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B. MISHELEVICH ET AL
CAR COUNTING SYSTEMS

3,046,394

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3 Sheets-Sheet 1

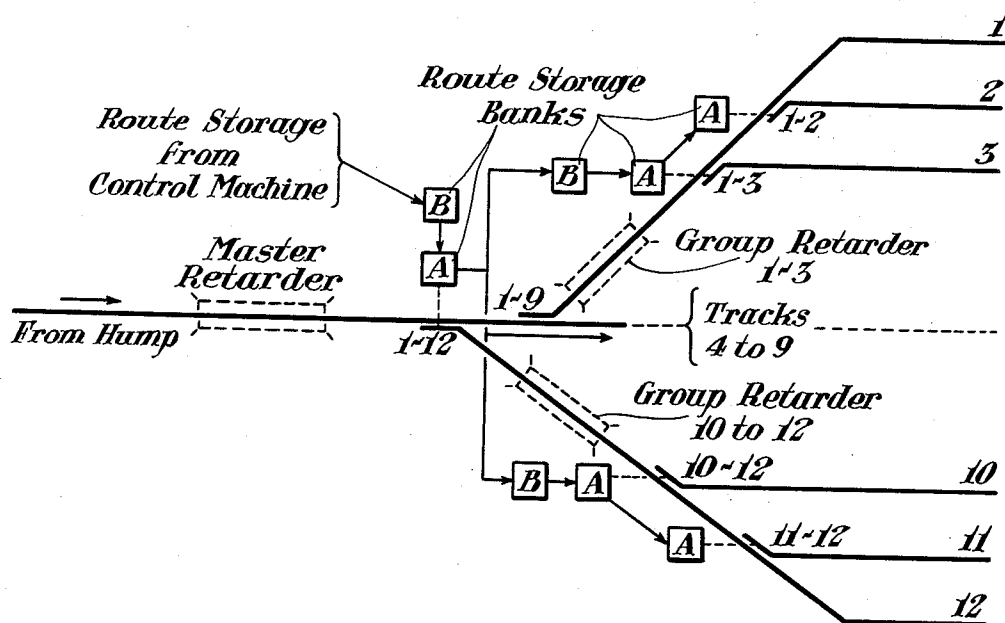
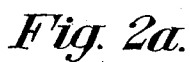


Fig. 1.

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3 Sheets-Sheet 2



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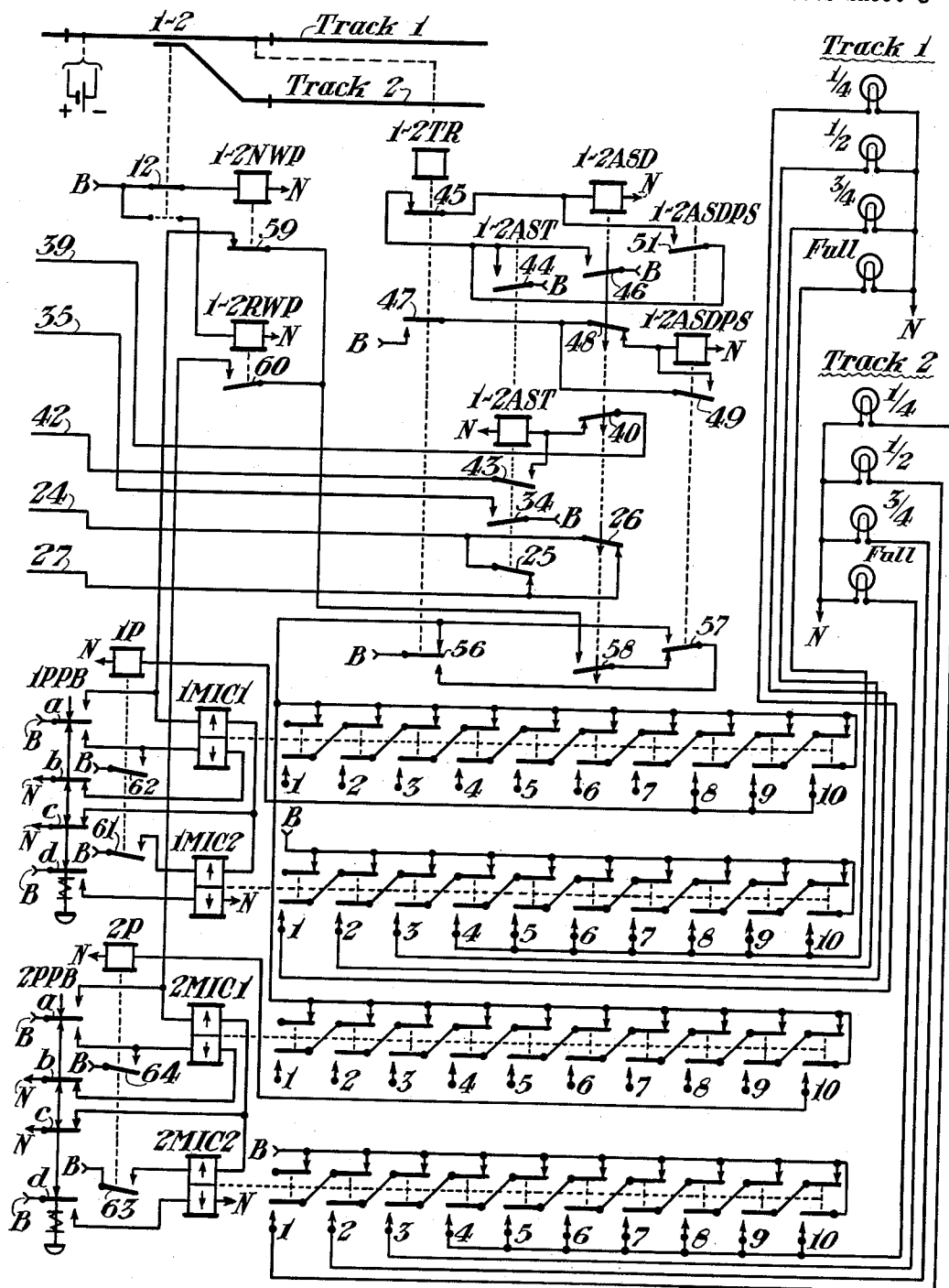


Fig. 2b.

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1

3,046,394

CAR COUNTING SYSTEMS

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10 Claims. (Cl. 246—182)

Our invention pertains to a railway car counting system and more particularly to a system for indicating the fullness of the storage tracks in a railway classification yard.

Reference is made to the railway car counting system disclosed and claimed in Letters Patent of the United States 2,964,617, issued to us December 13, 1960, on an application filed May 11, 1956, both cases being assigned to the same assignee. However, although disclosing apparatus having similar purpose, there is no common subject matter shown in this application and claimed in Patent 2,964,617, and vice-versa.

In the operation of automatic classification yards, it is sometimes the practice to completely automatically control only the master and intermediate car retarders and retain the control of the group or final car retarders on a partially manual basis. In other words, the main or master retarder on the hump lead and the following intermediate retarders on the main diverging leads are provided with speed control systems in which the leaving speed from the rear for a car or a cut of cars is automatically selected according to the measured weight of the cars, the rolling resistance of the cut, and/or other factors. The pressure applied by this car rearder is then automatically controlled in order that the cut will leave the retarder at the selected speed. Such systems of speed control are well known and are presently used in classification yards. The final or group retarders are then provided with a speed control system in which the leaving speed is selected manually by the retarder operator according to his estimate of the leaving speed required in order for a cut of cars to reach its final destination at the proper speed. This manually selected leaving speed is then used to control the speed control system which automatically provides the necessary retarder pressure to result in the car leaving the retarder at the selected speed. To assist the retarder operator, as much information as possible is given to him regarding the car or the cut of cars approaching any particular group retarder. In addition to such factors as weight and rolling resistance, it is desirable to include in this information an indication of the fullness of the final storage track to which the car is destined. All of this information enables the operator to estimate more accurately the proper leaving speed necessary to have the cars arrive at their destination at a speed which will result in coupling with the standing cars without damage to any car or its contents.

In many such classification yards, a count of only the cuts of cars entering a particular storage track is sufficiently accurate for purposes of retarder control. In other words, knowing the average number of cars in the cuts in a particular yard from experience in operating the yard, an estimate of how many such multiple and single car cuts each storage track will hold is possible with a reasonable degree of accuracy. With the automatic switching system generally provided in such yards, a means is readily available to determine when a cut of cars enters a track without having to supply extra detector equipment. A visible display or other indication can then be provided to show a fullness factor for each storage track according to the fractional degree of track occupancy. Coupled with other information, this track fullness indication allows the operator of the final or

2

group car retarders to more accurately estimate the required leaving speed for each cut of cars.

It is therefore an object of our invention to provide an improved car counting system for railway classification yards.

Another object of our invention is to provide a track fullness indication for each storage track in a railway classification yard.

A further object of our invention is to provide an improved cut counting scheme for the multiple car cuts entering a storage track in a railway classification yard.

Still another object is to provide an improved track fullness indication for storage tracks in a railway classification yard using the detection provided as part of the automatic switching system for that yard.

Other objects and features of our invention will be obvious from the following specification when taken in connection with the accompanying drawings.

In practicing our invention, we provide for each storage track in such a classification yard an electrical counting device of the type which advances one step, that is, one unit in the count, each time the device is energized. The counting device for a particular storage track is then energized each time the detector track section of the last switch in the route is occupied by a cut of cars destined to that particular storage track. Since our arrangement is particularly designed for use in railway classification yards having an automatic switching system, contacts of the relays associated with this automatic switching system are utilized to determine the destination of a cut of cars and to prevent an overcount, that is, to permit only one count for each cut of cars. As the multiple car cut enters a switch detector track section, the position of that switch determines which counting device will be actuated to record that particular cut and thus the count is made in the proper storage track. The relay action which occurs to transfer or cancel the route stored in the associated storage bank is utilized to assure that the cut is counted only once. By use of the relays of the automatic switching system, we also differentiate between cuts passing over a particular switch where the route over one position of that switch leads to a single end or storage track and the route over the other position of the switch leads to several storage tracks over other switches. In other words, unless the cut of cars passing over a particular switch is actually entering a storage track, the cut is not counted at the time it occupies that particular detector circuit. Finally, the counting devices for each storage track are used to provide a visible indication, of the degree of track fullness, to the operator of the final or group retarders in that yard.

We will now describe two forms of apparatus embodying our invention and then point out the novel features thereof in the appended claims.

Referring to the drawings, FIG. 1 is a diagrammatic view of the layout of a small railway classification yard and includes a conventional flow chart showing the progression of the route storages through the various storage banks of the automatic switching system.

FIGS. 2a and 2b, taken together with FIG. 2a to the left, show diagrammatically the cut counting circuits for tracks 1, 2, and 3 of FIG. 1.

In each of the drawings, similar reference characters refer to similar parts of the apparatus.

Referring now to FIG. 1, there is shown therein portions of the layout for a small, 12 track railway classification yard which will provide a basis for description of our invention. It is not intended that this classification yard as shown is a typical yard but only a layout which will be sufficient for an understanding of our invention. Much of this drawing is shown conventionally. In other words, the tracks are shown by conventional

single lines while car retarders and route storage relay banks of the automatic switching system are shown by conventional blocks. It will be noted that only six of the 12 tracks are actually indicated, the intervening six tracks, Nos. 4 to 9, being assumed to be divided into two groups of three tracks each. This yard is equipped with a single master retarder and a final or group retarder for each group of three tracks, the yard being of such a small nature that intermediate retarders are not needed. Each of the group retarders shown is numbered according to the classification or storage tracks to which cars passing through the retarder are destined. Each switch is designated by a number which is indicative of the storage tracks to which cars passing over that switch may be routed. For example, the switch 1—2 controls the routing of cars between tracks 1 and 2 while the switch 1—3 has control of cars routed to track 3 or to the tracks 1 and 2. This yard is also equipped with an automatic switching system and a flow chart for the route storages for the cuts of cars is indicated in a conventional way for the tracks shown. The flow of the route storages is from the control machine through the various storage banks at each of the switches shown and is obvious by following the arrows on the drawings. It will be noted that switches 1—3 and 10—12 are provided with A and B storage banks while the final switches 1—2 and 11—12 are each supplied with only a single storage bank as is the custom in such automatic switching systems.

The master retarder in this classification yard shown in FIG. 1 is assumed to be provided with an automatic speed control apparatus in which the proper or desired leaving speed is automatically selected by the car weight. The actual apparatus used forms no part of our invention and any such speed control system well known in the art may be used. It is to be noted that such automatic speed control systems are in present day use in railway classification yards. Each group retarder in this symbolic yard is assumed to be provided with an automatic speed control system in which the leaving speed is manually selected by an operator. Again, such systems are in general use in classification yards but the details form no part of our invention and any such well known system may be used. For example, the speed control system used for the group retarders may be that shown in the copending application for Letters Patent of the United States, Serial No. 283,931, filed April 23, 1952 by David P. Fitzsimmons, for Railway Car Speed Determining and Control Apparatus, now Patent No. 2,751,492, granted June 19, 1956. The operator controlling this speed control system for the group retarders is provided with information regarding the car weight, rolling resistance, and other factors of the cars or cuts of cars approaching and passing through each of the group retarders. By our invention, the operator is also provided with an indication of the fullness of each storage track to which the cars are destined to permit him to more closely estimate the proper leaving speed from the various retarders. The details of this track fullness system of our invention are shown in FIG. 2 and, bearing this classification yard of FIG. 1 in mind, we shall now describe the operation of the system of our invention.

Referring now to FIGS. 2a and 2b, there is shown across the top of the two drawings, by conventional symbols, the stretch of track that is the lead to the group of storage tracks 1, 2, and 3 of the classification yard of FIG. 1. Switch 1—3 diverts cars from the group lead into track 3 while switch 1—2 routes the cars between track 1 and track 2, these being the final tracks in this particular group. As was previously mentioned, this classification yard is provided with an automatic switching system. Although the details of the automatic switching system as such are not part of the system of our invention, for purposes of the following discussion it is assumed that the switching system here provided is that shown in the copending application for Letters Patent of

the United States, Serial No. 355,281, filed May 15, 1953, by Benjamin Mishelevich for Automatic Control of Railway Classification Yard Track Switches, now Patent No. 2,863,991, issued December 9, 1958. This automatic switching system is also shown and described in Manual 517 entitled "Union Automatic Switching for Classification Yards," published in January 1953 by the Union Switch & Signal, Division of Westinghouse Air Brake Co. Reference is made to either of these publications for a complete description and understanding of the automatic switching system here provided. Only that portion necessary to describe and understand our invention is shown. In other words, in FIG. 2, only the route storage transfer circuits are illustrated, as these are the only portion of the system that is required for an understanding of our invention.

In each of the drawings of FIG. 2, a local source of direct current energy is provided, although not shown. It is assumed that this source is a battery having positive and negative terminals B and N, respectively.

In FIG. 2a, as previously mentioned, switch 1—3 is used to divert single or multiple car cuts from the group track lead to track 3. The positioning of this switch to its normal and reverse positions is respectively repeated by the normal switch repeater relay 1—3NWP and the reverse switch repeater relay 1—3RWP. These two relays are energized by obvious circuits completed over a contactor 11 which is operably connected to the switch movement 1—3 to move between its normal position shown solid in the drawings and its reverse position shown dotted in the drawings. The similar switch repeater relays for the switch 1—2 shown in FIG. 2b are the relays 1—2NWP and 1—2RWP. These relays are energized one at a time over similar circuits controlled by a contactor 12.

Each switch shown is included in a detector track section set off by insulated joints and having a track circuit to provide for switch locking when a cut of cars is passing over the switch. Each of these track circuits includes a track relay designated by the reference character TR prefixed by a numeral corresponding to the numerical designation of the switch. Each track relay is energized through a simple circuit, including the rails of the track section, by a track battery, the connections of the track relay and battery to the rails being shown in a conventional manner. Each of these track relays is normally energized when no car occupies any portion of the rails of the track circuit and becomes deenergized during the occupancy of the track section by a car or cut of cars. Each detector track section is of such length that the track relay is continuously deenergized during the occupancy of the track section by a car or cut of cars. In other words, each track relay is continuously deenergized from the time that the leading pair of wheels of a cut of cars enters the track corresponding section until the last pair of wheels has passed completely out of the track section.

The final or A route storage bank at each switch location includes the storage transfer relay AST, the storage detector relay ASD, and the storage detector repeater stick relay ASDPS. The storage transfer relay AST picks up to initiate the transfer of a route storage from the preceding storage bank into the particular bank with which it is associated. The storage detector relay ASD picks up to complete the route transfer and then holds up to retain the route description stored in the associated storage bank. Finally, the storage detector repeater stick relay ASDPS in a sense repeats the release of the track relay. It can pick up only once during a track circuit occupancy and thus enforces the condition that only one storage can be transferred each time a cut occupies the associated track section. In addition, at switch 1—3, the A bank also includes a storage transfer repeater stick relay ASTPS which picks up when the transfer of storage to the succeeding storage unit is made. This relay also

5

picks up only once during each occupancy of the detector track section and as will appear shortly enforces this same condition on the associated ASDPS relay. Each of these mentioned relays at a particular switch location is designated by the reference character given above prefixed by a numeral corresponding to the switch reference numeral.

Referring now to FIG. 2a, storage transfer relay 1—3AST is energized, to initiate a transfer of a route storage into the A storage bank when empty, over a circuit traced from terminal B over back contact 13 of transfer relay 1—3BST and front contact 14 of storage relay 1—3BSD, both in the B storage bank at this location, and thence over back contact 15 of relay 1—3ASD through the winding of relay 1—3AST to terminal N. When this relay picks up, its front contact 16 provides a stick circuit by-passing back contact 15 of the storage detector relay. With relay 1—3AST picked up and its front contacts closed, the energizing circuit for the storage detector relay is completed and may be traced from terminal B over front contact 17 of relay 1—3AST, the winding of relay 1—3ASD, and back contact 18 of relay 1—3ASDPS to terminal N. Relay 1—3ASD picks up and closes its front contact 19 to complete a stick circuit by-passing front contact 17. As will appear shortly, this latter relay remains held up by its stick circuit until a cut enters the detector track section of the associated switch. When relay 1—3ASD picks up, it also permits the route stored in the B storage bank to be transferred into the storage relays of the A storage bank, as is described in the previously mentioned publications dealing with this automatic switching system. When this route storage is transferred from the B bank, relay 1—3BSD is deenergized and releases to open its front contact 14 which interrupts the stick circuit for relay 1—3AST which in turn releases. It will be noted that, with a route stored in the A bank, the storage transfer relay 1—3AST, once released, cannot be reenergized due to open back contact 15 until the route is transferred to the next storage bank at the next switch location or until the route is cancelled if the car is destined for track 3.

When the cut of cars whose route destination is stored in the A bank at this switch location enters the detector track section, relay 1—3TR is deenergized and releases. This completes a circuit for energizing relay 1—3ASDPS extending from terminal B over front contact 20 of relay 1—3ASD, back contact 21 of 1—3ASTPS, back contact 22 of relay 1—3TR, and the winding of relay 1—3ASDPS to terminal N. The closing of its own front contact 23 completes a stick circuit for relay 1—3ASDPS which also includes front contact 20 of relay 1—3ASD. If this cut of cars is destined for either track 1 or track 2, relay 1—3ASD is held energized until the route transfer is completed. The circuit for holding relay 1—3ASD energized under these circumstances includes its own front contact 19 and the relay winding, wire 24, back contacts 25 and 26, in multiple, of relays 1—2AST and 1—2ASD, respectively, wire 27, back contact 28 of relay 1—3TR, and front contact 29 of relay 1—3NWP. This latter contact is closed only when the cut destination is track 1 or 2. Otherwise, relay 1—3ASD is deenergized by the opening of back contact 18 of relay 1—3ASDPS. However, relay 1—3ASD holds its front contacts closed until the expiration of its slow release period.

If the cut of cars is destined for track 3, relay 1—3ASTPS is energized as soon as track section 1—3 is occupied. This circuit may be traced from terminal B over back contact 31 of relay 1—3AST, front contact 32 of relay 1—3ASDPS, front contact 33 of relay 1—3RWP which designates that the cut is scheduled for track 3, and the winding of relay 1—3ASTPS to terminal N. If the cut is destined for track 1 or 2, relay 1—3ASTPS is energized only when the storage transfer relay in the next storage bank is energized to initiate the transfer of the route storage. This circuit includes front contact 34 of

6

relay 1—2AST, wire 35 and the winding of relay 1—3ASTPS. In either case, this latter relay is held energized by a stick circuit including back contact 36 of relay 1—3TR and front contact 37 and the winding of relay 1—3ASTPS. Since relay 1—3ASTPS thus remains energized until the cut has cleared the detector track section, it assures that only one route transfer or one route cancellation can occur for each track occupancy. In other words, relay 1—3ASDPS, which is deenergized and releases following the release of relay 1—3ASD, cannot again become energized due to the open back contact 21 of relay 1—3ASTPS. Thus, even though a following route destination is transferred from the B storage bank into the corresponding A storage bank at this location resulting in the energization of relay 1—3ASD, the route remains stored since relay 1—3ASD is held energized by its stick circuit including back contact 18 of relay 1—3ASDPS. Relay 1—3ASDPS thus picks up and releases only once during each occupancy of the detector track section 1—3, a fact which is utilized in the cut counting system as will be explained hereinafter.

At switch location 1—2, relay 1—2AST is energized when a cut destined for track 1 or 2 reaches location 1—3, if no storage is at that time stored in the single A bank at location 1—2. This circuit may be traced from terminal B at back contact 31 of relay 1—3AST over front contact 32 of relay ASDPS, front contact 33 of relay 1—3NWP which indicates that the cut is routed to location 1—2, wire 39, back contact 40 of relay 1—2ASD, and the winding of relay 1—2AST to terminal N. When relay 1—2AST picks up, it completes a stick circuit at its front contact 43 which also includes front contact 41 of relay 1—3ASD and wire 42. Relay 1—2AST thus remains energized until the route storage is transferred from location 1—3, as will be indicated by the release of relay 1—3ASD. Relay 1—2ASD is then energized, to complete the route transfer, by the circuit extending from terminal B over front contact 44 of relay 1—2AST, front contact 45 of relay 1—2TR, and the winding of relay 1—2ASD to terminal N. Relay 1—2ASD picks up and completes a stick circuit at its own front contact 46 which holds this relay energized until the corresponding detector track section is occupied as will be indicated by the opening of front contact 45 of relay 1—2TR.

When the cut of cars enters detector track section 1—2, relay 1—2ASD is deenergized and at the end of its slow release period releases to open its front contact. This completes a circuit for energizing relay 1—2ASDPS. This circuit may be traced from terminal B over back contact 47 of relay 1—2TR, back contact 48 of relay 1—2ASD, and the winding of relay 1—2ASDPS to terminal N. The closing of front contact 49 of this latter relay completes a stick circuit for itself including back contact 47 which holds the relay energized as long as the track section is occupied by this cut of cars. With relay 1—2ASD released, the route destination for the cut of cars then occupying the detector track section is cancelled and the storage bank is free to receive a new route storage. In this case, the energizing circuit for relay 1—2ASD is completed from front contact 44 of relay 1—2AST over front contact 51 of relay 1—2ASDPS. Thus relay 1—2ASD is reenergized to store a route destination for a following cut of cars and this second route destination cannot be cancelled while the first cut still occupies the detector track section. In other words, relay 1—2ASDPS picks up and holds up only once for each occupancy of the detector track section 1—2, that is, for each cut of cars.

Briefly reviewing the described operation of the automatic switching equipment, it is to be noted that, at each location, relay ASDPS picks up only once for each cut of cars, that is, for each occupancy of the corresponding detector track section. Where the corresponding switch at that location leads to two end or storage tracks as at location 1—2, relay ASDPS picks up and is held energized until the detector track section is again clear. Where

the switch at the location leads to but one end or storage track as at location 1—3, relay ASDPS picks up and then releases as the route storage is either cancelled or transferred to the next location. Relay ASDPS at such a location, however, cannot pick up again since its energizing circuit is interrupted by a back contact of the corresponding relay ASTPS which is provided only at such a location and picks up and holds up only once for each cut of cars or track circuit occupancy.

Each switch location is also provided with a cut counting device for each end or storage track to which the switch leads, that is, to which a cut may be routed over that switch directly. Therefore, one such device is provided at switch location 1—3 and two devices at the switch location 1—2. In the form of our invention shown, these cut or car counting devices are shown as magnetic impulse counters, each designated by the reference character MIC prefixed by a number corresponding to the track for which a track fullness indication is provided. Two of these magnetic impulse counters are necessary for each track and the reference characters have been suffixed with a numeral 1 or 2 to designate between the two impulse counters for a particular track. It is herein assumed, for purposes of this description, that the magnetic impulse counters here used are similar to those shown and described in any of the Letters Patent of the United States Nos. 2,487,015, 2,538,817, and 2,538,819, granted to John I. Bellamy for Electromagnetic Counting Devices, the earliest patent being issued November 1, 1949, and the latter two patents being issued January 23, 1951. It is to be understood, however, that other types of counting devices may be used and that our invention is not limited to the use of a magnetic impulse counter of the form shown in these three reference patents.

Briefly described, each of these magnetic impulse counters shown in the present application has two windings and is provided with ten individual armatures, each armature controlling a make and a break contact. These armatures are operated sequentially in response to electrical impulses, or pulses of current, flowing through the upper winding of the corresponding impulse counter. This operating winding of the magnetic impulse counter is designated by an arrow pointing upward inside the symbol for the particular winding. Only one armature is operated with each pulse of current flowing through this upper winding, the armatures being interlocked in such a fashion that a pulse of current operates a particular armature and at the same time conditions the next armature in the sequence to operate on the next pulse of current. However, only a single pulse of current is required to operate the first armature. Once actuated, each armature is held in its operated position by residual magnetism, supplied in some types from a permanent magnet provided in the impulse counter. As shown in the drawings, the armatures operate sequentially in the ascending order of the numbers used as reference characters for each armature, that is, from 1 to 10 in order. Release of the actuated armatures is accomplished by energizing a second or lower winding which acts to neutralize the residual magnetism holding the armatures in their operated position. In the drawing, this release winding is designated by an arrow pointing downward inside the symbol for the winding. Restated in another fashion, the first pulse of current flowing through the upper winding of one of these magnetic impulse counters actuates the No. 1 armature to open its upper contact and close its lower contact. This pulse also conditions the No. 2 armature to operate on the next pulse of current. However, the No. 2 armature cannot be operated by this pulse of current which operated the No. 1 armature. The second pulse of current flowing through the upper winding of the counter then causes the No. 2 armature to operate, similarly opening the upper contact and closing the lower contact, and conditions the No. 3 armature to operate on the succeeding pulse. Once operated,

the Nos. 1 and 2 armatures are held in their operated position by residual magnetism until the impulse counter is released by a pulse of current flowing through the lower winding.

Each switch location is also provided with an indication device for each storage track to which the switch directly leads. As shown, the indicator comprises a series of four lamps which are energized one at a time over contacts of the second magnetic impulse counter. According to the lamp which is lighted, each indication device displays visible information as to the fullness of the corresponding storage track, that is, one-quarter, one-half, three-quarters, or completely full. It is to be understood, however, that this indicator could supply additional information as to the degree of fullness of the particular storage track and that other types of indicators may be used, such being contemplated by the system of our invention.

Each switch location is further provided with a repeater relay for each No. 1 magnetic impulse counter. These relays are designated by the reference character P prefixed by a numeral corresponding to the storage track with which the counter is associated. Each of these repeater relays is energized at a selected point in the sequential operation of the associated No. 1 impulse counter, which point is not necessarily selected to be at the limit of operation of the impulse counter. When energized, the repeater relay causes the upper winding of the No. 2 impulse counter to be energized and also resets the No. 1 impulse counter to its initial or at-rest position.

A push-pull button, designated by the basic reference PPB, is also supplied for each storage track for which a counting device is provided. These push-pull buttons provide for manual resetting of the track fullness indicator and the magnetic impulse counters. Each of these push-pull buttons is provided with contacts which are actuated only when the button is pushed or pulled. For example, in each of the buttons, contact arm *a* is closed in its upper position only when the button is pushed and is closed in its lower position only when the button is pulled. Contact *b* opens only when the button is pushed and will not open if the button is pulled. Contact *c* operates in the reverse order, that is, it is opened when the button is pulled but remains closed when the operator pushes the push-pull button. Contact *d* is closed only when the push-pull button is pulled by the operator.

It is believed that the operation of the track fullness indication apparatus will be best understood by describing the operation during the counting of cuts of cars, and such description follows.

At location 1—3, relay 1—3ASDPS is used to actuate the counters while reverse switch repeater relay RWP is used to designate those cuts destined for track 3. Since switch 1—3 controls directly only storage track 3, only one counting device is provided at this location. When a cut of cars destined for track 3 occupies the detector track section at this location, magnetic impulse counter 3MIC1 is energized through the circuit traced from terminal B over front contact 52 of relay 1—3ASDPS, front contact 53 of relay 1—3RWP, the upper winding of the magnetic impulse counter, and normally closed contact *c* of push-pull button 3PPB to terminal N. The release of relay 1—3ASDPS when the route storage is cancelled deenergizes the magnetic impulse counter and, at back contact 52, completes a circuit for energizing relay 3P at the proper point in the operation of magnetic impulse counter 3MIC1. This circuit for relay 3P is finally completed over lower contact 10 of the impulse counter when relay 1—3ASDPS releases during the occupancy of the track section by the tenth cut destined for track 3. When relay 3P picks up, its front contact 54 completes a circuit for energizing the upper winding of impulse counter 3MIC2, this circuit also including contact *c* of push-pull button 3PPB. Closing of front contact 55 of relay 3P completes

a circuit, including normally closed contact *b* of push-pull button 3PPB, to energize the lower or reset winding of impulse counter 3MIC1 which resets this impulse counter to its at-rest position releasing all of the armatures of the counter.

It is herein assumed that track 3 will hold 80 cuts of cars of the average length of such cuts in this classification yard. Therefore, the circuit arrangement chosen or selected is such as to energize the second impulse counter at the end of each complete operation of the first impulse counter. However, not until the second impulse counter has been energized twice is any positive indication provided as to the fullness of this particular track. In other words, when the upper winding of impulse counter 3MIC2 has been energized by two pulses of current, the circuit is completed for energizing the one-quarter full lamp of the indicator for track 3. This circuit is traced from terminal B over upper contact 3 and lower contact 2 of impulse counter 3MIC2, wire 66, and through the lamp to terminal N. The lighting of this one-quarter lamp provides an indication to the retarder operator that track 3 is now one-quarter full. This indication remains until impulse counter 3MIC2 has received two more pulses of current at which time a circuit is completed for the one-half full indication lamp by the closing of lower contact 4 of the impulse counter. It is obvious that before the track-full lamp can be lighted, impulse counter 3MIC2 must receive eight pulses of current through its upper winding which indicates 8 complete operations of impulse counter 3MIC1 or 80 cuts of cars having passed into track 3. This track-full indication will remain even though more cuts of full indication will remain even though more cuts of cars enter track 3 before the track is cleared.

When track 3 is cleared of the cars occupying it after the classification process has been completed or when the cars in track 3 are withdrawn to make up a departing train, the operator of the group retarders resets his indicator by pulling button 3PPB. The closing of contact *d* of this button energizes the lower winding of impulse counter 3MIC2 resetting this impulse counter to its at-rest condition, that is, releasing all of the armatures. The closing of lower contact *a* of button 3PPB energizes the lower winding of impulse counter 3MIC1 resetting all the armatures of this impulse counter. It is to be noted that contact *c* of button 3PPB is open at this time to prevent the simultaneous supply of energy to both windings of either impulse counter. If the cars occupying track 3 are not all withdrawn, the retarder operator then inserts an indication which corresponds to the number of cars or cuts of cars remaining in that track. This is accomplished by pushing button 3PPB which closes its upper contact *a* to energize the upper winding of impulse counter 3MIC1, the circuit also including contact *c* of the button which remains closed during this operation. Button 3PPB is pushed once for each cut of cars which it is desired to insert in the counting device. Contact *b* of the button is opened each time the button is pushed to prevent supplying energy to the lower winding of this No. 1 counter at the same time. If impulse counter 3MIC1 is actuated 10 times, relay 3P will be energized over its usual circuit which is closed at back contact 52 of relay 1—3ASDPS. This will cause impulse counter 3MIC2 to be energized through its upper winding. Thus before more cars are routed into track 3, the remaining cars in that track may be accounted for in order to provide a proper indication of the track fullness to the operator during the succeeding switching operation.

At location 1—2, the occupancy of the detector track section with the corresponding release of relay 1—2TR is used to activate the No. 1 impulse counter, with the pulse being interrupted by the release of relay 1—2ASD upon the cancellation of the route storage for that particular cut. It is to be noted that the impulse counters at this location could be controlled by the track relay only.

However, it is desirable to prevent the continuous energization of a counter in case of a track circuit failure. Thus, the energizing circuit is arranged so that it is interrupted when relay 1—2ASD is released. A second activation of the No. 1 impulse counter during this same track occupancy when a second route is transferred into the storage bank is prevented by interrupting the impulsing circuit when 1—2ASDPS picks up. Since there are two storage tracks to which this switch directly routes the cars, two sets of track fullness indication apparatus including the impulse counters and the lamp indicators are provided. The switch position repeater relays are used to designate which of the recording devices is to be actuated by any particular cut of cars. Thus, for a cut of cars destined for track 1, impulse counter 1MIC1 will be energized when the cut occupies track section 1—2 through a circuit traced from terminal B over back contact 56 of relay 1—2TR, back contact 57 of relay 1—2ASDPS, front contact 58 of relay 1—2ASD, front contact 59 of relay 1—2NWP, the upper winding of impulse counter 1MIC1, and contact *c* of button 1PPB to terminal N. The first or No. 1 armature of this impulse counter will thus be operated to close its lower contact and open the corresponding upper contact. If the cut of cars is destined to track 2, the circuit may be traced over back contacts 56 and 57, front contact 58, and thence over front contact 60 of relay 1—2RWP, the upper winding of impulse counter 2MIC1, and contact *c* of button 2PPB to terminal N. In either case, the pulse of energy through the upper winding of the corresponding impulse counter is terminated by the release of relay 1—2ASD to open its front contact 58 at the end of its slow release period. It is to be remembered that this relay is deenergized by the release of track relay 1—2TR, opening its front contact 45, when the cut occupied the associated track section.

The following pickup of relay 1—2ASDPS completes a circuit over back contact 56 of relay 1—2TR and front contact 57 of relay 1—2ASDPS to energize, at the proper time, the repeater relays 1P and 2P. When relay 1P picks up, the closing of its front contact 61 energizes the upper winding of impulse counter 1MIC2 over an obvious circuit causing the first armature of this impulse counter to operate. Closing of front contact 62 completes a circuit through the lower winding of impulse counter 1MIC1 and contact *b* of button 1PPB to reset this impulse counter, releasing all of its armatures to their at-rest position. The energization of relay 2P to close its front contacts energizes the upper winding of the impulse counter 2MIC2 and the lower winding of impulse counter 2MIC1, the circuits being completed at front contacts 63 and 64, respectively. This causes the No. 1 armature of impulse counter 2MIC2 to be operated and resets impulse counter 2MIC1 to its at-rest condition.

For purposes of this description, it is herein assumed that track 1 is relatively short and will hold only 32 average length cuts of cars. Therefore, a connection for the circuit for relay 1P is made to lower contact 8 of impulse counter 1MIC1 so that impulse counter 1MIC2 is energized by a pulse of current in its upper winding for every eight cuts of cars which pass over switch 1—2 into track 1. The circuits for energizing the various lamps of the track fullness indicator for track 1 are then made at lower contacts 1, 2, 3, and 4 of impulse counter 1MIC2. The circuits for these lamps are similar to those previously traced for the indicator for track 3 and are obvious from an examination of the drawing. Further, it is assumed that track 2 is slightly longer and will hold 40 average length cuts of cars. Thus the circuit for energizing relay 2P is connected over lower contact 10 of impulse counter 2MIC1. Relay 2P is thus energized once every ten counts and each operation of the impulse counter 2MIC2 thus represents 10 cuts of cars entering track 2. The lamps of the indicator for track 2 are similarly connected over lower contacts 1, 2, 3, and 4 of

impulse counter 2MIC2 to give the corresponding indications of one-quarter, one-half, three-quarters, and completely full for this particular track.

The impulse counters at this switch location may be manually controlled by use of buttons 1PPB and 2PPB in a manner similar to that already described for the impulse counters at switch 1—3. It is believed that the circuits for this control are obvious from an examination of the drawings when taken in connection with the previous discussion in connection with the other location. It is to be noted, in considering these circuits, that energy for relays 1P and 2P, when required during such manual operation, is supplied over front contact 56 of relay 1—2TR.

The system of our invention thus provides a cut counting means which will supply to the operator of the group retarders in a railway classification yard an indication of the relative fullness of each of the various storage tracks in that yard. The operator may combine this information with that provided as to car weight and car rolling resistance to more efficiently select a proper leaving speed for the various cuts of cars from the group retarders in order that they may enter the storage tracks and couple with cars already standing there at a speed which will not damage any car or its contents. This cut counting and track fullness system utilizes the apparatus already available in the automatic switching system for the railway classification yard and thus requires a minimum amount of additional equipment in order to provide the indication. The circuits are so arranged that only one count is made for each cut of cars as it enters a storage track, regardless of whether or not a route for a following car is transferred into the storage banks at the corresponding switch location prior to the leading cut clearing the switch location. In other words, the system of our invention provides to the retarder operator in such a classification yard an indication of the relative fullness of each of the storage tracks in that yard without requiring a completely separate system of detection of the movements of the cars.

Although we have herein shown and described but two forms of apparatus for a car counting system embodying our invention, it is to be understood that various changes and modifications may be made therein within the scope of the appended claims without departing from the spirit and scope of our invention.

Having thus described our invention, what we claim is:

1. At a railway track switch over which cuts of cars are routed into diverging tracks in accordance with preselected routes stored in an automatic switching system in the order of the approaching cuts, each route being moved into an active position to control said switch prior to the arrival of the corresponding cut and cancelled upon the arrival of said cut, the combination comprising, an electrical counting device which is advanced one count for each period of energization, an energizing circuit for said counting device, and an indicator, said circuit including a first contact closed in response to the passage of a car cut over said switch only if a preselected route is stored in said active position and a second contact controlled by said switch and closed only when said switch is positioned for a particular route, said first contact re-opening after the cancellation of said preselected route and being held open during the remainder of the passage of said cut, said indicator being controlled by said counting device to display an indication in accordance with the count to which said device has been advanced.

2. At a railway track switch over which cuts of cars are routed into diverging tracks according to preselected routes stored at said switch in the order of the approaching cuts, the stored route for a particular cut of cars being moved into an active position to control said switch prior to the arrival of that cut and being released from said active position during the passage of that cut over said

switch; a cut counting means for cuts of cars moving over said switch into a particular track, said counting means including a counting device which advances one count during each period of energization, an indicator controlled by said device to provide an indication according to the count to which said device has advanced, and an energizing circuit for said device including a first contact closed only when said switch is positioned to route cuts into said particular track and a second contact closed in response to the passage of a cut of cars over said switch only if a preselected route is stored in said active position, said second contact re-opening after the stored route has been released and being held open during the passage of that cut of cars.

3. At a railway detector track section including a track switch and through which cuts of cars are routed according to preselected routes stored at said track section in the order of the approaching cuts of cars, the stored route for the next approaching cut being moved into an active position to control said switch prior to the entry of that cut into said track section, the stored route for each cut of cars being released from said active position when the corresponding cut occupies said track section, a cut counting means to count cuts of cars moving through said track section into a particular route, said counting means including a counting device which advances one count during each period of energization, an indicator controlled by said device to display an indication in accordance with the count to which said device has advanced, and a circuit having connections when closed to energize said device, said circuit including a first contact closed when said switch is positioned to establish said particular route and a second contact closed when a cut of cars occupies said track section only if a route is stored in said active position, said second contact being re-opened when the route is released from said active position and remaining open while that cut of cars occupies said track section.

4. At a railway track switch over which cuts of cars are routed into diverging tracks according to preselected routes stored at said switch in the order of the approaching cuts, the stored route for a particular car cut being brought into an active position prior to the arrival of that cut, the combination comprising: a cut counting device for each possible route over said switch, each said counting device being advanced one step during each period of energization; an energizing circuit for each of said devices having connections to cause the associated device to count the number of car cuts passing into the corresponding route, and indicating means for each possible route operably connected to the corresponding device and adapted to display an indication of the position to which said corresponding device has advanced, each said energizing circuit including a repeater contact closed only when the corresponding route is established, a detector contact closed in response to the arrival of a car cut and another contact closed when a route is stored at said switch in said active position, said other contact being opened a predetermined time after the arrival of said car cut.

5. At a railway track switch over which cuts of cars are routed into diverging tracks according to preselected routes stored at said switch in the order of the approaching cuts, the stored route for a particular cut of cars being moved into an active position to control said switch prior to the arrival of that cut and being released from said active position during the passage of that cut over said switch, a cut counting means for cuts of cars moving over said switch into a particular track, said counting means including a counting device which advances one count during each period of energization, an indicator controlled by said device to display an indication according to the count to which said device has advanced, and an energizing circuit for said device including a first contact controlled by said switch to close when said

13

switch is positioned to route cuts into said particular track, a second contact responsive to the occupancy of the track to close during the passage of a cut of cars over said switch, and a third contact controlled by the active route storage position to close when a preselected route is stored in said active position and to open when the stored route is released.

6. At a railway detector track section including a track switch and through which cuts of cars are routed according to preselected routes stored at said track section in the order of the approaching cuts of cars, the stored route for the next approaching cut being moved into an active position to control said switch prior to the entry of that cut into said track section, the stored route for each cut of cars being released from said active position when the corresponding cut occupies said track section, a cut counting means to count cuts of cars moving through said track section into a particular route, said counting means including a counting device which advances one count during each period of energization, an indicator controlled by said device to display an indication in accordance with the count to which said device has advanced, and an energizing circuit for said device including a first contact closed when said switch is positioned to establish said particular route, a second contact closed in response to a cut of cars occupying said track section, a third contact closed in response to a preselected route being stored in said active position and becoming open when the stored route is released, and a normally closed fourth contact opened in joint response to a cut of cars occupying said track section and to the release of the corresponding stored route from said active position, said fourth contact being held open while that cut occupies said track section.

7. At a railway track switch over which cuts of cars are routed to diverging routes according to a sequence of preselected routes stored at said switch in the order of the approaching cuts, the route for the next cut being brought into an active position prior to the arrival of that cut and released from said active position during the passage of the corresponding cut of cars over said switch, counting apparatus to count the number of car cuts passing over said switch along a particular route including a counting device which advances one count during each period of energization, an indication circuit arrangement controlled by said device in accordance with the count to which said device has advanced, and an energizing circuit for said device including a contact closed only when said switch is positioned to route a cut along said particular route and controlled jointly by the release of a stored route and by the passage of a corresponding car cut over said switch to energize said device once and only once for each cut passing over said switch along said particular route.

8. At a railway track switch over which cuts of cars are routed to diverging routes according to a sequence of preselected routes stored at said switch in the order of the approaching cuts, the route for the next cut being brought into an active position prior to the arrival of that cut and

14

released from said active position during the passage of the corresponding cut of cars over said switch, the combination comprising, a counting device which advances one count during each period of energization, an indication means controlled by said device to provide an output in accordance with the count to which said device has advanced, and a circuit means to energize said device for only a single period each time a cut moving along a particular route passes over said switch, said circuit means including a contact closed only when said switch is positioned to direct a cut along said particular route and being controlled jointly by the passage of a car cut over said switch and by the corresponding release of a stored route to close for only one predetermined interval during the passage of each cut.

9. In a railway classification yard which is provided with an automatic switching system to route cuts of cars into preselected storage tracks, track fullness measuring apparatus for each storage track including a counting device which advances one count during each period of energization, an indicator controlled by said device to provide a fullness measurement for the corresponding storage track according to the position to which said device has advanced, and an energizing circuit for said device including a contact closed only when the last switch in the route to said corresponding storage track is positioned to route cuts of cars into that track and controlled by said switching system to energize said device for only a single period during the passage over said last switch of a cut of cars destined for said corresponding storage track.

10. In a railway classification yard which is provided with an automatic switching system to route cuts of cars into preselected storage tracks, track fullness measuring apparatus for each storage track including a counting device which advances one count during each period of energization, an output circuit arrangement controlled by said device in accordance with the position to which it has advanced to provide a fullness measurement for the corresponding storage track, and an energizing circuit having connections to energize said device once and only once for each cut of cars entering the corresponding storage track, said energizing circuit including a contact closed only when the last switch preceding said corresponding storage track is positioned to route cuts into that track and a circuit portion controlled by the operation of said switching system to close for only one interval during the passage of a cut of cars over said last switch.

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