

Feb. 22, 1938.

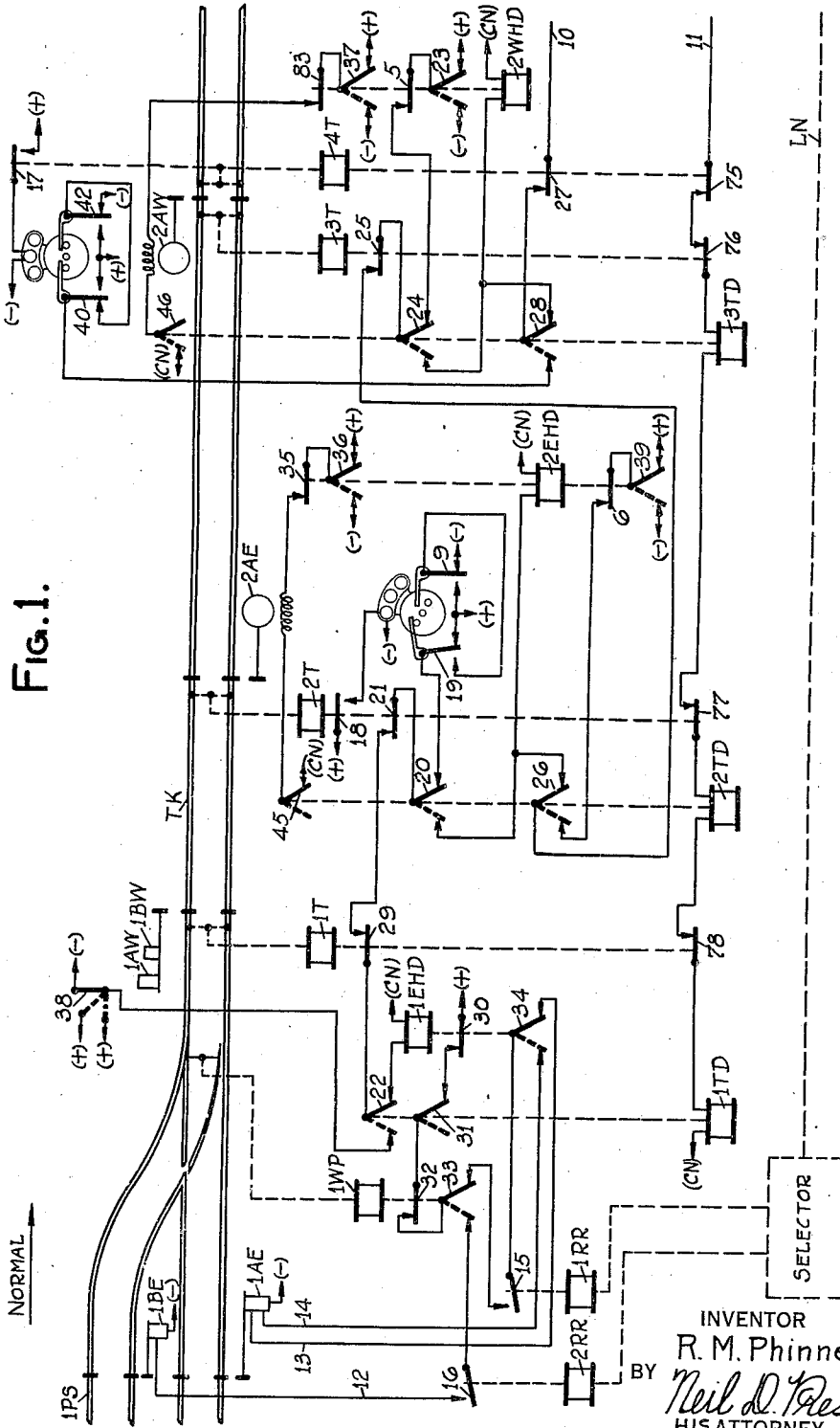
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2,109,153

TRAFFIC DIRECTION CONTROLLING SYSTEM FOR RAILROADS

Filed Dec. 28, 1933

3 Sheets-Sheet 1



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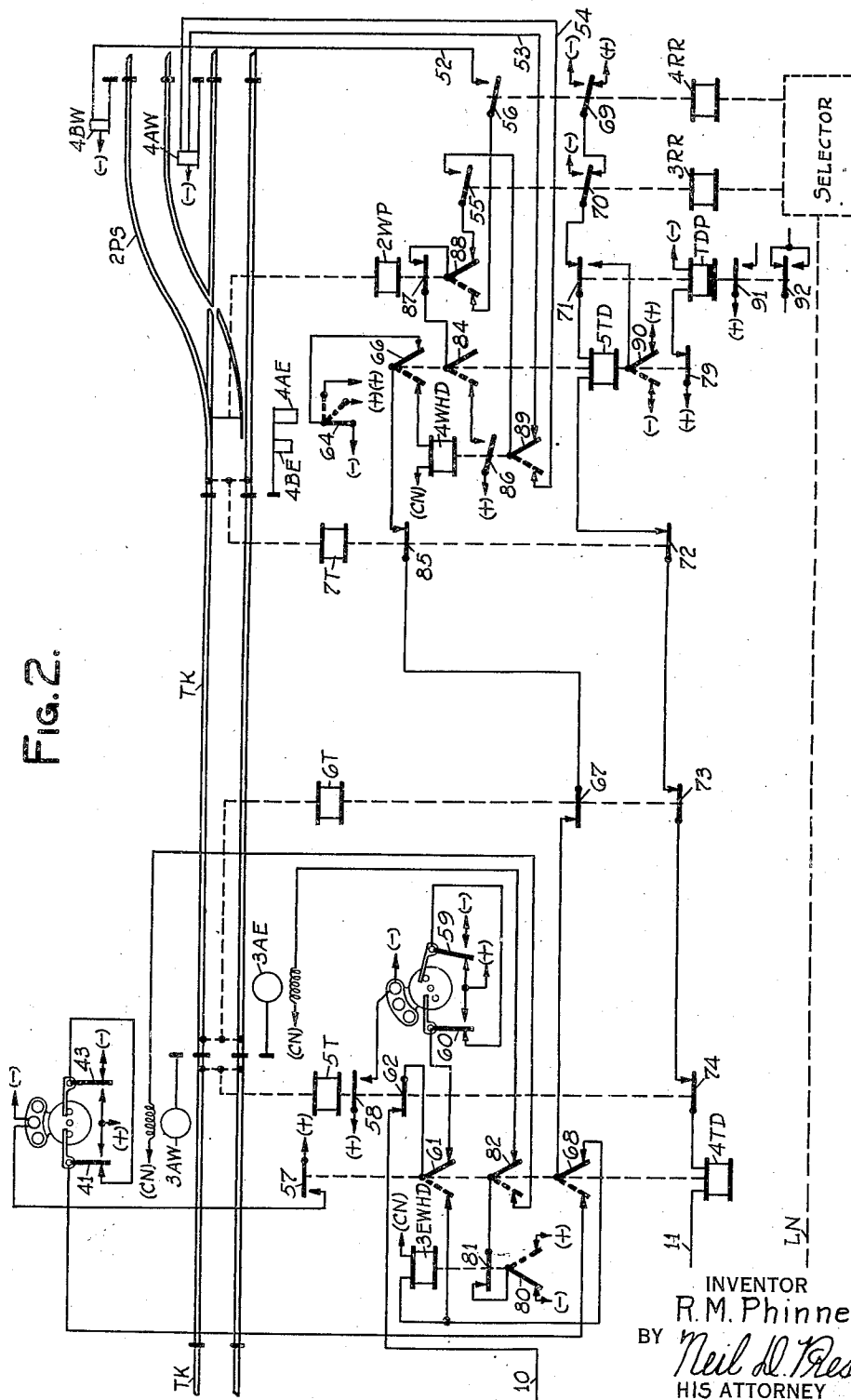
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3 Sheets-Sheet 2



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3 Sheets-Sheet 3

FIG. 6.

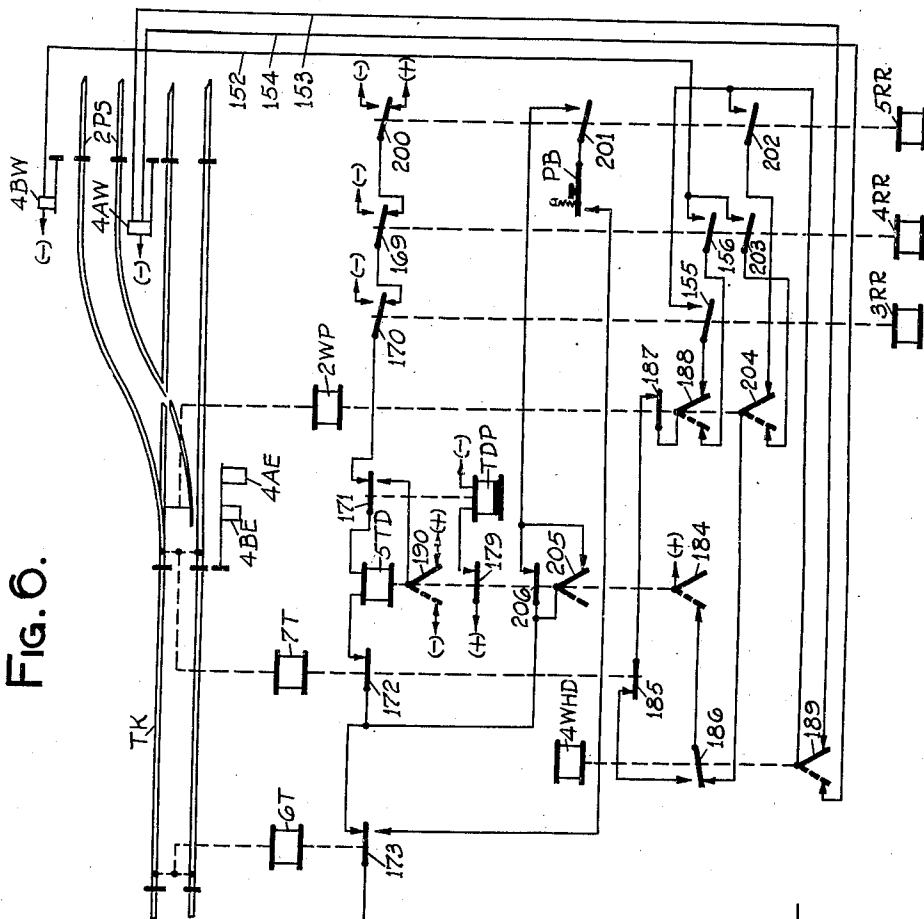


FIG. 3.

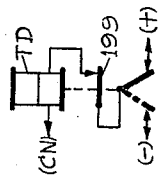


FIG. 4.

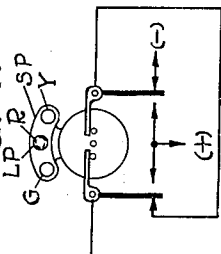
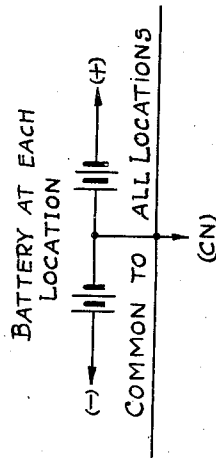


FIG. 5.



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TRAFFIC DIRECTION CONTROLLING SYSTEM FOR RAILROADS

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22 Claims. (Cl. 246—3)

This invention relates to a traffic direction controlling system for railroads and it more particularly pertains to a system of this type applied to a stretch of single track signaled through the medium of a centralized traffic controlling system to facilitate train movements in both directions.

Single track railroads are usually equipped with signaling systems of the absolute permissive block type in which trains may move in only one direction in a single track section at one time and where following trains are protected by signaling indications of clear, caution and stop depending on the extent of unoccupied track ahead, the same as in double track signaling where a danger signal indicates the entrance into an occupied block, a caution signal indicates the entrance into a block in the rear of an occupied block and a clear signal manifests at least two unoccupied blocks in advance of said signal. In other words, absolute permissive block or APB systems prevent the entrance of all opposing trains and permit the movement of following trains with the usual train spacing. In APB signaling systems of the superimposed manual control type, the starting signals as well as the entering signals located at each end of each single track section have superimposed thereon manual control so that these signals may be permitted to clear through suitable control mechanism governed from a central office.

In view of the above and other important considerations, it is proposed in accordance with the present invention to provide a less expensive equivalent of APB signaling. One particular application of the present invention relates to the provision of APB signaling in territory where other forms of signaling are at present in service such as on single track with overlap signaling and on double track signaling with line circuits or repeated track circuits.

The present invention is applicable to manually controlled signaling systems and although it may be applied to the unit wire type, the present embodiment indicates one manner of providing the characteristic features of the invention in a centralized traffic controlling system of the selector type. The selectors indicated in the drawings by the dotted rectangles are controlled from a central control office through the medium of the line circuit indicated by dotted line LN which connects the selectors with the control office. Although the control office is not shown it will be understood that it may be located at

either end of the line as determined by local conditions.

Other objects, purposes and characteristic features of the invention will in part be pointed out in the following description and will in part be obvious from the drawings.

In describing the invention in detail, reference will be made to Figs. 1, 2, 3, 4, 5 and 6. Figs. 1 and 2 when placed end to end with Fig. 2 to the right of Fig. 1 and with correspondingly numbered lines in alignment constitute a drawing which shows the invention applied to a single track section connecting the ends of diverging routes or passing sidings.

Fig. 3 indicates a modified arrangement of the traffic direction relays TD which may be provided if desired and which will be explained more in detail later.

Fig. 4 illustrates a portion of a light signal of the quick acting spectacle type operated to the danger position. This type of light signal is indicated in connection with the circuit diagram of Figs. 1 and 2 in the danger, clear and caution positions, and the showing in Fig. 4 indicates more in detail the plan of the device.

Fig. 5 indicates the battery used at each location. It will be understood that a separate battery with a center tap (CN) is provided at each location with terminals (+) and (—) connected to the circuits so indicated at the respective locations only. Center tap (CN) of the battery at each location is connected to a common conductor which leads to all locations so that the center taps of all the batteries are connected together.

Fig. 6 indicates a modification of the invention whereby a call-on signal may be controlled to permit its clearing for an engine to return to its train which has been left in the approach track section.

Equipment

Referring to Figs. 1 and 2 the stretch of track has been shown divided into blocks by insulating joints to provide the usual track circuits and detector track circuits. At the left hand or west end of the single track section is shown a passing siding 1PS and the movement of traffic between this siding and the single track section is governed by a track switch. At the right hand or east end of the single track section is shown a passing siding 2PS connected to the main track by a track switch for governing the movement of traffic between this passing siding and the single track section.

With the track switch at the west end of the

single track section are associated a main starting signal 1AE and a dwarf starting signal 1BE for governing respectively movement of trains off the main track and off the side track of passing siding 1PS onto the single track section TK. This track switch also has associated therewith the entering signal 1AW and the associated low speed signal 1BW for governing the movement of trains off of the single track section TK into the main track and the side track respectively of the passing siding 1PS. Similarly, the track switch at the east end of track section TK has associated therewith starting signals 4AW and 4BW, an entering signal 4AE and a low speed signal 4BE.

The detector track circuit associated with the switch at the west end of the track section includes a track relay 1T normally energized by the usual track battery. The second track circuit in advance of signal 1AE includes the track relay 2T normally energized by the usual track battery. The track circuit in advance of signal 2AE includes the track relay 3T normally energized by the usual track battery. The next two track circuits in advance of signal 2AE include track relays 4T and 5T normally energized by the usual track batteries. The track circuit in advance of signal 3AE includes the track relay 6T normally energized by the usual track battery. The detector track circuit associated with the switch at the east end of the track section includes a track relay 7T normally energized by the usual track battery.

Attention is called to the fact that each of the starting signals 1AE, 1BE, 4AW and 4BW and the entering signals 1AW, 1BW, 4AE and 4BE are stop and stay signals, as conventionally indicated by the rectangular single blades and that the intermediate signals are permissive signals, it being of course understood that the present invention is not limited to signals of the type shown and that multiple aspect control light signals may be used if desired. The intermediate permissive signals are indicated as being of the quick acting spectacle type light signal such, for example, as disclosed in the pending application of Joaquin Rosell, Ser. No. 607,111 filed April 23, 1932.

Each signal has been shown controlled by an associated home and distant relay HD having a prefix number and letter corresponding to the signals which it controls. These HD relays may be of the retained neutral polar type for the purpose of preventing more than one signal being affected by the reversal of polarity on the circuit. This eliminates the necessity of a slow releasing repeater relay for this purpose. The retained neutral feature refers to the particular design of the relay whereby its neutral contact remains in its picked up position when the current through its winding is reversed for switching the position of the polar contacts.

The position of the track switch at the west end of the track section is indicated by the usual switch repeating relay 1WP and the position of the switch at the east end of the track section is indicated by switch repeating relay 2WP. With the corresponding switch in its normally locked position the associated WP relay has its neutral contacts picked up and its polar contacts positioned to the right. With the corresponding switch in its reverse locked position, the switch repeating relay has its neutral contacts picked up and its polar contacts positioned to the left. These switch repeating relays indicate the asso-

ciated switches in their unlocked positions by dropping their neutral contacts.

At each signal location is shown a traffic direction relay TD having a prefix number corresponding to its location in the circuit. The control of these traffic direction relays is such that they have their polar contacts positioned to the right for governing traffic from left to right or in an eastbound direction and with their polar contacts positioned to the left they govern traffic from right to left or in a westbound direction, all subject to traffic conditions as will be explained in detail.

At the west end of the single track section has been shown a route control relay 1RR used for governing the eastward movement of trains from the main track onto the track section TK. Route control relay 2RR is used for governing the eastward movement of trains from the passing siding 1PS onto the main track section TK. Similarly, route control relay 3RR shown at the east end of the single track section is used for governing the westward movement of trains from the main track onto the track section TK. Route control relay 4RR is used for governing the movement of trains from the passing siding 2PS onto the track section TK. The control of these route control relays is not shown in the present drawings but they may be controlled over the communication line circuit of the centralized traffic controlling system, as disclosed, for example, in the prior application of N. D. Preston, Ser. No. 573,079 filed November 5, 1931.

The control of signals 1AW, 1BW, 4AE and 4BE is not shown in the present drawings. This control is contemplated as being by means of additional HD relays in accordance with traffic in advance in the same manner as disclosed for signals 1AE, 1BE, 4AW and 4BW. It is not believed necessary to further complicate the drawings by showing these additional controls since sufficient structure is provided to indicate the method of carrying out the present invention.

Relay TDP repeats the operation of the neutral contact of relay 5TD for a purpose which will be explained in detail. Having now pointed out the essential elements of a single track section of railway track through which trains may move in opposite directions, it is believed expedient to consider the operation of the system, that is, the movement of trains from one passing siding to the other and observing how such direction of train movements may be changed by the operator. In addition to the common line above mentioned which connects the various locations, these locations are also connected by two conductors such as 10 and 11 over which signaling is governed in a manner to be later described in detail.

Operation

The starting signals at the west and east ends of the track section normally indicate stop. Signals 1AE and 1BE at the west end of the section indicate stop due to conductors 12, 13 and 14 leading to these signals being deenergized at normally open front contacts 15 and 16 of relays 1RR and 2RR respectively. Similar conductors leading to signals 1AW and 1BW are likewise normally deenergized but since these signals are controlled in accordance with traffic conditions in advance, their controlling circuits have been omitted. Signals 4AW and 4BW at the east end of the track section normally indicate stop because conductors 52, 53 and 54 lead-

ing to these signals are deenergized at normally open front contacts 55 and 56 of relays 3RR and 4RR respectively. Likewise, signals 4AE and 4BE normally indicate stop and since these signals are controlled in accordance with traffic conditions in advance, their controlling circuits have been omitted.

As indicated by the arrow in the upper left hand portion of Fig. 1, the normal direction of traffic is from west to east. The intermediate permissive signals 2AW and 3AW, which are the permissive signals for westbound traffic, do not normally show any indication since the lamp circuits of these signals are normally deenergized. The circuit leading to the lamp of signal 2AW is deenergized at normally open back contact 17 of relay 4T. The lamp circuit of signal 3AW is deenergized at normally open back contact 57 of relay 4TD. Likewise, the lamp circuits of signals 2AE and 3AE are deenergized at normally open back contacts 18 and 58 of relays 2T and 5T respectively.

By referring to Fig. 4, it will be noted that lamp LP of the intermediate signal is permanently positioned behind the spectacle SP at the center position. In this position the red filter or screen (R) is in front of lamp LP. It will also be noted that when spectacle SP is actuated to the left, the yellow screen (Y) is positioned in front of lamp LP and when actuated to the right the green screen (G) is positioned in front of the lamp. The spectacles of these intermediate permissive signals occupy the positions indicated in Figs. 1 and 2 due to the assumed conditions of the circuits illustrated in these drawings, and it will be understood that they are actuated to the proper positions and the lamps are lighted when conditions are set up for indicating traffic conditions over the various blocks of the track section TK. It will be assumed that the operating mechanisms of these intermediate signals position the green or clear screens over the lamps when (+) potential is applied to the motor as shown, for example, in connection with signal 2AE. When (-) potential is applied to the motor which actuates these signal devices, the yellow or caution screen is positioned opposite the lamp as indicated in connection with signal 3AE. When the motor is deenergized the red or stop screen is positioned in front of the indicating lamp as indicated in connection with signals 2AW and 3AW.

Relay 1EHD is energized to its right hand (clear) position over a circuit which extends from (+), contact 19 of signal 2AE in its right hand position, contact 20 of relay 2TD in its right hand position, front contact 21 of relay 2T, front contact 29 of relay 1T, contact 22 of relay 1TD in its right hand position and winding of relay 1EHD, to (CN). Relay 2EHD is energized to its right hand (clear) position over a circuit extending from (+), contact 23 of relay 2WHD in its right hand position, front contact 5 of relay 2WHD, contact 24 of relay 3TD in its right hand position, front contact 25 of relay 3T, contact 26 of relay 2TD in its right hand position and winding of relay 2EHD, to (CN).

Relay 2WHD is energized to its right hand (clear) position over a circuit extending from (+), contact 59 of signal 3AE in its left hand position, contact 60 of signal 3AE in its left hand position, contact 61 of relay 4TD in its right hand position, front contact 62 of relay 5T, conductor 10, front contact 27 of relay 4T, contact 28 of relay 3TD in its right hand position

and winding of relay 2WHD, to (CN). Relay 3EWHHD is energized to its left hand (caution) position over a circuit which extends from (-), contact 64 of signal 4AE, contact 66 of relay 5TD in its right hand position, front contact 85 of relay 7T, front contact 67 of relay 6T, contact 68 of relay 4TD in its right hand position and winding of relay 3EWHHD, to (CN). Relay 4WHD is deenergized (stop) due to contact 66 of relay 5TD being in its right hand position.

Relays 1TD, 2TD, 3TD, 4TD and 5TD are energized to their right hand (east) positions by means of a circuit which extends from (+), back contact 69 of relay 4RR, back contact 70 of relay 3RR, front contact 71 of relay TDP, winding of relay 5TD, front contact 72 of relay 7T, front contact 73 of relay 6T, front contact 74 of relay 5T, winding of relay 4TD, conductor 11, front contact 75 of relay 4T, front contact 76 of relay 3T, winding of relay 3TD, front contact 77 of relay 2T, winding of relay 2TD, front contact 78 of relay 1T and winding of relay 1TD, to (CN). Relay TDP is normally energized over an obvious circuit extending through front contact 79 of relay 5TD.

It will now be assumed that there is an east-bound train standing on the main track of passing siding 1PS and that the operator in the control office wishes this train to pass into the main track of the passing siding 2PS. The operator may first clear entering signal 4AE, which is accomplished through the medium of the communication system in a manner which is not shown but which will be obvious from the manner in which signal 1AE is cleared as described below. The clearing of signal 4AE switches contact 64 of this signal from (-) to (+) which energizes relay 3EWHHD to its right hand (clear) position over the above described circuit.

Signal 3AE is now actuated to its clear position by means of a circuit extending from (+), contact 80 of relay 3EWHHD in its right hand dotted position, front contact 81 of relay 3EWHHD, contact 82 of relay 4TD in its right hand position, and winding of the motor which governs the signal mechanism of signal 3AE, to (CN). Since track relay 5T is energized at this time the lamp circuit associated with signal 3AE is deenergized. The movement of contact 60 of the signal mechanism associated with signal 3AE to its right hand position applies (+) potential to the circuit leading to relay 2WHD so that this relay remains in its right hand position. It will thus be seen that the clearing of signal 4AE allows signal 3AE to assume its clear position by reason of the reversal of polarity applied to relay 3EWHHD.

The operator may clear the signal 1AE by causing the communication system circuits to function to pick up relay 1RR. Signal 1AE is cleared over a circuit which extends from (+), front contact 30 of relay 1EHD, contact 31 of relay 1TD in its right hand position, front contact 32 of relay 1WP, contact 33 of relay 1WP in its right hand (normal) position, front contact 15 of relay 1RR, contact 34 of relay 1EHD in its right hand position, conductor 13 and through signal 1AE, to (-).

The train under consideration may now respond to the clearing of signal 1AE and pass into the single track section TK. As the train enters the track section associated with signal 1AE, relay 1T will be dropped to effect the putting of signal 1AE to stop by opening the above described circuit of relay 1EHD at front contact 29 which in turn drops contact 30 of relay 1EHD

to deenergize signal 1AE. Relay 1T likewise opens at front contact 78 the above described circuit of the TD relays so that it is impossible to change the direction of traffic while a train is in the track section.

When the train enters the block to the left of signal 2AE, track relay 2T is deenergized which closes a circuit at its back contact 18 for lighting the lamp of signal 2AE and since this signal is in its clear or green position, an indication is given to the approaching train that the next block is clear. The dropping of relay 2T maintains the circuit of the traffic direction relays open at front contact 77. The dropping of front contact 21 of relay 2T deenergizes the circuit leading to relay 1EHD so that signal 1AE is maintained in its stop position because contact 30 remains down after relay 1T picks up its front contact 29.

As the train passes into the block associated with signal 2AE, relay 3T is deenergized and at front contact 76 the circuit of the traffic direction relays is maintained open. The dropping of front contact 25 of relay 3T deenergizes the circuit of relay 2EHD so that signal 2AE is put to stop by deenergizing the motor circuit at front contact 35 of relay 2EHD. The indicator contacts of signal 2AE now assume the stop positions indicated in Fig. 4 which connects (—) through contact 9 in its right hand position, contact 19 in its left hand position, contact 20 of relay 2TD in its right hand position to the winding of relay 1EHD over the remainder of the circuit previously described. Relay 1EHD now assumes its left hand position and since relay 1RR is picked up, a circuit is closed for actuating signal 1AE to give a caution indication which circuit extends from (+), front contact 30 of relay 1EHD, contact 31 of relay 1TD in its right hand position, front contact 32 of relay 1WP, contact 33 of relay 1WP in its right hand position, front contact 15 of relay 1RR, contact 34 of relay 1EHD in its left hand dotted position and conductor 14 to signal 1AE.

As the train passes into the next section of track, relay 4T is deenergized. Relay 4T maintains the circuit of the TD relays open at front contact 75. The dropping of front contact 27 of relay 4T deenergizes relay 2WHD so that signal 2AW is maintained in its stop position by the dropping of front contact 83 of relay 2WHD. As the train passes into the next section, relay 5T is deenergized and at its front contact 74 the circuit of the TD relays is maintained open. The dropping of front contact 62 of relay 5T also maintains the circuit of relay 2WHD deenergized. The dropping of back contact 58 of relay 5T energizes the lamp associated with signal 3AE and since this signal is in its clear position as previously pointed out, a visual indication is given of this fact.

As the train passes into the block associated with signal 3AE, track relay 6T is deenergized. The dropping of front contact 67 of relay 6T deenergizes relay 3EWHHD which actuates signal 3AE to its stop position by opening its motor circuit at contact 81. Signal 3AE in its stop position connects (—) over the previously described circuit leading to relay 2WHD so that this latter relay is energized to its left hand dotted position. A circuit is now closed for actuating relay 2EHD to its left hand dotted position which extends from (—), contact 23 of relay 2WHD in its left hand dotted position, front contact 5 of relay 2WHD, contact 24 of

relay 3TD in its right hand position, front contact 25 of relay 3T, contact 26 of relay 2TD in its right hand position and winding of relay 2EHD, to (CN). Relay 2EHD in its left hand position closes a circuit for actuating signal 2AE to its caution position which circuit extends from (—), contact 36 of relay 2EHD in its left hand dotted position, front contact 35 of relay 2EHD and winding of the motor, contact 45 at relay 2TD in its right hand position to (CN). With signal 2AE in its caution position, (+) potential is applied to relay 1EHD over the previously described circuit which positions this relay to the right for causing signal 1AE to give a clear indication by means of a circuit completed through contact 34 of relay 1EHD in its right hand position.

As the train passes into the block associated with passing siding 2PS, relay 7T is deenergized. The dropping of front contact 72 of relay 7T maintains the circuit of the traffic direction relays open so that the direction of traffic cannot be reversed. Since contacts 66 and 84 of relay 5TD cannot be actuated to their left hand dotted positions, signals 4AW and 4BW cannot be cleared. The dropping of front contact 85 of relay 7T also prevents clearing of signals 4AW and 4BW as long as this section of track is occupied. The dropping of front contact 85 of relay 7T deenergizes relay 3EWHHD which holds signal 3AE at stop by maintaining the conductor leading to the motor of this signal deenergized by reason of open front contact 81.

The train may thus continue its movement into the next section and relay 7T will be energized. Since signal 4AE will now assume its caution position (in the same manner that signal 1AE assumed its caution position when track relay 3T was dropped), (+) potential through contact 64 is connected to the winding of relay 3EWHHD for clearing signal 3AE by positioning contact 80 of relay 3EWHHD to the right. It will thus be seen that the circuit arrangement is such that a caution signal is displayed in the first block to the rear of a danger signal and a clear signal is displayed in the first block to the rear of the caution signal.

It will now be assumed that there is a west-bound train standing on the main track associated with passing siding 2PS and that the operator in the control office wishes this train to proceed through the single track section TK and into the main track of passing siding 1PS. The operator may first clear entering signal 1AW which is accomplished through the medium of the communication system in a manner which is not shown but which will be obvious from the manner in which other signals are cleared as described. The clearing of signal 1AW switches contact 38 of this signal from (—) to (+).

Similarly, the operator may clear signal 4AW by causing the communication system circuits to function to pick up relay 3RR. The picking up of relay 3RR switches the circuit including all of the traffic direction relays from (+) to (—) at contact 70. This change in potential causes all of the TD relays to be energized to their left hand positions. Signal 4AW is cleared over a circuit extending from (+), front contact 86 of relay 4WHD (which will be energized as later pointed out), contact 84 of relay 5TD in its left hand dotted position, front contact 87 of relay 2WP, contact 88 of relay 2WP in its right hand (normal) position, front contact 55 of relay 3RR,

contact 89 of relay 4WHD in its right hand position, conductor 53 and signal 4AW, to (-).

The clearing of signal 1AW, above mentioned closes a circuit for energizing relay 2EHD to its right hand position, which circuit extends from (+), contact 38 of signal 1AW, contact 22 of relay 1TD in its left hand dotted position, front contact 29 of relay 1T, front contact 21 of relay 2T, contact 20 of relay 2TD in its left hand dotted position and winding of relay 2EHD, to (CN). Relay 2EHD closes a circuit for actuating relay 2WHD to its right hand position which extends from (+), contact 39 of relay 2EHD in its right hand position, front contact 6 of relay 2EHD, contact 26 of relay 2TD in its left hand dotted position, front contact 25 of relay 3T, contact 24 of relay 3TD in its left hand dotted position and winding of relay 2WHD, to (CN).

Relay 2WHD closes an obvious circuit through its contact 37 in the right hand position and contact 46 of relay 3TD in its left hand dotted position for actuating the mechanism of signal 2AW to its clear position. A circuit is closed for actuating relay 3EWHHD to its right hand position which extends from (+), contact 40 of signal 2AW in its right hand position, contact 28 of relay 3TD in its left hand dotted position, front contact 27 of relay 4T, conductor 10, front contact 62 of relay 5T, contact 61 of relay 4TD in its left hand dotted position and winding of relay 3EWHHD, to (CN). Relay 3EWHHD closes a circuit for clearing signal 3AW which extends from (+), contact 80 of relay 3EWHHD in its right hand dotted position, front contact 81 of relay 3EWHHD, contact 82 of relay 4TD in its left hand dotted position and winding of the motor of signal 3AW, to (CN).

Signal 3AW in its clear position closes a circuit for energizing relay 4WHD to its right hand position, which circuit extends from (+), contact 41 of signal 3AW in its right hand position, contact 68 of relay 4TD in its left hand dotted position, front contact 67 of relay 6T, front contact 85 of relay 7T, contact 66 of relay 5TD in its left hand dotted position and winding of relay 4WHD, to (CN).

Since all the track relays and relay 4TD are energized at this time, all of the lamp circuits of the associated intermediate signals are deenergized. The train under consideration may now respond to the clearing of signal 4AW and pass into the single track section TK. As the train enters the track section associated with signal 4AW, relay 7T will be dropped to put signal 4AW to stop by opening the above described clearing circuit of this signal at front contact 86 of relay 4WHD which drops when contact 85 of relay 7T is dropped. Relay 7T likewise opens at front contact 72 the above described circuit of the TD relays so that it is impossible to change the direction of traffic while a train is in track section TK.

When the train enters the block to the left of signal 4AE, track relay 6T is deenergized which maintains the circuit of the TD relays open at its front contact 73. Relay 6T also opens at its front contact 67 the above described circuit of relay 4WHD so that this latter relay maintains its front contact 86 open to maintain signal 4AW at stop.

As the train passes into the block associated with signal 3AW, relay 5T is deenergized, to keep the circuit of the traffic direction relays open by dropping front contact 74. The dropping of contact 62 of relay 5T opens the above described

circuit of relay 3EWHHD which drops front contact 81 to put signal 3AW to stop by deenergizing the motor circuit. As the train passes into the next block, relay 4T is deenergized and at its back contact 75 the circuit of the TD relays is maintained open. The dropping of back contact 17 of relay 4T energizes the lamp of signal 2AW and since this signal is in its clear position as above described, a clear indication is given to the train crew. The dropping of front contact 27 accomplishes the same result as contact 62 of relay 5T after this latter contact is picked up.

As the train passes into the block associated with signal 2AW, relay 3T is deenergized which opens at its front contact 25 the above described circuit of relay 2WHD. At front contact 83 of 2WHD, signal 2AW is actuated to its stop position by the deenergization of the motor circuit. With signal 2AW in its stop position a circuit is closed for actuating relay 3EWHHD to its left hand position which extends from (-), contact 42 of signal 2AW in its right hand position, contact 40 of signal 2AW in its left hand position, contact 23 of relay 3TD in its left hand dotted position, front contact 27 of relay 4T, conductor 10, front contact 62 of relay 5T, contact 61 of relay 4TD in its left hand dotted position and winding of relay 3EWHHD, to (CN). Relay 3EWHHD actuates signal 3AW to the caution position over a circuit extending from (-), contact 80 of relay 3EWHHD in its left hand position, front contact 81 of relay 3EWHHD, contact 82 of relay 4TD in its left hand dotted position and winding of the motor of signal 3AW, to (CN).

Signal 3AW in its caution position closes a circuit for actuating relay 4WHD to the right which extends from (+), contact 43 of signal 3AW in its left hand position, contact 41 of signal 3AW in its left hand position, contact 68 of relay 4TD in its left hand dotted position, front contact 67 of relay 6T, front contact 85 of relay 7T, contact 66 of relay 5TD in its left hand dotted position and winding of relay 4WHD, to (CN). Relay 4WHD again closes the circuit for clearing signal 4AW, which circuit has been previously described.

As the train passes into the block to the left of that associated with signal 2AW, relay 2T is deenergized. The dropping of front contact 21 of relay 2T deenergizes relay 2EHD which drops its front contact 35. Contact 35 and contact 45 of relay 2TD both hold signal 2AE at stop since both of these contacts are open.

As the train passes into the block associated with passing siding IPS, relay 1T is deenergized and its contact 78 is dropped so that the direction of traffic cannot be reversed. Since contact 31 of relay 1TD is in its left hand dotted position, neither signal 1AE or 1BE can be cleared at this time. The dropping of front contact 29 of relay 1T also prevents clearing signals 1AE and 1BE as long as this section of track is occupied.

The train may thus continue its movement into the next section and relay 1T is energized. Since signal 1AW will now assume its caution position, (+) potential through contact 38 is applied to the circuit leading to relay 2EHD which positions this relay to the right for positioning relay 2WHD to the right over a circuit extending from (+), contact 39 of relay 2EHD in its right hand position, front contact 6 of relay 2EHD, contact 26 of relay 2TD in its left hand dotted position, front contact 25 of relay 3T, contact 24 of relay 3TD in its left hand dotted position and winding of re-

lay 2WHD, to (CN). The energization of relay 2WHD to its right hand position closes the circuit for clearing signal 2AW by way of its contacts 37 and 83 as previously described. It will thus be seen that the circuit arrangement is such that when the traffic direction is reversed a caution signal is displayed in the first block to the rear of a danger signal and a clear signal is displayed in the first block to the rear of the caution signal.

It is believed that the above typical showing of a single intermediate signal for each direction at different locations and a pair of intermediate signals for both directions at a single location is sufficient to indicate the method of signaling under the various conditions which may be encountered in practice. It will be noted that approach lighting of the intermediate signals 2AE, 2AW and 3AE is accomplished by carrying the lamp circuits of these signals through back contacts of the associated track relays. This provides approach lighting for each block as the train enters the block. By energizing these lamp circuits through back contacts of the TD relays, such as is indicated by back contact 57 of relay 4TD, an optional arrangement is provided whereby the signals will be lighted all the time the train is between control points, since under this condition all TD relays are deenergized. Either plan or a combination of both plans may be used to meet the requirements of practice.

To prevent the circuit of the TD relays becoming energized momentarily due to a car passing from one track section to another, repeater relay TDP is provided for relay 5TD at the controlling end of the circuit. Relay TDP is made slow in picking up so that this relay will not pick up if relay 5TD should pick up momentarily. The proper polarity is maintained on the TD relay circuit through contact 90 of relay 5TD in the position last assumed by this latter relay when relay TDP closes its back contact 71. Relay TDP is made slow in dropping so that it will not drop its contact when the polarity of the TD relay circuit is reversed. It is to be understood that any timing device such as a thermal relay can be used in connection with the pick-up circuit of relay TDP if necessary to obtain a time interval in addition to that provided by the slow pick-up characteristics of relay TDP.

Contacts 91 and 92 are provided on relay TDP for the purpose of giving continuous indication of track occupancy between control points. It will be obvious that the closure of back contact 91 may be indicated in the control office by means of the centralized traffic controlling communication circuit and that the shifting of contact 92 may effect the starting of such system, all in a manner which has been described in various patent applications and which is immaterial to an understanding of the present invention.

As shown in Fig. 3, a stick coil can be provided for the TD relay when desired to provide an attraction of the armature by the magnet at all times except when this relay is reversing its position. The additional coil shown as the lower winding of relay TD in Fig. 3 can be of high resistance so that the reversal of current through the upper winding, which is included in the line circuit, neutralizes the effect of the lower coil, forcing the neutral armature down and reversing the stick circuit when the neutral contact 199 again closes the stick circuit of proper polarity. It will thus be seen that the stick coil assists the

permanent magnet of the relay except when the relay is reversing its position and contact 199 is dropped.

Modification Fig. 6

Referring to Fig. 6, it will be assumed that the engine leaves its train in the block of track TK associated with track relay 6T and proceeds into the block to the right of signals 4AW and 4BW, either over the main line or the siding of this track section. The reference letters associated with the apparatus in Fig. 6 correspond to letters associated with similar apparatus shown in Fig. 2 and the reference numerals of Fig. 6 having numeral 1 prefixed correspond to similar reference numerals of Fig. 2. The reference numerals of Fig. 6, beginning with the numeral 2 indicate additional apparatus which is typical of the modification shown.

Relay 6T will be dropped and relay 7T will be picked up, since it is assumed that neither the train nor the engine is in the block associated with the relay 7T. The dropping of front contact 173 of relay 6T causes the neutral contact 179 of relay 5TD to drop and deenergize relay TDP, which drops its contacts after a short interval of time. It will be understood that the polar contacts of relay 5TD are in their right hand positions at this time due to the traffic direction being established from left to right. Relay 4WHD is deenergized so that its neutral contact 186 is dropped and it will be assumed that contact 189 is positioned to the right. Relay 4WHD is of course deenergized because contact 66 (Fig. 2) of relay 5TD is positioned to the right.

It will now be assumed that it is desired to clear either signal 4AW or 4BW so that the engine may return in a west-bound direction to its train. The control office operator after receiving proper instructions causes route relay 5RR to be picked up by means of the communication system and push button PB is actuated by a member of the train crew. A circuit is now closed for energizing the traffic direction circuit including all of the TD relays extending from (+), contact 190 of relay 5TD in its right hand position, back contact 171 of relay TDP, winding of relay 5TD, front contact 172 of relay 7T, contact 205 of relay 5TD in its right hand position, front contact 201 of relay 5RR, contact of push button PB, back contact 173 of relay 6T and the remainder of the TD relay circuit shown in Figs. 1 and 2, to (CN). This energizes the TD relay circuit in the same direction last energized (for energizing all TD relays to the right) and picks up front contact 179 of relay 5TD which in turn energizes relay TDP for picking up contact 171.

A circuit is now closed for reversing the current flow in the TD relay circuit which extends from (-), front contact 200 of relay 5RR, back contact 169 of relay 4RR, back contact 170 of relay 3RR, front contact 171 of relay TDP, winding of relay 5TD, front contact 172 of relay 7T, contact 205 of relay 5TD in its right hand position, front contact 201 of relay 5RR, contact of push button PB, back contact 173 of relay 6T and over the remainder of the circuit including the TD relays, to (CN), as shown in Figs. 1 and 2. All of the TD relays will now be energized to their left hand dotted positions including relay 5TD and after contact 205 of relay 5TD leaves its right hand position, the continuity of the above circuit is maintained at front contact 206 of this relay.

Since relay 6T is deenergized, the circuit of 75

relay 4WHD is maintained open at contact 67 (see Fig. 2) of relay 6T. A circuit is now closed for clearing either signal 4AW or 4BW depending upon the position of relay 2WP. With relay 2WP in its normal position, this circuit extends from (+), contact 184 of relay 5TD in its left hand dotted position, back contact 186 of relay 4WHD, contact 204 of relay 2WP in its right hand position, front contact 202 of relay 5RR and contact 189 of relay 4WHD in its right hand position to conductor 153 which clears signal 4AW. With relay 2WP in its left hand dotted position the circuit is switched at contact 204 of this relay to clear signal 4BW by way of front contact 203 of relay 4RR.

It will be noted that this circuit of the TD relays can be reversed with a train in the approach track section only by the control operator clearing the proper lever (for picking up relay 5RR) with local cooperation by means of the push button. In the event that it is desired to provide this service by means of control from the control office only, then the push button can be omitted and the circuit from contact 201 of relay 5RR connected directly to back contact 173 of relay 6T. It will also be noted that the call-on signal will clear only when there is no other train approaching behind the first. If there is such a train to the rear of the first train then some one of the track relays 1T, 2T, 3T, 4T or 5T will be deenergized to prevent reversal of the traffic direction circuit.

It will be understood that contacts 203 of relay 4RR and 202 of relay 5RR which control these signals as above described may lead to separate call-on signals instead of to the regular signals if desired.

From the foregoing description it will be observed that improved circuits have been provided for governing traffic direction in a centralized traffic controlling system of the selector type or of the unit wire type. Numerous checking and self checking features are embodied in the invention, some of which have been pointed out in detail while others are more or less obvious from the drawings and description. For example, the operation of the TD relay circuit is self checking since if one fails to respond the HD circuits will have relays at both ends or battery at both ends, either of which will hold the signals at stop. It will be understood that protective resistances may be provided to protect the batteries and circuits in the event of a failure in the circuit operation connecting the circuits of the battery or batteries in an unsafe condition.

Having described a traffic direction controlling system as one specific embodiment of the present invention, it is desired to be understood that this form is selected to facilitate in the disclosure of the invention rather than to limit the number of forms which it may assume and it is to be further understood that various modifications, adaptations and alterations may be applied to the specific form shown to meet the requirements of practice without in any manner departing from the spirit or scope of the present invention except as limited by the appended claims.

What I claim is:

1. In a signaling system for railroads, the combination with a single track section connecting two adjacent track sections, of a first signal for governing traffic in one direction and a second signal for governing traffic in the other direction through said section, a single control relay included in a circuit controlled by the next signal

in advance of either said first or said second signal for controlling said first and second signals, manually controlled means for selecting the direction from which said relay is controlled, and a track relay controlled over one of said sections for preventing the control of said control relay by said next signal in advance.

2. In a signaling system for railroads, the combination with a single track section connecting two adjacent track sections, of first signals for governing traffic in one direction and second signals for governing traffic in the other direction through said section, a single control relay included in a circuit controlled by the next signal in advance of one of said first and one of said second signals for controlling a plurality of signals, manually controllable means for selecting said signals in accordance with the direction of traffic to be controlled, and a track relay controlled over one of said sections for preventing the control of said control relay by said next signal in advance.

3. In a signaling system for railroads, the combination with a single track section connecting two adjacent track sections, of a plurality of signal locations, signals at said locations for governing traffic in both directions through said section, a signal relay for each signal having controlling and controlled circuits, a traffic direction circuit for both directions of traffic comprising a plurality of traffic direction relays, and means controlled by one of said traffic direction relays for selectively connecting the controlling and controlled circuits of said signal relay to the next location in advance.

4. In a signaling system for railroads, the combination with a single track section connecting two adjacent track sections, of a plurality of signal locations, signals at said locations for governing traffic in both directions through said section, a signal relay for each signal having controlling and controlled circuits, a traffic direction circuit for both directions of traffic comprising a plurality of traffic direction relays, means controlled by one of said traffic direction relays for selectively connecting the controlling and controlled circuits of said signal relay to the next location in advance, and means controlled by a train in said section for preventing a change in said selective connection.

5. In a signaling system for railroads, the combination with a stretch of railway track divided into sections, a source of current and a signal controlling relay associated with each section, a traffic direction relay associated with each section, means controlled by the traffic direction relay of a section for connecting the signal controlling relay of the associated section to the source of current of the next section in advance, means controlled by each signal controlling relay for actuating the associated signal to clear, caution and stop positions, and a track relay controlled over one of said sections for preventing the connection of said signal controlling relay to said source of current.

6. In a signaling system for railroads, the combination with a stretch of railway track divided into sections, a source of current and a signal controlling relay associated with each section, a traffic direction relay associated with each section, means controlled by the traffic direction relay of a particular section for connecting the source of current or the signal controlling relay of the associated section to the signal controlling relay or the source of current respectively of an

adjacent section, means controlled by each signal controlling relay for actuating the associated signal to clear, caution and stop positions, and a track relay controlled over the track circuit of said particular section for preventing the connection of said sources of current and said signal controlling relays.

7. In a signaling system for railroads, the combination with a stretch of railway track divided into sections, a source of current and a signal controlling relay associated with each section, a traffic direction relay associated with each section, means controlled by the traffic direction relay of a section for connecting the source of current or the signal controlling relay of the associated section to the signal controlling relay or the source of current respectively of an adjacent section, means controlled by each signal controlling relay for actuating the associated signal to clear, caution and stop positions, remotely controlled manual means for controlling said traffic direction relays, and a track relay controlled over the track circuit of one of said sections for preventing the connection of said sources of current and said signal controlling relays.

8. In a signaling system for railroads, the combination with a stretch of railway track divided into sections, a source of current and a signal controlling relay associated with each section, a traffic direction control circuit, a traffic direction relay connected to said circuit at each section, means controlled by the traffic direction relay of a section for connecting the source of current or the signal controlling relay of the associated section to the signal controlling relay or the source of current respectively of an adjacent section, means controlled by each signal controlling relay for actuating the associated signal to clear, caution and stop positions, remotely controlled manual means for characteristically energizing said circuit for controlling said traffic direction relays, and means controlled by the presence of a train in one of said sections for opening said circuit.

9. In a signaling system for railroads, the combination with a stretch of railway track over which traffic moves in both directions said stretch of track being divided into a plurality of successive sections, a signaling circuit associated with said stretch of track said signaling circuit being divided into a plurality of successive sections corresponding to said track sections, a traffic direction control circuit associated with said sections, a source of current at the junction of each two sections, means controlled over said control circuit for selectively connecting each source of current to the signaling circuit of one adjacent section or the other, and train controlled means for opening said control circuit.

10. In a signaling system for railroads, the combination with a stretch of railway track over which traffic moves in both directions said stretch of track being divided into a plurality of successive sections, a signaling circuit associated with said stretch of track said signaling circuit being divided into a plurality of successive sections corresponding to said track sections, a traffic direction control circuit associated with said sections, a source of current at the junction of each two sections, means controlled over said control circuit controlled from a central point for selectively connecting each source of current to the signaling circuit of one adjacent section or the other, and train controlled means for open-

ing said control circuit at each of said sections.

11. In a signaling system for railroads, the combination with a stretch of railway track over which traffic moves in both directions said stretch of track being divided into a plurality of sections, a signaling circuit associated with said stretch of track said signaling circuit being divided into a plurality of successive sections corresponding to said track sections, a traffic direction control circuit associated with said sections, a source of current at the junction of each two sections, a traffic direction relay at each junction arranged to be energized in normal and reverse directions over said control circuit, means controlled by each traffic direction relay when energized in normal direction for connecting the associated source of current with one adjacent section of said signaling circuit, means controlled by each traffic direction relay when energized in reverse direction for connecting the associated source of current with the other adjacent section of said signaling circuit, means for controlling said traffic direction relays from a central point, and train controlled means for opening said control circuit at each of said sections.

12. In a signaling system for railroads, the combination with a stretch of railway track over which traffic moves in both directions said stretch of track being divided into a plurality of sections, a signaling circuit associated with said stretch of track said signaling circuit being divided into a plurality of successive sections corresponding to said track sections, a source of current and a signal relay at the junction of each two sections, means including a polar control circuit for at times connecting the source of current at one end and the relay at the other end with a section of said signaling circuit, means including said polar control circuit for at other times connecting the relay at said one end and the source of current at said other end with said section of signaling circuit, signals for said section controlled by said signal relays, and train controlled means for opening said polar control circuit.

13. In a signaling system for railroads, the combination with a section of railway track over which traffic moves in both directions, a signaling circuit associated with said section, two sources of direct current one at each end of said circuit, means for connecting one or the other of said sources to said circuit according to the direction in which traffic is to move over said section, and means for connecting the source of current to said circuit for causing direct current to flow in a direction determined by the condition of the signal in advance of said section.

14. In a signaling system for railroads, the combination with a section of railway track over which traffic moves in both directions, a signaling circuit associated with said section, two relays one at each end of said circuit, means for connecting one or the other of said relays to said circuit according to the direction in which traffic is to move over said section, and means for energizing the connected relay from a source of direct current with current of a polarity determined by the condition of the signal in advance of said section.

15. In a signaling system for railroads, the combination with a section of railway track over which traffic moves in both directions, signals for governing traffic in both directions over said section, a signaling circuit associated with said section, two relays one at each end of said cir-

cuit, means including two other relays connected in series for connecting one or the other of said first mentioned relays to said circuit according to the direction in which traffic is to move over said section, means controlled by said first mentioned relays for governing said signals, and means controlled by the presence of a train in said section for opening said circuit.

16. In a signaling system for railroads, the combination with a first section and a plurality of other sections of railway track over which traffic moves in both directions, a normal signal and a reverse signal for governing traffic over said first section, a source of current, a remotely controlled traffic direction relay associated with said first section arranged to be energized in normal and reverse directions by current from said source, means controlled by said traffic direction relay when energized in normal direction for preventing the clearing of said reverse signal, means controlled by said traffic direction relay when energized in reverse direction for permitting the clearing of said reverse signal, means controlled by a train in one of said plurality of sections for preventing the operation of said traffic direction relay to reverse direction, and manually controllable means for operating said traffic direction relay to reverse direction when a train is in one of said plurality of sections.

17. In a signaling system for railroads, the combination with a first section and a plurality of other sections of railway track over which traffic moves in both directions, a normal signal and a reverse signal for governing traffic over said first section, a source of current, a remotely controlled traffic direction relay associated with said first section arranged to be energized in normal and reverse directions by current from said source, means controlled by said traffic direction relay when energized in normal direction for preventing the clearing of said reverse signal, means controlled by said traffic direction relay when energized in reverse direction for permitting the clearing of said reverse signal, means controlled by a train in one of said plurality of sections for preventing the operation of said traffic direction relay to reverse direction, and manually controllable means for operating said traffic direction relay to reverse direction when a train is in one of said plurality of sections but not when a train is in another of said plurality of sections.

18. In a signaling system for railroads, the combination with a single track section connecting two adjacent track sections, of signals for governing traffic in one direction and signals for governing traffic in the other direction through said section, a control relay included in a circuit controlled by the next signal in advance for controlling each signal, manually controlled means for selecting the direction from which said relay is controlled, and a plurality of track relays controlled over a plurality of said sections for preventing the control of said control relay by said next signal in advance.

19. In a signaling system for railroads, the combination with a stretch of railway track divided into sections, a source of current and a signal controlling relay associated with each section, a traffic direction relay associated with each section, means controlled by the traffic direction

relay of a particular section for connecting the source of current or the signal controlling relay of the associated section to the signal controlling relay or the source of current respectively of an adjacent section, means controlled by each signal controlling relay for actuating the associated signal to proceed and stop positions, and a track relay controlled over the track circuit of said adjacent section for preventing the connection of said sources of current and said signal controlling relays.

20. In combination, a stretch of railway track divided into sections, a signal line circuit divided into line sections corresponding to said track sections, a battery and a signal relay associated with the junction of a pair of line sections, manually controlled means for establishing the direction of traffic over said track sections, means for connecting the line conductors of each end of said pair of line sections with the associated battery or the associated signal relay in accordance with the direction of traffic established, signals for said stretch of track, means including said signal relay controlled over one of said line sections for controlling the signals at said junction in accordance with the condition of the signals in advance, and means including said battery for repeating the condition of the signals at said junction to the signals in the rear over the other of said line sections.

21. In a signaling system for railroads, a stretch of single track, signals located at intervals in said stretch of track for governing traffic in one direction over said single track, signals at a particular location in said stretch of track for governing traffic in both directions over said single track, track circuits for said stretch of track, means including a plurality of interconnected and separately energized line circuits for controlling each signal in accordance with the condition of the track circuits in advance of such signal, a single line circuit controlled in accordance with the condition of all of said track circuits, means for applying current of normal and reverse polarity to said single line circuit, and means controlled by the polarity of current applied to said line circuit for selectively controlling the signals at said particular location in accordance with the direction of traffic over said stretch of track.

22. In a signaling system for railroads, a stretch of single track, signals located at intervals in said stretch of track for governing traffic in one direction over said single track, signals at a particular location in said stretch of track for governing traffic in both directions over said single track, track circuits for said stretch of track, means including a plurality of interconnected and separately energized line circuits for controlling each signal in accordance with the condition of the track circuits in advance of such signal, a single line circuit controlled in accordance with the condition of all of said track circuits, means for applying current of normal and reverse polarity to said single line circuit, and means including a single polar relay controlled by the polarity of current applied to said line circuit for selectively controlling the signals at said particular location in accordance with the direction of traffic over said stretch of track.

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