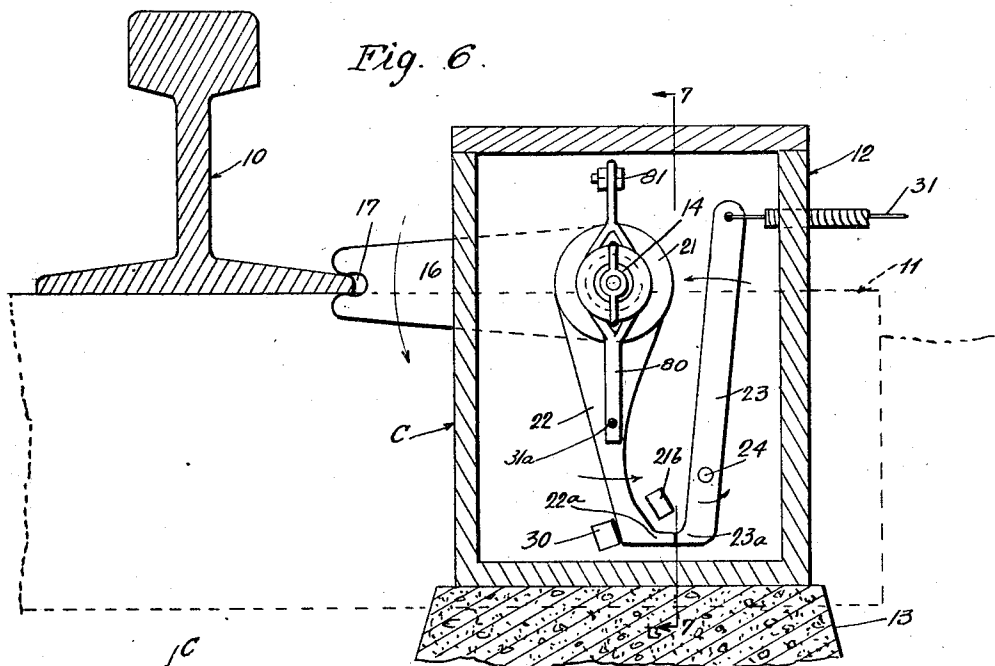
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1,787,752

RAILWAY SIGNAL SYSTEM

Original Filed Aug. 6, 1927 3 Sheets-Sheet 3



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RAILWAY SIGNAL SYSTEM

Application filed August 6, 1927, Serial No. 211,016. Renewed May 28, 1930.

This invention has reference particularly to that class of railway signal systems wherein a signal is actuated by or under control of a passing train. The actuated signal itself
5 may be of any type or kind and perform any desired signaling service; but for the purpose of explaining the present invention it may be assumed, but without limitation, that the signal is of the crossing signal type
10 adapted to warn persons at crossings of the approach of trains. The invention is not concerned with the nature or details of the signal itself, but with the nature and characteristics of a signal actuating or control-
15 ling system.

Although there are many minor objects and corresponding accomplishments of the invention, as will appear from the following detailed description, it may be said that gen-
20 erally the main object of the invention is to provide a signal system that is simple in construction and operation, not liable to disorder and therefore trustworthy and sure in action, in which the parts, that are directly
25 actuated from the rail by the weight of a passing train, are mechanical in their nature and are simple and rugged in construction and in which the electrical parts of the system can be removed from the track. In my
30 system the parts located at or upon the track and at or near the ground are purely mechanical in their nature and of such a construction that water, mud, etc., cannot interfere with their action. These mechanical parts
35 actuate the electrical parts of the system which may be (but not necessarily) located at an elevation above the ground and can therefore be protected effectively enough that high voltage, such as is used on trolley
40 lines, may be used in the electric circuits.

The invention also contemplates improved forms of track instruments and relays, as will appear hereinafter.

The accompanying drawings show typical
45 forms of the various elements that go to make up the system; but it will be understood that these are merely illustrative of my invention and not necessarily limitative thereof as to detail. The accompanying
50 drawings also show one simple and typical

circuiting arrangement for a simple crossing signal installation; but it will be readily understood by those skilled in the signal art that the system may be utilized in many various arrangements to suit different situations. 55

Referring now to the drawings:

Fig. 1 is a diagram illustrating a typical system arrangement;

Fig. 2 is a plan of the release relay;

Fig. 3 is an enlarged detail section on line 3—3 of Fig. 2; 60

Fig. 4 is an enlarged detailed section on line 4—4 of Fig. 2;

Fig. 5 is a plan of the actuating relay;

Fig. 6 is a vertical cross section showing 65 the track instrument; and

Fig. 7 is a section on line 7—7 of Fig. 6.

Referring first to Figs. 6 and 7 I first explain the track instrument in its now preferred form. In Fig. 6 the numeral 10 may designate 70 the track rail, the usual rail supporting ties or sleepers being indicated at 11. The track instrument will preferably be set in a suitable box or other casing 12 mounted upon a foundation 13 which is independent of the rail supports 11; so that when the rail is depressed by the weight of a passing train the track instrument will not be correspondingly depressed. It is the relative motion between 80 the rail and the track instrument that I make use of in my system for actuating the control relays.

Within the box of the track instrument in its preferred form there is a rotative shaft 14 mounted in a suitable bearing, as for instance 85 a bearing 15 formed in one side of box 12. The outer end of this shaft has a rail engaging arm 16, the end of this arm being notched as shown at 17, or otherwise suitably, so as to engage the upper and lower surfaces of the rail flange and thus to cause vertical swinging movement of arm 16 with the vertical movement of the rail. When the rail is depressed the arm 16 swings around in the direction indicated by the arrow in Fig. 6 and 95 turns shaft 14 in that direction. Mounted on shaft 14 and turning with it are two plates 18 and 19. Between these two plates there are two friction disks 20 and between the two friction disks lies the hub 21 of a depending 100

arm 22 whose lower end 22a presses against the lower end 23a of lever 23 pivoted at 24. Pivot 24 may preferably be located near the lower end of lever 23 so that a relatively short swinging movement of arm 22 will cause a relatively larger movement of the upper end of lever 23. From an inspection of Fig. 6 it will be seen that downward movement of rail 10 and corresponding movement of arms 16 and lever 22 will cause movement of the upper end of lever 23 towards the left in Fig. 6, the limit of that movement occurring when lever 22 brings up against stop 21b.

Friction plate 19 is pressed toward friction plate 18 by the spring 25 adjustable by nut 26; so that the friction pressure on hub 21 is adjustable. Arm 22 is thus frictionally rotatively connected with arm 16; and the friction is adjusted at such pressure that it is sufficient to move arm 22 against the resistance of the apparatus parts which are connected to and operated by lever 23; but the friction at hub 21 is insufficient to cause further movement of arm 22 when arm 22 brings up against stop 21b. For instance when rail 10 is moved down by the weight of a passing train the action will be to move lever 23 to the left in Fig. 6. The parts are so designed and proportioned that the minimum rail depression will always be sufficient to move arm 22 up against stop 21b; so that, after arm 22 has gone through its full motion, further depression of the rail will cause a slippage of the friction joint. On the back travel—the upward movement of rail 10 and the movement of arm 22 toward the left in Fig. 6—the arm 22 will then always bring up against stop 30 and the friction will again slip to allow arm 16 to move on up with the rail. Stop 30 thus limits the normal position of arm 22 and also the normal position of lever 23; and the amount of movement possible to arm 22 is the movement from the position shown in Fig. 6 to a position where it brings up against stop 21b. The arm 22 and lever 23 being thus limited in their movements, they will always be moved through definite movements by the depression of rail 10, the friction taking care of the over movement of rail 10. Also, as will now readily be seen, the frictional slippage takes care of any gradual or permanent change of position of rail 10, due to settling or due to tamping up.

Connected with the upper end of lever 23 there is a mechanical connection element preferably in the form of a Bowden wire 31 which extends to the relay for causing its actuation, the relay being actuated by a pull upon the wire.

The starting or initial actuating relay is shown in Fig. 5 and designated as a whole by the letter R. It consists essentially in a snap action switch which may be formed in the simple manner shown. A pivot arm 35 is adjustably connected to the Bowden wire 31.

A turnbuckle 36 may be used for adjustment. An adjustable spring 37 holds arm 35 in its normal position, the position shown in Fig. 5. A pivoted switch arm 38 is connected to arm 35 through the medium of a spring 39; the relative positions of the two arms being such that when arm 35 is in its normal position the tension of the spring 39 will hold switch arm 38 in its illustrated normal position against the stop 40. Movement of arm 35 in the direction indicated by the arrow, caused by a pull upon Bowden wire 31, will, after a certain amount of movement of arm 35, snap switch arm 38 over against the adjustable contact 41. Arm 35 will remain in the second mentioned position just so long as the pull is continued to be exerted on wire 31—just so long as the track instrument remains actuated by a depression of the rail. As soon as the rail rises and the pull on wire 31 ceases, spring 37 will pull the parts back to their normal positions, causing switch arm 38 to break contact with the contact 41 and to go back to its normal position as shown in Fig. 5. So far as the operation of my system is concerned the engagement of switch arm 38 with contact 41 may be either momentary or of some duration, as will be understood from what follows.

The release relay is shown in Fig. 2. A pivoted switch arm 45 is adapted to swing between two positions in which it contacts with either of the adjustable contacts 46 and 47. Tension spring 48 connects switch arm 45 with a slider 49 which is shown in detail in Fig. 3. This slider is mounted on a slide bar 50 and may preferably be constructed as shown in Fig. 3. A block of insulating material 51 rests on slide bar 50 and has a strap 52 which passes around the bar. A spring attachment plate 53 is mounted on the upper side of block 51, spring 48 being attached to this plate. Slider 49, so constructed, is slidable upon and with reference to slide bar 50; but the tension of spring 48 tends at all times to bind the slider 49 on bar 50 so that when bar 50 is moved the slider will move with the bar, although the slider can be moved on the bar without the bar moving at all.

Slide bar 50 is pivotally connected at 55 at one end to one arm 56 of a bell crank lever 57, the other arm 58 of which is pulled to its normal position by a spring 59. The Bowden wire 31 is connected to arm 58 through the medium of the adjusting turn-buckle 60. Also arm 58 has a dash pot 61 connected to it, the dash pot acting to allow relatively free movement of arm 58 in the direction indicated by the arrows, but retarding movement of the arm and of bell crank lever 57 in the opposite direction.

All the parts so far described are mounted upon a suitable base or in a suitable box or other enclosure 62 so as to be protected from weather. Also mounted within the enclosure is a solenoid magnet 63 which when energized

draws a core 64 towards the left in Fig. 2. On the end of this core there is a finger 65 which will engage slider 53 to move it to the left when solenoid 63 is energized. The parts 66 merely form a guide for the slider.

The left hand end of slide bar 50 may be movably supported in any suitable manner so that it may be moved longitudinally by the swinging of lever arm 56. For instance it may slide more or less freely between two pins or rollers 67 and between upper and lower guide blocks 68 and 69, as shown in detail in Fig. 4; this form of mounting allowing freedom for the slight oscillation of the pivot end at 55.

Referring now more particularly to Fig. 1 I here illustrate diagrammatically a railroad track T with its rails R. In a typical installation two or more track instruments C may be used. For instance supposing that the direction of train travel is towards the left in Fig. 1, one track instrument C will be located to the right at a suitable distance from the crossing and another track instrument C—1 will be located at a suitable distance to the left of the crossing. When a train approaches the crossing from the right it depresses the rail at track instrument C and actuates that instrument to pull upon the wire 31 and to actuate the relay R in the manner before described. Switch arm 38 of this relay is connected by wire 70 to ground as illustrated. From contact 41 a wire 71 connects to one side of solenoid 63 of release relay R—1, the other side of the solenoid being connected by wire 72 to one side of signal S. The other side of signal S is connected by wire 73 to the current supply wire 74, which wire connects directly into contact 46 of relay R—1. It will be understood that in describing the circuits in this system I am assuming the current is being used from a trolley circuit; and that therefore in this specific illustration one side of the circuit will come from the trolley wire or trolley feed system while the other side of the circuit will be formed by ground. In other installations both sides of the feed circuit in my system may be formed by wires or other conductors.

The other contact 47 of relay R—1 is connected by wire 75 to ground, switch arm 45 of relay R—1 is connected by wire 76 to wire 72.

When the relay switch at R is closed, solenoid 63 is then energized in a circuit as follows: from wire 74 through contact 46, switch arm 45, wire 76, wire 72, solenoid 63, wire 71, contact 41, switch arm 38 and wire 70 to ground. This energization causes the solenoid to move slider 49 towards the left far enough that the spring 48 acts to snap switch arm 45 over to engagement with contact 47. Immediately this occurs current then flows from wire 74 through wire 73 to

and through the signal S, thence through wire 72, wire 76, switch arm 45, contact 47 and wire 75 to ground. If in the meantime relay R has not gone back to normal position current will continue to flow also through wire 72 and through solenoid 63 and on to ground through relay R. But as soon as relay R goes back to its normal position, which it does as soon as the rail at track instrument C rises (as soon as the train has passed that point) then current through the solenoid 63 is cut off; but the switch arm 45 of relay R—1 remains in its position in engagement with contact 47 until track instrument C—1 is actuated by depression of the rail at its location. When the head end of the train reaches the location of track instrument C—1 and the rail there is depressed, that track instrument operates to pull upon its Bowden wire 31 and move bell crank lever 57 in the direction indicated by the arrows in Fig. 2. This movement of the bell crank lever moves the slide bar 50 toward the left through slider 49. Slider 49 has been moved up against block 68 by the action of the solenoid and can move no further to the left. Consequently when slide bar 50 is moved to the left it moves through slider 49. The parts having been moved to the described position, they remain in that position until after the last truck of the train has passed the location of the track instrument C—1, when the parts are slowly returned to their normal position by the action of spring 59,—dash pot 61 regulating the speed of this return. The useful function of dash pot 61 is to prevent the return of the parts of relay R—1 to normal position immediately after a truck has passed over the location of track instrument C—1, thus keeping the relay R—1 in its actuated position during the intervals between the passage of successive trucks over the location of track instrument C—1, and preventing a multiplicity of successive actuations of relay R—1 by the passage of successive trucks. When the last truck has passed over the location of track instrument C—1, then spring 59 moves the parts of relay R—1 back to the normal position shown in Fig. 2, snapping the switch arm 45 back to its normal position and cutting off current from signal S.

If it is desired to prevent the actuation of the signal system by a train traveling in the opposite direction on track T (for instance toward the right in Fig. 1) then a third track instrument C—2 may be installed at a suitable distance to the left of track instrument C. This track instrument C—2 will be, in structure and operation, the same as the track instrument before described. Its Bowden wire 31a will extend to the track instrument C and there connect with an arm 80 pivoted at 81 and engaging the friction plate 19 in such a manner that a pull upon wire

31a will cause friction plate 19 to be moved back against the pressure of spring 25 and relieve the frictional pressure of disks 20 upon hub 21 of arm 22. The track instrument C—2 being located a proper distance to the left of track instrument C, if a train should travel toward the right upon track T, it would first depress the rail at the location of track instrument C—2 and exert a pull upon wire 31a to relieve the friction of track instrument C. Then as the first truck of that train proceeds onward toward track instrument C, and as the rail at the location of C is being depressed, the rail at the location of C—2 will remain depressed to some extent, depression of the rail at the location of C will not act to operate the arm 22 of track instrument C and therefore will not act to actuate relay R. This provision prevents any train which is traveling in such a direction that it passes track instrument C after passing track instrument C—1 from setting the signal system into action and leaving it in action.

I have given a specific description of my now preferred form of system and devices; but it will be understood that many variations, in detail and in arrangement, may be made without exceeding the invention. Other detail designs, forms of parts, etc., will readily occur to those skilled in the art; for instance the forms and arrangements of the lever arms, and the engagement or connection of arm 16 with the rail, which may be effected in any suitable manner. Likewise the relative arrangements of the elements of the system may be varied to suit any given requirements. Although I have particularly mentioned the fact that the relays may be situated at a distance from the track instrument, they are not necessarily so placed. They may be placed close to their respective track instruments or even in the same box with them, eliminating the necessity of a long Bowden wire or other mechanical connection. If the Bowden wire is thus made short enough, or other short mechanical connection be used, it becomes an element through which a push can be communicated as well as a pull. In that case, the operative connection 31 to lever 57 of relay R1 will, when the track at C1 is depressed, move the lever to actuated position, and then move it slowly back to normal position as the rail rises after a train has passed. In that case the dash pot 61 and spring 59 might be dispensed with.

I claim:

1. A railway signal system adapted to be actuated by rail depression, embodying two track instruments adapted to be mechanically actuated by local rail depression, an initial actuating relay mechanically connected with one instrument and comprising a switch, another relay mechanically connected with the

other instrument and comprising a switch, mechanical switch operating means actuated from said instrument, and electro-magnetic switch operating means; a signal, and circuits by which the electro-magnetic means is energized through the switch of the first mentioned relay and the signal is energized through the switch of the second mentioned relay.

2. A railway signal system adapted to be actuated by rail depression, embodying two track instruments adapted to be mechanically actuated by local rail depression, an initial actuating relay mechanically connected with one instrument and comprising a snap-action switch, another relay mechanism comprising a snap-action switch, a slider whose movement actuates the switch, electro-magnetic means for moving the slider in one direction, mechanical means for moving the slider in the opposite direction, said mechanical means being mechanically connected with the other track instrument; a signal, and circuits leading through the first mentioned switch, the electro-magnetic means and the signal, and through the second mentioned switch and the signal.

3. In a signal system, the combination of two track instruments, each having a frame adapted to be supported independently of a rail, an actuating arm movable on the frame and connectible with the rail, an actuated arm yieldingly connected with the actuating arm and having a limited movement with respect to the frame, means provided on one of the instruments for releasing the yielding connection between its actuating and actuated arms, and the actuated arm of the other instrument being connected to said means to cause its release.

4. In a signal system, a relay device embodying a double throw switch with a pivoted switch arm, a slide bar adapted to move in a direction transverse of the switch arm, a slider on the slide bar and movable on and with relation thereto, a spring connecting the slider with the switch arm, means for actuating the slide bar, and independent means for moving the slider on and with relation to the slide bar.

5. In a signal system, a relay device embodying a double-throw switch with a pivoted switch arm, a slide bar adapted to move in a direction transverse of the switch arm, a slider on the slide bar and movable on and with relation thereto, a spring connecting the slider with the switch arm, mechanical means for moving the slide bar, and electro-magnetic means for moving the slider independently of the slide bar.

6. In a signal system, a relay device embodying a double-throw switch with a pivoted switch arm, a slide bar adapted to move in a direction transverse of the switch arm, a slider on the slide bar and movable on

and with relation thereto, a spring connecting the slider with the switch arm, mechanical means for moving the slide bar, and electro-magnetic means for moving the slider independently of the slide bar, said means
5 embodying a pivoted lever moved in one direction by a spring, and a dash pot allowing free movement of the lever in the other direction but retarding the movement of the lever by the spring.

10 7. In a railway system, a track instrument comprising a frame adapted to be supported independently of a rail, an actuating arm movable on the frame and connectible with
15 the rail, an actuated arm yieldingly connected with the actuating arm and having a limited movement with respect to the frame, and automatic means for releasing the yielding connection between the actuating and
20 actuated arms.

8. A railway system adapted to be actuated by rail depression, embodying a track instrument adapted to be mechanically actuated by local rail depression, an initial actuating relay mechanically connected with said
25 instrument and comprising a switch, another relay comprising a switch, electro-magnetic switch operating means for said last mentioned relay, a signal, and circuits by which
30 the electro-magnetic means is energized through the switch of the first mentioned relay and the signal is energized through the second mentioned relay.

9. A railway system adapted to be actuated by rail depression, embodying a track instrument adapted to be mechanically actuated by local rail depression, an initial actuating relay mechanically connected with said
35 instrument and comprising a switch, another relay comprising a switch, electro-magnetic switch operating means for said last mentioned relay, a signal, circuits by which the
40 electro-magnetic means is energized through the switch of the first mentioned relay and the signal is energized through the second mentioned relay and automatic means for
45 actuating the switch of the second mentioned relay to de-energize the signal.

In witness that I claim the foregoing I
50 have hereunto subscribed by name this 14th day of June, 1927.

SAMUEL E. McFARLAND.

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