

May 8, 1934.

H. L. BONE ET AL

1,958,294

RAILWAY CAR RETARDER

Filed June 2, 1932

3 Sheets-Sheet 1

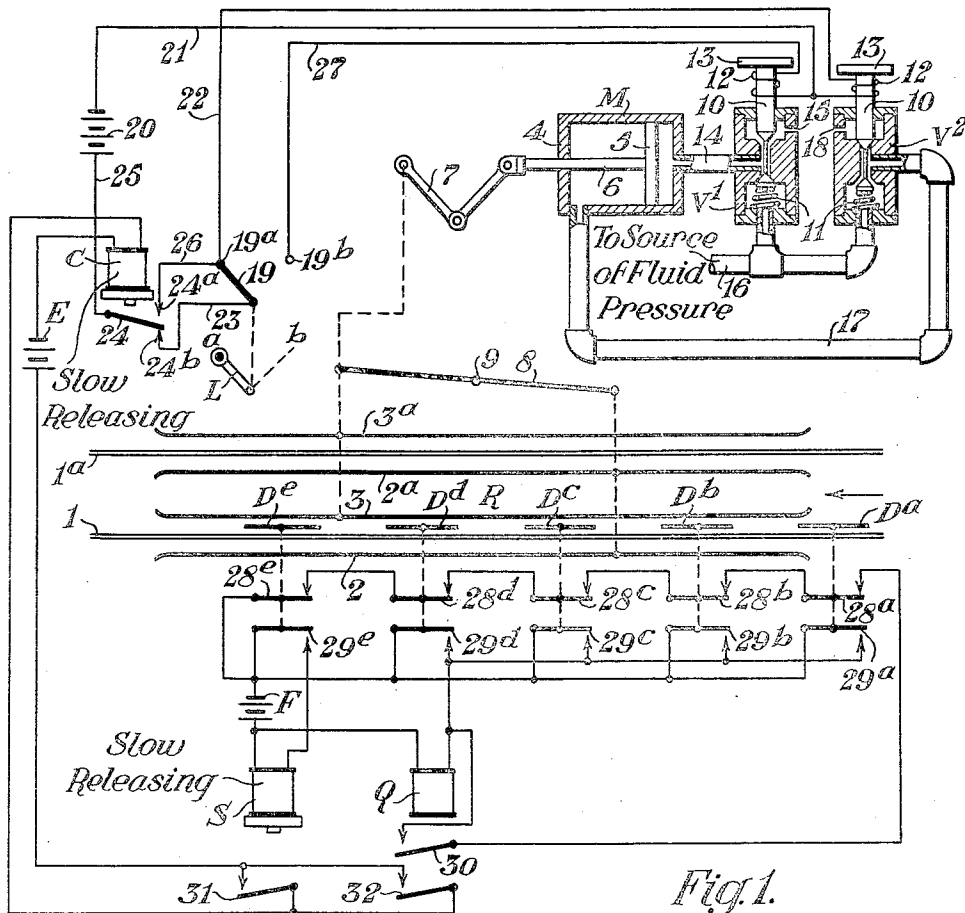


Fig. 1.

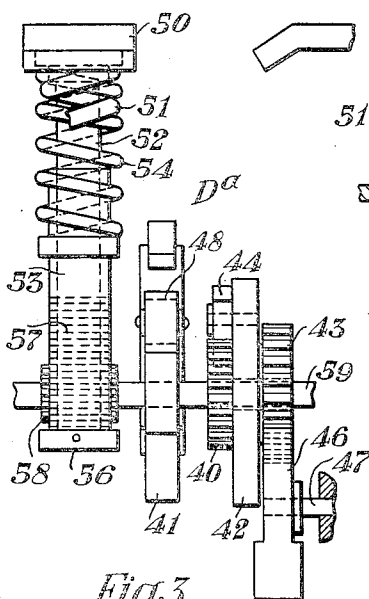


Fig. 3.

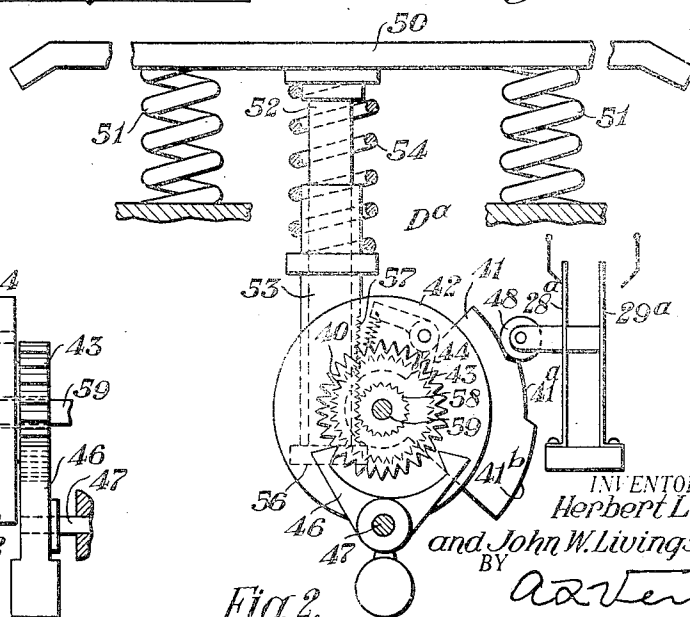


Fig. 2.

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3 Sheets-Sheet 2

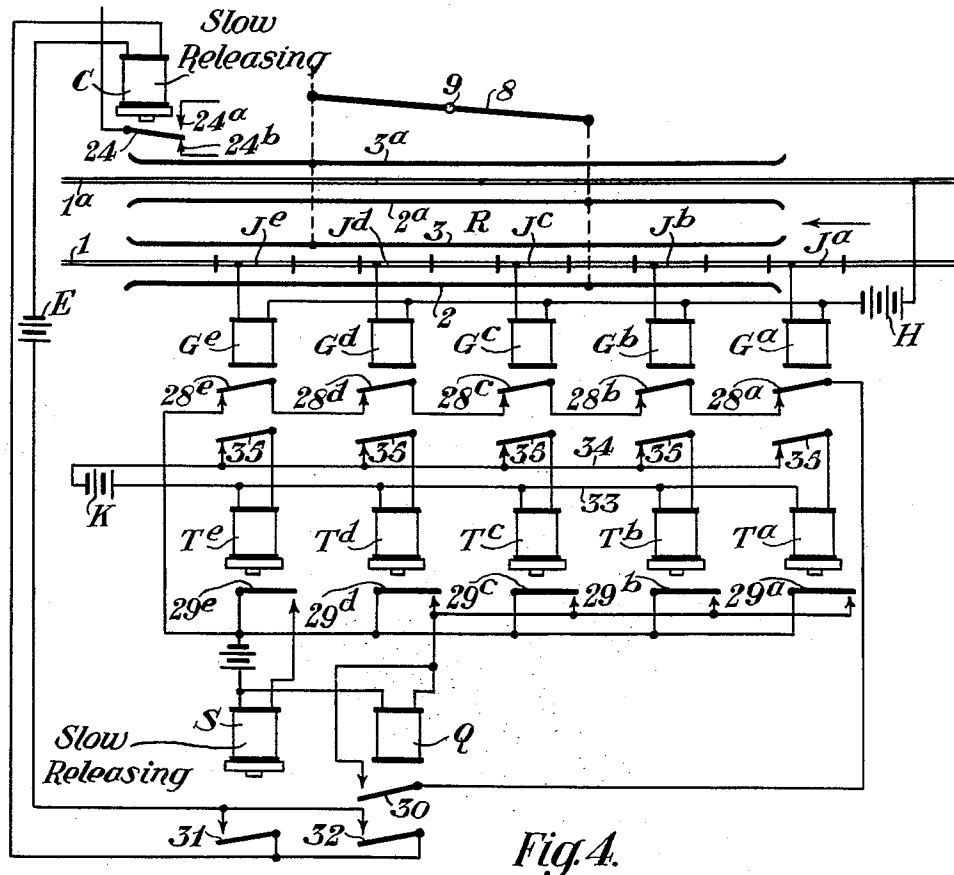


Fig. 4.

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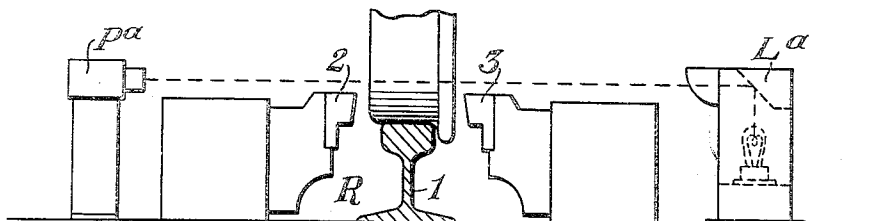
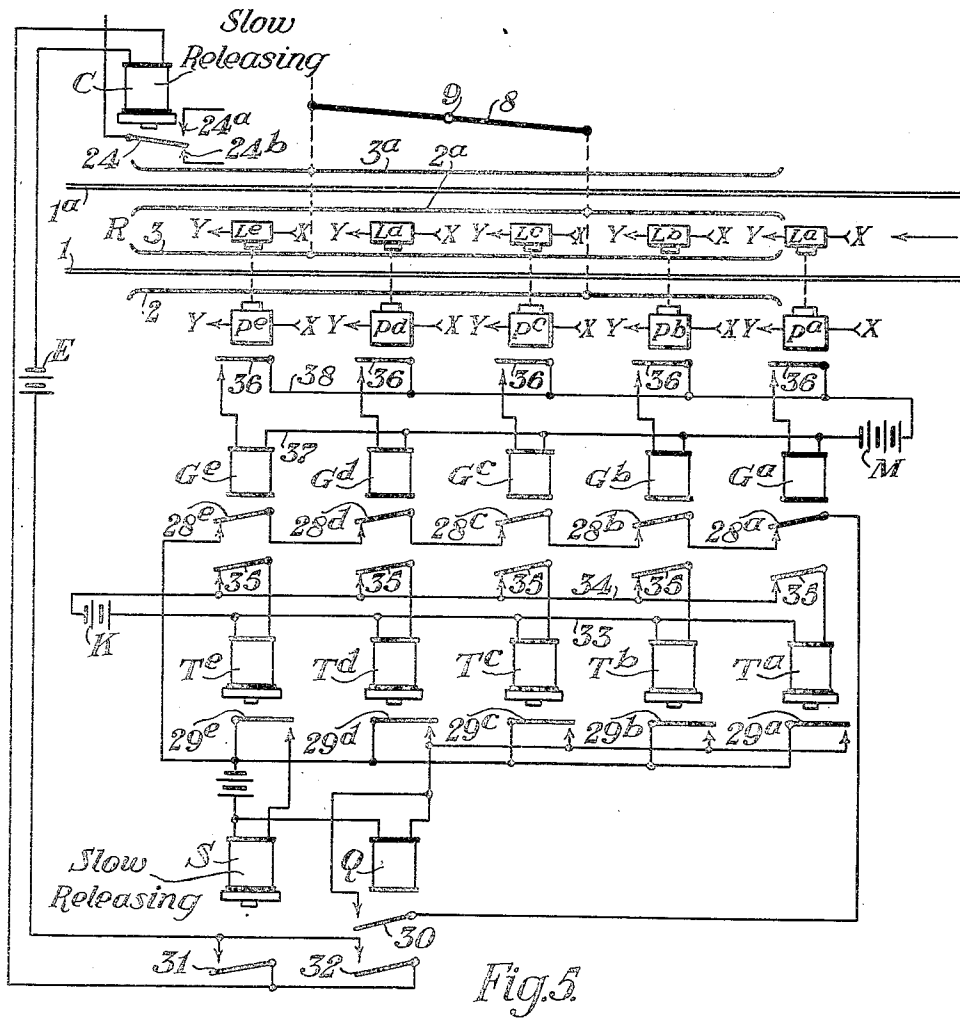
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RAILWAY CAR RETARDER

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3 Sheets-Sheet 3



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1,958,294

RAILWAY CAR RETARDER

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Application June 2, 1932, Serial No. 614,940

24 Claims. (Cl. 246—29)

Our invention relates to railway car retarders, and particularly to car retarders of the track brake type used in classification or hump yards of railroads for controlling the speed of cars.

- 5 One object of our invention is the provision of improved automatic apparatus for controlling the braking action of a car retarder of the type described in accordance with the speed of cars approaching or passing through the retarder.
- 10 We will describe one form of car retarder controlling apparatus embodying our invention, and will then point out the novel features thereof in claims.

- 15 In the accompanying drawings, Fig. 1 is a view, partially sectioned and partially diagrammatic, illustrating one form of apparatus embodying our invention. Fig. 2 is a front elevational view of a car operated treadle device forming part of the apparatus shown in Fig. 1. Fig. 3 is a left-
- 20 hand end view of a treadle device shown in Fig. 2. Fig. 4 is a diagrammatic view showing a modified form of a portion of the apparatus illustrated in Fig. 1. Fig. 5 is a diagrammatic view showing another modified form of a portion of
- 25 the apparatus illustrated in Fig. 1. Fig. 6 is a detail view showing a portion of the apparatus illustrated in Fig. 5.

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

- 30 Referring to the drawings, the reference characters 1 and 1^a designate the track rails of a stretch of railway track over which cars normally move in the direction indicated by the arrow under such conditions that it is desirable to
- 35 control the speed of the cars automatically. For example, the stretch of track here shown might be in a classification yard of the "hump" type through which cars move under the influence of gravity. It is obvious that in service of this
- 40 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
- 45 car as to whether it is a free running car or otherwise.

- 50 In order to control the speed of the cars, the stretch of track illustrated in the drawings is provided with a car retarder R which, in the form here shown, comprises two braking bars 2 and 3 extending parallel with, and located on opposite sides of rail 1, and two similar braking bars
- 55 2^a and 3^a, extending parallel with, and located on opposite sides of rail 1^a.

- The braking bars 2, 3, 2^a and 3^a are operated

by a fluid pressure motor M comprising a piston 5 reciprocally mounted in a cylinder 4 and attached to one end of a piston rod 6. The braking bars 2, 3, 2^a and 3^a are operatively connected with the piston rod 6 through suitable linkwork including a bell crank 7 and a lever 8 pivotally supported at point 9. When piston 5 occupies its extreme right-hand position in which position it is illustrated in the drawings, the braking bars occupy their non-braking or ineffective positions in which they are out of engagement with the wheels of a car traversing the rails 1 and 1^a. When piston 5 is moved to its left-hand position, however, as when fluid pressure is admitted to the right-hand end of cylinder 4, the braking bars 2, 3, 2^a and 3^a are moved toward the associated rail to their effective or braking positions in which they will engage the wheels of a car traversing the rails 1 and 1^a, to retard the speed of the car.

The motor M is controlled by two magnet valves V¹ and V², each comprising a valve stem 10 biased to an upper position by means of a spring 11, and each provided with a winding 12 and an armature 13. When winding 12 of valve V¹ is deenergized, as shown in the drawings, valve stem 10 of this valve is moved to its upper position by the spring 11, and under these conditions the right-hand end of cylinder 4 is connected with atmosphere through a pipe 14 and a port 15. When winding 12 of this valve is energized, however, valve stem 10 is moved downwardly against the bias of spring 11 to disconnect pipe 14 from atmosphere, and to connect this pipe with a suitable source of fluid pressure, usually air, through a pipe 16. When winding 12 of valve V¹ is energized, therefore, the fluid pressure supplied to the right-hand end of cylinder 4 moves piston 5 toward the left, thereby moving the braking bars to their effective or braking positions.

When winding 12 of valve V² is deenergized, valve stem 10 of this valve is moved to its upper position, and the left-hand end of cylinder 4 is then connected with atmosphere, through a pipe 17 and a port 18. When winding 12 of valve V² is energized, however, as shown in the drawings, valve stem 10 is moved downwardly, disconnecting pipe 17 from port 18, and connecting pipe 17 with pipe 16. It will be apparent, therefore, that when valve V² is energized, piston 5 is urged toward the right, thus holding the braking bars in their effective or non-braking positions.

The magnet valves V¹ and V² are controlled by means of a normally deenergized slow-releas-

ing relay C and by a manually operable lever L. The lever L, in the form here shown, is capable of assuming a left-hand position *a* in which it is illustrated in the drawings, and a right-hand position *b*, indicated by a dotted line in the drawings. Operatively connected with the lever L is a contact arm 19 which engages a fixed contact 19^a or 19^b to close a contact 19—19^a or 19—19^b according as lever L occupies its *a* or *b* position.

Winding 12 of valve V² is provided with a circuit which passes from a suitable source of current here shown as a battery 20 through wire 21, winding 12 of valve V², wire 22, contact 19—19^a of lever L, wire 23, back contact 24—24^b of relay C, and wire 25 back to battery 20. Winding 12 of valve V² is also provided with another circuit which is similar to the circuit just traced with the exception that this circuit includes a wire 26 and a front contact 24—24^a of relay C instead of contact 19—19^a of lever L, wire 24, and back contact 24—24^b of relay C. It will be apparent, therefore, that winding 12 of lever V² will become energized when relay C is deenergized and lever L occupies its *a* position, or when relay C is energized regardless of the position of lever L.

Winding 12 of valve V¹ is provided with a circuit which passes from battery 20 through wire 21, winding 12 of valve V¹, wire 27, contact 19—19^b of lever L, wire 23, back contact 24—24^b of relay C, and wire 25 back to battery 20. It will be apparent, therefore, that winding 12 of valve V¹ will be energized when and only when lever L occupies its *b* position and relay C is deenergized.

It follows from the foregoing that when relay C is deenergized, the braking bars will occupy their non-braking or braking positions according as lever L occupies its *a* or its *b* position, but that, when relay C becomes energized, if the braking bars do not already occupy their non-braking positions, they will automatically be moved to their non-braking positions.

The apparatus also includes a first series of contacts 28^a, 28^b, 28^c, etc., a second series of contacts 29^a, 29^b, 29^c, etc., one of which is provided for each contact 28 of the first series, an ordinary quick-acting relay Q, and a slow-releasing relay S.

In accordance with our present invention, novel means are provided for controlling the contacts 28 and 29 in such manner that when no car is traversing the stretch of track shown in the drawings, the contacts 28 will all be closed and the contacts 29 will all be open, but that, when a car is traversing the stretch of track shown in the drawings, each time a wheel of the car traverses any one of a plurality of portions of said stretch of fixed length located at spaced intervals along the stretch, and each individual to a different one of said contacts 28 and the associated contact 29, the contact 28 for such portion will become open during the entire time the wheel is traversing such portion and the associated contact 29 will become closed while the wheel is traversing such portion if and only if the speed of the car is equal to, or less than, a predetermined speed which we shall term "control" speed. As shown in Fig. 1, the means here illustrated for controlling the contacts 28 and 29 comprises a series of treadle devices D^a, D^b, D^c, etc., located at spaced intervals along the stretch, one such treadle device being provided for each contact 28 and the associated contact 29. These treadle devices are all similar, and an understanding of each will be had from a description of only one.

Referring now to Figs. 2 and 3 in which the treadle device D^a is illustrated in detail, this

treadle device comprises, in the form here shown, a treadle bar 50 which is biased to an upper position by means of springs 51. Secured to the underside of the treadle bar 50 is a vertical rod 52, and slidably mounted on this rod is a sleeve 53. The sleeve 53 is biased, by means of a spring 54, to a lowermost position on the rod, in which position it engages a stop collar 56 secured to the rod, and has formed thereon rack teeth 57 which mesh with a pinion 58 secured to a rotatable shaft 59. A ratchet wheel 40 and a cam 41 are also secured to the shaft 59, and journaled on this shaft adjacent the ratchet wheel 40 is a dog plate 42 and an escapement wheel 43. The dog plate 42 and escapement wheel 43 are fastened together, and pivotally mounted on the dog plate is a spring biased dog 44 which cooperates with the ratchet wheel 40 in such manner that the dog plate, and hence the escapement wheel 43, will be rotated in response to counter-clockwise rotation of the shaft 59, as viewed in Fig. 2, but that, when the shaft 59 is rotated in a clockwise direction, the dog will ride idly over the teeth of the ratchet wheel, with the result that the dog plate and escapement wheel will then remain stationary. The escapement wheel 43 cooperates with the pallets of a pendulum controlled escapement pawl 46 which is pivotally mounted on a fixed shaft 47.

Formed on the cam 41 are two cam swells 41^a and 41^b which cooperate with a cam follower 48 operatively connected with the contacts 28^a and 29^a. The parts are so arranged and so proportioned that when the shaft 59 occupies its normal position in which it is shown in the drawings, the cam 41 will occupy the position in which the cam swells 41^a and 41^b are both out of engagement with the cam follower 48, and under these conditions, contact 28^a will be closed and contact 29^a will be open. As soon, however, as shaft 59 is rotated from its normal position through a small angle in a counter-clockwise direction, as viewed in Fig. 2, cam swell 41^a will move into engagement with cam follower 48, thus forcing the contacts 28^a and 29^a from the positions shown to the positions in which contact 28^a becomes opened and contact 29^a remains open; and, when the cam is rotated in a counter-clockwise direction to its extreme position, the cam swell 41^b will move into engagement with the cam follower, thus causing contact 29^a to become closed.

With the treadle device D^a constructed in the manner just described, it will be seen that when a car wheel moves into engagement with the treadle bar 50 and depresses it, rod 52 will slide downwardly within the sleeve 53, and spring 54 will become compressed. A downward force will then be exerted on the sleeve by the spring 54 which will tend to rotate the pinion 58, and hence the shaft 59, in a counter-clockwise direction, as viewed in Fig. 2. As previously pointed out, when the shaft 59 is rotated in a counter-clockwise direction, the dog 44 will cooperate with the ratchet wheel 40 to operatively connect the escapement wheel 43 with the shaft, and it will be readily understood, therefore, that the speed at which the shaft can rotate in a counterclockwise direction will be limited by the action of the pendulum controlled escapement pawl 46 on the escapement wheel 43, with the result that the shaft will rotate at a relatively slow uniform speed. It follows, therefore, that when the treadle bar 50 becomes depressed, the shaft 59 will be rotated from its normal position to an angular position which depends upon the length of time the treadle bar

50 is held depressed, and hence upon the speed of the car, the extreme angular position to which the shaft can be rotated being the position which the shaft will occupy when the sleeve 53 has been moved, by the compressed spring 54, to its lowermost position on the rod 52 while the treadle bar is still depressed. As soon as the shaft starts to move away from its normal position, contact 28^a will become opened, and if the shaft is rotated to its extreme position, contact 29^a will become closed. It will be seen, therefore, that if the treadle bar 50 is depressed by the wheel of a car which is moving at a speed which is equal to, or less than, a predetermined speed which depends upon the proportioning of the parts, contact 28^a will be held open during the entire time the treadle bar is depressed, and contact 29^a will become closed sometime before the wheel departs from the treadle bar, but that, if the speed of the car is above such predetermined speed, contact 28^a will be held open during the entire time the treadle bar is depressed as previously described, and contact 29^a will remain open. The parts are preferably so proportioned that the predetermined speed at which contact 29^a will just become closed is the speed at which it is desired to have cars depart from the retarder, this speed being the "control" speed referred to hereinbefore.

As soon as a car wheel which has depressed the treadle bar 50 departs from the treadle bar, the treadle bar will be restored to its normal position by the biasing springs 51. During this return movement, if the rod 52 does not already occupy the relative position with respect to the sleeve 53 in which the collar 56 engages the lower end of the sleeve, it will slide upwardly within the sleeve until it reaches this position, after which the rod and sleeve will move upwardly as a unit. When the rod 52 occupies the position relative to the sleeve 53 in which the collar 56 engages the lower end of the sleeve, the force due to the spring 54 tending to rotate the shaft 59 in a counterclockwise direction is removed, and as the sleeve moves upwardly, it acts through the pinion 58 to rotate the shaft 59 in a clockwise direction until the shaft is restored to its normal position. During this clockwise rotation of the shaft, the cam 41 is returned to its normal position as rapidly as the treadle bar 30 is restored to its normal position, thus quickly restoring the contacts 28 and 29 to their normal positions. The clockwise rotation of the shaft 59 is not limited by the action of the escapement pawl 46 and escapement wheel 43 since, as previously pointed out, the dog 44 rides idly over the ratchet wheel 40 during clockwise rotation of the shaft.

The construction and operation of each of the remaining treadle devices D is similar in all respects to that just described for the treadle device D^a.

The contacts 29^a, 29^b, 29^c and 29^d are each included in a different pick-up circuit for relay Q, all of which pick-up circuits, as here shown, are supplied with current from a suitable source such, for example, as a battery F. It will be apparent, therefore, that when any one of the treadle devices, D^a, D^b, D^c or D^d is depressed by a car wheel for a long enough period of time to cause the associated contact 29 to become closed, relay Q will become energized. The contact 29^e controls a pick-up circuit for relay S which is similar in all respects to any one of the pick-up circuits for relay Q.

Relay Q, in addition to being provided with the

pick-up circuits described above, is also provided with a stick circuit which includes the contacts 28^a, 28^b, 28^c, 28^d and 28^e in series, battery F, the winding of relay Q, and a front contact 30 of relay Q.

It will be apparent that when a treadle device D becomes depressed by a car wheel and closes its associated contact 29, thus closing one of the pick-up circuits for relay Q, and hence energizing this relay, the contact 28 controlled by such treadle device will then be open, so that the stick circuit just traced for this relay will be open at this latter contact. It will also be apparent that when the car wheel subsequently departs from such treadle device, the contact 29 of the treadle device will become opened before the associated contact 28 becomes closed, and the pick-up circuit which was previously closed for relay Q and its stick circuit will then both be open, so that this relay will again become deenergized. Relay Q will not release its armature under these conditions, however, unless another treadle device is then depressed, because the contact 28 of the treadle device will become closed so soon after the contact 29 becomes opened, that the armature of the relay will not have had time to release before the contact 28 becomes closed, and when the contact 28 becomes closed, the stick circuit for the relay will then be completed, which will reenergize the relay, thus causing the relay to hold its armature closed. It will be seen, therefore, that when relay Q is once energized, it will not release its armature until a treadle device D is operated subsequent to the operation of the treadle device whose operation caused relay Q to pick up.

The relays Q and S control relay C by virtue of two parallel pick-up circuits each of which includes the winding of relay C, a suitable source of current here shown as a battery E, and a front contact 31 of relay S or a front contact 32 of relay Q, as the case may be. It follows that when either relay S or relay Q becomes energized, relay C will also become energized.

Relay C is made sufficiently slow releasing so that this relay will hold its armature closed, after its winding becomes deenergized, for a time interval which is a little longer than the time interval required for the wheel of a car which is moving at control speed to pass over the treadle bar of a treadle device.

As shown in the drawings, the parts are in the positions which they normally occupy when no car is traversing the stretch of track shown in the drawings. That is to say, the contacts 28 are all open and the contacts 29 are all closed. Relays Q and S, and hence relay C, are all deenergized. Lever L occupies its *a* position, and the braking bars are held in their non-braking positions.

In explaining the operation of the apparatus as a whole, we will assume that the braking bars have been moved to their braking positions by moving lever L from its *a* to its *b* position, and that a car which is approaching the stretch of track shown in the drawings in the direction of the arrow, at a speed which is greater than control speed, traverses the stretch of track shown in the drawings. As the car moves through the retarder, the treadle devices D will be successively operated by each wheel of the car running on rail 1, but as long as the speed of the car is above control speed, none of these treadle devices will remain operated long enough to cause the associated contact 29 to become closed. The relays

Q and S, and hence the relay C will therefore all remain deenergized, and the braking bars of the car retarder R will therefore remain in their braking positions so that the car retarder will continue to slow down the car. As soon, however, as the car has been slowed down to a speed which is equal to, or less than, control speed, and a wheel of the car passes one of the treadle devices, the associated contact 29 will then become closed, which will complete one of the pick-up circuits for relay Q, or the pick-up circuit for relay S, depending upon which contact 29 happens to become closed. Relay Q or relay S, as the case may be, will therefore become energized, thus causing relay C to also become energized. When relay C becomes energized, the braking bars will be moved to their non-braking positions in the manner previously described, and it will be apparent, therefore, that no further retardation of the car will take place until relay C again becomes deenergized and remains deenergized long enough to cause it to close its back contact 24—24^b. Relay C will not again become deenergized long enough to close its back contact 24—24^b until the car has departed entirely from the retarder, unless the car again attains a speed which is greater than control speed. For, as long as the speed of the car is below control speed, if the car occupies a position in which one or more of the treadle devices D is being operated, either one of the contacts 29 will then be closed, so that relay C will be held energized due to the resultant energization of relay Q or relay S, or, if none of the contacts 29 is then closed, so that both relays Q and S, and hence relay C, are then deenergized, one of these contacts will become closed soon enough to cause relay C to again become energized before the relay will have been deenergized long enough to release its armature; and, if the car does not occupy a position in which one of the treadle devices is being operated, either relay S, due to a previous energization, will not yet have released its armature, or else relay Q will be held energized by virtue of its stick circuit, with the result that, in either event, relay C will be held energized. Assuming, however, that the car again attains a speed which is greater than control speed before the car has departed entirely from the retarder, then as soon thereafter as a treadle device becomes operated, the stick circuit for relay Q will become opened at the associated contact 28, and the associated contact 29 will remain open, so that if relay Q is not already deenergized, it will become deenergized and will subsequently remain deenergized. Furthermore, relay S, if not already deenergized under these conditions, will shortly become deenergized and will subsequently remain deenergized, and relay C will therefore also become deenergized and will remain deenergized. When relay C closes its back contact 24—24^b, the braking bars will, of course, be moved to their braking positions to again retard the car, and it will be seen, therefore, from the foregoing, that with apparatus embodying our invention, the braking action of the retarder will be automatically controlled in accordance with the speed of the car in such manner that the car will depart from the retarder at substantially the control speed.

It should be particularly pointed out that if a car which has been slowed down by the retarder to a speed which is equal to, or less than, control speed, is still moving at a speed which is equal to, or less than, control speed when the last wheel

of the car passes the last treadle device D^e of the series, all circuits for relay Q will then be open and will subsequently remain open, so that relay Q will remain deenergized, but the resultant closing of contact 29 of treadle device D^e will cause relay S, and hence relay C, to become energized. The braking bars will therefore remain in their braking positions, after the wheel has completely passed the treadle device D^e, until a time interval has expired which is equal to the combined release times of the two relays S and C which release times, due to the slow releasing characteristics of these relays are relatively long, whereupon the braking bars will be automatically restored to their braking positions. It will be seen, therefore, that the treadle device D^e may be located several feet in rear of the leaving end of the retarder without any danger of a car becoming stalled in the retarder, or slowed down to an undesirably low speed because of the braking bars being restored to their braking positions before the car has departed entirely from the retarder. One advantage of this feature is that it permits the desired operation of the system to be obtained with a minimum number of treadle devices.

Referring now to Fig. 4, in which we have illustrated a modified form of our invention whereby the desired operation of the contacts 28 and 29 is effected by electrical means instead of by mechanical means, as here shown, each contact 28 comprises the back contact of a different one of a series of auxiliary control relays, each designated by the reference character G with a suitable distinguishing exponent, and each contact 29 comprises the back contact of a different one of a series of timing relays, each designated by the reference character T with a suitable distinguishing exponent.

Each auxiliary control relay G is connected in a track circuit which includes the rail 1^a, a suitable source of current, here shown as a battery H, and an associated one of a series of relatively short insulated control sections which are formed in the rail 1 at spaced intervals along the stretch, and each of which is designated by the reference character J with the same distinguishing exponent as the exponent for the reference character of the associated control relay G. It will be apparent, therefore, that when no car is traversing the stretch of track shown in the drawings, all of the auxiliary control relays G will be deenergized so that all of the contacts 28 will be closed, but that, when a car is traversing the stretch of track shown in the drawings, each time a car wheel moves onto one of the auxiliary control sections J, the auxiliary control relay for such section will become energized and will open its back contacts, thus opening the contact 28 controlled thereby. It will also be apparent that the length of time the auxiliary control relay G will remain energized when a car is traversing the associated section will depend upon the length of the section and the speed of the car. The lengths of the control sections may be varied, as desired, to vary this time interval, but the sections will preferably be of uniform length and will be sufficiently short so that two wheels of a car cannot occupy the same section at any one time.

The timing relays T are similar relays, and as here shown have slow-releasing characteristics. Each timing relay T is connected with a pair of line wires 33 and 34 over a back contact 35 of the associated auxiliary control relay G, and the line wires 33 and 34, in turn, are constantly connected with a suitable source of electromotive force here

shown as a battery K. It will be seen, therefore, that when none of the control relays G is energized, as when no car is traversing the stretch of track shown in the drawings, all of the timing relays T will be energized so that all of the contacts 29 will be open, but that, when a car is traversing the stretch of track shown in the drawings, each time a car wheel moves onto one of the control sections J and causes the associated auxiliary control relay G to become energized, the timing relay T controlled by such auxiliary control relay will become deenergized and will remain deenergized for a time interval which depends upon the speed of the car. If the speed of the car is sufficiently slow so that this time interval is longer than the release time of such timing relay T, this timing relay will close its back contact 29, but if the speed of the car is not sufficiently slow so that this time interval is longer than the release time of this timing relay, this timing relay will not close its back contact 29. The parts are so proportioned that the speed at which the timing relay T will just close their contacts 29 will be the control speed at which it is desired to have the cars leave the retarder.

The remainder of the apparatus shown in Fig. 2 is similar to that shown in Fig. 1.

In explaining the operation of the apparatus shown in Fig. 4 as a whole, I will assume, as in the description of Fig. 1, that the braking bars have been moved to their braking positions by moving lever L from its *a* to its *b* position, and that a car which is approaching the stretch of track shown in the drawings in the direction of the arrow, at a speed which is greater than control speed, traverses the stretch of track shown in the drawings. As the car moves through the retarder, each time a wheel of the car moves onto one of the control sections J, the associated control relay G will become energized and will deenergize the associated timing relay T, but as long as the speed of the car is above the control speed, none of the timing relays T will remain deenergized long enough to close its back contact 29. The relays Q and S, and hence the relay C, will therefore all remain deenergized and the car retarder will therefore continue to slow down the car. As soon, however, as the car has been slowed down by the car retarder to a speed which is equal to, or less than, control speed, and a wheel of the car traverses one of the control sections J, the associated timing relay T will close its back contact 29, and either relay Q or relay S will then become energized, depending upon which contact 29 happens to become closed. When either relay Q or relay S becomes energized, relay C will become energized, and when relay C becomes energized, the braking bars will be moved to their non-braking positions in the manner previously described. It will be apparent, therefore, that no further retardation of the car will take place unless relay C again becomes deenergized and remains deenergized for a sufficient time interval to cause it to open its front contact 24—24^a and to close its back contact 24—24^b while the car is still within the limits of the retarder. For, as long as the speed of the car is below control speed, if the car occupies a position in which a wheel of the car is engaging any one of the control sections, the associated timing relay T will be deenergized and will either have already closed its back contact 29, in which event relay Q or relay S, as the case may be, will be energized so that relay C will also be energized, or, if the associated timing relay T has not al-

ready closed its back contact 29, it will do so and cause relay Q or relay S to become energized before a sufficient time interval will have elapsed to permit relay C to release its armature, and furthermore, if the car does not occupy a position in which a wheel of the car is engaging any one of the control sections J, either relay S will not yet have been deenergized long enough, following a previous energization, to release its armature, or else relay Q will be held energized by virtue of its stick circuit, with the result that under any of these conditions relay C will be held continuously energized. Assuming, however, that the speed of the car does increase to a speed which is greater than control speed before the car has departed entirely from the limits of the retarder, then as soon thereafter as a wheel of the car moves onto a control section J, the resultant energization of the associated relay G will open the stick circuit for relay Q and, as a result, if relay Q is not already deenergized, it will become deenergized and will subsequently remain deenergized since none of the contacts 29 will now become closed. Relay S will, of course, also now be deenergized, and relay C will therefore release its armature, thus restoring the braking bars to their braking positions so that the retarder will again slow down the car.

Referring now to Fig. 5, the apparatus here shown is similar in all respects to that shown in Fig. 4 with the exception that the auxiliary control relays G instead of being controlled by track circuits, are each controlled by an associated light sensitive device designated by the reference character P with a suitable distinguishing exponent. These light sensitive devices are disposed in spaced relation at one side of rail 1 opposite the car retarder R, and located on the other side of the rail 1 opposite each light sensitive device P is a light unit designated by the reference character L with a suitable distinguishing exponent. Each light sensitive device P and its associated light unit L are so related that the device will normally receive light from the light unit, but that, this light will be intercepted while each car wheel running on rail 1 is passing the unit, as will be clearly understood from an inspection of Fig. 6, in which the positions of the light unit L^a and the light sensitive device P^a relative to the rail 1, and to the wheel of a car on rail 1 which has just passed the device P^a, are illustrated.

Each device P comprises an enclosing tube which is open at the end toward the rail, in order to prevent the light sensitive element of such device from being influenced by light other than that which is received from the associated light unit. Similarly each light unit comprises an enclosing tube which is open at the end toward the rail, a source of light, and a suitable optical system. Each light sensitive device P further comprises a contact 36 which is open when the device is receiving light from the associated light unit, but which becomes closed when the supply of light is cut off by the passage of a wheel. It will be seen, therefore, that when a wheel is passing one of the light sensitive devices P, the associated contact 36 will become closed for a time interval which depends upon the size of the wheel, the height above the rail at which the beam is located, and the speed of the car. The beam may be located at any desired height above the rail consistent with clearance regulations, a preferred height being approximately one and a half inches. When the beam is located this height above the rail, the chord of the wheel which is effective in

cutting off the light beam will only vary between seventeen and eighteen inches in length as the diameter of the wheels vary in length between the usual values of twenty-nine and thirty-three inches. It follows, therefore, that with the beam of light from each unit located at the preferred height above the rail, the length of time the contact 36 of a light sensitive device is closed, during the passage of different car wheels moving at the same speed, will be substantially constant regardless of small variations in the size of the wheels.

The lamp of each light unit and the light sensitive device associated therewith are constantly supplied with operating current from the terminals X and Y of a suitable source not shown in the drawings, and may be similar to the elements now commonly employed to count objects on a moving conveyor belt, for instance.

Each relay G, as here shown, is connected with a pair of line wires 37 and 38 over the contact 36 of the associated light sensitive device P, and the line wires 37 and 38, in turn, are constantly connected with a source of current here shown as a battery M. It will be seen, therefore, that when no car is traversing the stretch of track shown in the drawings, all of the auxiliary control relays G will be deenergized, but that, when a car is traversing the stretch of track shown in the drawings each time a car wheel passes one of the light sensitive devices P, the associated relay G will become energized and will remain energized for a time interval which depends upon the speed of the car.

The operation, as a whole, of the apparatus shown in Fig. 5 is similar to the operation of the apparatus shown in Fig. 4, and it is believed that it will be readily understood from the foregoing and from an inspection of the drawings without further detailed description here.

Although we have herein shown and described only three forms of railway car retarder controlling 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. In combination, a stretch of railway track, a braking bar located in the trackway adjacent one of the rails of said stretch and movable into engagement with a part of a car traversing said stretch for retarding the speed of the car, a first series of contacts, a second series of contacts one for each contact of the first series, means effective when a car is traversing said stretch for operating the contacts of the first series in order and means set into operation when each contact of the first series is operated for a predetermined time interval for operating the corresponding contact of the second series, a relay, a plurality of pick-up circuits for said relay one controlled by each contact of the second series, a stick circuit for said relay controlled by its own front contact and by all of the contacts of the first series, and means controlled by said relay for controlling said braking bar.

2. In combination, a stretch of railway track, a braking bar located in the trackway adjacent one of the rails of said stretch and movable into engagement with a part of a car traversing said stretch for retarding the speed of the car, a first series of contacts, a second series of contacts one for each contact of the first

series, means effective when a car is traversing said stretch for operating and restoring the contacts of the first series in order and for operating each contact of the second series whenever each contact of the first series remains operated for more than a predetermined time interval, a relay, a plurality of pick-up circuits for said relay one controlled by each contact of the second series, a stick circuit for said relay controlled by its own front contact and by all of the contacts of the first series, and means controlled by said relay for controlling said braking bar.

3. In combination, a stretch of railway track, a braking bar located in the trackway adjacent one of the rails of said stretch and movable into engagement with a part of a car traversing said stretch for retarding the speed of the car, a first series of contacts, a second series of contacts one for each contact of the first series, means for operating each contact of the first series while a car wheel occupies a portion of said stretch individual to said contact and means for operating each contact of the second series if the car wheel remains in the associated portion of the stretch for more than a predetermined time interval, a relay, a plurality of pick-up circuits for said relay one controlled by each contact of the second series, a stick circuit for said relay controlled by its own front contacts and by all of the contacts of the first series, and means controlled by said relay for controlling said braking bar.

4. In combination, a stretch of railway track, a braking bar located in the trackway adjacent one of the rails of said stretch and movable into engagement with a part of a car traversing said stretch for retarding the speed of the car, a first series of contacts, a second series of contacts one for each contact of the first series, means effective when a car is traversing said stretch for operating the contacts of the first series in order and means set into operation when each contact of the first series is operated for a predetermined time interval for operating the corresponding contact of the second series, a first relay, a plurality of pick-up circuits for said first relay one controlled by each contact of the second series but the last, a stick circuit for said first relay controlled by its own front contact and by all of the contacts of the first series, a slow release relay controlled by the last contact of the second series, and means controlled by said two relays for controlling said braking bar.

5. In combination, a stretch of railway track, a braking bar located in the trackway adjacent one of the rails of said stretch and movable into engagement with a part of a car traversing said stretch for retarding the speed of the car, a first series of contacts, a second series of contacts one for each contact of the first series, means for operating each contact of the first series while a car wheel occupies a portion of said stretch individual to said contact and means for operating each contact of the second series if the car wheel remains in the associated portion of the stretch for more than a predetermined time interval, a first relay, a plurality of pick-up circuits for said first relay one controlled by each contact of the second series but the last, a stick circuit for said first relay controlled by its own front contact and by all of the contacts of the first series, a slow release relay controlled by the last contact of the second series, and means controlled by said two relays for controlling said braking bar.

6. In combination, a stretch of railway track, a

braking bar located in the trackway adjacent one of the rails of said stretch and movable into engagement with a part of a car traversing said stretch for retarding the speed of the car, a first series of contacts, a second series of contacts one for each contact of the first series, means effective when a car is traversing said stretch for operating the contacts of the first series in order and means set into operation when each contact of the first series is operated for a predetermined time interval for operating the corresponding contact of the second series, a first relay, a plurality of pick-up circuits for said first relay one controlled by each contact of the second series but the last, a stick circuit for said first relay controlled by its own front contact and by all of the contacts of the first series, a first slow release relay controlled by the last contact of the second series, a second slow release relay controlled by said first relay and by said first slow release relay, and means controlled by said second slow release relay for controlling said braking bar.

7. In combination, a stretch of railway track, a braking bar located in the trackway adjacent one of the rails of said stretch and movable into engagement with a part of a car traversing said stretch for retarding the speed of the car, a series of treadle devices located at spaced intervals along the stretch in positions where they will be successively operated by the wheels of a car traversing the stretch, each said treadle device being provided with a first contact which becomes operated whenever the associated treadle device is operated and with a second contact which becomes operated if the associated treadle device remains operated for more than a predetermined time interval, a relay, means controlled by the contacts of said treadle devices for controlling said relay, and means controlled by said relay for controlling said braking bar.

8. In combination, a stretch of railway track, a braking bar located in the trackway adjacent one of the rails of said stretch and movable into engagement with a part of a car traversing said stretch for retarding the speed of the car, a series of treadle devices located at spaced intervals along the stretch in positions where they will be successively operated by the wheels of a car traversing the stretch, each said treadle device being provided with a first contact which becomes operated whenever the associated treadle device is operated and with a second contact which becomes operated if the associated treadle device remains operated for more than a predetermined time interval, a relay, a plurality of pick-up circuits for said relay one controlled by the second contact of each treadle device, a stick circuit for said relay controlled by the first contact of all of said treadle devices and by its own front contact, and means controlled by said relay for controlling said braking bar.

9. In combination, a stretch of railway track, a braking bar located in the trackway adjacent one of the rails of said stretch and movable into engagement with a part of a car traversing said stretch for retarding the speed of the car, a series of treadle devices located at spaced intervals along the stretch in positions where they will be successively operated by the wheels of a car traversing the stretch, each said treadle device being provided with a first contact which becomes operated whenever the associated treadle device is operated and with a second contact which becomes operated if the associated treadle device

remains operated for more than a predetermined time interval, a first relay, a plurality of pick-up circuits for said first relay one controlled by the second contact of each treadle device of the series but the last, a stick circuit for said first relay controlled by its own front contact and by the first contact of all of said treadle devices, a slow release relay, a pick-up circuit for said slow release relay controlled by the second contact of the last treadle device of the series, and means controlled by said two relays for controlling said braking bar.

10. In combination, a stretch of railway track, a braking bar located in the trackway adjacent one of the rails of said stretch and movable into engagement with a part of a car traversing said stretch for retarding the speed of the car, a series of treadle devices located at spaced intervals along the stretch in positions where they will be successively operated by the wheels of a car traversing the stretch, each said treadle device being provided with a first contact which becomes operated whenever the associated treadle device is operated and with a second contact which becomes operated if the associated treadle device remains operated for more than a predetermined time interval, a first relay, a plurality of pick-up circuits for said first relay one controlled by the second contact of each treadle device of the series but the last, a stick circuit for said first relay controlled by its own front contact and by the first contact of all of said treadle devices, a slow release relay, a pick-up circuit for said slow release relay controlled by the second contact of the last treadle device of the series, a third relay controlled by said first relay and said slow release relay, and means controlled by said third relay for controlling said braking bar.

11. In combination, a stretch of railway track, a braking bar located in the trackway adjacent one of the rails of said stretch and movable into engagement with a part of a car traversing said stretch for retarding the speed of the car, a series of treadle devices located at spaced intervals along the stretch in positions where they will be successively operated by the wheels of a car traversing the stretch, each said treadle device being provided with a first contact which becomes operated whenever the associated treadle device is operated and with a second contact which becomes operated if the associated treadle device remains operated for more than a predetermined time interval, a first relay, a plurality of pick-up circuits for said first relay one controlled by the second contact of each treadle device of the series but the last, a stick circuit for said first relay controlled by its own front contact and by the first contact of all of said treadle devices, a first slow release relay, a pick-up circuit for said first slow release relay controlled by the second contact of the last treadle device of the series, a second slow release relay, two pick-up circuits for said second slow release relay one controlled by a front contact of said first relay and one controlled by a front contact of said first slow release relay, and means controlled by said second slow release relay for controlling said braking bar.

12. In combination, a stretch of railway track, a braking bar located in the trackway adjacent one of the rails of said stretch and movable toward and away from the rail into braking and non-braking positions, a series of insulated control sections formed in one rail of said stretch, a series of control relays; a track circuit for each of said control relays including a source of cur-

- rent, a corresponding one of said control sections and the other rail of the stretch; a series of timing relays one controlled by a back contact of each of said control relays, an auxiliary relay, a plurality of pick-up circuits for said auxiliary relay one controlled by a back contact of each of said timing relays, a stick circuit for said auxiliary relay controlled by its own front contact and by a back contact of each of said control relays, and means controlled by said auxiliary relay for moving said braking bar to its braking and non-braking positions. 80
13. In combination, a stretch of railway track, a braking bar located in the trackway adjacent one of the rails of said stretch and movable toward and away from the rail into braking and non-braking positions, a series of insulated control sections formed in one rail of said stretch, a series of control relays; a track circuit for each of said control relays including a source of current, a corresponding one of said control sections, and the other rail of the stretch; a series of timing relays one controlled by a back contact of each of said control relays, an auxiliary relay, a plurality of pick-up circuits for said auxiliary relay one controlled by a back contact of each of said timing relays but the last relay of the series, a stick circuit for said auxiliary relay controlled by its own front contact and a back contact of each of said control relays, a slow release relay controlled by a back contact of the last timing relay of the series, and means controlled by said auxiliary relay and said slow release relay for controlling said braking bar. 85
14. In combination, a stretch of railway track, a braking bar located in the trackway adjacent one of the rails of said stretch and movable toward and away from the rail into braking and non-braking positions, a series of insulated control sections formed in one rail of said stretch, a series of control relays; a track circuit for each of said control relays including a source of current, a corresponding one of said control sections, and the other rail of the stretch; a series of timing relays one controlled by a back contact of each of said control relays, an auxiliary relay, a plurality of pick-up circuits for said auxiliary relay one controlled by a back contact of each of said timing relays but the last relay of the series, a stick circuit for said auxiliary relay controlled by its own front contact and by a back contact of each of said control relays, a first slow release relay controlled by a back contact of the last timing relay of the series, a second slow release relay, two pick-up circuits for said second slow release relay one controlled by a front contact of said auxiliary relay and one controlled by a front contact of said first slow release relay, and means controlled by said second slow release relay for moving said braking bar toward and away from its braking positions. 90
15. In combination, a stretch of railway track, a braking bar located in the trackway adjacent one of the rails of said stretch and movable toward and away from the rails into braking and non-braking positions, a plurality of light sensitive devices disposed at spaced intervals along one side of one rail of said stretch, a plurality of light units disposed on the opposite side of said one rail from said light sensitive devices and one cooperating with each of said light sensitive devices, each said light unit and the associated light sensitive device being so arranged that the light from the unit will normally illuminate the associated device but that when a car passes such associated device the wheels of the car will successively cut off the light passing from the unit to the device, a series of control relays one controlled by each of said light sensitive devices, a series of timing relays one controlled by each of said control relays and each responsive to the length of time the light from the source is cut off while a wheel is passing the associated device, and means controlled by said control relays and said timing relays for controlling said braking bar. 95
16. In combination, a stretch of railway track, a braking bar located in the trackway adjacent one of the rails of said stretch and movable toward and away from the rails into braking and non-braking positions, a plurality of light sensitive devices disposed at spaced intervals along one side of one rail of said stretch, a plurality of light units disposed on the opposite side of said one rail from said light sensitive devices and one cooperating with each of said light sensitive devices, each said light unit and the associated light sensitive device being so arranged that the light from the unit will normally illuminate the associated device but that when a car passes such associated device the wheels of the car will successively cut off the light passing from the unit to the device, speed measuring means controlled by each of said light sensitive devices and each responsive to the length of time the light from the source is cut off while a wheel is passing the associated device, and means controlled by said speed measuring means for controlling said braking bar in accordance with the speed of the car. 100
17. In combination, a stretch of railway track, a braking bar located in the trackway adjacent one of the rails of said stretch and movable toward and away from the rails into braking and non-braking positions, a plurality of light sensitive devices disposed at spaced intervals along one side of one rail of said stretch, a plurality of light units disposed on the opposite side of said one rail from said light sensitive devices and one cooperating with each of said light sensitive devices, each said light unit and the associated light sensitive device being so arranged that the light from the unit will normally illuminate the associated device but that when a car passes such associated device the wheels of the car will successively cut off the light passing from the unit to the device, a series of control relays one controlled by each of said light sensitive devices, a series of timing relays one controlled by each of said control relays and each responsive to the length of time the light from the source is cut off while a wheel is passing the associated device, and means controlled by said control relays and said timing relays for controlling said braking bar. 105
18. In combination, a stretch of railway track, a braking bar located in the trackway adjacent one of the rails of said stretch and movable toward and away from the rails into braking and non-braking positions, a plurality of light sensitive devices disposed at spaced intervals along one side of one rail of said stretch, a plurality of light units disposed on the opposite side of said one rail from said light sensitive devices and one cooperating with each of said light sensitive devices, each said light unit and the associated light sensitive device being so arranged that the light from the unit will normally illuminate the associated device but that the rays of light passing from the unit to the associated device will be intercepted while a wheel of a car is passing such associated device, a series of control relays one controlled by each of said light sensitive devices, a series of timing relays one controlled by each of said control relays, an auxiliary relay, a plurality 110
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of pick-up circuits for said auxiliary relay one controlled by a contact of each of said timing relays, a stick circuit for said auxiliary relay controlled by its own front contact and by a contact of each of said control relays, and means controlled by said auxiliary relay for controlling said braking bar.

19. In combination, a stretch of railway track, a braking bar located in the trackway adjacent one of the rails of said stretch and movable toward and away from the rails into braking and non-braking positions, a plurality of light sensitive devices disposed at spaced intervals along one side of one rail of said stretch, a plurality of light units disposed on the opposite side of said one rail from said light sensitive devices and one cooperating with each of said light sensitive devices, each said light unit and the associated light sensitive device being so arranged that the light from the unit will normally illuminate the associated device but that the rays of light passing from the unit to the associated device will be intercepted while a wheel of a car is passing such associated device, a series of control relays one controlled by each of said light sensitive devices, a series of timing relays one controlled by each of said control relays, an auxiliary relay, a plurality of pick-up circuits for said auxiliary relay one controlled by a contact of each of said timing relays but the last timing relay of the series, a stick circuit for said auxiliary relay controlled by its own front contact and by a contact of each of said control relays, a slow release relay controlled by a contact of the last timing relay of the series, and means controlled by said timing relay and said slow release relay for controlling said braking bar.

20. In combination, a stretch of railway track, a braking bar located in the trackway adjacent one of the rails of said stretch and movable toward and away from the rails into braking and non-braking positions, a plurality of light sensitive devices disposed at spaced intervals along one side of one rail of said stretch, a plurality of light units disposed on the opposite side of said one rail from said light sensitive devices and one cooperating with each of said light sensitive devices, each said light unit and the associated light sensitive device being so arranged that the light from the unit will normally illuminate the associated device but that the rays of light passing from the unit to the associated device will be intercepted while a wheel of a car is passing such associated device, a series of control relays one controlled by each of said light sensitive devices, a series of timing relays one controlled by each of said control relays, an auxiliary relay, a plurality of pick-up circuits for said auxiliary relay one controlled by a contact of each of said timing relays but the last timing relay of the series, a stick circuit for said auxiliary relay controlled by its own front contact and by a contact of each of said control relays, a first slow release relay controlled by a

contact of the last timing relay of the series, a second slow release relay controlled by said auxiliary relay and by said first slow release relay, and means controlled by said second slow release relay for controlling said braking bar.

21. Apparatus responsive to the speed of a car comprising a light sensitive device and a source of light disposed on opposite sides of a track rail in positions where the device will normally be supplied with light from the source but that when a car passes the device the wheels of the car will successively cut off the light passing from the source to the device, and a relay controlled by the device and responsive to the length of time the light from the source is cut off while a wheel is passing the device.

22. In combination, a source of light and a light sensitive device disposed on opposite sides of a track rail and so arranged that the device will normally receive light from the source but that when a car running on said rail is passing said device the wheels of the car will successively cut off the light passing from the source to the device for time intervals which depend upon the speed of the car, and means controlled by said light sensitive device and responsive to the length of time the light from the source is cut off while a wheel is passing the device for controlling the speed of the car.

23. In combination, a source of light and a light sensitive device disposed on opposite sides of a track rail and so arranged that the device will normally receive light from the source but that when a car running on said rail is passing said device the wheels of the car will successively cut off the light passing from the source to the device for time intervals which depend upon the speed of the car, a timing relay controlled by said light sensitive device and responsive to the length of time the light from the source is cut off while a wheel is passing the device, a braking bar located adjacent said track rail and movable toward and away from the rail into braking and non-braking positions, and means controlled by said timing relay for controlling said braking bar in accordance with the speed of the car.

24. In combination, a series of light sensitive devices disposed at spaced intervals along one rail of a stretch of railway track and a plurality of light units disposed on the other side of said one rail and each adapted to cooperate with an associated one of said devices, said units and said devices being so arranged that each device will normally receive light from the associated unit but that when a car passes a device the wheels of the car will successively interrupt the light from the associated unit for time intervals which depend upon the speed of the car, and means including elements controlled by said units and each responsive to the length of time the light from the source is cut off while a wheel is passing the associated device for controlling the speed of the car.

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