

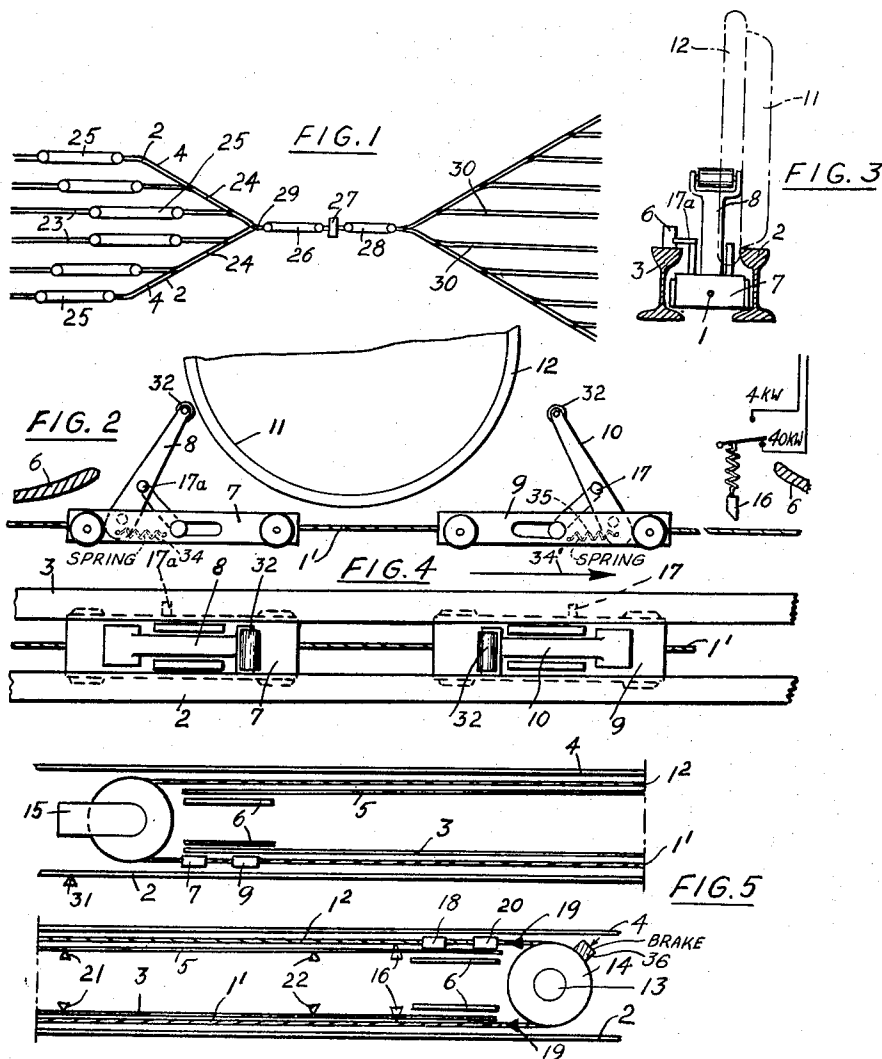
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METHOD OF AND ARRANGEMENT FOR AUTOMATICALLY CONTROLLING THE
RELEASE OPERATION IN A MARSHALLING YARD

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METHOD OF AND ARRANGEMENT FOR AUTOMATICALLY CONTROLLING THE RELEASE OPERATION IN A MARSHALLING YARD
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This invention relates to a method of and an arrangement for automatically controlling the release operation in a marshalling yard using driven endless cables moving to and fro adjacent the two rails of each track.

In flat railroad stations the cars of railroad trains to be disassembled are moved by shunting locomotives from the incoming tracks over a hump, then distributed in the following switch zone over classification tracks and collected there. The hump has two functions. It is intended firstly to guarantee that the range of movement of the cars extends up to the classification tracks and secondly to provide such distances between the cars released that the switches can be re-adjusted. The first function determines the height of the hump and the second one the sectional shape of the hump.

The hump has considerable disadvantages. Its height is so dimensioned that poorly running cars in low temperatures and with a head wind move far enough on to the classification tracks. This means that the well running cars must be braked at normal temperature. This is not satisfactory both in technical and economical respect.

The pushing-off of the cars over the hump is uneconomical and expensive because the frictional weight and the starting energy of the shunting locomotive must be such that even the heaviest trains on the ramp leading to the hump can be accelerated. The large weight and the great starting power are, however, required for a short time only since the weight of the train becomes gradually smaller during the course of the pushing-off operation. After a train has been pushed off the hump, the shunting locomotive must travel back on the incoming tracks and be placed behind the next train so as to push it forward as far as the hump. The time required for pushing off a train is the same as that which is necessary for driving the locomotive back behind the next train and for pushing the train forward. The hump is thus utilized for only half the time. This want of economy can be avoided by working with two shunting locomotives, in which case the costs for pushing-off double.

Also known are inclined railroad stations having incoming tracks from which the trains to be disassembled are automatically released. The trains released is held by a retarder which controls the release of the individual cars. On inclined railroad stations one train can be released after the other without intervals. But these stations are expensive as to their installation and in operation.

Keeping distances between the cars requires efficient marshalling yards with short time intervals between the successive cars (e.g. 7 sec.) corresponding to a high speed of pushing off (e.g. 1.4 m./sec.), high speeds of the cars in the switch zone because the different travel times caused by the different travelling capabilities of the cars become the less effective the higher the speeds of travel and the shorter the paths of travel. The regulation of the distances which is necessary in spite thereof requires heavy and expensive retarders in view of the high speeds of travel. This applies particularly when the release operation is automatically controlled because in the case of the known automatically operating collecting methods it is worked with low speeds of about 1 m./sec.

in the classification tracks and the high speeds must be reduced before the classification tracks.

In order to automatically control the release operation, the present invention eliminates the hump and the expensive shunting locomotives and retarders, putting in place thereof an industry-like conveyor-line starting from the incoming tracks, by means of which both complete trains and individual cars can be conveyed in timed sequence and the cars separated from each other to such an extent that a sufficient distance is provided for re-adjusting the distributing switches.

It is possible to eliminate the shunting locomotive in inclined railroad stations having tracks arranged at such an incline that the automatic start of run of a railroad train is ensured, using brakes. The economic installation of inclined railroad stations is subject to a predetermined gradient of the ground.

To eliminate the retarders it is old to use for individual cars and groups of cars accelerating drives, chain haulage systems and shunting devices for humps in which either rollers engage behind the axles of the cars to be accelerated or arms adapted to be raised engage behind a buffer or a wheel of such a car. The final velocity produced is not constant and there is no assurance that they are in continuous engagement.

Also known is an arrangement for mechanizing the work in train-assembling tracks which consists of trolleys with four wheels capable of travelling between the feet and heads of a rail and a guide rail and carrying arms which can be raised by spring tension. The trolleys can be coupled to a driven cable through contacts operated by the railroad car to be transported. The raisable arms engage behind the wheel rim of the car and transport the car through sections of the track.

It is the object of the present invention to overcome the deficiencies inherent in the known arrangements and to expand only those forces required and not to generate unnecessary energies and dissipate them again so that the trains can be pushed off without shunting locomotives and without hump, and sufficient distances can be provided between the individual cars for re-adjusting the switches.

This object is achieved according to the invention by providing a method of automatically controlling the release operation in a marshalling yard, and an arrangement for carrying out said method, which method comprises the steps of bringing a railroad train to be disassembled into a medium incline corresponding to half the difference of the greatest and lowest possible resistance value of the cars of the entire train so that the train is in labile balanced condition, putting the train into motion by external, controllable, small forces and optionally retarding it again, and subsequently accelerating individual or groups of cars at time intervals by further externally acting and controllable forces and optionally retarding them thereby to provide distances between the cars required for re-adjusting distributing switches.

The arrangement for carrying out said method comprises a number of incoming tracks arranged at an incline of equilibrium to cause railroad trains standing thereon to be in labile balanced condition, a stationary automatically operating pushing-off equipment substituting for a shunting locomotive and arranged at the end of each of said incoming tracks for continuously supplying externally acting, controllable, small forces to the cars of the trains, said pushing-off equipment serving for acceleration and retardation and being arranged to produce and maintain a predetermined final velocity, classification tracks, a connecting track between said incoming tracks and said classification tracks, and a stationary automatically operating accelerator substituting for a hump for separating the railroad cars and arranged in said connecting track, said accelerator being continuously in

engagement with a car being classified and serving for acceleration and retardation of the cars being classified and being arranged to produce a predetermined final velocity independent of the weight of the cars and serving to provide sufficient distances between the individual cars for the purpose of re-adjusting distributing switches.

Preferably, the pushing-off equipment which may also be used as accelerator comprises two pairs of trolleys having four wheels, arms carried by the trolleys and raisable by spring tension to engage similarly constructed parts of all railroad cars, guide rails for controlling the arms, further guide rails associated one with each of the two rails of the incoming tracks, the trolleys being arranged to travel between the feet and heads of the rails of the tracks and the associated guide rails, an endless cable which is arranged to move between one rail of the tracks and its associated guide rail and back between the other rail of the tracks and its associated guide rail and to which the trolleys are firmly connected, and an electric drive for the cable, one pair of the trolleys being associated with one rail of the tracks at the beginning of the associated guide rail and the other pair of the trolleys with the other rail of the tracks at the end of the associated guide rail so that one pair of the trolleys is prepared for engagement at any time and can engage with its raisable arms a car wheel positioned between the individual trolleys of the one pair of trolleys.

The car wheel may be accelerated by the pair of trolleys engaging it with its arms with the electric cable drive acting as a drive means.

The car wheel may be retarded by the pair of trolleys engaging it with its arms with the electric cable drive acting as a generator brake.

According to an important feature of the invention, the pushing-off equipment may be used for locking the train in balanced condition by preventing a car wheel which is positioned between the raised arms of one pair of the trolleys from unintentionally starting, a brake connected to the cable drive motor being set in currentless condition.

Instead of a pair of trolleys consisting of two trolleys, one trolley with two raisable arms may be provided.

A preferred embodiment of the invention will now be described by way of example and with reference to the accompanying drawing, in which:

FIG. 1 is schematic top plan view of an arrangement according to the invention;

FIG. 2 is a schematic side view of one pair of the trolleys with a car wheel positioned between the trolleys;

FIG. 3 is a vertical cross section through the guide for the trolleys;

FIG. 4 is a top plan view of the arrangement shown in FIG. 2, and

FIG. 5 is a fragmentary schematic top plan view of a track provided with the pushing-off equipment.

FIG. 1 schematically illustrates the automatically controlled release operation. A number of incoming tracks 23 are arranged at a medium incline corresponding to half the difference of the greatest and smallest possible resistance value of the cars of a railroad train, for example 4.5%, so that the train being on the incoming track is in balanced condition. At the end of each incoming track 23 there is arranged an automatically operating stationary pushing-off equipment 25 which, in operation, is continuously in engagement with a car being classified and serves for acceleration and retardation of that car and is arranged to produce and maintain a predetermined final velocity of the car. As the pushing-off equipment 25 is only capable of pushing until the last car has left it, a further stationary pushing-off equipment 26 which takes charge of conveying the last part of the train is arranged in a connecting track 29 between switches 24 of the incoming tracks 23 and classification tracks 30.

Behind the pushing-off equipment 26 there is an electric brake 27 which has the function of blocking briefly

the running cars to facilitate the uncoupling. An automatically operating stationary accelerator 28 which, in operation, is continuously in engagement with a car and serves for its acceleration and retardation and is arranged to produce a predetermined final velocity of the cars independent of their weight is arranged behind the brake 27 and intended to provide sufficient distances between the cars for the purpose of re-adjusting the switches.

Each pushing-off equipment 25 which may also be used as accelerator 28 has, as shown in FIGS. 2 to 5, an endless cable 1 arranged to circulate in a length of between approximately 30 and 150 feet between a rail 2 and an associated guide rail 3 and between another rail 4 and an associated guide rail 5. Associated in pairs with the two rails 2 and 4 are trolleys 7 and 9 firmly connected to the run 1¹ of the endless cable and trolleys 18 and 20 firmly connected to the run 1² of the endless cable, respectively. These trolleys consist of frames with four wheels, which are arranged to travel between the feet and the heads of the rails 2 to 5 and carry arms 8 and 10, respectively, raisable by the tension of springs 34 and 35 and adapted to engage similarly constructed parts of all railroad cars, for example a car wheel 11, and an axle bearing housing or the like. Raising and depressing as well as locking and unlocking of the arms 8 and 10 is controlled in a known manner by stationary guide rails 6. Every two of the trolleys form a co-operating pair of trolleys. Each pair consists of the trolley 7 or 18 acting with the arm 8 as a pressure trolley and of the trolley 9 or 20 acting with the arm 10 as a braking trolley. The fixed distance between the two trolleys of a pair is so dimensioned that the car wheel 11 positioned between the trolleys is seized by the raisable arms 8 and 10 which engage with rollers 32 the front and rear part, respectively, of the rim 12 of the car wheel and can accelerate or retard the car wheel. The two trolleys 7, 9 and 18, 20, respectively, may be combined into one trolley by means of a suitable frame.

The cable 1 is driven by an electric motor 13 (FIG. 5) of variable speed and reversible direction of rotation which transmits its power to a cable drive pulley 14 through a coupling, brake, and gear not shown. If the electric motor 13 is supplied with current, the brake 36 is electrically released, and in the currentless condition the brake 36 is set. The initial tension required for the cable 1 is produced by a self-adjusting tensioning device 15. If the speed of the electric motor 13 corresponding to the cable speed and thus to the speed of pushing-off, e.g., about 4.5 feet/sec. is exceeded, the electric motor operates as a generator which is driven through the arm 10 of the trolley 9 acting as braking trolley. The electric motor 13 can be switched to two output stage, i.e. the full output and an output of 10%. The output of 10% is sufficient to drag the cable 1 under initial tension with the trolleys 7 and 9 without any power being delivered or taken up by the arms 8 and 10. In the second half of the pushing-off equipment there are arranged at a distance of about 40 feet apart, i.e. the largest occurring distance between the axles of a car, two known sensing magnets 21 and 22. When the same number of axles has passed over the two contacts of the sensing magnets, i.e. when the last car of a railroad train has passed the pushing-off equipment, the electric motor 13 is switched off by end contacts 19.

The arrangement operates as follows:

A railroad train runs in on an incoming track 23 and comes to a standstill with its first axles on the pushing-off equipment 25 arranged at the end of each incoming track. The electric motor 13 is switched in from a signal box (not shown) to operate with its output of 10% and the cable 1 is put into motion. Thereby the trolleys 7 and 9 are moved in the direction of arrow 34' (FIGS. 2 and 4) out of the region of the guide rail 6. The arm 10 of the trolley 9 and the arm 8 of the trolley 7 are raised by spring tension. When the arm 10 abuts

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against a stopping car wheel 11 it is depressed and raised again after it has passed under the car wheel 11. Immediately thereafter the arm 8 of the trolley 7 abuts against the same car wheel 11 and tends to push it forward. Thereby an overload relay of the electric motor 13 is released, which is operated when the output of 10% is exceeded, and a brake 36 is switched in. The railroad train is locked through the wheel set and prevented from moving.

As soon as the train is prepared for release, the electric motor 13 is switched to its full output from the signal box. The train being in balanced condition is accelerated to about 4.5 feet/sec. If the train runs faster, it is braked through the arm 10 of the trolley 9. The electric motor 13 is then driven and operates as generator. Shortly before the end of its path of travel the trolley 9 actuates a contact 16 (FIGS. 2 and 5 which is arranged adjacent the rail 2 and the rail 4, whereby the electric motor 13 is switched back to its output of 10%. Power is neither delivered nor taken up by the arms 8 and 10. In this condition a control lever 17 of the trolley 9 passes under the guide rail 6 with the result that the arm 10 is depressed into its inoperative position. Immediately thereafter a control lever 17a of the trolley 7 passes under the guide rail 6 whereby the arm 8 is depressed into its inoperative position.

During the operation of the first pair of trolleys 7 and 9 the second pair of trolleys 18 and 20 has, due to its firm connection to the cable 1, travelled back idling to the beginning of the pushing-off equipment. As soon as both pairs of trolleys are positioned under the guide rails 6 at the beginning and at the end of the pushing-off equipment and the trolley 9 has operated the end contact 19 arranged adjacent the rail 2 and the guide rail 4, the direction of movement of the endless cable 1 is reversed by the electric motor 13. Now the trolleys 18 and 20 operate in the manner described above, whereas the trolleys 7 and 9 travel back idling.

There are two possibilities of the arms 8 and 10 engaging the rim 12 of the rolling car wheel. Either the railroad train runs at a lower speed than the cable 1, in which case the arm 10 passes under the first car wheel 11 and after it has been raised again engages the front part of the rim of the wheel, whereas the arm 8 engages the rear part of the rim and begins to push the wheel forward. Or the train runs faster than the cable, in which case the first car wheel depresses the arm 8, then passes over it and abuts against the arm 10 by which it is braked.

If the pushing-off equipment is used as an accelerator, the sensing magnets 21 and 22 are omitted. The end contacts 19 not only change over the direction of movement of the cable 1 but also disengage the coupling between the electric motor and the cable drive pulley. The re-engagement is effected by a rail contact 31 (FIG. 5) arranged adjacent the rail 2 and operable by the wheel rim of the car to be accelerated. The electric motor 13 is switched off automatically if no further car follows, e.g. after 30 seconds have elapsed, i.e. after the last car of a railroad train has been pushed off.

This ensures that the railroad train is automatically pushed off at a constant speed by the pushing-off equipments 25 and 26 which are continuously in engagement and thus have control over the train at any time. The accelerator 28 operates automatically and separates the cars of the train to such an extent as is required for re-adjusting the distributing switches.

I claim:

1. The method of automatically controlling the disassembling and classification of railroad cars in a marshalling yard in which the incoming tracks are inclined downwardly in the direction of the classification tracks at an angle such that the car in average operating condition is barely stable thereon and in which each incoming track has associated with it a first accelerator posi-

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tioned at a first fixed track location, said method comprising the steps of bringing a railroad train to be disassembled onto said inclined tracks so that said train is in labile balanced condition, the tracks being inclined at such an angle that the average car in any train when placed on said track has its friction substantially balanced by the force of gravity acting thereon and is in labile balanced condition, automatically placing said train in motion by the continuous application by said first accelerator of first external controllable forces only of sufficient amplitude to upset the balanced condition of the cars of said train to accelerate and to retard said train as required to maintain the train in motion at the desired speed, separating the individual cars of said train, and subsequently automatically applying by a second accelerator positioned at a second fixed track location second controllable external forces to said separate cars at spaced intervals of time to provide adequate distances between separated cars for the operation and re-adjusting of distributing switches.

2. An arrangement for automatically controlling the disassembly and classification of a railroad train in a marshalling yard, said arrangement comprising a plurality of incoming tracks, a plurality of classification tracks, a connecting track connecting said plurality of incoming tracks with said plurality of classification tracks, said incoming tracks being inclined downwardly toward said classification tracks at an angle sufficient that the forward component of gravitational force on the average car in average condition is sufficiently large to substantially balance the friction of that car so that a train stationed on said incoming tracks is in labile balanced condition, an automatically operating pushing-off equipment substituting for a shunting locomotive and arranged at the head of each track of said plurality of incoming tracks, said automatic pushing-off equipment being arranged to apply to a train situated on any of said incoming tracks controllable external forces only of sufficient amplitude to upset the balanced condition of the cars of the train to accelerate and retard the train as required to maintain forward motion of said train within prescribed limits of velocity, and an automatically operating accelerator situated at said connecting track to substitute for a hump, said accelerator operating continuously to accelerate any car placed onto said connecting track to a prescribed velocity, said accelerator accelerating and retarding said car when necessary to attain said velocity and to ensure proper spacing between adjacent cars to permit time for the classification switches to be re-adjusted.

3. An arrangement as claimed in claim 2, wherein the pushing-off equipment which may also be used as an accelerator comprises two pairs of trolleys having four wheels, arms carried by the trolleys and raisable by spring tension to engage similarly constructed parts of all railroad cars, first guide rails for controlling the arms, second guide rails associated one with each of the two rails of the incoming tracks, the trolleys being arranged to travel between the feet and heads of the rails of the tracks and the associated second guide rails, an endless cable which is arranged to move forth between one rail of the tracks and its associated second guide rail and back between the other rail of the tracks and its associated second guide rail and to which the trolleys are firmly connected, and an electric drive for the cable, one pair of the trolleys being associated with one rail of the tracks at the beginning of the associated second guide rail and the other pair of the trolleys with the other rail of the tracks at the end of the associated second guide rail so that one pair of the trolleys is prepared for engagement at any time and can engage with its raisable arms a car wheel positioned between the individual trolleys of the one pair of trolleys.

4. An arrangement as claimed in claim 3, wherein the car wheel can be accelerated by the pair of trolleys

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engaging it with its arms with the electric cable drive acting as a motor.

5. An arrangement as claimed in claim 3, wherein the car wheel can be retarded by the pair of trolleys engaging it with its arms with the electric cable drive acting as a generator. 5

6. An arrangement as claimed in claim 3, wherein a brake is connected with the cable drive and the car wheel positioned between the raised arms of one pair of the trolleys is lockable when the brake is set and the motor is not energized thereby to prevent an unintentional start of run of the train. 10

7. The arrangement as claimed in claim 6 further including means for connecting together the two trolleys of each pair of trolleys to form a single trolley of each pair, each single trolley having only a single pair of arms. 15

8. An arrangement as claimed in claim 7, wherein said accelerator and said pushing-off equipment are built up on the normal permanent bed and arranged outside the 20

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confines of the railroad cars so that the tracks equipped with the arrangement are free for unobstructed travel by locomotives and cars after the cable drive has been switched off.

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