

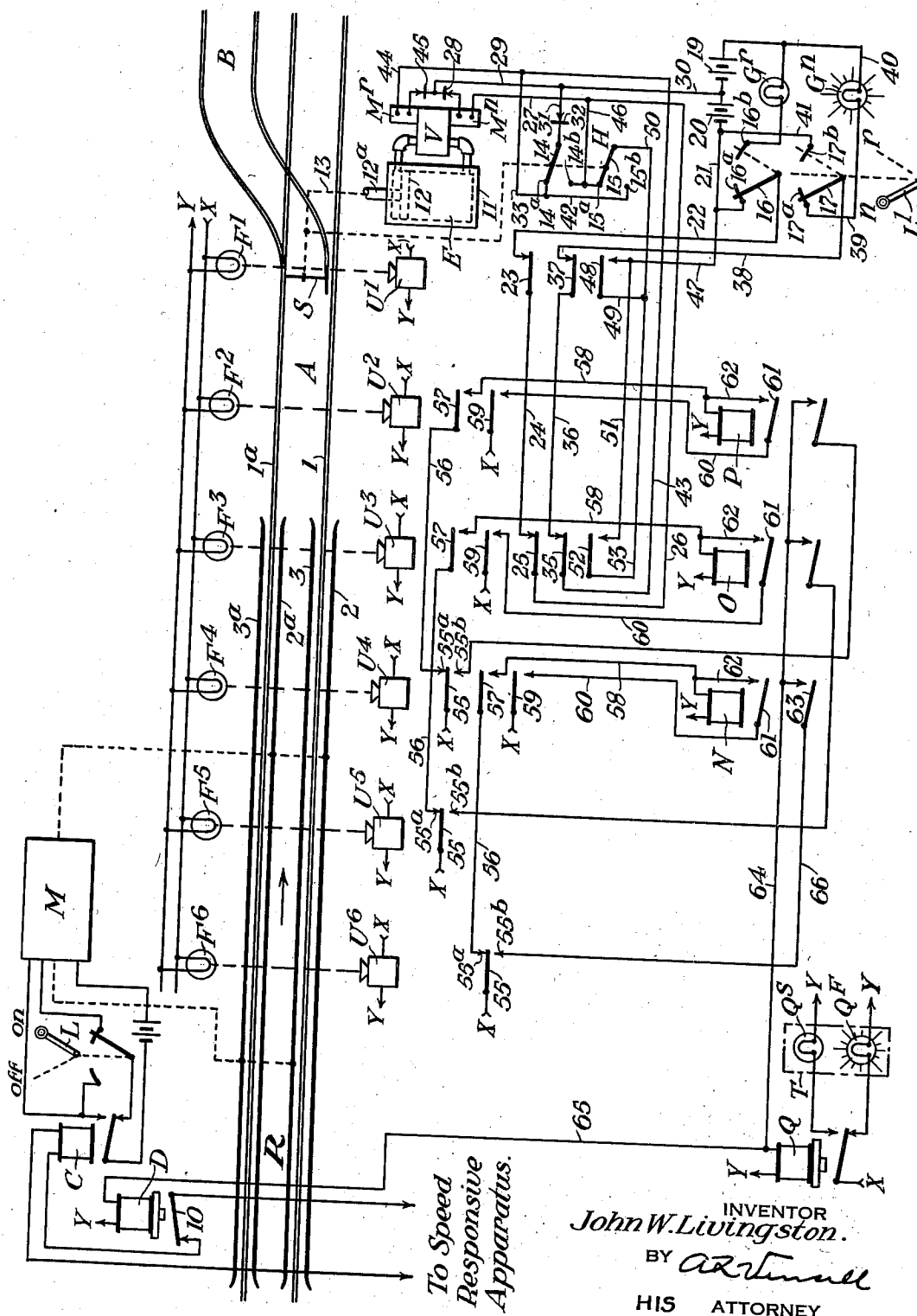
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COMBINED CAR RETARDER AND SWITCH CONTROL SYSTEM FOR CAR RETARDER YARDS

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COMBINED CAR RETARDER AND SWITCH
CONTROL SYSTEM FOR CAR RETARDER
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My invention relates to a combined car retarder and switch control system for car retarder yards.

One object of my invention is to provide novel means for jointly controlling a car retarder and the associated switch in a car retarder yard of the type in which cars approach a switch under the influence of gravity in such manner that the car retarder will limit the speed of the car approaching the switch and will control the minimum spacing between successive cars, and that the switch can not be thrown between cars unless there is sufficient spacing between them to prevent the switch from derailing the cars.

I will describe one form of car retarder and switch control system embodying my invention, and will then point out the novel features thereof in claims.

The accompanying drawing is a diagrammatic view illustrating one form of a combined car retarder and switch control system embodying my invention.

Referring to the drawing, the reference characters 1 and 1^a designate the track rails of a stretch of railway track A which is connected with a ladder track B by means of a switch S, and over which cars normally move toward the switch S, in the direction indicated by the arrow, under such conditions that it is desired to be able to control the speed of the cars to prevent them from passing through the switch at too high a rate of speed, and also to control the spacing between successive cars or groups of cars in such manner that the cars or groups of cars will be spaced apart far enough to permit the switch to be thrown between them without danger of derailing the cars. For example, the stretch of track shown in the drawing might be in a classification yard of the "hump" type through which cars move toward the switch S under the influence of gravity, and are adapted to be sorted into two or more groups by manipulation of the switch S. It is obvious that in systems of this kind the speed of individual cars or strings of cars will vary through wide limits depending, among other things, upon the speed at which they go over the hump, the temperature, the weight of the car and contents, and the condition of the car as to whether it is a free running car or otherwise.

In order to control the speed and spacing of cars approaching the switch S, the stretch of track shown in the drawing is provided with a car retarder, designated as a whole by the reference character R, and comprising in the form here shown, two braking bars 2 and 3 located on op-

posite sides of, and extending parallel with, rail 1, and two similar braking bars 2^a and 3^a, located on opposite sides of, and extending parallel with, rail 1^a. The braking bars of each pair are so disposed that when they are moved toward the associated rail they will occupy positions in which they will engage the wheels or other parts of a passing car and will thus retard the speed of the car.

The car retarder R is operated by a mechanism M which is controlled by a relay C and by a lever L. The construction of the mechanism M, and the manner in which this mechanism is controlled by the relay C and lever L may, for example, be similar to that shown in Letters Patent of the United States No. 1,876,014, granted to me, on Sept. 6, 1932, and it is believed, therefore, that for purposes of the present disclosure it is sufficient to state that when relay C is deenergized, the operating mechanism M will move the braking bars to their braking or non-braking positions according as lever L occupies its right-hand or "on" position in which it is shown in the drawing, or its left-hand or "off" position, but that, when relay C becomes energized, if the braking bars do not already occupy their non-braking positions, the mechanism M will automatically move them to their non-braking positions.

The relay C is controlled in part by a relay D and in part by speed responsive apparatus not shown, in such manner that this relay will become energized when and only when relay D is deenergized, and the speed of a car which is passing through the retarder R has decreased below a predetermined speed. The speed responsive apparatus for controlling relay C may, for example, be similar to that illustrated in my previously referred to Patent No. 1,876,014, and the circuit for relay C may be identical with that shown in this patent with the exception that a back contact 10 of relay D has been included in this circuit.

The switch S is operated by a motor E comprising a cylinder 11 containing a reciprocable piston 12 which drives a piston rod 12^a. The piston rod 12^a is operatively connected with the switch S by any suitable form of switch mechanism indicated diagrammatically in the drawing by the dash line 13. Fluid under pressure, usually compressed air, is at times supplied to one end or the other of the cylinder 11 from a suitable source not shown in the drawing, and the supply of fluid pressure is controlled by a switch valve designated by the reference charac-

ter V. This valve comprises a normal magnet M^n and a reverse magnet M^r .

As shown in the drawing, the switch S occupies its normal position. If, now, reverse magnet M^r is energized, fluid pressure will be supplied to motor E to operate switch S to its reverse position. If, when the switch occupies its reverse position, magnet M^n is energized, fluid pressure will be supplied to motor E to restore switch S to its normal position. One form of switch valve which will operate in the manner described is disclosed and claimed in Letters Patent of the United States No. 1,238,888, issued Sept. 4, 1917, to J. P. Coleman, for Railway traffic controlling apparatus.

The valves M^n and M^r of the mechanism V are controlled in part by a circuit controller H. This circuit controller is operatively connected with the switch S and as here shown, comprises two contacts 14—14^a and 15—15^a which are closed when and only when the switch occupies its full normal position in which it is shown in the drawing, and two contacts 14—14^b and 15—15^b which are closed when and only when the switch S occupies its full reverse position.

The valves M^n and M^r of the mechanism V are also controlled in part by a manually operable lever L¹. This lever is movable to a normal position *n* in which it is shown in the drawing and to a reverse position *r*, and is provided with two contact arms 16 and 17 which cooperate respectively with fixed contacts 16^a and 17^a or 16^b and 17^b to close contacts 16—16^a and 17—17^a or 16—16^b and 17—17^b according as lever L occupies its *n* or its *r* position.

The valves M^n and M^r are further controlled in part by two light sensitive devices U¹ and U³ forming part of a series of such devices here shown as six in number, and designated by the reference characters U¹ to U⁶, inclusive. The device U¹ is located on one side of the track directly opposite the switch S, and the device U³ is located on the same side of the track as the device U¹, but is spaced from the device U¹ in the direction of the retarder a distance which is equal to the spacing required to reverse the switch S between two successive cars or strings of cars without danger of derailing the cars when the cars or strings of cars are traveling at the maximum speed at which they are permitted to pass over the switch S. In actual practice, the distance between the two devices U¹ and U³ will usually be about 12 feet, but it should be distinctly understood that this particular spacing is not essential to my invention. The device U² is located midway between the devices U¹ and U³, and the remaining units are located at equal spacings toward and partway through the retarder, the distance between adjacent units preferably being the same as the distance between the devices U¹ and U², and between the devices U² and U³. Located on the opposite side of the track from, and directly opposite to, each light sensitive device is an electric lamp designated by the reference character F with the same distinguishing exponent as the exponent for the reference character of the associated device. Each light sensitive device U and its associated lamp F are so related that the device will normally receive light from the lamp, but that the beam of light will be interrupted at all times when a car is between the device and the lamp. For example, each device and its associated lamp may be located in such relative positions that the light which normally passes from the lamp

to the unit will be intercepted by the coupler and center sill of each car which passes the device. Each light sensitive device is provided with one or more front contacts which are closed when and only when the device is receiving light from the associated lamp, and with one or more back contacts which are closed when and only when the light to the device from the associated lamp is interrupted. Each light sensitive device is constantly supplied with current from the terminals X and Y of a suitable source of current not shown in the drawing, and the lamps F are connected in parallel and are also constantly supplied with current from the terminals X and Y.

Associated with the lever L¹ are two indication lights Gⁿ and G^r, the functions of which will be made clear presently.

As shown in the drawing, switch S and lever L¹ both occupy their normal positions and the devices U¹ and U³ are both receiving light from the associated lamps F¹ and F³. Under these conditions, a circuit is completed from normal magnet M^n which passes from a suitable source of current here shown as a battery 20 through wire 21, contact 16—16^a of lever L, wire 22, front contact 23 of device U¹, wire 24, front contact 25 of device U³, wires 26 and 27, winding of magnet M^n , an asymmetric unit 28 in its low resistance direction, and wires 29 and 30 back to battery 20. Normal magnet M^n is therefore energized, so that the switch is held in its normal position. Furthermore, under the conditions just described a circuit is completed for indication lamp Gⁿ which passes from a suitable source of current here shown as a battery 19, through wires 39 and 31, an asymmetric unit 32 in its low resistance direction, contacts 14—14^a of circuit controller H, wires 33 and 43, front contact 35 of device U³, wire 36, front contact 37 of device U¹, wire 38, contact 17—17^a of lever L¹, wire 39, lamp Gⁿ, and wire 40 back to battery 19. Lamp Gⁿ is therefore lighted, thus indicating that the switch S and lever L both occupy their normal positions, and that no car occupies the portion of the stretch A in advance of the switch S for a distance which is sufficient to permit the switch to be reversed without danger of derailing any car which may be approaching the switch.

I will now assume that the switch S and associated devices are in the positions just described, and that it is desired to reverse the switch. To do this, the operator moves lever L to its reverse position *r*. This movement of the lever interrupts the circuits which were previously closed for magnet M^n and indication lamp Gⁿ, and completes a circuit for magnet M^r , which latter circuit passes from battery 20 through wire 41, contact 17—17^b of lever L¹, wire 38, front contact 37 of device U¹, wire 36, front contact 35 of device U³, wires 43 and 44, winding of magnet M^r , and asymmetric unit 45 in its low resistance direction, and wires 29 and 30 back to battery 20. Magnet M^n therefore becomes deenergized and magnet M^r becomes energized, thus causing the switch S to move to its reverse position. As soon as the switch S reaches its full reverse position, a circuit becomes completed for indication lamp G^r passing from battery 19 through wires 39 and 31, asymmetric unit 32 in its low resistance direction, contact 14—14^b of circuit controller H, wires 46 and 26, front contact 25 of device U³, wire 24, front contact 23 of device U¹, wire 22, contact 16—16^b of lever L¹, and lamp G^r back to battery 19. Lamp G^r therefore becomes energized, thus indicating that the switch and lever

both occupy their reverse positions, and that no car occupies the portion of the stretch A in advance of the switch S for a distance which is sufficient to permit the switch to be operated without any danger of derailing a car which may be approaching the switch.

When the switch S 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 operator restores the lever L¹ to its normal position. The operation of the apparatus under these conditions is just the reverse of that just described and will be readily understood from the foregoing description without further detailed description.

I will now assume that the switch S and associated apparatus occupy their normal positions, and that the supply of light to either the device U¹ or the device U³ or both is interrupted by a car. Under these conditions, the circuits which were previously closed for normal magnet Mⁿ and lamp Gⁿ will become interrupted at the front contacts of the device U¹ or the device U³, or both, as the case may be, and one or the other or both of two holding circuits for magnet Mⁿ will then become energized depending upon whether the light to device U¹, the light to device U³, or the light to both devices is interrupted by the car. The one holding circuit for magnet Mⁿ passes from battery 20 through wires 21 and 47, back contact 48 of device U¹, wires 49 and 50, contact 15—15^a of circuit controller H, wires 46 and 27, winding of magnet Mⁿ, asymmetric unit 28 in its low resistance direction, and wires 29 and 30 back to battery 20. The other holding circuit for magnet Mⁿ is similar to the circuit just traced with the exception that this latter circuit includes wire 51, back contact 52 of device U³ and wire 53 in place of back contact 48 of device U¹ and wire 49. When either or both of the holding circuits just traced for magnet Mⁿ is closed, this magnet will be energized, and it follows, therefore, that under these conditions the switch will be held in its normal position. Furthermore, when either or both of these holding circuits for magnet Mⁿ is closed, all of the remaining circuits for magnet Mⁿ and also for magnet M^r will be interrupted, so that if lever L¹ is then moved to its reverse position, the switch will remain in its normal position.

I will next assume that switch S has been moved to its reverse position by moving lever L¹ to its reverse position, and that one or both of the devices U¹ or U³ has the light which is normally supplied thereto cut off by a car. Under these conditions, the normal energizing circuit which was previously closed for the reverse magnet M^r and the circuit which was previously closed for the reverse indication lamp G^r will both become interrupted, and one or the other or both of two holding circuits for the reverse magnet M^r will then become completed depending upon whether the light to the device U¹, the light to the device U³ or the light to both of these devices is interrupted by the car. The one holding circuit for reverse magnet M^r passes from battery 20 through wires 21 and 47, back contact 48 of device U¹, wires 49 and 50, contact 15—15^b of circuit controller H, wire 42, wires 33 and 44, reverse magnet M^r, asymmetric unit 45 in its low resistance direction, and wires 29 and 30 back to battery 20. The other holding circuit for this magnet is similar to the holding circuit just described with the exception that this latter holding circuit includes wire 51, back contact 52 of device U³, and wire 53 in place of back contact 48

of device U¹ and wire 49. When either one or both of these holding circuits for reverse magnet M^r is closed this magnet will, of course, be energized, and the switch will therefore be held in its reverse position. Furthermore, when either one or both of these holding circuits is closed, the normal energizing circuit for normal magnet Mⁿ will be interrupted at the front contact of the device U¹ or U³ or both, as the case may be, so that it is impossible to energize this magnet even though lever L¹ is then moved to its normal position.

It will be seen from the foregoing that when a car is passing through the switch S, or has approached the switch to within a distance which is shorter than the distance that the device U³ is spaced from the device U¹, the normal and reverse energizing circuits for the magnets Mⁿ and M^r will be open and the holding circuit for one or the other of these magnets will be closed depending upon the position which the switch occupied at the time the holding circuit became closed, thus preventing any movement of the switch under these conditions.

Relay D is a slow releasing relay and is controlled by means which I will now describe in such manner that this relay will become energized if and only if a following car or string of cars gets closer to the preceding car or a preceding string of cars while any of the cars or strings of cars is passing through the retarder than the spacing between alternate light sensitive devices U.

As here shown, these means include three stick relays N, O and P. The stick relay N is controlled by the devices U⁴ and U⁶, and is provided with a pick-up circuit which passes from terminal X through front contact 55—55^a of device U⁶, wire 56, back contact 57 of device U⁴, wire 58, and the winding of relay N to terminal Y. The stick relay N is also provided with a stick circuit which passes from terminal X through back contact 59 of device U⁴, wire 60, front contact 61 of relay N, wire 62, and the winding of relay N to terminal Y. It will be seen, therefore, that when no car is passing through the retarder, both the pick-up and stick circuits for relay N will be open, and this relay will therefore be deenergized, but that, when a car is passing through the retarder, as soon as the rear end of the car clears the light beam from the lamp F⁶ to the device U⁶, the pick-up circuit for relay N will become closed and this relay will therefore pick up its armature and will complete its stick circuit. It will also be seen that when the pick-up circuit for this relay once becomes closed, this relay will subsequently remain energized by virtue of its stick circuit until the rear end of the car which caused it to become energized passes the device U⁴, even though a following car subsequently interrupts the light beam to the device U⁶.

The relay O is controlled by the devices U³ and U⁵ in the same manner that the relay N is controlled by the devices U⁴ and U⁶, and the relay P is similarly controlled by the devices U² and U⁴.

Relay D is provided with a pick-up circuit which is controlled by device U⁶ and by relay N, and which passes from terminal X through back contact 55—55^b of device U⁶, wire 66, front contact 63 of relay N, wires 64 and 65, and the winding of relay D to terminal Y. It will be apparent, therefore, that relay D will become picked up whenever relay N has become picked up and the supply of light to the device U⁶ is subsequently cut off, which condition will only happen when a first car has started through the retarder, and a second car has

interrupted the supply of light to the device U⁶ before the first car has cleared the light beam to the device U⁴.

Relay D is provided with two other pick-up circuits one of which is controlled by relay O and by device U⁵, and the other of which is controlled by relay P and the device U⁴. These latter pick-up circuits are similar to the previously traced pick-up circuit for relay D, and will be obvious from an inspection of the drawing without further description. It will be apparent that the pick-up circuit for relay D controlled by device U⁵ and by relay O will only become closed when the supply of light to the device U³ is interrupted by a first car and the supply of light to the device U⁵ is subsequently interrupted by a second car, and that, the pick-up circuit for relay D controlled by relay P and by the device U⁴ will become closed when and only when the light beam to the device U² is interrupted by a first car and the light beam to the device U⁴ is interrupted by a second car.

A slow releasing indication relay Q is connected in multiple with the relay D, and so it will be seen that this relay will become energized whenever the relay D becomes energized.

Associated with relay Q is a signal T which is provided for the purpose of informing the engineman in charge of the engine which pushes the cars over the hump how fast to push the cars. As here shown, this signal comprises a lamp Q^F which, when illuminated, indicates that the car should be pushed over the hump at a relatively high speed, and a lamp Q^S which, when illuminated, indicates that the cars should be pushed over the hump at a relatively low speed. The lamps Q^S and Q^F are controlled by a lever not shown which is operated by the hump foreman, and by the relay Q, the control being such that when relay Q is deenergized a circuit for the lamp Q^F may be completed by moving the hump lever to the proper position, but that, when the relay Q is energized a circuit will then be completed for the lamp Q^S regardless of the position of the hump lever.

In explaining the operation of the apparatus as a whole, I will first assume that all parts of the apparatus are in the positions in which they are shown in the drawing, and that a car which is initially traveling at a higher rate of speed than that which causes the speed responsive apparatus to complete the energizing circuit for relay C starts to traverse the stretch of track shown in the drawing, from a point to the left of the retarder R. As soon as the car enters the retarder R, the braking bars will start to slow down the car, and as the car continues through the retarder the braking bars will continue to slow down the car until the car speed has decreased to that at which the speed responsive apparatus completes the energizing circuit for relay C, whereupon the mechanism M will move the braking bars to their non-braking positions, and will subsequently retain them in their non-braking positions unless the car again accelerates to a speed which is above that which caused the energizing circuit for relay C to become closed, in which event relay C will again release its armature and will cause the mechanism M to restore the braking bars to their braking positions. Furthermore, as the car moves through the retarder as soon as the front end of the car passes the light sensitive device U⁶, this device will open its front contact and will close its back contact, and as the car con-

tinues through the stretch, each of the remaining devices U will open its front contact or front contacts and will close its back contact or back contacts as soon as the front end of the car passes the device. The opening of the front contacts of the devices U⁶, U⁵, U⁴ and U² will have no immediate effect on the remainder of the apparatus for reasons which will be clear from the foregoing description of the control of relay D by these devices, but the opening of the front contacts of the devices U³ and U¹ and the closing of the back contacts of these devices will cause the switch S to be held in its normal position in such manner that it can not be moved to its reverse position, and the opening of the front contacts of the devices U¹ and U³ will also cause the indication lamp G^a to become extinguished. As the rear end of the car clears the devices U⁶, U⁵, U⁴, U³, U² and U¹, these devices will, of course, successively restore their contacts to their normal positions. When the device U⁶ restores its contacts to their normal positions, relay N will pick up; when the device U⁵ restores its contacts to their normal positions, relay O will pick up; when the device U⁴ restores its contacts to their normal positions, relay N will release and relay P will pick up; when the device U³ restores its contacts to their normal positions, relay O will release; when the device U² restores its contacts to their normal positions, relay P will release; and when the device U¹ restores its contacts to their normal positions, the holding circuit for magnet M^a will become interrupted, the normal energizing circuit for magnet M^a will become closed, and light G^a will become lighted. All parts will then be restored to their normal positions in which they are shown in the drawing.

I will now assume that a first car which is traversing the stretch of track shown in the drawing has reached the point where its rear end is between the devices U⁵ and U⁴, that this car has been slowed down by the retarder to a speed which has caused the speed responsive apparatus to complete the energizing circuit for relay C, thus causing the car retarder to release, and that a second car which is traveling at a higher rate of speed than the first car has reached a point within the retarder where its front end will intercept the supply of light to the device U⁶ before the rear end of the first car clears the device U⁴. Under these conditions, the supply of light to the device U³ will be interrupted, the switch S will be held in its normal position, relays N and O will be energized, relay P will be deenergized, relay Q will be deenergized, lamp Q^F will be lighted, and relay D will be deenergized. When the front end of the second car passes the device U⁶, the pick-up circuit for relay D controlled by this device and by relay N will become closed, and relay D will therefore become energized. The energization of relay D will cause relay C to become deenergized, and when this happens the braking bars will move to their braking positions even though the speed of the first car is below that at which the speed responsive apparatus completes the energizing circuit for relay C. Due, however, to the fact that the front end of the first car will now be beyond the retarder, the retardation of the second car will be much greater than the retardation of the first car. When the rear end of the first car now passes device U⁴, the resultant opening of back contact 59 of this device will interrupt the stick circuit which was previously closed for relay N at this contact, and

since the pick-up circuit for relay N will then be open at front contact 55—55^a of device U⁶, relay N will become deenergized and will interrupt the pick-up circuit which was previously closed for relay D. As was pointed out hereinbefore, however, relay D is a slow releasing relay, and the parts are so proportioned that when this relay becomes deenergized under these conditions it will retain its armature picked up for a time interval which is sufficient to permit a car, moving at the control speed at which the speed responsive apparatus completes the pick-up circuit for relay C, to traverse a distance which is just a little longer than the distance between two adjacent devices U. As a result, when the front end of the second car passes the device U⁵, if the spacing between the first and second cars is then less than that between alternate ones of the devices U so that the rear end of the first car has not cleared the device U³ and caused relay O to release, the resultant closing of back contact 55—55^b of device U⁵ will complete another pick-up circuit for relay D, and relay D will therefore retain its armature picked up so that the car retarder will continue to slow down the second car. If however, when the front end of the second car passes the device U⁵, the second car has been slowed down to such an extent that the spacing between the first and second cars is then greater than that between alternate devices U so that the rear end of the first car will then have passed the device U³ and will thus have caused the relay O to become deenergized, the closing of the back contact 55—55^b of the device U⁵ will not complete the pick-up circuit for relay D controlled by this back contact, and relay D will then release its armature, thus restoring the circuit for relay C, and hence causing the retarder to release. Assuming that when the front end of the second car passes the device U⁵, the rear end of the first car has not passed the device U³, relay D will then retain its armature closed, and the retarder will therefore continue to slow down the car at least until the rear end of the first car passes the device U³, for reasons which will be clear from the foregoing, and if when the front end of the second car passes the device U⁴ the spacing between the cars is still less than that between alternate light beams, relay D will then retain its armature picked up until after the front end of the second car has cleared the device U³. If, however, the spacing between the cars becomes greater than the spacing between alternate devices U by the time the front end of the second car passes either the device U⁴ or the device U³, relay D will then release its armature, and if the speed of the car is then less than that at which the speed responsive apparatus completes the circuit for relay C and causes this relay to pick up, the retarder will release thus preventing further retardation of the car. If relay D has not become released by the time the front end of the second car passes the device U³, it will then automatically become released, and unless the speed of the car is then less than that at which the speed responsive apparatus completes the circuit for relay C, relay C will remain deenergized and the braking bars will remain in their braking positions. Under usual operating conditions, the second car will have become spaced from the first car a distance which is greater than that between alternate devices U, and will also have been slowed down to the speed at which the speed responsive apparatus completes the circuit for relay C before the front end of the

second car passes the device U³ and it follows, therefore, that under usual conditions by the time the front end of the second car passes the device U³, the car retarder will have become released. When two cars which are uncoupled are permitted to follow each other through the retarder, it is usually desired to have the one car continue on the main track past the switch S, and to have the other car enter the ladder track B, and if the spacing between the two cars becomes greater than that between alternate devices U the operator will be able to reverse the switch in a manner which will be readily understood from the foregoing description as soon as the rear end of the first car passes the device U¹. If, however, the two cars remain too close together while they are traversing the stretch A, the operator will then be prevented from throwing the switch, thus preventing the possibility of reversing the switch in a manner which would derail the second car. As was previously pointed out, the indication relay Q is connected in multiple with relay D, so that this relay will become energized whenever relay D becomes energized, and whenever this relay becomes energized the hump signal indication will automatically change from hump fast to hump slow, thus indicating to the engineman on the engine which is pushing the cars over the hump that they are being pushed over the hump at too high a rate of speed.

It will be apparent that while in the foregoing I have described the operation of the system while a single car is traversing the stretch A or while two following cars are traversing the stretch A, the operation of the system by a string of cars and the operation of the system by two following strings of cars will be similar to that for two following cars.

Although I have herein shown and described only one form of car retarder and switch control system 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 stretch of railway track over which spaced cars move toward a switch under such conditions that it is desirable to be able to maintain between successive cars a minimum spacing which is sufficient to permit said switch to be operated between the cars, and a car retarder associated with said switch and controlled automatically by means responsive to the spacing between cars for retarding the speed of a following car if it gets close to the preceding car than said minimum spacing.

2. In combination, a stretch of railway track over which spaced cars move without motive power toward a switch, and a car retarder controlled automatically by means which are responsive to the spacing between two successive cars for retarding the speed of the rear car if the spacing between the cars becomes less than that necessary to permit operation of said switch between them.

3. In combination, a stretch of railway track over which cars move under the influence of gravity, a car retarder associated with said stretch, a plurality of devices disposed at spaced intervals along said stretch and arranged to be successively operated by a car traversing said stretch, and means controlled by said devices for controlling the braking action of said car retarder

in a manner to maintain a predetermined spacing between successive cars traversing said stretch.

4. In combination, a stretch of railway track over which cars move toward a switch under the influence of gravity, a car retarder associated with said stretch, a plurality of devices disposed at spaced intervals along said stretch and arranged to be successively operated by a car traversing said stretch, and means controlled by said devices for controlling the braking action of said car retarder in a manner to maintain sufficient spacing between successive cars traversing said stretch to permit said switch to be thrown between them.

5. In combination, a stretch of railway track over which cars move under the influence of gravity, a car retarder associated with said stretch, a plurality of light sensitive devices, a plurality of lamps, one for each of said devices, said devices being disposed at spaced intervals on one side of said stretch and said lamps being disposed on the other side of said stretch in such manner that when no car is traversing said stretch each said device will receive light from its associated lamp but that when a car is traversing said stretch the supply of light to each device will be continuously cut off during the entire time the car is passing the device, and means controlled by said light sensitive devices for controlling the braking action of said car retarder in a manner to maintain a minimum spacing between successive cars.

6. In combination, a stretch of railway track over which cars move toward a switch under the influence of gravity, a car retarder associated with said stretch, a plurality of light sensitive devices, a plurality of lamps, one for each of said devices, said devices being disposed at spaced intervals on one side of said stretch and said lamps being disposed on the other side of said stretch in such manner that when no car is traversing said stretch each said device will receive light from its associated lamp but that when a car is traversing said stretch the supply of light to each device will be continuously cut off during the entire time the car is passing the device, and means controlled by said light sensitive devices for controlling the braking action of said car retarder in a manner to maintain sufficient spacing between successive cars to permit said switch to be reversed between them.

7. In combination, a stretch of railway track over which cars move toward a switch under such conditions that it is desirable to control the spacing between the cars, a car retarder associated with said stretch, means for moving said switch between normal and reverse positions, means for preventing movement of said switch while a car is passing over the switch or is within a predetermined distance in advance of the switch, and means controlled by cars traversing said stretch for automatically controlling the braking action of said car retarder in a manner to maintain sufficient spacing between successive cars to permit operation of said switch between them.

8. In combination, a stretch of railway track over which cars move toward a switch without motive power, a car retarder associated with said stretch, means for moving said switch between normal and reverse positions, and means controlled by cars traversing said stretch for controlling the braking action of said car retarder in a manner to maintain a predetermined mini-

mum spacing between said cars and for preventing operation of said switch between cars unless they are spaced apart said predetermined minimum spacing.

9. In combination, a stretch of railway track over which cars move toward a switch without motive power, a car retarder associated with said stretch, means for moving said switch between normal and reverse positions, and means controlled by cars traversing said stretch for controlling the braking action of said car retarder in a manner to maintain sufficient spacing between successive cars to permit said switch to be thrown between them and for preventing operation of said switch when a car is within a predetermined distance in advance of the switch or is passing through the switch.

10. In combination, a stretch of railway track over which cars move toward a switch without motive power, a car retarder associated with said stretch in advance of said switch, a series of light sensitive devices located on one side of said stretch, the first device of the series being located opposite said switch and said devices being spaced apart approximately one-half the minimum distance required between two successive cars in order to reverse the switch between them when the cars are traveling at a predetermined speed, a plurality of lamps disposed on the opposite side of said stretch from said light sensitive devices and one cooperating with each of said light sensitive devices, each said lamp and the associated device being so arranged that the light from the lamp will normally illuminate the associated device but that when a car is traversing said stretch the supply of light to each device will be continuously cut off during the entire time the car is passing the device, operating mechanism for said switch, means for preventing operation of said mechanism when the supply of light to either the first or the third device of the series is cut off, a plurality of relays controlled by alternate ones of said devices, a slow acting relay controlled by said devices and by said plurality of relays, and means controlled by said slow acting relay for controlling the braking action of said car retarder.

11. In combination, a stretch of railway track over which cars move toward a switch without motive power, a car retarder associated with said stretch in advance of said switch, a series of light sensitive devices located on one side of said stretch, the first device of the series being located opposite said switch and said devices being spaced apart approximately one-half the minimum distance required between two successive cars to permit reversal of the switch between them when the cars are traveling at a predetermined speed, a plurality of lamps disposed on the opposite side of said stretch from said light sensitive devices and one cooperating with each of said light sensitive devices, each said lamp and the associated device being so arranged that the light from the lamp will normally illuminate the associated device but that when a car is traversing said stretch the supply of light to each device will be continuously cut off during the entire time the car is passing the device, operating mechanism for said switch, means for preventing operation of said mechanism when the supply of light to either the first or third device of the series is cut off, a plurality of other relays controlled by alternate ones of said devices in such manner that when the supply of light to a device is cut off and the device second in rear to

such device is illuminated the associated relay will be energized, a slow releasing relay controlled by said plurality of relays and by said devices in such manner that when one of said relays is energized and the supply of light to the farthest in rear of the devices which control such relay is cut off said slow acting relay will be energized, and means controlled by said slow acting relay for controlling said car retarder.

12. In combination, a stretch of railway track over which cars move toward a switch without motive power, a car retarder associated with said stretch in advance of said switch, a series of light sensitive devices located on one side of said stretch, the first device of the series being located opposite said switch and said devices being spaced apart approximately one-half the minimum distance required between two successive cars to permit reversal of said switch between them when the cars are traveling at a predetermined speed, a plurality of lamps disposed on the opposite side of said stretch from said light sensitive devices and one cooperating with each of said light sensitive devices, each said lamp and the associated device being so arranged that the light from the lamp will normally illuminate the associated device but that when a car is traversing said stretch the supply of light to each device will be continuously cut off during the entire time the car is passing the device, front and back contacts controlled by each of said devices in such manner that the front contacts will be closed when the associated device is illuminated and that the back contacts will be closed when the supply of light to the associated device is cut off, a plurality of stick relays each provided with a pick-up circuit including a back contact of an associated one of said devices and a front contact of the second device in rear of the associated device, a stick circuit for each of said stick relays including its own front contact and a back contact of the associated device, a slow releasing relay, a plurality of pick-up circuits for said slow releasing relay each including a front contact of one of said stick relays and a back contact of the second device in rear of the associated device, and means controlled by said slow releasing relay for controlling said car retarder.

13. In combination, a stretch of railway track over which cars move toward a switch without motive power, a car retarder associated with said stretch in advance of said switch, a series of light sensitive devices located on one side of said stretch, the first device of the series being located opposite said switch and said devices being spaced apart approximately one-half the minimum distance required between two successive cars in order to reverse the switch between them when the cars are traveling at a predetermined speed, a plurality of lamps disposed on the opposite side of said stretch from said light sensitive devices and one cooperating with each of said light sensitive devices, each said lamp and the associated device being so arranged that the light from the lamp will normally illuminate the associated device but that when a car is traversing said stretch the supply of light to each device will be continuously cut off during the entire time the car is passing the device, front and back contacts controlled by each of said devices in such manner that the front contacts will be closed when the associated device is illuminated and that the back contacts will be closed when the supply of light to the associated device is cut off, a plurality of stick relays each provided with a pick-up circuit

including a back contact of an associated one of said devices and a front contact of the second device in rear of the associated device, a stick circuit for each of said stick relays including its own front contact and a back contact of the associated device, a slow releasing relay, a plurality of pick-up circuits for said slow releasing relay each including a front contact of one of said stick relays and a back contact of the second device in rear of the associated device, a car retarder control relay which becomes energized when the speed of a car traversing said stretch decreases below a predetermined speed provided said slow releasing relay is then deenergized, and means for moving said car retarder to its braking or non-braking position according as said car retarder control relay is deenergized or energized.

14. In combination, a traffic path along which spaced vehicles are adapted to travel under such conditions that it is desirable to maintain a minimum spacing between them, a plurality of devices disposed along said path at intervals equal to approximately one-half the distance of said minimum spacing and arranged to be successively operated by each vehicle traversing said path, and means controlled by said devices for retarding a following vehicle if it gets closer to the preceding vehicle than said minimum spacing.

15. In combination, a traffic path along which spaced vehicles are adapted to travel under such conditions that it is desirable to maintain a minimum spacing between them, a plurality of devices disposed along said path at intervals equal to approximately one-half the distance of said minimum spacing and arranged to be successively operated by each vehicle traversing said path, and means controlled by said devices for retarding a following vehicle if it gets closer to the preceding vehicle than the distance between alternate ones of said devices.

16. In combination, a traffic path along which spaced vehicles are adapted to travel under such conditions that it is desirable to maintain a minimum spacing between them, a plurality of devices disposed along said path at intervals equal to approximately one-half the distance of said minimum spacing and arranged to be successively operated by each vehicle traversing said path, and means controlled by alternate ones of said devices for retarding a following vehicle if it gets closer to the preceding vehicle than said minimum spacing.

17. In combination, a traffic path along which spaced vehicles are adapted to travel under such conditions that it is desirable to maintain a minimum spacing between them, a series of light sensitive devices disposed along said path on one side of the path at spaced intervals equal to approximately one-half said minimum spacing, a plurality of lamps disposed on the opposite side of said path from said light sensitive devices and one cooperating with each of said light sensitive devices, each said lamp and the associated device being so arranged that the light from the lamp will normally illuminate the associated device but that when a vehicle is traversing said path the supply of light to each device will be continuously cut off during the entire time the vehicle is passing the device, and means controlled by said devices for retarding a following vehicle if it gets closer to the preceding vehicle than said minimum spacing.

18. In combination, a traffic path along which spaced vehicles are adapted to travel under such conditions that it is desirable to maintain a mini-

5 mum spacing between them, a series of light sensitive devices disposed along said path on one side of the path at spaced intervals equal to approximately one-half said minimum spacing, a plurality of lamps disposed on the opposite side of said path from said light sensitive devices and one cooperating with each of said light sensitive devices, each said lamp and the associated device being so arranged that the light from the lamp will normally illuminate the associated device but that when a vehicle is traversing said path the supply of light to each device will be continuously cut off during the entire time the vehicle is passing the device, and means controlled by said devices for retarding a following vehicle if it gets closer to the preceding vehicle than the distance between alternate ones of said devices.

10 19. In combination, a traffic path along which spaced vehicles are adapted to travel under such conditions that it is desirable to maintain a minimum spacing between them, a series of light sensitive devices disposed along said path on one side of the path at spaced intervals equal to approximately one-half said minimum spacing, a plurality of lamps disposed on the opposite side of said path from said light sensitive devices and one cooperating with each of said light sensitive devices, each said lamp and the associated device being so arranged that the light from the lamp will normally illuminate the associated device but that when a vehicle is traversing said path the supply of light to each device will be continuously cut off during the entire time the vehicle is passing the device, and means controlled by alternate ones of said devices for retarding a following vehicle if it gets closer to the preceding vehicle than said minimum spacing.

20 20. In combination, a stretch of railway track over which spaced cars move under such conditions that it is desirable to maintain a minimum spacing between the cars, a plurality of devices disposed along said stretch at intervals equal to approximately one-half said minimum spacing and arranged to be operated successively by each car traversing said stretch, and means controlled by said devices for retarding a following car if it gets closer to a preceding car than said minimum spacing.

21. In combination, a stretch of railway track

over which spaced cars move under such conditions that it is desirable to maintain a minimum spacing between the cars, a car retarder associated with said stretch, a plurality of devices disposed along said stretch at intervals equal to approximately one-half said minimum spacing and arranged to be operated successively by each car traversing said stretch, and means controlled by alternate ones of said devices for controlling said car retarder in such manner that said car retarder will retard a following car if it gets closer to the preceding car than said minimum spacing.

22. In combination, a stretch of railway track over which spaced cars move under such conditions that it is desirable to maintain a minimum spacing between the cars, a plurality of devices disposed along said stretch at intervals equal to approximately one-half said minimum spacing and arranged to be operated successively by each car traversing said stretch, and means controlled by alternate ones of said devices for retarding a following car if it gets closer to a preceding car than said minimum spacing.

23. In combination, a stretch of railway track over which spaced cars move under such conditions that it is desirable to maintain a minimum spacing between the cars, a plurality of devices disposed along said stretch at intervals equal to approximately one-half said minimum spacing and arranged to be operated successively by each car traversing said stretch, a plurality of relays one controlled by each alternate pair of said devices, and means controlled by said relays for retarding a following car if it gets closer to the preceding car than said minimum spacing.

24. In combination, a stretch of railway track over which spaced cars move under such conditions that it is desirable to maintain a minimum spacing between the cars, a plurality of devices disposed along said stretch at intervals equal to approximately one-half said minimum spacing and arranged to be operated successively by each car traversing said stretch, a plurality of relays one controlled by each alternate pair of said devices, and a car retarder controlled by said relays and effective for retarding a following car if it gets closer to the preceding car than said minimum spacing.

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