

Oct. 26, 1937.

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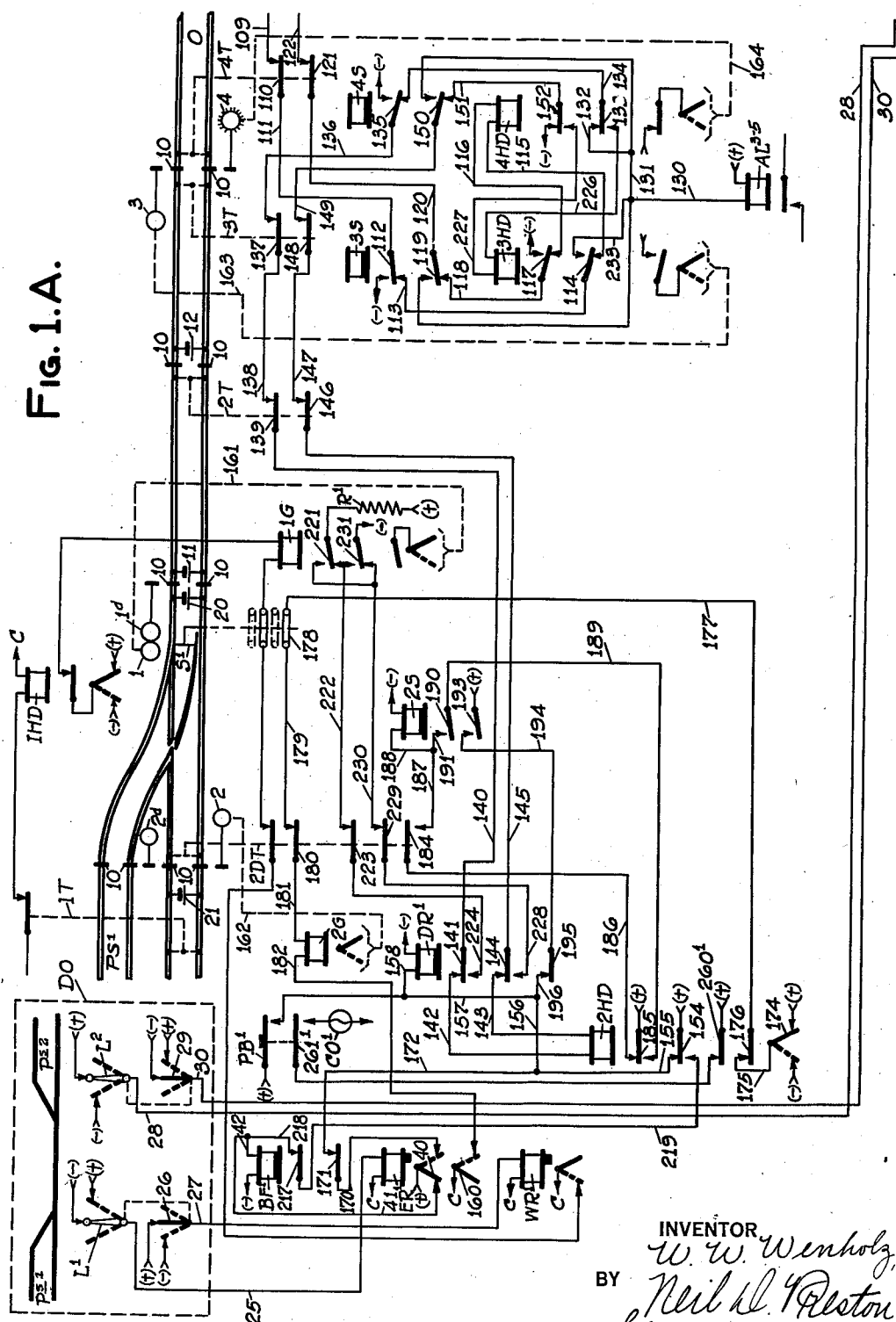
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CENTRALIZED TRAFFIC CONTROLLING SYSTEM

Filed Dec. 8, 1930

3 Sheets-Sheet 1

Fig. 1.A.



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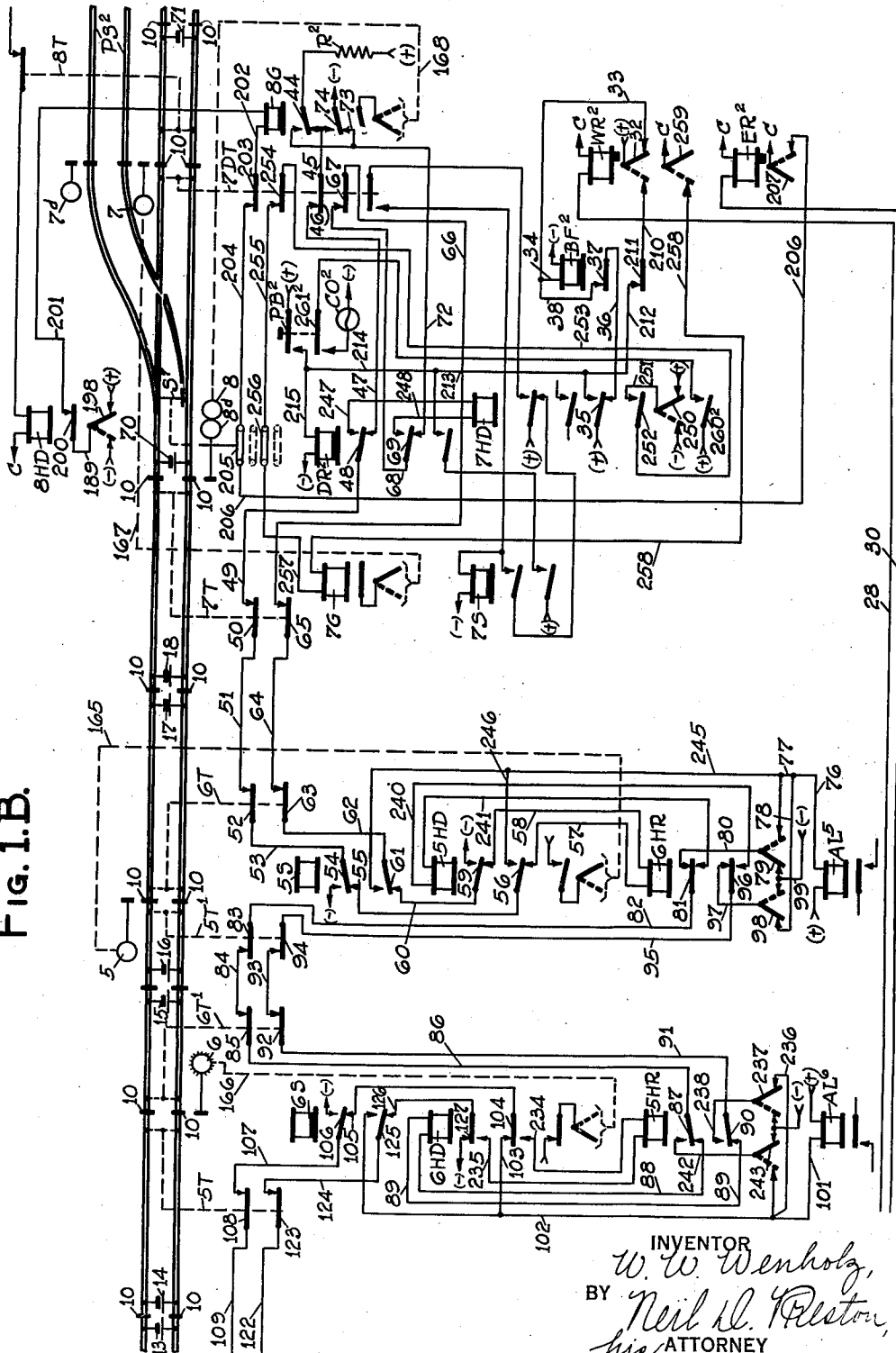
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Filed Dec. 8, 1930

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Fig. 1.B.



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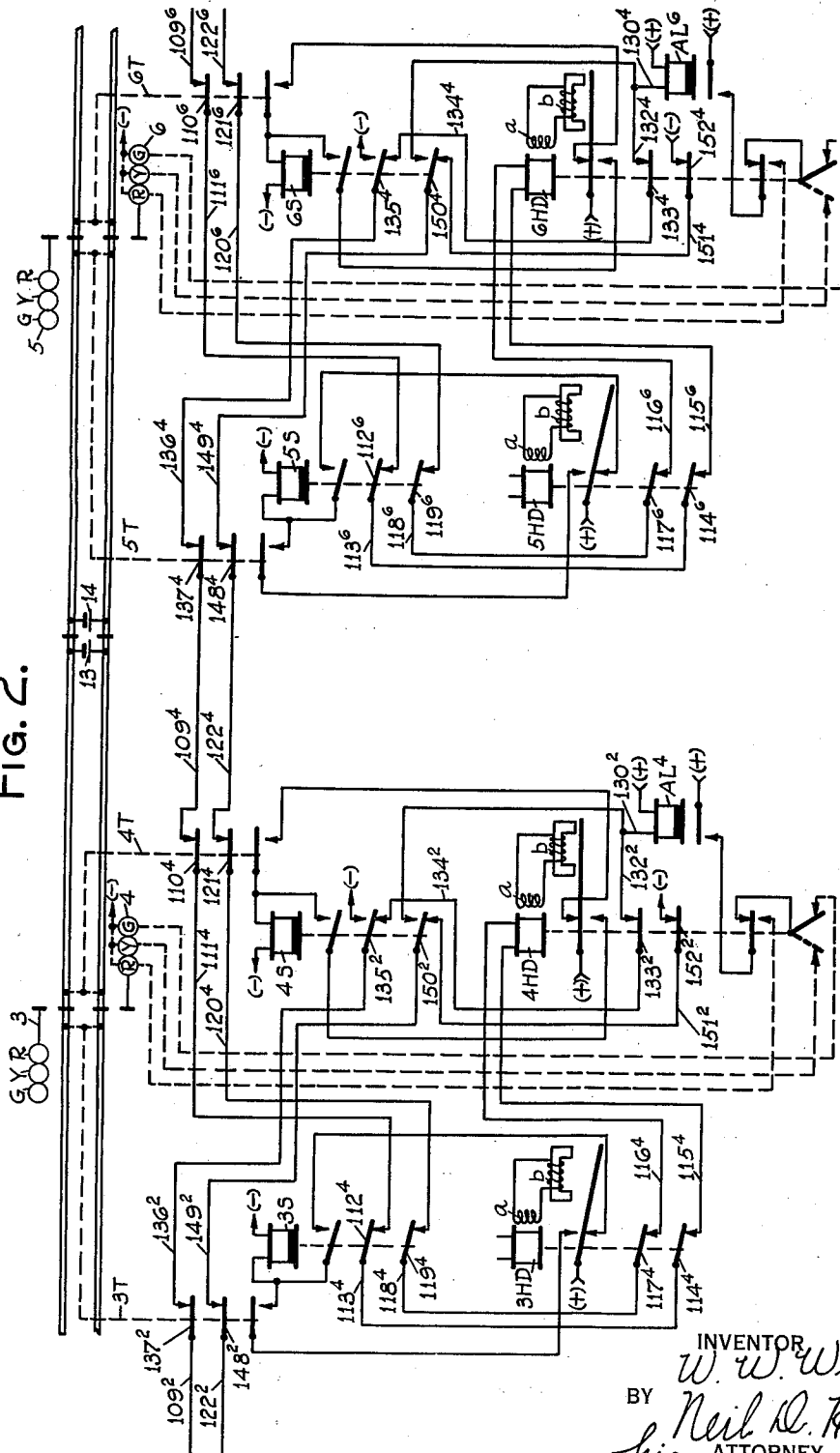
2,096,832

CENTRALIZED TRAFFIC CONTROLLING SYSTEM

Filed Dec. 8, 1930

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FIG. 2.



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2,096,832

CENTRALIZED TRAFFIC CONTROLLING
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Application December 8, 1930, Serial No. 500,802

46 Claims. (Cl. 246—3)

This invention relates to centralized traffic controlling systems, and more particularly to a system of this type when applied to a single track railroad signalled to facilitate both directions of train movement.

Single track railroads are usually equipped with a signalling system of the absolute-permissive-block type, in which trains may move only in one direction through a single track section at one time, and where following trains are protected by signal indications of clear, caution and stop the same as in double track signalling where trains can move in one direction only. In other words, an absolute-permissive-block or A. P. B. system blocks all opposing trains and permits the movement of following trains with the usual train spacing. In absolute-permissive-block signalling 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 held at stop through suitable control mechanism controlled from a central office. A system of this type has been shown in the prior application of S. N. Wight, Ser. No. 48,553 filed August 6, 1925. Absolute-permissive-block signalling systems usually include two tumble-down circuits, one for each direction of traffic through the medium of which the home-and-distant relay for each signal of a single track section is controlled by the home-and-distant relay of the signal next in advance, these tumble-down circuits using a common return wire, so that at least three line wires are necessary, the common wire of which can of course not include any track relay contacts. Certain signal engineers are unwilling to rely on a circuit for railway signalling purposes extending any appreciable distance along the railway track without breaking such circuit for each wire at each track relay, so that as a matter of fact the signal system of the prior application of Wight above referred to would require four line wires to carry out this checking theory.

In view of the above and other important considerations, it is proposed in accordance with the present invention to employ only two line wires extending from each signal location to the next signal location in a single track section, to break both of these line wires at each track relay, and to use the same two line wires in each of the two tumble-down circuits, each section of these tumble-down circuits having a source of current at one end and a relay at the other end for one direction of traffic movement, and having a relay at said one end and a source of current at said other end for movement of traffic in the opposite direction, suitable manually superimposed control being employed to

change the direction of traffic and the direction in which these tumble-down circuits have overlapped control.

Other objects, purposes and characteristic features will be obvious from the accompanying drawings and will in part be pointed out in the specification hereinafter.

In describing the invention in detail, reference will be made to the accompanying drawings Figs. 1A and 1B which if laid end to end illustrate only one single track section and the adjacent ends of two passing sidings of a railway signalling system embodying the present invention, and to Fig. 2 which shows somewhat more in detail the wiring for signals 4 and 6, wired as shown for signal 4 in Fig. 1A and with the home-distant relays shown conventionally as relays of the polar neutral-retained type.

Although only one single track section O and a portion of two passing sidings PS¹ and PS² have been illustrated in the drawings, it is to be understood that a large number of single track sections are connected by passing sidings in practicing the invention, and that the left hand or west end of the passing siding PS¹ is controlled by apparatus such as shown at the west end of passing siding PS² and that similarly the east end of passing siding PS² is equipped with apparatus such as shown at the east end of the passing siding PS¹. The east end of the passing siding PS¹ is provided with a track switch S¹, which track switch may be either manually operated or may be operated by a switch machine all in a manner as described in the prior application above referred to and for convenience no specific means for operating the switch S¹ has been illustrated, as is also true of the track switch S⁷ located at the west end of the passing siding PS².

The track switch S¹ has associated therewith a main entering signal 1, a take-siding entering signal 1^d, a main starting signal 2 and a dwarf starting signal 2^d, the entering signals of which govern the movement of trains into the main track and side track, respectively, whereas the starting signals govern the movement of trains off of the main track and the side track, respectively, into the single track section O. Similarly, the track switch S⁷ has associated therewith starting signals 7 and 7^d and entering signals 8 and 8^d.

As is the practice in earlier A. P. B. systems one or more intermediate signals for each direction of traffic may be employed, and for west bound traffic the signals 3 and 5 have been illustrated, whereas for east bound traffic the intermediate signals 4 and 6 have been illustrated. All of these signals may be either signals of the semaphore type or may be light signals of the multiple aspect or the movable spectacle type

and are preferably three indication signals and are controlled by home-and-distant relays through suitable means illustrated by dotted lines, so that each signal displays a clear or green signal when the home-and-distant relay assumes its right hand energized position, indicates caution when the home-and-distant relay assumes its left hand energized position and indicates stop if the home-and-distant relay is de-energized.

These various home-and-distant relays have been designated HD with a prefix corresponding to the signal which it controls. In this connection it may be pointed out that entering and starting signals are not directly controlled by their associated home-and-distant relays but are controlled through repeater relays designated G with a prefix corresponding to the number of the signal, these signal relays 1G, 2G, 7G, and 8G having superimposed detector track circuits and manual control, the manual control of these starting and entering signals being carried out through the medium of the east relay ER¹, the east relay ER², the west relay WR¹ and the west relay WR², controlled from a central dispatcher's office DO, in which the passing sidings are reproduced in miniature by passing siding PS¹ and PS², as indicated. The single track section O as well as the main track of the passing siding is divided by insulating joints 10 into track circuit sections, of which the single track section O contains track circuits including track batteries 11, 12, 13, 14, 15, 16, 17, and 18 for controlling track relays 2T, 3T, 4T, 5T, 5T¹, 6T, 6T¹, and 7T, whereas the track switch S¹ has associated therewith a detector track circuit including a track relay 2DT and a battery 20, and the track switch S⁷ has associated therewith a detector track circuit containing a track relay 7DT and a track battery 70.

The main track of the passing siding PS¹ is provided with a track relay 1T and a battery 21, whereas the main track of the passing siding PS² is provided with a track circuit containing a track relay 8T and a track battery 71. Attention is directed to the fact that the signals 3 and 4 are opposite signals and govern traffic in opposite directions and are located at the same point whereas the signals 5 and 6 are staggered signals in that they are not located at the same point and also govern traffic in opposite directions. These staggered signals 5 and 6 have been illustrated for the purpose of showing how the novel circuit arrangement may be applied to a staggered signal type A. P. B. system without the use of more than two wires along the track even at a staggered signal location.

Attention is directed to the fact that signals 4 and 6 are illuminated, signifying that they are indicating either caution or clear, whereas the signals 3 and 5 are not illuminated conventionally indicating that they are in the stop condition. This fact that one direction of traffic is set up at intermediate signals is an inherent condition in the system, and is due to the characteristic that the tumble-down circuit which was last established remains in its established condition even though the starting and entering signals at both ends of the single track section are thereafter put to stop, as will be readily understood after the operation of the system has been considered.

Although the control relays ER¹, ER², WR¹, and WR² may be controlled as illustrated in the drawings or as illustrated in the prior applica-

tion of S. N. Wight, Ser. No. 48,553 above referred to, these signals are preferably controlled by a suitable selector type system, such for instance as illustrated in the prior application of Preston and Hitchcock, Ser. No. 455,304, filed May 24, 1930. These relays ER¹, ER², WR¹, and WR² are preferably two position relays of the polar magnetic stick type, as conventionally illustrated by the solid square, which relays may be operated to one position by current of one polarity and may be operated to the other position by current of the reverse polarity and will remain in the last operated position even though their energizing circuits are broken. The relay ER¹ is controlled by the lever L¹ located at the central office DO through the medium of wire 25, the relay WR¹ is controlled by the contact 26 of the lever L¹ and through the medium of wire 27. The relay WR² is controlled by the lever L² through the medium of wire 28 and the relay ER² is controlled through the contact 29 of the lever L² through the medium of the line wire 30, a common return wire C being used for all of these circuits.

Each of the signals and its associated home-and-distant relay has associated therewith a directional stick relay designated S with a prefix corresponding to that of the signal. These directional stick relays are controlled in the usual way as more specifically pointed out in the prior application of S. N. Wight, Ser. No. 120,423 dated July 3, 1926, and generally speaking each include a pick-up circuit including a front contact of its associated home-and-distant relay and a back contact of the track relay next in advance of the signal associated therewith, and having a stick circuit including a back contact of said associated home-and-distant relay (see circuits of stick relays 2S and 7S in the drawings).

It is considered expedient to first trace all of the circuits which are shown closed in the drawings and then consider the operation of the system. As shown in the drawings the back-and-forth relay BF² is shown energized through a pick-up circuit:—beginning at the terminal (+) of a suitable battery, contact 32 of the relay WR², wires 33 and 34, winding of the relay BF² to the (−) terminal of this same battery, and a stick circuit beginning at the terminal (+) of said battery, the back contact 35 of the relay 7HD, wires 36, stick contact 37 of the relay BF², wires 38 and 34, winding of the relay BF² to the (−) terminal of said battery. The back-and-forth relay BF¹, on the other hand, is only energized through its pick-up circuit, which may be traced as follows:—beginning at the terminal (+), normally closed contact 40 of the relay ER¹, wires 41 and 42, winding of the relay BF¹, to the other terminal (−) of the same battery. The relays BF¹ and BF² have been called back-and-forth relays, because a back-and-forth movement of the relay ER¹ is necessary to obtain a result.

The home relay 6HR is shown energized through the following circuit:—beginning at the terminal (+) of a suitable battery, resistance unit R², preferably comprising a resistance of 100 ohms, back contact 44 of the relay 2G, wire 45, front contact 46 of the detector track relay 7DT, wire 47, back contact 48 of the direction relay DR², wire 49, front contact 50 of the track relay 7T, wire 51, front contact 52 of the track relay 6T, wire 53, back contact 54 of the directional stick relay 5S, wire 55, back contact 56 of the home-and-distant relay 5HD, wire 57, wind-

ing of the home relay 6HR, wire 58, back contact 59 of the relay 5HD, wire 60, back contact 61 of the relay 5S, wire 62, front contact 63 of the track relay 6T, wire 64, front contact 65 of the relay 7T, wire 66, front contact 67 of the track relay 7DT, wire 68, back contact 69 of the relay DR², wires 72 and 73, back contact 74 of the relay 8G to the other terminal (—) of said battery.

With the home relay 6HR energized the following energizing circuit for the home-and-distant relay 6HD is closed:—beginning at the terminal (—) of a suitable battery, wire 99, polar contact 79 of the relay 6HR, wire 80, front contact 81 of the relay 6HR, wire 82, front contact 83 of the relay 5T¹, wire 84, front contact 85 of the relay 6T¹, wire 86, back contact 87 of the relay 5HR, wire 88, winding of the relay 6HD, wire 89, back contact 90 of the relay 5HR, wire 91, front contact 92 of the relay 6T¹, wire 93, front contact 94 of the relay 5T¹, wire 95, front contact 96 of the relay 6HR, wire 97, polar contact 98 of the relay 6HR, wires 78 and 75, winding of the approach lighting relay AL⁵, back to the terminal (+) of the same battery.

With the relay 5HD now energized the energizing circuit for the relay 4HD may be traced as follows:—beginning at the terminal (+) of a suitable battery, winding of the approach lighting relay AL⁶, wires 101, 102 and 103, front contact 104 of the relay 6HD, wire 105, back contact 106 of the relay 6S, wire 107, front contact 108 of the track relay 5T, wire 109, front contact 110 of the track relay 4T, wire 111, back contact 112 of the relay 3S, wire 113, back contact 114 of the relay 3HD, wire 115, winding of the relay 4HD, wire 116, back contact 117 of the relay 3HD, wire 118, back contact 119 of the relay 3S, wire 120, front contact 121 of the track relay 4T, wire 122, front contact 123 of the relay 5T, wire 124, back contact 125 of the relay 6S, wire 126, front contact 127 of the relay 6HD to the other terminal (—) of the same battery.

With the relay 4HD energized the following energizing circuit for the home relay 2HD is closed:—beginning at the terminal (+) of a suitable battery, winding of the approach relay AL³⁻⁵, wires 130, 131 and 132, front contact 133 of the relay 4HD, wire 134, back contact 135 of the relay 4S, wire 136, front contact 137 of the relay 2T, wire 138, front contact 139 of the relay 2T, wire 140, front contact 141 of the direction relay DR¹, wire 142, winding of the relay 2HD, wire 143, front contact 144 of the relay DR¹, wire 145, front contact 146 of the track relay 2T, wire 147, front contact 148 of the relay 3T, wire 149, back contact 150 of the relay 4S, wire 151, front contact 152 of the relay 4HD, to the other terminal (—) of the same battery.

With the home relay 2HD energized the direction relay DR¹ is energized through the following circuit:—beginning at the terminal (+) of a suitable battery, front contact 154 of the relay 2HD, wires 155, 156, 157, and 158, winding of the relay DR¹ to the other terminal (—) of the same battery. In this connection it should be noted that the relay DR¹ is energized through a front contact of the relay 2HD, and the relay 2HD is energized through front contact of the relay DR¹. Obviously, the relay DR¹ was energized through another of its various energizing circuits at the time the relay 2HD was picked up. These inter-related circuits will be more particularly considered in connection with the operation of the system. Attention is directed to the fact that although the relay 2HD is energized, signifying

that traffic conditions in advance of signal 2 are either clear or caution, the signal 2 controlled by the relay 2G is held at stop because the circuit for the relay 2G is open at the polar contact 160 of the control relay ER¹.

Referring to the various circuits just traced, and particularly the circuits for the relays 2HD, 4HD, and 6HD, it will be noted that each of these home-and-distant relays are controlled by home-and-distant relays having a higher prefix, except that the relay 6HD is controlled by the relay 8G which latter relay is controlled by the relay 8HD. Also, it will be noted that the circuit for each of these home-and-distant relays includes all of the track relay contacts between it and the next signal in advance, and that these track relay contacts are included in both wires of the circuit, this in order to give an additional assurance against crosses and accidental sticking up of some of these contacts. Attention is further directed to the fact that the relay 6HD is not directly controlled by the relay 8G as above inferred, but is controlled by this relay 8G through the medium of the home relay 6HR, this because the relay 6HD is located at a staggered signal location.

Each of these various home-and-distant relays has been illustrated as a polar-neutral relay having both polar and neutral contacts, but the invention is not limited to this particular construction, for in case of alternating current systems a polar relay of the three-position induction type would preferably be used. In a direct current system, such as illustrated, these various home-and-distant relays as well as the home relays 5HR and 6HR are preferably relays that will not open their neutral contacts upon reversal of current applied to its windings, such for instance as shown in the application of Larson, Ser. No. 253,880 filed February 13, 1928, now Patent No. 1,852,210 granted April 5, 1932. These relays HD and HR with various prefixes may also comprise a polar relay connected in series with a neutral relay which will not open its contacts upon reversal of current in the circuit, the neutral relay being constructed as shown in the application of O. S. Field, Ser. No. 428,090 filed February 13, 1930, now Patent 1,852,406, granted April 5, 1932, and on the other hand the neutral contacts for these various home-and-distant relays and home relays may be shifted to a slow acting repeater relay which repeats the condition of energization of such home-and-distant or home relay, so that the circuit for the next home-and-distant relay in the rear will not actually be broken upon pole changing of the corresponding circuit in advance.

Studying these various home-and-distant relay circuits it will be noted that in each of these circuits wires are provided with a source of current at the east end and a relay at the west end, but that upon energization of the relays 3HD, 5HD and 5HR and upon deenergization of the relays 4HD, 6HD, and 6HR each of these circuits will have a relay on the east end thereof and a source of current on the west end thereof, these various features of interlocking will be more clearly apparent upon consideration of the operation of the system.

Although no specific circuits have been illustrated for controlling the various signals by their respective home relays or signal relays, these various signals may be controlled in any well known way, such for instance as illustrated in the prior application of S. N. Wight, Ser. No. 48,553

filed August 6, 1925, if semaphore signals are used and as illustrated in the prior application of S. N. Wight Ser. No. 120,423 filed July 3, 1926 if light signals are used. The signal 1 is controlled by the relay 1G through suitable circuits conventionally shown by the dotted line 161, and similarly signals 2, 3, 4, 5, 6, 7, and 8 are controlled by suitable circuits conventionally shown by dotted lines 162, 163, 164, 165, 166, 167, and 168, respectively. Although no specific means has been shown for indicating at the central office DO the condition of occupancy of the various detector track circuits, the position of the track switches, and the like, it is to be understood that suitable means such as indicated in any of the prior applications above referred to may be employed.

Operation

As heretofore mentioned, and as manifested by the illumination of signals 4 and 6, the last direction of train movement was from left to right, that is from west to east, and for this reason we will assume that there is a train on the main track of the passing siding PS¹ and that the operator in the central office DO wishes to allow this train to pass through the single track section O and into the main track of the passing siding PS². It will of course be necessary for the operator to clear the signal 2 before the train under consideration can proceed into the single track section O. The operator will therefore move his lever L¹ to its right hand position, and in so doing will apply current of positive polarity to the line wire 25 thereby operating the control relay ER¹ to the right, it being noted that the contact 26 of the lever L¹ will not be connected to energy when the lever L¹ assumes its right hand position.

Movement of the control relay ER¹ to the right deenergizes the back-and-forth relay BF¹, this because the stick circuit for this relay BF¹ is broken at the back contact 154 of the relay 2HD. The relay BF¹ is a slow acting relay, and for this reason current may momentarily flow through the contact 40 of the relay ER¹ assuming its right hand position through the wire 170, front contact 171 of the relay BF¹, wires 172, 156, 157, and 158 to the direction relay DR¹. This momentary completion of the circuit just traced is, however, of no importance at this time, because the relay DR¹ is now energized through the front contact of the home relay 2HD. Movement of the contact 160 of the relay ER¹ to its right hand position, will however close the following circuit for the signal relay 2G:—beginning at the terminal (+) of a suitable split battery, polar contact 174 of the relay 2HD, wire 175, neutral contact 176, wire 177, switch box contact 178 closed only when the track switch S¹ is in its main track position, wire 179, front contact 180 of the detector track relay 2DT, wire 181, winding of the relay 2G, wire 182, contact 160 of the relay ER¹ assuming its right hand position to the middle point C of this split battery. The completion of the circuit just traced energized the relay 2G and displays a green proceed indication by the signal 2. In this connection it should be noted that if the relay 2HD is energized to the reverse position the polar relay 2G will be energized to its reverse position and will cause the signal 2 to display a yellow caution signal.

The east bound train under consideration may now pass off of the main track of the passing siding PS¹ in response to the clear signal 2 and into the single track section O. As soon as this

train treads upon the detector track circuit associated with the switch S¹ the track relay 2DT will be deenergized, thereby opening its contact 180 and actuating the signal 2 to its stop position or condition. Deenergization of the relay 2G will of course pole change the energizing circuit for the next home-and-distant relay in the rear, thereby causing the display of a caution signal at the entering signal at the west end of the passing siding PS¹, in accordance with the usual practice, it being understood that the entering signals 1 and 8 at opposite ends of the passing siding are interlocked so that only one of the entering signals can indicate proceed at one time, all as clearly disclosed in the prior application Ser. No. 120,423 above referred to.

The dropping of the detector track relay 2DT not only effects deenergization of the relay 2G, but by the closure of its contact 184 closes the following pick-up circuit for the relay 2S:—beginning at the terminal (+) of a suitable battery, front contact 185 of the relay 2HD, wire 186, back contact 184 of the relay 2DT, wires 187 and 188, winding of the relay 2S, to the other terminal (—) of said battery. As the train in question now passes the insulating joint 10 adjacent the signal 1, it will shunt the track relay 2T, thereby effecting deenergization of the relay 2HD and in so doing will close the following stick circuit for the relay 2S:—beginning at the terminal (+), back contact 185 of the relay 2HD, wire 189, front contact 190 of the relay 2S, wires 191 and 188, winding of the relay 2S, to the other terminal (—).

Although dropping of the relay 2HD by the opening of its contact 154 will break the circuit heretofore traced for the direction relay DR¹, this direction relay DR¹ will remain energized through the medium of the following auxiliary circuit:—beginning at the terminal (+), front contact 193 of the relay 2S, wire 194, front contact 195 of the relay DR¹, wires 196, 157 and 158, winding of the relay DR¹ to the other terminal (—) of said battery.

As the train under consideration proceeds in an easterly direction, it will drop the track relay 3T and thereafter pick up the track relay 2T, and upon its passage of the signal 4 which displays a clear or green signal it will drop the track relay 4T and in so doing pick up the stick relay 4S, which stick relay 4S is controlled in the same way as the relay 2S. Picking up of the relay 4S will reverse the polarity of current applied to the relay 2HD, and as soon as the rear end of the train passes off of the track circuit containing the track relay 3T the relay 2HD will be energized to its reverse position and will cause the signal 2 to display a caution indication. The signal 6 is still displaying a caution signal, because the signal relay 8G under the assumed condition remains deenergized.

The operator in the meantime will have operated his lever L² to the right hand position and will thereby apply current of positive polarity to the wire 30, and will thereby have operated the indication relay ER² to the right, thereby completing the following energizing circuit for the relay 8G:—beginning at the terminal (+) of a suitable split battery, polar contact 198 of the relay 8HD assuming its right hand position, wire 189, front contact 200 of the relay 8HD, wire 201, winding of the relay 8G, wire 202, front contact 203 of the track relay 1DT, wire 204, switch box contact 205 closed only if the switch S¹ is in the main track position, wire 206, contact 207 of the

relay ER² to the mid-point C of the split battery. Energization of the relay 8G will not only cause the signal 8 to display a clear or green signal, but will also pole change the current applied to the circuit for the relay 6HR, without opening the neutral contacts 81 and 96 of this relay for reasons heretofore given, so that this relay 6HR will have its polar contacts move from its left hand to its right position. With the relay 6HR assuming its right hand energized position instead of its left hand energized position the polarity of current applied to the relay 6HD is reversed, so that this relay 6HD assumes its right hand instead of its left hand position and causes the signal 6 to assume a clear instead of a caution position. The train under consideration is now assumed to be moving in an eastwardly direction between the signals 4 and 6. As this train passes the signal 6 it will cause the directional stick relay 6S to be picked up, thereby reversing the polarity of current applied to the relay 4HD, and thereby causing the signal 4 to display a caution signal as soon as the rear end of the train passes the signal 6. Also, as the rear end of the train passes the signal 6 the stick relay 4S will again be deenergized, this because the relay 4HD picks up, and this deenergization of the relay 4S and energization of the relay 4HD causes current of positive polarity to be applied to the relay 2HD, thereby causing a clear or green indication to be displayed by the signal 2 instead of a caution indication.

Movement of the train under consideration in an eastwardly direction between the signals 6 and 5 will of course cause the relay 6HD to be deenergized because the track relay 6T¹ and 5T¹ will be deenergized during this movement of said train, and similarly as the train moves between the signal 5 and the signal 8 the home relay 6HR will remain deenergized, and it will thereby cause the relay 6HD which repeats the relay 6HR to be deenergized, and as soon as the train passes the signal 8 the detector track relay 7DT is deenergized thereby opening the circuit for the signal relay 8G at the contact 293, and thereby causing the signal 8 to display a stop signal. It is of course understood that the signal 8 is thereafter controlled in accordance with the condition of energization of the home relay 8HD and as soon as the train in question passes beyond the detector track circuit 7DT the relay 8G is controlled in accordance with the position of this relay 8HD. The home-and-distant relay 8HD is of course controlled in accordance with traffic conditions in advance as indicated in the prior application No. 120,423 above referred to.

Let us now assume that there is a west bound train on the main track of the passing siding PS² and that the operator wishes to change the direction of traffic movement in the single track section O. Under ordinary working conditions the operator will first restore his lever L¹ to normal and thereby return the relay ER¹ to normal. Let us however assume that for some reason or other, such as a broken line wire, the operator is unable to change the position of the relay ER¹, which now assumes its right hand position and causes the starting signal 2 to display a proceed indication. The operator now moves his lever L² to its left hand position signifying permissible west bound entrance of a train into the single track section O. This movement of the lever L², when it reaches its intermediate position, effects momentary negative energization of the wire 30

thereby causing the relay ER² to be moved to its left hand position if it has not already assumed such position. When the lever L² reaches its extreme left hand position current of negative polarity is applied to the control relay WR², thereby operating this relay WR² to its left hand dotted position. The relay 7HD is of course still deenergized because the direction relay DR² is still deenergized, and with the relay 7HD deenergized the relay BF² is energized through its stick circuit heretofore traced. Movement of the relay WR² to its left hand position therefore completes the following pick-up circuit for the relay DR²:—beginning at the terminal (+) of a suitable battery, contact 32 of the relay WR² to the left, wire 210, front contact 211 of the relay BF², wires 212, 213, 214, and 215, winding of the relay DR², to the other terminal (—) of said battery.

Picking up of the direction relay DR² will of course effect deenergization of the relay 6HR, because the relay 7HD is now connected to the east end of the line wires connecting signal locations 5 and 8. Deenergization of the relay 6HR will effect deenergization of the relay 6HD, deenergization of the relay 6HD will effect the deenergization of the relay 4HD, and deenergization of the relay 4HD will effect the deenergization of the relay 2HD. In other words, a tumble down of line relays will result in an east-to-west direction. With the relay ER¹ still assuming its right hand position the relay BF¹ will of course have been deenergized as soon as the relay 2HD picked up after it had been deenergized by passage of the east bound train, this because its stick circuit including its stick contact 217, wires 218 and 219 and back contact 154 of the relay 2HD was broken when this relay 2HD picked up. Furthermore, the dropping of the relay 2HD, by the tumble down function just explained, opens the front contact 154 of the relay 2HD and effects dropping of the direction relay DR¹, it being understood that the relays BF¹ and 2S are now deenergized. With the direction relay DR¹ now deenergized, the following energizing circuit for the home relay 3HD is completed:—beginning at the terminal (+), resistance unit R¹, preferably of 100 ohms resistance, back contact 221 of the relay 1G, wire 222, front contact 223 of the track relay 2DT, wire 224, back contact 141 of the relay DR¹, elements 140, 139, 138, 137, 136, 135, 134, 133, and 226, winding of the relay 3HD, elements 227, 152, 151, 150, 149, 148, 147, 146, 145, 144, 228, 229, 230 and 231 and back to the terminal (—) of said battery. The completion of the circuit just traced will cause the relay 3HD to assume its left hand energized position, thereby causing the signal 3 to display a caution indication.

Picking up of the relay 3HD will cause the following circuit for the relay 5HR to be completed:—beginning at the terminal (+) of a suitable battery, winding of the approaching lighting relay AL³—5, elements 130, 233, 112, 113, 112, 111, 110, 109, 108, 107, 106, 105, 104, and 234, winding of the relay 5HR, elements 235, 127, 126, 125, 124, 123, 122, 121, 120, 119, and 118, contact 117 in its energized position, to the other terminal (—) of said battery.

The completion of the circuit just traced will energize the relay 5HR to its right hand position, thereby completing an energizing circuit for the relay 5HD which may be traced as follows:—beginning at the terminal (+) of a suitable battery, winding of the approach lighting relay AL⁶, elements 101, 236, 237, 238, 99, 91, 92, 93, 94, 95, 96,

and 240, winding of the relay 5HD, elements 241, 81, 82, 83, 84, 85, 86, 87, and 242, contact 243 of the relay 5HR assuming its right hand position to the other terminal (—) of said battery. The completion of the circuit just traced will energize the relay 5HD to its right hand position, thereby causing the signal 5 to display a clear proceed position.

With the relay 5HD energized the following energizing circuit for the relay 7HD is closed:—beginning at the terminal (+) of a suitable battery, winding of the approach lighting relay AL⁵, elements 76, 77, 245, 246, 56, 55, 54, 53, 52, 51, 50, 49, 48, 247, winding of the relay 7HD, elements 248, 69, 68, 67, 66, 65, 64, 63, 62, 61 and 60, contact 59 of the relay 5HD in its attracted position, to the other terminal (—) of said battery.

With the relay 7HD now energized to its right hand position and the control relay WR² assuming its left hand position the following energizing circuit for the signal relay 7G is completed:—beginning at the terminal (+) of a suitable split battery, contact 250 of the relay 7HD, wire 251, front contact 252 of the relay 7HD, wire 253, front contact 254 of the track relay 1DT, wire 255, switch box contact 256 closed only when the switch S⁷ is in its main track position, wire 257, winding of the relay 7G, wire 258, contact 259 of the control relay WR², to the middle point C of said split battery. The circuit just traced will of course energize the signal relay 7G to its right hand position, thereby causing the signal 7 to display a clear or green proceed indication, thereby allowing the west bound train occupying the main track of the passing siding PS² to proceed into the single track section O. The train under consideration will of course encounter a caution signal when it reaches the signal 3, this because, as assumed, the operator was unable to change the position of either of the relays ER¹ or WR¹ at the west end of the single track section O. The train can of course proceed at caution until it reaches the signal 1 at which time the train crew can get in communication with the operator through the medium of a telephone, preferably located at the end of each passing siding.

It is thus seen that irrespective of the condition of the control relays, such as, relays ER and WR at one end of a single track section the operator may through the medium of the control relays at the other end of the single track section change the direction of train movement in such single track section. This is accomplished by reason of the back-and-forth stick relays BF¹ and BF², these relays enabling the direction relays DR¹ or DR² to be picked up only in response to a back-and-forth movement of the contacts of the relays ER¹ and WR², respectively. These back-and-forth relays can be picked up only with the associated control relay ER¹ or WR² in one position and allow the direction relay DR¹ or DR² to be picked up only through a front contact of the back-and-forth relay and with the control relay ER¹ or WR² assuming the opposite position.

Similarly, the direction relay DR² if once picked up, as for instance in the manner just indicated, thereafter can be held up only through either a holding circuit or a stick circuit the holding circuit of which includes a front contact of the associated home relay 7HD which can only be up with this direction relay DR² up, and the other or stick circuit of which includes a front contact of the associated directional stick relay 7S, from

which it is apparent that with no train in the single track section, the directional stick relay 7S must assume its deenergized position, so that the direction relay DR² may be deenergized from the opposite end of the single track section, by reason of the fact that the home-and-distant relay 7HD, associated with such direction relay, is in a tumble-down circuit energized from the opposite end of the single track section. In other words, to change the direction of traffic movement, the home-and-distant and home relays are caused to tumble down in one direction and in so doing effect deenergization of the direction relay at the remote end of the single track section, and with this direction relay once deenergized the home relays for governing the opposite direction of traffic will tumble up, so to speak.

It has already been explained how the operator may set up a direction of traffic to allow a train to move into one end of a single track section, even though he has no control over the control relays located at the opposite end of the single track section. Let us now see how the train crew may itself set up its own direction of traffic in the event that the entire selector system or other control for the various control relays ER and WR is out of order, and that the operator has absolutely no control over the system. In this case, the train crew when it is ready to enter a single track section will get into communication with the operator at the central office to receive orders, as over the telephone system, or even without any order from the operator in case the telephone system is out of order, a member of the train crew will depress the push button PB¹ if they are located at the west end of the single track section O or the push button PB² if they are located at the east end of this single track section, and in so doing will effect energization of the associated direction relay DR¹ or DR², and thereby will cause the direction of traffic to be changed in exactly the same manner as heretofore described in connection with the west bound train movement through the single track section O, except that the direction relay DR² is now picked up by the push button PB², where in the case heretofore considered in detail this relay DR² was picked up by the operation of the control relay WR² to its left hand position. Should, however, the relay WR² be assuming the right hand position, under which condition the relay 7G cannot be picked up and the signal 7 cannot be cleared the call-on signal CO² would be cleared through the front contact 260² of the relay 7HD and the back contact 261² of the push button PB².

Referring to Fig. 1A of the drawings, it will be noted that the relay 2HD is energized over the line wires 136, 140 and 145-149 by a source of current located at the signal 4. It will also be noted that if relay DR¹ were to be deenergized, that by such deenergization of relay DR¹ the line wires 136-140 and 145-149 would be connected to a source of current located at the signal 2 through the medium of back contact 141 and 144 of relay DR¹. Such deenergization of the relay DR¹ is ordinarily not possible, because one of its energizing circuits includes only one contact, namely, contact 154 of the relay 2HD, which could not be opened so long as energy is fed to the relay 2HD. Let us, however, assume that a workman momentarily short circuits the track circuits feeding track relay 2T or 3T, such momentary deenergization could cause deenergization of the relay DR¹, and as soon as the crowbar is removed

there would be a source of energy at each end of the line wires 136-140 and 145-149, and the voltages of these sources might be cumulative. Such simultaneous application of energy on the opposite ends of the line wires 136-140 and 145-149 is however not detrimental to these sources of current, by reason of the inclusion of the resistance R^1 in the circuit. Furthermore, such simultaneous application of two sources of current on the same line circuit should be a very rare and unusual occurrence. What has been said in regard to the purpose of the resistance R^1 shown in Fig. 1A is also true of the resistance R^2 shown in Fig. 1B.

The applicant has thus provided an A. P. B. system with supervisory control from a central office, which has all of the operating characteristics of commercially recognized practical absolute-permissive-block systems, in which he has used less line wires and in which his circuits are protected by more relay contacts, to assure against various false indications due to crosses or sticking relay contacts, and in which each home-and-distant relay has its energizing circuit checked through the back contact of the home-and-distant relay for governing opposing train movements, for instance, home relay 3HD can only be energized through back contacts of home relay 4HD, and home relay 4HD can only be energized through back contacts of relay 3HD. Furthermore, the system is so organized that upon failure of a portion of, or the failure of the entire manual supervisory control system, a reversal of direction of traffic may be set up by the train crew from that end of the single track section from which the train under the control of such train crew must enter. Also, the momentary false closure of a particular home-and-distant relay circuit, as for instance by a short train, such as a gasoline propelled car, moving, as for instance, from the track circuit of relay 2T into the track circuit of relay 3T, thereby momentarily closing the energizing circuit for the home relay in the rear, cannot set up any false indication permanently, as is apt to be the case in absolute-permissive-block systems of earlier construction, this by reason of the fact that the various home-and-distant relays are so interlocked that only one direction of traffic can be set up at one time, and the system is so organized that the train itself cannot set up such direction of traffic, the direction of traffic being determined entirely by the condition of energization of the direction relays DR^1 and DR^2 located at opposite ends of a single track section. It is of course understood that the intermediate signals 3 and 4 or 5 and 6, together with their associated circuits may be omitted, if desired.

It is, of course, understood that the track switches S^1 and S^2 are preferably controlled from the central office DO, as through the medium of a switch machine, and that the starting dwarf signals 2^d and 7^d and the entering signals 1^d and 8^d will be cleared in accordance with the direction of traffic to be set up providing of course that the track switches with which they are associated assume the take-siding position, all as shown in the prior applications above referred to.

Fig. 2

In Fig. 2 has been illustrated a little more in detail the wiring for signals 4 and 6 of two intermediate signal locations, where both of these signal locations have their signals located opposite as distinguished from having the signals

staggered. The home-distant relays 4HD and 6HD are wired the same as is the relay 4HD for Fig. 1A, that is, energy is applied to the line circuits in identically the same manner as the relay 4HD of Fig. 1A applies energy to the line circuit for the next relay in the rear, and the relays 4HD and 6HD are connected to the line circuit in exactly the same manner as relay 4HD of Fig. 1A is connected to the line circuit. The signals 3, 4, 5, and 6 have been illustrated as three-aspect color light signals, none of these signal aspects of green G, yellow Y or red R being lighted, however, unless the approach lighting relay AL associated with that signal is deenergized. The reference characters employed in Fig. 2 are the same as in Fig. 1A, except that distinctive exponents 4 and 6 have been added. The windings b of the HD relays receive their energy conductively from the windings a , and these windings a are inductively connected to the main windings of these relays. The operation of the system to control signals 4 and 6 of Fig. 2 is exactly the same as the operation of signal 4 of Fig. 1A, and therefore need not be repeated.

Having described one rather specific embodiment of the present invention it is desired to be understood, that the particular embodiment illustrated has been illustrated for the purpose of disclosing the nature of the invention, its operating characteristics and its underlying principles, and that the particular embodiment selected has not been selected for the purpose of showing the scope of the invention nor the exact construction preferably employed in practicing the same, and that various changes, modifications and additions may be made to adapt the invention to the particular type of railway system to which it is to be applied, all without departing from the spirit or scope of the invention or the idea of means underlying the same, except as demanded by the scope of the following claims.

What I claim as new is:—

1. In an absolute-permissive-block signaling system for railroads, a single track section, signals at each end of said section for governing the entrance and exit of trains into and out of said section, signals at an intermediate point for governing the movement of trains in both directions through said section, a circuit leading from one end of said section to said intermediate point for at times controlling a signal at said one end and at other times controlling a signal at said intermediate point, another circuit leading from the other end of said section to said intermediate point for at times controlling a signal at said intermediate point and at other times controlling a signal at said other end, and means for at times controlling said one circuit by said another circuit and for at other times controlling said another circuit by said one circuit.

2. In an absolute-permissive-block signal system, the combination with a single track section, signals for governing the movement of trains through said section, means for controlling said signals including two circuits arranged end to end and together extending the length of said section, means for at one time controlling one of said circuits by the other circuit and at other times controlling said other circuit by said one circuit, and two stick relays for determining which of said two circuits shall control the other of said two circuits.

3. In an absolute-permissive-block block signal system, the combination with a single track section, signals for governing the movement of trains

through said section, means for controlling said signals including two circuits arranged end to end and together extending the length of said section, means for at one time controlling one of said circuits by the other circuit and at other times controlling said other circuit by said one circuit, two stick relays for determining which of said two circuits shall control the other of said two circuits, and a control relay controlled from a distant point for each of said stick relays for controlling the same.

4. In an absolute-permissive-block signal system, the combination with a single track section, signals for governing the movement of trains through said section, means for controlling said signals including two circuits arranged end to end and together extending the length of said section, means for at one time controlling one of said circuits by the other circuit and at other times controlling said other circuit by said one circuit, two stick relays for determining which of said two circuits shall control the other of said two circuits, a control relay controlled from a distant point for each of said stick relays for controlling the same, and a pick-up circuit for each of said stick relays which when such stick relay is de-energized can be closed only upon a change in the position of its associated control relay.

5. In an absolute-permissive-block signal system, the combination with a single track section, signals for governing the movement of trains through said section, means for controlling said signals including two circuits arranged end to end and together extending the length of said section, means for at one time controlling one of said circuits by the other circuit and at other times controlling said other circuit by said one circuit, two stick relays for determining which of said two circuits shall control the other of said two circuits, a control relay controlled from a distant point for each of said stick relays for controlling the same, and a pick-up circuit for each of said stick relays which can be closed only upon a change in the position of its associated control relay.

6. In an absolute-permissive-block signal system, the combination with a single track section, signals for governing the movement of trains through said section, means for controlling said signals including two circuits arranged end to end and together extending the length of said section, means for at one time controlling one of said circuits by the other circuit and at other times controlling said other circuit by said one circuit, two stick relays for determining which of said two circuits shall control the other of said two circuits, an auxiliary relay for each of said stick relays, a control relay for each of said stick relays, a circuit for each auxiliary relay closed only when the associated control relay assumes one position, and a pick-up circuit for each stick relay closed only when the associated control relay assumes another position and then only if the associated auxiliary relay assumes its energized position.

7. In an absolute-permissive block signal system, the combination with a single track section, signals for governing the movement of trains through said section, means for controlling said signals including two circuits arranged end to end and together extending the length of said section, means for at one time controlling one of said circuits by the other circuit and at other times controlling said other circuit by said one circuit, two stick relays for determining which of

said two circuits shall control the other of said two circuits, an auxiliary relay for each of said stick relays, a control relay for each of said stick relays, a pick-up circuit for each auxiliary relay closed only when the associated control relay assumes one position, and a pick-up circuit for each stick relay closed only when the associated control relay assumes another position and then only if the associated auxiliary relay assumes its energized position.

8. In an absolute-permissive-block signal system, the combination with a single track section, signals for governing the movement of trains through said section, means for controlling said signals including two circuits arranged end to end and together extending the length of said section, means for at one time controlling one of said circuits by the other circuit and at other times controlling said other circuit by said one circuit, two stick relays for determining which of said two circuits shall control the other of said two circuits, an auxiliary relay for each of said stick relays, a control relay for each of said stick relays, a pick-up circuit for each auxiliary relay closed only when the associated control relay assumes one position, a stick circuit for each auxiliary relay closed if the associated stick relay assumes its deenergized position, and a pick-up circuit for each stick relay closed only when the associated control relay assumes another position and then only if the associated auxiliary relay assumes its energized position.

9. In an absolute-permissive-block signaling system for railroads, a single track section, signals at each end of said section for governing the entrance and exit of trains into and out of said section, signals at an intermediate point for governing the movement of trains in both directions through said section, a circuit leading from one end of said section to said intermediate point for at times controlling a signal at said one end and at other times controlling a signal at said intermediate point, another circuit leading from the other end of said section to said intermediate point for at times controlling a signal at said intermediate point and at other times controlling a signal at said other end, two relays located at said intermediate point one at times included in one of said circuits and the other at times included in the other of said circuits, interlocking means for preventing more than one of said relays being energized at one time, and means for controlling said other circuit by said one relay and controlling said one circuit by said other relay.

10. In an absolute-permissive-block signaling system for railroads, a single track section, signals at each end of said section for governing the entrance and exit of trains into and out of said section, signals at an intermediate point for governing the movement of trains in both directions through said section, a circuit leading from one end of said section to said intermediate point for at times controlling a signal at said intermediate point, another circuit leading from the other end of said section to said intermediate point for at times controlling a signal at said intermediate point and at other times controlling a signal at said other end, track circuits having front contacts included in said circuits, two relays located at said intermediate point one at times included in one of said circuits and the other at times included in the other of said circuits, interlocking means for preventing more than one of said relays being energized at one time, and means for

controlling said other circuit by said one relay and controlling said one circuit by said other relay.

11. In a single track railway signalling system, the combination with a single track section, signals for governing traffic in each direction through said section, manually controllable means for determining the clearing of signals for establishing a particular direction of traffic through said section, and other manually controllable means for reversing the direction of traffic set up by said first mentioned manually controllable means through said section, said other manually controllable means being effective irrespective of said first mentioned manually controllable means.

12. In an absolute-permissive-block signal system, the combination with a single track section, signals for governing the movement of trains through said section, means for controlling said signals including two circuits arranged end to end and together extending the length of said section, means for at one time directly controlling one of said circuits by the other circuit and at other times directly controlling said other circuit by said one circuit, and two stick relays for determining which of said two circuits shall control the other of said two circuits.

13. In a single track railway signalling system, the combination with a single track section having an intermediate signal location, a signal at said location for governing traffic in one direction, a signal at said location for governing traffic in the opposite direction, a relay for each signal to control the same, and a circuit for each relay including a back contact of the other relay and said circuit being energizable only when the track in advance of the signal for that relay is unoccupied by a train, whereby only one of said signals can be cleared at one time.

14. In a single track railway signalling system, the combination with a single track section having an intermediate signal location, a signal at said location for governing traffic in one direction, a signal at said location for governing traffic in the opposite direction, a relay for each signal to control the same, circuit wires for each relay, and contacts on each relay which if down connect the circuit wires of the other relay to such other relay but if up connect such wires to a source of current.

15. In a single track railway signalling system, the combination with a single track section connecting two double track sections, intermediate signal locations each including two signals one governing traffic in one direction and the other governing traffic in the other direction, a circuit extending from each signal location to an adjacent signal location, and means for controlling each circuit directly by the adjacent circuit to constitute a tumble-down arrangement which at times operates from right to left and at other times operates from left to right.

16. In a single track railway signalling system, the combination with a single track section connecting two double track sections, intermediate signal locations each including two signals one governing traffic in one direction and the other governing traffic in the other direction, a circuit extending from each signal location to an adjacent signal location, a relay for each end of each of said circuits, means for at times energizing each circuit from the right-hand end to energize the relay at the left-hand end and for at other times energizing each circuit from the left-hand

end to energize the relay at the right-hand end, and contacts on said relays for controlling each of said circuits by an adjacent circuit.

17. In a single track railway signalling system, the combination with a single track section connecting two double track sections, intermediate signal locations each including two signals one governing traffic in one direction and the other governing traffic in the other direction, a circuit extending from each signal location to an adjacent signal location, a relay for each end of each of said circuits, means for at times energizing each circuit from the right-hand end to energize the relay at the left-hand end and for at other times energizing each circuit from the left-hand end to energize the relay at the right-hand end, a directional stick relay associated with each end of each of said circuits, and contacts on said directional stick relays for at times applying current to said circuits.

18. In a single track railway signalling system, the combination with a single track section connecting two double track sections, intermediate signal locations each including two signals one governing traffic in one direction and the other governing traffic in the other direction, a circuit extending from each signal location to an adjacent signal location, a directional stick relay for each signal, and contacts on said directional stick relays for at times energizing said circuits from one end and at other times energizing said circuits from the other end.

19. In a single track railway signalling system, the combination with a single track section connecting two double track sections, intermediate signal locations each including two signals one governing traffic in one direction and the other governing traffic in the other direction, a circuit extending from each signal location to an adjacent signal location for governing said signals, manually operable control means controllable from a central office for permitting clearing of signals for only one direction of travel at one time, and other manually operable control means at each end of said single track section for changing the direction of traffic set up by said first mentioned manually operable means.

20. In a single track railway signalling system, the combination with a single track section connecting two double track sections, intermediate signal locations each including two signals one governing traffic in one direction and the other governing traffic in the other direction, a circuit extending from each signal location to an adjacent signal location for governing said signals, manually operable control means controllable from a central office for permitting clearing of signals for only one direction of travel at one time, other manually operable control means at each end of said single track section for changing the direction of traffic set up by said first mentioned manually operable means, and visual indicating means for indicating when the direction of traffic has been changed.

21. In a single track railway signalling system, the combination with a single track section connecting two double track sections, intermediate signal locations each including two signals one governing traffic in one direction and the other governing traffic in the other direction, a circuit extending from each signal location to an adjacent signal location for governing said signals, manually operable control means con-

trollable from a central office for permitting clearing of signals for only one direction of travel at one time, other manually operable control means at each end of said single track section for changing the direction of traffic set up by said first mentioned manually operable means, and visual indicating means effective only so long as said other manually operable control means is in its operated condition for indicating when the direction of traffic has been changed.

22. Route control means for allowing railway traffic to move in one direction at one time only over a particular section comprising, a circuit connecting the ends of said section, a first relay at each end of said circuit for manifesting energization of said circuit, a second relay at each end of said section for energizing said circuit from that end, and means for interlocking said first and said second relay at each end of said circuit so that said circuit cannot be conditioned to be energized from that end if it has already been energized from the other end.

23. Route control means for allowing railway traffic to move in one direction at one time only over a particular section comprising, a circuit connecting the ends of said section, a first relay at each end of said circuit for manifesting energization of said circuit, a second relay at each end of said section for energizing said circuit from that end, and means for interlocking said first and said second relay at each end of said circuit so that when said circuit is energized from one end such energization cannot be interfered with by the second relay at the other end.

24. In combination, a stretch of single track over which traffic moves in both directions, signals governing the entrance of traffic into said stretch, intermediate signals located at intervals along the stretch for governing traffic in both directions through the stretch, all of said signals being capable of indicating stop, caution, and proceed, manually operable means for separately controlling the signals governing the entrance of traffic into said stretch, in either direction, and means for rendering said manually operable means ineffective to cause such entering signals to indicate caution or proceed unless all of the opposing intermediate signals indicate stop.

25. In combination, a stretch of single track over which traffic moves in both directions, a first signal for governing traffic in one direction through said stretch, a first polarized line relay, means effective when said first line relay is deenergized for causing said first signal to indicate stop, manually operable means for causing said first signal to display a caution indication when said first line relay is energized by current of one polarity and a proceed indication when said first line relay is energized by current of the other polarity, a second signal for governing traffic in the opposite direction through said stretch, a second polarized line relay; means controlled by said second line relay for controlling said second signal in such manner that said second signal indicates stop, caution, or proceed according as said second line relay is deenergized or is energized by current of one polarity or the other; manually operable means for at times supplying said second line relay with current of one polarity or the other when the portion of said stretch between said signals is unoccupied, and means for at times supplying said first line relay with current of one polarity or the other when the portion of said stretch between said

signals is unoccupied and said second line relay is deenergized.

26. In combination, a stretch of single track over which traffic moves in both directions, a first signal for governing traffic in one direction through said stretch, a first polarized line relay, means effective when said first line relay is deenergized for causing said first signal to indicate stop, manually operable means for causing said first signal to display a caution indication when said first line relay is energized by current of one polarity and a proceed indication when said first line relay is energized by current of the other polarity, a second signal located at some distance from said first signal for governing traffic in the opposite direction through said stretch, a second polarized line relay; means controlled by said second line relay for controlling said second signal in such manner that said second signal indicates stop, caution, or proceed according as said second line relay is deenergized or is energized by current of one polarity or the other; manually controlled means for at times supplying said second line relay with current of one polarity or the other when the portion of said stretch between said signals is unoccupied, means for supplying said first line relay with current of one polarity when the portion of track between said signals is unoccupied and said second line relay is deenergized; and means for supplying said first line relay with current of the other polarity when the portion of track between said signals is unoccupied, said second line relay is deenergized, and the portion of track immediately beyond said second signal for traffic moving in the opposite direction from that governed by said second signal is occupied.

27. In combination, a stretch of single track over which traffic moves in both directions, a first signal for governing traffic in one direction through said stretch, a first polarized line relay, means effective when said first line relay is deenergized for causing said first signal to indicate stop, manually operable means for causing said first signal to display a caution indication when said first line relay is energized by current of one polarity and a proceed indication when said first line relay is energized by current of the other polarity, a second signal located at some distance from said first signal for governing traffic in the opposite direction through said stretch, a second polarized line relay; means controlled by said second line relay for controlling said second signal in such manner that said second signal indicates stop, caution, or proceed according as said second line relay is deenergized or is energized by current of one polarity or the other; manually operable means for at times supplying said second line relay with current of one polarity or the other when the portion of said stretch between said signals is unoccupied, and said first line relay is deenergized, and means for at times supplying said first line relay with current of one polarity or the other when the portion of said stretch between said signals is unoccupied and said second line relay is deenergized.

28. In combination, a stretch of single track over which traffic moves in both directions, signals for governing traffic in one direction through said stretch and other signals for governing traffic in the opposite direction through said stretch, a plurality of line relays one associated with each signal and each arranged to control the associated signal in such manner that the associated

signal indicates stop when the relay is deenergized, and means for controlling said relays in such manner that a relay associated with a signal which controls traffic in one direction cannot become energized unless the relay associated with the opposing signal which governs the entrance of traffic into the same portion of the stretch is deenergized.

29. In combination, a stretch of single track over which traffic moves in both directions, signals for governing traffic in one direction through said stretch and other signals for governing traffic in the other direction through said stretch, a plurality of line relays one associated with each signal and each arranged to control the associated signal in such manner that the associated signal indicates stop when the relay is deenergized, and means for energizing each line relay when and only when the portion of track between the associated signal and the signal next in advance governing traffic in the same direction is unoccupied and the line relay associated with the signal next in advance governing traffic in the opposite direction is deenergized.

30. In combination, a stretch of single track over which traffic moves in both directions, head block signals governing the entrance of traffic into said stretch, intermediate signals located at intervals along the stretch for governing traffic in both directions through the stretch, a plurality of line relays one associated with each of said signals and each arranged to control the associated signal in such manner that the associated signal indicates stop when the line relay is deenergized, and means for controlling said line relays in such manner that the line relay associated with each head block signal cannot become energized unless all of the line relays associated with the intermediate signals which control traffic in the opposite direction are deenergized and all of the line relays associated with the intermediate signals which control traffic in the same direction are energized.

31. In combination, a stretch of single track over which traffic moves in both directions, signals for governing traffic in one direction through said stretch and other signals for governing traffic in the other direction through the stretch; a plurality of line relays one associated with each signal and each arranged to control the signal with which it is associated in such manner that the signal will indicate stop, caution, or proceed according as the associated relay is deenergized or is energized by current of one polarity or the other; means for at times supplying each line relay with current of one polarity when the portion of track between the signal controlled thereby and the signal next in advance governing traffic in the same direction is unoccupied, the line relay associated with the signal next in advance governing traffic in the same direction is energized, and the line relay associated with the signal next in advance governing traffic in the opposite direction is deenergized; and means for at other times supplying each line relay with current of the opposite polarity when the portion of track between the signal controlled thereby and the signal next in advance governing traffic in the same direction is unoccupied, the line relay associated with the signal next in advance governing traffic in the same direction is deenergized; and the line relay associated with the signal next in advance governing traffic in the opposite direction is deenergized.

32. In combination, a stretch of single track

over which traffic moves in both directions; a first signal for governing traffic in one direction through said stretch; a first polarized relay for controlling said first signal to the clear, caution and stop condition when said first relay is respectively energized by current of normal polarity, by current of reverse polarity and is deenergized; a second signal for governing traffic in the opposite direction through said stretch, a second polarized relay for controlling said second signal to the clear, caution and stop condition when said second relay is respectively energized by current of normal polarity, by current of reverse polarity and is deenergized, control circuits for each of said polarized relays so organized that each said relay may be energized by current of either normal or reverse polarity if said stretch is unoccupied and the other of said relays is deenergized, and manually operable means for holding either of said relays deenergized.

33. In combination, a stretch of railway track divided into sections, signals governing traffic in both directions through said stretch, a polarized line relay and a slow-releasing stick relay for each signal, means operating when a given line relay is closed and the associated stick relay is open to supply current of normal polarity to the line relay for the signal next in the rear, means operating when the associated stick relay is closed to supply current of reverse polarity to the line relay for the signal next in the rear independently of the given line relay, track circuits for said sections for controlling said line relays, means for energizing each stick relay when a train moving in the direction in which the associated signal governs traffic passes such signal and for keeping it energized as long as the line relay for such signal remains deenergized, and means controlled by each polarized line relay for energizing the associated signal to display a clear or caution indication when its line relay is energized by current of normal or reverse polarity, respectively, and to display a stop indication when its line relay is deenergized.

34. In combination, a stretch of railway track divided into a forward block and a rear block and the forward block further divided into a forward section and a rear section, a forward signal and a rear signal for governing traffic movements through the forward and rear blocks, respectively, a track circuit for each of the sections of said forward block each including a track relay, a line relay for controlling said forward signal energized by a circuit including in series contacts closed by said track relays in their energized condition, a polarized line relay for controlling said rear signal, a slow-releasing stick relay, a circuit controlled by a front contact of said first line relay and by a back contact of said stick relay for energizing said polarized line relay by current of normal polarity, a second circuit controlled by a front contact of said stick relay for energizing said polarized relay by current of reverse polarity independently of said first line relay, a pick-up circuit for energizing said stick relay when a train moves from said rear block into said forward block, and a stick circuit for said stick relay controlled by a back contact of said first line relay.

35. In combination, a stretch of railway track, signals located at intervals to govern traffic in one direction through the stretch, other signals located at intervals to govern traffic in the opposite direction through the stretch, a sectionalized line wire adapted for use as the common line wire in the control of said signals, a traffic locking cir-

cuit for the stretch having as one conductor the different sections of said sectionalized line wire, directional means at each end of the stretch to govern traffic entering the stretch at its end and
 5 each arranged to be at times controlled by the traffic locking circuit, a current source at each end of the stretch each adapted to at times supply current to the traffic locking circuit for controlling the directional means at the opposite
 10 end of the stretch, and repeating means including two directional relays at each sectionalized location of said line wire said relays being arranged to bridge the traffic locking circuit from one section of the line wire to the next section in either
 15 direction and thereby carry through from end to end of the stretch the control effected by the current source at one end to the directional means at the other end in either direction.

36. In combination, a stretch of railway track, signals located at intervals to govern traffic in one
 20 direction through the stretch, other signals located at intervals to govern traffic in the opposite direction through the stretch, a sectionalized line wire adapted for use as the common line wire in the control of said signals, a traffic locking
 25 circuit for the stretch having as one conductor the different sections of said sectionalized line wire, directional means at each end of the stretch to govern traffic entering the stretch at its end and each arranged to be at times controlled by the traffic locking circuit, a current source at
 30 each end of the stretch each adapted to at times supply current to the traffic locking circuit for controlling the directional means at the opposite end of the stretch, and repeating means including two directional relays at each sectionalized location of said line wire and arranged to repeat the effect of the traffic locking circuit from one section of said line wire to the next in either direction and thereby carry through from end to end
 40 of the stretch the control effected by the current source at one end to the directional means at the other end in either direction.

37. In combination, a stretch of railway track, signals located at intervals to govern traffic in one
 45 direction through the stretch, other signals located at intervals to govern traffic in the opposite direction through the stretch, a sectionalized line wire adapted for use as the common line wire in the control of said signals, a traffic locking circuit for the stretch having as one conductor the different sections of said sectionalized common line wire, a current source and a relay at each
 50 end of the stretch, a manually controlled selector at each end adapted to include either the relay or the current source at its end in the traffic locking circuit, repeating means at each sectionalized location of the common line wire including two directional relays controlled by the traffic locking
 55 circuit and arranged to repeat the effect of the traffic locking circuit from one section of the common line wire to the next in a direction corresponding to the direction from which said relays are controlled to carry through the influence effected by the applying of current to the traffic locking circuit at one end to the relay at the other end, a signal at each end of the stretch to govern the movement of traffic into the stretch, and means controlled by the relay at the same
 60 end of the stretch for clearing said signal.

38. In combination, a stretch of railway track, signals located at intervals to govern traffic in one direction through the stretch, other signals located at intervals to govern traffic in the opposite
 70 direction through the stretch, a sectionalized

line wire for the stretch adapted for use as the common line wire in the control of said signals, a traffic locking circuit for the stretch arranged into a plurality of sections each section of which includes a corresponding section of said common
 5 line wire, a relay and a current source at each end of the stretch, a manually controlled selector at each end adapted to include either the relay or the current source at its end in the traffic locking circuit, repeating means at each junction
 10 of adjacent sections of the traffic locking circuit including two directional relays controlled by the traffic locking circuit and arranged to repeat the effect of the traffic locking circuit from one section to the next in the direction corresponding
 15 to that from which said relays are controlled to carry through the influence effected by applying current to the traffic locking circuit at either end of the stretch to the relay at the other end, a signal at each end of the stretch to govern
 20 the movement of traffic into the stretch, and means controlled by the relay at the same end of the stretch for clearing said signal.

39. In combination, a stretch of railway track, signals located at intervals to govern traffic in
 25 one direction through the stretch, other signals located at intervals to govern traffic in the opposite direction through the stretch, a sectionalized line wire for the stretch adapted for use as the common line wire in the control of said signals, a traffic locking circuit for the stretch arranged into a plurality of sections each section of which includes a corresponding section of said common
 30 line wire, a relay and a current source at each end of the stretch, a manually controlled selector at each end adapted to include either the relay or the current source at its end in the traffic locking circuit, repeating means at each junction of adjacent sections of the traffic locking circuit including two directional relays controlled by the
 40 traffic locking circuit and arranged to supply current to either adjacent section in response to being controlled from the other adjacent section, to thereby carry through the influence effected by applying current to the traffic locking circuit at either end of the stretch to the relay at the other end, a signal at each end of the stretch to govern the movement of traffic into the stretch, and means controlled by the relay at the same
 45 end of the stretch for clearing said signal.

40. In combination, a stretch of railway track, signals located at intervals to govern traffic in one direction through the stretch, other signals located at intervals to govern traffic in the opposite
 50 direction through the stretch, a sectionalized line wire for the stretch adapted for use as the common line wire in the control of said signals, a traffic locking circuit for the stretch arranged into a plurality of sections each section of which includes a corresponding section of said common
 60 line wire, means at each end of the stretch each adapted to at times supply current to the traffic locking circuit, a relay at each end of the stretch each controlled by the traffic locking circuit and arranged when energized to permit traffic to enter the stretch, and two directional relays and a current source at each junction of adjacent sections of the traffic locking circuit controlled by the traffic locking circuit and arranged to supply current to either adjacent section when controlled by current from the other adjacent section to thereby supply current to the relay at either end of the stretch in response to current supplied to the traffic locking circuit at the end
 65 opposite that relay.

41. In combination, a stretch of railway track arranged into track sections each of which is provided with the usual track circuit including a track relay, a traffic locking circuit extending along the stretch arranged into a plurality of different sections with each section including a front contact of each track relay of the track sections adjacent that section of the traffic locking circuit, a source of current and a directional relay at each end of the stretch, manually controlled means at each end to include either the current source or the relay at its end in the traffic locking circuit, repeating means at each junction of adjacent sections of said traffic locking circuit including a current source and two directional relays controlled by the traffic locking circuit and arranged to supply current to either adjacent section when controlled by current from the other adjacent section whereby under clear traffic conditions the relay at either end of the stretch will become energized when current is supplied to the traffic locking circuit at the other end, a signal at each end of the stretch to govern the movement of traffic into the stretch, and means controlled by the relay at the same end of the stretch for clearing said signal.

42. In combination, a stretch of railway track arranged into track sections each of which is provided with the usual track circuit including a track relay, a traffic locking circuit extending along the stretch arranged into a plurality of different sections with each section including a front contact of each track relay of the track sections adjacent that section of the traffic locking circuit, a source of current and a directional relay at each end of the stretch, manually controlled means at each end to include either the current source or the relay at its end in the traffic locking circuit, repeating means at each junction of adjacent sections of said traffic locking circuit including two directional relays controlled by the traffic locking circuit and arranged to supply current to either adjacent section when controlled by current from the other adjacent section, to thereby carry through under clear traffic conditions of the stretch the influence effected by supplying current to the traffic locking circuit at one end of the stretch to the relay at the opposite end for energizing that relay, a signal at each end of the stretch to govern the movement of traffic into the stretch, and means controlled by the relay at the same end of the stretch for clearing said signal.

43. In combination, a stretch of railway track divided into track sections each of which is provided with the usual track circuit including a track relay, signals located along said stretch and arranged to govern traffic in both directions, a sectionalized line wire for the stretch adapted for use as the common line wire in the control of said signals, a traffic locking circuit for the stretch arranged into a plurality of sections each section of which includes a corresponding section of the sectionalized line wire and a front contact of the track relay of each track section adjacent that section of the traffic locking circuit, means at each end of the stretch adapted to at times supply a control current to the traffic locking circuit, a directional relay at each end of the stretch controlled by the traffic locking circuit, two directional relays at each junction of adjacent sections of the traffic locking circuit controlled by

said circuit and arranged to supply current to one adjacent section when controlled by current from the other adjacent section and to supply current to said other adjacent section when controlled by current from said one adjacent section for energizing the relay at the end of the stretch opposite that at which current is supplied to the traffic locking circuit, a signal at each end of the stretch to govern the movement of traffic through the stretch, and means for clearing said signal when the relay at its end of the stretch becomes energized.

44. In combination, a stretch of railway track divided into sections, a track circuit including a track relay for each track section, a line circuit for the stretch divided into sections each including front contacts of the track relays of the track sections adjacent such line circuit section, a source of current and a directional relay at each end of each section of the line circuit, manually controlled means at each end of the stretch for selectively including in the section of the line circuit having one end adjacent said means the source of current or directional relay at that end of said section, means at each junction of adjoining sections of the line circuit for including in each of said sections the source of current or directional relay at the adjacent end of such section according as the directional relay at the adjacent end of the other adjoining section is energized or deenergized, a signal at each end of the stretch to govern the movement of traffic through the stretch, and means controlled by the directional relay at the same end for controlling said signal.

45. In combination, a stretch of railway track, a signal at each end of the stretch to govern the movement of traffic through the stretch, a line circuit for the stretch divided into sections, a source of current and a directional relay at each end of the stretch, manually controlled means at each end of the stretch for selectively including in the end section of the line circuit adjacent said means its source of current or directional relay, repeating means at each junction of adjoining sections of the line circuit effective to include a source of current in either of said sections at the end adjacent such junction when the other adjoining section is energized at the end remote from such junction, and means controlled by each directional relay for clearing the signal at the same end of the stretch.

46. 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 circuit, each of said relays being of the polar-neutral type opening its neutral contacts when deenergized, 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, means controlled by neutral and polar contacts of said relays for governing said signals, and means controlled by the presence of a train in said section for opening said circuit to deenergize the one of said two relays then connected to said circuit and thereby cause the corresponding signal to indicate stop so long as said section is occupied.

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