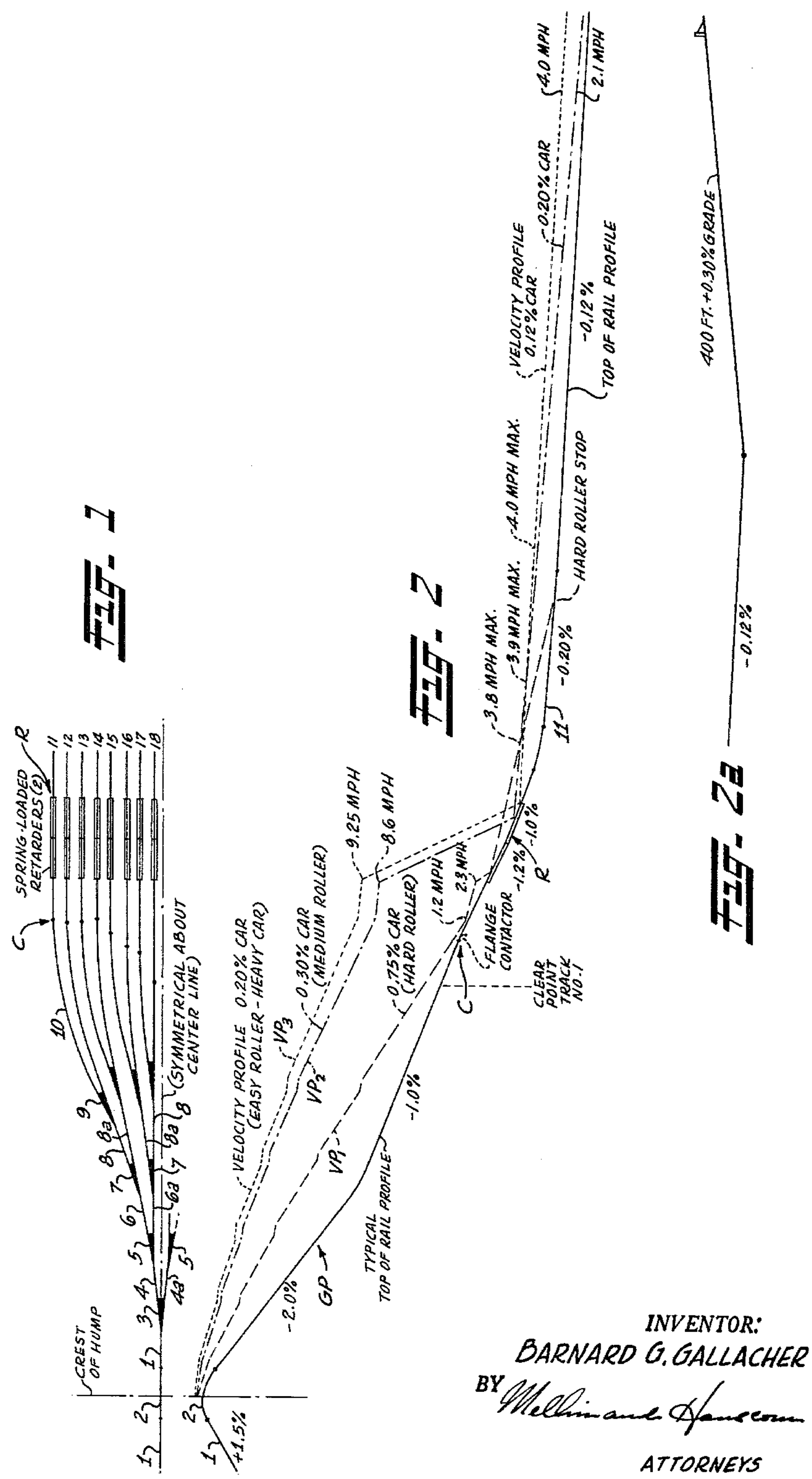
RAILROAD CAR RETARDER SYSTEM

Filed Feb. 13, 1961



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Feb. 8, 1966 B. G. GALLACHER 3,234,378

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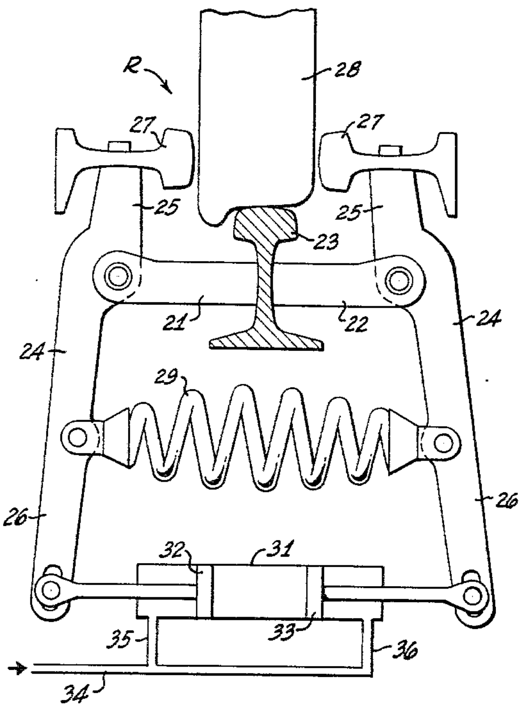

FIG. 4

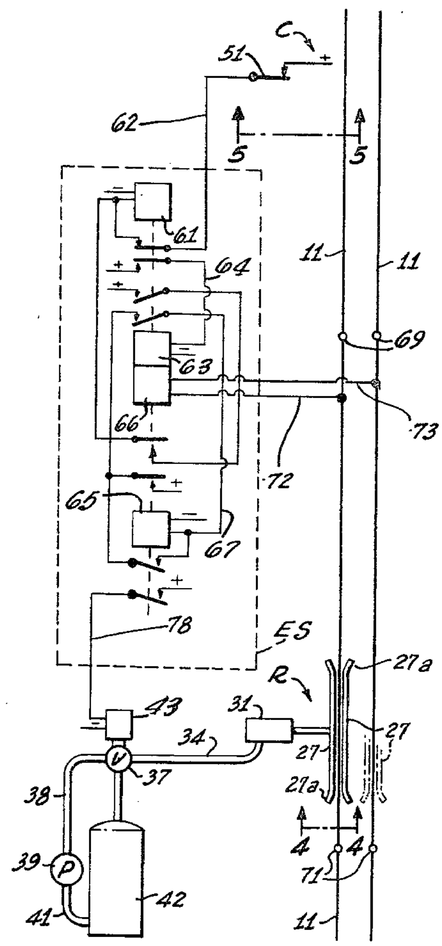

FIG. 3

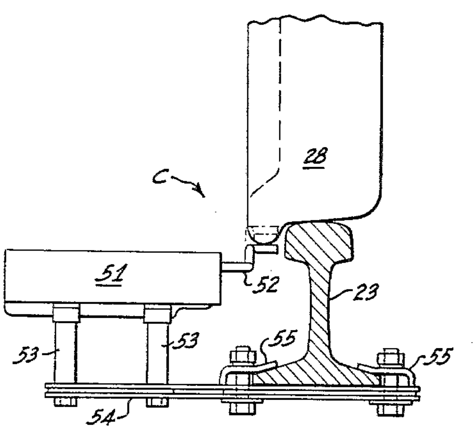

FIG. 5

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RAILROAD CAR RETARDER SYSTEM

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This invention relates to and in general has for its object the provision in a railroad classification yard of a retarder system for reducing and substantially equalizing the velocities of cars having different rolling characteristics, and which have been humped and classified as to destination, by the time that said cars have reached their coupling points.

As railroad freight trains move along a railroad, it is necessary at yards, usually at junctions, to disassemble the trains into cars and groups of cars by destination, and to later reassemble each group of cars destined to a common point into a new train. Outbound trains often contain up to 10 and more groups or "blocks" of cars in station order, so that the blocks are set out progressively at the designated stations as the train progresses along the line.

At the present time, at many of the major terminals and junction points there are in operation what are known as retarder yards. In these yards an entire incoming train is shoved by a switch engine at a uniform speed of about 2 m.p.h. over an artificial hump or crest, which is is usually 17 to 20 feet high. As cars reach the crest, they are cut off one by one or in groups of up to three cars and allowed to descend by gravity to one of many classification tracks. The number of classification tracks in a major retarder yard normally runs from 24 to 84. Because of the difference in the resistance or rollability of the cars, most cars have to be slowed down as they descend the hump under gravity. This is done by heavy steel castings and appurtenances known as retarders, which are attached to the track and rub against the sides of the wheels to slow the cars down. The degree of pressure of the retarders against the wheels is controlled (1) manually by one of several retarder operators, or (2) by electronic computer. In the latter case, the acceleration of the car on a known uniform grade is observed by radar. The acceleration is an index of the rolling resistance of the car. This and other pertinent factors are fed into the electronic computer, which computes the theoretical release speed from the last retarder, and the retarders are controlled by the electronics to release the car at this speed. This operation must be overseen by a retarder operator.

At other than major terminals, trains are broken up into the various classifications by what is known as "flat-switching." In flat-switching, a switch engine shoves a train or group of cars down a flat lead or ladder track at speeds of 2 to 8 m.p.h. A switchman walks or runs alongside the head end of the train, and at the proper time uncouples a car or several cars, which are then allowed to roll by their momentum into a classification track. The switch engine then reverses direction, pulls the whole train back a distance up to several hundred feet, and the process is repeated until the entire train is broken up or classified. The switches from the lead to the classification tracks are hand-thrown by switchmen. This is a very inefficient, expensive, and time-consuming operation.

The major retarder yards first referred to are generally satisfactory, but because of their extreme expense, most of which is concentrated in the retarders, radar, and computers at the hump and which is not proportional to the number of classification tracks, are not justified for small classification yards. Their cost can be justified only at major terminals that switch 1200 cars or more per day. Another consideration is that in existing major retarder yards, the cars frequently couple into each other as they roll along the classification tracks under gravity at speeds that are damaging to cars and lading.

On the other hand, flat-switching operations at other than major yards is unsatisfactory for the reasons previously mentioned.

There is thus a definite need by the railroads for a small, inexpensive, automatic classification yard at points where a major retarder yard cannot be justified because of the high initial cost. The object of this invention is the design of an automatic classification yard that is inexpensive, automatic, and in which cars will couple at speeds not to exceed 4 m.p.h.

More specifically the object of this invention is the provision in a classification yard of classification tracks, each including: a first section having a negative grade and arranged to receive humped classified cars; normally closed, elongated car retarder means located adjacent a portion of said first section intermediate the ends thereof for stopping a car at some point within the length of said retarder means, depending upon the momentum of said car; and means for then opening said retarder means so that said car, starting from a standstill, can continue its travel over said first track section under the influence of gravity (a momentum depending upon the point at which it was stopped on said first track section).

Another object of my invention is the provision of a car retarder system of the character above set forth wherein the track section portion straddled by the car retarder is made up of an upstream subsection and a downstream subsection, and wherein the upstream subsection has a greater negative grade than the downstream subsection.

Still another object of this invention is the provision of a car retarder system of the character above described, including: a track section having a negative grade, a car retarder straddling a portion of said track section intermediate the ends thereon; biasing means for biasing said car retarder to a normally closed position; opening means for opening said car retarder; sensing means for sensing the passage of a car on said track past a predetermined point upstream of said car retarder; time delay means under the control of said sensing means for actuating said opening means; and means responsive to the presence of a car within said car retarder for holding said car retarder in its open position so long as a car is disposed within said car retarder.

The invention possesses other advantageous features, some of which, with the foregoing, will be set forth at length in the following description where that form of the invention which has been selected for illustration in the drawings accompanying and forming a part of the present specification is outlined in full. In said drawings, one form of the invention is shown, but it is to be understood that it is not limited to such form, since the invention as set forth in the claims may be embodied in other forms.

Referring to the drawings:

FIG. 1 is a diagrammatic plan view of a classification yard embodying the objects of my invention.

FIG. 2 is a track and velocity profile of the uppermost track shown in FIG. 1 and which embodies the objects of my invention.

FIG. 2A is a continuation of the grade profile curve of FIG. 2.

FIG. 3 is a diagram showing the one pair of normally closed car retarders operatively associated with one rail of my system and the control circuits for opening and closing the retarders at the required time.

FIG. 4 is a section taken on the section line 4—4 of FIG. 3 diagrammatically showing the retarder means of my invention in end view and in which its hydraulic system has likewise been diagrammatically illustrated.

FIG. 5 is an end view of the car wheel flange contactor switch or memory device used for controlling the electric circuit of my system, and which in turn controls the retarder hydraulic system, one track rail being shown in section.

Illustrated in FIG. 1 is a classification yard for disassembling a train into cars and/or groups of cars by destination, and which as viewed in plan is of more or less typical configuration. However, and as illustrated in FIG. 2, the track profiles of the system, particularly with respect to the first track section above referred to, do not necessarily conform with conventional profiles.

The system as illustrated in FIGS. 1 and 2 includes a main track **1** arranged to pass over an artificial hump or crest **2** which conveniently may be in the order of 8 feet above the floor of the classification yard. Here it might be observed that in FIG. 1 the track **1**, as well as other tracks presently to be described, is indicated by a single line, although it consists, as usual, of a pair of rails.

Diverging from the track **1** through switching means **3** are a pair of first classification tracks **4** and **4***a*. Each of the tracks **4** and **4***a* similarly diverges through switch means **5** located at or beyond the "clear point" of the latter tracks into classification tracks **6** and **6***a*, and each of these tracks diverges through switch means **7** into classification tracks **8** and **8***a*. Here it might be observed that the "clear point" of each pair of diverging tracks is that point at which a car on one such track will clear an adjacent car on the other track, and that the pattern of the various classification tracks is symmetrical about a line containing the main track **1**. Diverging from each of the tracks **8** and **8***a* through switch means **9** on each side of the center line of the track **1** are parallel classification tracks **10**. As a result of this construction it will be noted that the main line **1**, together with each of the classification tracks **4**, **6**, **8** and **10**, makes up eight tracks or lines **11** through **18** symmetrically disposed about the center line of the track **1**.

Straddling each rail of track **10** is a car retarder assembly generally referred to by the reference letter R, and located upstream of each retarder assembly is a rail contactor generally referred to by the reference letter C.

Each of the tracks or lines **11–18** is so graded that it has a profile such as, for example, generally indicated in FIG. 2 by the line GP. As shown in FIG. 2, for purposes of illustration the track **1** on the left-hand side of the hump **2** has a grade of +1.5%, and the hump **2** on its right-hand side has a grade of —2.0%. This latter grade is maintained through the tracks **4** and **6** and up to the switch **7**. From this point on up to the upstream side of the retarder assembly R the classification tracks **8** and **10** have a grade of —1.0%. As will be presently more fully described, each retarder assembly is made in two sections arranged in tandem. That portion of the track **10** passing through the first or upstream section of the retarder assembly has a —1.2% grade, whereas that portion of the track passing through the downstream section of the retarder has a —1.0% grade. Beyond the retarder R, each track **10** has a section having a —0.2% grade merging with a section having an even slighter grade of —0.12% and which in turn, and as illustrated in FIG. 2A, merges with a final track section having a slight positive grade in the order of +0.30% but insufficient to cause a car to reverse its direction of travel.

In FIG. 2, the curve VP_1 is a velocity profile of a hard roller car traveling over the track line **11** (uppermost line of FIG. 1) under the influence of gravity after it has been humped over the hump or crest **2** at a speed of 1.7 m.p.h. Similarly, VP_2 is a velocity profile of a medium roller car and VP_3 is a velocity profile of an easy roller or heavy car starting over the hump **2** at 1.7 m.p.h. The slope of these curves represents the rate of change of energy of these three cars, respectively.

More generally, the grades above referred to are such that all cars can be brought to a stop somewhere within the length of the retarder assembly shoes (a total length of 78 feet), and then when released will continue to travel over the remainder of the tracks into coupling engagement with the next preceding car.

Retarder assembly

As diagrammatically illustrated in FIG. 4, each retarder R includes a pair of opposed, outwardly extending fulcrum bars **21** and **22** fixed to each rail **23** of one of the tracks in question. Pivoted to the outer end of each of the bars **21** and **22** is a first-class lever **24** having legs **25** and **26**. Fixed to the upper end of each leg **25** in parallelism with the rail **23** is an elongated shoe **27** arranged in the closed position of the device to frictionally engage one side of a car wheel **28**. Fixed to and extending between the legs **26** intermediate their ends is a heavy compression spring **29** arranged to bias the shoes **27** to their closed positions against the car wheel **28**. Disposed between the outer ends of the legs **26** is a hydraulic cylinder **31** including a pair of pistons **32** and **33**, each provided with an outwardly extending stem connected to one of the legs **26**. Connecting the opposed ends of the cylinder **31** to a hydraulic line **34** are branch lines **35** and **36**. Under the influence of pressure in the line **34**, the legs **26** are moved inwardly, thereby releasing the shoes **27** from the wheel **28**. Upon release of the pressure in the line **34**, the spring **29** serves to bring the shoes **27** into braking engagement with the sides of the car wheel **28**.

Conveniently, each of the shoes **27** can be made of two 39-foot sections of railroad rail connected together in tandem, and preferably each roll of each track should be provided with a retarder assembly of this type so that each side of each car will be uniformly braked and several hydraulic actuators should be spaced along the length of each retarder assembly so as to continuously subject the car wheels to a uniform braking action as they traverse the length of the retarder assembly.

As illustrated in FIG. 3, the hydraulic line **34** communicates through a control valve **37** and a flow line **38** with a pump **39**, which in turn communicates through a line **41** with a reservoir **42**. Also connected to the control valve **37** is a return flow line communicating with the reservoir **42**. The control valve **37** is under the control of an operatively associated solenoid **43** and is procurable on the open market from Union Switch & Signal Co. of Swissvale, Pennsylvania, as a Type C Solenoid and Control Valve.

By means of the hydraulic circuit above described, each retarder assembly can be left in its normally closed position under the influence of its spring **29**, or it can be periodically held in its open position under the influence of the solenoid **43**.

As diagrammatically indicated in FIG. 3, the free ends **27***a* of the shoes **27** should be outwardly flared so as to form a reentrant angle for the reception of a car wheel.

The retarder assemblies associated with each track should be located approximately 100 feet downstream on this track relative to the upstream clear point.

Flange contactor assembly C

The flange contactor assembly C associated with each track should be located approximately 50 feet upstream of the upstream ends of the track's retarder assemblies.

As illustrated in FIG. 5, each such assembly includes a "Silec" contactor or switch **51** provided with a single spring-biased actuating arm **52** arranged to be depressed by the passage of a car wheel **28** over one of the track rails **23** and so open the switch **51**. To this end the switch **51** is supported at the proper height by brackets **53** mounted on a base **54** and the base is fastened to the foot of the rail **23** by clamps **55**. "Silec" rail contactors are patented devices procurable from Transcontrol Corp. of Port Washington, New York, although manufactured by Silec Cie, of Paris, France.

Electrical control assembly

Associated with the flange contactor assembly C and the retarder assembly R is an electric control system or assembly generally referred to in FIG. 3 by the reference letters ES.

Included in this assembly is a relay switch **61** controlled by the contactor switch **51** through a line **62**. The switch **61**, in turn, controls a time delay relay switch **63** through a line **64**. Conveniently, the switch **63** is set to close about 16 seconds after the switch **51** has opened under the influence of a car passing over the switch arm **52**. Connecting the relay **63** with a retarder control relay **65** is a relay **66** and a line **67**, and connecting the relay **65** with the solenoid **43** is a line **78**.

Both rails of that portion of the track **11** straddled by the shoes **27** of the retarder assemblies R are insulated as at **69** and **71** from the up- and downstream portions of the track **11**. Connected to the two rails of the insulated portion of the track **11** are lines **72** and **73** connected to the relay **66** and which serve to de-energize this relay when the lines **72** and **73** are shorted out by the presence of a car within the retarder zone. The relay **66**, insofar as the relay **63** and the line **67** are concerned, merely serves as a closure switch, but is otherwise independent of the relay **63**, and, as above stated, is de-energized only in response to the presence of a car in the retarder zone.

Now assuming that there is no car in the retarder zone, and that a car passes over the switch arm **52**. This opens the switch **51** and de-energizes the relay **61**. The relay **61**, de-energized, closes the line **64**, and as a consequence the time delay relay **63** is energized and serves to close the line **67** and so energize the retarder control relay **65**. The latter relay closes the line **78**, and this in turn energizes the solenoid **43**, and as a result the retarder assemblies are forced to their open positions by the hydraulic system. However, and as above noted, this occurs 16 seconds after the car in question has depressed the switch arm **52**. In the meantime this car has entered the retarder zone and has been brought to a dead stop somewhere within the 78-foot length of the normally closed retarder shoes, depending upon the inertia of the car when it enters the retarder zone.

Following this, and at the end of the 16-second interval, the relay **63** energizes the solenoid **43**, and as a consequence the hydraulic cylinder **31** is pressurized and the retarder shoes **27** are forced to their open position. However, sometimes instead of sending single cars through the retarder zone, it is desirable to send two or three coupled cars through this zone. In this event it is essential that the retarder shoes be held in their open position until all of the cars which have been previously brought to a stop in the retarder zone have cleared this zone. To insure this, the relay **66**, acting independently of the relay **63**, functions to maintain the retarder control relay **65** energized so long as the lines **72** and **73** are connected through any car disposed within the insulated retarder zone. Once all cars have cleared the retarder zone, contact between lines **72** and **73** is broken, the relay **66** is energized, and the relay **65** and the solenoid **43** are de-energized. The valve **37** then connects the hydraulic line **34** with the hydraulic reservoir **42** to thus relieve the pressure in the cylinder **31** and the springs **29** return the retarder shoes **27** to their closed positions, ready to receive the wheels of another car or group of cars.

The relays **61**, **65** and **66** are standard relay switches obtainable from the Union Switch & Signal Co. under the name Control Relay Type DN–11. The time delay relay **63** is a standard item obtainable from General Railway Signal Co. as Type KB.

Operation

As a result of the system above described, each car or group of coupled cars is humped over the hump **2** at a given speed. The momentum or inertia of each car entering any given retarder zone depends upon its rollability. The three velocity profiles of FIG. 2 show the velocity heads of an easy rolling (low resistance) car, a medium resistance car, and a high resistance car. The vertical distance of each velocity profile above the top of the rail profile represents the velocity head of the car at any point. The velocity head may be converted to speed by the equation:

$$h=\frac{V^2}{g^2}$$

where

h represents the velocity head in feet,
V represents velocity in feet per second, and
g represents the acceleration due to gravity.

FIG. 2, by way of example, shows the speeds of cars at critical points.

From FIG. 2, and as above described, it is to be noted that that portion of the track **10** straddled by the first or upstream section of the retarder assembly has a grade of −1.2%, and that the downstream section of the retarder straddles a portion of track having a lesser grade of −1.0%. The reason for this is that it is the hard rolling cars which are brought to a stop in the upstream section of the retarder, and to insure that when these cars are released they will continue on their way under the influence of gravity, this section of track is given a steeper inclination. The easy rolling cars are stopped on the downstream section of the retarder and, being easy rollers, do not need this additional inclination to again start rolling after they have been released. This dual inclination of the tracks within the retarder zone is a desirable precaution but not essential, for this entire section of track could be given such an inclination that cars of all types would start down the grade after being released.

It will therefore be appreciated that the hard rolling high resistance cars will be sorted automatically from the easy rollers in that the hard rollers will approach the retarders at low speed and will be stopped at the upper end of the retarders. After being stopped and released, the hard rollers will have a considerable vertical distance to drop through and beyond the retarders, so they will roll a reasonable distance before they stop. On the other hand, it will take the entire length of both retarder sections (78 feet) to stop an easy (low resistance) roller, this car having attained a speed of more than 9 m.p.h. approaching the retarder. When this car is stopped, then released, it will have only a short vertical distance to drop, and will therefore not attain a great speed, which is desirable. Coupling speed will thus be held to 4 m.p.h. or less and no damage to cars or contents will ensue. Medium resistance cars will be stopped between the top and bottom ends of the retarder, and will have a medium vertical distance to drop after release from the retarder. Retarder will reclose in sufficient time to stop the next following car before it can couple into the first car with a damaging impact.

At the low end of the classification tracks (FIG. 2A), due to the low speeds involved, cars will be stopped by placing 400 feet of the end of the classification tracks on a +0.30% grade, upon which cars will not reverse themselves and roll back toward the hump and possibly collide with the following car. No skates or skatemen will be required as in major retarder yards. The grades enumerated cannot be placed in present major retarder yards because speeds of 9 to 10 m.p.h. must be protected against.

In major retarder yards, after cars are classified on the classification tracks, the cars are pulled by a "trimmer" or "pull-down" engine out the bottom end of the classification yard, as each classification track becomes full.

In the small automatic classification yard above described, one hump engine can classify 400 cars in 4 to 5 hours and still leave enough time in an 8-hour shift to pull the groups of cars, as each classification track becomes full, from the classification tracks back over the hump, to a departure yard. Elimination of the need for a trimmer engine would be a distinct advantage.

Another unique advantage of this design is that the cost would be directly proportional to the number of classification tracks, and the cost per track of the retarders and control apparatus would be less than half the cost per track of the retarders and control apparatus for the present major type retarder yard.

Still another unique advantage of this system is that retardation and speed control is completely automatic, and no retarder operators are required, as at existing major retarder yards.

I claim:

1. A car retarder system comprising: a track having a crest, a track section extending from said crest to thereby define a direction, said section having a negative grade in said direction; normally closed braking means located adjacent said section for braking a car to a standstill at a point within said braking means; means connected with said braking means for opening said braking means after said car has been brought to a standstill within said braking means; and means for then maintaining said brake in its open position until said car has cleared said braking means.

2. A structure such as set forth in claim 1 wherein said track section gradually merges at its downstream end with a terminal track section having a positive grade insufficient to permit a car only under the influence of gravity to roll towards said hump.

3. In a classification yard: a track provided with a hump and a track section extending from said hump to thereby define a direction, said section having a negative grade in said direction; an elongated car retarder straddling a portion of the length of said track section and operative to brake a car to a standstill within the length thereof; first means for resiliently holding said car retarder in its closed position; sensing means for sensing the presence of a car on said track section at a point in advance of said car retarder; time delay means under the control of said sensing means for opening said car retarder at a predetermined interval of time after said sensing means has sensed said car; and second means responsive to the presence of a car within the confines of said car retarder for holding said car retarder in its open position against the action of said holding means until said car has cleared said car retarder.

4. A structure of the character set forth in claim 3 wherein said first biasing means is in the form of a spring; wherein said sensing means includes a first switch under the control of a switch arm located in the path of a car traversing said track section; wherein said time delay means includes a relay switch circuit under the control of said first switch, and wherein said second means includes a second normally open relay switch circuit arranged to be closed in response to the presence of a car within the confines of said car retarder.

References Cited by the Examiner

UNITED STATES PATENTS

1,553,723	9/1925	Shepard	246—182
1,681,131	8/1928	Prescott.	
2,727,138	12/1955	Agnew	246—182
2,814,996	12/1957	Albrighton	246—182

FOREIGN PATENTS

649,753	1/1951	Great Britain.
816,163	7/1959	Great Britain.

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