

[54] METHOD AND APPARATUS FOR IMPROVING CAR ROLLABILITY IN A RAILROAD CLASSIFICATION YARD

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[51] Int. Cl. **B61b 1/00**

[58] Field of Search..... **246/182 A; 104/26 R, 26 A; 188/62**

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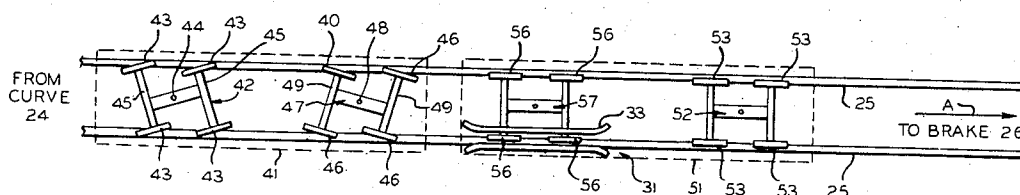
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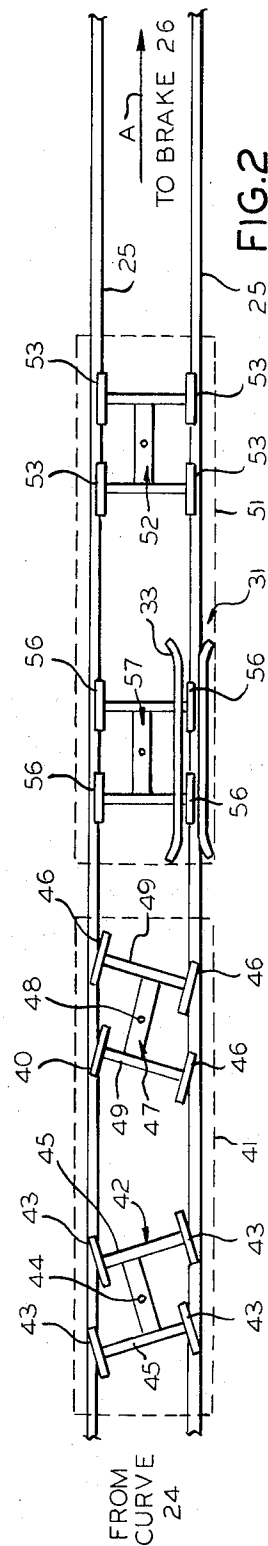
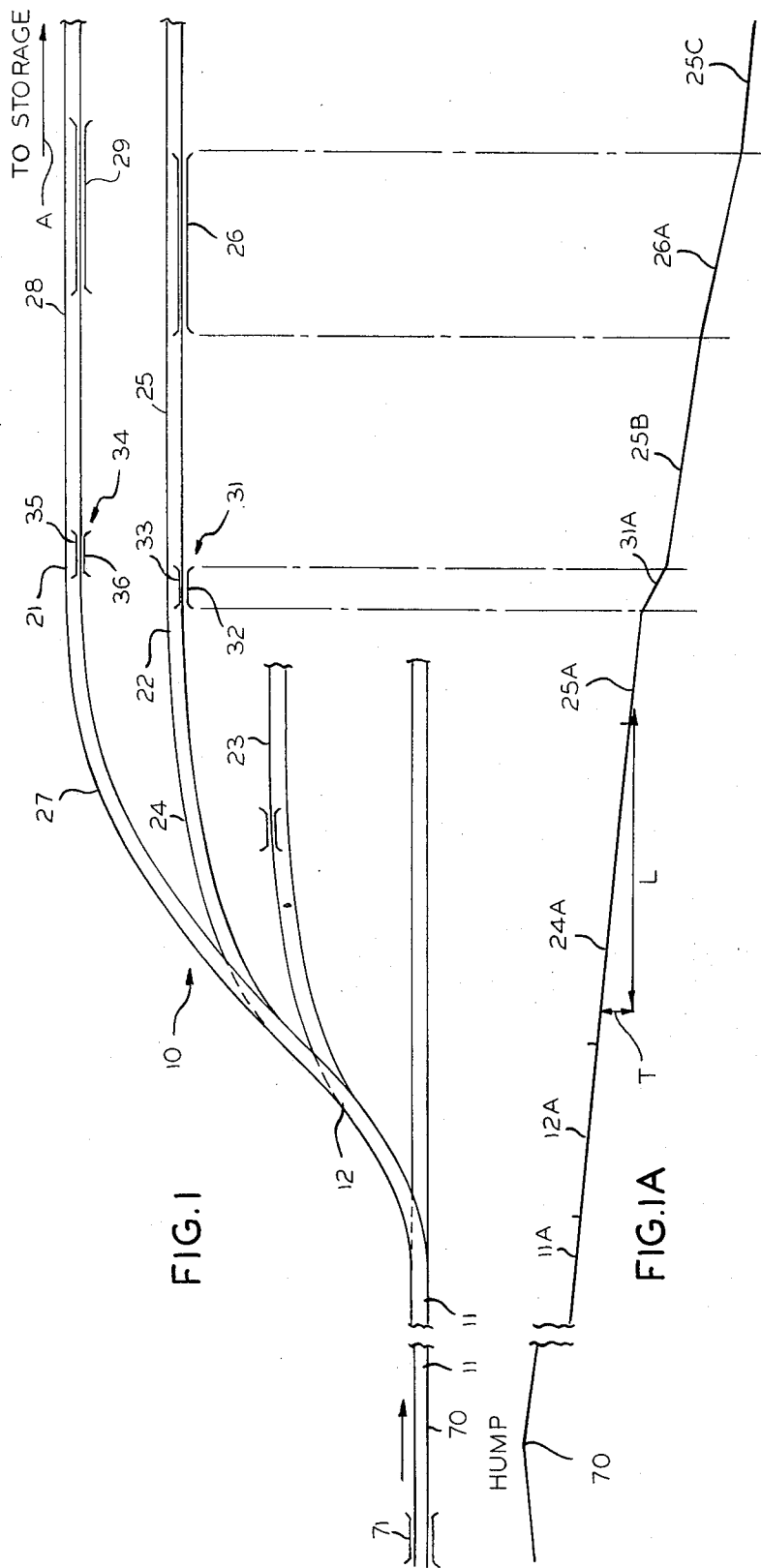
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ABSTRACT

A method and apparatus for improving the rollability of railroad cars moving into a classification yard or into the straight storage sections of the classification tracks of a classification yard; at least two wheels on each truck of each car are engaged by a guide rail which may be a part of a small retarder and which extends parallel to the track. The guide rail forces the wheels, and hence the truck, into alignment with the track. As applied to storage tracks, the track is preferably inclined, through the length encompassing the guide rail, at an angle sufficient to compensate for any loss of kinetic energy due to the limited braking effect of the guide rail.

8 Claims, 4 Drawing Figures





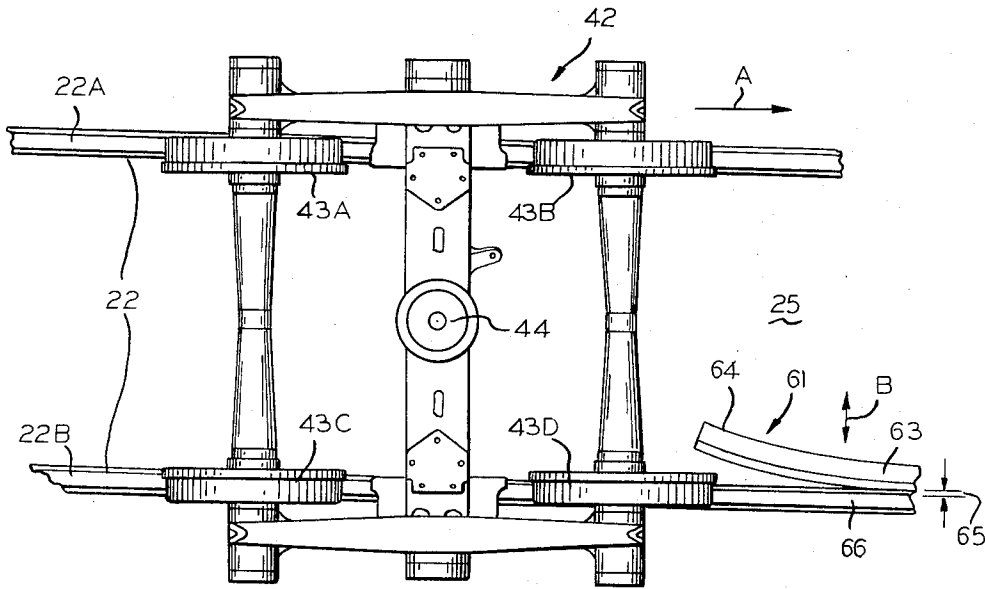


FIG. 3

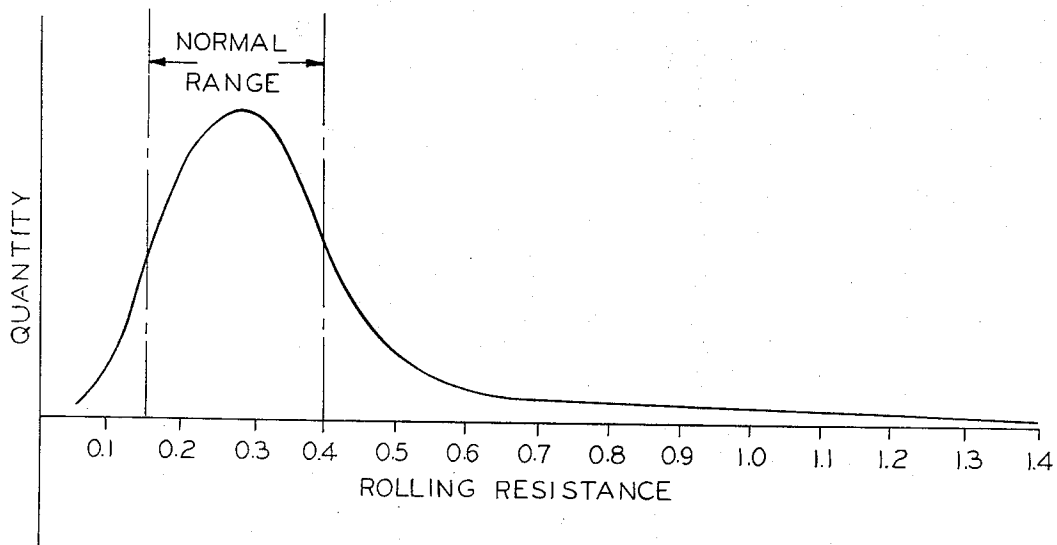


FIG. 4

METHOD AND APPARATUS FOR IMPROVING CAR ROLLABILITY IN A RAILROAD CLASSIFICATION YARD

BACKGROUND OF THE INVENTION

In a railroad classification yard, the rollability characteristics of the cars being classified play an important part in determining the efficiency of the classification operation. For example, a car with extremely high rollability may tend to accelerate through the yard to an excessive extent, and may couple to other cars on a storage track at an excessive speed. Such high-rollability cars occur infrequently, and can usually be maintained in good control by the provision of adequate retarder facilities in the yard. On the other hand, a car of extremely poor rollability may stall before it reaches the end of a classification track, causing an excessive impact when engaged by the next car moving down the same track.

In many classification yards, particularly those in which braking is effected on distribution or "group" tracks ahead of the actual classification tracks, braking is controlled in accordance with the rolling resistance of the individual cars. The rolling resistance of a given car is affected by many different factors, including the construction of the car trucks, irregularities in the classification yard tracks, curves and turnouts in the tracks, the release speed of the car at the top of the yard hump, air friction, wind, temperature variations, rain, snow, dirt and other factors. In many yards, an attempt is made to compute the rolling resistance of each cut of cars before braking in order to establish a safe and effective release speed for the cars. The characteristics of given individual tracks may be taken into account in making this computation. However, controls of this nature are not always reliable because the rolling resistance for a given car or cut of cars may vary widely depending on whether the cars are accelerating or decelerating, have been moving or are moving on curved or straight tracks, or are subject to other variable factors.

In some classification yards, in which each classification track in the yard is equipped with an individual controllable retarder, these variations in car rollability do not play such an important part. This is true primarily because the braking point is much nearer the ultimate coupling point on the storage track and the cars are not subject to some of the major rollability variation factors, including grade changes, curves, turnouts and the like. In yards of this nature, most cars can be effectively controlled on the basis of relatively simple speed measurements without requiring an actual computation of rolling resistance. Even in a yard of the latter type, however, cars exhibiting extremely high rolling resistance can interfere with efficient and consistent yard operation at a high classification rate. This is particularly true of cars for which rollability may change markedly from the time of entry into the yard to the time of movement onto a given storage track.

One factor materially affecting rollability, which can cause substantial difficulty in the operation of any classification yard, results from the presence of the curves in the track ahead of the yard and in the track required to transfer cars from the hump track to the individual classification tracks. A railroad car moving around a curve inherently tends to come out of the curve with the trucks of the car misaligned, substantially increas-

ing the friction at the interface between the car wheel flanges and the rails. A car which is a poor roller to begin with, when coming out of a curve, is likely to be moving so slowly as to require no braking. Under these circumstances, even though there may be a retarder on the classification track, the car wheels remain out of alignment. Moreover, braking would be undesirable, tending to slow the car even more and quite possibly stalling the car in the retarder with potentially disastrous results. Consequently, even in a well-designed yard it may be necessary to limit operational speeds to compensate for poor rolling cars, reducing the efficiency and capacity of the yard to a marked extent.

SUMMARY OF THE INVENTION

It is a primary object of the present invention, therefore, to provide a new and improved method and apparatus for improving the rollability of railroad cars, by aligning the trucks on each car, as the cars move into a classification yard or onto the straight storage sections of the classification tracks of a classification yard.

A further object of the invention is to provide a new and improved method and apparatus for aligning the trucks on each car moving into a classification track, parallel to the track, without substantial reduction in the kinetic energy of the cars.

A specific object of the invention is to provide a new and improved method and apparatus for operation of a classification yard of the kind having a controllable retarder in each classification track, the improvement comprising means for aligning the trucks on each car parallel to the track when each car enters the yard and re-aligning the trucks after the car has traversed the last curve on each classification track and has entered the straight storage section of the track but before the car reaches the retarder that determines the final release speed for the car.

A specific object of the invention is to increase the efficiency and operational rate for a railroad classification yard by assuring maximum rollability for each car moving into the storage sections of the classification tracks of the yard, utilizing apparatus that is simple in nature and relatively inexpensive to construct, and that requires a minimum of maintenance.

In its method aspect, the invention relates to a method for improving the rollability of railroad cars during classification operations in a railroad classification yard of the kind in which individual cars or cuts of cars are released from a hump location and roll, by gravity, down an inclined hump track and thence down a classification track which includes a transition section comprising at least one curve leading into a straight storage section. The method of the invention comprises positively engaging at least two wheels on each truck of each car, simultaneously, to align each car truck parallel with the storage section of the classification track after the car has completely traversed the curved transition section of the classification track and before the car has moved any substantial distance down the straight storage section of the track.

In its apparatus aspect, the invention relates to an improvement in a gravity-operated railroad classification yard of the kind including a hump, a hump track inclined downwardly from the hump, a plurality of classification tracks connected to and inclined downwardly from the hump track, with each classification track

comprising a curved transition section leading into a straight storage section, and retarder means for braking each car as the car traverses the yard between the hump and the storage section of one of the classification tracks. The improvement of the invention comprises a plurality of truck aligning means, one located at the upper end of the storage section of each classification track, for aligning each truck of each car in parallel relation to the storage section of the associated classification track. Each truck aligning means comprises an elongated guide rail, long enough to engage at least two wheels on each car truck, positioned parallel to the flange side of the classification track storage section and close enough to the track to engage the flange side of each car wheel traversing the classification track.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a simplified plan view of a part of a gravity-operated railroad classification yard modified to incorporate the present invention;

FIG. 1A is a gradient profile of one of the classification tracks in the yard of FIG. 1;

FIG. 2 is a schematic plan view of the trucks of two railroad cars, utilized to explain the operation of the invention;

FIG. 3 is a plan view of a single car truck entering truck-aligning means in accordance with the present invention; and

FIG. 4 is a chart of the distribution of rolling resistance characteristics for railroad cars in general.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 1 is a plan view of a classification yard 10 modified to operate in accordance with the method of the present invention and incorporating car truck alignment apparatus constructed in accordance with a preferred embodiment of the invention. Classification yard 10 comprises a downwardly inclined hump track 11, leading into the yard from an elevated hump 70. Hump track 11 branches into a distribution track 12 which in turn branches into a series of classification tracks 21, 22, and 23. It will be understood that the classification yard 10 would ordinarily include many more such classification tracks; only three classification tracks have been shown in FIG. 1 because these are adequate to afford an effective description of the invention.

Classification track 22 is typical of the classification tracks in yard 10. It comprises a curved transition section 24 extending from a switch on the distribution track 12 and leading into a straight storage section 25. A car retarder 26 is located near the upper end of classification track 22, on the straight storage section 25 of the track. The storage section 25 of track 22 extends beyond retarder 26 for a substantial distance to afford a storage area for a large group of cars being made up into a train.

Classification track 21 is similar to track 22. It includes a curved transition section 27 leading from distribution track 12 into a straight storage section 28. A car retarder 29 is located on the straight storage section 28 of track 21, not far from the juncture of the curved transition section 27 with the straight storage section 28. Retarders 26 and 29 may be conventional weight-responsive track brakes, and are preferably provided with speed-responsive braking controls.

FIG. 1A illustrates the gradient profile for classification track 22, together with a part of distribution track 12 and hump track 11. The incoming end of the track profile, at the left of FIG. 1A, which extends from hump 70 along track 11 through distribution track 12 and through the curved transition section 24 of classification track 22 (FIG. 1), is of relatively constant grade. The grade selection is made in accordance with the average rolling resistance for most of the cars that will be handled by the yard. The distribution of rolling resistance among American railroad cars is generally illustrated in FIG. 4. The rollability or rolling resistance for a car may be determined theoretically in accordance with the expression:

$$h = \frac{1}{1 + \frac{4wr^2}{D^2} \frac{1}{W}} H$$

in which:

h = velocity head (translational head), in feet.

H = energy head in feet.

w = weight of car wheels and axles in pounds.

w = gross weight of car in pounds.

r = radius of gyration of the car wheels and axles with respect to their axis of rotation, in inches.

D = car wheel diameter at tread in inches.

As shown by FIG. 4, most cars exhibit a rolling resistance in a normal range of 0.15 to 0.4. The gradients for the classification tracks in yard 10, as illustrated by the profile of classification track 22 in FIG. 2, are ordinarily selected to accommodate cars of rolling resistances falling within the normal range illustrated in FIG. 4. Typically, most of the length of the trackage in the yard, including the hump yard section 11A, the distribution track section 12A, the transitional classification track section 24A, and the straight storage track sections 25A, 25B, and 25C (FIG. 1A) are constructed with a uniform gradient that will assure a relatively safe coupling speed for cars falling in the normal rolling resistance range of 0.15 to 0.4 with a minimum of braking by the classification track retarder 26 (FIG. 1). In a typical yard, the gradients for all of these sections will be of the order of 0.12 percent, corresponding to a drop T of twelve feet in a length L of one thousand feet. The gradient through the classification track retarder 26, as represented by profile section 26A in FIG. 1A, is usually made slightly greater. For example, the slope of segment 26A may be of the order of 0.3 percent.

In Classification yard 10, however, each of the classification tracks such as tracks 21 and 22 is equipped with a truck-aligning apparatus for aligning each truck of each car in parallel relation to the straight storage section of the classification track just after the car has left the curved transition section of the classification track. On classification track 22, this truck-aligning means comprises a short car "retarder" or aligning device 31 located at the upper end of the straight storage section 25 of track 22 just below the curved transition section 24 of that track. The aligning device 31 comprises two elongated guide rails 32 and 33 located on opposite sides of one rail of classification track 22. The guide rails 32 and 33 do not extend for the full length of a car and are not employed for significant braking; hence, they may be much shorter than the conventional 39 foot length for an individual track brake section. However, rails 32 and 33 should be long enough to en-

gage at least two wheels on each car truck. Preferably, the two guide rails 32 and 33 of the aligning retarder 31 are of the order of eight to ten feet long, assuring simultaneous engagement of at least two wheels on each car truck.

A similar truck-aligning retarder 34 comprising two guide rails 35 and 36, is located on classification track 21 at the upper end of the storage section 28 of that track just below the curved transition section 27. A similar truck-aligning retarder is positioned at a corresponding location on classification track 23 and on each of the other classification tracks (not illustrated) in yard 10. Moreover, an additional short truck-aligning retarder 71 is located just ahead of hump 70.

Each of the truck-aligning retarders, such as devices 31, 34 and 71, is provided with a spring-actuated mechanism or other simple operating mechanism normally maintaining the retarder in closed condition to afford positive engagement with the wheels on each truck of each car entered the straight storage section of the classification track. Preferably, each of the truck-aligning retarders is provided with some means for opening the retarder, as when a trim operation is required in classification yard 10, to enable the passage of trains into and out of the individual classification tracks without having the retarder in operation. One form of retarder operating mechanism that is quite suitable for the truck-aligning retarders such as devices 31 and 34 is that shown in U.S. Pat. No. 3,557,910, to R. W. Wilson, issued Jan. 26, 1971. Inasmuch as that particular retarder has been manufactured and sold as a commercial unit by Abex Corporation, under the model designations R-11 and R-11A, and since the mechanism is illustrated and described in the aforementioned U.S. Pat. No. 3,557,910, no detailed description of the retarder apparatus is deemed necessary herein. It should be understood that any other relatively simple and inexpensive normally closed retarder, preferably about eight to 10 feet in length and equipped with a suitable release means, may be utilized for the truck-aligning devices 31, 34 and 71.

As shown in FIG. 1A, the grade for the classification track through the section 31A that includes the truck-aligning retarder 31 is increased so that there is no net braking effect on the cars due to operation of the truck alignment device. The grade of this short track section 31A is made somewhat greater than the head removal characteristics of the retarder so that the velocity of the cars moving through the alignment device 31 and down the straight classification track section 25 is not reduced appreciably. In a typical yard, with the gradients set forth above, the slope for segment 31A may be of the order of 0.6 percent, depending to some extent upon the braking characteristics of the particular retarder mechanism selected for truck alignment purposes.

FIG. 2 illustrates the effect of the curved transition segments of the classification tracks on the alignment of the trucks of a typical railroad car; and also shows the effect of one of the truck alignment devices such as the truck-aligning retarder 31. As shown in FIG. 2, a railroad car 41 passing from the curved transition section 24 to the straight storage section 25 of classification track 22 has the car trucks canted at a substantial angle to the track rails. Car 41 includes two trucks 42 and 47. Truck 42 is pivotally mounted on the car at a

pivot 44, the truck having two axles 45 upon which the wheels 43 of the truck are mounted. Similarly, truck 47 is pivotally mounted upon the car at a pivot 48 and includes two axles 49 upon which the wheels 46 of the truck are mounted. The angle of displacement of trucks 42 and 47 from a true parallel relation with the rails of classification track 22 is exaggerated in FIG. 2. However, there is a definite angular displacement of the car trucks and wheels relative to the rails caused by the movement of the car around the curved track section 24. Moreover, this misalignment of the car trucks causes a definite increase in the friction loss at the point of engagement between the wheel flanges and the heads of the rails. In many instances, this misalignment of the car trucks is sufficient to produce a marked increase in the rolling resistance of the car as compared with operating conditions in which the car trucks are accurately aligned in parallel relationship to the rails.

FIG. 2 also shows another car 51 comprising two trucks 52 and 57. Truck 52 has already passed through the truck-aligning retarder device 31 and truck 57 is shown engaged by the truck-alignment retarder. As shown in FIG. 2, the truck-aligning retarder brake rails 32 and 33 have widely flared ends to admit car wheels that are substantially misaligned without producing the possibility of a derail or other mishap. The wheels 56 on one side of truck 57 are engaged by guide rails 32 and 33 and have been forced, by the guide rails, into substantially parallel alignment with the traffic rails of the straight storage section 25 of classification track 22. Truck 52, having already passed through the aligning device 31, has its wheels 53 parallel with the classification track. From the point shown in FIG. 2, car 51 rolls freely along the storage section 25 of track 22, toward brake 26, in the direction of the arrow A. Since the wheels on both trucks 52 and 57 have been engaged by the guide rails 32 and 33 of alignment device 31, and the trucks have both been straightened relative to the track, the excessive drag introduced by canting of the car trucks has been eliminated and this rolling resistance factor has been minimized. The same effect will be attained with respect to car 41 as the car continues its movement down track 22 and passes through the truck-aligning retarder 31 on its way to the track brake 26 (see FIG. 1).

FIG. 3 affords a more detailed illustration of the car truck 42, moving along classification track 22 at the upper end of the storage section 25 of the track. As shown in FIG. 3, truck 42 is canted with respect to the two traffic rails 22A and 22B. As a result of the misalignment of the truck, two of the wheels 43A and 43D roll freely along the rails but two of the wheels 43B and 43C have their flanges disposed in dragging frictional engagement with the heads of the rails 22A and 22B respectively. The result is a substantial increase in the rolling resistance of the car on which truck 42 is mounted, as described above.

In FIG. 3, truck 42 is shown about to enter a truck-aligning device 61 that has some of the characteristics of the alignment retarders 31 and 34 described in connection with FIGS. 1 and 2 but that is specifically different in that it does not constitute a complete retarder mechanism. Thus, device 61 comprises an elongated guide rail 63, only part of which is shown in FIG. 3. The total length of guide rail 63 is preferably about eight to ten feet to assure engagement with both of the wheels

43C and 43D on one side of truck 42. The entrance end 64 of guide rail 63 is flared to a substantial extent to permit entry of wheels that are substantially canted with respect to the traffic rails of track 22. The guide rail 63 is located on the flange side of classification track rail 22B. Furthermore, the spacing 65 between guide rail 63 and the head 66 of rail 22B is narrow enough so that guide rail 63 positively engages the flange side of each wheel passing through device 61 if the wheel is canted to any appreciable extent.

For a conventional guard rail, the flange spacing 65 would be of the order of 1½ inch or greater. For effective truck alignment operation, however, rail 63 should be positioned closer to rail head 66, preferably with a spacing 65 of about 1½ to 1¾ inches. If the wheels 43C and 43D on truck 42 are already substantially parallel to rail 22B, the guide rail 63 has little or no effect on the wheels; with the usual flange depth of approximately 1½ inch, the flanges on the wheels pass alongside rail 63 without substantial braking and with no change in truck orientation. With the wheels on truck 42 canted as shown, however, the guide rail 63 forces wheels 43C and 43D into parallel alignment with rail 22B, turning truck 42 about pivot 44 and reducing the rolling resistance of the car attributable to misalignment of the truck because the entire truck is straightened up as wheels 43C and 43D are re-aligned.

As in the case of the retarder aligning devices 31 and 34, the grade through the track segment covered by guide rail 63 should be made somewhat greater than the normal incline for the yard to compensate for any friction loss that may occur as the car wheels move through the aligning device. Guide rail 63 may be of rigid construction. Alternatively, guide rail 63 may be mounted for quite limited movement in a direction toward and away from the traffic rail 22B (arrow B), with one or more large springs or other resilient mounting means urging the guide rail toward the head 66 of the traffic rail and allowing some "give" as the truck 42 moves through the alignment device 61.

Cars entering classification yard 10 frequently must traverse curved track in the approach to hump 70, skewing the car tracks in the same manner as described above with respect to the curved track segments in the yard itself. For optimum efficiency in operation of the yard, each car or cut of cars leaving the hump should be restored to maximum rollability. To this end, the car-aligning device 71 is positioned immediately ahead of the yard hump and is employed to straighten the trucks on each car as the car enters the yard. Device 70 may comprise a short retarder of limited braking effect, like device 31, or a close-coupled guide rail apparatus like device 61, imposing only a limited additional load on an engine pushing the cars to the top of the hump.

From the foregoing description, it will be seen that the method and apparatus of the invention assures optimum rollability (minimum rolling resistance) for each car moving into yard 10 and on to the storage tracks in the yard. The canting of the car trucks caused by the curves in track ahead of the yard and within the yard is promptly and effectively corrected, minimizing friction at the rail-wheel interface and allowing safe high-speed yard operation. The track-aligning devices employed are relatively simple and inexpensive, and require a minimum of maintenance.

I claim:

1. The method of improving the rollability of railroad cars during classification operations in a railroad classification yard, in which individual cars or cuts of cars are released from a hump location to roll, by gravity, down an inclined hump track and thence down a classification track including a transition section comprising at least one curve leading into a straight storage section, said method comprising positively engaging at least two wheels on each truck of each car, simultaneously, to align each truck in parallel relation to said storage section of said classification track, without appreciable braking of the car, after the car has completely traversed said transition section of said classification track and before the car has moved any substantial distance down the straight storage section of said classification track.

2. The method of improving car rollability, in operation of a classification yard, according to claim 1, comprising the further step of positively and simultaneously engaging at least two wheels on each truck of each car, as the car approaches the hump location, to align each truck parallel to the hump track prior to release of the car to roll down said hump track.

3. In a gravity-operated railroad classification yard of the kind including a hump, a hump track extending over and inclined downwardly from said hump, a plurality of classification tracks connected to and inclined downwardly from said hump track, each classification track comprising a curved transition section leading into a straight storage section, and retarder means for braking each car as the car traverses said yard between said hump and the storage section of one of said classification tracks, the improvement comprising: a plurality of truck aligning means, one located at the upper end of the storage section of each classification track, for aligning each truck of each car in parallel relation to the storage section of the associated classification track without appreciable braking of the cars, each said truck aligning means comprising an elongated guide rail, long enough to engage at least two wheels on each car truck, positioned parallel to the flange of one rail of said classification track and close enough to said classification track to engage the flange side of each car wheel traversing said classification track at any appreciable angle of misalignment relative thereto, the downward inclination of said storage section of each classification track, in the portion thereof extending through said truck aligning means, being somewhat in excess of the head removal characteristics of said truck aligning means.

4. A gravity-operated railroad classification yard according to claim 3, in which the length of said guide rail is of the order of eight to ten feet.

5. A gravity-operated railroad classification yard according to claim 3, in which said truck aligning means further comprises a second elongated guide rail, said guide rails being parallel to each other and located on opposite sides of said one rail, and means urging said guide rails toward each other to engage both sides of the wheels on each car truck passing through said aligning means.

6. A gravity-operated railroad classification yard according to claim 5, in which said truck aligning means further comprises release means for separating said guide rails to allow free passage of car wheels there-through.

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7. A gravity-operated railroad classification yard according to claim 3, in which said truck aligning means further comprises resilient means urging said guide rail toward engagement with said wheels.

8. A gravity-operated railroad classification yard according to claim 3, and further comprising an addi-

tional truck aligning means, positioned on said hump track ahead of said hump, for aligning each truck of each car parallel with said hump track before the car is released to roll into the yard.

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