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J. R. GEORGE ET AL
AUTOMATIC CONTROL OF RAILWAY CLASSIFICATION
YARD TRACK SWITCHES

2,863,992

Filed June 18, 1956

7 Sheets-Sheet 1

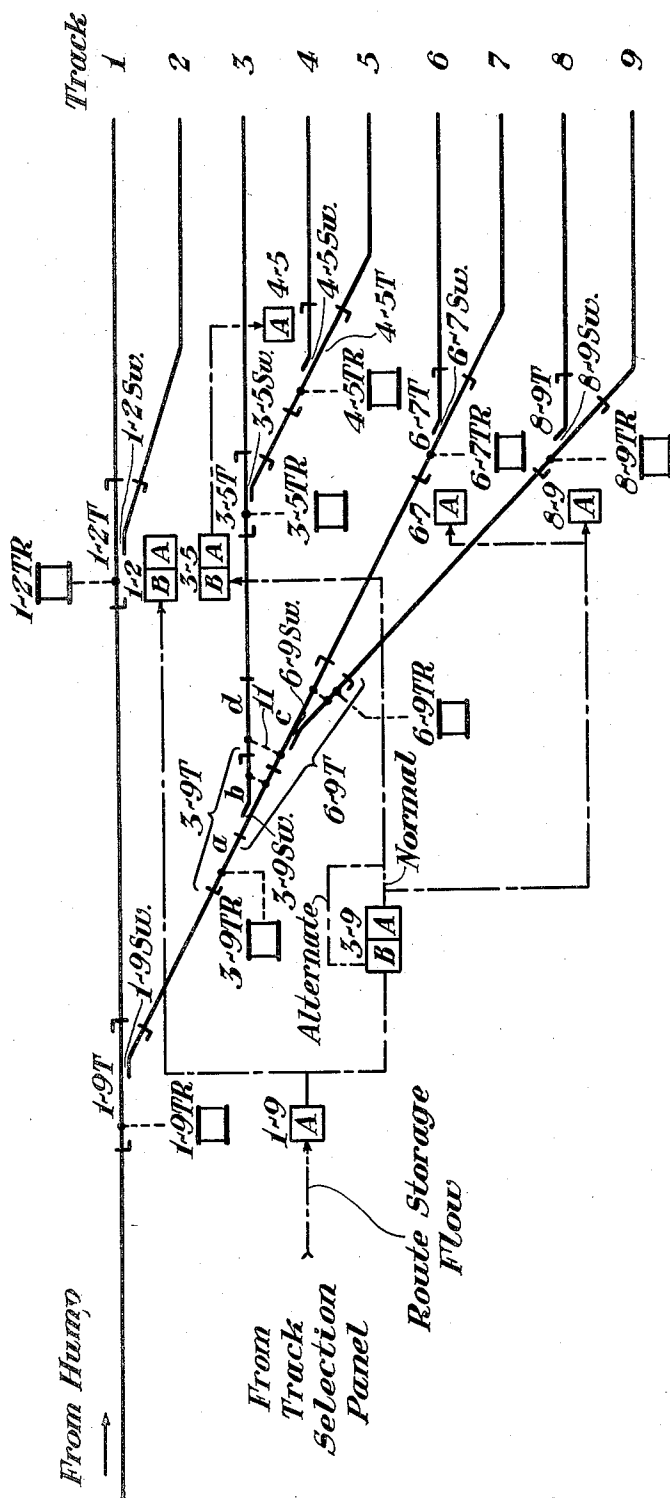


Fig. 1.

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7 Sheets-Sheet 2

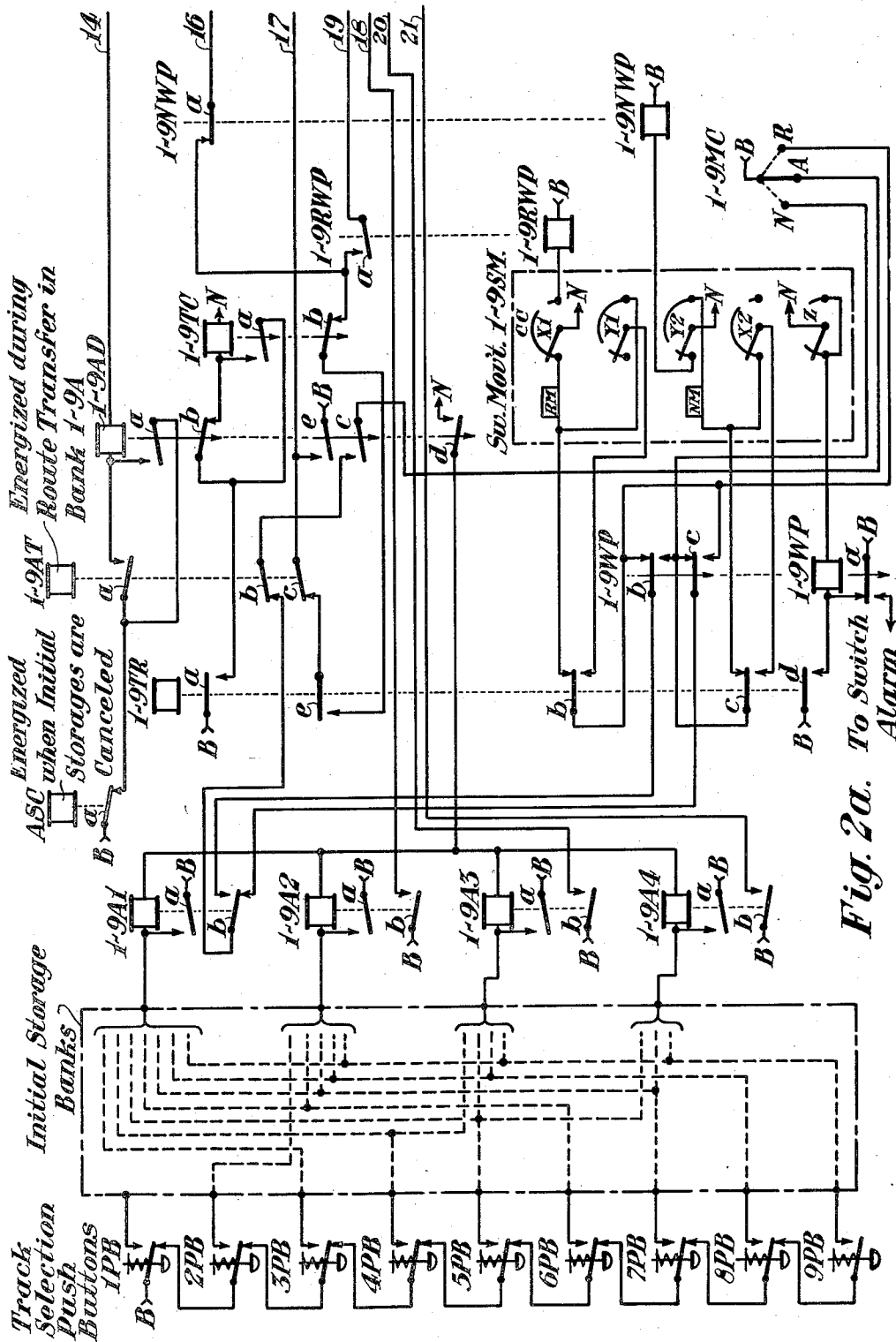


Fig. 2a. To Switch Alarm

Dec. 9, 1958

J. R. GEORGE ET AL
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7 Sheets-Sheet 3

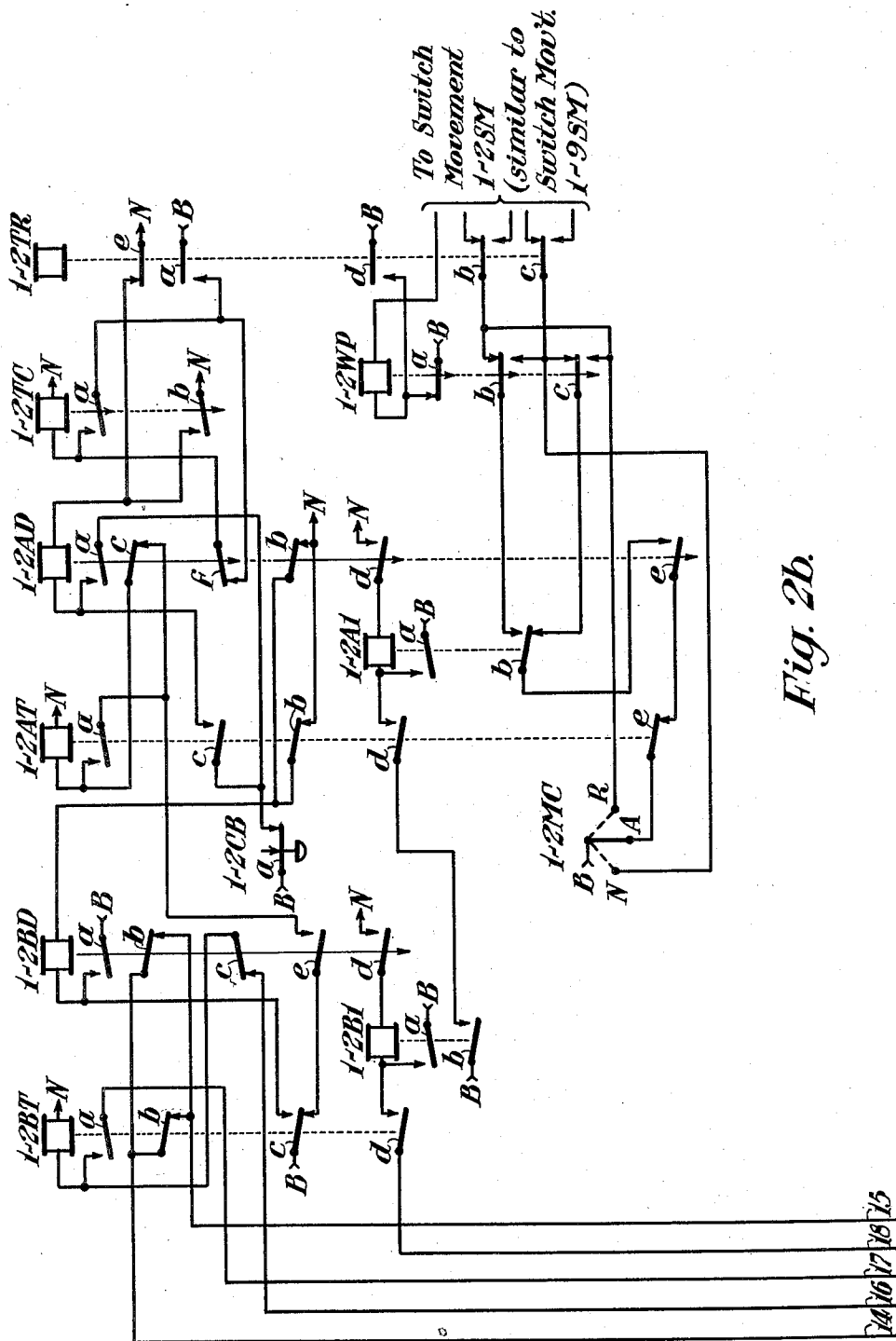


Fig. 2b.

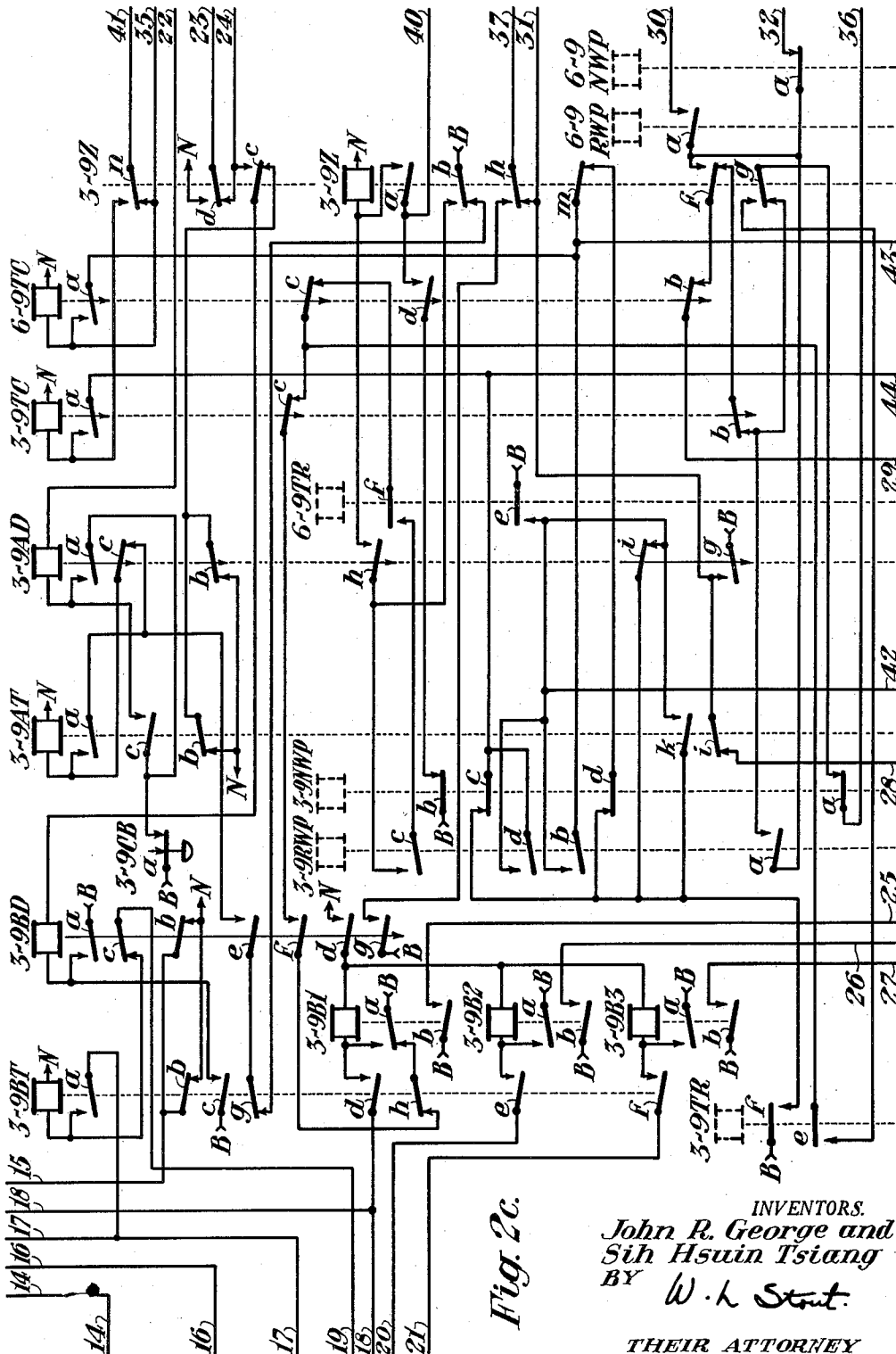
Dec. 9, 1958

J. R. GEORGE ET AL
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2,863,992

Filed June 18, 1956

7 Sheets-Sheet 4



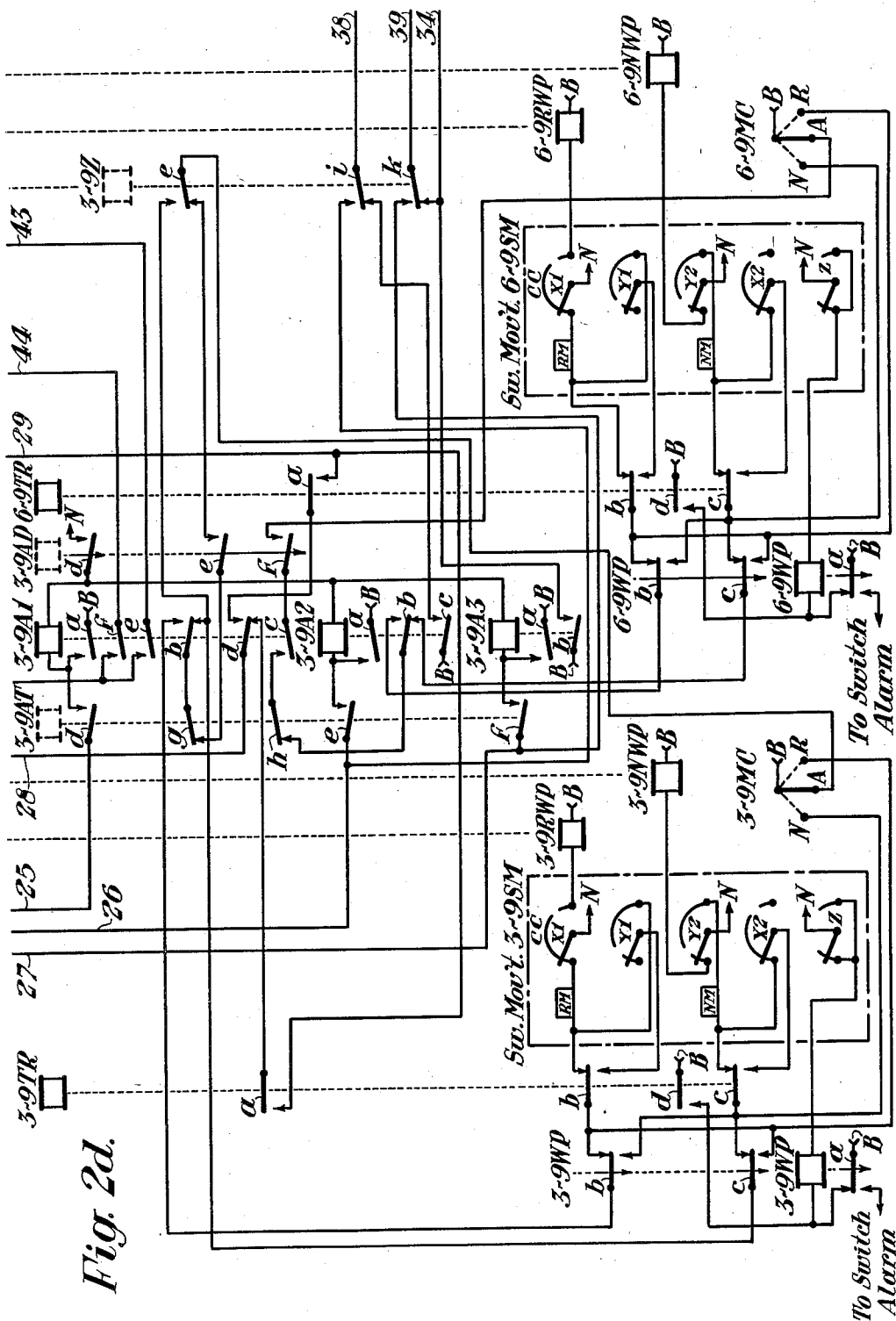
Dec. 9, 1958

J. R. GEORGE ET AL
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2,863,992

Filed June 18, 1956

7 Sheets-Sheet 5



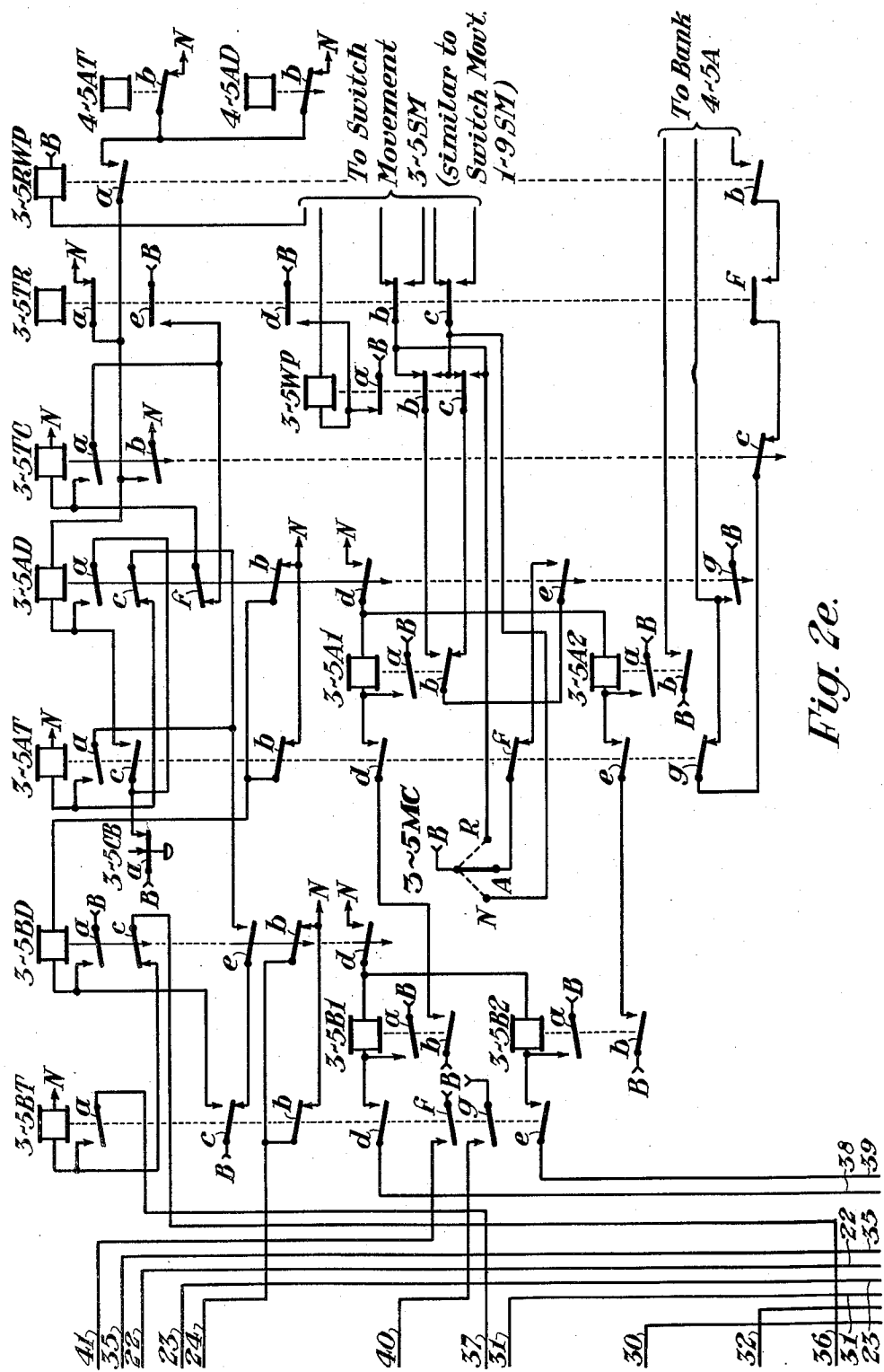
Dec. 9, 1958

J. R. GEORGE ET AL
AUTOMATIC CONTROL OF RAILWAY CLASSIFICATION
YARD TRACK SWITCHES

2,863,992

Filed June 18, 1956

7 Sheets-Sheet 6



Dec. 9, 1958

J. R. GEORGE ET AL
AUTOMATIC CONTROL OF RAILWAY CLASSIFICATION
YARD TRACK SWITCHES

2,863,992

Filed June 18, 1956

7 Sheets-Sheet 7

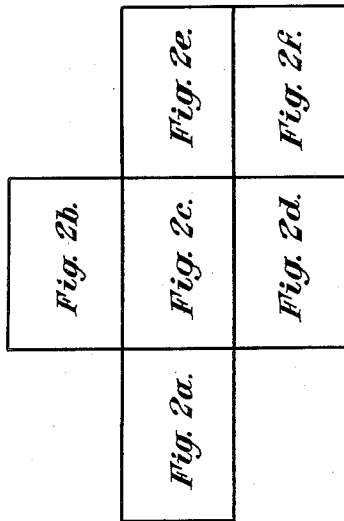
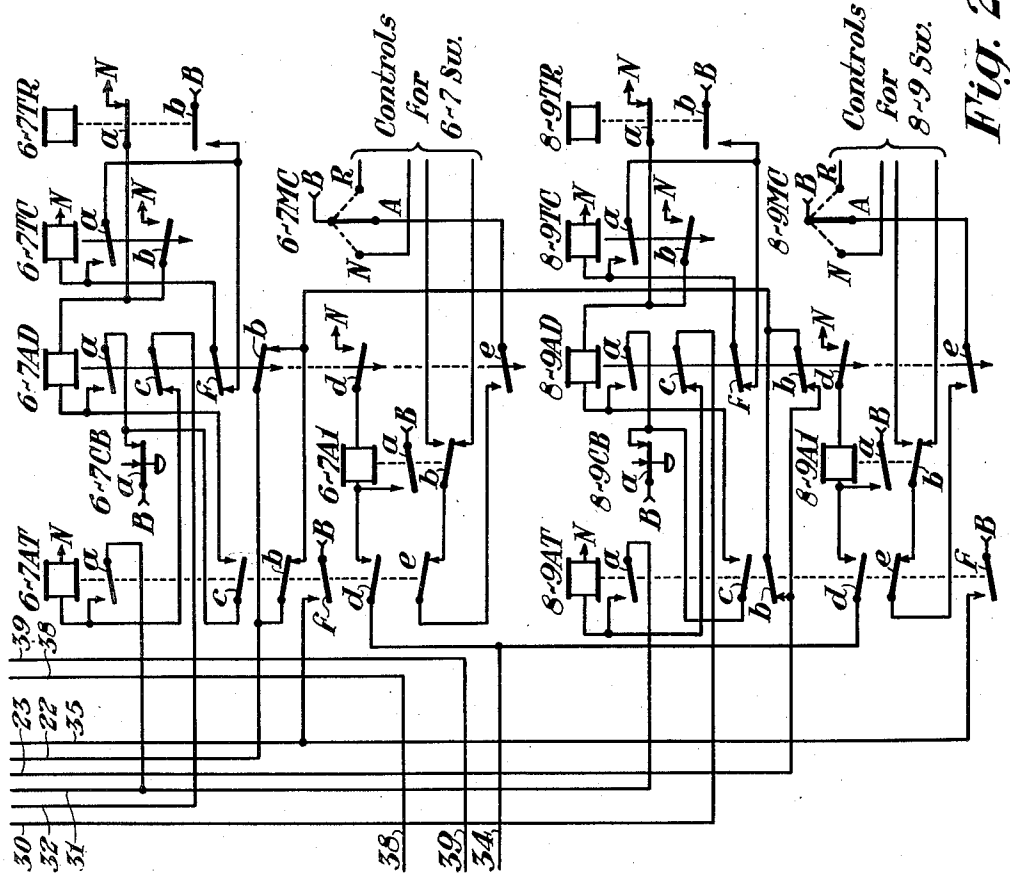


Fig. 3.



1

2,863,992

AUTOMATIC CONTROL OF RAILWAY CLASSIFICATION YARD TRACK SWITCHES

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Application June 18, 1956, Serial No. 592,198

14 Claims. (Cl. 246—2)

Our invention relates to the automatic control of railway classification yard track switches and more particularly to an improved means of transferring preselected switch controls from one switch location to the succeeding switch location along the route to be followed by the corresponding cars, this improved transferring means being particularly adaptable in yards including lap switch arrangements.

Our invention is an improvement on the system shown in the copending application for Letters Patent of the United States, Serial No. 355,281, filed May 15, 1953 by Benjamin Mishelevich for the Automatic Control of Railway Classification Yard Track Switches.

A railway classification yard is a group of railway tracks wherein a single track, preferably leading from a hump or hill, diverges into a large number of storage tracks through suitable track switches. In such a yard, railway cars, either singly or in multiple car groups or cuts, are allowed to run down the hump in close succession with each car or cut of cars being directed to a particular storage track in accordance with its eventual destination. Since in practice a large number of such cuts of cars follow each other off the hump in close succession, it has been found advantageous in the operation of such classification yards to have an automatic control system for the various track switches by which the cars are routed to a proper storage track. Such automatic control systems are known in the art as is evidenced by the previously mentioned copending application, Serial No. 355,281.

In the operation of the automatic control systems formerly used, some disadvantages have been encountered, particularly in those yards having one or more lap switch arrangements. For example, an occasional double transfer of route storages occurs due to close spacing of cuts of cars and the physical layout of the lap switches. This results in the misrouting of some of the following cuts of cars until the error can be rectified by the operator of the yard. A second disadvantage encountered is the unnecessary delay in the transfer of route storages from the lap switch storage units when a succeeding route storage is to be transferred along the route which includes only the first switch of the lap arrangement. It would be advantageous, under this situation, if the second storage may be transferred direct to the next switch location without cascading into the final storage bank associated with the lap switch arrangement. Thus to assure a high humping rate, that is, the handling of cuts of cars close together, it is advantageous in the operation of a classification yard to assure rapid transfer of route storages through the automatic control

2

system but at the same time to prevent any double transfer of these storages during the passage of a single cut over any particular switch, particularly a lap switch arrangement.

Accordingly, it is an object of our invention to provide an improved system of automatic control of railway classification yard track switches.

Another object of our invention is to provide such an automatic switching system which permits cars to be handled close together in the yard without delaying the transfer of the route storages between switch locations.

A further object of our invention is to provide such an automatic switching system in which a double transfer of route storages during the passage of a single cut of cars over a particular switch is prevented.

Still another object of our invention is to provide such a switching system in which the route storage unit associated with a lap switch arrangement may at times function as two separate storage units.

It is also an object of our invention to provide a switching system which permits simultaneous transfer of two separate and distinct route storages along two separate routes diverging from a single lap switch location.

Still another object of our invention is to provide a switching system in which a second and therefore improper transfer of a route storage during a single occupancy of a switch detector circuit is prevented.

Another object of our invention is to provide an improved automatic switching system in which each occupancy of a switch detector circuit by a car transfers only one route storage and in which a succeeding route storage may be transferred directly from a preceding storage bank of the storage unit if the transfer of the leading route storage from the final bank is delayed.

Other objects and features of our invention will be obvious as the specification progresses.

In practicing our invention, we first provide a transfer control relay in conjunction with the storage unit associated with each switch location. This transfer control relay is energized when a route storage is transferred from that storage unit, that is, from the final bank of that storage unit, to the initial storage bank in the corresponding storage unit associated with the next switch along any of the possible routes. Once energized, this transfer control relay prevents the transfer of a route storage. In the storage unit associated with a lap switch arrangement, that is, with both switches of such an arrangement, special circuits are provided which hold the transfer control relay energized after the initial route transfer regardless of the sequence of events until that particular cut of cars clears the entire switch location. In other words, regardless of the sequence of release or reenergization of the detector track relays associated with the lap switches or of the immediate transfer into the unit of succeeding route storages, the transfer control relay is held energized to prevent another route storage transfer from the unit until the cut of cars is completely clear of all of the detector circuits associated with the lap switches. At this time, it is permissible to release the transfer control relay and permit a second transfer when the next cut arrives.

Secondly, in practicing our invention, we provide a circuit arrangement at the same storage unit associated with the lap switches which allows certain route transfers to be made direct from a preceding storage bank without

3

these routes cascading into the final storage bank. These circuits are effective when a first cut is following a pre-selected route which requires it to traverse both switches of the lap arrangement while a second or following cut is so routed as to traverse only the first switch of the lap arrangement. Under these conditions, an auxiliary relay is energized which disconnects the single switch route transfer controls from their normal channels and connects them to certain auxiliary channels provided as part of our invention. This reconnection permits the second route storage to be transferred direct from the preceding bank to the storage unit associated with the next switch along the route including only the first switch of the lap arrangement. As will appear in the following description, these two improvements allow a rapid and accurate transfer of all route storages along the proper channel of flow.

We shall now describe one form of an automatic control system for classification yard track switches embodying our invention and then point out the novel features thereof in the appended claims.

In the accompanying drawings, Fig. 1 is a partly diagrammatic, partly schematic view of a railroad classification yard equipped with an automatic switching system embodying the details of our invention.

Figs. 2a to 2f show diagrammatically the control circuits of the automatic switching system for the classification yard of Fig. 1.

Fig. 3 is an assembly diagram for the various parts of Fig. 2.

In each of the drawings similar reference characters refer to similar parts of the apparatus. It is also pointed out at this time that a suitable source of control energy is provided for the control circuits of Fig. 2, this power source being preferably a battery of proper voltage and capacity. However, for the sake of simplicity, this power source is not shown in the drawings, its positive and negative terminals being identified by the conventional reference characters B and N, respectively. Also, the contacts of slow acting relays are identified in a conventional manner by the use of vertical arrows thereon, the direction of the arrows indicating the direction in which the relays are slow in operating.

Referring now to Fig. 1, there is shown in this drawing in a conventional manner a nine track railroad classification yard. Cuts of cars enter this yard from the hump over the single track at the left of the drawing. This single track diverges through the various switches into the nine storage or classification tracks which are numbered 1 to 9 from the top to the bottom of the drawing, respectively. The cuts of cars being classified are routed into the selected storage track by the various switches. It will be considered throughout this specification that a switch which is positioned to divert cars traversing it to the left-hand lead is in its normal position while a switch positioned to divert cars to the right-hand lead is considered to be in its reverse position. In the conventional form used in Fig. 1, the switches are shown in the simplest manner possible. The switches are designated by the reference character SW prefixed by a hyphenated number which indicates the storage tracks to which that switch leads. For example, the initial switch in the yard is designated by the reference character 1—9SW to indicate that it leads to, or controls the routes to, storage tracks 1 to 9, that is, all of the tracks in the yard. As another example, the next switch which a car traverses if it passes over switch 1—9SW in its normal position is the switch designated by the reference character 1—2SW which indicates that this latter switch controls the routes to storage tracks 1 and 2. The significance of the reference characters designating the remaining switches in this yard will now be obvious from this preceding explanation.

Each switch in this classification yard is provided with a power operated switch movement which controls the

4

positioning of the switch points to their normal or reverse positions. These switch movements are not shown in this particular figure of the drawings as any well known type of switch movement may be used. A specific type will be discussed hereinafter in connection with the actual circuit details to provide a specific showing of switch control. It is to be understood that these power operated switch movements are controlled to operate the switch to the desired position according to the preselected routes which flow through the automatic switching system embodying our invention with which this classification yard is equipped. It is to be further understood that the system of our invention may be applied to railroad classification yards having any desired number of storage tracks and is not limited to the particular size yard of nine tracks shown in Fig. 1 of the drawings.

Each switch of this classification yard here shown is also provided with a detector track section. These sections are set off by insulated joints from the remainder of the rails of the various tracks, these insulated joints being shown in a conventional manner by the heavy lines at right angles to the conventional single line representing the railroad track. Each detector track section is designated by the reference character T prefixed by a hyphenated number corresponding to the similar number associated with the switch reference. For example, track section 1—9T is associated with the initial switch in the yard, switch 1—9SW. Each of these detector track sections is further provided with a track circuit which includes a power source, the rails of the section, and a track relay. In the conventional showing used herein, only the track relay connections to the rails are shown, this being indicated by the dotted line between the single line track symbol and the symbol for the corresponding track relay. Each of the track relays is designated by the reference character TR prefixed by a hyphenated number which corresponds to that for the track section which in turn corresponds to the numerical designation of the corresponding switch. As an example, track relay 1—9TR is associated with track section 1—9T which in turn is associated with the initial switch 1—9SW. Any type of well known track circuit may be used to provide this detector track circuit. For purposes of this explanation, it will be considered that the track relays are normally energized when no car is occupying any portion of the associated track section. These track relays are also shown in Fig. 2 in connection with the detailed circuit arrangements but the showing in this latter figure is of the relay winding and contacts only without any of the operating circuits which are shown conventionally here in Fig. 1.

Two of the switches shown in this classification yard, namely switches 3—9SW and 6—9SW, comprise what is known in the art as a lap switch arrangement. Such an arrangement is employed where it is desired to conserve space. The construction of a lap switch is such that the switch points of the second switch in the layout, in this case switch 6—9SW, fall between the switch points and the frog of the first switch, here switch 3—9SW. In connection with such a switch layout, there is provided a special track circuit arrangement to assure the proper detection for the control of the two lap switches. This track circuit arrangement may be as is fully shown and described in Letters Patent of the United States, No. 1,797,561, issued to Howard A. Thompson on March 24, 1931, for Railway Traffic Controlling Apparatus. A similar track circuit arrangement is also shown in the previously mentioned copending application, Serial No. 355,281. However, other arrangements which provide equivalent operation are well known in the art and for the purpose of understanding the system of our invention it is sufficient to show the track circuits for the lap switch arrangement including switches 3—9SW and 6—9SW as illustrated conventionally in Fig. 1.

Switch 3—9SW is provided with a detector track section 3—9T which is set off in the usual manner by in-

5

insulated joints and is further divided by other insulated joints into two subsections *a* and *b*. The track circuit arrangement for this track section is so arranged that track relay 3—9TR is released when any portion of a railroad car is occupying either subsection *a* or subsection *b* with switch 3—9SW in either of its two positions. A similar detector track section 6—9T is provided for the second switch 6—9SW. This latter track section is set off by the usual insulated joints as illustrated and is further subdivided into two subsections *b* and *c*. The track circuit arrangement for this section 6—9T includes track relay 6—9TR and is so arranged that this track relay is released when any portion of a railroad car occupies subsections *b* or *c* with either switch in either of its two positions. It is to be seen therefore that subsection *b* forms a portion common to both these track sections and is usually known as the overlap section. Further, a portion of the rails in the turnout over switch 3—9SW in its normal position is also a part of the track circuit for section 6—9T, as indicated by the dotted connection 11. This subsection *d* becomes a part of the section 6—9T due to the mechanical construction of such lap switch arrangements. The inclusion of subsection *d* in the detector track circuit for the second switch of the lap arrangement is unavoidable without certain insulation measures which entail considerable additional expense. Since this expense is not warranted, the operation of the track circuits is such that when any portion of a railroad car occupies subsection *d*, track relay 6—9TR is released. However, our invention, as will appear hereinafter, is designed to overcome any disadvantages resulting from this track circuit arrangement. It is to be understood that the over-all arrangement at these lap switches is such that track relay 3—9TR is not released when a car is occupying only the aforementioned subsection. *d*.

Fig. 1 also includes a flow chart to illustrate the progression of the route storages in the automatic switching system as they are transferred throughout the circuit arrangements to control the various switches along the pre-selected routes. This progression path is here illustrated as the dot, dash line with the lettered blocks representing the route storage banks associated with the various switches. Each of the storage units associated with the lap switches and with switches 1—2SW and 3—5SW comprise two storage banks. Each of the other storage units shown comprises but a single storage bank. However, as will be more fully explained hereinafter, the storage unit associated with initial switch 1—9SW is assumed to include more than one storage bank but only the final bank A is shown as this is sufficient for an understanding of our invention.

In general, the route storages are initiated in the track selection push button panel and progress as discussed in the previously mentioned copending application into storage bank 1—9A associated with the initial switch location. From here, each route storage is transferred as the corresponding cut of cars progresses throughout the yard to the storage units associated with the track switches which must be traversed by that corresponding cut of cars. For example, for a cut of cars being routed to track 9, the route storage would be initiated in the push button bank and transfer eventually into bank A at switch 1—9SW. As the corresponding cut of cars occupies detector track section 1—9T, this route storage is transferred into storage bank B of the storage unit 3—9 associated with the lap switch arrangement. When the route storage is transferred into bank A at this location, the switches are properly positioned. When the corresponding cut of cars occupies the detector track sections, the route storage is transferred to storage bank 8—9A associated with switch 8—9SW. Switch 8—9SW is then properly positioned to route this cut of cars into track 9. When that cut eventually occupies detector track section 3—9T, the route storage in bank 8—9A is cancelled.

6

The transfer of storages along other routes is similar and is obvious from the preceding description and the drawing. It may be noted that, in transferring a route storage from storage unit 3—9 to storage unit 3—5, an alternate route from bank B of unit 3—9 to bank B of unit 3—5 is available. This alternate route is provided by our invention and will be more fully discussed hereinafter.

Referring now to Figs. 2a to 2f, inclusive, these drawings, when arranged in accordance with the chart shown in Fig. 3, show the major portion of the automatic switching system for the classification yard illustrated in Fig. 1. The circuit arrangement for this automatic switching system as shown in the various parts of Fig. 2 embody the circuits of our invention. Further, this system as shown includes a sufficient number of the storage banks illustrated in the route storage flow chart of Fig. 1 to provide an understanding of the complete system and of our invention. In addition to the circuits within the storage banks, the necessary connections between the storage banks are provided to allow transfer of the route storages throughout the system.

The control panel for the classification yard, by which the operator of the yard selects the proper storage track for each cut of cars moving over the hump, is represented by the push buttons at the extreme left of Fig. 2a. Each of these nine push buttons is designated by a reference character PB prefixed by a number corresponding to the storage track with which that particular push button is associated. In other words, the operation of push button 1PB establishes a route selection to storage track 1 of the yard, whereas the operation of push button 6PB, for example, establishes a similar route to storage track 6. The proper route is selected by the operator pushing the correct push button as the corresponding cut of cars moves over the hump. It is to be noted that the circuit arrangement is such that only one push button is effective at any one time. In other words, if two push buttons are inadvertently operated simultaneously, the lower numbered one of the pair establishes the route selection.

Except for the switch control circuits in the lower right of Fig. 2a, the remaining circuits in this particular drawing comprise the storage unit 1—9 associated with the leading switch of the yard, switch 1—9SW. For purposes of this description, it may be assumed that this storage unit consists of three storage banks A to C, although a greater or less number of banks may be used. However, for the purpose of understanding our invention, it is necessary to show the details only of the final bank of this unit, that is, bank A of the initial storage unit. Thus, there is illustrated in Fig. 2a the switch control storage relays 1—9A1 to 1—9A4, inclusive, a storage transfer relay 1—9AT, a storage detector relay 1—9AD, and the transfer control relay 1—9TC, all of which are included in storage bank 1—9A associated with the leading switch 1—9SW. The switch control storage relays are energized in different combinations as determined by the operation of the various route selection push buttons as previously discussed. However, the circuit arrangements by which these relays are energized are not part of our invention. It may be assumed that these circuit details are identical to the circuit arrangement by which the similar relays shown in the previously mentioned copending application, Serial No. 355,281, are energized. For the sake of simplicity, these circuits are shown in a conventional manner by the dotted lines inside the dot dash rectangle used to represent the initial storage banks of the present system, that is, storage banks C and B of the storage unit associated with the leading switch. Reference is made to this copending application for a complete description and showing of these circuits. The circuit arrangement is also shown in the instruction pamphlet Manual 517, entitled "Union Automatic Switching for Classification Yards," and published by the Union Switch & Signal, Division of Westinghouse Air Brake Company in January 1953.

For purposes of the present description, it is sufficient to understand that in this initial storage bank 1—9A there must be one switch control storage relay for each switch in the route having the maximum number of track switches. In the yard illustrated in Fig. 1, the maximum number of track switches in any route is four. Thus four switch control storage relays are required in storage bank 1—9A associated with the leading switch. Throughout the specification, it will be assumed that when a switch control storage relay is energized, the corresponding switch in whatever route has been selected will be operated to its reverse position. If it is desired that a switch be operated to its normal position, the corresponding switch control storage relay will remain de-energized in the combination for that route. Examination of the yard shown in Fig. 1 will determine that the route to track 1 passes over switch 1—9SW and switch 1—2SW, both in their normal position. Thus for the route selection to track 1, no switch control storage relay need be energized and the conventional dotted line circuit connections shown in Fig. 2a are so arranged that none of the relays 1—9A1 to 1—9A4 are energized when push button 1PB is operated. Correspondingly, the route to track 9 passes over switches 1—9SW, 3—9SW, 6—9SW, and 8—9SW, each in its reverse position. Thus each of the switch control storage relays in bank A at the leading switch must be energized to establish the route combination to track 9. The conventional circuit arrangement in the initial storage banks is so connected that the operation of push button 9PB energizes each of the relays 1—9A1 to 1—9A4, inclusive. From this description, the energized combinations required to establish routes to the various other storage tracks may be determined from a study of the yard layout of Fig. 1 and the circuit arrangement of the initial storage banks.

Transfer relay 1—9AT, the operating winding of which is shown in Fig. 2a, is energized during the transfer of a route storage into bank 1—9A. Since the actual energizing circuit for this relay forms no part of our invention, it is sufficient to understand only that this relay is energized when the route selection transfers into the corresponding bank, and that the relay releases immediately upon completion of the transfer action. Again this operation is identical to that described for the similar relay in the previously discussed compending application or Manual 517.

Storage detector relay 1—9AD must be energized in order to retain a route storage in bank 1—9A. This is accomplished by a circuit which may be traced from terminal B over back contact *a* of cancellation relay ASC, which is energized when the initial storages are cancelled by the operator, front contact *a* of relay 1—9AT, the winding of relay 1—9AD, wire 14, back contacts *b* in multiple of relays 1—2BT and 1—2BD (Fig. 2b), wire 15, and back contacts *b* in multiple of relays 3—9BT and 3—9BD (Fig. 2c) to terminal N. When relay 1—9AD picks up, the closing of its front contact *a* completes a stick circuit which by-passes front contact *a* of relay 1—9AT in the previously traced energizing circuit so that relay 1—9AD remains energized when transfer relay 1—9AT releases upon completion of the transfer action. Back contacts *b* of the transfer and detector relays in the succeeding storage banks shown in Figs. 2b and 2c assure that relay 1—9AD will be deenergized each time that a route storage is transferred to any succeeding switch location.

It is also to be noted at this time that the energizing circuits for switch control storage relays 1—9A1 to 1—9A4, inclusive, are completed only when relay 1—9AD picks up to close its front contact *d*. Also, the stick circuits for such of the switch control storage relays as may be energized are completed over front contact *a* of the energized switch control storage relay and front contact *d* of relay 1—9AD. Thus the switch control storage relays are retained in their existing energized combination

until the storage detector relay is released upon completion of the transfer of the route storage to a succeeding storage bank.

The transfer control relay 1—9TC is provided in bank 1—9A to assure that only one route storage transfer from bank 1—9A occurs during each occupancy of the detector track circuit associated with the leading switch. Relay 1—9TC is energized when track section 1—9T is occupied through a circuit traced from terminal B over back contact *a* of relay 1—9TR, back contact *b* of relay 1—9AD, and the winding of relay 1—9TC to terminal N. Thus it is to be seen that relay 1—9TC is energized upon the release of the detector track relay and the storage detector relay when the route storage is transferred. When relay 1—9TC picks up, the closing of its front contact *a* completes a stick circuit which by-passes back contact *b* of relay 1—9AD so that the transfer control relay remains energized as long as the detector track section is occupied by the cut of cars. As will become apparent later in the description, the storage transfer relays in the succeeding storage banks cannot be energized while the transfer control relay is picked up so that its back contacts are open.

Track switch 1—9SW is provided, as is each of the other track switches in the classification yard of Fig. 1, with a switch movement SM which may be of any suitable type. These switch movements are herein shown and described as being of the direct acting, electropneumatic type such as is shown and described in detail in Letters Patent of the United States, No. 2,092,828 granted to Herbert L. Bone on September 14, 1937. Associated with each of the switch movements in the yard is a normal and a reverse switch repeater relay such as relays 1—9NWP and 1—9RWP, respectively, associated with switch movement 1—9SM shown in Fig. 2a. These relays serve to govern the various route selection circuits for cascading the route storages through the proper storage units in accordance with the routes preselected by the operator of the yard.

A switch restoring relay such as relay 1—9WP is associated with each switch movement. This relay is arranged to operate in such a manner that the relay functions to restore the switch to its original position in case the switch points do not complete their operation within a specified time due to an obstruction at one of the switch points. In order to provide manual control of the various switches at times when it may be desirable such as during trimming operations, a three position switch control lever is associated with each switch movement, such as lever 1—9MC shown in Fig. 2a associated with switch movement 1—9SM. When this lever is positioned in its center position designated by the letter A, circuits are completed for governing the operation of the switch movement automatically in accordance with the route descriptions in the system. When the switch lever is moved to one or the other of the two extreme positions designated by the letters N and R, respectively, the switch movement is operated to its normal or reverse position in accordance with the position of the lever provided that a car or cut of cars is not occupying the detector track section including that switch.

Each of the switch movements shown in Fig. 2 is provided with a normal magnet NM, a reverse magnet RM, and a circuit controller CC having a plurality of contacts. When normal magnet NM is energized, the switch movement operates to position the switch points in their normal position. Correspondingly, when reverse magnet RM is energized, the switch movement positions the switch points in their reverse position. The contacts of the circuit controller CC are of three types, X, Y, and Z, respectively, there being two type X and two type Y contacts in each circuit controller. These contacts are illustrated schematically in the drawings and as shown are occupying their normal position, that is, the position which they occupy when the switch points are in

their normal position. The type X contacts are so arranged that during the movement of the switch points the contact remains closed in its left-hand or normal position until the switch points are within a short distance, for example, one-half inch of the reverse position. The normal contact then opens and the right-hand or reverse contact is closed when the switch points are within one-quarter inch, for example, of their reverse position. The type Y contacts are so arranged that circuit is closed to the left terminal when the switch points are in their normal position and become open when the switch points move to a position one-quarter inch from the normal. Type Y contacts are made to the right terminal when the switch points reach a position one-half-inch from the normal position and remain closed during the movement to and including the reverse position. The type Z contacts are closed to the left or right terminal when the switch points are within one-quarter inch of their normal or reverse position, respectively. The use of these contacts of the circuit controller will appear shortly.

Using switch movement 1—9SM as an example, we shall now describe how the various switches are operated to their opposite positions. It is assumed that switch 1—9SW is occupying its normal position as shown in the drawings and the circuit controller contacts are therefore shown in their normal or left-hand position. If the route stored in the switch control storage relays in bank 1—9A designates a route over switch 1—9SW in its reverse position, a circuit will be completed from terminal B at lever 1—9MC which may be traced over this lever in its A position, as shown solid in the drawings, front contact *c* of relay 1—9AD, back contact *b* of relay 1—9AT, front contact *b* of relay 1—9A1, front contact *b* of relay 1—9WP, front contact *b* of relay 1—9TR, reverse magnet RM, and circuit controller normal contact X1 to terminal N. Energizing reverse magnet RM causes the switch movement to operate the switch points to their reverse position. When the switch points reach a position approximately one-half inch from reverse, normal contact X1 opens and reverse magnet RM is deenergized. However, the switch movement continues until the switch points are closed in the reverse position at which time reverse contact X1 closes, completing an obvious circuit for energizing relay 1—9RWP. Relay 1—9NWP, which was originally energized by an obvious circuit including circuit controller contact Y2 closed in its normal position, is deenergized shortly after the movement of the switch points begins. A similar circuit for energizing normal magnet NM may be traced over lever 1—9MC and contacts of relays 1—9AD and 1—9AT, and thence over back contact *b* of relay 1—9A1, front contacts *c* of relays 1—9WP and 1—9TR, normal magnet NM, and circuit controller contact Y2 closed in its reverse position to terminal N.

Switch restoring relay 1—9WP is normally energized by its stick circuit traced from terminal B over front contact *a* and the winding of relay 1—9WP and either normal or reverse contact Z of the circuit controller to terminal N. This stick circuit is interrupted during the movement of the switch points from their normal to reverse positions or vice-versa and is re-established when the switch points are within a quarter inch of the full movement. However, relay 1—9WP has slow release characteristics and will hold its front contacts closed during this open circuit period of contact Z of the circuit controller. However, if the switch points are prevented by some obstruction from reaching either the full normal or full reverse position during the movement, relay 1—9WP will eventually release, opening its front contacts and closing its back contacts. This will interrupt, for example, at front contact *b* of relay 1—9WP, the circuit previously traced for energizing reverse magnet RM. At the same time, however, closing of back contact *b* completes a circuit which may be

traced from that point over front contact *c* of relay 1—9TR through normal magnet NM and reverse contact Y2 to terminal N. This energizes normal magnet NM and causes the switch movement 1—9SM to operate the switch points back to their normal position. The closing of back contact *a* of relay 1—9WP energizes a switch alarm which indicates to the operator that the switch has failed to complete its movement to the desired position and allows him to take such action as is appropriate to correct the condition. If the switch points are prevented from occupying their normal position, the release of relay 1—9WP and the opening of its front contact *c* interrupts the circuit for energizing normal magnet NM and completes over back contact *c* and front contact *b* of relay 1—9TR a circuit for energizing reverse magnet RM which causes the switch points to be returned to their reverse position. In either case, relay 1—9WP is not reenergized until the detector track section 1—9T is occupied, releasing relay 1—9TR to close its back contact *d* which completes an obvious circuit for reenergizing relay 1—9WP.

The switch control circuits shown here provide for continuing the movement of the switch points if the detector section is occupied prior to the completion of the switch movement. For example, if reverse magnet RM is energized over the circuit previously traced and the switch points have moved at least one-half inch from their normal position when track section 1—9T is occupied by a cut of cars, the release of relay 1—9TR transfers the control circuit for reverse magnet RM from front contact to back contact *b* of relay 1—9TR and thence through reverse contact Y1 of circuit controller CC, reverse magnet RM, and normal contact X1 of circuit controller CC to terminal N. A similar circuit including back contact *c* of relay 1—9TR and normal contact X2 of the circuit controller may be traced for energizing normal magnet NM to cause the movement of the switch points to their normal position to continue when track section 1—9T is occupied. Thus in either case, if the switch points have moved at least one-half inch from their former position in their progress towards the opposite position, the movement of the switch points will continue even though the cut occupies the detector track section. If the cut of cars occupies the track section prior to the switch points moving the one-half inch from their former position, the corresponding magnet is deenergized and the switch points are returned to their former position by spring action within the switch movement.

If it is desired to control one of the track switches manually, this may be accomplished by moving the corresponding control lever MC to the extreme position associated with the switch position which it is desired to establish. For example, switch 1—9SW may be controlled to its reverse position manually by operating lever 1—9MC to its extreme right-hand or reverse position R. If the switch is already occupying its normal position as shown, a circuit is then established from terminal B over the control lever in its reverse position, front contact *b* of track relay 1—9TR, reverse magnet RM, and normal contact X1 of circuit controller CC to terminal N. The switch movement then operates the switch points to their reverse position upon the completion of which the relay 1—9RWP is energized and picks up. Correspondingly, this switch may be moved manually to its normal position by operating lever 1—9MC to its extreme left or normal position N, thus establishing a circuit from terminal B over the lever in this position N, front contact *c* of track relay 1—9TR, normal magnet NM, and reverse contact Y2 of circuit controller CC to terminal N. The switch movement 1—9SM then operates the switch points to their normal position causing the normal repeater 1—9NWP to be energized upon the completion of the movement.

Associated with each of the other track switches shown in the yard layout of Fig. 1 is a route storage unit simi-

lar to that discussed in connection with storage bank 1—9A associated with the initial switch of the yard. For example, in Fig. 2b, there is shown the storage unit 1—2 associated with track switch 1—2SW, this storage unit consisting of two storage banks 1—2B and 1—2A. Bank B at this location includes transfer relay 1—2BT, storage detector relay 1—2BD, and a single switch control storage relay 1—2Bi. Bank A correspondingly includes transfer relay 1—2AT, detector relay 1—2AD, switch control storage relay 1—2Ai, and transfer control relay 1—2TC. This unit also has associated therewith track relay 1—2TR, only the operating winding of which is shown, the control circuits having been previously discussed in connection with Fig. 1. The switch movement 1—2SM which operates or controls track switch 1—2SW is not shown since it is identical with the similar switch movement 1—9SM already discussed. In connection with this switch, only the switch restoring relay 1—2WP, the control lever 1—2MC, and that portion of the control circuits which include the control lever and contacts of relays 1—2WP and 1—2TR are shown, as it is believed that this is sufficient for an understanding of our invention and that the remainder of these control circuits may be understood by referring to the circuit arrangement for switch movement 1—9SM.

The storage unit 3—9 associated with lap switches 3—9SW and 6—9SW is shown in Figs. 2c and 2d. There are two storage banks in this storage unit, banks 3—9B and 3—9A. In connection with the circuit arrangement at the lap switches, both of the switch movements 3—9SM and 6—9SM associated with the correspondingly designated switches are shown including the complete control circuits. The relays in the storage banks at this location including the switch control storage relays are similar to those already discussed in connection with bank 1—9A associated with the leading switch and the utility of these relays will be apparent from the drawings when taken in connection with operational description to follow. In addition, in this storage unit, a second transfer control relay 3—9TC and an auxiliary relay 3—9Z are provided, the use for which will appear hereinafter. In Fig. 2c, the storage unit 3—5 associated with track switch 3—5SW is shown with its two storage banks 3—5B and 3—5A. The switching circuits for the transfer of the route storages are not continued beyond this location to the storage unit 4—5 associated with switch 4—5SW as these circuits are identical with those shown in connection with storage unit 1—2. The storage units associated with switches 6—7SW and 8—9SW are shown in Fig. 2f. These storage units each consist of a single bank only and in each case it is designated as the A storage bank. Each of the storage banks shown in Figs. 2c and 2f includes the usual transfer and detector relays and the switch control storage relays. As will be apparent in the following description, there is also included a transfer control relay with each storage unit and associated therewith is the corresponding track relay whose operating circuits were discussed in connection with Fig. 1.

With the rather brief preceding description of the apparatus generally provided in each of the storage units, it is believed that the automatic switching system embodying our invention may be best understood by a description of its operation under different conditions.

Description of operation

As shown in the drawings, the apparatus is in its at-rest condition. That is, no routes are stored in any of the storage banks and no cars are moving through the yard to any of the storage tracks. In addition, all of the track switches are assumed to be in their normal position with the control levers MC positioned in the center or automatic operation position A. Each of the NWP relays is thus energized and has its contacts picked up, that is, front contacts closed. The RWP relays cor-

respondingly are all deenergized with their contacts released. In addition, it will be noted that each of the track relays is energized and thus their contacts are picked up so that front contacts are all closed. Also, each of the switch restoring relays WP is likewise energized by its stick circuit. All other relays are deenergized and have their contacts released.

We shall now assume that the first cut of cars passing over the hump is destined to storage track No. 2. The yard operator thus pushes track selection push button 2PB to select the route of storage track 2 for this first cut of cars. It is obvious from the layout of the yard shown in Fig. 1 that the route to track 2 requires leading switch 1—9SW to be positioned normal and the second switch in that particular route, switch 1—2SW, to be positioned reverse. Thus the route stored in the switch control storage relays of the final or A storage bank associated with the leading switch must designate that the leading switch is to be positioned normal, that is, the switch control storage relay released, and the second switch positioned reverse, that is, the switch control storage relay energized. Thus, upon the operation of push button 2PB, circuits are established in the initial storage banks from terminal B over lower contact of push button 1PB, upper contact of push button 2PB, a circuit within the initial storage banks shown conventionally by a dotted line to the winding of relay 1—9A2 and thence over front contact *d* of relay 1—9AD to terminal N. As soon as it picks up, relay 1—9A2 establishes a stick circuit for itself at its own front contact *a*, this circuit also including front contact *d* of relay 1—9AD. It is to be understood, of course, that this route description is not stored in bank 1—9A until storage detector relay 1—9AD is energized. This relay is energized as soon as conditions are proper which will be indicated by relay 1—9AT closing its front contacts. A circuit may be traced from terminal B over back contact *a* of cancellation of relay ASC, front contact *a* of relay 1—9AT, the winding of relay 1—9AD, wire 14, back contacts *b* in multiple of relays 1—2BT and 1—2BD, wire 15, and back contacts *b* in multiple of relays 3—9BT and 3—9BD to terminal N. As previously discussed, relay 1—9AD, thus energized, picks up and closes its front contact *a* to complete a stick circuit which by-passes front contact *a* of relay 1—9AT, this latter relay releasing in the usual manner as soon as the transfer action is completed.

Since it was assumed that track switch 1—9SW was already in its normal position, no movement of the switch points is necessary to establish the first route over the leading switch. However, if this initial switch had been occupying its reverse position, the completion of the storage action in bank 1—9A would establish a circuit for energizing normal magnet NM of switch movement 1—9SM, which circuit may be traced from terminal B at control lever 1—9MC over this lever in its automatic position, front contact *c* of relay 1—9AD, back contact *b* of relay 1—9AT, back contact *b* of relay 1—9A1, front contact *c* of relay 1—9WP, front contact *c* of track relay 1—9TR, normal magnet NM, and reverse contact Y2 of circuit controller CC to terminal N. Thus, as soon as the switch is positioned properly for this initial route and prior to the arrival of the cut of cars at the detector track section, initial bank 1—9A is in the condition of having energized detector relay 1—9AD, switch control storage relay 1—9A2, and normal switch repeater relay 1—9NWP, as well as the normally energized switch restoring relay 1—9WP and track relay 1—9TR.

As this initial cut enters track section 1—9T, the track circuit is shunted and relay 1—9TR releases. This prepares a circuit for transferring the route designation to storage bank 1—2B which is the following bank along the designated route for this cut of cars. To transfer the route storage, transfer relay 1—2BT must

be energized and this circuit may be traced from terminal B at front contact *e* of relay 1—9AD over back contact *c* of relay 1—9AT, back contact *e* of relay 1—9TR, back contact *b* of relay 1—9TC, front contact *a* of relay 1—9NWP, wire 16, back contact *c* of relay 1—2BD, and the winding of relay 1—2BT to terminal N. Thus energized, relay 1—2BT picks up and establishes a stick circuit for itself including front contact *e* of relay 1—9AD, wire 17, and front contact *a* and the winding of relay 1—2BT. The closing of front contact *c* of relay 1—2BT completes the energizing circuit for relay 1—2BD which extends from terminal B at front contact *c* of relay 1—2BT through the winding of relay 1—2BD and back contacts *b* in multiple of relays 1—2AT and 1—2AD to terminal N. Relay 1—2BD picks up and completes a stick circuit for itself at its own front contact *a* which eliminates front contact *c* of relay 1—2BT from the initial pickup circuit.

Conditions are now established for transferring the actual route designation from the switch control storage relays of bank 1—9A to the similar relays in storage bank 1—2B. It will be noted that the initial switch control storage relay 1—9A1 of bank 1—9A controls the switch at the associated location, and thus the switch control stored in this relay is cancelled when the cut arrives at that switch and is not transferred to succeeding locations. In the present case, only one other switch control remains to be transferred, the switch control stored in relay 1—9A2. This control is transferred by energizing relay 1—2B1 through the circuit traced from terminal B over front contact *b* of relay 1—9A2, wire 18, front contact *d* of relay 1—2BT, the winding of relay 1—2B1, and front contact *d* of relay 1—2BD to terminal N. Upon picking up, relay 1—2B1 establishes a stick circuit at its own front contact *a* which also includes the relay winding and front contact *d* of relay 1—2BD. A route designation calling for switch 1—2SW reverse is now stored in bank 1—2B.

With both relays 1—2BT and 1—2BD picked up, the multiple path over back contacts *b* of these two relays is open thus deenergizing relay 1—9AD by interrupting its stick circuit. However, relay 1—9AD has slow release characteristics and the opening of its front contacts is delayed for a sufficient period to allow the route transfer to complete into bank 1—2B. Relay 1—9AD then releases, interrupting the stick circuit for the switch control relays of the initial bank and in the present case deenergizing relay 1—9A2 so that it immediately releases. The release of relay 1—9AD also completes the energizing circuit for transfer control relay 1—9TC, this circuit including back contact *a* of relay 1—9TR and back contact *b* of relay 1—9AD. Relay 1—9TC, thus energized, picks up and its front contact *a* completes a stick circuit which by-passes back contact *b* of relay 1—9AD, so that relay 1—9TC remains energized during the entire period that the initial cut of cars occupies track section 1—9T. The opening of back contact *b* of relay 1—9TC interrupts the energizing circuits for transfer relays 1—2BT and 3—9BT. Thus, as long as this initial cut occupies section 1—9T so that relay 1—9TR is released, no other route transfer can be initiated from bank 1—9A. Transfer control relay 1—9TC thus assures that only one route transfer can occur during the occupancy of the detector section 1—9T by any one cut of cars.

The opening of front contact *e* of relay 1—9AD interrupts the stick circuit previously traced for relay 1—2BT and this latter relay then releases. Closing of back contact *b* of relay 1—2BT completes again the energizing circuit for relay 1—9AD so that a second route destination may be transferred into bank 1—9A as soon as other conditions are proper. However, the transfer of a following route into this storage bank cannot affect the operation or the position of switch 1—9SW since switch movement 1—9SM is locked out at this

time due to the release of track relay 1—9TR to open its front contacts *b* and *c*. A more complete discussion of the operation of the apparatus for the following route storage will be considered shortly.

Meanwhile, since storage bank 1—2A is empty, a route transfer immediately occurs from bank B to bank A within the storage unit 1—2 shown in Fig. 2b. Relay 1—2AT is energized as soon as relay 1—2BT releases through the circuit from terminal B over back contact *c* of relay 1—2BT, front contact *e* of relay 1—2BD, back contact *c* of relay 1—2AD, and the winding of relay 1—2AT to terminal N. Relay 1—2AT picks up and the closing of its front contact *a* completes a stick circuit which is the same as the energizing circuit just traced with the exception that front contact *a* replaces back contact *c* of relay 1—2AD. Relay 1—2AD is now energized, the circuit including a normally closed contact *a* of cancellation button 1—2CB, front contact *c* of relay 1—2AT, the winding of relay 1—2AD and front contact *e* of relay 1—2TR. Relay 1—2AD picks up and completes a stick circuit for itself which is the same as the energizing circuit except front contact *a* of relay 1—2AD by-passes front contact *c* of relay 1—2AT. Cancellation button 1—2CB in these circuits is for the purpose of enabling the operator, if he so desires, to cancel the route stored in bank 1—2A prior to the arrival of the corresponding cut of cars at this location. This cancel button and the similar buttons associated with other final storage banks shown in the drawings are of the pull type, that is, the button must be pulled in order to open its contact *a* and likewise must be manually pushed in order to restore the contact to its closed position. With relays 1—2AT and 1—2AD both energized, a circuit is complete for energizing switch control storage relay 1—2A1 to transfer the route destination from bank B to bank A. This latter circuit is traced from terminal B over front contact *b* of relay 1—2B1, front contact *d* of relay 1—2AT, the winding of relay 1—2A1, and front contact *d* of relay 1—2AD to terminal N. A stick circuit for relay 1—2A1 includes its own front contact *a* and front contact *d* of relay 1—2AD. The designated route for the leading cut of cars is now stored in bank 1—2A associated with switch 1—2SW.

With both relays 1—2AT and 1—2AD picked up, the stick circuit previously traced for relay 1—2BD is interrupted at back contacts *b* of these two relays of bank A and relay 1—2BD thus is deenergized. However, this relay is slow enough in releasing so that its front contacts remain closed for sufficient time to allow the route transfer to be completed. The release of relay 1—2BD deenergizes relay 1—2B1 which releases to cancel the route storage in this particular bank. Release of relay 1—2BD also completes again the energizing circuit for transfer relay 1—2BT which prepares the way for the transfer of a succeeding route storage into bank 1—2B if appropriate. The release of relay 1—2BD also interrupts the stick circuit for transfer relay 1—2AT which then releases at this time.

Upon the release of relay 1—2AT, a circuit is completed for energizing reverse magnet RM of switch movement 1—2SM. This circuit is not completely shown as it is very similar to the circuits previously discussed in connection with switch movement 1—9SM. It is obvious from the drawing that the circuit for reverse magnet RM of switch movement 1—2SM includes the lever arm of control lever 1—2MC in its automatic position, back contact *e* of relay 1—2AT, front contact *e* of relay 1—2AD, front contact *b* of relay 1—2A1, and front contacts *b* of relays 1—2WP and 1—2TR. If switch 1—2SW was to be controlled to its normal position, the circuit for normal magnet NM would be similar to that just traced for the reverse magnet but would include back contact *b* of relay 1—2A1 and front contacts *c* of relays 1—2WP and 1—2TR. Under the present conditions, of course,

15

reverse magnet RM is energized and switch 1—2SW is moved to its reverse position.

When the leading cut enters detector section 1—2T, the track circuit is shunted and track relay 1—2TR releases. This deenergizes relay 1—2AD by interrupting its stick circuit at front contact *e* of the track relay. Relay 1—2AD, at the end of its slow release period, releases to cancel the route storage by interrupting, at front contact *d*, the stick circuit for relay 1—2A1. The release of relay 1—2AD completes the energizing circuit for transfer control relay 1—2TC, this circuit being traced from terminal B over back contact *a* of relay 1—2TR, back contact *f* of relay 1—2AD, and the winding of relay 1—2TC to terminal N. The closing of front contact *a* of relay 1—2TC completes a stick circuit for that relay which includes back contact *a* of relay 1—2TR, so that the transfer control relay remains energized and picked up during the entire time that the cut occupies the detector track section. The closing of front contact *b* of relay 1—2TC provides a second energizing circuit for relay 1—2AD so that any route stored in bank 1—2B may now be transferred into bank A at this location. This transfer action would be identical with that already described with the exception that front contact *b* of relay 1—2TC replaces front contact *e* of track relay 1—2TR in the energizing circuit for relay 1—2AD. Since relay 1—2TC holds until the track relay again picks up, relay 1—2AD cannot release and this second route storage is held in bank A. Thus relay 1—2TC assures that only one route cancellation can occur during each occupancy of detector track section 1—2T.

Returning now to the initial storage units shown in Fig. 2a, we shall assume that the second cut over the hump is destined to storage track 9. In other words, the route for the second cut requires that all switches over which it must pass in traveling to its storage track be in their reverse position. The yard operator pushes button 9PB to select this second route and when the conditions are proper, that is, relay 1—9AD is again energized over its previously traced circuit, this selected route transfers from push button 9PB through the initial storage banks and causes all of the switch control storage relays of bank 1—9A to become energized. In the conventional showing to the left of Fig. 2a, this circuit from terminal B includes the lower contacts of push buttons 1PB to 8PB, inclusive, the upper contact of push button 9PB, the conventional dotted line circuits, and thence through the windings of the four switch control storage relays in multiple and front contact *d* of relay 1—9AD to terminal N. Each relay establishes a stick circuit including its own front contact *a*, the relay winding, and front contact *d* of relay 1—9AD.

As soon as transfer relay 1—9AT releases upon completion of the transfer action, reverse magnet RM of switch movement 1—9SM is energized. This circuit is traced from terminal B at control lever 1—9MC over the lever arm in position A, front contact *e* of relay 1—9AD, back contact *b* of relay 1—9AT, front contact *b* of relay 1—9A1, front contacts *b* of relays 1—9WP and 1—9TR, reverse magnet RM, and normal contact X1 of circuit controller CC to terminal N. Relay 1—9NWP is deenergized and releases shortly after the movement of the switch points begins, as previously explained, and relay 1—9RWP is energized upon the completion of the movement of the switch points to their reverse position, the circuit including reverse contact X1 of circuit controller CC.

When this second cut of cars occupies the detector track section, relay 1—9TR again releases and at this time completes the circuit for energizing transfer relay 3—9BT in bank 3—9B shown in Fig. 2c. This circuit includes front contact *e* of relay 1—9AD, back contact *c* of relay 1—9AT, back contact *e* of track relay 1—9TR, back contact *b* of relay 1—9TC, which released as soon as the first cut vacated the detector track section, front contact *a* of

16

relay 1—9RWP, wire 19, back contact *c* of relay 3—9BD, and the winding of relay 3—9BT. The closing of front contact *a* of relay 3—9BT completes a stick circuit for this relay which includes front contact *e* of relay 1—9AD and wire 17. The circuit is now complete for energizing relay 3—9BD, this circuit being traced from terminal B over front contact *c* of relay 3—9BT, the winding of relay 3—9BD, back contact *c* of relay 3—9Z, and back contacts *b*, in multiple, of relays 3—9AT and 3—9AD to terminal N. When relay 3—9BD picks up, it completes a stick circuit in which its own front contact *a* replaces front contact *c* of relay 3—9BT in the previously traced energizing circuit.

The circuits are now complete for transferring the selected route from the switch control storage relays of bank 1—9A to the similar relays of bank 3—9B. It will be remembered that the switch control stored in relay 1—9A1 is used at the initial switch location and thus this information is not transferred to the succeeding switch locations. A first one of the transfer circuits may be traced from terminal B over front contact *b* of relay 1—9A2, wire 18, front contact *d* of relay 3—9BT, the winding of relay 3—9B1, and front contact *d* of relay 3—9BD to terminal N. The similar circuit for relay 3—9B2 includes front contact *b* of relay 1—9A3, wire 20, and front contact *e* of relay 3—9BT, front contact *d* of relay 3—9BD being common to all of the switch control relay circuits. The circuit for the third switch control storage relay 3—9B3 includes front contact *b* of relay 1—9A4, wire 21, and front contact *f* of relay 3—9BT. Each of the switch control storage relays of bank 3—9B, upon picking up, completes a stick circuit for itself at its own front contact *a*, these stick circuits all including in common front contact *d* of relay 3—9BD. It will be further noted that the route now stored in bank 3—9B designates that each switch remaining in the route must be placed in its reverse position, that is, all of the switch control storage relays are energized.

The opening of back contacts *b* of relays 3—9BT and 3—9BD interrupts the previously traced stick circuit for relay 1—9AD. This latter relay releases at the end of its slow release period which is of sufficient duration to assure the transfer of the route storage into the following bank. Release of relay 1—9AD energizes transfer control relay 1—9TC as has been previously described. As before, relay 1—9TC is held energized by its stick circuit which is completed over back contact *a* of track relay 1—9TR and prevents a second route transfer during this occupancy of detector track section 1—9T.

The release of relay 1—9AD also deenergizes relay 3—9BT which releases at once. The release of this relay completes a circuit for energizing relay 3—9AT in the A bank associated with the lap switch location. This energizing circuit extends from terminal B at back contact *b* of relay 3—9Z over back contact *g* of relay 3—9BT, front contact *e* of relay 3—9BD, back contact *c* of relay 3—9AD, and the winding of relay 3—9AT to terminal N. When relay 3—9AT picks up, the closing of its front contact *a* by-passes back contact *c* of relay 3—9AD in this energizing circuit and thus provides a stick circuit to retain the transfer relay energized until the transfer action is complete. The energizing circuit for relay 3—9AD is now complete and may be traced from terminal B at normally closed contact *a* of cancel button 3—9CB over front contact *c* of relay 3—9AT, the winding of relay 3—9AD, wire 22, back contacts *b*, in multiple, of relays 6—7AT and 6—7AD (in Fig. 2f), back contacts *b* in multiple of relays 8—9AT and 8—9AD, wire 23, back contact *d* of relay 3—9Z, wire 24, and back contacts *b*, in multiple, of relays 3—5BT and 3—5BD (in Fig. 2e) to terminal N. Relay 3—9AD, thus energized, picks up and completes a stick circuit which is the same as the previously traced energizing circuit except that front contact *a* of relay 3—9AD replaces front contact *c* of relay 3—9AT in the circuit.

The route stored in the switch control storage relays of bank 3—9B is now transferred to the similar relays of storage bank 3—9A. One circuit may be traced from terminal B over front contact *b* of relay 3—9B1, wire 25, front contact *d* of relay 3—9AT, the winding of relay 3—9A1 (in Fig. 2*d*), and front contact *d* of relay 3—9AD (common to all of the transfer circuits) to terminal N. A similar circuit for relay 3—9A2 includes front contact *b* of relay 3—9B2, wire 26, and front contact *e* of relay 3—9AT. The circuit for the third switch control relay 3—9A3 includes front contact *b* of relay 3—9B3, wire 27, and front contact *f* of relay 3—9AT. Each of the switch control relays upon picking up completes a stick circuit for itself at its own front contact *a*, the stick circuits including in common front contact *d* of relay 3—9AD.

With both relay 3—9AT and relay 3—9AD picked up, the opening of their back contacts *b* interrupts the stick circuit for relay 3—9BD. This latter relay, thus deenergized, releases at the end of its slow release period prior to which the route transfer has completed. The release of relay 3—9BD opens the stick circuit for relay 3—9AT and this latter relay shortly releases. The release of relay 3—9AT to close its back contact *b* permits the energizing circuit for relay 3—9BD to be completed when conditions are otherwise proper in order that a following route storage may transfer into bank 3—9B.

The release of relay 3—9AT, signifying that the transfer action of the route storage into bank 3—9A is complete, allows the energization of the proper switch magnets to position each switch of the lap arrangement as called for by the route storage. Since the first two of the switch control storage relays are energized, both switches of this lap switch arrangement are thus required to occupy their reverse position to establish the designated route. The circuit for operating switch movement 3—9SM may be traced from terminal B at control lever 3—9MC (shown in Fig. 2*d*) over the lever arm in its A or automatic position, back contact *e* of relay 3—9Z, front contact *e* of relay 3—9AD, back contact *g* of relay 3—9AT, front contact *b* of relay 3—9A1, front contacts *b* of relays 3—9WP and 3—9TR, reverse magnet RM, and normal contact X1 of circuit controller CC of switch movement 3—9SM to terminal N. This energization of reverse magnet RM causes the switch points to be moved to their reverse position and, upon the completion of this movement, switch repeater relay 3—9RWP is energized by completion of the obvious circuit at reverse contact X1 of controller CC. At the beginning of the movement of the switch points, the circuit for relay 3—9NWP is interrupted at normal contact Y2 of controller CC and this repeater relay releases. A similar circuit may be traced from terminal B over the lever arm of control lever 6—9MC in its A position, front contact *f* of relay 3—9AD, front contact *c* of relay 3—9A1, which assures that the route storage requires the cut to pass over both switches of the lap arrangement, back contact *h* of relay 3—9AT, front contact *b* of relay 3—9A2, front contacts *b* of relays 6—9WP and 6—9TR, reverse magnet RM and normal contact X1 of circuit controller CC of switch movement 6—9SM to terminal N. Repeater relay 6—9NWP is deenergized and releases shortly after the switch points begin their travel to the reverse position and relay 6—9RWP is energized upon the completion of the movement of the switch points, the circuit arrangements being similar to those previously described for other switch movements.

As this second cut passes over the lap switches, it progressively enters track section 3—9T and track section 6—9T. Shunting of the corresponding track circuits causes track relays 3—9TR and 6—9TR to release in that order. This completes the circuit for energizing transfer relay 8—9AT of the next or succeeding storage bank (shown in Fig. 2*f*). This circuit may be traced from terminal B at front contact *g* of relay 3—9AD (Fig. 2*c*)

over back contact *i* of relay 3—9AT, wire 28, front contact *d* of relay 3—9A1, back contact *a* of relay 6—9TR, wire 29, back contact *b* of relay 6—9TC, back contact *f* of relay 3—9Z, back contact *b* of relay 3—9TC, front contact *a* of relay 3—9RWP, front contact *a* of relay 6—9RWP, wire 30, back contact *c* of relay 8—9AD, and the winding of relay 8—9AT to terminal N. Relay 8—9AT thus energized picks up and completes a stick circuit for itself including front contact *g* of relay 3—9AD, wire 31, and front contact *a* and the winding of relay 8—9AT. If this particular cut had been routed to storage track 6 or 7, relay 6—7AT would be energized at this time over a circuit which would be identical with the energizing circuit just traced to and including front contact *a* of relay 3—9RWP, and thence over front contact *a* of relay 6—9NWP, since switch 6—9SW would be in its normal position, wire 32, back contact *c* of relay 6—7AD, and the winding of relay 6—7AT to terminal N. The stick circuit for relay 6—7AT is the same as the stick circuit for relay 8—9AT except for including front contact *a* and the winding of relay 6—7AT.

The closing of front contacts of relay 8—9AT completes the energizing circuit for relay 8—9AD, this circuit extending from terminal B at normally closed contact *a* of cancel button 8—9CB over front contact *c* of relay 8—9AT, the winding of relay 8—9AD, and front contact *a* of relay 8—9TR to terminal N. The closing of front contact *a* of relay 8—9AD completes a stick circuit for this relay which by-passes front contact *c* of transfer relay 8—9AT. A circuit is now prepared to transfer the route storage from bank 3—9A to bank 8—9A. However, since the particular route here involved required the control of two switches at the lap switch location, the switch controls stored in the first two relays of bank 3—9A have been used and only the switch control stored in relay 3—9A3 remains to be transferred to the succeeding location. The circuit for this may be traced from terminal B over front contact *b* of relay 3—9A3, wire 34, front contact *d* of relay 8—9AT, the winding of relay 8—9A1, and front contact *d* of relay 8—9AD to terminal N. Thus energized, relay 8—9A1 picks up and completes a stick circuit for itself including its own front contact *a* and front contact *d* of relay 8—9AD.

When relay 8—9AT picks up, it also completes an energizing circuit for transfer control relay 6—9TC. This circuit extends from terminal B at front contact *f* of relay 8—9AT through wire 35 and the winding of relay 6—9TC to terminal N. Relay 6—9TC picks up and completes a stick circuit which at this time extends from terminal B at back contact *e* of relay 6—9TR over front contact *b* of relay 3—9RWP and front contact *a* and the winding of relay 6—9TC to terminal N. Relay 6—9TC is thus held energized until this cut of cars clears track section 6—9T, and prevents the transfer of a second route storage from bank 3—9A during this occupancy of the track section.

With both relay 8—9AT and relay 8—9AD picked up, the stick circuit for relay 3—9AD is interrupted at back contacts *b* of the two first mentioned relays and this latter relay releases at the end of its slow release period. This occurs, as is usual, after the route storage has been transferred to the succeeding storage bank. Release of relay 3—9AD deenergizes relay 8—9AT by interrupting the stick circuit for the latter relay at front contact *g* of relay 3—9AD. Relay 8—9AT releases to complete the transfer action into bank 8—9A. The release of relay 3—9AD also conditions bank 3—9A to receive a succeeding route storage, that is, fulfills the conditions to allow a succeeding route to be transferred into bank 3—9A.

At storage bank 8—9A, release of relay 8—9AT completes the circuit for the operation of switch 8—9SW to its reverse position. This circuit includes the lever arm of control lever 8—9MC in its A position, front contact *e* of relay 8—9AD, back contact *e* of relay 8—9AT, and front contact *b* of relay 8—9A1. The remainder of this

control circuit for switch movement 8—9SM is similar to that shown and already discussed for switch movement 1—9SM, and for the sake of simplicity is not shown or described here.

When this second cut of cars enters detector track section 8—9T associated with switch 8—9SW, the track circuit is shunted and track relay 8—9TR releases. The opening of front contact *a* of this track relay deenergizes relay 8—9AD and this latter relay shortly releases. Release of relay 8—9AD interrupts the stick circuit for switch control relay 8—9A1 and this relay releases cancelling the route storage in this storage bank. The closing of back contact *f* of relay 8—9AD completes the circuit for energizing relay 8—9TC, this circuit including in addition back contact *b* of relay 8—9TR. When relay 8—9TC picks up, it completes a stick circuit including back contact *b* of relay 8—9TR and its own front contact *a*, so that transfer control relay 8—9TC remains energized while this particular cut of cars continues to occupy the track section.

The closing of back contact *c* of relay 8—9AD at this time permits relay 8—9AT to be energized if conditions are otherwise appropriate to initiate the transfer of a following route storage into bank 8—9A. Under these conditions, relay 8—9AD would be energized over the circuit previously traced except that front contact *b* of relay 8—9TC replaces front contact *a* of track relay 8—9TR. As previously explained in connection with bank 1—2A, since transfer control relay 8—9TC remains energized while this second cut occupies the detector track section, relay 8—9AD is also held energized. Since track relay 8—9TR will pick up prior to the release of relay 8—9TC, any following route storage transferred into this storage bank cannot be cancelled during this occupancy of the track section by this cut of cars. In other words, transfer control relay 8—9TC assures that only one route storage may be cancelled for each occupancy of detector track section 8—9T.

The operation of the apparatus in storage bank 6—7A associated with switch 6—7SW is similar to that just described for storage bank 8—9A. If the transfer of the route storage just described had been into this storage bank, the operation of the relays would be identical with that already described for storage bank 8—9A. It is therefore believed unnecessary to describe in detail the operation of the relays and the circuits which form storage bank 6—7A, reference being made to the drawing and the previous discussion of the apparatus in storage bank 8—9A for a complete understanding of the equipment at this second location.

Returning once again to bank 1—9A in Fig. 2a, we shall now assume that the third cut of cars passing over the hump is to be routed to storage track 5. As may be seen from Fig. 1, the route to storage track 5 requires that the first switch in the route be positioned reverse, the second switch be positioned normal, and the third and fourth switches be positioned reverse. Upon the release of relay 3—9BT, which indicates that the transfer of the second route into bank 3—9B is complete, the circuits are prepared to reenergize relay 1—9AD. At this time, therefore, operation of push button 5PB to select track 5 eventually results in the energization of switch control storage relays 1—9A1, 1—9A3, and 1—9A4, the conventional circuits shown for energizing these relays being obvious. Upon completion of this route transfer into bank 1—9A, switch 1—9SW holds in its reverse position upon the release of relay 1—9AT.

When the third cut enters detector section 1—9T, the route storage is transferred to bank 3—9B in a manner similar to that already described for the transfer of the second route storage. The chief difference in the transfer action is that it results in relay 3—9B1 remaining deenergized while relays 3—9B2 and 3—9B3 are energized. Assuming now that the second route storage has already been transferred forward to bank 8—9A, this

third route storage cascades immediately into bank 3—9A at switch location 3—9SW in the same manner as previously described for the preceding route. When relay 3—9AT releases upon the completion of this transfer action, the circuit is completed for operating switch 3—9SW to its normal position. This circuit may be traced from terminal B at control lever 3—9MC, which is occupying its automatic position, over back contact *e* of relay 3—9Z, front contact *e* of relay 3—9AD, back contact *g* of relay 3—9AT, back contact *b* of relay 3—9A1, front contacts *c* of relays 3—9WP and 3—9TR, normal switch magnet NM, and reverse contact Y2 of circuit controller CC of switch movement 3—9SM to terminal N. The movement of switch 3—9SW to its normal position causes repeater relay 3—9RWP to release and relay 3—9NWP to be energized and pick up. Although relay 3—9A2 is energized, switch movement 6—9SM is not affected at this time since the energizing circuit for either of its switch magnets is interrupted at front contact *c* of relay 3—9A1, which is open at this time.

When the third cut of cars enters detector track section 3—9T, relay 3—9TR is deenergized and releases. This completes the circuit for energizing transfer relay 3—5BT which is part of storage bank 3—5B shown in Fig. 2e. This circuit for relay 3—5BT extends from terminal B at front contact *g* of relay 3—9AD, over back contact *i* of relay 3—9AT, wire 28, back contact *d* of relay 3—9A1, back contact *a* of relay 3—9TR, wire 29, back contacts *b*, *f*, and *b* of relays 6—9TC, 3—9Z, and 3—9TC, respectively, back contact *g* of relay 3—9Z, front contact *a* of relay 3—9NWP, wire 36, back contact *c* of relay 3—5BD, and the winding of relay 3—5BT to terminal N. The stick circuit for relay 3—5BT completed at front contact *a* of this relay also includes front contact *g* of relay 3—9AD, back contact *h* of relay 3—9Z, and wire 37. The closing of front contact *c* of relay 3—5BT energizes relay 3—5BD, this circuit also including back contacts *b*, in multiple, of relays 3—5AT and 3—5AD. When relay 3—5BD picks up, the closing of its front contact *a* by-passes front contact *c* in this energizing circuit and provides a stick circuit for relay 3—5BD.

The circuits are now complete for transferring the switch controls from the storage relays of bank 3—9A to the similar relays in bank 3—5B. The first of these circuits extends from terminal B over front contact *c* of relay 3—9A2, back contact *i* of relay 3—9Z, wire 38, front contact *d* of relay 3—5BT, winding of relay 3—5B1, and front contact *d* of relay 3—5BD to terminal N. The similar circuit for the second switch control storage relay 3—5B2 includes front contact *b* of relay 3—9A3, back contact *k* of relay 3—9Z, wire 39, and front contact *e* of relay 3—5BT. Each of these switch control storage relays picks up and completes a stick circuit including its own front contact *a* and front contact *d* of relay 3—5BD.

When relay 3—5BT picks up, a circuit is completed for energizing transfer control relay 6—9TC. This circuit may be traced from terminal B over front contact *f* of relay 3—5BT, wire 41, back contact *n* of relay 3—9Z, and the winding of relay 6—9TC to terminal N. Under the conditions at this moment, relay 6—9TC is held energized over a second stick circuit which extends from terminal B at back contact *f* of relay 3—9TR over front contact *d* of relay 3—9NWP, back contact *m* of relay 3—9Z, and front contact *a* and the winding of relay 6—9TC to terminal N. The opening of back contact *b* of relay 6—9TC interrupts the energizing circuit for relay 3—5BT previously traced and assures that no second route transfer can occur during the occupancy of track section 3—9T by this third cut of cars. Other stick circuits for relay 6—9TC which are effective under certain special conditions of operation will be discussed hereinafter, as they do not enter into the operation at the present moment.

The opening of back contact *b* of both relay 3-5BT and relay 3-5BD interrupts the stick circuit previously traced for relay 3-9AD and this latter relay, after the duration of its slow release period, releases. The opening of front contact *d* of relay 3-9AD interrupts the stick circuits for the switch control storage relays of bank 3-9A and these relays release. The stick circuit for relay 3-5BT is interrupted by the opening of front contact *g* of relay 3-9AD and, the transfer action being complete, relay 3-5BT now releases. Closing of back contact *c* of relay 3-5BT completes the energizing circuit for transfer relay 3-5AT in bank A of storage unit 3-5. This circuit may be traced from terminal B at back contact *c* of relay 3-5BT over front contact *e* of relay 3-5BD, back contact *c* of relay 3-5AD, and the winding of relay 3-5AT to terminal N. As has been previously described for other transfer relays, front contact *a* of relay 3-5AT closes to by-pass back contact *c* of relay 3-5AD, and provides a stick circuit for the transfer relay. The energizing circuit for storage detector relay 3-5AD is now complete, this circuit including the normally closed contact *a* of cancel button 3-5CB, front contact *c* of relay 3-5AT, the winding of the detector relay, and front contact *a* of relay 3-5TR. Relay 3-5AD picks up, and closes its front contact *a* to complete a stick circuit by-passing front contact *c* of relay 3-5AT.

The circuits are now complete for transferring the switch controls from bank 3-5B to 3-5A. The circuits for relays 3-5A1 and 3-5A2 include, respectively, front contacts *d* and *e* of relay 3-5AT, and each circuit includes front contact *b* of the corresponding switch control storage relay in bank B and also front contact *d* of relay 3-5AD. Since both remaining switches in the route must be in their reverse position for the cut to travel to track 5, both relay 3-5A1 and relay 3-5A2 are energized at this time and remain energized over their stick circuits which include front contact *a* of each relay, respectively, and front contact *d* of relay 3-5AD.

The opening of back contacts *b* of relays 3-5AT and 3-5AD interrupts the stick circuit for relay 3-5BD and this later relay, upon completion of its slow release period, releases. Relay 3-5AT is now deenergized by the opening of front contact *e* of relay 3-5BD. Release of relay 3-5AT permits the operation of switch 3-5SW to its reverse position. The circuit for controlling reverse magnet RM of the switch movement 3-5SM is only partially shown since it is very similar to that already described for switch movement 1-9SM. This circuit, however, would include the control arm of lever 3-5MC in its A position, back contact *f* of relay 3-5AT, front contact *e* of relay 3-5AD, and front contacts *b* of relays 3-5A1, 3-5WP, and 3-5TR. Upon the completion of the movement of switch 3-5SW to its reverse position, repeater relay 3-5RWP is energized and picks up, in a manner previously described for the similar relays at the other switches. The closing of front contact *a* of relay 3-5RWP completes a second stick circuit for relay 3-5AD, this circuit extending from the right-hand terminal of the relay winding over front contact *a* of relay 3-5RWP and back contacts *b*, in multiple, of transfer relay 4-5AT and storage detector relay 4-5AD to terminal N. The latter two mentioned relays are included in the storage bank associated with switch 4-5SW. This storage bank is not shown in detail since it corresponds in every detail, for example, to the storage bank 8-9A. It should be noted that this additional stick circuit for relay 3-5AD is completed only when switch 3-5SW occupies its reverse position.

When the third cut of cars enters detector track section 3-5T, the track circuit is shunted in the usual manner and relay 3-5TR releases. This initiates the transfer action of the route storage into bank 4-5A associated with the final switch in this route to track 5. As previously explained, storage bank 4-5A is not shown in detail since it is identical with other storage banks shown. The description of the route transfer into bank 4-5A is also not

given in detail since it is believed that it is so similar to route transfers already discussed that it will be obvious from an examination of the drawing when taken in connection with the preceding discussion. A portion of the energizing circuit for relay 4-5AT is shown as including front contact *g* of relay 3-5AD, back contact *g* of relay 3-5AT, back contacts *c* and *f* of relays 3-5TC and 3-5TR, respectively, and front contact *b* of relay 3-5RWP.

When relay 3-5AD releases upon completion of the route transfer to the following storage bank (back contacts *b* of relays 4-5AT and 4-5AD open), transfer control relay 3-5TC is energized by the circuit including back contact *e* of relay 3-5TR and back contact *f* of relay 3-5AD. In common with these transfer control relays as previously discussed, a stick circuit for relay 3-5TC including its own front contact *a* and back contact *e* of track relay 3-5TR holds this relay energized during the occupancy of section 3-5T by this third cut of cars. The opening of back contact *c* of relay 3-5TC assures that no second route transfer can occur during this occupancy of the detector track section.

It is to be noted at this time that if the third cut had been routed to storage track 3 over switch 3-5SW in its normal position, the release of track relay 3-5TR would deenergize relay 3-5AD, since the second stick circuit for this relay would be ineffective at this time due to front contact *a* of relay 3-5RWP being open. Release of relay 3-5AD under this condition cancels the route stored in storage bank 3-5A as there is no further need for the route storage, the switch 3-5SW being the final switch in the route to track 3. However, also under these conditions, the closing of front contact *b* of relay 3-5TC permits storage detector relay 3-5AD to be reenergized to allow a following route to be transferred into bank 3-5A. This is similar to the action previously discussed in connection with banks 1-2A, 6-7A, and 8-9A. It is to be seen, therefore that, at switch locations which may lead to a single track or to another switch depending upon the position of the local track switch, both types of circuit arrangements must be provided. In other words, one circuit arrangement must be provided to cancel the route storage when a cut is routed directly to the final storage track and there is no further requirement for the route storage. Likewise, a second selective circuit must be provided which will hold the route storage in the associated final bank until the route can be transferred to the succeeding storage bank at the next switch when the cut in question is traveling in that direction.

We shall return now in our discussion to the time when the route for the third cut of cars is stored in bank 3-9B. We shall further assume that the route storage for the second cut of cars is still held in bank 3-9A. Furthermore, it is assumed that the second cut of cars is occupying track sections 3-9T and 6-9T. A final condition assumes that the second route storage cannot at this moment be transferred forward to the appropriate succeeding storage bank because another cut of cars occupies the dead track between switches 6-9SW and 8-9SW. In other words, relay 8-9AD is energized since a route is stored in bank 8-9A and the energizing circuit for relay 8-9AT is thus interrupted.

Under these conditions, the energizing circuit for auxiliary relay 3-9Z is completed. This energizing circuit extends from terminal B at bank contact *a* of relay 3-9B1 over back contact *h* of relay 3-9BT, front contact *f* of relay 3-9BD, back contacts *c* of relays 3-9TC and 6-9TC, back contact *f* of relay 6-9TR, front contact *c* of relay 3-9RWP, front contact *h* of relay 3-9AD, and the winding of relay 3-9Z to terminal N. It will be noted this energizing circuit checks that a route is stored in bank 3-9B, that the route transfer into this bank is completed, and that this route calls for switch 3-9SW to be positioned in its normal position. The back contacts of the transfer control relays are included

In this circuit to assure that no route transfer has already occurred during the present track occupancy. Other checks are made that a route is stored in the bank 3—9A and that the initial switch of the lap arrangement is in its reverse position. A back contact of track relay 6—9TR is included to assure that the second of the two detector track sections is occupied.

When relay 3—9Z picks up, it completes a first stick circuit which includes its own front contact *b* and front contact *h* of relay 3—9AD. This first stick circuit for relay 3—9Z provides energy for holding that relay picked up if the transfer of the route stored in bank A at this location is further delayed. If the route in bank A is transferred shortly after relay 3—9Z is energized, relay 3—9Z is released and the action of the apparatus continues in a normal manner as previously described. Two other stick circuits for relay 3—9Z are at times effective to retain this relay picked up. The second stick circuit may be traced from terminal B at front contact *b* of relay 3—9NWP over a front contact *d* of relay 6—9TC and front contact *a* and the winding of relay 3—9Z to terminal N. This stick circuit is effective if the transfer of the route stored in bank A is delayed beyond the time that switch 3—9SW is moved to its normal position in a manner to be described shortly. This second stick circuit also assures that relay 3—9Z holds up until transfer control relay 6—9TC releases and thus assures the release of this transfer control relay. A third stick circuit extends from terminal B at front contact *g* of relay 3—5BT over wire 40, front contact *a* and the winding of relay 3—9Z to terminal N. This final stick circuit is effective to hold relay 3—9Z energized during the direct transfer of a route from bank 3—9B to storage unit 3—5, as will be described hereinafter, so that this transfer action will not be interrupted if the route storage in bank 3—9A is transferred simultaneously.

When the previously described second cut of cars, which moves over the lap switch arrangement with both switches in their reverse position along the route to track 9, clears track section 3—9T, a circuit is completed for causing switch 3—9SW to operate to its normal position. This circuit extends from terminal B at control lever 3—9MC which is in its A position over front contact *e* of relay 3—9Z, front contacts *c* of relays 3—9WP and 3—9TR, and normal magnet NM and reverse contact Y2 of switch movement 3—9SM to terminal N. With normal magnet NM energized, switch movement 3—9SM causes the switch points of track switch 3—9SW to move to their normal position. This movement deenergizes relay 3—9RWP and causes relay 3—9NWP to be energized and pick up.

Even though relay 3—9NWP is now picked up, section 6—9T is still occupied, and a route storage including relay 3—9A1 picked up is still stored in bank 3—9A, relay 3—5BT is not at this time energized as the previously traced circuit, otherwise completed due to the route stored in bank A, is interrupted at back contact *g* of relay 3—9Z. In addition, the previously traced energizing circuits for relays 8—9AT and 6—7AT are transferred at front contact *f* of relay 3—9Z to a connection which by-passes back contact *b* of relay 3—9TC and front contact *a* of relay 3—9RWP. This latter connection assures that, when the storage bank associated with either switch 6—7SW or switch 8—9SW is empty, the route stored in bank 3—9A can be transferred even though switch 3—9SW has been moved to its normal position under the influence of the route stored in bank 3—9B. When the route stored in bank 3—9A eventually transfers to bank 8—9A, for example, and relay 6—9TC is energized due to the pickup of relay 8—9AT, the previously traced second stick circuit for relay 6—9TC, including front contact *d* of relay 3—9NWP, is rendered ineffective, even though the third cut may have entered track section 3—9T to release relay 3—9TR, by the open back contact *m* of relay 3—9Z. The action of relay

6—9TC under these conditions is more fully discussed shortly.

We shall now assume that the third cut of cars enters track section 3—9T and, because the second route is still held in bank 3—9A, that the route for this third cut of cars is stored in bank 3—9B. It will be remembered that this third cut of cars is destined for storage track 5 and that switch 3—9SW has been positioned normal by the pickup of relay 3—9Z. At this time then, a second energizing circuit for transfer relay 3—5BT is completed, it being assumed that bank 3—5B is empty of any storages at this moment. This second energizing circuit may be traced from terminal B at back contact *a* of relay 3—9B1 over back contact *h* of relay 3—9BT, front contact *f* of relay 3—9BD, back contact *c* of relay 3—9TC, back contact *e* of relay 3—9TR, front contact *g* of relay 3—9Z, front contact *a* of relay 3—9NWP, wire 36, back contact *c* of relay 3—5BD, and the winding of relay 3—5BT to terminal N. Under the present conditions, the pickup of relay 3—5BT completes a stick circuit which extends from terminal B at front contact *g* of relay 3—9BD over front contact *h* of relay 3—9Z, wire 37, and front contact *a* and the winding of relay 3—5BT to terminal N. The closing of front contact *c* of relay 3—5BT completes the same energizing circuit previously traced for relay 3—5BD, which includes back contacts *b*, in multiple, of relays 3—5AT and 3—5AD.

Prior to this moment, the stick circuit previously traced for relay 3—9AD has been modified by contact *d* of relay 3—9Z to eliminate the multiple connection to terminal N over back contacts *b* of relays 3—5BT and 3—5BD. In other words, the opening of back contact *d* of relay 3—9Z disconnects this stick circuit from wire 24 and this multiple connection while the closing of front contact *d* connects wire 23 directly to terminal N, so that the stick circuit for relay 3—9AD is not interrupted at this time by the pickup of relays 3—5BT and 3—5BD. However, the previously traced stick circuit for relay 3—9BD is now connected at front contact *c* of relay 3—9Z to wire 24 and thence to terminal N, over back contacts *b*, in multiple, of relays 3—5BT and 3—5BD, the opening of back contact *c* of relay 3—9Z eliminating the previous multiple connection to terminal N over back contacts *b* of relays 3—9AT and 3—9AD. Therefore, the opening of back contact *b* of both relay 3—5BT and relay 3—5BD now deenergizes relay 3—9BD. However, this latter relay, having slow release characteristics, retains its front contacts closed for sufficient period to allow the route in bank 3—9B to be transferred to the following location as will now be explained.

At this present moment, both relays 3—9B2 and 3—9B3 are energized, since the remaining two switches in the route for the third cut of cars must occupy their reverse positions in order for the cut to be routed to track 5. Auxiliary transfer circuits are now complete to transfer this route information directly from bank 3—9B to bank 3—5B. For example, relay 3—5B1 is energized through the circuit traced from terminal B over front contact *b* of relay 3—9B2, wire 26, front contact *i* of relay 3—9Z, wire 38, front contact *d* of relay 3—5BT, the winding of relay 3—5B1, and front contact *d* of relay 3—5BD to terminal N. A similar circuit for relay 3—5B2 includes front contact *b* of relay 3—9B3, wire 27, front contact *k* of relay 3—9Z, wire 39, and front contact *e* of relay 3—5BT. Each of the switch control storage relays completes a stick circuit, upon picking up, at its own front contact *a*, each stick circuit also including front contact *d* of relay 3—5BD. The route for the third cut of cars which is now occupying track section 3—9T has thus been transferred directly from storage bank B associated with the lap switch arrangement to the bank B at the succeeding switch in the route being followed by that cut of cars.

When relay 3—9BD eventually releases, the opening of its front contact *g* interrupts the stick circuit for relay

3—5BT and this latter relay shortly releases. The release of relay 3—9BD also prepares bank 3—9B to receive another route storage for a following cut of cars. However, when relay 3—5BT initially picked up, a circuit was completed for energizing transfer control relay 3—9TC. This circuit includes front contact *f* of relay 3—5BT, wire 41, front contact *n* of relay 3—9Z, and the winding of relay 3—9TC. Relay 3—9TC, thus energized, picks up and the closing of its front contact *a* completes a first stick circuit which also includes back contact *f* of relay 3—9TR and front contact *c* of relay 3—9NWP. Since this first stick circuit obviously retains relay 3—9TC energized as long as this cut of cars occupies track section 3—9T, a following route transferred into bank 3—9B cannot be transferred forward improperly into bank 3—5B should this latter bank become clear of a route storage during this track occupancy. Relay 3—9TC, when energized, thus assures that only one route transfer can occur under these special conditions from bank 3—9B during a single occupancy of track section 3—9T.

The route presently stored in bank 3—9A can transfer, if the conditions ahead change, simultaneously with this transfer of the route from bank 3—9B. It has already been described that the stick circuit for relay 3—9AD is changed when relay 3—9Z picks up. If bank 8—9A clears of a route storage at this time, the energizing circuit for relay 8—9AT is then complete. Under the present conditions, this circuit extends from terminal B at front contact *g* of relay 3—9AD over back contact *i* of relay 3—9AT, wire 28, front contact *d* of relay 3—9A1, back contact *a* of relay 6—9TR, wire 29, back contact *b* of relay 6—9TC, front contact *f* of relay 3—9Z, front contact *a* of relay 6—9RWP, wire 30, back contact *c* of relay 8—9AD, and the winding of relay 8—9AT to terminal N. The stick circuit established for relay 8—9AT when this relay picks up is the same as previously traced and includes front contact *g* of relay 3—9AD and wire 31. The transfer of the route from bank 3—9A to bank 8—9A then continues as previously described.

As described before, relay 6—9TC is energized when relay 8—9AT picks up and closes its front contact *f*. At this time, the only stick circuit for relay 6—9TC which is complete is one including back contact *e* of relay 6—9TR, front contact *e* of relay 3—9A1, and wires 42 and 43, the real utility of which will be explained shortly. However, since relay 3—9A1 releases following the opening of front contact *d* of relay 3—9AD, this stick circuit is interrupted at about the same time that relay 8—9AT releases, upon the completion of the transfer action, to interrupt the energizing circuit. Relay 6—9TC is thus deenergized and releases. As previously explained, relay 3—9TC picks up during the route transfer from bank 3—9B to bank 3—5B and this relay is held energized by its stick circuit as long as section 3—9T is occupied. The prevention of a second route transfer along either route during the occupancy of sections 3—9T and 6—9T by the second and third cuts thus shifts to relay 3—9TC. Relay 3—9Z is deenergized upon the completion of these two simultaneous route transfers, since all its stick circuits are interrupted. Relay 3—9Z releases to return the various circuits to their initial conditions, including the energizing circuit arrangement for relays 3—5BT, 6—7AT, and 8—9AT. This latter circuit arrangement is held open by back contact *b* of relay 3—9TC until the track sections are again clear, thus assuring only one route transfer along each route during the passage of the second and third cuts over the lap switches.

We also provide by our invention special circuit arrangements in connection with the storage unit at the lap switch location to prevent a double transfer of route storages under certain special conditions. It is first

assumed that the previously discussed third route storage is in bank 3—9A and that this route will transfer at the proper time into bank 3—5B over circuits established by relay 3—9NWP picked up. A following route now stored in bank 3—9B is eventually to be transferred over circuits established by relay 3—9RWP picked up, that is, into either bank 6—7A or bank 8—9A, which are presently clear of any route storages. When the third cut of cars enters section 3—9T, relay 3—9TR releases and this release is followed shortly by the release of relay 6—9TR as the cut progresses over switch 3—9SW. Then, as described, the route storage for this cut of cars transfers to bank 3—5B. When relay 3—5BT picks up, it energizes transfer control relay 6—9TC, as was also previously described. This transfer control relay, under the present conditions, is held energized over the stick circuit including back contact *f* of relay 3—9TR, front contact *d* of relay 3—9NWP, and back contact *m* of relay 3—9Z. When relay 3—9AD releases, upon completion of the route transfer, the conditions are proper for the following route to transfer from bank B into bank A at this location and this route transfer takes place.

When the third cut of cars clears section 3—9T, the previously discussed circuit for magnet RM of switch movement 3—9SM is completed and switch 3—9SW is operated to its reverse position. This movement of the switch to its reverse position deenergizes relay 3—9NWP, which releases, and energizes relay 3—9RWP, which picks up. At this time, because the third cut is occupying subsection *d* of the track arrangement, relay 6—9TR is still deenergized and released. It is to be remembered that this subsection *d* is part of track section 6—9T due to the mechanical construction of the lap switches. Under these special conditions, relay 6—9TC is held energized by a third stick circuit which may be traced from terminal B over back contact *e* of relay 6—9TR, wire 42, front contact *e* of relay 3—9A1, wire 43, and front contact *a* and the winding of relay 6—9TC to terminal N. This third stick circuit holds the transfer control relay energized during the period between the opening of back contact *f* of relay 3—9TR in the second stick circuit and the closing of front contact *b* of relay 3—9RWP in the first stick circuit for this relay. If it were not for this special stick circuit, relay 6—9TC will release under these conditions in spite of its slow release characteristics and thus prepare the energizing circuit for either relay 6—7AT or 8—9AT for completion when the lap switches are positioned. Under these conditions, the route for the following cut of cars now transferred into bank 3—9A would be transferred forward into the following bank due to the third cut of cars shunting track section 6—9T. This improper transfer is prevented by the circuit arrangement here provided. It is to be noted that if the succeeding route storage transferred into bank 3—9A designates a route via switch 3—9SW normal, relay 6—9TC releases when the third cut clears section 3—9T. This release of relay 6—9TC causes no harm, even if the route storage for the third cut has already transferred into bank 3—5A, since the energizing circuit for relay 3—5BT is now open at back contact *a* of relay 3—9TR and no transfer action can be initiated.

If, following a direct transfer from bank 3—9B, relay 3—9TC is picked up under these conditions instead of relay 6—9TC, a similar stick circuit is provided which extends from terminal B at back contact *e* of relay 6—9TR over wire 42, front contact *f* of relay 3—9A1, wire 44, and front contact *a* and the winding of relay 3—9TC to terminal N. This auxiliary stick circuit for relay 3—9TC is effective to retain this relay energized while a cut occupies subsection *d* of track section 6—9T with a route storage in bank 3—9A which is to be transferred to bank 6—7A or 8—9A.

We shall now assume that no route storage occupies bank 3—9B when the third route transfers from bank

3—9A into bank 3—5B over circuits established by relay 3—9NWP picked up. When this third cut clears track section 3—9T, switch 3—9SW remains in its normal position since relay 3—9A1 remains down, no route having transferred into bank 3—9A, since none is available in bank 3—9B for transfer. Under these conditions, all of the previously traced stick circuits for relay 6—9TC are open, either due to relay 3—9TR being picked up or due to relays 3—9RWP and 3—9A1 being released. While the third cut remains in subsection *d* and relay 6—9TR remains released, a fourth stick circuit for relay 6—9TC is effective to retain this relay energized. This circuit extends from terminal B at back contact *e* of relay 6—9TR over back contact *i* of relay 3—9AD, front contact *d* of relay 3—9NWP, back contact *m* of relay 3—9Z, and front contact *a* and the winding of relay 6—9TC to terminal N. If a following route storage, requiring switch 3—9SW to be reversed, is now transferred into bank 3—9B and immediately cascades into bank 3—9A, this fourth stick circuit is retained effective by the closing of front contact *k* of relay 3—9AT to by-pass back contact *i* of relay 3—9AD. This circuit arrangement retains relay 6—9TC energized until front contact *e* of relay 3—9A1, followed shortly by front contact *b* of relay 3—9RWP, closes to complete other stick circuits for this relay. Thus the energizing circuits for relays 6—7AT and 3—9AT remain open at back contact *b* of relay 6—9TC during this period and the following route is not transferred from bank 3—9A even though relay 6—9TR is released due to the third cut of cars still occupying subsection *d*. If relay 3—9TC is picked up instead of relay 6—9TC, a similar circuit arrangement is provided to retain relay 3—9TC energized under these conditions until relays 3—9A1 and 3—9RWP pick up. This stick circuit for relay 3—9TC includes back contact *e* of relay 6—9TR, back contact *i* of relay 3—9AD in multiple with front contact *k* of relay 3—9AT, and front contact *c* of relay 3—9NWP. Thus, these circuit arrangements prevent a double transfer of route storages which might otherwise occur as a result of conditions which are due to the mechanical construction of the lap switch layout.

It is to be seen, therefore, that, in the system for the automatic control of railway classification yard track switches provided by our invention, delay in the transfer of route storages from lap switch locations, due to congestion in the storage banks along one route over these lap switches, is avoided by providing a circuit arrangement which permits simultaneous transfers of route storages along two of the possible routes over the lap switches, one of which routes includes only the first of the two switches. In addition, any possible double transfer of route storages during a single occupancy of the track layout at the lap switches is avoided by the special stick circuit arrangements provided for the transfer control relays. These special stick circuits take into account the usual track circuits required due to the mechanical construction of lap switches. As a result, the system provided by our invention allows rapid classification of cars or cuts of cars by reducing the spacing required between successive cuts and also permits more efficient operation by eliminating improper transfers of route storages which otherwise result in the misclassification of cars.

Although we have herein shown only one form of automatic control of railway classification yard track switches embodying our invention, it is to be understood that 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. In combination with a route storage bank associated with a track layout of the lap switch type, said layout including a first and a second track switch and being capable of routing cars from a common lead track to a

first, a second, and a third diverging track, the route to said first track traversing only said first switch in its normal position, the routes to said second and said third tracks traversing in sequence said first switch in its reverse position and said second switch, said switches having overlapped detector track circuits including a first detector track relay associated with said first switch and a second detector track relay associated with said second switch, each detector track relay being normally energized and releasing when the corresponding track circuit is shunted by a car, said storage bank being capable of storing in sequence the preselected routes for successive cars traversing over said track layout, each route being transferred to a succeeding storage bank along that route as the corresponding car traverses said track layout, means to prevent the transfer of two route storages while a single car traverses said layout, said means including a transfer control relay, an energizing circuit and a stick circuit network therefor, said control relay being effective when energized to prevent the initiation of a route transfer to any succeeding storage bank, said energizing circuit including in multiple a plurality of contacts one for each succeeding storage bank, each said contact being closed during a route storage transfer into the corresponding storage bank, said stick circuit network having a first path including a deenergized position contact of said second detector track relay in series with the multiple connection of a contact closed when said first switch occupies its reverse position and another contact closed when a route to said second or third track is stored in said bank, a second path including a deenergized position contact of said first detector track relay and another contact closed when said first switch occupies its normal position, and a third path including in series said second track relay contact, said first switch normal repeater contact, and the multiple connection of a contact closed when said bank is clear of any storage and a contact closed when a storage is transferring into said bank.

2. In combination with a route storage bank associated with a track layout of the lap switch type, said layout including a first and a second track switch and being capable of routing cars from a common lead track to a first, a second, and a third diverging track, the route to said first track traversing only said first switch in its normal position, the routes to said second and said third tracks traversing in sequence said first switch in its reverse position and said second switch, said switches having overlapped detector track circuits including a first detector track relay associated with said first switch and a second detector track relay associated with said second switch, each detector track relay being normally energized and releasing when the corresponding track circuit is shunted by a car, said storage bank being capable of storing in sequence the preselected routes for successive cars traversing over said track layout, each route being transferred to a succeeding storage bank along that route as the corresponding car traverses said track layout, means to prevent the transfer of two route storages while a single car traverses said layout, said means including a transfer control relay which is effective when energized to prevent the initiation of a route transfer from said bank to any of the succeeding storage banks, said control relay being provided with circuit means to initially energize that relay during the first transfer of a route to any of said succeeding banks, said means further including a stick circuit network to retain said control relay energized while the cut corresponding to the first transferred route occupies either detector track circuit, said stick circuit network having a first path including a deenergized position contact of said second detector track relay in series with the multiple connection of a contact closed when said first switch occupies its reverse position and another contact closed when a route to said second or said third track is stored in said bank, a second path including a deenergized position contact of said first

detector track relay and another contact closed when said first switch occupies its normal position, and a third path including in series said second track relay contact, said first switch normal repeater contact, and the multiple connection of a contact closed when said bank is clear of any storage and a contact closed when a storage is transferring into said bank.

3. In combination with a route storage bank associated with a track layout of the lap switch type, said layout including a first and a second track switch and being capable of routing cars from a common lead to a first, a second, and a third diverging track, the route to said first track traversing only said first switch in its normal position, the routes to said second and said third tracks traversing in sequence said first switch in its reverse position and said second switch, said switches having overlapped detector track circuits including a first detector track relay associated with said first switch and a second detector track relay associated with said second switch, each detector track relay being normally energized and releasing when the corresponding track circuit is shunted by a car, said storage bank being capable of storing in sequence the preselected routes for successive cars traversing over said track layout, each route being transferred to a succeeding storage bank along that route as the corresponding car traverses said track layout, means to prevent the transfer of two route storages while a single car traverses said layout, said means including a transfer control relay which is effective when energized to prevent the initiation of a route transfer from said storage bank to any of the succeeding storage banks, said control relay being initially energized during the first route transfer from said storage bank while a particular car occupies said detector circuits, said means further including a stick circuit to retain said control relay energized while said particular car occupies said detector track circuits, said stick circuit including in series a deenergized position contact of said second detector track relay, a contact closed when said first switch occupies its normal position, and the multiple connection of a contact closed when said bank is clear of a route storage and another contact closed during the transfer of a route into said bank.

4. In combination with a route storage bank associated with a track layout of the lap switch type, said layout including a first and a second track switch and being capable of routing cars from a common lead track to a first, a second, and a third diverging track, the route to said first track traversing only said first switch in its normal position, the routes to said second and said third tracks traversing in sequence said first switch in its reverse position and said second switch, said switches having overlapped detector track circuits including a first detector track relay associated with said first switch and a second detector track relay associated with said second switch, each detector track relay being normally energized and releasing when the corresponding track circuit is shunted by a car, said storage bank being capable of storing in sequence the preselected routes for successive cars traversing over said track layout, each route being transferred to a succeeding storage bank along that route as the corresponding car traverses said track layout, means to prevent the transfer of two route storages while a single car traverses said layout, said means including a transfer control relay which is effective when energized to prevent the initiation of a route transfer from said storage bank to any of the succeeding storage banks, said control relay being initially energized during the first route transfer from said storage bank while a particular car occupies said detector circuits, said means further including a stick circuit to retain said control relay energized while said particular car occupies said detector track circuits, said stick circuit including in series a deenergized position contact of said second detector track relay and the multiple connection of a contact closed

when said first switch occupies its reverse position and a contact closed when a route for said second or said third track is stored in said bank.

5. In combination with a classification yard track layout including a first and a second track switch diverging from a common lead track, said first switch having a normal position in which traffic moves from said lead track to a first track without traversing said second switch, and having a reverse position in which traffic moves from said lead track over said first and said second switches in sequence, said first and said second switches having overlapped detector track circuits including a first detector track relay associated with said first switch and a second detector track relay associated with said second switch, each detector track relay being normally energized and releasing when the associated track circuit is shunted, said switches together being provided with a route storage unit including a plurality of route storage banks, each route storage bank including a plurality of switch storage relays which indicate a particular route over the corresponding switches according to their energized or deenergized condition, transfer means to transfer the route stored in the final bank of said storage unit to a subsequent storage unit and at times to transfer a route stored in the next preceding bank of said storage unit to said subsequent storage unit, said transfer means including an auxiliary relay, a first circuit arrangement, and a second circuit arrangement; said auxiliary relay having an energizing circuit effective to energize said relay when a route is stored in said final bank, another route is stored in said preceding bank requiring said first switch to be normal, said first switch occupies its reverse position, and said second detector circuit is shunted; said first circuit arrangement including contacts of said final bank storage relays, deenergized position contacts of said auxiliary relay, other contacts closed when a transfer to said subsequent unit is permissible, and windings of the storage relays of said subsequent unit; said first circuit arrangement being effective when completed to transfer a route from said final bank to said subsequent unit; said second circuit arrangement including contacts of the storage relays of said preceding bank, energized position contacts of said auxiliary relay, said other contacts, and said subsequent unit storage relay windings; said second circuit arrangement being effective to transfer a route storage from said preceding bank direct to said subsequent unit when said final bank is filled with a route storage which is not to be transferred to said subsequent unit.

6. In combination with a route storage unit in a classification yard layout, said unit being associated with a first and a second track switch diverging from a common lead track, said first switch having a normal position in which railway cars move from said lead to a first track without traversing said second switch and a reverse position in which cars move from said lead over said first and said second switches in sequence, said first and said second switches having a first and a second detector track circuit respectively, each track circuit including a normally energized track relay which is released when the corresponding track circuit is shunted by a car, said track circuits being overlapped for a portion of their lengths, said storage unit comprising a plurality of storage banks, each bank including a plurality of switch control storage relays which indicate a particular route according to their energized combination; means to transfer to a succeeding storage bank the routes stored in said storage unit according to the position of said switches, said means including a transfer relay associated with said succeeding bank, an auxiliary relay, and a first and a second transfer circuit arrangement; said auxiliary relay being provided with an energizing circuit including contacts closed respectively when a first route is stored in the final bank of said storage unit, another route is stored in the next preceding bank of said unit, said second track circuit is shunted, said first switch occupies its reverse position, and said other route

31

designates a route which includes said first switch at its normal position; said transfer relay having a first energizing circuit which is completed over a deenergized position contact of said auxiliary relay when said first route is stored in said final bank, said succeeding bank is empty, said first switch occupies its normal position, and said first detector circuit is occupied; said transfer relay also having a second energizing circuit completed over an energized position contact of said auxiliary relay when said succeeding bank is empty, said first switch occupies its normal position, said first detector section is occupied, and said other route is stored in said preceding bank which designates a route including said first switch in its normal position; said first transfer circuit arrangement including contacts of said final bank storage relays, deenergized position contacts of said auxiliary relay, energized position contacts of said transfer relay, and windings of the storage relays of said succeeding bank; said first transfer circuit arrangement being effective when completed to transfer said first route to said succeeding bank, said second transfer circuit arrangement including contacts of said preceding bank storage relays, energized position contacts of said auxiliary relay, said energized position contacts of said transfer relay, and the windings of said succeeding bank storage relays; said second transfer circuit arrangement being effective when completed to transfer said other route directly from said preceding bank to said succeeding bank when said first route is not intended for said succeeding bank and has not cleared said final bank.

7. In an automatic switching system for a railway classification yard including at least one lap switch arrangement, said system including a route storage unit associated with each track switch including said lap switches, the storage unit associated with said lap switches including at least a final storage bank and a preceding storage bank, the selected route for each car moving through said yard being transferred in sequence from an initial storage unit to the succeeding storage units associated with the switches which that car must traverse, means to permit said storage unit associated with said lap switches to at times function as two separate units to transfer route storages from both said final bank and said preceding bank, said means comprising an auxiliary relay and an auxiliary transfer circuit means; said auxiliary relay being provided with an energizing circuit including a plurality of contacts in series closed respectively when a route is stored in both said final and said preceding storage banks and the route in said preceding bank designates a route over the first switch of said lap arrangement in its normal position, when the first switch occupies its reverse position, when a car is traversing the second switch of said lap arrangement, and when no route transfer has occurred during the traverse of said car over said switches; said auxiliary relay being effective when energized to connect said preceding bank to said auxiliary transfer circuit means to transfer the route stored in said preceding bank directly to the succeeding bank along the route over said first switch normal.

8. In combination with a classification yard track layout including a first and a second track switch diverging from a common lead track, said first switch having a normal position in which traffic moves from said lead track to a first track without traversing said second switch, and having a reverse position in which traffic moves from said lead track over said first and said second switches in sequence, said first and said second switches having overlapped detector track circuits including a first detector track relay associated with said first switch and a second detector track relay associated with said second switch, each detector track relay being normally energized and releasing when the associated track circuit is shunted, said switches together being provided with a route storage unit including a plurality of route storage banks, each route storage bank includ-

32

ing a plurality of switch storage relays which indicate a particular route over the corresponding switches according to their energized or deenergized condition, transfer means to transfer the route stored in the final bank of said storage unit to a subsequent storage unit and at times to transfer a route stored in the next preceding bank of said storage unit to said subsequent storage unit, said transfer means including an auxiliary relay, a first circuit arrangement, and a second circuit arrangement; said auxiliary relay having an energizing circuit effective to energize said relay when a route is stored in said final bank, another route is stored in said preceding bank requiring said first switch to be normal, said first switch occupies its reverse position, and said second detector circuit is shunted; said auxiliary relay having a stick circuit network comprising a first path effective to hold said relay energized when a route is stored in said final bank, a second path effective to hold said relay energized when said first switch occupies its normal position and a route transfer is made from said final bank, and a third path effective to hold said relay energized when a route transfer into said subsequent bank is in progress; said first circuit arrangement including contacts of said final bank storage relays, deenergized position contacts of said auxiliary relay, other contacts closed when a transfer to said subsequent unit is permissible, and windings of the storage relays of said subsequent unit; said first circuit arrangement being effective when completed to transfer a route from said final bank to said subsequent unit; said second circuit arrangement including contacts of the storage relays of said preceding bank, energized position contacts of said auxiliary relay, said other contacts, and said subsequent unit storage relay windings; said second circuit arrangement being effective to transfer a route storage from said preceding bank direct to said subsequent unit when said final bank is filled with a route storage which is not to be transferred to said subsequent unit.

9. In combination with a route storage unit in a classification yard layout, said unit being associated with a first and a second track switch diverging from a common lead track, said first switch having a normal position in which railway cars move from said lead to a first track without traversing said second switch and a reverse position in which cars move from said lead over said first and said second switches in sequence, said first and said second switches having a first and a second detector track circuit respectively, each track circuit including a normally energized track relay which is released when the corresponding track circuit is shunted by a car, said track circuits being overlapped for a portion of their lengths, said storage unit comprising a plurality of storage banks, each bank including a plurality of switch control storage relays which indicate a particular route according to their energized combination; means to transfer to a succeeding storage bank the routes stored in said storage unit according to the position of said switches, said means including a transfer relay associated with said succeeding bank, an auxiliary relay, and a first and a second transfer circuit arrangement; said auxiliary relay being provided with an energizing circuit including contacts closed respectively when a first route is stored in the final bank of said storage unit, another route is stored in the next preceding bank of said unit, said second track circuit is shunted, said first switch occupies its reverse position, and said other route designates a route which includes said first switch at its normal position; said auxiliary relay being further provided with a stick circuit network comprising a first path including a contact closed when said first route is stored in said final bank and a second path including an energized position contact of said transfer relay, said transfer relay having a first energizing circuit which is completed over a deenergized position contact of said auxiliary relay when said first route is stored in said final bank, said succeed-

ing bank is empty, said first switch occupies its normal position, and said first detector circuit is occupied; said transfer relay also having a second energizing circuit completed over an energized position contact of said auxiliary relay when said succeeding bank is empty, said first switch occupies its normal position, said first detector section is occupied, and said other route is stored in said preceding bank which designates a route including said first switch in its normal position; said first transfer circuit arrangement including contacts of said final bank storage relays, deenergized position contacts of said auxiliary relay, energized position contacts of said transfer relay, and windings of the storage relays of said succeeding bank; said first transfer circuit arrangement being effective when completed to transfer said first route to said succeeding bank, said second transfer circuit arrangement including contacts of said preceding bank storage relays, energized position contacts of said auxiliary relay, said energized position contacts of said transfer relay, and the windings of said succeeding bank storage relays; said second transfer circuit arrangement being effective when completed to transfer said other route directly from said preceding bank to said succeeding bank when said first route is not intended for said succeeding bank and has not cleared said final bank.

10. In an automatic switching system for a railway classification yard including at least one lap switch arrangement, said system including a route storage unit associated with each track switch including said lap switches, the storage unit associated with said lap switches including at least a final storage bank and a preceding storage bank, the selected route for each car moving through said yard being transferred in sequence from an initial storage unit to the succeeding storage units associated with the switches which that car must traverse, means to permit said storage unit associated with said lap switches to at times function as two separate units to transfer route storages from both said final bank and said preceding bank, said means comprising an auxiliary relay and an auxiliary transfer circuit means; said auxiliary relay being provided with an energizing circuit including a plurality of contacts in series closed respectively when a route is stored in both said final and said preceding storage banks and the route in said preceding bank designates a route over the first switch of said lap arrangement in its normal position, when the first switch occupies its reverse position, when a car is traversing the second switch of said lap arrangement, and when no route transfer has occurred during the traverse of said car over said switches; said auxiliary relay being further provided with a stick circuit arrangement including a first path completed when a route is stored in said final bank, a second path completed when said first switch occupies its normal position and a route transfer from said final bank is in progress, and a third path complete while a route transfer is in progress into the succeeding bank along the route over said first switch normal; said auxiliary relay being effective when energized to connect said preceding bank to said auxiliary transfer circuit means to transfer the route stored in said preceding bank directly to said succeeding bank.

11. In an automatic switching system for a railway classification yard including at least one lap switch arrangement, said system including a route storage unit associated with each track switch including said lap switches, the storage unit associated with said lap switches including at least a final storage bank and a preceding storage bank, the selected route for each car moving through said yard being transferred in sequence from an initial storage unit to the succeeding storage units associated with the switches which that car must traverse, means to permit said storage unit associated with said lap switches to at times function as two separate units to transfer route storages from both said final bank and said preceding bank, said means including an

auxiliary relay energized when a first route is stored in said final bank and a second route is stored in said preceding bank, said second route being different from said first route and including only the first of said lap switches, said auxiliary relay when energized being effective to disconnect said final bank from and to connect said preceding storage bank directly to the succeeding storage bank along said second route, said final bank remaining connected to the succeeding bank along said first route.

12. In combination with a route storage unit associated with a set of lap switches in a railway classification yard, each route storage comprising a series of switch controls which determine the route for a cut of cars moving through the yard, said lap switch storage unit being one of a plurality of such units through which the route storages are transferred in sequence according to the progress of the corresponding cuts of cars, said lap switch storage unit including at least a final storage bank and a preceding storage bank, said route storages normally transferring in sequence from said preceding bank to said final bank, means to permit said preceding bank to at times function as a separate storage unit and by-pass said route storages around said final bank, said means comprising an auxiliary relay and auxiliary transfer circuits, said auxiliary relay being energized when a first route is stored in said final bank and a second route is stored in said preceding bank, said second route being different from said first route and including only the first switch of said lap switches, said auxiliary relay when energized being effective to disconnect said final bank from and to connect said auxiliary transfer circuits to the succeeding storage unit along said second route, said final bank remaining connected to the succeeding storage unit along said first route, said auxiliary transfer circuits also being connected to said preceding bank to provide a direct connection between said preceding bank and said second route succeeding unit when said auxiliary relay is energized.

13. In an automatic switching system for a railway classification yard including a lap switch layout, said system comprising a route storage unit for each track switch location including said lap switch layout, preselected route storages for cuts of cars moving to the classification tracks being transferred from storage unit to storage unit along the preselected route as the corresponding cuts progress from switch location to switch location, in combination with the lap switch storage unit, a transfer control means responsive initially to the transfer of a route storage corresponding to a particular cut of cars to the next storage unit along that route and subsequently to the passage of said particular cut through said lap switch layout to prevent the transfer of more than one route storage to said next unit while said particular cut is traversing said lap switch layout, and an auxiliary transfer means responsive to a second route storage stored in the associated storage unit for a following cut routed over only the lead switch of said lap switch layout and to the passage of a preceding cut traversing both switches to effect an immediate transfer of the route storage corresponding to said following cut if the transfer of the route storage corresponding to said preceding cut is delayed beyond the arrival of said following cut.

14. In an automatic switching system for a railway classification yard including a lap switch layout, said system comprising a storage unit associated with each track switch location including said lap switch layout, selected information describing the cuts of cars moving through said yard being transferred from storage unit to storage unit as the corresponding cuts traverse the associated switch locations, in combination with the lap switch storage unit, a transfer control means responsive initially to the transfer to another storage unit of the information describing a particular cut and subsequently to the passage of said particular cut through

35

said lap switch layout to prevent the transfer to said other storage unit of the descriptive information for another cut while said particular cut is traversing said lap switch layout, and an auxiliary transfer means responsive to a second descriptive information stored in the associated storage unit for a following cut which will traverse only the lead switch of said lap switch layout and to the passage of a preceding cut traversing both switches to effect an immediate transfer to a different storage unit of the descriptive information for said following cut if the transfer to said other storage unit of the information

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for said preceding cut is delayed beyond the arrival of said following cut.

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