

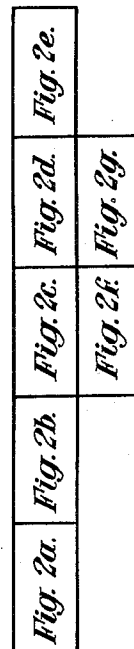
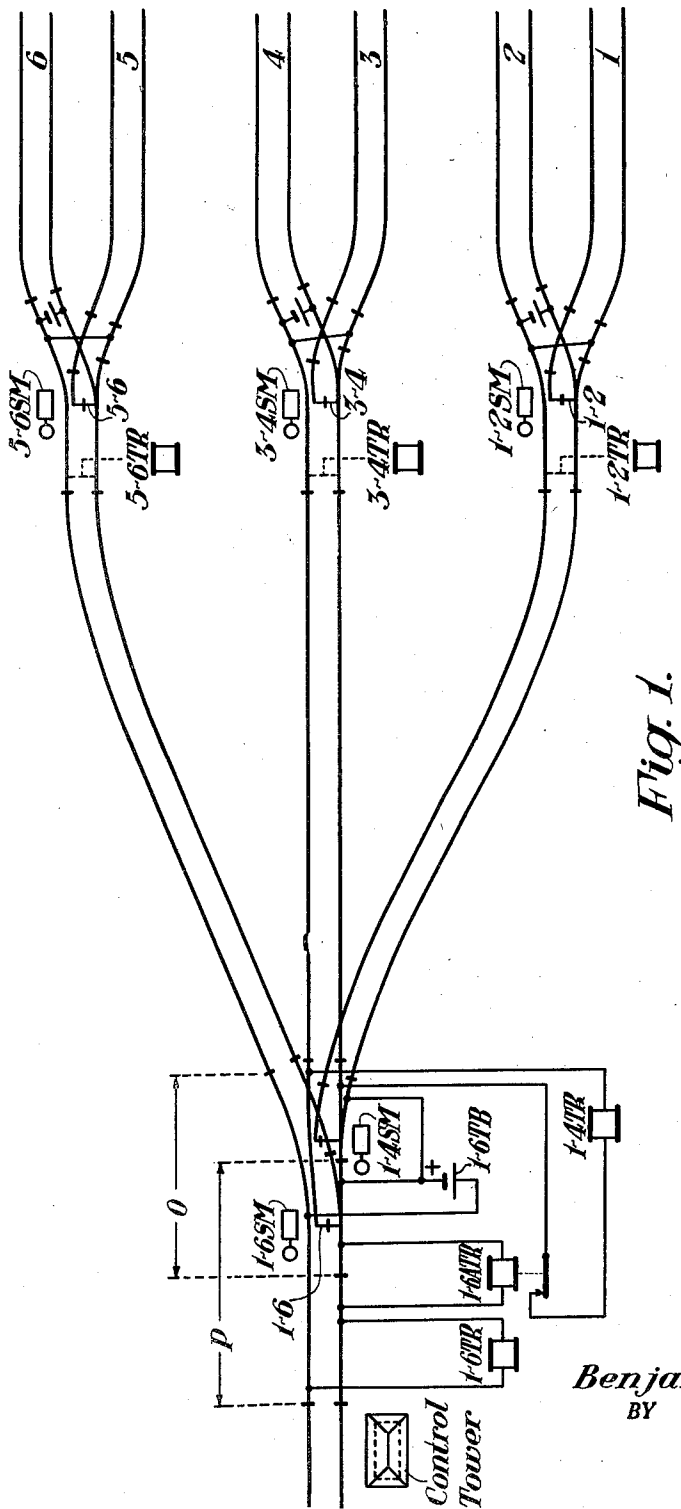
Dec. 9, 1958

B. MISHELEVICH
AUTOMATIC CONTROL OF RAILWAY CLASSIFICATION
YARD TRACK SWITCHES

2,863,991

Filed May 15, 1953

8 Sheets-Sheet 1



INVENTOR.
Benjamin Mishelevich
BY *W. L. Stout.*

HIS ATTORNEY

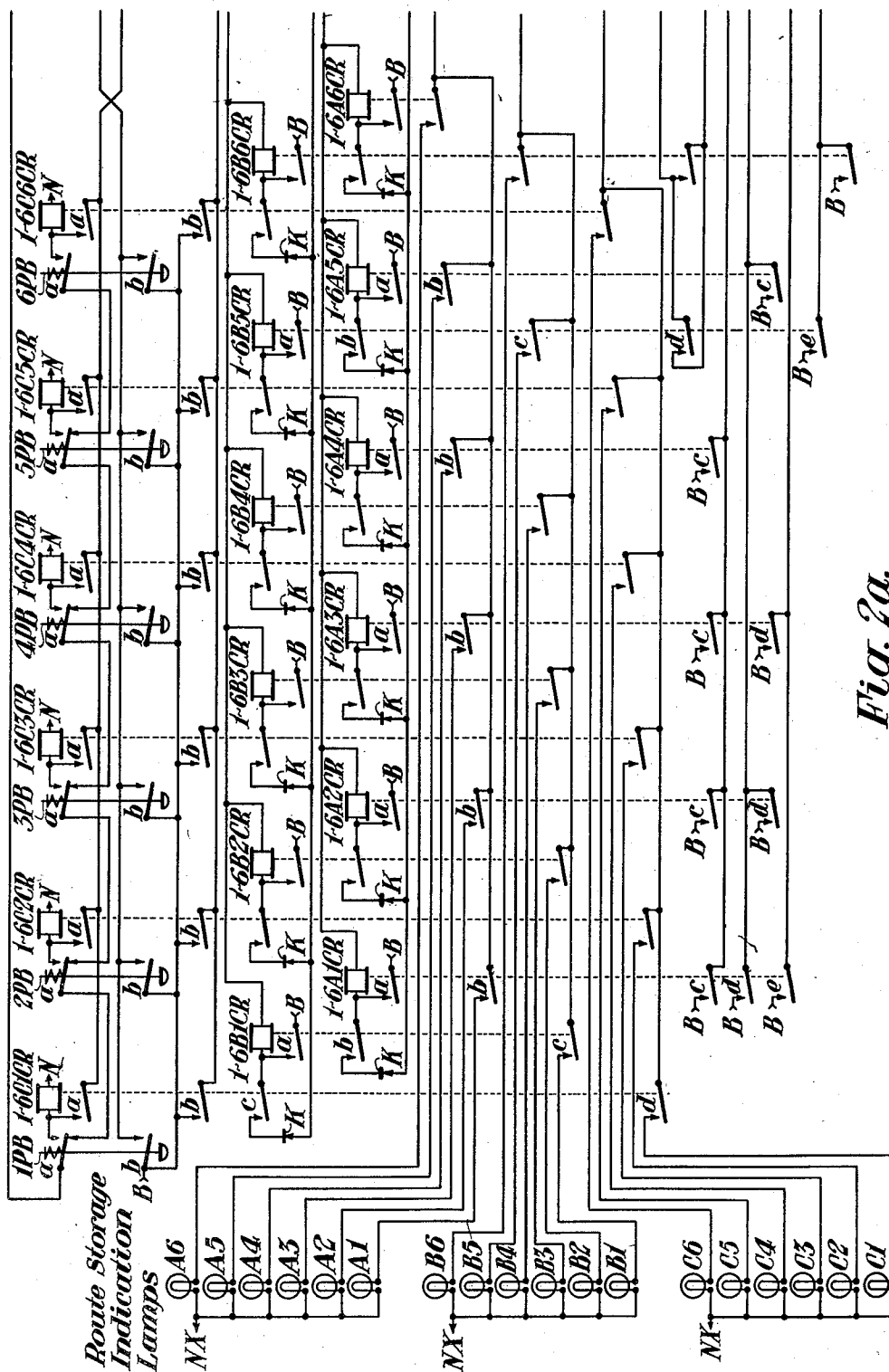
Dec. 9, 1958

B. MISHELEVICH
AUTOMATIC CONTROL OF RAILWAY CLASSIFICATION
YARD TRACK SWITCHES

2,863,991

Filed May 15, 1953

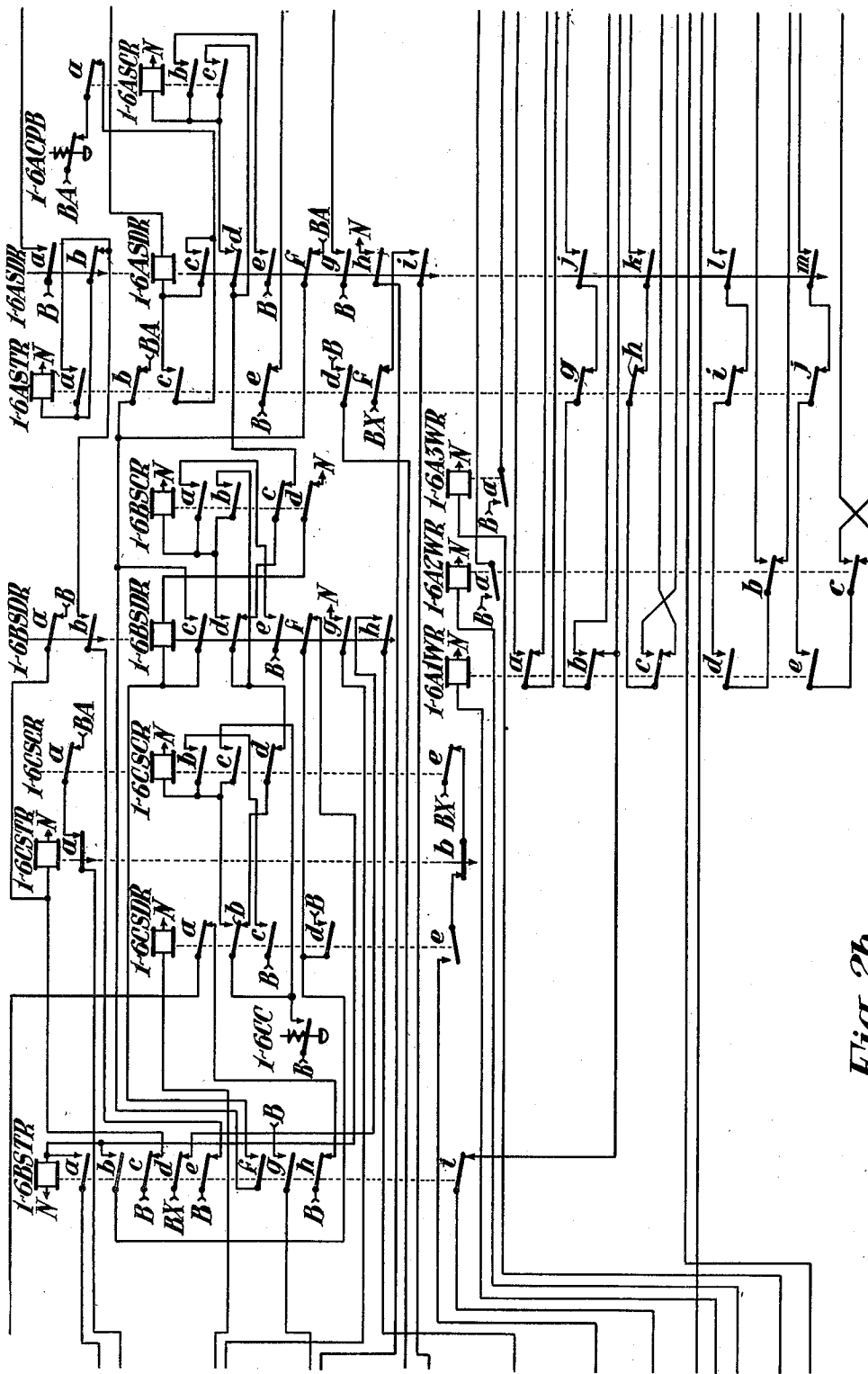
8 Sheets-Sheet 2



B. MISHELEVICH
AUTOMATIC CONTROL OF RAILWAY CLASSIFICATION
YARD TRACK SWITCHES

8. Sheets-Sheet 3

Filed May 15, 1953



Dec. 9, 1958

B. MISHELEVICH
AUTOMATIC CONTROL OF RAILWAY CLASSIFICATION
YARD TRACK SWITCHES

2,863,991

Filed May 15, 1953

8 Sheets-Sheet 4

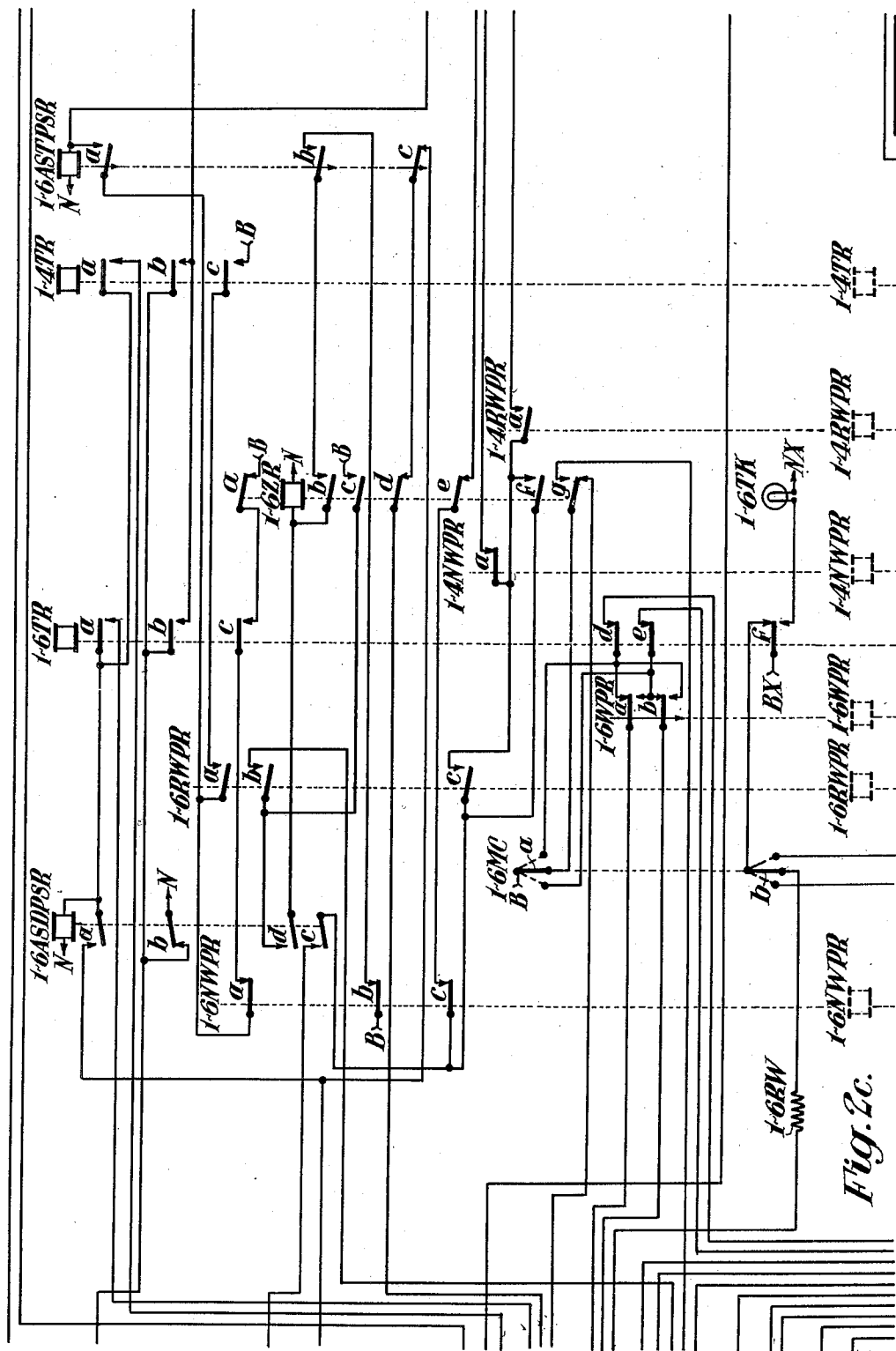


Fig. 2c.

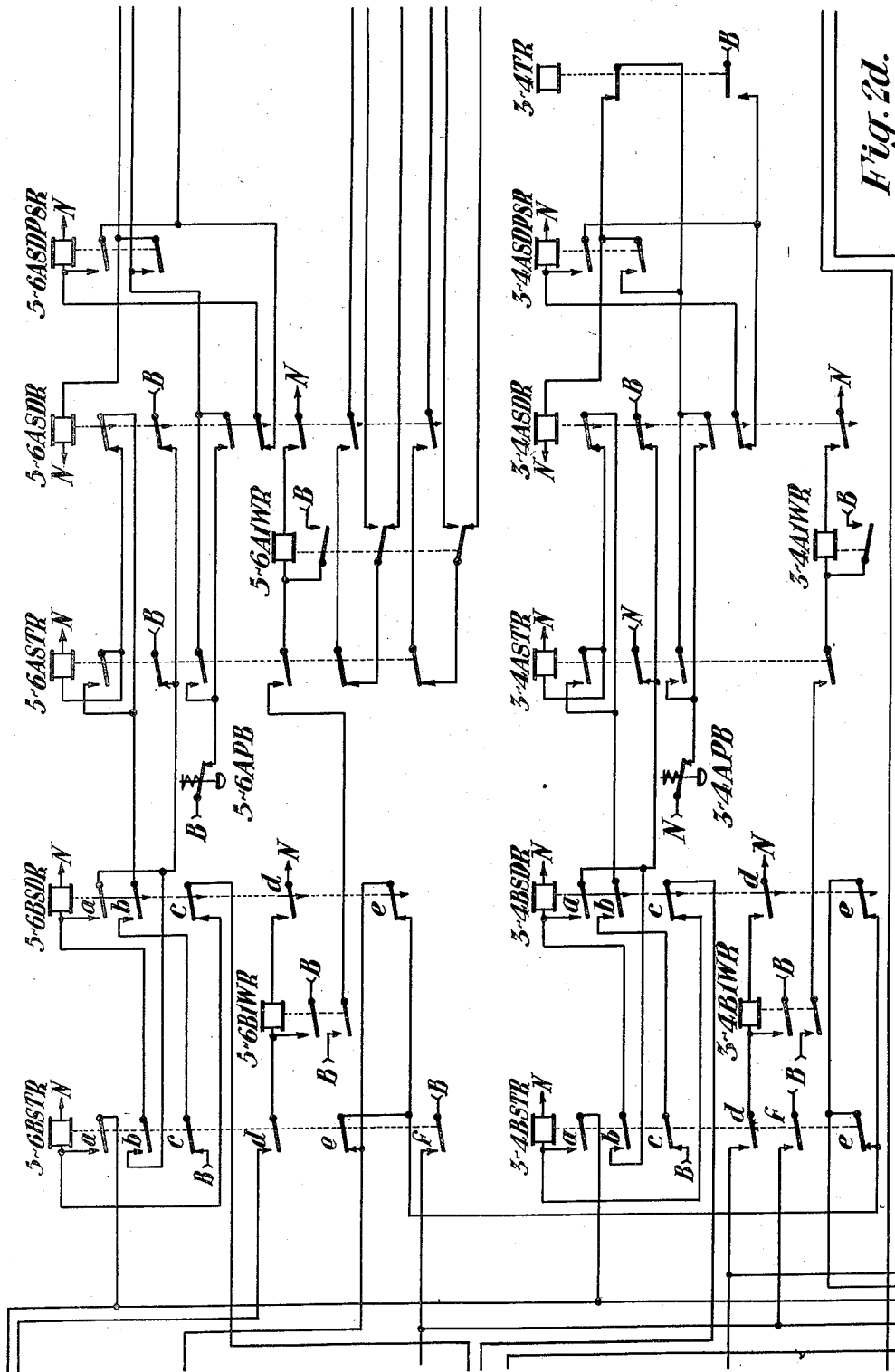
Dec. 9, 1958

B. MISHELEVICH
AUTOMATIC CONTROL OF RAILWAY CLASSIFICATION
YARD TRACK SWITCHES

2,863,991

Filed May 15, 1953

8 Sheets-Sheet 5



Dec. 9, 1958

B. MISHELEVICH
AUTOMATIC CONTROL OF RAILWAY CLASSIFICATION
YARD TRACK SWITCHES

2,863,991

Filed May 15, 1953

8 Sheets-Sheet 6

Typical Switch Control and Indication Circuits for Switches 1-2, 3-4, and 5-6.

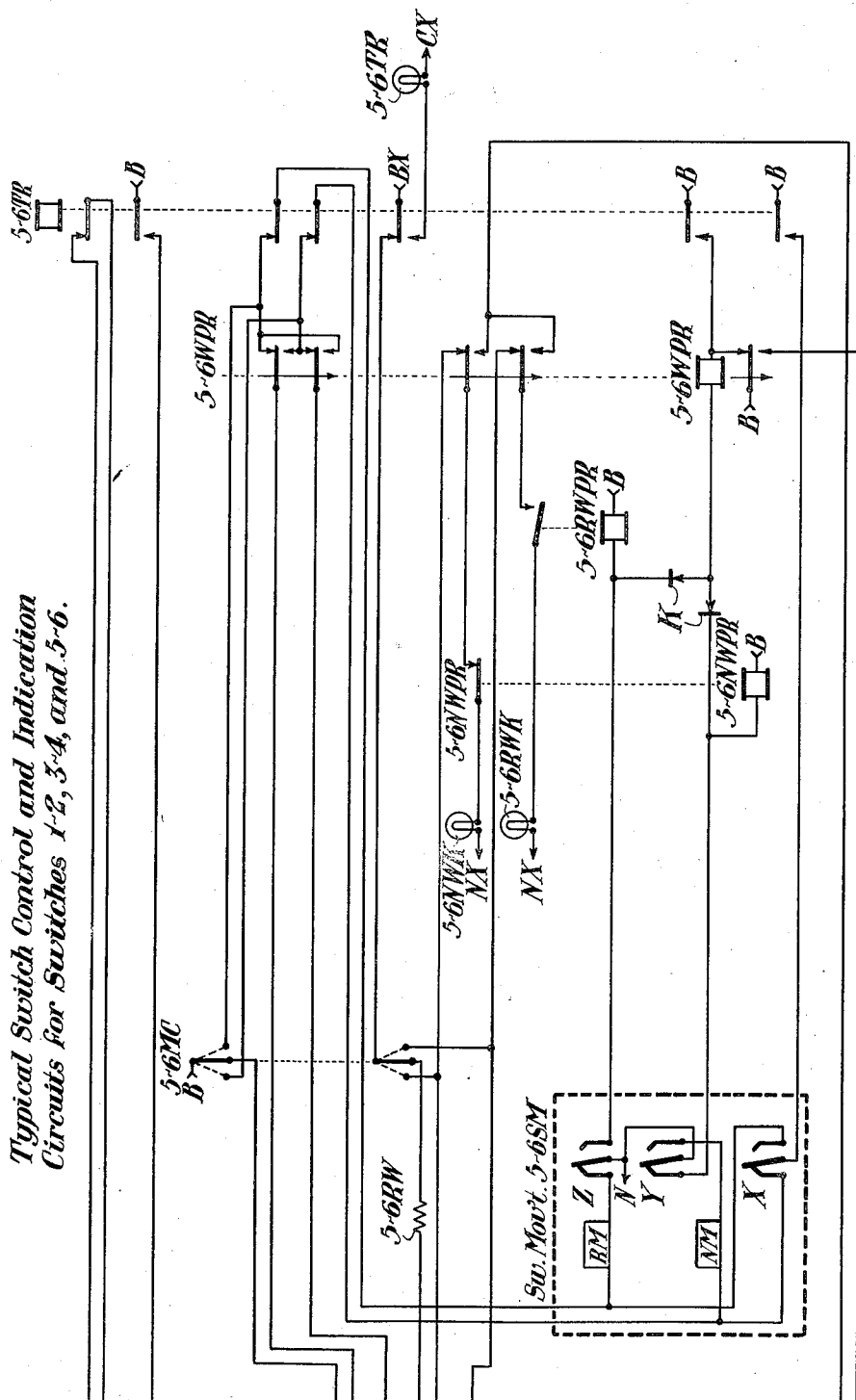
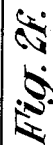


Fig. 2e.

Filed May 15, 1953

YARD TRACK SWITCHES

8 Sheets-Sheet 7



Dec. 9, 1958

B. MISHELEVICH
AUTOMATIC CONTROL OF RAILWAY CLASSIFICATION
YARD TRACK SWITCHES

2,863,991

Filed May 15, 1953

8 Sheets-Sheet 8

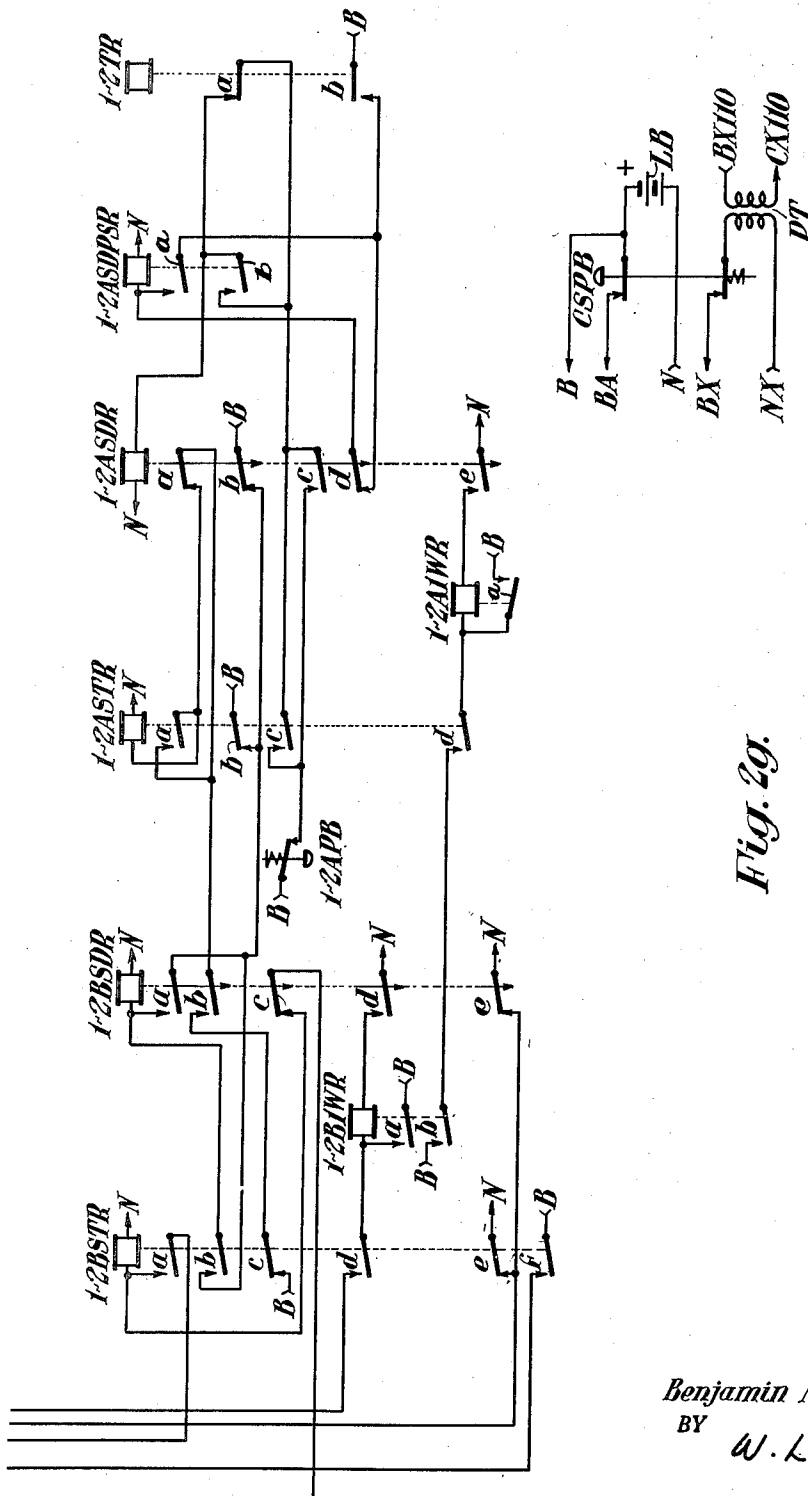


Fig. 29.

INVENTOR.
Benjamin Mischelevich
BY *W. L. Stout.*
HIS ATTORNEY

1

2,863,991

AUTOMATIC CONTROL OF RAILWAY CLASSIFICATION YARD TRACK SWITCHES

Benjamin Mishelevich, Pittsburgh, Pa., assignor to Westinghouse Air Brake Company, Wilmerding, Pa., a corporation of Pennsylvania

Application May 15, 1953, Serial No. 355,281

6 Claims. (Cl. 246—2)

My invention relates to automatic control of railway classification yard track switches, and particularly to an improved system for automatic control of railway classification yard track switches, in which, with a minimum amount of apparatus, improved operation is obtained in that the routing of cars through the yard is speeded up because less spacing is required between successive cars or cuts of cars. Furthermore, information as to the routing of successive cars or cuts of cars is presented to the operator of the system in such manner as to facilitate more rapid operation of the system.

A hump yard classification system is a yard of railway tracks and track switches, wherein a single track preferably leading from a hump or hill diverges into a large number of storage tracks through suitable track switches. In practice, cars, or cuts of cars as they are sometimes called, are allowed to run down the hump in close succession, each car or cut of cars going to a particular storage track. In practice, a large number of such cars, or cuts of cars, follow each other off the hump in close succession, and in order that a track switch may assume the proper position when a particular car reaches it, it is often necessary that the track switch be operated immediately upon the vacancy of the detector track circuit associated therewith by the car next in advance. In other words, the requirement of time of operation of track switches is often so precise that automatic control of the track switches is desirable in order that a track switch may be operated as soon as its detector track circuit becomes unoccupied by a preceding car. Since the cars to be classified may be so closely spaced that several differently classifiable cars may occupy the same stretch of non-track-circuited track between two successive track switches, it is necessary to have suitable train describer storage apparatus which will store, so to speak, the destination each particular car or several cars is to take, so that this stored indication may operate the track switch before the car designated thereby reaches such track switch. In modern hump yard train classification systems the cars or cuts of cars are retarded by suitable track brakes or retarders, which track brakes are controlled from a control tower located below the hump and from which tower the distribution and storage tracks are clearly visible. Additionally, in systems wherein the track switches are manually controlled, the usual practice is to have the manual control levers for the operation of the track switches on the same control board as the control apparatus for the car retarders, so that the towerman controls both the routing of the cars and the retardation as the cars pass along the various leads to their final storage tracks. In the use of a system for automatically governing the track switches, the car or cut description stored in the system is preferably registered therein by the control tower operator, so that thereafter he need only be concerned with controlling the retardation of the various cuts of cars as they pass down the hump, since the switches will automatically be operated

2

in advance of each cut of cars to route the cars to their proper storage track.

It has previously been proposed to provide systems of the type described, which comprise an arrangement of manually operable contacts, relays and circuits, which relays are neutral relays many of which are provided with various stick or holding circuits. These systems are arranged to employ a plurality of relay storage banks, the number of storage banks in each storage unit being set so that all of the cars that may occupy a stretch of track leading to a particular track switch will have their descriptions stored therein, one description for each storage bank. Each of these storage banks includes three kinds or characters of relays. Each storage unit includes storage detector relays which when energized indicate that a train description or routing is stored in the associated bank of such a unit, switch storage relays which designate the route that the approaching cut of cars is to take, and storage transfer relays which determine when a route description may be transferred from one storage bank to the next successive storage bank.

The route descriptions are usually entered into the apparatus by the operation of push button or other manually operable contacts which designate the final storage track to which the particular car or cut of cars is assigned. The operation of these contacts stores in the initial unit of the apparatus the route description for the cut of cars, in a digital form, that is, by providing a storage relay for each storage track in the classification yard. In systems previous to the one disclosed in this application, it has been the practice to translate the digital route storage in the initial bank to a combination code, that is to energize a plurality of busses or code wires in a particular combination which determines the route of the cut of cars. Additional banks of combination storage relays are then provided, so that a plurality of route descriptions may be stored in the initial unit of the system.

However, with this type of arrangement, the provision of indications to the operator of the system as to the routes which are stored in the system is difficult from the standpoint that complicated translation circuits are required if the information is to be presented to the operator in sequential form, that is, if the operator is to be given indications of the storages which exist in the initial storage unit of the system, in the sequence in which they are entered in the system. Accordingly, one object of my invention is to provide a system of the type described in which the initial storages in the system are contained in a system of digital storage relays, of which a plurality of banks may be provided, with the storage in each bank being transferred to the next succeeding bank when the succeeding bank is in the position to receive an incoming storage. The storage relays in each bank of the initial unit are provided with circuits which govern indicators to advise the operator of the equipment of the condition of the initial storage unit both as to the capacity remaining in the unit and the specific description of the cars or cuts of cars which have been entered in the unit.

The route descriptions stored in the final bank of digital storage relays in the initial unit are translated into a combination code, which is transferred to succeeding storage units, though the operation of storage detector and storage transfer relays, as well as by relays which are governed by the occupancy of a detector section of the track switch by a car or cut of cars. In the succeeding storage units following the initial storage unit, the route descriptions are stored as a combination code, this arrangement requiring fewer relays than if the digital code were maintained throughout the system. As in the previous systems, the apparatus is

arranged so that the energized or deenergized condition of a switch storage relay in one of the storage units other than the initial unit determines whether or not the switch associated with that unit will be positioned to its normal or reverse position. If the switch is to remain in its normal position, the switch storage relay will remain deenergized, but if the switch is to be reversed, the switch storage relay will be energized and its contacts picked up. The circuits are constructed and arranged in such manner that the switch storage relays may all remain released for a particular route, in which all switches are to be positioned in their normal positions, in which case the route description is obtained through the use of the storage detector and transfer relays of the various units following the initial unit.

In systems of this type as previously proposed, it is necessary to provide a storage unit for each of the switch locations in a classification yard automatic switching apparatus. Accordingly, where lap switches are employed to conserve space in a classification yard, such lap switches being arranged so that the switch point of one of the switches falls between the switch points and the frog of a preceding switch, it may be necessary to provide an additional storage unit, to govern the operation of the first and second switch of the lap switch layout. However, an object of my invention is to provide an arrangement for a system of the type described in which the operation of the two switches of the lap switch layout is governed by a single set of switch storage relays, together with their storage detector and transfer relays, by the provision of one auxiliary relay which is governed in such manner as to insure the proper positioning of the two switches of the lap switch combination.

A further object of my invention is to provide an automatic switching system for railway track switches in a railway classification yard, which system may be readily expanded to govern these switches in a layout of any size.

Other objects of my invention and features of novelty thereof will become apparent from the following specification, taken in connection with the accompanying drawings.

In practicing my invention I provide a system of interconnected relay circuits arranged in groups designated as storage units. In general, one storage unit is provided for each switch location in the classification yard. Within each of the storage units, the relays and circuits are further sub-divided into storage banks. One storage bank is provided for each route description to be stored in such storage unit at any particular time, as determined by the construction of the classification yard and the number of cars or cuts of cars which can be moving through the yard between successive switches at any one time. The route descriptions are entered in the system by operation of suitable switches, such as manually operated push buttons, in accordance with the storage tracks to which the cars or cuts of cars are to be routed, and in the order in which the cars or cuts of cars enter the classification yard. These contacts control a plurality of digital storage relays in the first, or initial bank of the initial storage unit. The route descriptions are represented in the initial bank by the picked up or released condition of the digital storage relays, the relay associated with a particular route being picked up when the route is entered in the storage unit. Additional banks of digital storage relays in the initial storage unit are provided, in order that a predetermined number of routes can be stored therein, by cascading the route description from the first storage bank to the subsequent storage banks, provided these banks are empty, i. e., none of the storage relays in that bank are picked up. The route descriptions stored in the storage banks of the initial storage unit are indicated to the operator by a plurality of lamps governed by the digital storage relays, one lamp

being associated with each relay. Transfer of the route storages from one bank to the next is accomplished through the medium of a storage transfer relay and a storage detector relay associated with each storage bank, the storage transfer relay acting to energize the storage relays of the succeeding bank in accordance with the energization of the storage relays in the preceding storage bank, providing the storage detector relay indicates by its released condition that the succeeding bank is vacant, i. e., that none of the storage relays in that bank are picked up.

The storage relays in storage units subsequent to the initial storage unit are arranged to store the route description in a combination code form, which is a simpler and more economical manner of storing the route descriptions where numerical indications are not required. This type of storage is obtained in my invention by providing as many storage relays in each storage bank as the maximum number of switches which can be traversed by a car or cut of cars after passing the location with which the particular storage banks are associated. Each of these switch storage relays in a particular bank defines the position which a particular switch is to take for the route description stored in that bank, the switch being controlled to its normal position if the switch storage relay is deenergized and being controlled to its reverse position if the switch storage relay is energized.

In the system proposed by my invention, the route descriptions are forwarded from one storage unit to the next upon the occupancy of the detector track section associated with the storage unit. This operation is governed by a storage transfer repeater stick relay and a storage detector repeater stick relay governed by the detector track relay of the associated track switch, in such manner that the repeater stick relays can function only once during a track circuit occupancy to forward a route description from the final bank of the associated storage unit to the initial bank of the succeeding storage unit.

The control of the track switches is accomplished by circuits including contacts of the associated switch storage relay. The usual detector locking is provided by carrying the main switch control circuits over front contacts of the detector track relay. In order to provide for positive operation of the switch to one or the other of its two positions in the event that the main switch control circuits are opened during the operation of the switch, I provide auxiliary switch control circuits governed by contacts associated with the switch and by a back contact of the associated track relay so that if the switch detector track section is occupied during the transit of the switch, the switch will be operated to the final position to which it is closest at the time.

In order to control the operation of the second switch in a "lap" switch layout, where separate detector sections are provided, my invention includes the provision of an auxiliary relay which includes in its control circuit the switch storage relays (or the digital storage relays, in the event that the lap switch is the first switch in the yard layout) of the second preceding bank in the associated storage unit. Contacts of this auxiliary relay are interposed in the switch control circuit for the first lap switch of the lap switch layout so that the first lap switch may be operated to the proper position for a following cut of cars as soon as a preceding cut of cars has vacated the first of the overlapped detector track sections.

I shall describe one form of automatic control of railway classification yard track switches embodying my invention and shall then point out the novel features thereof in claims.

In the drawings, Fig. 1 is a diagrammatic view of a classification yard equipped with an automatic switching control system according to my invention.

Figs. 2a, 2b, 2c, 2d, 2e, 2f and 2g illustrate, diagram-

5

matically, the automatic switching control circuits for Fig. 1.

Fig. 3 is an assembly diagram for Figs. 2a, 2b, 2c, 2d, 2e, 2f and 2g.

Similar reference characters refer to similar parts in each of the several views.

Referring to Fig. 1 of the drawings, there is shown, in schematic form, the layout of track switches in a six track classification yard, which is equipped with an automatic switching system constructed in accordance with my invention. As shown, the single lead track at the left diverges through various switches to six storage tracks, numbered consecutively 1, 2, 3, 4, 5 and 6 from bottom to top at the right-hand end of the track layout. At the left or hump end of the layout, there is shown a control tower at which point the control equipment may be disposed, and from which point the operator governs the operation of the classification yard. Each of the track switches is provided with a suitable power operated switch movement designated by the reference character SM, preceded by a hyphenated number combination which indicates the tracks to which the switch leads. For example, 1—2SM is the switch movement associated with the switch which diverges the car or cut of cars to track 1 or track 2. Each of the single switch locations 1—2, 3—4 and 5—6, is provided with a suitable type of track circuit, here shown as a conventional direct current track circuit including a track battery connected across the rails at one end of the section and a track relay connected across the rails at the other end of the section. These track relays provide detector locking for the switch with which they are associated, so that the switch cannot be operated under the wheels of a car or cut of cars which is traversing the switch. It is to be understood that various types of track circuit arrangements may be employed, and my invention is not limited to use with direct current neutral track circuits of the type shown. As previously pointed out, each of the track circuits for the single switches is provided with a track relay, which is designated by the reference character TR, preceded by the number of the switch, as for example, 1—2TR.

The first two switches in the layout, namely, 1—6 and 1—4 comprise what is known in the art as a "lap" switch. Such an arrangement is employed where it is desired to conserve space, and is constructed and arranged so that the switch points of the second switch in the layout, in this case the switch 1—4, fall between the switch points and the frog of the first switch, in this case 1—6. In connection with the lap switch layout as shown in Fig. 1, there is provided a special track circuit arrangement for providing the proper detector operation for the control of the two lap switches. This arrangement includes a track battery 1—6TB and 3 track relays, 1—6TR, 1—6ATR and 1—4TR. This track circuit arrangement 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. The operation of the track circuit arrangement as shown in Fig. 1 is explained in detail in the aforementioned Thompson patent. It is deemed sufficient to point out herein that the apparatus is arranged in such manner that track relay 1—6TR will be released at any time that a car or cut of cars is occupying the stretch indicated by the reference character P together with the limits shown by the arrows associated with this reference character, and that relay 1—4TR will be released at any time that the stretch of track between the limits indicated by the reference character O together with the arrows associated therewith is occupied by a car or cut of cars. Accordingly, as a car or cut of cars approaches the switches 1—6 and 1—4 from the hump, the switch movement 1—6SM will be locked by the release of the track relay 1—6TR as soon as the first pair of wheels of the car or cut of cars passes the first pair of insulated joints at the left-hand end of the track stretch. Switch 1—6 will remain locked until the last

6

pair of wheels has passed off the insulated joint located at the right-hand end of the limits indicated by the reference character P. Also, the switch movement 1—4 will become locked as soon as the first pair of wheels passes the insulated joint at the left-hand limit shown to the left of the reference character O, and will remain locked until the last pair of wheels passes the limit indicated to the right of the reference character O.

Throughout the drawings, it will be found that the contacts associated with each of the relays shown in the circuit arrangement are arranged in a vertical line with the operating winding of the relay, with the exception of the contacts of the track relays, in which case, an operating winding is shown associated with the track relay contacts, and it will be understood that this winding is connected as shown by Fig. 1.

The circuits for providing the automatic control of the switches shown in Fig. 1 are shown in Figs. 2a through 2g when these drawings are arranged in the manner shown in Fig. 3.

In the control tower, there is provided a control board or machine which includes a plurality of manually operated contacts such as the push buttons designated by the reference characters 1PB through 6PB, Fig. 2a. One push button is provided for each of the storage tracks in the yard, in this instance, the tracks 1 through 6. Associated with each of the push buttons is a series of digital storage relays, such as the relays 1—6C1CR, 1—6B1CR and 1—6A1CR, Fig. 2a, associated with the push button 1PB. Additionally, located at a convenient point on the control machine for observation by the operator are a plurality of indication lamps, such as the lamps A1 through A6, B1 through B6, and C1 through C6, Fig. 2a, which are employed to indicate to the operator of the machine what route storages are present in the initial storage unit of the apparatus. The digital storage relays, such as relays 1—6C1CR, 1—6B1CR, and 1—6A1CR are arranged and governed in such manner that these relays govern the storage routes which are put into the machine by operation of the push buttons in the sequence in which the cars or cut of cars coming off the hump are to be routed to their various storage tracks. The control circuits for the initial digital storage relays are arranged in such manner that the operation of the push button causes the associated relay in the initial or C bank to be picked up, provided no other relay in that bank is picked up. With a particular initial digital storage relay picked up in the C bank, the corresponding relays in the B and A banks will pick up in sequence, provided that these banks are empty. Accordingly, a route description entered into the initial storage unit is cascaded from the initial digital storage relay to the final digital storage relay as long as the following bank is empty. Since the route storage indication lamps are governed by contacts on the digital route storage relays, these lamps will operate in sequence to indicate the position of the route storage. That is, for example, if the operator depresses push button 1PB, relay 1—6C1CR will pick up to thereby light indication lamp C1. Upon picking up the relay 1—6C1CR, circuits are established which detect whether or not the subsequent storage banks contain a route information, that is, whether or not one of the route storage relays in the next bank is picked up, and if the banks are empty the route storage is cascaded through to the final bank. In the particular instance cited, the relays 1—6B1CR and 1—6A1CR would become picked up in sequence, so that lamps B1 and A1 would light in the same sequence. It is of course necessary that the transfer of the storage from one bank to another releases the storage relay in the preceding bank, so that in effect, the operation of push button 1PB will cause the lamps C1, B1 and A1 to be lighted in the sequence named, with the lamp A1 remaining lit as long as the storage remains in the initial storage unit. It will be apparent that the initial storage unit is not limited in its capacity either to the number of tracks or routes which

are to be stored therein, or the number of storages made possible, since the circuits may be readily expanded to take care of any number of route descriptions and any number of storages for these route descriptions. From the foregoing, it will be seen that the route descriptions are stored in the initial storage unit in the manner of a digital code, that is, a relay is provided for each of the possible routes, in each of the storage banks in the initial storage unit. In this manner, it is comparatively simple to provide a route storage indication lamp arrangement of the type shown, in which individual lamps representing the various routes are lighted for each storage in the initial unit.

The transfer of the route storages from one bank to another in the various storage units is made through the medium of the operation of storage transfer relays and storage detector relays, together with repeating stick relays of each storage transfer relay and storage detector relay for the final bank of each unit. For example, in the initial unit there are provided storage transfer relays 1—6CSTR, 1—6BSTR, and 1—6ASTR, Fig. 2b, corresponding to the three banks C, B and A, respectively, in the initial storage unit. Likewise there are provided the storage detector relays 1—6CSDR, 1—6BSDR and 1—6ASDR, Fig. 2b. In the final or A bank of the initial storage unit there are also provided the repeater stick relays 1—6ASDPSR and 1—6ASTPSR, Fig. 2c. These relays serve to provide means for transferring the route descriptions stored in the various banks of the storage unit from one bank to the next bank in accordance with whether or not the following bank is occupied by a route description. Additionally, the storage detector relays and the storage transfer repeater stick relays in the final or A banks of each of the units are governed in part by the contacts of the track relay associated with the switches, to thereby provide for advancing the route description from one storage unit to another as the car or cut of cars associated with the route description moves through the various detector sections as it passes from the hump to the storage track. The operation of these relays will be explained in detail subsequently.

As previously explained, the route descriptions are stored in the initial storage unit in the form of a digital code, in order to render the provision of route storage indications possible by relatively simple circuits. However, following the initial storage unit, the route descriptions are stored in subsequent storage units in the form of a combination code, that is, a group of switch storage relays are provided which are arranged to be picked up or released in different combinations depending upon the route stored in the particular unit. The translation from the digital code to the combination code is provided in the initial storage unit, and the route descriptions are cascaded from the initial storage unit to the subsequent storage unit for the following track switches in the layout by combination code busses. The combination code storage is provided by switch storage relays which when deenergized indicate that the associated switch is to take one position, and when energized indicate that the associated switch is to take the other position. For the purposes of this disclosure, it will be considered that a switch is occupying its normal position when it is set to divert traffic to the left as a car or cut of cars approaches the switch from the hump, and it will be considered to be in its reverse position when it is set to divert a car or cut of cars to the right as the car or cut of cars proceeds over the switch from the hump. The switch storage relays in the initial unit are governed by circuits including contacts of the digital route storage relays, in such manner that the pick up of one or more of the digital storage relays in the final bank will energize a particular switch storage relay, and the energization of this switch storage relay will cause the operation of the associated switch to its reverse position, whereas if the particular route description stored in the digital storage relays does not

energize a particular switch storage relay, the switch associated with that relay will remain in its normal position.

Power for the operation of the relays other than the track relays is obtained from a suitable source, such as the batter LB shown, the power bus BA including a normally closed contact of a push button CSPB. The power for the various indication lamps is obtained from a suitable alternating current source such as the transformer PT, the power bus BX also including a closed contact of push button CSPB. These power supplies are shown in Fig. 2g.

In order to provide for the cancellation of improperly registered route descriptions in the apparatus, several cancellation push buttons are provided which when operated cancel the description contained in certain parts of the system. The cancellation button for clearing the system, CSPB, is arranged so that when this push button is operated the supply of energy to certain of the circuits in the initial storage unit is cut off, so that all of the digital route storage relays in the initial storage unit are released. An additional contact on the clear system push button CSPB is provided in the circuit for supplying energy to light the various indication lamps, so that during the time that the system is being cleared, the lamps will remain dark and not flash or blink. Operation of this push button cancels all the route storages in the initial bank. In the final bank of each of the storage units there is provided a cancellation push button such as the push button 1—6ACPB, Fig. 2b, which when operated cancels the route description stored in the final bank of the associated unit. Additionally, there is provided for the initial unit a cancellation push button 1—6CC, Fig. 2b, which when operated cancels the route descriptions in succession from the initial bank to the final bank of the storage unit. By operation of this push button, the routes stored in the banks of the initial storage unit may be cancelled by operating the push button the same number of times as the number of the storage which it is desired to cancel. This push button governs the operation of storage cancellation relays such as relays 1—6CSCR, 1—6BSCR and 1—6ASCR, Fig. 2b, which are governed in such manner that these relays are picked up in sequence as the push button is operated, to thereby cancel the route description in the storage bank associated with the cancellation relay.

Each of the track switches, such as, for example, switch 1—6, is provided with a switch movement such as 1—6SM, Fig. 2f, which may be of any suitable type, and is herein shown and described as being of the direct-acting electropneumatic type switch machine, one such type being 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 or machines, there is provided a normal and a reverse switch repeater relay, such as relays 1—6NWPR and 1—6RWPR, Fig. 2f, which serve to govern the various route selection circuits for cascading the route descriptions through the proper storage units in accordance with the routes as set up in the initial storage unit. The apparatus also includes a switch restoring relay such as relay 1—6WPR, Fig. 2f, which is arranged to operate in such manner that the relay functions to restore the switch to its normal or reverse position in case the switch does not complete its operation within a specified time, such as might be due to an obstruction at one of the switch points. In order to provide manual control of the switches at times when it may be desirable, such as during trimming operations, to manually govern the position of the switches, a three-position switch control lever such as lever 1—6MC, Fig. 2c, is provided for each of the track switches. When this lever is positioned in its usual or center position, circuits are completed for governing the operation of the associated switch movement automatically in accord-

ance with the route descriptions in the system. When the switch lever is moved to one or the other of the two extreme positions, the switch movement is operated to its normal or reverse position in accordance with the position of the lever, provided, of course, that a car or cut of cars is not occupying the detector track circuit including the switch. Normal and reverse switch indication lamps, such as, for example, 1-6NWK and 1-6RWK, Fig. 2f, are provided on the control machine to indicate to the operator of the machine the actual position of the switch points. The circuits for controlling the switch indication lamps are arranged in such manner that the lamps are lighted as the route description is provided for the operation of each switch in the route in advance of the car or cut of cars, so that the switch indication lamps also serve as route progression lamps on the control board. Each of the track relays govern an indication lamp on the control board, which lamps when lighted indicate that the detector section associated with the track relay is occupied, such as lamp 1-6TK, Fig. 2c, which is governed by track relay 1-6TR. Each of the switch movements is provided with a plurality of contacts, such as the contacts X, Y and Z shown in connection with each of the switch movements on the drawings, with these contacts arranged to open and close in such a sequence that "carry through carry back" operation is secured. In this type of operation, the parts are constructed and arranged in such manner that if the switch movement begins to operate from one position to the other, the movement will continue operation even though a car enters the detector section, provided the switch has passed its center position. If the switch has not reached its center position at the time the track relay is released, indicating the entrance of a car or cut of cars into the detector section, the switch is restored to the position from which it started.

Description of operation

It is believed that a description of the operation of the switching system will provide a clear understanding of the invention by describing it under various conditions of operation.

It will first be assumed that there are no route descriptions stored in any of the storage units and that all of the manual switch control levers are in the automatic position, and additionally, that there are no cars moving over the leads from the hump to the various storage tracks. Assuming that the first car proceeding from the hump is to be routed to storage track 1, the operator in the control tower will depress push button 1PB, Fig. 2a.

When the push button 1PB is depressed momentarily by the operator, a pick up circuit for relay 1-6C1CR is established, which circuit may be traced from terminal B at back contact h of relay 1-6BSTR, Fig. 2b, over back contact a of relay 1-6CSDR, over contact a of 1PB and through the winding of relay 1-6C1CR to terminal N. The back contact h of relay 1-6BSTR provides a check that no transfer is in progress from the C to the B bank of digital storage relays in the initial unit, and the back contact a of relay 1-6CSDR checks that the bank C does not have a digital storage relay picked up, in other words, that the bank C is empty at this time. It will be seen that the pick up circuit for the various digital storage relays in the initial or C bank of the initial storage unit are checked over the back contacts of the preceding push buttons, so that a check is provided that only one push button may be operated at a time, and in case two push buttons are depressed simultaneously with no storages in the C bank, the lower-numbered digital storage relay will be picked up, and no other relay may be picked up at this time.

When relay 1-6C1CR picks up, it establishes a stick or holding circuit for itself which circuit may be traced from terminal BA at back contact a of relay 1-6CSCR, 75

Fig. 2b, over front contact a of relay 1-6CSTR, front contact a of relay 1-6C1CR, and through the winding of relay 1-6C1CR to terminal N. The picking up of relay 1-6C1CR also closes a circuit including front contact b of the relay which energizes relay 1-6CSDR, and as previously pointed out, the back contact a of relay 1-6CSDR is provided in the pick up circuit over the contact of the push button, so that at this time with relay 1-6C1CR picked up no further route storages can be entered in the initial or C bank of the initial storage unit. At this time, a circuit is established for supplying energy to the route storage indication lamp C1, which circuit may be traced from terminal BX over back contact e of relay 1-6CSCR, Fig. 2b, from contact b of relay 1-6CSTR, front contact e of relay 1-6CSDR, over front contact d of relay 1-6C1CR, and through the lamp C1 to terminal NX. Accordingly, the indication lamp bank will show that a route description to storage track 1 is stored in bank C of the initial storage unit.

When relay 1-6CSDR picks up, its front contact d establishes a circuit for supplying energy to the winding of relay 1-6BSTR; which circuit may be traced from terminal B at front contact d of relay 1-6CSDR, Fig. 2b, over back contact f of relay 1-6BSDR, and through the winding of relay 1-6BSTR to terminal N. The back contact f of relay 1-6BSDR checks that the B bank in the initial storage unit contains no route description. When relay 1-6BSTR picks up, two stick circuits are established for maintaining the relay energized. The first of these stick circuits includes a contact b of each of the push buttons 1PB to 6PB, which insures that only one storage may be entered into the system and transferred from the C bank to the B bank with one operation of the push button. This circuit includes front contact a of relay 1-6BSTR, and the contacts b of each of the push buttons. The second stick circuit for relay 1-6BSTR includes front contact b of relay 1-6BSTR and front contact d of relay 1-6CSDR, this circuit being provided to insure that relay 1-6BSTR will remain picked up while the route description is being transferred from the digital route storage relays in bank C of the initial unit to bank B of the same unit.

When relay 1-6BSTR picks up, a circuit is established for supplying energy to the winding of relay 1-6BSDR, which circuit may be traced from terminal BA at back contact b of relay 1-6ASTR, Fig. 2b, and terminal BA at back contact f of relay 1-6ASDR, Fig. 2b, over front contact f of relay 1-6BSTR, through the winding of relay 1-6BSDR, and over back contact d of relay 1-6BSDR to terminal N. When relay 1-6BSDR picks up, its front contact c will establish a stick circuit for the relay which bypasses the front contact f of relay 1-6BSTR, so that relay 1-6BSDR will remain picked up subsequent to the release of relay 1-6BSTR.

With relays 1-6BSTR, 1-6BSDR and relay 1-6C1CR picked up, a circuit is established for transferring the route description stored in bank C by relay 1-6C1CR, to bank B, by picking up relay 1-6B1CR. The pick up circuit for relay 1-6B1CR may be traced from terminal B at front contact g of relay 1-6BSTR, Fig. 2b, through the blocking rectifier K, over front contact c of relay 1-6C1CR, through the winding of relay 1-6B1CR, and over front contact g of relay 1-6BSDR to terminal N. When relay 1-6B1CR picks up, it establishes a stick circuit for itself including front contact a of relay 1-6B1CR, the winding of the relay, and the front contact g of relay 1-6BSDR. It will be noted that the pick up circuit for each of the digital storage relays in banks A and B of the initial storage unit are provided with blocking rectifiers. These rectifiers are poled in such manner that pick up energy may flow therethrough to pick up the associated digital storage relay, but energy cannot flow through the recti-

fier when the stick circuit of the associated storage relay is closed. This arrangement prevents run-around circuits, or sneak circuits, from occurring in the pick up circuits of the various digital storage relays in the banks of the initial storage unit.

Relay 1—6CSTR is governed by a circuit including back contact *c* of relay 1—6BSTR and back contact *a* of relay 1—6BSDR. With relays 1—6BSTR and 1—6BSDR both picked up, the energizing circuit for relay 1—6CSTR will be open. However, relay 1—6CSTR is selected and arranged so that it is slow in releasing its contacts, and accordingly the contact of the relay will remain picked up for an interval of time which is sufficient for the digital storage relays in the second or B bank of the unit to pick up and close their stick circuits. At the expiration of the release time of relay 1—6CSTR, front contact *a* of relay 1—6CSTR opens and thereby interrupts the supply of energy to the stick circuit for relay 1—6C1CR, so that relay 1—6C1CR releases. The release of contact *c* of relay 1—6C1CR interrupts the previously traced pick up circuit for relay 1—6B1CR, but relay 1—6B1CR remains picked up at this time because of its previously established stick circuit including front contact *a* of the relay. Additionally, when contact *d* of relay 1—6C1CR releases it interrupts the circuit for supplying energy to the route storage indication lamp C1, so that this lamp is extinguished thereby denoting that no route storages are in the C bank of the initial storage unit. The release of contact *b* of relay 1—6C1CR opens the previously traced circuit for supplying energy to the winding of relay 1—6CSDR, and accordingly the relay 1—6CSDR releases. If at this time the operator has released the pressure upon the push button 1PB, the previously traced stick circuit for relay 1—6BSTR including front contact *a* of relay 1—6BSTR is open and the release of relay 1—6CSDR opens the other stick circuit for relay 1—6BSTR which includes front contact *b* of relay 1—6BSTR and front contact *d* of relay 1—6CSDR. At this time, therefore, the route description is stored in the B bank of the initial storage unit, by virtue of the picked up state of digital storage relay 1—6B1CR. At this time, a circuit is established for supplying energy to the lamp B1 of the route storage indication lamps which circuit may be traced from terminal BX at back contact *d* of relay 1—6BSTR, Fig. 2*b*, over front contact *h* of relay 1—6BSDR, front contact *c* of relay 1—6B1CR, and through the lamp B1 to terminal NX. Accordingly, the operator will be provided with an indication that a route storage to storage track 1 is present in the second or B bank of the initial storage unit.

When relay 1—6BSTR releases, its back contact *c* again establishes the circuit for supplying energy to the relay 1—6CSTR, and relay 1—6CSTR picks up so that contact *a* of relay 1—6CSTR which governs the stick circuits for the first or C bank of digital storage relays in the initial storage unit is again closed, so that a subsequent storage can be now entered in the initial or C storage bank of the initial storage unit.

The route storage stored at this time in the B bank of the unit is now transferred to the final or A bank of the unit by the following sequence of relay operation. When relay 1—6BSTR releases, its back contact *e* establishes a circuit for supplying energy to the winding of the transfer relay 1—6ASTR, which circuit may be traced from terminal B at back contact *e* of relay 1—6BSTR, Fig. 2*b*, over contact *b* of relay 1—6BSDR, back contact *b* of relay 1—6ASDR, and through the winding of relay 1—6ASTR to terminal N. When relay 1—6ASTR picks up, its front contact *a* closes a stick circuit for the relay which circuit bypasses back contact *b* of relay 1—6ASDR. The picking up of relay 1—6ASTR establishes a pick up circuit for the storage detector relay 1—6ASDR, which circuit may be traced from terminal BA at the cancellation push button

1—6ACPB, Fig. 2*b*, over back contact *a* of relay 1—6ASCR, front contact *c* of relay 1—6ASTR, through the winding of relay 1—6ASDR, and over back contact *b* of relay 1—6ADPSR to terminal N. With relays 1—6ASTR and 1—6ASDR picked up, a circuit is established for energizing relay 1—6A1CR, which circuit may be traced from terminal B at front contact *d* of relay 1—6ASTR, Fig. 2*b*, through the blocking rectifier K, over front contact *b* of relay 1—6B1CR, through the winding of relay 1—6A1CR, and over front contact *h* of relay 1—6ASDR to terminal N. When relay 1—6A1CR picks up, its front contact *a* establishes a stick circuit for the relay which circuit may be traced from terminal B at front contact *a* of relay 1—6A1CR, through the winding of the relay, and over front contact *h* of relay 1—6ASDR to terminal N.

When contact *f* of relay 1—6ASDR picks up, the contact *b* of relay 1—6ASTR is up at this time, and the circuit for supplying energy to the winding of relay 1—6BSDR is interrupted, so that relay 1—6BSDR releases. When relay 1—6BSDR releases, its front contact *b* interrupts the circuit for supplying energy to relay 1—6ASTR, and relay 1—6ASTR will be released.

With contact *f* of relay 1—6ASTR released, and contact *i* of relay 1—6ASDR picked up, a circuit is established which includes front contact *b* of relay 1—6A1CR, for supplying energy to the lamp A1 of the route storage indication lamp, so that this lamp now indicates that a route to storage track 1 is stored in the final storage bank of the initial storage unit. Additionally, the release of front contact *h* of relay 1—6BSDR interrupts the circuit for supplying energy to the lamp B1 of the route storage indication lamp so that this lamp is now extinguished. The release of contact *g* of relay 1—6BSDR interrupts the previously traced stick circuit for relay 1—6B1CR, so that this relay releases, and at this time the second or B bank of the initial storage unit is empty.

From the foregoing, it will be apparent that the entry of a route description into the initial storage unit of the system, by operating one of the push buttons, causes the corresponding digital storage relay in the initial storage bank of the unit to become picked up, and if the subsequent storage banks are empty, the digital storage relays in the subsequent banks are picked up in sequence, with the storage relays in the preceding banks dropping out as soon as the storage is transferred to the next bank in advance. It will also be apparent that three storages can be made, one in each of the three storage banks, the storages proceeding as described above from the initial bank to the following banks until the next bank is found occupied, at which time the circuits operate to prevent the transfer of the storage to the following bank. Also it will be seen that the operator is provided with an indication of the storages present in the initial storage unit by means of the route storage indication lamps, which are controlled over relatively simple circuits including the digital storage relays in the initial storage unit.

As previously pointed out, each route description is stored in the initial storage unit in the form of a numerical or digit code in the banks of the initial storage unit for the purpose of simplifying the control of the route storage indication lamp. However, the numerical or digit code is translated to a combination code from the final bank of the initial storage unit, and this combination code is employed to govern all of the switches including the initial switch. Moreover, the storage units subsequent to the initial storage unit, namely the storage units associated with each of the remaining switches in the system employ combination codes for storing the route description. In the combination code, a group of relays of which there are as many as the maximum number of switches in a route are provided, and the energized or deenergized condition of these relays determine whether or not the switch associated with that relay is

to be operated to its normal or reverse position, the switch being operated to the reverse position if the associated combination storage relay is energized and being operated to its normal position if the storage relay is deenergized. Accordingly, if the first switch storage relay in the storage bank is energized the first switch in the route will be controlled to the reverse position. If the second switch storage relay in a particular storage bank is deenergized the second switch in the route will be controlled to the normal position, etc.

As previously pointed out, the switch position which leads to the left as one looks from the hump toward the storage tracks is called the normal position and the position leading to the right is called the reverse position. Referring to Fig. 1, to route a car or cut of cars from the hump to storage track 1, it is necessary that switch 1-6 be operated to its reverse position, switch 1-4 operated to its reverse position, and switch 1-2 operated to its reverse position. Accordingly, under the operation being described, with a route description in the initial storage bank for storage track 1, the combination switch storage relays, namely relays 1-6A1WR, 1-6A2WR and 1-6A3WR, must all be energized, so that all of the switches will be operated to their reverse position. It will be noted that three switch storage control relays are provided in the initial unit, since there are a maximum of three switches in any of the routes leading from the hump to any one of the switch storage tracks.

Since the digit storage relay in the A bank, namely relay 1-6A1CR, is picked up at this time, its front contact *c* establishes a circuit for supplying energy to the winding of relay 1-6A1WR, its front contact *d* establishes a circuit for supplying energy to the winding of relay 1-6A2WR, and its front contact *e* establishes a circuit for supplying energy to the winding of relay 1-6A3WR, so that all of the combination switch storage relays are energized at this time and their contacts are picked up.

With the switch storage relays 1-6A1WR and 1-6A2WR picked up, and with the detector track sections including switches 1-6 and 1-4 unoccupied, so that track relays 1-6TR and 1-4TR are picked up, circuits are established for operating the switches 1-6 and 1-4 to their reverse position, as necessary to route a car for storage track No. 1 from the hump. The reverse magnet RM of switch movement 1-6SM is energized at this time by energy supplied over a circuit which may be traced from terminal B, over a contact *a* of the manual control lever 1-6MC in its center position, Fig. 2c, over back contact *g* of relay 1-6ZR, front contact *j* of relay 1-6ASDR, back contact *g* of relay 1-6ASTR, front contact *b* of relay 1-6A1WR, front contact *a* of relay 1-6WPR, front contact *d* of track relay 1-6TR, through the winding of reverse magnet RM of the switch movement 1-6SM, over contact *Z* of the switch movement closed in the normal position, to terminal N.

The contacts associated with the switch movement are shown in the position which they occupy with the switch in its normal position, and are adjusted and arranged so that the contacts are operated from their normal or left-hand positions to their right-hand or reverse positions when the switch moves from its normal to reverse position. Additionally, the contacts *Z* are adjusted to open in the reverse position with the switch points $\frac{1}{4}$ " or other suitable distance from the full reverse position of the switch and to close in the normal position with the switch point open $\frac{1}{2}$ " or other predetermined distances slightly greater than the first distance from the reverse position. Accordingly, it will be seen that at this time the contact *Z* will maintain the previously traced circuit closed until the switch is within $\frac{1}{2}$ " of its reverse position, at which time the contact *Z* will interrupt the circuit to the reverse magnet RM. In

switches of the type usually employed in classification yards, the switch movement is usually provided with toggle spring arrangements or other devices for maintaining the switch points in the position to which they were last operated after the supply of air to the operating cylinder of the switch is cut off by the deenergization of the magnet controlling the admission of air to the cylinder. Accordingly, when the energizing circuit for the reverse magnet RM is interrupted by contact *Z*, the holding mechanism will operate to move the switch to its full reverse position, and to maintain it in that position with the air cut off from the operating cylinder. The contact *Y* of the switch movement is arranged in a manner similar to that described for the contact *Z* except that the normal contact is opened when the switch point is a slight distance away from the normal position and the reverse contacts are closed when the switch point moves a small distance further than the first distance from the normal position such as, for example, the normal contacts may open with the switch $\frac{1}{4}$ " from the full normal position and the reverse contact may close with the switch points $\frac{1}{2}$ " from normal. Accordingly, with the switch operated from normal to reverse the normal contact of the contact *Y* will be open so that the circuit for energizing the normal switch repeater relay 1-6NWPR, which is obvious from the drawings, will be interrupted and relay 1-6NWPR will release. At the same time, with contact *Z* now in its right-hand or reverse position a circuit will be established for supplying energy to the winding of the reverse switch repeater relay 1-6RWPR, so that this relay will pick up its contacts.

It will be noted that the switch restoring relay 1-6WPR is supplied with energy at this time by a circuit which may be traced from terminal B at contact *e* of relay 1-6WPR, Fig. 2f, which is picked up, through the winding of relay 1-6WPR and through the blocking rectifiers K to the normal and reverse indication circuits. Accordingly, it will be seen that the relay 1-6WPR will be supplied with energy over this circuit as long as the switch points are within $\frac{1}{4}$ " from their full normal or full reverse position. Since the switch movements are relatively fast in operation, the circuit for energizing the relay 1-6WPR will be interrupted only for a short time while the switch movement is operating from one position to the other, unless, for some reason or other, the switch points should be obstructed so that the switch controller contacts do not complete their operation. In such case, the supply of energy will be cut off for a relatively long time from the winding of relay 1-6WPR, and if this time is longer than the release time of relay 1-6WPR, the relay will release. Upon the release of relay 1-6WPR, its contact *a* will transfer the energizing circuit previously traced for the reverse control magnet RM to a circuit including front contact *e* of the track relay 1-6TR which will energize the normal control magnet NM, so that the switch movement will be restored to its normal position. Additionally, the release of contact *e* of relay 1-6WPR interrupts the stick circuit for relay 1-6WPR so that the relay remains released until such time as the car or cut of cars shunts the track relay 1-6TR, at which time the contact *g* of relay 1-6TR will establish an energizing circuit for relay 1-6WPR, and if the switch points are at that time in their full normal position the relay 1-6WPR will be picked up again. During the time that contact *e* of relay 1-6WPR is released energy is supplied to the winding of a coding device 75CT, which may be of any suitable form well known in the railway signaling art, and comprises contacts which are recurrently operated at a specified rate, for example, 75 times per minute, when energy is supplied to the windings. With the winding of the coding device 75CT energized, energy is supplied over contact *b* of 75CT to a bell, causing the bell to ring recurrently and thereby

notifying the operator that a switch obstruction has taken place.

As previously pointed out, switch indication lamps are provided on the control board to indicate to the operator the position which a particular switch occupies, when that switch is in the route for an approaching car or cut of cars. In the particular instance presently being described, with a route being set up to storage track 1, the reverse indication lamp 1—6RWK will be lighted by a circuit which may be traced from terminal BX, at front contact *f* of relay 1—6TR, Fig. 2c, over contact *b* on manual control lever 1—6MC, through a current limiting resistor 1—6RW, front contact *k* of relay 1—6ASDR, back contact *h* of relay 1—6ASTR, front contact *c* of relay 1—6A1WR, front contact *d* of relay 1—6WPR, front contact *d* of relay 1—6RWPR, and through the lamp 1—6RWK to terminal NX. Accordingly, the lamp 1—6RWK will be lighted at a reduced voltage, since the current is flowing through the limiting resistor 1—6RW, to thereby designate to the operator that the switch 1—6 is in its reverse position and that a car or cut of cars will be routed over switch 1—6 in the reverse position.

If, as previously pointed out, the switch machine 1—6SM should be unable to complete its operation due to an obstruction in the switch points, the relay 1—6WPR will release and remain released, causing operation of the coding device 75CT. In addition to sounding the warning bell, a contact *a* of relay 75CT recurrently closes to supply energy from terminal BX over contact *a* of the coding device 75CT, Fig. 2f, back contact *c* of relay 1—6WPR, front contact *d* of relay 1—6NWPR, and through the lamp 1—6NWK to terminal NX. Accordingly, the lamp 1—6NWK will be intermittently flashed, and since the voltage supplied to the lamp at this time is not reduced by the current limiting resistor, the lamp will flash brilliantly to thereby notify the operator which switch has failed to complete its movement to the reverse position.

It is to be noted that at this time the manual control lever 1—6MC is in its center or automatic position, so that the operation of the switch 1—6 is governed entirely by the operation of the automatic routing circuit. However, manual operation may supersede the automatic operation at any time, by virtue of the operator operating the manual control lever 1—6MC to its left-hand or normal, or right-hand or reverse position, depending upon the position to which the switch 1—6 is to be operated. With the lever 1—6MC in its normal or reverse position, the circuits for energizing the switch control magnet are carried over the contacts of the detector track relay, in this case contacts *d* and *e* of relay 1—6TR, and are not affected by the operation of the switch storage relays or the storage detector and transfer relays in the storage bank which controls the switch when on automatic operation. Moreover, it will be seen that the operation of the switch restoring relay 1—6WPR has no effect on the operation of the switch while the switch is being operated manually. The switch indication lamps are not governed by the automatic switching circuits when the switches are being operated manually, but indicate only the correspondence between the control lever position and the switch position. Additionally, the limiting resistor, such as 1—6RW, is not included in the circuit at such times, so that the indication lamps are lighted to full brilliance when the switch is controlled manually.

The control and indication circuits for the switch 1—4 are similar to those described above for the switch 1—6, with the exception that the control and indication circuits for switch 1—4 include, in addition to the contacts of switch storage relay 1—6A2WR which govern the position of the switch, a front contact of the switch storage relay 1—6A1WR, this arrangement being provided so that the switch 1—4 is governed by the automatic switching circuits only when the switch storage relay 1—6A1WR is picked up to indicate that the preceding switch, namely

switch 1—6, is to be reversed, so that the route will include switch 1—4. If the switch 1—6 is to remain normal in accordance with the route being set up, then the contacts *d* and *e* of relay 1—6A1WR will be released, and the switch movement 1—4SM will not be operated at this time.

However, in connection with the operation being described, that is, the routing of a car or cut of cars to storage track 1, it will be seen that both switches 1—6 and 1—4 should be reversed, and as previously pointed out, the switch storage relays 1—6A1WR, 1—6A2WR and 1—6A3WR, are all picked up so that switch movement 1—4SM is operated to operate the switch 1—4 to its reverse position in view of the fact that the relays 1—6A1WR and 1—6A2WR are both picked up.

The operations described above are all carried out prior to the time that the car or cut of cars proceeding from the hump yard arrive at the detector track section associated with the switches 1—6 and 1—4. As previously pointed out, when the car or cut of cars enters the track section associated with the switches, the track relay 1—6TR will release and remain released during the time that the car or cut of cars occupies the track between the limits designated by the arrows indicated with the reference character P and the track relay 1—4TR will be released during the time that the car or cut of cars occupies the track stretch between the limits designated by the arrows associated with the reference character O. When relay 1—6TR releases, its front contacts *d* and *e* interrupt the circuit for the control of the normal and reverse control magnets of switch movement 1—6SM, so that the switch movement cannot be operated while the car or cut of cars is moving over this portion of the lap switch layout. When the car or cut of cars causes the release of relay 1—4TR, the supply of energy to the control magnets of the switch movement 1—4SM is cut off, so that this switch cannot be operated while the car or cut of cars is preceding over it. It will be apparent that the track relay 1—6TR will pick up again when the rear wheels of a car or cut of cars moves off the track section indicated by the limits associated with the reference character P, so that switch 1—6 can be operated at this time even though the car or cut of cars has not cleared the following switch 1—4 of the lap switch layout.

The occupancy of the various detector track sections is indicated to the operator of the machine by the lighting of the associated track indication lamp, such as lamp 1—6TK, governed by an obvious circuit including back contact *f* of relay 1—6TR.

The automatic switching circuits are devised and arranged in such manner that the route description is forwarded from the initial storage unit, which governs the lap switches, to the storage unit associated with the track switch 1—2, at the time that the car or cut of cars enters the detector track section of the preceding switch, in this case the lap switches 1—6 and 1—4.

As previously described, the relay 1—6ASDR is energized at this time by a circuit which includes the back contact *b* of relay 1—6ASDPSR. When the car or cut of cars destined for the storage track 1 enters the second portion of the detector track section at the switches 1—6 and 1—4, the relay 1—4TR will release, and a pick up circuit will be provided for energizing relay 1—6ASDPSR. This circuit may be traced from terminal B at front contact *g* of relay 1—6ASDR, Fig. 2b, over back contact *c* of relay 1—6ASTPSR, back contact *d* of relay 1—6ZR, front contact *a* of relay 1—6A1WR, back contact *a* of relay 1—4TR, and through the winding of relay 1—6ASDPSR to terminal N. When the relay 1—6ASDPSR picks up, a stick circuit for this relay is established which may be traced from terminal B at front contact *g* of relay 1—6ASDR, Fig. 2b, over front contact *a* of relay 1—6ASDPSR, and through the winding of relay 1—6ASDPSR to terminal N. Accordingly, it will be seen that once relay 1—6ASDPSR picks up, it

will release only upon the release of relay 1—6ASDR, which indicates that the route description has been forwarded to the next storage unit. The picking up of contact *b* of relay 1—6ASDPSR interrupts the stick circuit for relay 1—6ASDR, which was previously traced, but at this time a second stick circuit is established so that relay 1—6ASDR is not released. This second stick circuit may be traced from terminal BA at the push button 1—6ACPB, Fig. 2b, over back contact *a* of relay 1—6ASCR, over front contact *c* of relay 1—6ASDR, through the winding of relay 1—6ASDR, over the back contacts *b* of relays 1—6TR and 1—4TR in multiple, over the back contacts *e* of relays 5—6BSTR and 5—6BSDR in multiple, over the back contacts *e* of relays 3—4BSTR and 3—4BSDR in multiple, and over the back contacts *e* of relays 1—2BSTR and 1—2BSDR in multiple to terminal N.

At this time, it will be considered that there are no storages in the initial storage bank of the storage unit associated with the switch 1—2. Accordingly, relay 1—2BSDR will be released. Under these circumstances, a circuit is established at this time for energizing the storage transfer relay associated with the initial or B bank of the storage unit associated with switch 1—2. This circuit may be traced from terminal B at back contact *e* of relay 1—6ASTR, Fig. 2b, over front contact *c* of relay 1—6ASDPSR, front contact *c* of relay 1—6RWPR, front contact *a* of relay 1—4RWPR, back contact *c* of relay 1—2BSDR, and through the winding of relay 1—2BSTR to terminal N. When relay 1—2BSTR picks up, it establishes a stick circuit for itself which circuit may be traced from terminal B at front contact *a* of relay 1—6ASDR, over front contact *a* of relay 1—2BSTR, and through the winding of relay 1—2BSTR to terminal N. At this time, even though back contact *e* of relay 1—2BSTR in the stick circuit for relay 1—6ASDR previously traced is open, relay 1—6ASDR will continue to be energized, since relay 1—2BSDR is still released at this time and its back contact *e* maintains the stick circuit previously traced for relay 1—6ASDR. When the relay 1—2BSTR picks up, its front contact *f* establishes a circuit for energizing relay 1—6ASTPSR, which circuit may be traced from terminal B at front contact *f* of relay 1—2BSTR, Fig. 2g, and through the winding of relay 1—6ASTPSR to terminal N. When the relay 1—6ASTPSR picks up, its front contact *a* establishes a stick circuit for the relay which may be traced from terminal B at back contact *c* of relay 1—4TR, Fig. 2c, over front contact *a* of relay 1—6RWPR, over front contact *a* of relay 1—6ASTPSR, and through the winding of the relay to terminal N. By providing a stick circuit for relay 1—6ASTPSR which includes a back contact of the track relay associated with the section, the relay 1—6ASTPSR is prevented from picking up more than once during the track circuit occupancy. Moreover, since back contact *c* of relay 1—6ASTPSR is in the pick up circuit for relay 1—6ASDPSR, the relay 1—6ASDPSR is prevented from picking up more than once during the occupancy of the associated track circuit.

When relay 1—2BSTR picks up, a circuit for picking up the storage detector relay 1—2BSDR is established, which circuit may be traced over the back contacts *b* of relays 1—2ASTR and 1—2ASDR in multiple, Fig. 2g, over front contact *b* of relay 1—2BSTR, and through the winding of relay 1—2BSDR to terminal N. When relay 1—2BSDR picks up, its front contact *a* establishes a stick circuit which bypasses the front contact *b* of relay 1—2BSTR, so that relay 1—2BSDR will remain picked up following the release of relay 1—2BSTR.

With relays 1—2BSTR and 1—2BSDR picked up, a circuit is now established for transferring the route storage from the initial storage unit to the initial or B bank of the storage unit associated with switch 1—2. This is accomplished by picking up the switch storage relay 1—2B1WR which is the initial switch storage relay in

the storage unit associated with switch 1—2. The circuit may be traced from terminal B at front contact *a* of relay 1—6A3WR, Fig. 2b, over front contact *d* of relay 1—2BSTR, through the winding of relay 1—2B1WR, and over front contact *d* of relay 1—2BSDR to terminal N. When relay 1—2B1WR picks up, it establishes a stick circuit for itself which may be traced from terminal B over front contact *a* of relay 1—2B1WR, through the winding of the relay, and over front contact *d* of relay 1—2BSDR to terminal N.

When relay 1—2BSDR picks up, its back contact *e* interrupts the previously traced stick circuit for relay 1—6ASDR, so that relay 1—6ASDR will release after a short interval. When front contact *g* of relay 1—6ASDR releases, the supply of energy to relay 1—6ASDPSR is cut off, so that relay 1—6ASDPSR releases following the release of relay 1—6ASDR. When contact *h* of relay 1—6ASDR releases, it interrupts the stick circuit for the digital storage relay 1—6A1CR, so that relay 1—6A1CR releases. Release of contact *i* of relay 1—6ASDR interrupts the supply of energy to indication lamp A1. The release of contact *b* of relay 1—6A1CR further interrupts the circuit for supplying energy to the storage indication lamp A1. The release of contacts *c*, *d* and *e* of relay 1—6A1CR interrupts the supply of energy to the switch storage relays 1—6A1WR, 1—6A2WR and 1—6A3WR and these relays release. This operation completes the transfer of the route description from the initial storage unit associated with the lap switches, to the initial bank of the storage unit associated with switch 1—2.

Considering now the further operation of the apparatus associated with the storage unit at which 1—2, the release of contact *a* of relay 1—6ASDR interrupts the stick circuit for relay 1—2BSTR, and since the pick up circuit for relay 1—2BSTR is open at back contact *c* of relay 1—2BSDR, relay 1—2BSTR will release. The release of contact *d* of relay 1—2BSTR opens the pick up circuit for relay 1—2B1WR, but, as previously pointed out, the relay 1—2B1WR is provided with a stick circuit at this time including front contact *d* of relay 1—2BSDR and this relay remains picked up. With relay 1—2BSTR released and 1—2BSDR picked up, a circuit is established for picking up relay 1—2ASTR to initiate the transfer of the switch storage to the final or A bank of the 1—2 storage unit. This circuit may be traced from terminal B at back contact *c* of relay 1—2BSTR, Fig. 2g, over front contact *b* of relay 1—2BSDR, over back contact *a* of relay 1—1ASDR, and through the winding of relay 1—2ASTR to terminal N. When contact *a* of relay 1—2ASTR picks up, it establishes a stick circuit for the relay which bypasses the back contact *a* of relay 1—2ASDR. When contact *b* of relay 1—2ASTR picks up, it interrupts its connection to the stick circuit of relay 1—2BSDR, but the circuit remains closed over back contact *b* of relay 1—2ASDR, so that relay 1—2BSDR remains picked up at this time. When front contact *c* of relay 1—2ASTR closes, a circuit is established for energizing relay 1—2ASDR, which circuit may be traced from terminal B at the cancellation push button 1—2APB, Fig. 2g, over front contact *c* of relay 1—2ASTR, over front contact *a* of track relay 1—2TR, and through the winding of relay 1—2ASDR to terminal N. When relay 1—2ASDR picks up, its back contact *a* interrupts the pick up circuit for relay 1—2ASTR, but relay 1—2ASTR remains energized over the stick circuit previously traced. The pick up of contact *b* of relay 1—2ASDR cuts off the supply of energy to the stick circuit of relay 1—2BSDR, but since relay 1—2BSDR is of the slow release variety, its contacts will remain in their picked up position for a predetermined time interval after the supply of energy is discontinued to the relay winding. The pick up of front contact *c* of relay 1—2ASDR establishes a bypass around the front contact *c* of relay 1—2ASTR in the circuit govern-

ing relay 1—2ASDR, so that relay 1—2ASDR will remain picked up after the subsequent release of relay 1—2ASTR. Front contact *d* of relay 1—2ASTR and front contact *e* of relay 1—2ASDR are closed at this time, and a circuit is now established for energizing the switch storage relay 1—2A1WR, which circuit may be traced from terminal B at front contact *b* of relay 1—2B1WR, over front contact *d* of relay 1—2ASTR, through the winding of relay 1—2A1WR and over front contact *e* of relay 1—2ASDR to terminal N. The pick up of relay 1—2A1WR provides a stick circuit for maintaining the relay energized which includes front contact *a* of relay 1—2A1WR and front contact *e* of relay 1—1ASDR.

When relay 1—2BSDR releases at the end of its release time, its front contact *d* interrupts the stick circuit for the switch storage relay 1—2B1WR, and relay 1—2B1WR releases opening the pick up circuit for relay 1—2A1WR, which relay remains picked up at this time because of the stick circuit previously traced. The release of contact *b* of relay 1—2BSDR interrupts the circuit for supplying energy to relay 1—2ASTR, and relay 1—2ASTR will thereby be released at this time.

With relay 1—2ASTR released, relay 1—2A1WR picked up, and relay 1—2ASDR picked up, assuming that the route storage transfer to bank A has been completed, the circuit for governing switch 1—2 to its reverse position will be completed. As previously pointed out, the circuits for controlling the switches 5—6, 3—4 and 1—2, are identical and it will be apparent by reference to the typical circuits shown for the single switches on Figs. 2*d* and 2*e*, that at this time with the relays in the final storage bank of the 1—2 storage unit in the condition as previously described, the switch control circuit will be closed to operate the switch to its reverse position, and the switch indication circuit will provide a reverse switch indication on the control board, showing that the car or cut of cars will proceed over switch 1—2 reversed to storage track 1.

At this time, considering the apparatus in the initial storage unit, the relay 1—6ASDR can now pick up again if there is a subsequent storage in the B bank of the initial storage unit. However, at this time relay 1—6ASTPSR is picked up since the car or cut of cars is still occupying the latter portion of the track circuit over switch 1—4, so that the back contact *c* of relay 1—4TR maintains the stick circuit for relay 1—6ASTPSR. With relay 1—6ASTPSR picked up, so that its back contact *c* is open, the relay 1—6ASDPSR cannot pick up at this time, and accordingly a new storage which is transferred from storage bank B to the final storage bank in the initial storage unit cannot be further transferred to the initial storage bank associated with any of the single switch locations 1—2, 3—4 and 5—6. In other words, with front contact *c* of relay 1—6ASDPSR open, the circuit for energizing the storage transfer relays, such as relay 1—2BSTR, in each of the storage units associated with the final switches is open, and the storage transfer relays cannot be energized at this time.

It is to be pointed out that if the storage unit for switch 1—2 had been full when the car or cut of cars destined for storage track 1 first entered the detector section 1—4 at the lap switch location, relay 1—2BSDR would be picked up and consequently the storage transfer relay 1—2BSTR could not pick up at this time since this pick up circuit would be open at back contact *c* of relay 1—2BSDR. Accordingly, the route description could not be forwarded at this time from the initial storage unit to the storage unit at switch location 1—2. If the route description had not been transferred from the initial unit to the storage unit associated with switch 1—2 by the time the car or cut of cars vacated the detector section and track relay 1—4TR picked up, the route description would be cancelled automatically in the initial storage unit, since the picking up of relay 1—4TR interrupts the stick circuit for relay 1—6ASDR, with the re-

sult that relay 1—6ASDR would release. The release of relay 1—6ASDR would cause the release of relay 1—6ASDPSR, and with relay 1—6ASDPSR released there would be no circuit established for energizing the relay 1—2BSTR to transfer a route description from the initial storage unit to the storage unit for switch 1—2.

Assuming that the switch storage previously described to route the car or cut of cars to track 1 has been entered in the storage unit associated with switch 1—2 and has cascaded from the initial to the final bank, thereby causing operation of the switch 1—2 to its reverse position, it will now be assumed that the car or cut of cars, having left the lap switch location has preceded further down the classification track and now enters the detector track section associated with switch 1—2, so that the track relay 1—2TR is released.

When contact *a* of relay 1—2TR releases, it interrupts the circuit for energizing the relay 1—2ASDR, and relay 1—2ASDR releases after a short time interval. The release of contact *d* of relay 1—2ASDR establishes a circuit for energizing relay 1—2ASDPSR, which circuit may be traced from terminal B at back contact *b* of relay 1—2TR, Fig. 2*g*, over back contact *d* of relay 1—2ASDR, and through the winding of relay 1—2ASDPSR to terminal N. When relay 1—2ASDPSR picks up, its front contact *a* establishes a stick circuit including the back contact *b* of relay 1—2TR, so that relay 1—2ASDPSR will remain energized as long as the detector track section is occupied. The picking up of contact *b* of relay 1—2ASDPSR establishes a circuit for reenergizing relay 1—2ASDR should a subsequent storage be present in the initial bank of the 1—2 storage unit at the time. Accordingly, a subsequent storage occupying the initial storage bank of the 1—2 storage unit can be transferred to the final or A storage bank at this time even though the detector track section relay is released, since relay 1—2ASDR can be energized by a circuit including the front contact *b* of relay 1—2ASDPSR which bypasses the front contact *a* of relay 1—2TR in the pick up circuit for relay 1—2ASDR. If such subsequent storage is made, when the preceding car or cut of cars vacates the detector track section, relay 1—2TR will pick up and its front contact *a* will reestablish the circuit for energizing relay 1—2ASDR, and at the same time, the picking up of contact *b* of relay 1—2TR will deenergize relay 1—2ASDPSR, so that contact *b* of relay 1—2ASDPSR in the pick up circuit for relay 1—2ASDR will be open.

The foregoing description illustrates the manner in which a route description is entered in the initial unit of the machine, and is cascaded through the various storage banks in the initial unit, with route storage indications being provided to the machine operator to indicate what routes may be stored in the initial unit. Also, the operation of the apparatus and the forwarding of route descriptions from the initial unit to the units associated with the following switches in the classification yards have been described, together with the manner in which the switches at the various locations are operated in accordance with the route descriptions stored for that location.

Under certain operating conditions, for example, the discovery that a car or cut of cars should be routed to a different track from that which was designated in storing the route in the initial unit, the operator may wish to cancel one or more route descriptions that have been stored in the initial unit. In order to provide for such cancellation, there is provided a cancellation push button 1—6CC, Fig. 2*b*, which governs a series of cancellation relays, one for each storage bank in the initial storage unit, as represented by the cancellation relays 1—6CSCR, 1—6BSCR and 1—6ASCR, Fig. 2*b*. The circuits for governing the cancellation relays are arranged in such manner that the routes stored in each of the storage banks of the initial storage unit beginning with the initial stor-

age bank and ending with the final storage bank are cancelled by sequential operation of the cancellation push button. When the cancellation relay associated with the particular storage bank is picked up, it opens the stick circuit for the corresponding storage detector or SDR relay associated with that bank, with the exception of the initial storage bank, where the picking up of the cancellation relay associated with that bank opens the stick circuit for the storage relays themselves, with the result that a pick up of the cancellation relay associated with the particular bank causes the route description stored in that bank to be cancelled. Considering the detailed operation of the cancellation circuits, it will be assumed that a route is stored in the final or A bank of the initial storage unit, and that a route description stored in the intermediate or B bank of the initial storage unit is to be cancelled. When the cancellation push button 1—6CC is depressed, a circuit is established for picking up the cancellation relay 1—6BSCR associated with the B storage bank of the initial storage unit. This circuit may be traced from terminal B at the push button contact, Fig. 2b, over a back contact *b* of relay 1—6CSDR, back contact *d* of relay 1—6CSCR, over a front contact *d* of relay 1—6BSDR (the relay 1—6BSDR being picked up at this time because a storage is present in the B bank of the unit), and through the winding of relay 1—6BSCR to terminal N. When relay 1—6BSCR picks up, it establishes a first stick circuit for itself including a front contact *b* of relay 1—6BSCR, which stick circuit may be traced from terminal B over the push button contact, Fig. 2b, over back contact *b* of relay 1—6CSDR, back contact *d* of relay 1—6CSCR, over front contact *b* of relay 1—6BSCR, and through the winding of relay 1—6BSCR to terminal N. This stick circuit is, of course, maintained as long as the cancellation push button is depressed. If the operator releases the cancellation push button before the route storage in the B bank has been cancelled, the relay 1—6BSCR will still remain energized through the medium of a second stick circuit which may be traced from terminal B at front contact *e* of relay 1—6BSDR, Fig. 2b, over front contact *a* of relay 1—6BSCR, and through the winding of the relay to terminal N. The pick up of the contact *d* of relay 1—6BSCR opens the circuit for energizing the storage detector relay 1—6BSDR, and relay 1—6BSDR will thereupon release. Upon the release of relay 1—6BSDR, its contacts will open the stick circuit for the digital storage relays such as relay 1—6B1CR in the storage bank B of the initial storage unit, so that any of the relays in the B storage bank which are picked up will be released at this time. When the contacts of relay 1—6BSDR release, the previously traced pick up and second stick circuit for relay 1—6BSCR are open, and if the operator has released the cancellation push button at this time, relay 1—6BSCR will release, thereby restoring the cancellation circuits to their normal condition.

If at this time it should be also decided to cancel the route storage in the A bank of the initial storage unit, the operator will again depress the cancellation push button 1—6CC, which will provide a circuit for energizing the cancellation relay 1—6ASCR associated with the final or storage bank A of the initial storage unit. This circuit may be traced from terminal B at the contact of the cancellation push button, Fig. 2b, over back contact *b* of relay 1—6CSDR, back contact *d* of relay 1—6CSCR, back contact *d* of relay 1—6BSDR, back contact *c* of relay 1—6BSCR, over front contact *d* of relay 1—6ASDR, and through the winding of relay 1—6ASCR to terminal N. Relay 1—6ASCR is provided with a first and second stick circuit similar to those described for relay 1—6BSCR, so that relay 1—6ASCR when once picked up will remain picked up until the route storage in the final bank of the initial storage unit is cancelled by the release of the storage detector relay 1—6ASDR associated with that storage bank, or until the operator releases the push button 1—6CC, whichever occurs later.

Additionally, as shown in Figs. 2b, 2d and 2g, each of the storage detector relays associated with the final storage bank in each of the storage units, such as relays 1—6ASDR, 1—2ASDR, 3—4ASDR and 5—6ASDR, is provided with a cancellation push button in the control circuits for the relay, such as push button 1—2APB associated with relay 1—2ASDR. Operation of this push button will cause the release of the storage detector relays associated with the final storage bank in each of the various storage units including the initial storage unit. Accordingly, if the operator wishes to cancel the storage in the final storage bank of any unit, he may operate the associated cancellation push button which will thereby deenergize the storage detector relay associated with the final storage bank in that particular unit to thus cause the route storage in the final bank of that unit to be cancelled.

One other cancellation feature is provided in my system, in that the energy supplied to the various SDR or storage detector relays in each bank of the initial storage unit, as well as the energy supplied for the indication lamps, is carried over contacts of a "clear system" push button CSPB, so that, if this push button is operated, all power is cut off the storage detector relays in each of the storage banks, and additionally the power is cut off the various indication lamps. Thus the storage detector relays for all the banks will be simultaneously released, when the push button is depressed, and at the same time, all the indication lamps will be extinguished, so that the lamps will not flash during the time that the indications are being cancelled. It will be seen therefore, that all of the route descriptions stored in the initial storage unit may be cancelled simultaneously by operating the "clear system" cancellation push button.

As previously pointed out, the manner in which the switches of a lap switch layout are governed is extremely important in systems of the type herein described. If only one detector track section is employed, the circuit arrangement is somewhat similar to that provided for a single track switch. However, the use of a single detector track section for the lap switch layout greatly reduces the speed of classification, since neither of the switches can be lined up for a following cut of cars until the preceding cut of cars has cleared both switches. If separate detector track sections are employed, then the first switch of the lap switch layout is free to operate as soon as a cut of cars vacates the first section, and before the second section is vacated. To provide operation of the first switch in a lap switch layout while the detector track section associated with the second switch is still occupied, in order that a route can be lined up for a following cut before the first cut has vacated the second detector section, I provide an auxiliary relay such as relay 1—6ZR, Fig. 2e. This relay is controlled by the switch repeater relays of the first switch of the lap switch layout and by the route storage relays in the bank preceding the final bank which normally controls the switch operation, so that under conditions where the first cut of cars moves over the first and second switches of the lap switch layout, but the next cut of cars will move over the first switch only, the auxiliary relay becomes picked up. The contacts of the auxiliary relay govern the operation of the first switch of the lap switch layout and additionally govern the operation of the storage transfer circuits for the storage units following the unit which governs the lap switch layout, so that the proper routing is obtained.

There are three operating conditions involving the lap switches and these conditions will now be described, in order that the purpose and utility of the auxiliary relay ZR will be made clear. Each of these conditions involves two successive cars or cuts of cars proceeding from the hump and over the lap switches to various storage tracks.

The first condition is that in which the two successive cuts are being routed over switch 1—6 normal. Under

this condition, the second switch 1—4 is not involved for either route, since switch 1—6 is normal for each cut, and the circuits operate in a manner similar to that already described for a single cut of cars being routed to track 1. As previously described, switch 1—4 includes in its control circuits front contacts *d* and *e* of relay 1—6A1WR, so that switch 1—4 is not operated unless relay 1—6A1WR is picked up, indicating a route to tracks 1 through 4. Accordingly, two successive cuts routed over switch 1—6 normal will not require switch 1—4 to be operated. The route description for the two successive cuts moving over switch 1—6 normal will be transferred to the storage unit associated with switch 5—6 when the cuts enter the first track section at the lap switches. At this time, relay 1—6ASDPSR is energized by a circuit which may be traced from terminal B at front contact *g* of relay 1—6ASDR, Fig. 3*b* (which is picked up at this time since a route storage exists in the final bank of the initial storage unit), over back contact *c* of relay 1—6ASTPSR, back contact *d* of relay 1—6ZR, back contact *a* of relay 1—6A1WR, back contact *a* of relay 1—6TR, and through the winding of relay 1—6ASDPSR to terminal N. Accordingly, relay 1—6ASDPSR picks up and sticks up over a stick circuit including its own front contact *a* and front contact *g* of relay 1—6ASDR. Relay 1—6ZR remains released at this time since its pick up circuit is open at front contact *b* of relay 1—6RWPR.

With relay 1—6ASDPSR picked up, a circuit is established for energizing the transfer relay 5—6BSTR associated with switch 5—6. This circuit may be traced from terminal B at back contact *e* of relay 1—6ASTR, Fig. 2*b*, over front contact *c* of relay 1—6ASDPSR, front contact *c* of relay 1—6NWPR, back contact *e* of relay 1—6ZR, back contact *c* of relay 5—6BSTR, and through the winding of relay 5—6BSTR to terminal N. When relay 5—6BSTR picks up, it establishes a stick circuit including its own front contact *a* and front contact *a* of relay 1—6ASDR, which insures that relay 5—6BSTR will remain picked up until the route storage is transferred from the initial storage unit. With relay 5—6BSTR picked up, a circuit is established for picking up relay 5—6BSTR, which circuit includes front contact *b* of relay 5—6BSTR. With relays 5—6BSTR and 5—6BSTR picked up, the route storage will be transferred from the initial storage unit to the storage unit associated with switch 5—6.

The action described above takes place for both the first and second cut of cars under the condition where both cuts are routed over switch 1—6 normal.

The second condition to be considered is that wherein two successive cuts have their destination to tracks 1 through 4, so that the cuts move over switch 1—6 reverse, and switch 1—4 either normal or reverse. Under this condition, the two switches will be operated simultaneously, and the route description will be transferred to the next storage unit when the second track section is occupied, i. e., when relay 1—4TR releases. The detailed circuit operation is similar to that described originally for a cut of cars moving to storage track 1, and further description is deemed unnecessary.

The third condition, which involves the operation of relay 1—6ZR, is that in which the first cut moves over switch 1—6 reverse and over switch 1—4 normal or reverse, and the second cut moves over the switch 1—6 normal. For example, let it be considered that the first cut is destined for storage track 1 and the second cut is destined for storage track 5.

The route descriptions are entered in the initial storage bank in the manner previously described, by operation of push buttons 1PB and 5PB in succession. Assuming that the initial storage unit is vacant at the time, relays 1—6C1CR, 1—6B1CR and 1—6A1CR will be operated in succession after the operator depresses push button 1PB, so that the route description cascades to the

final or A bank of the initial storage unit. The relays 1—6C5CR and 1—6B5CR will then be operated in sequence after the operator depresses push button 5PB. The detailed circuit operation is similar to that previously described and need not be repeated in detail. Accordingly, the two routes will be stored in the final bank and the next preceding or penultimate bank of the initial storage unit, as indicated by relays 1—6A1CR and 1—6B5CR being picked up.

With relay 1—6A1CR picked up, switch storage relays 1—6A1WR, 1—6A2WR and 1—6A3WR will be picked up by the previously traced circuits including front contacts *c*, *d* and *e* of relay 1—6A1CR. At this time therefore, the control circuits for switches 1—6 and 1—4 will be energized to operate switch 16 reverse and switch 1—4 reverse.

At this time, with the first switch in the lap switch layout, namely switch 1—6, in its reverse position, and with a storage existing for a second cut which requires switch 1—6 to be operated to its normal position, it will be assumed that the first cut moves over the lap switches so that relay 1—6TR and 1—4TR are released in sequence. Since contact *a* of relay 1—6A1WR is picked up at this time, relay 1—6ASDPSR will be picked up when the first cut causes the release of contact *a* of relay 1—4TR, by energy supplied over the circuit previously traced. When relay 1—6ASDPSR picks up, it establishes a previously traced stick circuit for keeping the relay picked up until the transfer of the route storage is completed.

When relay 1—6ASDPSR picks up, a circuit is established for energizing relay 1—6ZR, which circuit may be traced from terminal B at front contact *e* of relay 1—6B5CR, Fig. 2*a*, over front contact *b* of relay 1—6RWPR, front contact *d* of relay 1—6ASDPSR, and through the winding of relay 1—6ZR to terminal N. When relay 1—6ZR picks up, it establishes a first stick circuit for itself including its own front contact *c* and front contact *d* of relay 1—6ASDPSR. The circuit for initiating the transfer of the route description from the initial storage unit to the storage unit associated with switch 1—2, by picking up relay 1—2BSTR, is now completed, and is the same circuit previously traced.

When the first cut vacates the first track section, so that relay 1—6TR picks up, a circuit is established for operating switch 1—6 to its normal position. This circuit may be traced from terminal B, over the contact *a* of the switch control lever 1—6MC in its center or automatic position, Fig. 2*c*, over front contact *g* of relay 1—6ZR, front contact *d* of relay 1—6B5CR, back contact *i* of relay 1—6BSTR, front contact *b* of relay 1—6WPR, front contact *e* of relay 1—6TR, through the normal magnet NM of switch movement 1—6SM, and over reverse contact Y of the switch movement circuit controller to terminal N. Accordingly, switch 1—6 is operated to its normal position, as required by the following cut. When relay 1—6NWPR picks up, a second stick circuit for relay 1—6ZR is completed, which extends from terminal B over front contact *b* of relay 1—6NWPR (Fig. 2*c*), front contact *b* of relay 1—6ASTPSR, front contact *b* and the winding of relay 1—6ZR to terminal N. The effect of this circuit is to hold relay 1—6ZR energized until relay 1—6ASTPSR releases, which in this particular situation occurs a short time after the release of relay 1—2BSTR since both stick circuits for relay 1—6ASTPSR are already open. This sequence of operations is necessary, as will appear shortly, to prevent any misrouting of the route descriptions.

Thus it will be seen that the first switch of the lap switch layout can be operated for the following cut even though the first cut may not have vacated the second detector section. This operation could not, of course, be obtained with only a single detector track section.

The transfer of the route description of the first cut

from the initial storage unit results in the cascading of the route description in the B bank to the final or A bank of the unit, with the result that relay 1-6A5CR picks up and subsequently relay 1-6B5CR releases. Relays 1-6A1CR, 1-6A1WR, 1-6A2WR and 1-6A3WR were released when the storage for the first cut was transferred to the storage unit associated with switch 1-2. The picking up of relay 1-6A5CR closes a control circuit including front contact *c* of relay 1-6A5CR for energizing relay 1-6A2WR.

If the second cut does not arrive in the first detector section until after the transfer of the route description of the first cut has been made, relay 1-6ASDPSR will be released, as will relay 1-6ASTPSR, so that relay 1-6ZR will be released. When the second cut enters the first detector section and causes relay 1-6TR to release, relay 1-6ASDPSR will be picked up by the pick up circuit including back contact *a* of relay 1-6A1WR and back contact *a* of relay 1-6TR. Accordingly, the route description for the second cut will now be forwarded to the storage unit associated with switch 5-6, since the circuit for picking up the associated transfer relay 5-6BSTR is completed over back contact *e* of relay 1-6ZR, front contact *c* of relay 1-6NWPR, and front contact *c* of relay 1-6ASDPSR.

If the second cut enters the first detector section before the first cut has vacated the second detector section, but after the route description for the first cut has been forwarded to the next storage unit, the circuits described in the preceding paragraph can function to transmit the route description to the storage unit for the next switch in the route for the second cut. Accordingly, it is thus possible to eliminate the extra storage bank which would be otherwise required in each succeeding storage unit to store the description of the first cut, in order to more quickly transfer the route description from the storage unit associated with the lap switch layout.

In the event that the second cut arrives at the first detector track section before the route description for the first cut has been transferred, relay 1-6ZR will not be released, since relay 1-6ASDPSR will be picked up at this time, and the stick circuit for relay 1-6ZR including front contact *d* of relay 1-6ASDPSR and front contact *c* of relay 1-6ZR is closed to keep relay 1-6ZR picked up. When the storage unit in advance can receive the route description, as indicated by the release of relay 1-2BSDR, the pick up circuit for transfer relay 1-2BSTR is completed over the circuit previously traced, with the exception that front contact *c* of relay 1-6RWPR, which contact is now open, is by-passed by front contact *f* of relay 1-6ZR, to permit the proper routing of the description of the first cut. Back contact *e* of relay 1-6ZR in the pick up circuit for relay 5-6BSTR interrupts this pick up circuit, and, even though contact *c* of relay 1-6NWPR in this circuit is closed at this time, relay 5-6BSTR is prevented from picking up and thereby entering an improper route description in storage unit 5-6.

Back contact *d* of relay 1-6ZR is included in the pick up circuit for relay 1-6ASDPSR to insure that relay 1-6ASDPSR can pick up, to transfer a second route description, only after ZR releases, to prevent misrouting of the second description due to relay ZR being picked up improperly. Back contact *a* of relay ZR in the stick circuit for relay 1-6ASTPSR which includes back contact *c* of relay 1-6TR is for the purpose of releasing relay 1-6ASTPSR in the event that the second cut enters the first detector section a very short time after the first cut has vacated the first detector section, since the relay 1-6ASTPSR, being somewhat slow release, would otherwise fail to drop out and accordingly no transfer of the route description for the second cut would take place.

It is to be noted that the circuits as shown and described

may be readily modified to control the switches of a classification yard of any size, and of any capacity by properly designing the storage units and the number of storage banks in each storage unit.

Although I have herein shown and described only one form of automatic control system for railway classification yard track switches, it is to be understood that various changes and modifications may be made therein, within the scope of the appended claims, without departing from the spirit and scope of my invention.

Having thus described my invention, what I claim is:

1. In combination, a first and a second track switch diverging from a common lead track, said first track 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 common lead track over said first and said second track switches in sequence, said first and said second track switches having overlapped detector track circuits including a first detector track relay associated with said first track switch and a second detector track relay associated with said second track switch, said detector track relays being released when the associated detector track circuit is occupied, a first and a second switch machine associated with said first and second track switches respectively, for operating said track switches between their normal and their reverse positions, a first and a second normal switch repeater relay associated with said first and second track switches, respectively, and arranged to be picked up when the associated track switch is in its normal position, a first and a second reverse switch repeater relay associated with said first and second track switches respectively, and arranged to be picked up when the associated track switch is in its reverse position, a route storage unit for controlling said track switches including at least a first and a second bank of storage relays, control circuits including contacts of said storage relays in said second bank for said switch machines for operating said switch machine in accordance with the route description stored in said storage unit, said control circuits for said first and said second switch machines including contacts of said first and said second detector track relays closed when said track relays are energized, an auxiliary relay, a control circuit for said auxiliary relay including a contact of said first reverse switch repeater relay and a contact of the storage relay in said first storage bank associated with said first track switch, and a contact of said auxiliary relay interposed in the control circuit for said first switch machine whereby said first switch machine is governed by the storage relays in said first bank when said auxiliary relay is picked up and is governed by the storage relays in said second bank when said auxiliary relay is released.

2. In a classification yard track layout including a first and a second track switch diverging from a common lead track, said first track 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 common lead track over said first and said second track switches in sequence, said first and said second track switches having overlapped detector track circuits including a first detector track relay associated with said first track switch and a second detector track relay associated with said second track switch, each said detector track relay being released when the associated detector track circuit is occupied, a first and a second switch machine associated with said first and said second track switches, respectively, for operating said track switches between their normal and their reverse positions, switch repeating contacts for said first and said second track switches for manifesting the position of said track switches, the combination with the foregoing of an automatic control system for governing the operation of said track switches comprising a route storage unit including a plurality of route storage banks,

each of said route storage banks including a plurality of switch storage relays which indicate a particular route in accordance with their energized or deenergized condition, transfer relay means associated with each of said storage banks for energizing the storage relays in a subsequent bank in correspondence with the storage relays in the preceding bank, switch control circuit means associated with the last bank of storage relays in the storage unit for controlling said switch machines to operate their associated track switches to their normal or their reverse positions in accordance with the deenergized or energized condition of said storage relays in the last bank of the unit, provided the associated detector track relays are not released, and means for at times operating said first switch in accordance with the storage relays in the storage bank preceding the last bank in said storage unit, said last named means comprising an auxiliary relay, a control circuit for said auxiliary relay including a switch repeating contact closed when said first switch is in its reverse position, and a contact of a switch storage relay in the bank of said storage unit preceding the final bank and closed to indicate a route storage requiring said first switch to be operated to its normal position, and a contact of said auxiliary relay interposed in the control circuit means for said first switch machine for transferring the control of said first switch machine from the storage relays in the last bank of said storage unit to the storage relays in the bank preceding the last bank of said storage unit.

3. In a classification yard track layout including a first and a second track switch diverging from a common lead track, said first track 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 common lead track over said first and said second track switches in sequence, said first and said second track switches having overlapped detector track circuits including a first detector track relay associated with said first track switch and a second detector track relay associated with said second track switch, each said detector track relay being released when the associated detector track circuit is occupied, a first and a second switch machine associated with said first and said second track switches, respectively, for operating said track switches between their normal and their reverse positions, switch repeating contacts for said first and said second track switches for manifesting the position of said track switches, the combination with the foregoing of an automatic control system for governing the operation of said track switches comprising a route storage unit including a plurality of route storage banks, each of said route storage banks including a plurality of switch storage relays which indicate a particular route in accordance with their energized or deenergized condition, transfer relay means associated with each of said storage banks for energizing the storage relays in a subsequent bank in correspondence with the storage relays in the preceding bank, switch control circuit means associated with the last bank of storage relays in the storage unit for governing said switch machines to operate their associated track switches to their normal or their reverse positions in accordance with the deenergized or energized condition of said storage relays in the last bank of the unit, provided the associated detector track relays are not released, and means for at times operating said first switch in accordance with the storage relays in the storage bank preceding the last bank in said storage unit, said last named means comprising an auxiliary relay, a pick up circuit for said auxiliary relay including a switch repeating contact closed when said first switch is in its reverse position, a contact of a switch storage relay in the storage bank preceding the final storage bank in said storage unit and closed to indicate a route storage requiring said first switch to be

operated to its normal position, and a detector contact controlled by said transfer relay means and closed when a route description is stored in the final bank of said storage unit; a first stick circuit for said auxiliary relay including a front contact of said auxiliary relay and said detector contact, a second stick circuit for said auxiliary relay including a front contact of said auxiliary relay, a contact controlled by said transfer relay means and closed when a route storage is transferred from said final bank of the route storage unit to the initial bank of a subsequent storage unit, and a switch repeating contact closed when said first switch is in its normal position; and a contact of said auxiliary relay interposed in the switch control circuit means for said first switch machine to transfer the control of said first switch machine from the storage relays in the final storage bank of the storage unit to the storage relays in the storage bank preceding the final storage bank in said storage unit.

4. In combination, a first and a second track switch diverging from a common lead track, said first track 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 common lead track over said first and said second track switches in sequence, said first and said second track switches having overlapped detector track sections including a first detector relay associated with said first track switch and a second detector relay associated with said second track switch, said detector relays having contacts which are operated from a first to a second position when the associated detector track section is occupied, a first and a second switch machine associated with said first and second track switches respectively, for operating said track switches between their normal and their reverse positions, a first and a second normal switch repeater relay associated with said first and second track switches, respectively, and arranged to be picked up when the associated track switch is in its normal position, a first and a second reverse switch repeater relay associated with said first and second track switches respectively, and arranged to be picked up when the associated track switch is in its reverse position, a route storage unit for controlling said track switches including at least a first and a second bank of storage relays, control circuits including contacts of said storage relays in said second bank for operating said switch machines in accordance with the route description stored in said storage unit, said control circuits for said first and said second switch machines including contacts of said first and said second detector track relays closed in their first position, an auxiliary relay, a control circuit for said auxiliary relay including a contact of said first reverse switch repeater relay and a contact of the storage relay in said first storage bank associated with said first track switch, and a contact of said auxiliary relay interposed in the control circuit for said first switch machine whereby said first switch machine is governed by the storage relays in said first bank when said auxiliary relay is picked up and is governed by the storage relays in said second bank when said auxiliary relay is released.

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 track 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 common lead track over said first and said second track switches in sequence, said first and said second track switches having overlapped detector track sections including a first detector relay associated with said first track switch and a second detector relay associated with said second track switch, said detector relays having contacts which are operated from a first to a second position

29

when the associated detector track circuit is occupied, a first and a second switch machine associated with said first and said second track switches, respectively, for operating said track switches between their normal and their reverse positions, switch repeating contacts for said first and said second track switches for manifesting the position of said track switches, an automatic control system for governing the operation of said track switches comprising a route storage unit including a plurality of route storage banks, each of said route storage banks including a plurality of switch storage relays which indicate a particular route in accordance with their energized or deenergized condition, transfer relay means associated with each of said storage banks for energizing the storage relays in a subsequent bank in correspondence with the storage relays in the preceding bank, switch control circuit means associated with the last bank of storage relays in the storage unit for governing said switch machines to operate their associated track switches to their normal or their reverse positions in accordance with the deenergized or energized condition of said storage relays in the last bank of the unit, provided the associated detector relay contacts are closed in their first position, and means for at times operating said first switch in accordance with the storage relays in the storage bank preceding the last bank in said storage unit, said last named means comprising an auxiliary relay, a control circuit for said auxiliary relay including a switch repeating contact closed when said first switch is in its reverse position, and a contact of a switch storage relay in the bank of said storage unit preceding the final bank and closed to indicate a route storage requiring said first switch to be operated to its normal position, and a contact of said auxiliary relay interposed in the control circuit for said first switch machine for transferring the control of said first switch machine from the storage relays in the last bank of said storage unit to the storage relays in the bank preceding the last bank of said storage unit.

6. In combination with a classification yard track layout including a first and a second track switch diverging from a common lead track, said first track 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 common lead track over said first and said second track switches in sequence, said first and said second track switches having overlapped detector track sections including a first detector relay associated with said first track switch and a second detector relay associated with said second track switch, said detector track relays having contacts which are operated from a first to a second position when the associated detector track section is occupied, a first and a second switch machine associated with said first and said second track switches, respectively, for operating said track switches between their normal and their reverse positions, switch repeating con-

30

tacts for said first and said second track switches for manifesting the position of said track switches, an automatic control system for governing the operation of said track switches comprising a route storage unit including a plurality of route storage banks, each of said route storage banks including a plurality of switch storage relays which indicate a particular route in accordance with their energized or deenergized condition, transfer relay means associated with each of said storage banks for energizing the storage relays in a subsequent bank in correspondence with the storage relays in the preceding bank, switch control circuit means associated with the last bank of storage relays in the storage unit for governing said switch machines to operate their associated track switches to their normal or their reverse positions in accordance with the deenergized or energized condition of said storage relays in the last bank of the unit, provided the associated detector relay contacts are closed in their first position, and means for at times operating said first switch in accordance with the storage relays in the storage bank preceding the last bank in said storage unit, said last named means comprising an auxiliary relay, a pick up circuit for said auxiliary relay including a switch repeating contact closed when said first switch is in its reverse position, a contact of a switch storage relay in the storage bank preceding the final storage bank in said storage unit and closed to indicate a route storage requiring said first switch to be operated to its normal position, and a detector contact controlled by said transfer relay means to close when a route description is stored in the final bank of said storage unit; a first stick circuit for said auxiliary relay including a front contact of said auxiliary relay and said detector contact, a second stick circuit for said auxiliary relay including a front contact of said auxiliary relay, a contact of said transfer relay means closed when a route storage is transferred from said final bank of the route storage unit to the initial bank of a subsequent storage unit, and a switch repeating contact closed when said first switch is in its normal position; and a contact of said auxiliary relay interposed in the switch control circuit means for said first switch machine to transfer the control of said first switch machine from the storage relays in the final bank of the storage unit to the storage relays in the storage bank preceding the final storage bank in said storage unit.

References Cited in the file of this patent

UNITED STATES PATENTS

1,794,568	Wight	Mar. 3, 1931
1,797,561	Thompson	Mar. 24, 1931
1,942,614	O'Hagan	Jan. 9, 1934
2,082,930	Young et al.	June 8, 1937
2,194,352	Brixner et al.	Mar. 19, 1940
2,194,353	Brown et al.	Mar. 19, 1940
2,216,610	Culbertson	Oct. 1, 1940
2,255,142	Wight	Sept. 9, 1941
2,700,728	Brixner et al.	Jan. 25, 1955

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 2,863,991

December 9, 1958

Benjamin Mishelevich

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 26, line 39, for "machine" read -- machines --; column 28, line 11, for "swish" read -- switch --.

Signed and sealed this 24th day of March 1959.