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TRAFFIC CONTROLLING SYSTEM FOR RAILROADS

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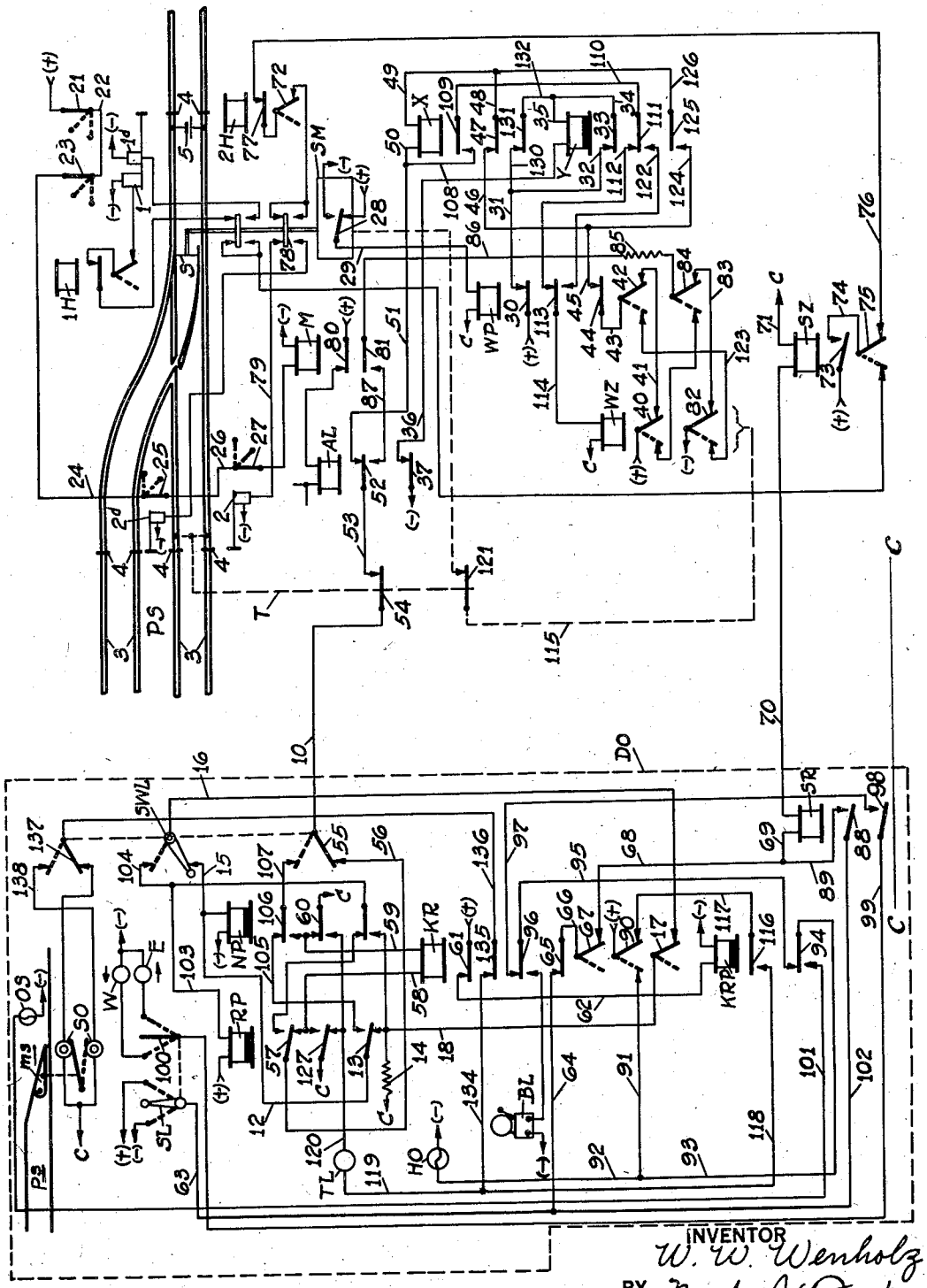

INVENTOR
W. W. Wenholz
BY
Neil D. Preston,
his ATTORNEY

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TRAFFIC CONTROLLING SYSTEM FOR RAILROADS

Walter W. Wenholz, Rochester, N. Y., assignor to General Railway Signal Company, Rochester, N. Y.

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This invention relates to a system in which a distant track switch and its associated signal are controlled over a comparatively few line wires, and wherein these same line wires are used for indicating traffic conditions at said distant location.

In accordance with the present invention, it is proposed to control a distant track switch over one line circuit, to control the signals associated with said track switch over another line circuit from a local point, and to indicate at said local point the position of the track switch, the indicating condition of the signals, the occupancy of a detector track circuit associated with said track switch, the fact whether or not the switch machine for operating such track section is locked against such operation by local locking means, and the fact whether the switch machine is in a transient or intermediate position. In accordance with the present invention, certain of these features are carried out by at times energizing a line circuit from one end and at other times energizing said line circuit from the other end, which is accomplished by the provision of means for permitting the use of the line to be shifted from a control line to an indication line, and vice versa, without the simultaneous application of current to both ends of the line wire.

Provision is made so that the positions of the switch repeating relay, switch control relay and switch lever must coordinate before a signal can be cleared and if cleared the signal will not be put to stop position if the switch lever is inadvertently manipulated. Provision is also made that if the switch lever is manipulated, while the switch is locked and a hands off lamp HO is lighted, the switch will not respond to the lever even though the lock circuit has been restored, making it thus necessary to restore the lever and then manipulate it again. Reversibility of switch in mid-stroke is also provided for, that is, if the switch should jam in an intermediate position, it may be returned to its original position without completing its original stroke.

Other objects, purposes and characteristic features of the invention will in part be more specifically pointed out hereinafter and will in part be obvious from the accompanying drawing.

In describing the invention in detail, reference will be made to the single drawing, which shows conventionally one circuit arrangement and associated devices embodying the present invention, and which illustrates both the apparatus in the central office and at a distant wayside location.

Referring to the drawing, the track rails 3 have been shown divided by insulating joints 4, into sections to facilitate track circuiting, of which the detector track circuit containing the track relay T and the track battery 5 only have been shown. This detector track circuit is associated with the track switch S which governs the movement of traffic into and out of the main track and side track, respectively, of the passing siding PS. With this track switch S are associated the main entering signal 1 and the take-siding signal 1^d, the starting signal 2 and the dwarf starting signal 2^d preferably of a signalling system of the absolute-permissive-block type, and this switch is operated by the switch machine SM. This switch machine SM is preferably controlled by switch machine control relay WZ, whereas the signals 1, 1^d, 2 and 2^d are preferably controlled by the signal control relay SZ.

At this way station, there is also provided an approach locking relay AL which is energized only in the event it is safe to operate the track switch S, and which may be controlled in a manner as indicated in the prior application of Wenholz and DeLong Ser. 409,010 filed November 22, 1929; a signal indicating relay M which is energized only when all of the signals associated with the track switch S are at stop; a switch machine repeater relay WP; and auxiliary relays X and Y which manifest whether the switch control line wire 10 is energized from the way station end, or is connected to the switch machine control relay WZ. Although only one track switch has been shown, the invention may be applied to all of the apparatus of an entire interlocking plant.

In the central office DO, there is provided a miniature track layout, which in every respect corresponds to the railway system to which the present invention has been applied, of which for convenience only the miniature passing siding *ps* corresponding to the actual passing siding PS has been shown. This miniature passing siding *ps* has associated therewith a miniature track switch *ms* which is operable by the miniature track switch operator SO. With this miniature track layout, there is also associated a switch control lever SWL, a signal control lever SL, a correspondence relay KR, a repeater correspondence relay KRP, a signal indicating relay SR, and two auxiliary relays NP and RP, which auxiliary relays manifest whether the correspondence relay KR or control energy is connected to the dispatcher's office end of the line wire 10.

The central office equipment also includes an indicating lamp OS, which indicates the occu-

pancy of the detector track circuit containing track relay T; direction arrow lights W and E which respectively indicate that west bound and east bound traffic is permitted to move over the track switch S; a transient light TL, which indicates that the switch machine is out of correspondence with its control relay; a hands-off light HO, which when lighted indicates that the track switch cannot be operated, and an audible signal BL.

Having now referred to each of the elements of the system, it is believed expedient to explain the operation of the system, this in order to more clearly understand the co-ordination between the various devices and the functions which may be carried out thereby.

Operation

The apparatus, as illustrated in the drawing, has been shown in its normal condition, that is, with the track switch S assuming the main track position, and the four wayside signals associated therewith assuming the stop position. Let us first observe what relays are normally energized and trace their closed energizing circuits. Referring to the drawing, it will be noted that the relay NP is energized through the following circuit:—beginning at the terminal (—), winding of the relay NP, wire **12**, back contact **13** of the relay RP, resistance unit **14**, to the common return wire C connected to the midpoint of the central office battery. A second energizing circuit may be traced for this relay NP as follows:—beginning at the same negative terminal, winding of the relay NP, wire **15**, switch lever SWL, wire **16**, polar contact **17** of the relay KR in its right hand position, wire **18**, resistance unit **14**, to the common return wire C connected to the midpoint of said battery.

Referring now to the way station location, the signal indicating relay M is energized through the following circuit:—beginning at the terminal (+) of the way station battery, contact **21** of the signal 1^d closed only when this signal assumes the stop position, wire **22**, contact **23** closed only when the signal **1** assumes the stop position, wire **24**, contact **25** closed only when the signal 2^d assumes the stop position, wire **26**, contact **27** of the signal **2** closed only when this signal assumes the stop position, winding of the relay M to the other terminal (—) of the way station battery.

The switch repeater relay WP is energized to its right hand normal position through a circuit which may be traced as follows:—beginning at the terminal (+) of the way station battery, contact **28** of the switch machine SM assuming the main track locked position, wire **29**, winding of the relay WP to the midpoint C of the way station battery. The auxiliary relay Y is energized through the following circuit:—beginning at the terminal (+) of the way station battery, front contact **30** of the switch repeater relay WP, wires **31** and **32**, stick contact **33** of the relay Y, wires **34** and **35**, winding of the relay Y, wire **36**, front contact **37** of the approach locking relay AL, to the other terminal (—) of the way station battery.

It will be noted, that the correspondence relay KR is normally energized and has included in series therewith the auxiliary relay X of the wayside location. This energizing circuit for the correspondence relay KR may be traced as follows:—beginning at the terminal (+) of the way station battery, polar contact **40** of the switch control relay WZ, (this relay WZ preferably being one of the two positioned magnetic stick type, so that its polar contacts remain in the position to which the relay was last energized, this relay WZ now being deenergized, but if desired this relay may include a neutral armature and associated contacts if desired), wire **41**, polar contact **42** of the switch repeater relay WP, wire **43**, neutral contact **44** of the relay WP, wires **45** and **46**, stick contact **47** of the auxiliary relay X, wires **48** and **49**, winding of the relay X, wires **50** and **51**, front contact **52** of the approach lock relay AL, wire **53**, front contact **54** of the track relay T, line wire **10**, contact **55** of the switch lever SWL, wire **56**, back contact **57** of the relay RP, wire **58**, winding of the correspondence relay KR, wire **59**, front contact **60** of the relay NP, to the common return wire C connected to the midpoint of the way station battery. With the relay KR energized its repeater relay KRP is of course also energized, and this circuit includes the front contact **61** of the relay KR and the wire **62**.

Let use first assume that the operator in the central office DO wishes to clear the signal **2** to permit the passage of a train over the track switch S in an eastwardly direction. This may be accomplished by moving the signal lever SL to the right hand position to complete the following circuit:—beginning at the terminal (+) of the central office battery, signal lever SL, wires **63** and **64**, neutral contact **65** of the relay KR, wire **66**, polar contact **67** of the relay KR, wires **68** and **69**, winding of the signal indicating relay SR, line wire **70**, winding of the signal control relay SZ, wire **71**, to the common return wire C connected to the midpoint of the central office battery.

The completion of this circuit will energize the relay SZ to the right hand position in which the signal **2** is cleared through the following circuit:—beginning at the terminal (+) of the way station battery, front contact **73** of the relay SZ, wire **74**, polar contact **75** of the same relay, wire **76**, front contacts **72** and **77** of the polar home relay **2H** (which home relay is energized by current of normal polarity when two blocks in advance of signal **2** are unoccupied), switch machine contact **78**, wire **79** through the mechanism of signal **2** to the negative terminal (—) of the way station battery. The signals **1**, **2** and 2^d are preferably **3**-position signals of which the caution circuits, have for convenience, been omitted, and the take-siding signal is preferably **2**-position.

Clearing of the signal **2** will open the contact **27** associated with said signal, thereby deenergizing the signal repeating relay M and effecting dropping of its contacts **80** and **81**. Dropping of the contact **80** will deenergize the approach lock relay AL (the detail of which circuit is shown in the prior application above referred to), and dropping of the contact **81** will complete a circuit including the back contact **52** of the approach lock relay AL, which circuit reverses the potential applied to the correspondence relay KR, which circuit may be traced as follows:—beginning at the terminal (—) of the way station battery, contact **82** of the relay WZ, wire **83**, contact **84** of the relay WP, series resistance unit **85** (having an ohmic resistance preferably equal to that of the relay X), wire **86**, back contact **81** of the relay M, wire **87**, back contact **52** of the relay AL, wire **53**, contact **54**, line wire **10**, lever contact **55**, wire **56**, back contact **57** of the relay RP, wire **58**, winding of the relay KR, wire **59**, front contact **60** of the relay NP, to common return wire C connected to the midpoint of the way station battery. The

flow of current in the relay KR is reversed thereby operating its polar contacts in its left hand position. In this connection, it may be pointed out that the relay KR is preferably of such construction that the neutral contacts will not drop during the reversal of polarity of current applied to the relay.

With the relay KR now assuming its left hand position, the energizing circuit for the signal control relay SZ is broken at the contact 67 of the relay KR, but since an auxiliary stick circuit including the relays SR and SZ in series and also including the front stick contact 68 of the relay SR and the wire 69 and 102 was previously closed, the relays SR and SZ are maintained energized. Also, with the relay KR now assuming its left hand position the hands-off light HO is energized through the following circuit:—beginning at the terminal (+) of the central office battery, polar contact 90 of the relay KR assuming its left hand position, wires 91 and 92, hands-off light HO to the other terminal (—) of the central office battery. Also, the east bound signalling lamp E is energized through the following circuit:—beginning at the terminal (+) of the central office battery, polar contact 90 of the relay KR in its left hand position, wires 91 and 93, front contact 94 of the relay KRP, wire 95, front contact 96 of the relay KR, wire 97, front contact 98 of the relay SR, wire 99, signal lever contact 100, through the east bound signal lamp E (indicating that a signal has been cleared for east bound traffic over the track switch S assuming its main track position as indicated by the miniature track switch *ms*) to the other terminal (—) of the central office battery. The illumination of the hands-off light HO informs the operator that he must not operate his switch lever SLW, this because the switch should not be attempted to be operated, and could not be operated by reason of the approach lock relay AL being down, so long as one of the signals associated with the switch S are in the clear position. Also, if the switch lever SWL actually were moved to the opposite position nothing would occur in response thereto, either immediately or after the signal 2 is again put to stop, this because the relay NP would not be stuck up through its front stick contact 106 and front contact 13 of relay RP because the relay RP cannot be picked up with the relay KR assuming its dotted left hand position. Furthermore, if the lever SWL is operated while the relay KR assumes the left hand position, the relay KR cannot be returned to the normal right hand position unless the lever SWL is first returned to the position it assumed when the hands-off lamp HO was first illuminated, this because the contacts 55—57 or 55—106, as the case may be, are out of correspondence under the conditions assumed.

Let us now bear in mind that the track switch S assumes the main track position, the signal 2 assumes its clear proceed position, the approach lock relay AL and the signal indicating relay M are deenergized. Let us further observe what effect the passage of a train over the detector track circuit containing the track relay T will have and let us observe how this deenergization of the track relay T will energize the OS-ing light OS associated with the miniature track layout *ps*. Let us assume that an east bound train is about ready to accept the clear signal 2, and as it does it treads upon the detector track circuit, thereby deenergizing the track relay T and dropping its contact 54, thereby breaking the energizing circuit for the correspondence relay KR heretofore traced. the dropping of which in turn deenergizes the repeater relay KRP, so that the detector track circuit occupancy lamp OS is lighted through the following circuit:—beginning at the terminal (+) of the central office battery, polar contact 90 of the relay KR in its left hand position, wires 91 and 93, neutral contact 94 of the relay KRP assuming its deenergized position, wire 101, the OS-ing lamp OS, to the other terminal (—) of the central office battery. Obviously, the OS lamp will be extinguished as soon as the track relay T picks up, thereby informing the operator at the central office that the train has passed beyond the detector track circuit containing track relay T and has entered into the single track section.

It will also be noted that dropping of the relay KR will deenergize the east bound signal lamp E. Also that the passage of the train by signal 2 will reenergize the relay M and the relay AL, thereby re-applying current of positive polarity to the relay KR, leaving the lamp E extinguished until the train has progressed into the single track section to a point where relay 2H is reenergized with normal polarity, under which condition relays M and AL are deenergized returning the relay KR to its dotted position and causing the lamp E to be again illuminated.

Should the operator now attempt to operate the switch machine SM, he would of course be unable to do so because the signal 2 will have again cleared as soon as the train has travelled beyond the zone which governs the home relay 2H, and with the signal 2 clear resulting in deenergization of the approach relay AL will prevent operation of the switch machine SM, all in a manner as indicated in the prior application above referred to. Also, should the operator move the switch lever SWL to the dotted position this would avail him nothing, because the wire 16 is no longer connected to the polar contact 17 of the relay KR, so that movement of the lever SWL will not effect picking up of the relay RP, nor will it effect dropping of the relay NP. Also, the contact 55 when moved to the dotted position would not complete a circuit, because this circuit would still be open at the contact 13 of the relay RP. Furthermore, the relay KR cannot be energized toward the right with the lever SWL out of correspondence with the relays RP and NP. It is thus seen that the operator must first return his signal lever SL to the neutral position before he can either extinguish his hands-off light HO or operate the switch machine SM, and when he does this he must remanipulate the lever SWL.

Let us therefore assume that the operator returns the signal lever SL to the middle position thereby effecting deenergization of the relays SR and SZ, and in this connection it should be noted that the circuit just broken was a stick circuit and included the stick contact 68 of the relay SR. Deenergization of the signal control relay SZ will of course return the signal 2 back to its stop position or condition (as in the event when light signals are used), thereby effecting energization of the signal repeater relay M, and after a short interval of time, this on the assumption that there is no train approaching, the relay AL will again pick up, and when this occurs the original circuit for the correspondence relay KR including the front contact 52 of the approach locking relay AL will be re-closed, thereby energizing the relay KR back to its right hand

position, extinguishing the hands-off light HO and extinguishing the east bound lamp E.

Let us now assume that the operator at the central office DO wishes to operate the track switch S to the take siding position, and in order to do so moves his switch machine control lever SWL to the dotted position. This movement of the lever SWL to the dotted position will break the energizing circuit for the relay KR at the contact 55 of the lever SWL, and in so doing will drop the auxiliary stick relay X, which also was included in series with this relay KR having included in series therewith its stick contact 47, so that the energy is cut off of the way station end of the line wire 10 at the front contact 47 of the relay X. Also, movement of the switch lever SWL to the dotted position effects closure of the following circuit for the relay RP:—beginning at the terminal (+), winding of the relay RP, wires 103 and 104, switch lever SWL, wire 16, polar contact 17 of the relay KR, wire 18, resistance unit 14, to the common return wire C connected to mid-point of the central office battery. The completion of this circuit will pick up the relay RP, which by its lifting of contact 13 will stick up the relay NP (this relay NP being slow dropping as conventionally shown) in series with relay WZ through the following circuit:—beginning at the terminal (—) of the central office battery, winding of the relay NP, wire 12, front contact 13 of the relay RP, wire 105, front contact 106 of the relay NP, wire 107, contact 55 of the lever SWL assuming its dotted line position, line wire 10, contact 54 of the track relay T, wire 53, front contact 52 of the approach relay AL, wires 51 and 108, back contact 109 of the relay X, wire 110, front contact 111 of the relay Y (the relay Y still being energized by its stick circuit including contacts 30 and 33), wire 112, front contact 113 of the relay WP, wire 114, winding of the relay WZ, to the common return wire C connected to the midpoint of the central office battery.

It is thus noted that the relay NP is included in a stick circuit including its own front contact 106 and including the relay WZ in series. The completion of this circuit will of course operate the polar contacts of the relay WZ to their left hand position, thereby operating the switch machine SM to its take siding position by a suitable circuit conventionally indicated by the dotted line 115 and front contact 121 of relay T.

Attention is directed to the fact that the relays RP and NP are now both energized, and that under this condition the relay KR has both of its terminals connected to the common return wire C and is deenergized, and that with the relays NP and RP both energized the transient light TL will not be illuminated in spite of the fact that the relay KRP has its back contact 116 closed and the fact that the contact 90 of the relay KR assumes its right hand position.

As soon as the switch machine SM has, however, been unlocked, the relay WP is deenergized and the back contact 113 of this relay WP assumes its retracted position, thereby opening the stick circuit for the relay NP. This stick circuit is maintained opened for a sufficient period of time to allow the contacts of the relay NP to drop away, as the relay Y is slightly slower acting than either of the relays NP or RP. With the relay NP now deenergized, the transient light TL is illuminated through the following circuit:—beginning at the terminal (+) of the central office battery, contact 90 of the relay KR assuming its right hand position, wire 117, back contact 116 of the relay KRP, wires 118 and 119, transient light TL, wire 120, back contact 60 of the relay NP, to the mid-point C of the central office battery. The illumination of this transient light TL informs the operator that the distant switch machine control relay WZ has been operated in response to the movement of his lever and that the switch machine SM has been unlocked in response thereto as manifested by dropping of the relay WP, but that the switch machine has not yet responded completely to the new position of the relay WZ, thus indicating that the switch machine is in a transient condition.

The switch machine is now presumed to be operating toward its take-siding position and the initiation of such operation of course effected deenergization of the switch machine repeater relay WP as soon as the switch machine was unlocked mechanically, and with the auxiliary relay X now deenergized the opening of the contact 30 of the relay WP effects deenergization of the auxiliary relay Y, so that both the relays X and Y are deenergized.

Let us assume for the purpose of considering the operation of the switch machine when stalled in mid-stroke at this time. With the relays X and Y both deenergized and the relays WP also deenergized it will be noted that the control relay WZ is again connected to the line wire 10 through the following partial circuit:—beginning at the line wire 10, front contact 54 of track relay T, wire 53, front contact 52 of approach relay AL, wires 51 and 108, back contact 109 of relay X, wire 110, back contact 111 of relay Y, wire 122, back contact 113 of relay WP, wire 114 to the relay WZ. It is thus apparent that the operator is free to operate the switch machine SM if it should be stalled in mid-stroke, this by reason of the partial circuit just traced including the wire 122 and the back contacts 111 and 113 of the relays Y and WP, it of course is understood that the operator is free to apply energy of either polarity to the line wire 10 from the central office DO if he so desires, this because the polar contacts of the relay KR now assume their right hand position.

Let us now assume that the switch machine has completed its operating stroke to the take siding position, and in so doing has energized the switch repeater relay WP to its left hand energized position, thus bringing it into correspondence with the polar position of the relay WZ. With the relays WZ and WP assuming corresponding polar positions and with the relays X and Y still deenergized, as heretofore explained, the following circuit for the correspondence relay KR is completed:—beginning at the negative terminal of the way station battery, contact 82 of the relay WZ assuming the left hand position, wire 123, polar contact 42 of the relay WP assuming the left hand position, wire 43, front contact 44 of the relay WP, wires 45 and 124, back contact 125 of the relay Y, wires 126 and 49, winding of the relay X, wires 50 and 51, front contact 52 of the relay AL, wire 53, front contact 54 of the relay T, wire 10, contact 55 of the lever SWL assuming its dotted position, wire 107, back contact 106 of the relay NP, wire 59, winding of relay KR, wire 58, front contact 127 of the relay RP, to the common return wire C connected to the midpoint of the way station battery. It is to be noted that this circuit for the relay KR has been pole changed on the energy end, and the ter-

minals of the relay KR itself have been pole changed. The relay KR can thus not be energized to its right hand position unless the switch repeater relay WP, the switch control relay WZ and the switch lever SWL assume corresponding normal or reverse positions.

The completion of this circuit for relay KR will of course operate this relay to its right hand position, and will effect picking up of the series relay X. With the relay X now picked up and with the relays AL and WP in their energized position the relay Y will again be picked up through the following pick-up circuit:—beginning at the terminal (+) of the way station battery, front contact 30 of the relay WP, wires 31 and 130, front contact 131 of the relay X, wires 132 and 35, winding of the relay Y, wire 36, front contact 37 of the relay AL, to the other terminal (—) of the way station battery. With the relay Y once picked up it is stuck up through its stick contact 33, and the circuit just traced for the relay KR is now closed through the front contact 47 of the relay X instead of the back contact 125 of the relay Y.

As the relay KR is picked up through the circuit last traced for this relay KR, and before the repeater relay KRP had sufficient time to pick up, a circuit is momentarily closed for the miniature track switch operator SO which may be traced as follows:—beginning at the terminal (+) of the central office battery, contact 90 of the relay KR assuming its right hand position, wire 117, back contact 116 of the relay KRP, wires 118 and 134, front contact 135 of the relay KR, wire 136, contact 137 of the switch machine lever SWL assuming the dotted position, wire 138, the reverse operating coil of the miniature track switch operator SO, to the common wire C connected to the midpoint of the central office battery. It is of course understood thatt he transient light TL is extinguished upon picking up of the repeater relay KRP which occurs immediately after the miniature track switch operator SO is operated to its new position.

Summary

Referring to the drawing, it is readily apparent that the line circuit 10 for operating the switch control relay WZ is normally energized from the way station end, and this is true irrespective of whether the relays AL and M are both energized or are both deenergized, this line circuit 10 being energized by one polarity with the relays AL and M energized and being energized with current of the other polarity with the relays AL and M deenergized. Also, operation of the switch control lever SWL will effect opening of said line circuit at the contact 55, this irrespective of the rapidity with which the lever SWL is operated, this by reason of the fact that the relays RP and NP are slow picking up, and that during this deenergization of the line circuit 10 the relay X is deenergized, thereby removing the source of current from the way station end of this line circuit 10. Also, since relay X drops quickly one of the relays RP or NP will be stuck up through the line circuit 10 in series with the relay WZ. Furthermore, it is readily seen that the relay WZ cannot be connected to the line wire 10 unless the relays WP and Y are either both energized or are both deenergized while the relay X is deenergized, as readily seen from the contacts 111 and 113 of relays Y and WP. It is also seen that the relays Y and WP will remain in their normal energized condition unless either the approach relay AL is deenergized and opens its contact 37, or the switch machine relay WP is deenergized as it would in response to initiation or operation of the switch machine SM, so that the relay WZ can be controlled from the line wire 10 with the relay X down so long as the switch machine SM has not already been initiated or the approach relay AL deenergized by reason of a hazardous traffic approaching condition.

Referring now more particularly to the apparatus in the central office DO it will be noted that the control relay WZ can only be energized in series with one of the relays RP or NP, and that this can occur only when the other relay NP or RP is also energized, from which it appears that one of the relays RP or NP are included in a stick circuit and that if the line circuit is open during this condition that the particular one of these relays RP or NP which is included in such stick circuit will assume its deenergized position, and that this occurs as soon as the relay WP is deenergized as it will in response to operation of the switch machine in response to a change in the position of the control relay WZ due to the circuit under consideration. Also, it will be noted that the relay KR can only assume an energized position when the relays RP and NP assume non-corresponding positions, that the relays RP or NP cannot be picked up unless the relay KR assumes its right hand normal position, and that the relay KR will be energized to its left hand dotted position when the relays AL and M assume their deenergized position manifesting a proceed indication by one of the wayside signals 1, 1^d, 2 and 2^d, from which it is apparent that movement of the lever SWL will not permit operation of the switch machine SM so long as one of these signals 1, 1^d, 2 and 2^d, are clear as manifested by deenergization of the relay M, and that if the lever SWL has been moved under this condition that subsequent movement of the clear signal to its stop position will not permit operation of the switch machine SM, this because the relay KR will under the condition assumed assume its dotted left hand position under which condition the lever SWL cannot pick up the relay RP or NP corresponding to the position then assumed by the lever SWL. Under this condition the hands-off light HO is illuminated. In other words, if the operator should move the lever when the hands-off light HO is illuminated no response of the switch machine will take place either immediately or after the cleared signal has been put to stop as may be done by operating the signal lever SL, and the operator must re-manipulate his lever SWL to effect operation of the switch machine SM. Attention is also directed to the fact that the signal relay SZ can only be energized with the relay KR energized toward the right, and that the relay KR will be energized toward its left hand position as soon as one of the signals 1, 1^d, 2 and 2^d assumes a clear position in response to energization of the signal relay SZ, and that movement of the relay KR to its left hand position will open the original energizing circuit for the relay SZ at the contact 67 of the relay KR, but that this signal circuit including relays SR and SZ will remain intact through the stick contact 90 of the relay SR.

Having thus shown and described one rather specific embodiment of the present invention and having illustrated this embodiment of the invention in considerable detail, it is desired to be understood that this has not been done for the purpose of showing the scope of the invention

nor the exact construction preferably employed in practicing the same but has been resorted to in order to facilitate description of the underlying principles of the invention and one manner in which these principles may be taken advantage of, and it is further desired to be understood that various changes, modifications and additions may be made to the particular embodiment of the invention illustrated to adapt the same to the particular problem encountered in practicing the same, all without departing from the spirit or scope of the invention, except as demanded by the scope of the following claims.

What I claim as new is:—

1. A switch control system comprising, a central office, a distant way station, a traffic controlling device at said way station, a circuit connecting said office and way station, means for controlling said traffic controlling device over said circuit by current derived from a source at said central office and automatically removed when said traffic controlling device has responded to such current, a stick means for giving an indication at said office of the condition of said traffic controlling device by being controlled by said current flowing over said circuit from a source at said central office.

2. A switch control system comprising, a central office, a distant way station, a traffic controlling device at said way station, a circuit connecting said office and way station, means for controlling said traffic controlling device over said circuit by current derived from a source at said central office and automatically removed when said traffic controlling device has completely responded to such current, a stick device at said way station for when deenergized permitting control of said traffic controlling device controlled over said line circuit from a current source at said central office, and indicating means at said office controlled over said circuit from a source at said way station.

3. In combination, a line circuit connecting a central office and a distant way station, a polar stick device at said way station, an electro-responsive indicating device at said central office normally energized from a source of current at said way station, means at said way station for removing said way station source from said line circuit a short period of time following momentary opening of said line circuit, means at said central office including a lever which upon operation of said lever will momentarily open said line circuit and then energize it from the office end to effect operation of said polar stick device, and means at said way station for preventing energization of said line circuit from said way station end if said stick device is out of correspondence with the device it controls.

4. In combination, a line circuit connecting a central office and a distant way station, an electro-responsive indicating device at said central office normally energized from a source of current at said way station, means at said way station for removing said way station source from said line circuit a short period of time following momentary opening of said line circuit, and means at said central office including a lever which upon operation of said lever will momentarily open said line circuit and then energize it from the office end.

5. In combination, a line circuit connecting a central office and a distant way station, a polar stick device at said way station, an electro-responsive indicating device at said central office normally energized from a source of current at said way station, means at said way station for removing said way station source from said line circuit a short period of time following momentary opening of said line circuit, means at said central office including a lever which upon operation of said lever will momentarily open said line circuit and then energize it from the office end, and means effective upon operation of said polar stick device for preventing said line circuit being energized from said way station end until a traffic controlling device controlled by said stick device has responded to the changed condition of said stick device.

6. In combination, a line circuit connecting a central office and a distant way station, a polar stick device at said way station, an electro-responsive indicating device at said central office normally energized from a source of current at said way station, means at said way station for removing said way station source from said line circuit a short period of time following momentary opening of said line circuit, means including a lever at said central office whereby operation of said lever will momentarily open said line circuit and then energize it from the office end, and means including an electro-responsive stick device for preventing said line circuit being re-energized from said way station end until a traffic controlling device controlled by said stick device has responded to the changed condition of said stick device.

7. In combination, a line circuit connecting two stations of a railway system, a lever at one of said stations for controlling a traffic controlling device to either of two positions, a polar relay at said one station having its windings directionally connected in said line circuit in accordance with the position of said lever, and means including a source of current at the other station for energizing said line circuit in accordance with the position of said traffic controlling device controlled by said lever.

8. In a traffic controlling system, the combination with a central office and a distant way station, a line circuit connecting said office and way station, multi-polarity energy applying means and a polar relay at said office, means for including either said energy applying means or said polar relay in said circuit and for including said polar relay in a particular polar direction in said circuit in accordance with the last polarity of current applied to said line circuit by said energy applying means, and means at said way station controlled by said energy applying means and for applying current from a source at said way station to said polar relay over said line circuit.

9. In a traffic controlling system, the combination with a central office and a distant way station, a line circuit connecting said office and way station, opposite polarity energy applying means and a two position polar relay at said office, means for including either said energy applying means or said polar relay in said circuit and for including said polar relay in a particular polar direction in said circuit in accordance with the last polarity of current applied to said line circuit by said energy applying means, and means at said way station controlled by said energy applying means and for applying current from a source at said way station to control said polar relay to one or the other of its polar positions over said line circuit.

10. In a traffic controlling system, the combi-

nation with a central office and a distant way station, a line circuit connecting said office and way station, multi-polarity energy applying means and a polar relay at said office, means for including either said energy applying means or said polar relay in said circuit and for including said polar relay in said circuit in accordance with the last polarity of current applied to said line circuit by said energy applying means, and means at said way station controlled over said line circuit by said energy applying means and for applying current from a source at said way station to said polar relay over said line circuit.

11. In a traffic controlling system, the combination with a central office and a distant way station, a line circuit connecting said office and way station, multi-polarity energy applying means and a polar relay at said office, means for including either said energy applying means or said polar relay in said circuit and for including said polar relay in a particular polar direction in said circuit in accordance with the last polarity of current applied to said line circuit by said energy applying means, and traffic controlling means at said way station controlled over said line circuit by said energy applying means and including means for applying current from a source at said way station to said line circuit to control said polar relay in accordance with the operated condition of said traffic controlling means.

12. In a traffic controlling system, the combination with a central office and a distant way station, a line circuit connecting said office and way station, opposite polarity energy applying means and a polar relay at said office, means for including either said energy applying means or said polar relay in said circuit and for including said polar relay in a particular polar direction in said circuit in accordance with the last polarity of current applied to said line circuit by said energy applying means, and a control relay at said way station controlled by said energy applying means and having contacts for controlling said polar relay only in the event suitable traffic controlling means controlled by said control relay assumes a condition corresponding to the position assumed by said control relay.

13. In a traffic controlling system, the combination with a central office and a distant way station, a line circuit connecting said office and way station, opposite polarity energy applying means and a polar relay at said office, means for including either said energy applying means or said polar relay in said circuit and for including said polar relay in a particular polar direction in said circuit in accordance with the last polarity of current applied to said line circuit by said energy applying means, and a control relay at said way station controlled by said energy applying means and having contacts for controlling said polar relay only in the event suitable traffic controlling means controlled by said control relay and said control relay are in correspondence.

14. In a traffic controlling system, the combination with a central office and a distant way station, a line circuit connecting said office and way station, opposite polarity energy applying means and a polar relay at said office, means for including either said energy applying means or said polar relay in said circuit and for including said polar relay in a particular polar direction in said circuit in accordance with the last polarity of current applied to said line circuit by said energy applying means, and means at said way station for non-simultaneously controlling said polar relay and receiving governing current from said energy applying means and including means for preventing energy from being applied to said line circuit at said way station when said energy applying means at said office is applying energy to said line circuit.

15. In combination, a central office, a distant way station, a line circuit connecting said office and way station, a lever at said office, a polar relay at said office includable in said circuit in a polar direction only in accordance with the position of said lever, a track switch at said way station, a signal for governing the movement of trains over said track switch, and means at said way station for energizing said line circuit and in turn said polar relay by current of a polarity depending on the position of said switch when said signal is at proceed and energizing said line circuit by current of the reverse polarity for the same position of said switch if said signal is at stop.

16. In combination, a central office, a distant way station, a line circuit connecting said office and way station, a lever at said office, a polar relay at said office includable in said circuit in a polar direction only in accordance with the position of said lever, a track switch at said way station, a plurality of signals for governing the movement of trains over said track switch, and means at said way station for energizing said line circuit and in turn said polar relay by current of a polarity depending on the position of said switch when any one of said signals is at proceed and energizing said line circuit by current of the reverse polarity for the same position of said switch if said signals are all at stop.

17. In combination, a central office, a distant way station, a line circuit connecting said office and way station, a lever at said office, a polar relay at said office includable in said circuit in a polar direction only in accordance with the position of said lever, a track switch at said way station, an approach locking relay for locking said switch, and means at said way station for energizing said line circuit and in turn said polar relay by current of a polarity depending on the position of said switch when said approach locking relay is energized and energizing said line circuit by current of the reverse polarity for the same position of said switch if said approach locking relay is deenergized.

18. In combination, means for controlling a switch machine in accordance with the polarity of current of a particular character transmitted wholly over a single line circuit from a source at a central office and for transmitting an indication to said central office by current of the same character over said line circuit but from a source at said way station and having a polarity corresponding to the position of said switch machine.

19. In combination, a line wire connecting a local office and a distant way station of a railway system, a source of energy at each end of said line circuit, a control relay at said way station, an indicating relay at said office, a way station series relay included in series with the way station source when said indicating relay is energized, an office series relay included in series with said office source when said control relay is energized, and means for excluding said respective series relays from said respective sources.

20. In combination, a line wire connecting a local office and a distant way station of a railway system, a traffic controlling device at said way station, a source of energy at each end of said line circuit, a control relay at said way station

for controlling said traffic controlling device, an indicating relay at said office, a way station series relay included in series with the way station source when said indicating relay is energized, an office series relay included in series with said office source when said control relay is energized, and means for excluding said respective series relays from said respective sources by momentary opening of said respective energizing circuits.

21. In combination, a line wire connecting a local office and a distant way station of a railway system, a traffic controlling device at said way station, a source of energy at each end of said line circuit, a control relay at said way station for controlling said traffic controlling device, an indicating relay at said office, a way station series relay included in series with the way station source when said indicating relay is energized, an office series relay included in series with said office source when said control relay is energized, a front contact on each of said series relays included in series with their respective windings, whereby momentary opening of the respective energizing circuits will result in excluding the respective series relays.

22. In combination, a line wire connecting a local office and a distant way station of a railway system, a traffic controlling device at said way station, a source of energy at each end of said line circuit, a control relay at said way station for controlling said traffic controlling device, an indicating relay at said office, means for energizing said control relay through said line wire from said office source through a front contact and the winding of a series relay at said office, means for energizing said indicating relay through said line wire from said way station source through a front contact and the winding of a series relay at said way station, whereby momentary opening of either of said energizing circuits results in opening of such circuit at the energy source end thereof.

23. In combination, a line wire connecting a local office and a distant way station of a railway system, a traffic controlling device at said way station, a source of energy at each end of said line circuit, a polar control relay at said way station for controlling said traffic controlling device, a polar indicating relay at said office, means for energizing said control relay through said line wire from said office source through a front contact and the winding of a series relay at said office and a back contact of a series relay at said way station, means for energizing said indicating relay through said line wire from said way station source through a front contact and the winding of a series relay at said way station and a back contact of said series relay at said office, whereby momentary opening of either of said energizing circuits results in disconnecting the source of current and substituting a polar relay therefor.

24. In a traffic controlling system for railroads, the combination with a local office and a distant point on a railroad, of a line circuit connecting said office and distant point, a track switch at said point, a switch machine for operating said track switch, a signal for governing traffic over said track switch, and means including a control lever for controlling said switch machine over said line circuit in accordance with the polarity of current applied to said line circuit at the office end thereof and for indicating at said office the correspondence between said lever and switch machine by the application of current to said line wire of one polarity at said distant point and indicating at said office a proceed condition of said signal by the application of current of the reverse polarity at said distant point.

25. In combination, a line circuit connecting two stations, a source of energy at both of said stations, means at both of said stations for connecting and disconnecting its source to said line circuit, said means being effective to disconnect its respective source from said line circuit when said line circuit is momentarily deenergized to thereby allow the source at the other station to be connected, and means at both stations controlled by the energized and deenergized condition of said line circuit.

26. In combination; a first station; a second station; a line circuit connecting said first and second stations; a source of energy at both of said stations; control means at both of said stations for at times connecting or disconnecting said sources in series in said line circuit, said control means at said first station normally disconnecting said source from said line circuit, and said control means at said second station normally connecting its source in said line circuit; means associated with each of said control means causing that particular one of said control means having its source connected in series in said line circuit to disconnect its source upon momentary deenergization of said line circuit to allow the other control means to connect its source in said line circuit; means at each station for at times momentarily opening said line circuit; and means at each station at times controlled by a source of energy at the other station over said line circuit.

27. In combination, a line circuit connecting two stations of a railway system, a lever at one of said stations for controlling a traffic controlling device at the other of said stations to either of two positions, a polar relay at said one station having its winding reversibly connected in said line circuit in accordance with the position of said lever, and means including a source of current at said other station for energizing said line circuit with one polarity or the other in accordance with the position of said traffic controlling device controlled by said lever.

28. In a system for governing power operated track switches, an outlying track switch, a control lever for governing the operation of said track switch, a miniature track switch associated with said control lever, indicating means effectively actuated only when said control lever and said track switch are in corresponding positions, and electro-responsive means governed only momentarily in accordance with the position of said lever and only when said indicating means is effectively actuated to thereby actuate said miniature track switch.

29. In a traffic controlling system for railroads, a central office, a distant way station, a traffic controlling device at said way station, a circuit connecting said office and said way station, means for controlling said traffic controlling device over said circuit by current derived from a source at said central office, a stick relay having a stick circuit energized by said current in said circuit, means for opening said circuit when said traffic controlling device responds to said current in said circuit, whereby said stick circuit is deenergized, and an indicator controlled by said stick relay to indicate the response of said traffic controlling device.

30. In a traffic controlling system for railroads; a central office; a field station; a line circuit con-

necting said office and said field station; a control lever at said central office having normal and reverse positions; normal and reverse stick relays at said office; pick up circuits for said normal and reverse stick relays closed when said lever is in corresponding normal or reverse positions; stick circuits for said normal and reverse stick relays, each of which circuits includes a contact of the opposite one of said stick relays, said lever in an opposite position and said line circuit; a polar relay at said field station responsive to the current flow in said line circuit when both of said stick relays are picked up to thereby control a traffic governing device at such field station; means for momentarily opening said line circuit when the traffic governing device responds to its control by said polar relay, whereby the stick circuit for said normal or reverse relay is open depending upon the position of said control lever; and indication means controlled by said normal and reverse stick relays.

31. In combination, a local office and a distant point, a pair of line wires connecting said office and point, a track switch at said distant point, a switch machine for controlling said track switch, manual means at said office for controlling said switch machine over said line wires, a polar relay at the office end of said line wires, and means for controlling said polar relay over said line wires to one polar position when said manual means and said switch machine assume corresponding positions and for controlling said polar relay to the other polar position when a signal for governing traffic over said track switch has been cleared.

32. In combination, a local office and a distant point, a pair of line wires connecting said office and point, a track switch at said distant point, a switch machine for controlling said track switch, manual means at said office for controlling said switch machine over said line wires, a polar relay at the office end of said line wires, and means for controlling said polar relay over said line wires to one polar position when said manual means and said switch machine assume corresponding positions, for controlling said polar relay to the other polar position when a signal for governing traffic over said track switch has been cleared, and deenergizing said polar relay when there is a train moving over said track switch.

33. In a centralized traffic control system for railroads, a track switch, a switch machine for operating said track switch, a free and non-lockable control lever for governing operation of said switch machine, indication means at times governed in accordance with the position and locked condition of said track switch, and means indicating a lack of correspondence between said control lever and said indication means initiated upon movement of said lever and remaining effective until said track switch starts to operate.

34. In a centralized traffic control system for railroads, a track switch, a switch machine for operating said track switch, a control lever for governing operation of said switch machine, indication means being at times governed in accordance with the position of said track switch, means registering a lack of correspondence between said control lever and said track switch until said track switch starts to operate, and an indicating lamp governed both by said indication means and by said means registering a lack of correspondence between said control lever and said track switch.

35. In a centralized traffic control system for railroads, a traffic controlling device, a free and non-lockable control lever for manually governing operation of said traffic controlling device, indication means selectively governed to indicate the condition of said traffic controlling device, means registering the lack of correspondence between said control lever and said traffic controlling device initiated upon movement of said lever and effective until said traffic controlling device starts to operate, and an indicator governed both by said indication means and by said registering means.

36. In combination; a track switch; a switch machine for operating said track switch; a freely movable control lever for governing operation of said switch machine; indication means only intermittently governed by the position or unlocked condition of said track switch; a relay rendered active whenever said control lever is out of correspondence with the position of said track switch as indicated by said indication means; and means maintaining said relay rendered active, independently of said lever and said indication means, if once rendered active, until said switch machine starts to operate said track switch.

37. In combination, a track switch, a switch machine for operating said track switch, a free and non-lockable control lever for governing the operation of said switch machine, indication means at times jointly controlled in accordance with the position of said track switch and said switch machine, means distinctively controlled when said control lever is out of correspondence with said track switch and said machine as indicated by said indication means, and other means for maintaining the distinctive condition of said means until said track switch starts to operate.

WALTER W. WENHOLZ.

DISCLAIMER

2,009,007.—*Walter W. Wenholz*, Rochester, N. Y. TRAFFIC CONTROLLING SYSTEM FOR RAILROADS. Patent dated July 23, 1935. Disclaimer filed October 10, 1936, by the assignee, *General Railway Signal Company*.

Hereby enters this disclaimer to claims 18, 19, and 20 of said Letters Patent.

[*Official Gazette November 3, 1936.*]