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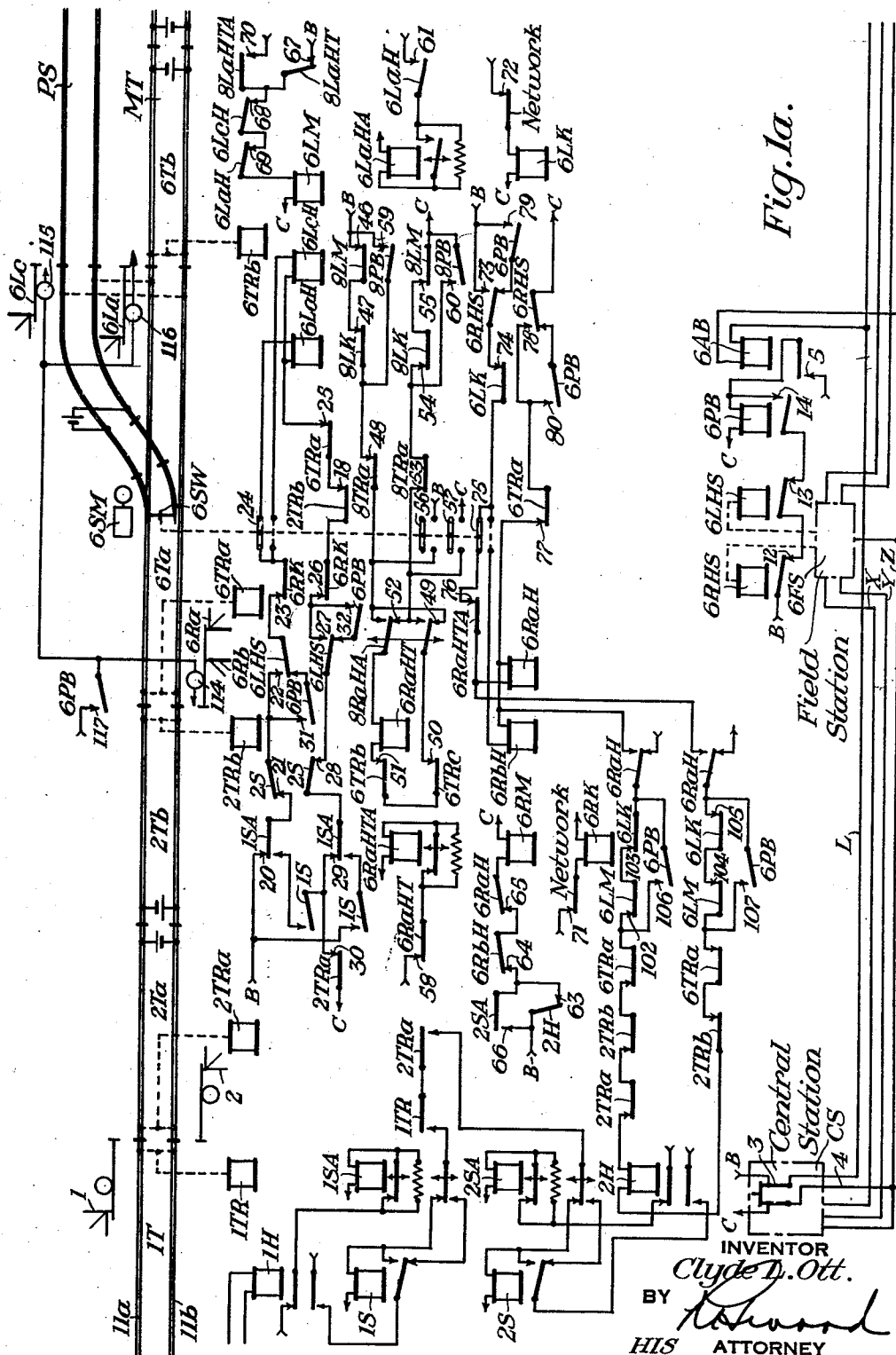
C. L. OTT

2,176,273

RAILWAY TRAFFIC CONTROLLING APPARATUS

Filed May 25, 1937

3 Sheets-Sheet 1



Oct. 17, 1939.

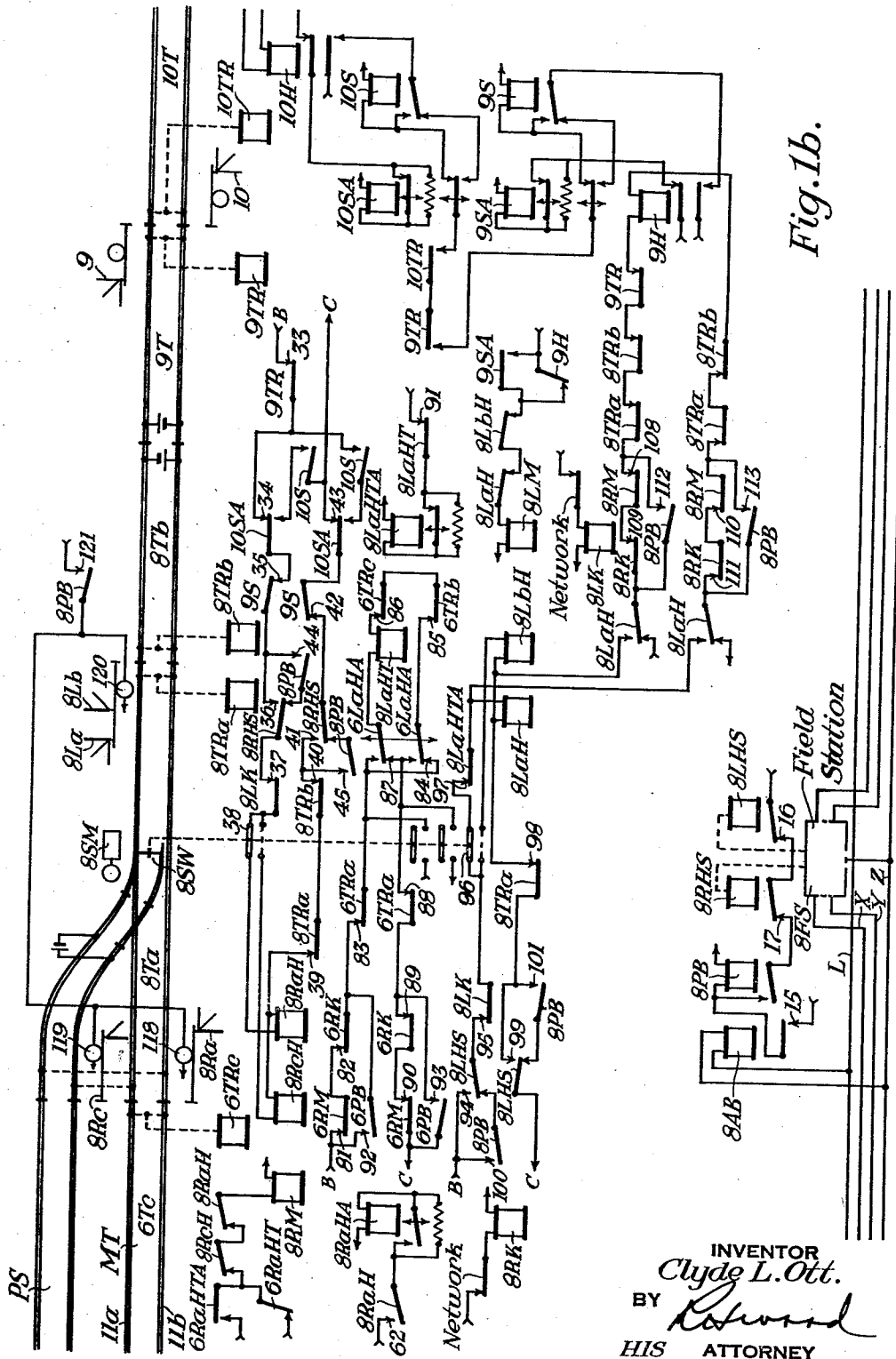
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Filed May 25, 1937

3 Sheets-Sheet 2



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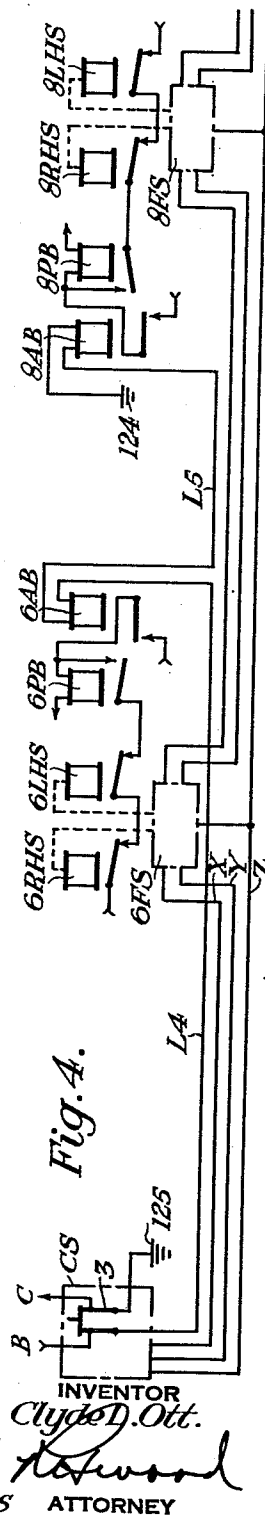
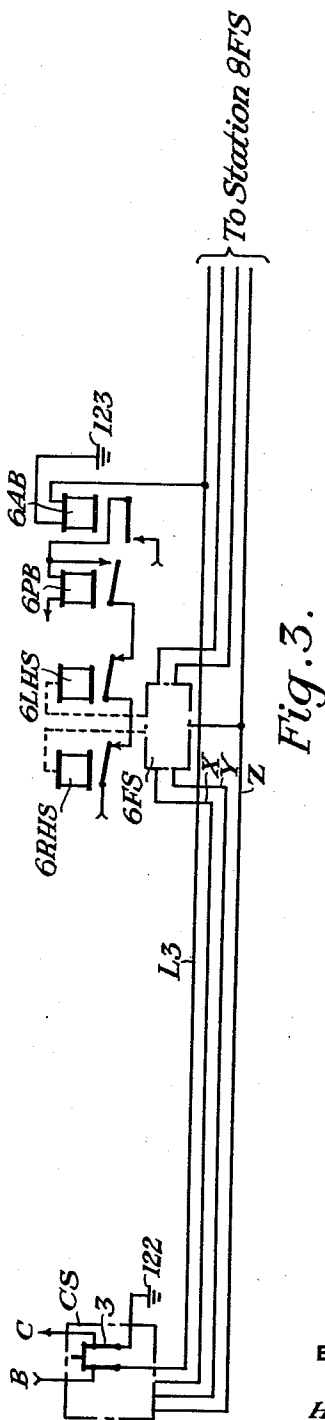
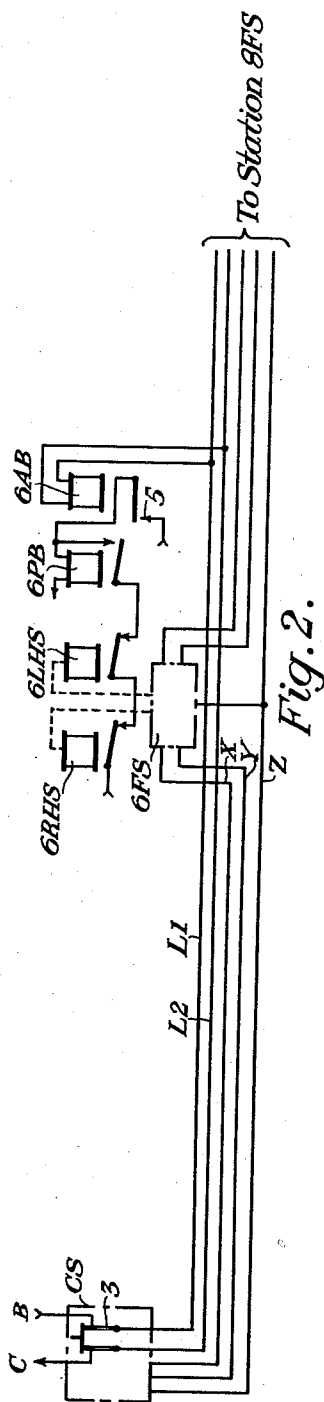
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RAILWAY TRAFFIC CONTROLLING APPARATUS

Filed May 25, 1937

3 Sheets-Sheet 3



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2,176,273

RAILWAY TRAFFIC CONTROLLING
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Application May 25, 1937, Serial No. 144,655

6 Claims. (Cl. 246—3)

My invention relates to railway traffic controlling apparatus, and particularly to apparatus of the type involving signals which are controlled jointly by devices automatically responsive to traffic conditions and apparatus manually controlled from a central station through the medium of line circuits.

A feature of my invention is the provision of novel and improved apparatus responsive to a failure of a controlling line circuit for removing a signal from the control of remotely controlled apparatus governed by such line circuit and allowing such signal to function automatically. Another feature of my invention is the provision of apparatus for a centralized traffic control or C. T. C. signal system which, upon failure of the controlling line circuit, automatically switches the signals for operation as an automatic signal system. A still further feature of my invention is the provision in systems of the type here under consideration of novel means for restoring the C. T. C. system to normal operation subsequent to reclosing of the controlling line circuit. Again, a feature of the invention is the provision of means wherewith the operator of a C. T. C. system may cause the signals to be operated as an automatic system. An additional feature of the invention is the provision of means to indicate to trainmen when the control of the remote operator is removed and they are operating under automatic signal protection only. Other features and advantages of my invention will appear as the specification progresses.

I shall describe several forms of apparatus embodying my invention, and shall then point out the novel features thereof in claims.

In present day signaling, it is common practice to subordinate automatic cab signals and wayside signals to manual control to the extent that an operator at a central station may hold the trains or indicate the movement they should make while at the same time permitting the signaling indications to reflect traffic conditions. In other words, the automatic cab or wayside signal system provides the required safety, but the operator may intervene to regulate the train movements that could be made with safety. With such centralized control there exists the possibility of delay and interruption to traffic in the case of a broken line wire or the complete wiping out of a stretch of line by a storm or other hazard, which immediately destroys centralized control operation and usually also destroys communicating facilities. According to my invention, the signals are automatically removed from

control of the remotely controlled apparatus upon failure of a line circuit, with the result that little or no delay to traffic follows a line circuit failure. The centralized control operation is put back into operation subsequent to the reclosing of the line circuit when proper steps have been taken by the operator at the central office.

Although the present invention, in whole or in part, may be applied to any suitable type of cab and wayside signal system either for a single track or a multiple track railway, the invention has been shown applied to a type of wayside signal system for a single track—generally known as the absolute permissive block signal system or A. P. B. system. Furthermore, the invention may be applied to any suitable type of centralized traffic control or C. T. C. system and is disclosed as applied to a circuit code type of C. T. C. system. The invention may be applied to any selected stretch of the signal system.

In the accompanying drawings, Figs. 1a and 1b, when placed end to end with Fig. 1a at the left-hand side, constitute a diagrammatic view of one form of apparatus embodying my invention applied to a C. T. C. system for a stretch of single track railway including a passing siding. Figs. 2, 3 and 4 are diagrammatic views of different forms of apparatus for detecting the integrity of the controlling line wires of the apparatus of Figs. 1a and 1b, and which different forms of apparatus each embody the invention. In each of the several views, like reference characters designate similar parts.

Referring to Figs. 1a and 1b, when taken together with Fig. 1a at the left, the reference characters 11a and 11b designate the track rails of a stretch of single track railway, the main track MT of which is provided with a passing siding PS connected with the main track MT by track switches 6SW and 8SW. A train movement from the left to right through this stretch of track is assumed to be an eastbound movement, and a movement from right to left is assumed to be a westbound movement.

At each end of the passing siding PS are located four signals governing traffic in both directions on the main track and onto and off the siding. At switch 6SW, the signal 6Ra governs eastbound traffic on the main track MT and the signal 6Rb governs traffic into the siding PS. Signal 6La governs main track westbound traffic and signal 6Lc governs traffic leaving the siding. At switch 8SW, the signals 8Ra and 8La govern east and westbound traffic on the main track, respectively, and the signals 8Lb and 8Rc govern

movements into and out of the passing siding, respectively. The signals 6La, 6Lc, 8Ra and 8Rc are commonly called starting signals, and the signals 6Ra, 6Rb, 8La and 8Lb are called entrance signals.

In addition to the signals at the two ends of the passing siding PS, as above described, there may be intermediate signals arranged in pairs or in staggered relation, in accordance with usual practice. In Fig. 1a, a pair of opposite intermediate signals 1 and 2 is illustrated for governing west and eastbound traffic, respectively. In Fig. 1b, a pair of opposite intermediate signals 9 and 10 is also illustrated.

These wayside signals may be of any desired construction, either semaphore, position light or color light, and are illustrated conventionally by symbols commonly used in the art.

The track rails 11a and 11b are formed in the usual manner into track circuited sections, the sections being indicated by a reference character T plus a distinguishing exponent to represent the relation to the wayside signals. The track relays for these sections are designated by the reference character R plus an exponent corresponding to the associated track section, their connections to the track rails being shown by dotted lines. It is clear that the track relays thus provided constitute devices automatically responsive to traffic conditions of the stretch. The signal control relays governed by the track relays and which in turn govern the operation of the wayside signals will be taken up and described more fully hereinafter.

CS designates a central station from where an operator governs traffic through the stretch by virtue of a centralized traffic control system which permits the operator to selectively govern the indications of the different wayside signals and preferably the positions of the track switches, such control system being carried out through the medium of field stations 6FS and 8FS located adjacent the track switches 6SW and 8SW, respectively, and line wires X, Y and Z extending from the central station CS to the field stations. It will be understood that additional field stations may be provided at selected points along the stretch and also along the railway outside of the stretch shown in the drawings, the line wires X, Y and Z being extended to such additional field stations. Other than certain relays to be referred to later, the C. T. C. system apparatus located partly at the central station CS and partly at the field stations 6FS and 8FS is not shown since this apparatus forms no part of my invention and it may be any one of several types. One type of C. T. C. apparatus that may be used is that described and claimed in the United States Letters Patent No. 2,062,839 granted December 1, 1936 to Clarence S. Snively for Selective controlling and indicating apparatus. It is deemed sufficient for the present application to point out that the operator at the central station CS can selectively control the relays 6RHS and 6LHS associated with the field station 6FS, and the relays 8RHS and 8LHS associated with the field station 8FS by sending code impulses over the line wires X, Y and Z, of which line wires the wire Z is the common return wire and the wires X and Y are the code control wires. Although three line wires X, Y and Z are shown for the C. T. C. system, it will be understood the line circuits may include only two line wires or they may consist of more than three line wires, as desired. The significant thing regarding these line

wires, as far as this application is concerned, is the fact that these line wires are ordinarily strung on a pole line where they are exposed to storms and other hazards.

The code control relays 6RHS and 6LHS at the field station 6FS are utilized to control the signals located adjacent the track switch 6SW by virtue of contacts operated by these relays being interposed in the control circuits for the signal relays in a manner to later appear. Likewise, the code control relays 8RHS and 8LHS at the field station 8FS are utilized to control the signals located adjacent the track switch 8SW by contacts of the relays being interposed in the control circuits for the signal relays.

The C. T. C. system preferably would also include apparatus for governing the position of the track switches 6SW and 8SW by controlling the operation of power actuated switch machines designated as 6SM and 8SM. The apparatus for governing the position of the track switches is not shown for the sake of simplicity since it is not involved in the present invention. According to usual practice, the switch machines 6SM and 8SM would be of the dual type provided with hand levers for operation by trainmen at the switch, with the result that operation of the switches may be effected in the event of a failure of the C. T. C. system.

To remove the signals from control of the C. T. C. system, a transfer or switching relay and a repeater relay are provided at each field station, a transfer relay 6AB and a repeater relay 6PB being located at field station 6FS, and a transfer relay 8AB and a repeater relay 8PB being located at the field station 8FS. The transfer relays 6AB and 8AB are normally energized over a line circuit supplied with power at the central station CS, the operating windings of these two relays being connected with the line circuit. As shown in Figs. 1a and 1b, this line circuit includes a line wire L and the common return wire Z of the C. T. C. system, the circuit being traced from the B terminal of any convenient source of current, such as a battery not shown, over one blade of a double-pole single-throw switch 3 located at the central station CS, line wire L, winding of relay 6AB at station 6FS or winding of relay 8AB at station 8FS, common return wire Z, wire 4, the other blade of switch 3, and to the C terminal of the current source. The line wire L is mounted on the pole line in a manner so as to be exposed to the same hazards as the other wires X, Y and Z. It follows that the relays 6AB and 8AB are normally energized and picked up but that failure of either the line wire L or Z, or operation of switch 3 causes the relays to be deenergized and released. Thus, any weather condition or hazard that destroys the line circuits of the C. T. C. system would, ordinarily at least, cause the transfer relays at the field stations to become deenergized.

Looking at field station 6FS, the repeater relay 6PB is provided with a simple pick-up circuit including the back contact 5 of the transfer relay 6AB, and with a stick circuit including the B terminal, back contact 12 of the code control relay 6RHS, back contact 13 of code control relay 6LHS, front contact 14 and winding of relay 6PB, and to the C terminal. At station 8FS, the repeater relay 8PB is provided with a pick-up circuit and a stick circuit, the pick-up circuit including back contact 15 of the transfer relay 8AB, and the stick circuit serially including back contact 16 of code control relay 8LHS and back con-

tact 17 of code control relay 8RHS. It is to be seen, therefore, that the repeater relays 6PB and 8PB are each normally deenergized and are each picked up upon release of the associated transfer relay. Once picked up, the repeater relay at each field station is retained energized until one of the code control relays at the same station is picked up. In other words, a failure of a line wire that causes the transfer relays at the field stations to be released causes, in turn, the repeater relays at each of the field stations to be energized and picked up, and the repeater relays are retained energized subsequent to reclosing of the line circuit until a code control relay of the C. T. C. system is selectively energized and picked up by the operator at the central station sending the necessary code. It is also clear that the operator at the central station can control the transfer and repeater relays at the different field stations by operating the switch 3, the repeater relays at the field stations being released subsequent to reclosing of the switch 3 by the operator sending a code to pick up a code control relay at the same field station. The manner whereby contacts of the repeater relays 6PB and 8PB are interposed in the control circuits for the signal control relays for removing the signals from the control of the C. T. C. system and permitting the signals to be operated in an A. P. B. system will be pointed out as the control circuits for the signal control relays are taken up and described.

The relays and circuits governing the operation of the signals are, as previously set forth, jointly governed by traffic conditions through the medium of the track relays and by the C. T. C. system through the medium of the code control relays at the field stations. The circuits for the signal control relays have been illustrated by showing, in most cases, the circuit controlling contact fingers of the various relays remote from the windings of the relays. The relation of each such contact finger with its relay is indicated by placing the reference character of the relay just above the contact finger, and showing the contact finger in the position corresponding to the normal energized or deenergized condition of the relay. In the present instance, the relays and circuits are those required to effect a well-known type of A. P. B. system in present-day use. This being so, it is believed sufficient to describe the signal control relays and their control circuits only in so far as is necessary for a full understanding of my invention. It is understood, of course, that the invention is not limited to the A. P. B. type of wayside signal system and is useful for other arrangements of signals governing traffic either on single track or multiple track railways. Furthermore, the wayside apparatus may be that required for a cab signal system or for a combination cab and wayside signal system.

Each signal is provided with a home relay designated by the reference character H, plus a prefix corresponding to the signal. The entrance signals 6Ra and 8La are further provided with a special home relay identified as HT, plus a prefix corresponding to the signal. The special home relays 6RaHT and 8LaHT and the home relays 6LaH and 8RaH for the starting signals 6La and 8Ra each have associated therewith a slow acting repeater relay designated by the reference character A, plus a prefix corresponding to the reference character of the associated relay.

The intermediate signals 1, 2, 9 and 10 are, in addition to the home relays, each provided with

a directional stick relay designated by the reference character S, plus a prefix corresponding to the signal, and each of the associated home relays is provided with a slow acting repeater relay designated by the reference character SA, plus a prefix corresponding to the reference character of the associated signal.

The immediate operating circuits for the several signals are in each case completed over contacts of the home and special home relays of the signal. However, such operating circuits are not shown in order not to unduly complicate the drawings since the signal operating circuits form no part of the invention, and it will be understood they would be in accordance with standard practice.

In accordance with usual practice in C. T. C. systems, the apparatus for the signals adjacent the switch 6SW includes the usual signal repeater relays and approach locking relays. A signal repeater relay 6RM checks the position of the signal 6Ra, 6Rb and the intermediate signal 2 by checking the position of the control relays of these signals. A signal repeater relay 6LM checks the position of the signals 6La, 6Lc and the entrance signal 8La by checking the position of the control relays of the associated signals. To be specific, the signal repeater relay 6RM is controlled over a circuit extending from the B terminal of the current source, polar contact 63 of the home relay 2H, back contact 64 of home relay 6RbH, back contact 65 of home relay 6RaH, winding of relay 6RM, and to the C terminal of the current source, a back contact 66 of the repeater relay 2SA completing a shunt path around the polar contact 63. The signal repeater relay 6LM is provided with a control circuit extending from the B terminal over polar contact 67 of special home relay 8LaHT, back contact 68 of home relay 6LcH, back contact 69 of home relay 6LaH, winding of relay 6LM, and to the C terminal, a back contact 70 of relay 8LaHTA completing a branch path around the polar contact 67. An approach locking relay 6RK associated with eastbound traffic approaching the switch 6SW is controlled over the usual circuit network provided for such locking relays and which network is indicated at 71. An approach locking relay 6LK associated with westbound traffic is governed over a similar circuit network indicated at 72. These two circuit networks 71 and 72 are not shown, since their specific arrangement forms no part of the invention, and may be any one of several well-known types.

The control circuits for the signal repeater relays 6RM and 6LM which check the signals at switch 6SW are similar to the circuits for the relays 6LM and 6RM, respectively, and will be readily understood by an inspection of the drawings. The approach locking relays 6RK and 6LK associated with traffic approaching the switch 6SW are governed over circuit networks similar to the networks provided for relays 6RK and 6LK.

Looking at the home relays 6LaH and 6LcH for the starting signals 6La and 6Lc, a control circuit selectively governs these relays in accordance with the position of the switch 6SW, the relay 6LaH being selected when the switch is set for traffic on the main track, and the relay 6LcH being selected when the switch is reversed for a movement to the passing siding. Starting at the B terminal shown at the upper left-hand portion of Fig. 1a, this control circuit may be

traced over front contact 20 of relay 1SA, back contact 21 of relay 2S, front contact 22 of code control relay 6LHS, front contact 23 of relay 6RK, contact 24 operated by the switch 6SW and closed with the switch normal, winding of relay 6LaH, front contact 25 of track relay 6TRA, front contact 18 of track relay 2TRb, front contact 26 of relay 6RK, front contact 27 of code control relay 6LHS, back contact 28 of relay 2S, front contact 29 of relay 1SA, front contact 30 of track relay 2TRA, and to the C terminal. This control circuit is pole-changed over contacts of the relays 1S and 1SA, as will be readily understood by an inspection of Fig. 1a. With switch 6SW reversed and the contact 24 moved to the dotted line position, the relay 6LcH is selected. When the home relay 6LaH is energized and picked up, its associated repeater relay 6LaHA is energized over a simple circuit including front contact 61 of relay 6LaH. It follows that the relays 6LaH and 6LcH, and, in turn, the corresponding signals 6La and 6Lc, are governed by traffic conditions to the left of switch 6SW and also by the code control relay 6LHS. Specific attention is directed to the fact that the front contacts 22 and 27 of the code control relay 6LHS are provided with by-paths governed by the repeater relay 6PB at the field station 6FS. The by-path around front contact 22 of relay 6LHS includes front contact 31 of relay 6PB, and the by-path around the front contact 27 includes the front contact 32 of relay 6PB. Consequently, a condition of the line circuits for the C. T. C. system which causes the repeater relay 6PB to be picked up in the manner described herinbefore removes the home relays 6LaH and 6LcH, and, in turn, their corresponding signals, from the control of the C. T. C. system and permits these relays and their signals to operate automatically in response to traffic conditions.

The home relays 8RaH and 8RcH for the starting signals 8Ra and 8Rc are provided with a control circuit similar to the control circuit just described for the home relays of the signals 6La and 6Lc. Starting at the B terminal shown at the upper right-hand portion of Fig. 1b, a control circuit extends over front contact 33 of track relay 9TR, front contact 34 of relay 10SA, back contact 35 of relay 9S, front contact 36 of code control relay 8RHS, front contact 37 of relay 8LK, contact 38 operated by the switch 8SW and closed when the switch is normal, winding of relay 8RaH, front contact 39 of track relay 8TRA, front contact 40 of relay 8TRb, front contact 41 of code control relay 8RHS, back contact 42 of relay 9S, front contact 43 of relay 10SA, and to the C terminal. This control circuit is pole-changed over contacts of the relays 10S and 10SA, as will be readily understood by an inspection of Fig. 1b. Also, when the switch 8SW is reversed and contact 38 moved to the dotted line position, the relay 8RcH is selected. When the home relay 8RaH is picked up, its associated slow acting relay 8RaHA is energized over a simple circuit including front contact 62 of relay 8RaH. It follows that the relays 8RaH and 8RcH, and, in turn, their associated signals 8Ra and 8Rc, are governed by traffic conditions to the right of switch 8SW and by the code control relay 8RHS of the C. T. C. system. Special attention is directed to the fact that the front contacts 36 and 41 of the code control relay 8RHS are each provided with a by-path controlled by the repeater relay 8PB at the field station 8FS, the by-path for the front

contact 36 including front contact 44 of relay 8PB, and the by-path for the front contact 41 including front contact 45 of relay 8PB. Consequently, any condition as to the line circuits of the C. T. C. system that causes the repeater relay 8PB to be energized and picked up removes the home relays 8RaH and 8RcH, and, in turn, their signals, from the control of the C. T. C. system and permits these relays and signals to operate automatically in accordance with traffic conditions.

Referring now to the control circuits for the relays of the entrance signals 6Ra and 6Rb, and looking first at the special home relay 6RaHT, a control circuit extends from the B terminal over front contact 46 of relay 8LM, front contact 47 of relay 8LK, front contact 48 of track relay 8TRA, back contact 49 of relay 8RaHA, front contact 50 of track relay 6TRc, front contact 51 of track relay 6TRb, winding of relay 6RaHT, back contact 52 of relay 8RaHA, front contact 53 of track relay 8TRA, front contact 54 of relay 8LK, front contact 55 of relay 8LM, and to the C terminal. This control circuit is pole-changed over contacts of the slow acting relay 8RaHA, and is supplied with current over contacts 56 and 57 when the switch 6SW is reversed. With relay 6RaHT picked up, the associated slow acting repeater relay 6RaHTA is supplied with current over front contact 58 of relay 6RaHT.

The important feature concerning this control circuit for the special home relay 6RaHT, as far as my invention is concerned, lies in the fact that the repeater relay 8PB at the field station 8FS governs by-paths around the contacts of the signal repeater relay 8LM and the approach locking relay 8LK interposed in this control circuit. The front contact 59 of relay 8PB completes a by-path around front contacts 46 and 47 of relays 8LM and 8LK, respectively, and the front contact 60 of relay 8PB completes a by-path around the front contacts 54 and 55 of relays 8LK and 8LM, respectively. Hence, a condition of the C. T. C. system that results in the repeater relay 8PB being picked up removes the special home relay 6RaHT from all control by the apparatus of the C. T. C. system and permits this relay to be governed automatically by traffic conditions.

The control circuit for the home relays 6RaH and 6RbH for the starting signals 6Ra and 6Rb extends from the B terminal over front contact 73 of code control relay 6RHS, front contact 74 of relay 6LK, contact 75 operated by switch 6SW and closed when the switch is normal, front contact 76 of the repeater relay 6RaHTA for the associated special home relay 6RaHT, winding of relay 6RaH, front contact 77 of track relay 6TRA, front contact 78 of code control relay 6RHS, and to the C terminal. When the switch 6SW is reversed and contact 75 is moved to the dotted line position, the relay 6RbH is energized. Thus, the home relays 6RaH and 6RbH, as well as the special home relay 6RaHT, are controlled by traffic conditions to the right of the switch 6SW, and the home relays are also controlled directly by the C. T. C. system through the medium of the code control relay 6RHS. The special feature to be here noted is the fact that by-paths are provided around the front contacts 73 and 78 of the code control relay 6RHS, the by-path around contact 73 being completed over front contact 79 of the repeater relay 6PB, and the by-path around front contact 78 being com-

pleted by the front contact 80 of the repeater relay 6PB.

Again, it is to be noted that a condition of the C. T. C. system that causes the repeater relay 6PB to be picked up removes the home relays 6RaH and 6RbH, and, in turn, their associated signals, from control of the S. T. C system and permits these relays and signals to operate automatically in accordance with traffic conditions.

Turning now to the special home relay 8LaHT associated with the entrance signal 8La, a control circuit extends from the B terminal over front contact 81 of relay 6RM, front contact 82 of relay 6RK, front contact 83 of track relay 6TRa, back contact 84 of relay 6LaHA, front contact 85 of track relay 6TRb, front contact 86 of track relay 6TRc, winding of relay 8LaHT, back contact 87 of relay 6LaHA, front contact 88 of relay 6TRa, front contact 89 of relay 6RK, front contact 90 of relay 6RM, and to the C terminal. With the relay 8LaHT picked up, its repeater relay 8LaHTA is supplied with current over front contact 91 of relay 8LaHT.

To remove relay 8LaHT from control of the signal repeater relay 6RM and the approach locking relay 6RK associated with the C. T. C. system, the front contacts 81 and 82 of relays 6RM and 6RK, respectively, are provided with a by-path including front contact 92 of relay 6PB, and the front contacts 89 and 90 of relays 6RK and 6RM, respectively, are provided with a by-path including front contact 93 of relay 6PB.

The home relays 8LaH and 8LbH provided for the entrance signals 8La and 8Lb are governed over a control circuit traced from the B terminal, front contact 94 of code control relay 8LHS, front contact 95 of relay 8LK, contact 96 operated by switch 8SW and closed with the switch normal, front contact 97 of relay 8LaHTA, winding of relay 8LaH, front contact 98 of track relay 6TRa, front contact 99 of code control relay 8LHS, and to the C terminal. With the switch 8SW reversed and the contact 96 moved to the dotted line position, the relay 8LbH is energized.

It is to be observed that the front contacts 94 and 99 of the code control relay 8LHS are provided with by-paths, the by-path around front contact 94 being completed at front contact 100 of repeater relay 6PB, and the by-path around front contact 99 being completed at front contact 101 of relay 6PB. It follows that the special home relay 8LaHT and the home relays 8LaH and 8LbH are removed from the control of the C. T. C system, and the signals 8La and 8Lb are operated automatically by traffic conditions in the event a condition arises in the C. T. C. system that results in the repeater relays 6PB and 6PB being energized and picked up.

The directional stick relays and the repeater relays provided for the intermediate signals 1, 2, 9 and 10 are in each case controlled over circuits of the standard form, and it is thought unnecessary to discuss these circuits in detail since they will be readily understood from an inspection of the drawings.

The control circuit for the home relay 2H of signal 2 is shown at the lower left-hand portion of Fig. 1a. This circuit for the relay 2H is that of standard form and need not be described in detail except to point out that front contacts 102 and 103 of signal repeater relay 6LM and approach locking relay 6LK, respectively, are interposed in one side of the circuit, and front contacts 104 and 105 of relays 6LM and 6LK,

respectively, are interposed in the other side of the circuit. That the relay 2H may operate in response to traffic conditions only in the event of a failure of the C. T. C. system which might effect the operation of the relays 6LM and 6LK, the front contact 106 of repeater relay 6PB completes a by-path around the front contacts 102 and 103, and the front contact 107 of relay 6PB completes a by-path around the front contacts 104 and 105.

The control circuit for the home relay 9H of signal 9 is shown in the lower right-hand portion of Fig. 1b. This circuit is in accordance with standard practice and need not be described except to point out that the front contacts 108 and 109 of signal repeater relay 6RM and approach locking relay 6RK, respectively, are interposed in one side of the circuit, and front contacts 110 and 111 of relays 6RM and 6RK, respectively, are interposed in the other side of the circuit. In order that the home relay 9H may operate in response to traffic conditions only in the event a failure of the C. T. C. system effects the operation of the relays 6RM and 6RK, a by-path around front contacts 108 and 109 is completed at front contact 112 of the repeater relay 6PB, and a by-path around front contacts 110 and 111 is completed at front contact 113 of relay 6PB.

A marker lamp is mounted on each of the starting and entrance signals to indicate to the trainmen when the signals are removed from the control of the C. T. C. system and are being operated in accordance with the A. P. B. system. In Fig. 1a, the marker lamps 114, 115 and 116 are mounted on the usual masts of the signals 6Ra, 6Lc and 6La, respectively. These marker lamps are connected in parallel in a circuit completed over front contact 117 of the repeater relay 6PB. Thus, a condition of the C. T. C. system that results in the repeater relay 6PB being picked up to remove the signals from control of the C. T. C. system in the manner described hereinbefore also causes the marker lamps 114, 115 and 116 to be illuminated.

In Fig. 1b, marker lamps 118, 119 and 120 are mounted on the masts of signals 8Ra, 8Rc and 8La, respectively, and are connected in parallel in a circuit completed at front contact 121 of repeater relay 6PB. Thus, a condition of the C. T. C. system that results in the repeater relay 6PB being picked up to remove the signals from control of the C. T. C. system also causes the marker lamps 118, 119 and 120 to be illuminated to indicate to the trainmen that the signals are being operated by the A. P. B. system.

In Fig. 2, the transfer relays at the field stations are controlled over a line circuit independent of the line wires of the C. T. C. system. This line circuit comprises two line wires L1 and L2 which are connected with the B and C terminals of the current source over the switch 3 at the central station CS, and across which line wires the operating winding of the transfer relay 6AB at station 6FS is connected. The transfer relays at other field stations would be connected across the line wires L1 and L2 in the same manner as shown for relay 6AB of field station 6FS. The line wires L1 and L2 would be disposed between the central station and the field stations in a manner so as to be exposed to the same hazards as the line wires X, Y and Z of the C. T. C. system. The transfer relay 6AB controls the pick-up circuit for the associated repeater relay 6PB over its back contact 5, and relay 6PB is provided with a stick circuit including back contacts of the code

control relays 6RHS and 6LHS, the same as in Fig. 1a. It is clear that, with the line circuit and transfer relays of Fig. 2 provided for the signal system of Figs. 1a and 1b, a condition of the line circuits that results in the transfer relays being deenergized and the associated repeater relays picked up will remove the signals from the control of the C. T. C. system and cause the signals to be operated automatically by the A. P. B. system in the same manner as described for Figs. 1a and 1b.

In Fig. 3, the transfer relays are controlled over a grounded line circuit including a line wire L3 disposed on the pole line so as to be exposed to the same hazards as the line wires of the C. T. C. system. The B terminal of the current source is connected over switch 3 to the line wire L3, and the C terminal is connected with a ground electrode 122. At field station 6FS, transfer relay 6AB has one terminal of its operating winding connected with the line wire L3 and the other terminal of its winding connected with a ground electrode 123. The transfer relay at field station 8FS would be connected between the line wire L3 and ground in the same manner as transfer relay 6AB. Thus, in Fig. 3, the transfer relays are normally energized and are deenergized upon a failure of the line circuits or by the operation of the switch 3 at the central station. The repeater relay 6PB of Fig. 3 is controlled in the same manner as described for Fig. 1a. Consequently, with the apparatus of Fig. 3 applied to the signal system of Figs. 1a and 1b, a failure of the line circuit that results in the deenergizing of the transfer relays and the picking up of the associated repeater relays will remove the signals from the control of the C. T. C. system and permit them to be operated by the A. P. B. system.

In Fig. 4, the transfer relays are serially interposed in a line circuit which is grounded. This line circuit extends from the B terminal of the current source over one side of the switch 3, line wire L4, operating winding of transfer relay 6AB, line wire L5, operating winding of transfer relay 8AB, ground electrodes 124 and 125, the other side of the switch 3, and to the C terminal. The line wires L4 and L5 are disposed on the pole line so as to be exposed to the same hazards as the wires X, Y and Z. It is clear that, with the apparatus constructed in the manner shown in Fig. 4, the transfer relays are normally energized and are deenergized by a failure of the line circuits or by operation of the switch 3. The transfer relays of Fig. 4 are effective to pick up the associated repeater relays, the same as in previous cases, and hence, with the apparatus of Fig. 4 applied to the signal system of Figs. 1a and 1b, a condition of the line circuits of the C. T. C. system that causes the transfer relays to be deenergized is effective to remove the signals from control of the C. T. C. system and permit them to be operated by the A. P. B. system.

Although I have herein shown and described only a few forms of apparatus embodying my invention, it is understood that various changes and modifications may be made therein within the scope of the appended claims without departing from the spirit and scope of my invention.

Having thus described my invention, what I claim is:

1. In combination, a stretch of railway track, a track relay responsive to traffic conditions of said stretch, a signal for governing traffic through the stretch, a remotely controlled relay located along the stretch, a central station, a circuit including a line wire for controlling said remotely

controlled relay from said central station, a signal relay for governing the operation of the signal, a control circuit for said signal relay including a front contact of the track relay and a front contact of the remotely controlled relay, a transfer relay, another circuit including said line wire for normally energizing said transfer relay, a repeater relay, a pick-up circuit for the repeater relay including a back contact of the transfer relay, a stick circuit for the repeater relay including a back contact of the remotely controlled relay, and a by-path around the front contact of the remotely controlled relay interposed in said control circuit including a front contact of said repeater relay.

2. In combination, a section of railway track, a track circuit for the section including a track relay, two signals one adjacent each end of the section for governing traffic in opposite directions through the section, a home relay for each signal for operating the signal, a field station adjacent said section, a control relay for each signal at said field station, an energizing circuit for each home relay including a front contact of the back relay and a front contact of the associated control relay, a central station, a circuit for selectively controlling said control relays including a pair of line wires extending from the central station to the field station, a transfer relay and a repeater relay at said field station, a pick-up circuit for the repeater relay including a back contact of the transfer relay, a stick circuit for the repeater relay including a back contact of each of said control relays, a normally closed circuit for energizing said transfer relay including another line wire extending from the central station to the field station and positioned so as to be exposed to the same hazards as said pair of line wires, and by-paths one around the front contact of the control relay interposed in each of said energizing circuits and each by-path including a front contact of said repeater relay.

3. In combination, a section of railway track, a track circuit for the section including a track relay, two signals one adjacent each end of the section for governing traffic in opposite directions through the section, a field station adjacent said section, two control relays at said field station one for each of said signals, operating means for each signal controlled jointly by the associated control relay and by the track relay, a central station, a circuit for selectively controlling said control relays from said central station including a line wire, a transfer relay and a repeater relay at the field station, a normally closed circuit for energizing said transfer relay including said line wire, means including front contacts of said repeater relay to remove said signals from control of the control relays and to permit them to be operated by the track relay alone, a pick-up circuit for the repeater relay including a back contact of the transfer relay, and a stick circuit for said repeater relay including a back contact of each of the control relays.

4. In combination, a stretch of railway track, automatic means responsive to traffic conditions in said stretch, a signal for governing traffic through the stretch, a remotely controlled relay located along the stretch, a central station, a line circuit for controlling said relay from said central station, operating means for said signal controlled jointly by said automatic means and said relay, a transfer relay, another line circuit extending between said stretch and said central station for normally energizing said transfer relay, a re-

peater relay, a pick-up circuit for said repeater relay including a back contact of the transfer relay, a stick circuit for said repeater relay including a back contact of said remotely controlled relay, and means including a front contact of the
5 repeater relay to remove said signal from control of said remotely controlled relay and to permit it to be controlled by said automatic means alone.

5. In combination, a section of railway track,
10 a track circuit for said section including a track relay, a signal for governing traffic through the section, a home relay for governing the operation of said signal, a control relay located adjacent said section, an energizing circuit for said home
15 relay including a front contact of the track relay and a front contact of the control relay, a central station, a line circuit extending from said central station to said section for at times energizing said control relay, a transfer relay and a
20 repeater relay, a pick-up circuit for the repeater relay including a back contact of the transfer relay, a stick circuit for said repeater relay including a back contact of said control relay, another line circuit extending from said central
25 station to said section for normally energizing said transfer relay, and a by-path around the front contact of said control relay interposed in said energizing circuit of the home relay including a front contact of said repeater relay.

30 6. In combination, a stretch of railway track

formed into insulated track sections, wayside signals located at selected points along the stretch for governing traffic through the stretch, automatic apparatus controlled by traffic conditions of the stretch and operating to govern the way-
5 side signals as required for an automatic wayside signal system, code controlled relays located at selected points along the stretch, a central station, means including a line circuit for selectively
10 controlling said code controlled relays from said central station, circuit means governed by said code controlled relays to modify the control of said automatic means over the signals as required to operate the signals as a centralized traffic control
15 system, a plurality of switching means one located at each selected point for the code controlled relays and each including a transfer relay and a repeater relay, means including another
20 line circuit for normally energizing each of said transfer relays from the central station, a pick-up circuit for each repeater relay including a back contact of the associated transfer relay, a stick
circuit for each repeater relay including a back contact of at least one of the code controlled
25 relays at the same location, and means controlled by said repeater relays when energized to remove the modification effected by said code controlled relays over the control of said automatic means.

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