Sept. 18, 1962 A. V. DASBURG 3,054,893

AUTOMATIC CAR RETARDER CONTROL SYSTEM

Filed April 6, 1959 2 Sheets-Sheet 1

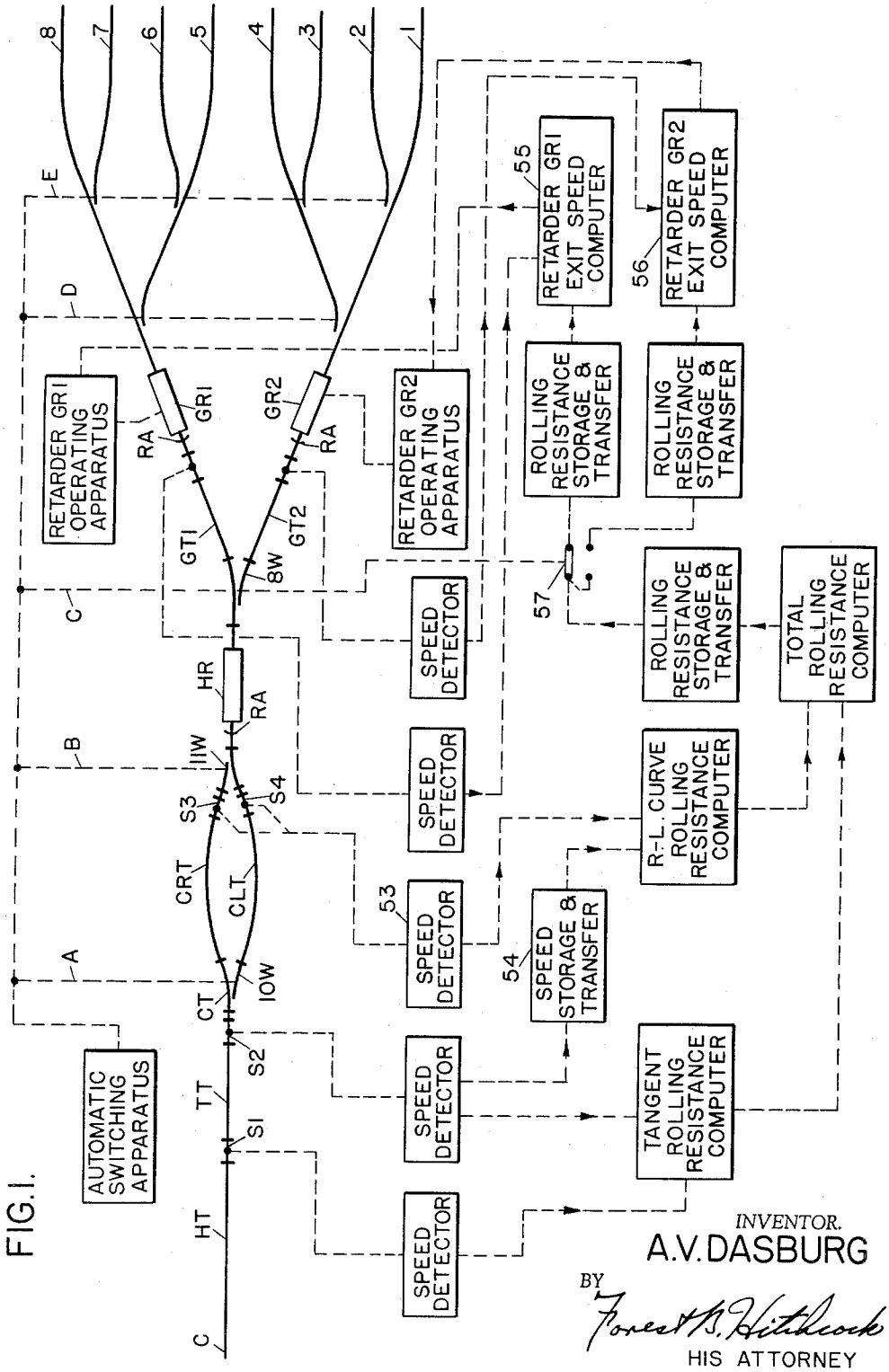

FIG. 1.

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Filed April 6, 1959 2 Sheets-Sheet 2

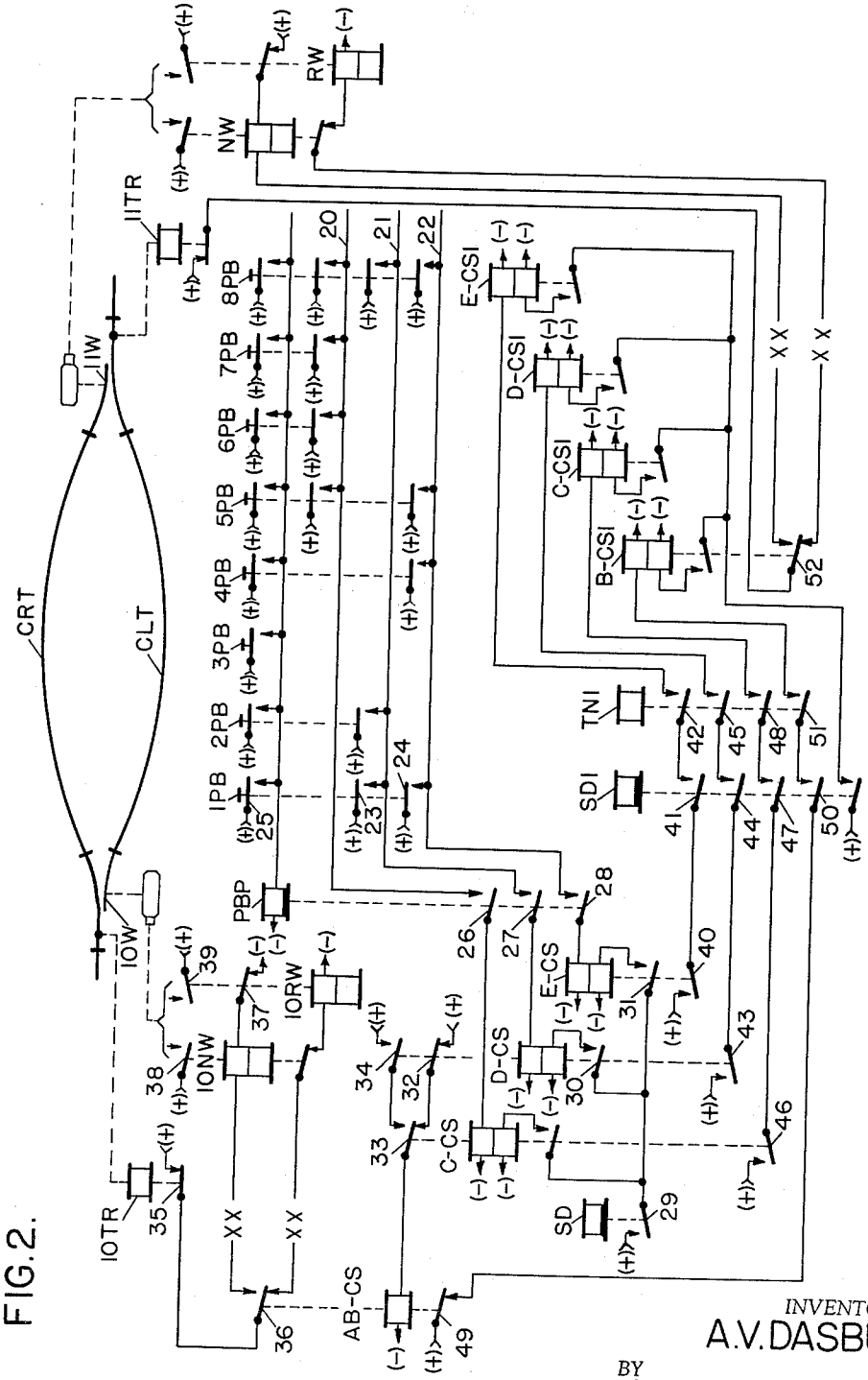

FIG. 2.

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United States Patent Office

3,054,893

Patented Sept. 18, 1962

3,054,893

AUTOMATIC CAR RETARDER CONTROL SYSTEM

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Filed Apr. 6, 1959, Ser. No. 804,294

5 Claims. (Cl. 246—182)

This invention relates to automatic car retarder control systems for railroads, and it more particularly pertains to systems for testing the performance of a car upon passage over a stretch of track in advance of an automatically controlled car retarder in a railway classification yard.

In modern gravity type railway classification yards, one of the parameters used in automatically controlling car retarders is the rolling resistance of the respective cars being classified. There is generally a "hump" car retarder through which all cars must pass after leaving the crest of a hump, and there is a "group" car retarder in each of several different group tracks branching out from a hump track extending from the crest of the hump. In order to anticipate the rolling resistance of a car in a curved stretch of track approaching a classification track beyond each group retarder and thus determine the amount of retardation that must be applied to a car, the performance of the car is tested in passing through a test stretch of both tangent and curved track in approaching the group retarder, and the speed at which the car should leave the group retarder is computed. Retardation is then applied to the car by the group retarder, only until the speed of the car is reduced to the computed release speed. This system is costly in that separate test sections are provided for the group retarders in each group track, and there is a certain amount of inaccuracy in that the curved track in the test section in some cases is curved in the opposite direction to the predominance of curvature which the car will encounter in passing from the group car retarder to its classification track.

The system according to the present invention requires only a single test section for the entire yard. This test section is disposed in the hump track between the crest of the hump and the hump retarder, and it comprises both tangent and curve test sections. The curve test section includes equilateral turnouts connecting the ends of two laterally disposed stretches of curved track in the curve test sections, such stretches having predominance of curvature in opposite directions. This organization provides that each car can be routed selectively through a stretch of track having right-hand curvature in access of left-hand curvature or through a stretch of track having left-hand curvature in access of right-hand curvature in accordance with which type of curved test section is more pertinent in view of the route each car is to take to its particular classification track.

The utility of such a selective organization in the test section is in the fact that some cars perform differently on curves in different directions as well as for different degrees of curvature. One reason for this difference is that the wheel on one side of an axle may be worn to a smaller diameter than the wheel on the other side, and thus the car under these conditions offers greater resistance in going around a curve in one direction as compared to a similar degree curve in the opposite direction. Also the loading of a car may be such that resistance on a curve may be greater in one direction than the other.

After the performance of a car has been determined in terms of rolling resistance in both a stretch of tangent track and in a curve test section of selected curvature, the tangent and curve rolling resistances are combined for each car to produce an analog of total rolling resistance for the stretch of track each car must traverse beyond the group car retarder. This total analog of the rolling resistance is stored and transferred as the associated car progresses in accordance with the positions of track switches as required so that the analog of the rolling resistance may be routed with the associated car for use in governing the proper group retarder. The analog of the total rolling resistance then becomes one of many parameter inputs to a suitable analog computer which computes the desired car speed, conveniently called "release speed," at which the associated group retarder must be operated to an open non-braking position in order that the car may leave the group retarder at the proper speed to arrive at its destination in its designated classification track at a predetermined coupling speed.

An object of the present invention is to control a car retarder in accordance with the performance of a car in passing through a test section selectively operable to include a predominance of curvature in either direction.

Another object of the present invention is to automatically select a test section for passage of a car in approaching the car retarder having one direction of curvature or another in accordance with the classification track designated as a distinction for each car.

Another object of the present invention is to automatically actuate track switches selecting a test track having one direction of curvature or another in accordance with a designated destination for each car.

Other objects, purposes and characteristic features of the present invention, will be in part obvious from the accompanying drawings and in part pointed out as the description of the invention progresses.

In describing the invention in detail, reference is made to the accompanying drawings in which similar parts are designated by similar letter reference characters and in which:

FIG. 1 illustrates by block diagram one embodiment of an automatic car retarder control system constructed according to the present invention; and

FIG. 2 illustrates circuit means for automatically selecting optional sections of curved track in a test section for determining car rolling resistance in accordance with designated car destinations.

With reference to FIG. 1, one embodiment of the present invention is illustrated as being applied to a gravity classification yard wherein a hump track HT extends over the crest C of a hump and includes a tangent test section TT and an adjoining curve test section CT and a hump retarder HR. The curve test section CT includes laterally disposed curved track portions CLT and CRT which are connected at their ends in the single hump track HT by suitable equilateral track switches 10W and 11W respectively.

The hump track HT is connected through a track switch 8W to group tracks GT1 and GT2. The group track GT1 has included therein a group retarder No. 1, and the group track GT2 has included therein a group retarder No. 2. The group track GT1 feeds classifica-

tion tracks 5, 6, 7 and 8 through suitable track switches, and the group track GT2 feeds classification tracks 1, 2, 3 and 4 through suitable track switches. It is to be understood that in practice the invention will be applied to more complex classification yard track layouts having many more classification tracks and track switches than is illustrated in FIG. 1. It should be readily apparent, however, to a person skilled in the art as to how the organization disclosed herein for the relatively simple classification yard layout may be applied to larger classification yards.

The group track GT1 includes a group car retarder GR1 and the group track GT2 includes a group car retarder GR2. Hump retarder HR and group retarders GR1 and GR2 may be of any suitable type that is power operable selectively to braking and non-braking positions, otherwise known as closed and open positions respectively. Thus the retarders may be of the type adjustable to different degrees of braking as provided by spring pressures, or the retarders may be of the weight-automatic type wherein the braking pressure is applied through leverage in response to the weight of the car as applied to the track rail. Suitable means such as electric motors or hydraulic operators well-known in the art are provided for actuation of the respective retarders selectively to their braking and non-braking positions. Speed measuring means including a radar antenna RA is associated with each retarder for reading the speeds of cars being retarded and thus acting to cause the associated retarder to be opened when the speed of each car is reduced to a computed release speed.

Speed measuring sections S1 and S2 are provided for use in detecting the entering and leaving speeds of cars passing through the tangent test section TT, speed measuring sections S2 and S3 are employed in detecting entering and leaving speed for the curve test track CRT, and speed measuring sections S2 and S4 are employed in detecting entering and leaving speeds for the curve test track CLT. It is to be understood that any suitable speed detecting means may be employed in connection with each of the speed sections S, one of which can be the provision of treadles actuated successively by a car wheel which start and stop a cycle counting timer, thus giving an accurate detection of car speed.

The track switches of the yard are divided into groups A, B, C, D and E as indicated by dotted lines A, B, C, D and E respectively of FIG. 1 in the order in which these groups are involved in the setting up of routes for the respective cuts of cars to be classified. The track switches of these groups are automatically operated by a suitable automatic switching system such as the system disclosed, for example, in the Brixner et al. Patent No. 2,700,728, granted January 25, 1955. As is illustrated in FIG. 2, the automatic switching system comprises storage relays CS for the respective groups of switches, slow drop-away storage detector relays SD, and transfer relays TN.

Manually operable push buttons PB are illustrated as being provided for the designation of the respective classification tracks to which the respective cuts of cars are to be routed. These buttons PB are generally provided on a control panel convenient for their actuation by a hump conductor, or by some other person who may be responsible for designating the destinations of the respective cuts of cars. It is also to be understood that the manually operable push buttons PB may be replaced in accordance with the requirements of practice by a system for programming the destinations of the cars in accordance with information provided in the form of a punched tape or the like.

Switch control relays NW and RW are provided for operating the respective track switches to their respective normal and reverse positions. Although the control circuits for these relays are not shown complete in FIG. 2, it is to be understood that these relays can be controlled as is shown, for example, in the above mentioned Brixner et al. Patent No. 2,700,728, granted January 25, 1955.

Speed storage and transfer means is provided where necessary as is illustrated by block diagram in FIG. 1 in order that the entering and leaving speeds may be compared for each of the test sections TT and CT. A Tangent Rolling Resistance Computer is illustrated as being provided for obtaining an analog of tangent rolling resistance of each car passing through the tangent test section TT. Also represented in the block diagram is a suitable R–L Curve Rolling Resistance Computer which is provided for obtaining an analog of curve rolling resistance of each car passing through the curve test section CT, irrespective of whether the car passes over the stretch of track CLT or the stretch of track CRT.

A Total Rolling Resistance Computer is provided for resolving the tangent and curve rolling resistance analogs for each car into a single analog which represents the total rolling resistance for each car in passing from a group retarder to its classification track. This computer takes into account the extent of curved track to be encountered beyond the group retarder as compared to the extent of curved track in the curve test section CT. The selection of such pertinent factors characteristic of the different classification tracks is made by the automatic switching circuits which register the destinations for the respective cars.

The analog of total rolling resistance is stored and transferred as the car for which the storage is provided progresses. This storage and transfer apparatus is represented in FIG. 1 as Rolling Resistance Storage and Transfer. This apparatus can, for example, be similar to storage and transfer apparatus disclosed in the prior U.S. patent application of Coley and Albrighton, Ser. No. 383,432, filed October 1, 1953. The transferring of the analog of rolling resistance is selected in accordance with the routes that have been designated for the associated cars as is disclosed in the above mentioned Coley and Albrighton application and as is illustrated in the block diagram of FIG. 1, wherein selection is made dependent upon the position of the track switch 8W.

An Exit Speed Computer is illustrated in FIG. 1 as being provided for each of the group retarders GR1 and GR2 for computing the car speed at which the retarder should be opened for each car passing through the retarder in order that such car will arrive at its destination at a safe coupling speed. One of the parameters used as an input to this computer is illustrated as being the total rolling resistance of each car. Other parameters which may very well be inputs to the computer, but which are not illustrated in detail, are analogs of car weight, length of the cut, distance to coupling point, coupling velocity, and other miscellaneous factors.

The condition of the apparatus illustrated in the drawings is assumed to be the normal condition of the system, which can be defined as the condition which exists when there are no cars being classified and when no route descriptions for cars have been designated. Under normal conditions it is assumed that the various retarders are in their braking positions as is provided in the circuit organization according to the above mentioned Coley and Albrighton application, Ser. No. 383,432, filed October 1, 1953, but it is to be understood that the retarders could be maintained normally open in accordance with the requirements of practice.

It is to be understood that, rather than having an exit speed computer for each of the group retarders, a single computer may be employed. If this is done, the rolling resistance parameter is fed into the single computer directly, and the computed exit velocity parameter is selectively transferred, according to the routes of the cars for control of the several group retarders.

Having thus considered the general organization of the apparatus for one embodiment of the present invention, more specific consideration as to the circuit organization

will now be given upon considering the mode of operation of the system under certain typical conditions of operation.

To consider one operating condition, it will be assumed that the classification track No. 1 is designated for the next car to pass over the hump. The designation of this track is rendered effective by the actuation of the push button 1PB of FIG. 2. The actuation of this push button, or the push button for any other classification track, applies energy selectively to the buses 20, 21 and 22 which in turn condition route storage relays C–CS, D–CS and E–CS respectively. The relay C–CS is picked up if the track switch 8W is required to be in its normal position for a route to the classification track that has been designated. Similarly the relay D–CS is picked up if a track switch of the group D of FIG. 1 is required to be in its normal position for a route to be established, and the relay E–CS becomes picked up if the route to be established requires a track switch in group E as designated in FIG. 1 to be in its normal position. Thus, for the route to track No. 1, the actuation of push button 1PB applies energy to bus wires 21 and 22 through contacts 23 and 24 respectively and also applies energy to a push button repeater relay PBP through push button contact 25. The relay PBP renders the energization of the relays C–CS, D–CS and E–CS effective in accordance with energization of the buses 20, 21 and 22 respectively through front contacts 26, 27 and 28 of relay PBP. The relay PBP is also effective to cause the picking up of relay SD to indicate that a route is being stored by the associated group of route storage relays. Although the circuit is not shown for the energization of relay SD, it is to be understood that this relay may be controlled as is shown, for example, in the above mentioned Brixner et al. Patent No. 2,700,728, granted January 25, 1955. The purpose of the relay SD is to indicate that a storage is present in its associated storage relays, and to maintain the associated storage relays conditioned by stick circuits until transfer is rendered effective for transferring the storage to another bank of storage relays. For the route to track 1, the relays D–CS and E–CS are picked up, but the relay C–CS remains in its dropped away position because the track switch 8W must be operated to its reverse position for the establishment of the route. Relay D–CS is maintained picked up by a stick circuit including front contact 29 of relay SD and front contact 30 of relay D–CS, and similarly relay E–CS is maintained picked up by a stick circuit including back contact 29 of relay SD and front contact 31 of relay E–CS.

The route storage relay AB–CS is actuated to its picked up or dropped away position in accordance with whether the route beyond a group car retarder to the classification track designated includes a predominance of left-hand or right-hand curvature. For the route to track 1 the predominance of curvature is to the left and therefore the curved stretch of track CLT must be selected to be included in the route for the car to classification track No. 1. This selection is made by failure to energize the relay AB–CS due to the fact that the relay C–CS is in its dropped away position and the relay D–CS is picked up. For a route to track 3 or track 4, however, both relays C–CS and D–CS are in their dropped away positions, and thus the relay AB–CS becomes energized by a circuit extending from (+) including back contact 32 of relay D–CS, back contact 33 of relay C–CS and winding of relay AB–CS, to (−).

Similarly if a route is designated for a car extending over the group track GT1, the relay AB–CS remains dropped away if the route is to either track 5 or track 6, but is picked up for routes to racks 7 and 8 because the relays C–CS and D–CS are both in their picked up positions. Under these conditions the relay AB–CS becomes energized by a circuit extending from (+) including front contact 34 of relay D–CS, front contact 33 of relay C–CS and the winding of relay AB–CS, to (−).

When the relay AB–CS is picked up, the track switch 10W is operated to its normal position in accordance with the energization of the normal switch control relay 10NW by a circuit extending from (+) including front contact 35 of detector track relay 10TR, front contact 36 of relay AB–CS, locking and interlocking contact selections not shown and designated as XX, upper winding of relay 10NW and back contact 37 of relay 10RW, to (−). Relay 10NW when picked up applies energy through its front contact 38 to cause the operation of the track switch 10W to its normal position. Similarly, if the relay AB–CS is maintained in its deenergized position to select the track CLT, the relay 10RW becomes energized through back contact 36 of relay AB–CS to apply energy through its front contact 39 to cause the power operation of track switch 10W to its reverse position. It is thus provided that the track switch 10W becomes operated to its reverse position to include the curve stretch of track CLT in the route for cars when classification tracks 1, 2, 5 and 6 are dsignated, and the track switch 10W is operated to its normal position to include the storage of track CRT when the classification tracks 3, 4, 7 and 8 are designated.

It is to be understood that the transfer of route storages from the storage associated with the track switch 10W to the storage associated with the track switch 11W is effected by the relays SD1 and TN1 being both in their energized positions, these relays being energized in a manner comparable to that disclosed in the above mentioned Brixner et al. Patent No. 2,700,728, granted January 25, 1955.

It is thus provided that when a car enters the detector track section for the track switch 10W so as to cause the deenergization of the relay 10TR, transfer is made of the route storage of the relays AB–CS, C–CS, D–CS and E–CS to the storage relays B–CS1, C–CS1, D–CS1 and E–CS1 which are associated with the track switch 11W at the exit end of the curve test section CT. When transfer is made, the relays B–CS1, C–CS1, D–CS1 and E–CS1 are maintained in their actuated positions by the relay SD1 in a manner similar to that which has been described for the storage associated with the track switch 10W. Relay E–CS1 becomes picked up upon transfer provided that the relay E–CS is energized, in accordance with the energization of a pick-up circuit including front contact 40 of relay E–CS, front contact 41 of relay SD1, and front contact 42 of relay TN1. Relay D–CS1 is energized if relay D–CS is picked up by a circuit including front contact 43 of relay D–CS, front contact 44 of relay SD1, front contact 45 of relay TN1. If relay C–CS is in its picked up position at the time when transfer is made, the relay C–CS1 becomes picked up by the energization of a circuit including front contact 46 of relay C–CS, front contact 47 of relay SD1 and front contact 48 of relay TN1. If relay AB–CS is energized when transfer is made, the relay B–CS1 remains in its dropped away position because the track switch 11W which is controlled by this relay is required to be in its reverse position if the route for the car is over the curve stretch of track CRT in accordance with the track switch 10W being normal, and similarly as the track switch 10W is operated to its reverse position in accordance with the relay AB–CS being in its dropped away position, the relay 11W must be normal, and therefore the relay B–CS1 is energized under these conditions by a circuit including back contact 49 of relay AB–CS, front contact 50 of relay SD1, and front contact 51 of relay TN1.

It is therefore provided that the track switch 11W is operated to its required normal or reverse position for each route in accordance with whether the relay B–CS1 is picked up or dropped away, the selection being made by contact 52 of relay B–CS1 as to whether relay 11NW or relay 11RW is picked up to operate the track switch 11W to its respective normal or reverse position, these relays 11NW and 11RW being selectively actuated in a manner similar to that which has been described more

specifically for the energization of the relays 10NW and 10RW which are associated with the control of track switch 10W.

Because of the respective cars being automatically rounted over the curve track CRT or the track CLT in accordance with the designated destination, the speed detector 53 of FIG. 1 is sometimes conditioned by the speed section S3, and at other times conditioned by the speed section S4. No circuit selection is required to be made between these two speed sections because of their being no condition under which they may be used simultaneously. The curve rolling resistance is therefore computed on the basis of entering speed for the section CT as indicated by speed storage and transfer means 54 in combination with the speed detected by the speed detector 53 and combination with either the speed timing section S3 or the speed timing section S4.

The curve rolling resistance is used in combination with the tangent rolling resistance to provide an analog of total rolling resistance as has been heretofore described and this information is routed circuitwise to the computer 55 for retarder GR1 or the computer 56 for the retarder GR2 in accordance with whether the track switch 8W is in its normal or reverse position as selected by a suitable switch selecting device 57 which may be considered as being a switch circuit controller, or may be considered as a switch control or switch repeater relay in accordance with the requirements of practice. Therefore the computing of the release speed for each group car retarder is accurately accomplished in that it takes into account the rolling resistance of each car passing through that car retarder in accordance with the direction of the predominance of curvature of the trackway over which the respective cars must pass after leaving the group retarder.

Having thus described one particular embodiment of an automatic car retarder control system, it is desired to be understood that this embodiment has been described more for the purpose of illustrating the organization and principles involved in operation of the system provided by the present invention, rather than to limit the number of forms that the present invention may assume, and it is to be further understood that various adaptations, alterations and modifications may be applied to the specific form shown without in any way departing from the spirit or scope of the present invention except as limited by the appending claims.

What I claim is:

1. In an automatic car retarder control system for a railway classification yard having a hump track connected selectively to a plurality of group tracks, a curve test section in said hump track comprising two laterally spaced stretches of curved track of opposite curvature, equilateral track switches connecting said stretches at both ends into said hump track, automatic switching means for routing cars over one or the other of said stretches of curve track in accordance with particular designated destinations for the respective cars, a power car retarder in each of the group tracks operable to braking and non-braking positions, and retarder control means for each of the group car retarders for causing the associated retarder to apply retardation to each car to an extent dependent upon the performance of that car in passing through said curve test section.

2. In an automatic car retarder control system for a railway classification yard having a hump track connected selectively by track switches to a plurality of group tracks, a power car retarder in each of the group tracks operable to braking and non-braking positions, a curve test section disposed in said hump track between the crest of the hump and said group tracks, said curve test section comprising two laterally disposed stretches of track wherein one of said stretches has a predominance of right-hand curvature and the other of said stretches has a predominance of left-hand curvature, automatic switching means for routing cars over said one stretch of curve track or said other stretch of curve track selectively in accordance with particular designated destinations for the respective cars, and retarder control means for each of the group car retarders for causing the associated car retarder to apply retardation to each car to an extent dependent upon the performance of that car in passing through said curve test section.

3. In an automatic car retarder control system for a railway classification yard having a hump track connected selectively by track switches to at least one group track, a power car retarder in said group track operable to braking and non-braking positions selectively, a curve test section disposed in approach of said hump retarder, said curve test section comprising two laterally disposed stretches of track wherein one of said stretches has a predominance of right-hand curvature and the other of said stretches has a predominance of left-hand curvature, automatic switching means for routing cars selectively over said one stretch of track or said other stretch of track in approaching said group retarder, said automatic switching means being effective to select one of said stretches or the other in accordance with the direction of the predominance of track curvature for the trackway each car must follow beyond the group retarder, and retarder control means for said group retarder for causing said group retarder to apply retardation to each car to an extent dependent upon the performance of that car in passing through said curve test section.

4. In an automatic car retarder control system for a railway classification yard having a hump track connected selectively by track switches to at least one group track, said hump track including a curve test section having two laterally spaced stretches of curve track connected at their ends by track switches so that cars may pass over the stretches selectively in passing from the crest of the hump over said hump track to said group track, one of said stretches having a predominance of right-hand curvature and the other of said stretches having a predominance of left-hand curvature, designating means for designating classification track destinations for cars to be classified, a bank of route designation storage relays, means for distinctively actuating said storage relays in response to the designation of the respective classification tracks by said designating means, means for selectively operating said track switches in accordance with the condition of said bank of storage relays whereby one or the other of said stretches of curve track in said curve test section is selected to be included in the route of each car in accordance with the designated destination for that car, a group retarder in each group track selectively operable to braking and non-braking positions, and retarder control means for said group retarder for causing said retarder to be actuated to apply braking to each car passing through the retarder to an extent dependent upon the performance of said car in passing through said test section.

5. In an automatic car retarder control system for a railway classification yard having a hump track connected selectively by track switches to at least one group track, said hump track including tangent test section and a curve test section, said curve test section having two laterally spaced stretches of track connected at their ends by track switches to said hump track, one of said stretches having a predominance of curvature in one direction, and the other of said stretches having predominance of curvature in the opposite direction, designating means for designating class track destinations for cars to be classified, automatic switching means for routing cars over said one stretch of curve track or said other stretch of curve track selectively in accordance with the particular destinations designated for the respective cars by said designating means, rolling resistance computing means for computing the rolling resistance of each car when passing through said tangent test section and said curve test section, exit speed computing means for computing the exit speed at which

car should leave said group retarder in order that it may arrive at its destinations at a predetermined coupling speed, said computing means having as one of its inputs a parameter of car rolling resistance as determined by said rolling resistance computing means, and retarder control means for said group retarder for causing said group retarder to apply retardation to each bar to an extent only to retard that car to a speed comparable to said computed exit speed.

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