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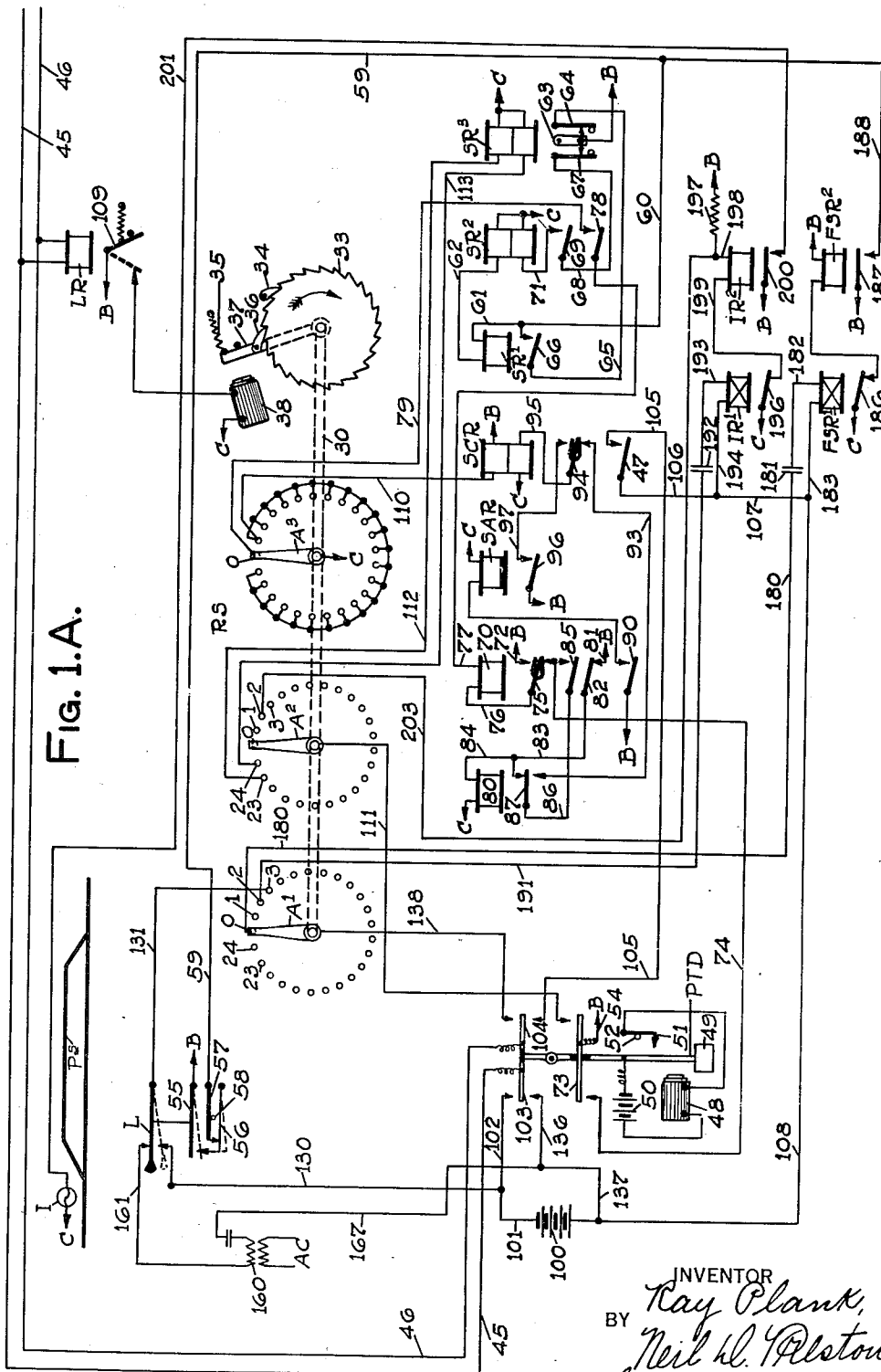
R. PLANK

2,085,039

TRAIN DISPATCHING SYSTEM FOR RAILROADS

Filed Nov. 25, 1929

2 Sheets-Sheet 1



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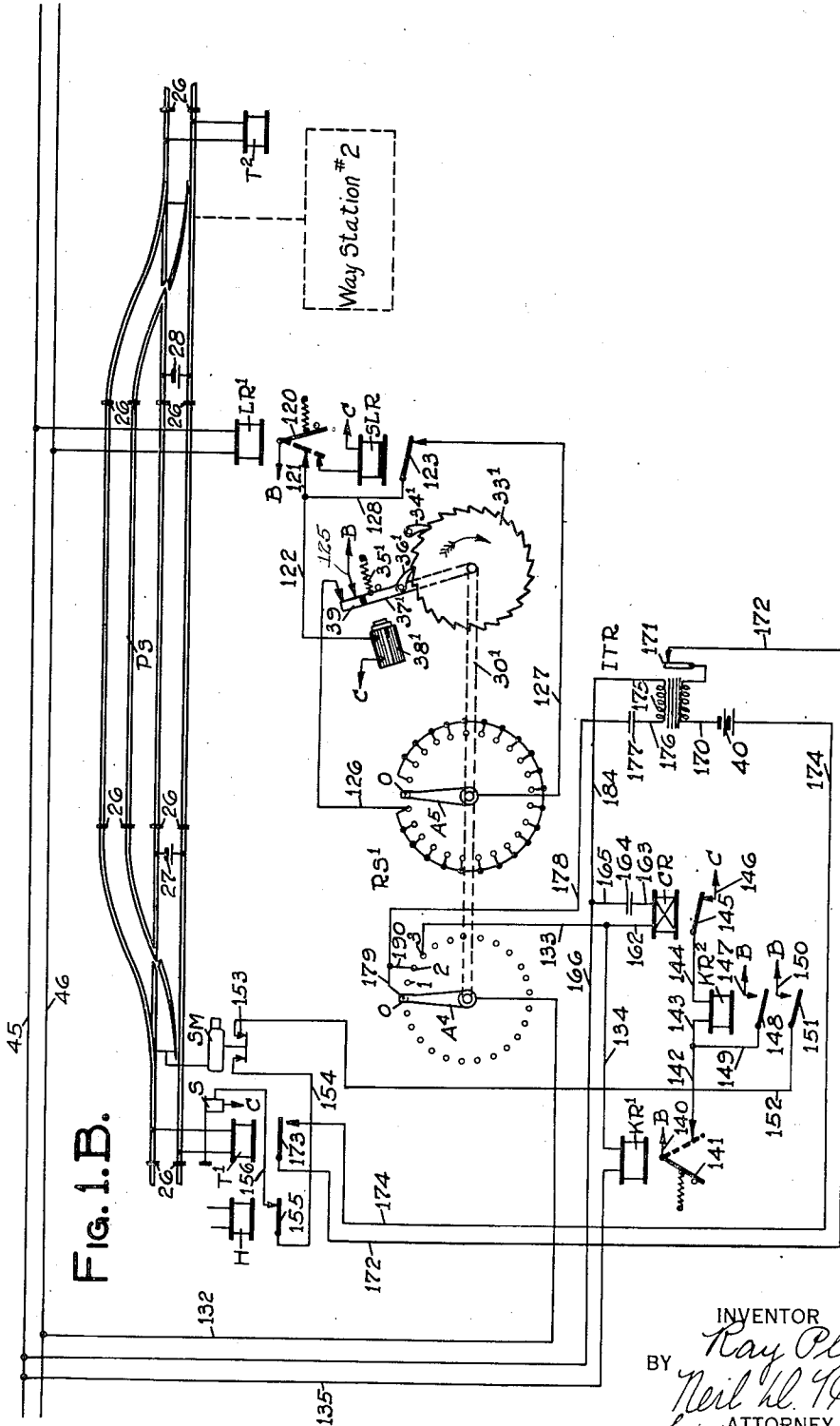
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TRAIN DISPATCHING SYSTEM FOR RAILROADS

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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

2,085,039

TRAIN DISPATCHING SYSTEM FOR
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27 Claims. (Cl. 246—3)

This invention relates to a train dispatching system of the wayside signal directing type, and more particularly to a synchronous selector system, in which synchronous apparatus is controlled and in which indications are transmitted over the same line circuit.

In my prior patent, Patent No. 1,852,367, dated April 5, 1932, I have disclosed a synchronous selector type train dispatching system, which requires three line wires, and if desired an additional checking wire, and the present invention has the advantage of requiring only two line wires, that is one line circuit.

There are many other advantageous features in the dispatching system of the present invention, which will in part appear from the accompanying drawings and will in part be pointed out in the detailed description hereinafter.

In describing the invention in detail, reference will be made to the accompanying drawings, in which:—

Fig. 1A illustrates the apparatus in the dispatcher's office; and

Fig. 1B illustrates the apparatus located at one of a large number of way stations. Figs. 1A and 1B if laid end to end illustrate a complete working portion of the entire system.

Considering the present invention generally, the line circuit is allotted alternately for the purpose of functioning as a stepping circuit and as a message circuit. Although this allotment of the line circuit may be accomplished in many ways, in the particular embodiment of the invention shown, it is accomplished by having two line relays at each way station, one of which responds only to direct current of one polarity, while the other responds only to direct current of the other polarity, and the dispatcher's office apparatus includes a pendulum timing device PTD which alternately connects the stepping mechanism and the message mechanism of the dispatcher's office to this line circuit. It is believed expedient to first consider the structural features of the system and then take up the operation of the system.

Structure.—In accordance with the present invention, each diverging point of a railway system, such as a spur track, or the end of a passing siding, has associated therewith suitable synchronous apparatus, and this location together with its apparatus will hereinafter be termed a way station. Although, in practice, there will be many such way stations in each system, for convenience only one such way station has been illustrated in detail, namely, the station at the

west end of the passing siding PS, the way station at the east end of the passing siding PS having been illustrated conventionally by the square "Way station 2".

The passing siding PS has its track rails divided by insulating joints 26 in the usual way, to provide the usual detector track circuit, of which the detector track circuit at the west end of the passing siding PS includes a track relay T¹ and battery 27, whereas the detector track circuit at the east end of the passing siding is provided with a detector track relay T² and a track battery 28. The passing siding PS is provided with the usual switch machines for controlling the track switches at the ends of the passing siding, of which the switch machine SM only has been shown, and is provided with the usual way side signals for directing train movements into and out of such passing sidings, of which signals the signal S only has been illustrated for convenience.

In accordance with the present invention, the entire railway system is preferably duplicated in miniature in the dispatcher's office, so that the levers, as well as suitable indicators may be located with respect to such miniature track layout, and the correlation of these levers and indicators with the miniature track layout will readily inform the dispatcher the purpose of each lever and indicator, without making reference to some other designation. For convenience, only the miniature passing siding *ps* of this miniature track layout has been illustrated.

Associated with the west end of this miniature passing siding *ps* is an indicating lamp I, which is controlled by the indication relay IR², and with the same end of this miniature passing siding *ps* is associated a lever L for controlling suitable traffic controlling apparatus, such as switch machines, derails or signals, and in accordance with the present invention this lever L is only used for controlling the signal S located at the west end of the passing siding PS (see Fig. 1B).

In the dispatcher's office is also located a rotary synchronous selector RS which includes a shaft 30 having 3 rotatable arms A¹, A² and A³ associated therewith, which arms synchronously rotate over suitable contacts all in a manner more clearly described hereinafter. The shaft 30 may be driven by suitable step by step mechanism, such for instance as shown in my prior patent to which reference has been made, or may be of the type conventionally illustrated, in which the shaft 30 is rotated by suitable electro-

magnetically operated ratchet mechanism. In the arrangement shown, the ratchet wheel 33 is prevented from rotating backwards by a pawl 34, and may be ratcheted in a clock-wise direction, as indicated by the arrow, through the medium of the spring 35 and the pawl 36 one step for each attraction and release of the armature 37 by the electro-magnet 38.

The dispatcher's office equipment includes a line relay LR, which responds to current of negative polarity, and also includes relays 80, 70, SAR, SCR, SR¹, SR², SR³, IR¹, IR², FSR¹ and FSR².

Referring now to the synchronous control apparatus located at the west end of the passing siding PS (see Fig. 1B), there is provided a similar rotary synchronous selector RS¹. This rotary selector RS¹ is provided with contact arms A⁴ and A⁵, the shaft 30¹ is operated by suitable ratchet mechanism, which is identical to that shown in Fig. 1A except that the armature 37 carries a movable contact 39 insulated therefrom.

The way station apparatus also includes a line relay LR¹, a signal control relay KR¹, a repeater control relay KR², a signal cancelling relay CR, and a slow acting relay SLR. The way station apparatus also includes an interrupter ITR for the purpose of generating an alternating current, when required, by energy derived from a local battery 40.

Operation.—Let us assume that the dispatcher located in the dispatcher's office, shown in Fig. 1A, wishes to clear the signal S at the west end of passing siding PS in Fig. 1B, this on the assumption that traffic conditions in advance of the signal S are favorable and the home relay H governed in accordance with such traffic conditions is energized. Under normal "at rest" conditions of the apparatus there are no impulses transmitted to the way station apparatus over the transmission line, comprising the line wire 45 and the common return wire 46. This is because no stepping current can flow with the stepping control relay SCR deenergized, as the front contact 47 of this relay SCR is included in the stepping circuit.

In this connection, attention is directed to the fact that even though the synchronous selector system is at rest, so to speak, the pendulum timing device PTD is continuously operated. This pendulum device PTD is kept in motion by the electro-magnet 48 attracting the pendulum armature 49 intermittently, this by reason of intermittent closure of the following circuit:—beginning at the battery 50, contacts 51 biased against a stop 52, electro-magnet 48 back to battery 50. It is thus seen that with the pendulum 49 once in motion it will remain in motion by the electric energy intermittently flowing in this circuit.

Let us assume that, in order to clear the signal S, the dispatcher moves his lever L to the dotted position, thereby causing momentary closure of the following circuit:—beginning at the terminal B, contacts 55, 56 and 57 (these contacts only closing the circuit momentarily this by reason of the provision of the stop 58), wires 59, 60 and 61, winding of the relay SR¹, wire 62, upper winding of the relay SR², to the common return wire C.

The closure of this circuit causes the relays SR¹ and SR² to be operated to their attracted positions, thereby closing the following two stick circuits:—(1) beginning at the terminal B, contacts 63 and 64, wire 65, stick contact 66, wire 61, winding of the relay SR¹, wire 62, upper winding of the relay SR² to the other terminal C of the

battery containing terminal B; and (2) beginning at the terminal B of said battery, contacts 63 and 67, wire 68, stick contact 69, wire 71, lower winding of the relay SR² to the terminal C of said battery.

With the relay SR² energized the following circuit for energizing the relay 70 is closed the next time the pendulum 49 swings to the right:—beginning at the terminal B, wire 54, pendulum contact 73, wire 74, back contact 75 of the relay 70 (this contact 75 being a make-before-break contact in that its front and back contact connections are made in over-lapped relation), wire 76, winding of the relay 70, wire 77, front contact 78 of the relay SR², wire 79, zero contact O, contact arm A³, to the other terminal C of said battery. The flow of current in this circuit causes the relay 70 to pick up and stick up through the following stick circuit:—beginning at the terminal B of said battery, wire 72, stick contact 75 of the relay 70, wire 76, winding of this relay 70, wire 77, front contact 78 of the relay SR², wire 79, contacts O and A³ back to the terminal C.

Picking up of the relay 70 opens the normal energizing circuit for the relay 80, which may be traced as follows:—beginning at the terminal B of a suitable battery, wire 81, back contact 82 of the relay 70, wires 83 and 84, winding of the relay 80 to the other terminal C of said battery. These successive actions of the relays SR¹, SR² and relay 70 take place during the time the pendulum 49 swings toward the left, and as the pendulum 49 again swings to the right, and so long as it remains there, the relay 80 is maintained energized through the following circuit:—beginning at the terminal B of a suitable battery, flexible wire 54, contact 73 of the pendulum timing device PTD, wire 74, front contact 85 of the relay 70, wire 86, front stick contact 87 of the relay 80, wire 84, winding of the relay 80 to the other terminal C of said battery. This circuit will of course only remain closed while the pendulum 49 is to the right of its pendent position, and assures that the relay 80 maintains its contact 87 closed during this period of the operation of the pendulum.

The relay 70 is, of course, now stuck up through the medium of its front contact 75. Through the medium of its front contact 90 it maintains the slow acting relay SAR energized through a circuit readily traced in the drawings. As the pendulum 49 swings to the left it drops the relay 80 and upon its next swing toward the right, it closes the following circuit for energizing the stepping control relay SCR:—beginning at the terminal B of a suitable battery, wire 54, contact 73 connected to, but insulated from the pendulum 49, wire 74, front contact 85 of the relay 70, wire 86, back contact 87 of the relay 80, wire 93, back contact 94 of the relay SCR (this contact 94 being a make-before-break contact, in that it makes its front and its back contacts in over-lapped relation), wire 95, lower winding of the relay SCR to terminal C.

This relay SCR will of course pick up, and with the relay SAR energized, the following stick circuit for the relay SCR is closed:—beginning at the terminal B of suitable battery, front contact 96 of the relay SAR, wire 97, front contact 94 of the relay SCR, wire 95, lower winding of the relay SCR to the other terminal C of said battery.

With the relay SCR now energized and the pendulum 49 to the left, the following circuit for energizing all of the various line relays, one at

each way station of which the line relays LR and LR¹ only have been shown, is closed:—beginning at the positive terminal of the battery 100, wires 101 and 102, contact 103 connected to, but insulated from the pendulum 49, line wire 45, through each of the various line relays LR, LR¹, etc., wire 46, contact 104, connected to, but insulated from the pendulum 49, wire 105, front contact 47 of the relay SCR, wires 106, 107 and 108, to the negative terminal of the battery 100.

The closure of this circuit causes the line relay LR to be operated towards the left, thereby causing the electromagnet 38 of the ratchet device to be energized through a circuit readily traced in the drawings and including the biased contact 109 of the line relay LR. This line relay LR will of course only operate to its left hand dotted position in the event that it is energized by current of the negative polarity, as is true of the circuit just traced through the line relay LR. This circuit will of course be maintained closed only for a short time, in that it will be interrupted when the pendulum 49 swings toward the right of the pendent position. After this of course, the spring 35 operates the ratchet wheel 33 toward the right one step through the medium of the dog 36, so that the contact arms A¹, A² and A³ will all be moved from the zero contact to the number 1 contact.

Movement of the contact arm A³ from the zero contact to the contact 1 causes the stick circuit for the relay 70 to be broken, which will of course effect deenergization of the relay 70 and in turn effect deenergization of the slow acting relay SAR. The relay SCR will however, not assume its deenergized position even though its lower winding was energized through front contact 96 of the relay SAR, because its upper winding is now energized through the following circuit:—beginning at the terminal B of a suitable battery, upper winding of the relay SCR, wire 110, stationary contact 1, rotary arm A³ to the other terminal C of said battery. Since all of the stationary contacts 1 to 24, inclusive, associated with the arm A³ are connected together and to the upper winding of the relay SCR, this relay SCR will remain energized during rotation of the shaft 30 until the arm A³ again reaches the zero contact O. The line relay LR will of course, be intermittently operated toward the left each time that the pendulum 49 swings to the left and closes the circuit of the various line relays. From this it will appear that the synchronous selector RS in the dispatcher's office will be operated step by step, one step for each swing of the pendulum 49 toward the left.

For reasons which will be more clearly pointed out hereinafter a message circuit may be completed during each swing of the pendulum 49 toward the right, only two such message circuits having been illustrated and will be considered hereinafter.

During the cycle of operation just considered when the rotary arm A² reached the stationary contact 23, the following circuit for the relay SR³ was momentarily closed:—beginning at the terminal B of suitable battery, wire 54, contact 73, wire 111, contact arm A², stationary contact 23, wire 112, upper winding of the relay SR³, to the other terminal C of said battery. The flow of direct current in this circuit is in a direction to cause the contact 63 of the polar relay SR³ to be moved to the right, thereby momentarily opening the stick circuit for the relay SR², but the relay SR² will not drop, because its upper wind-

ing is included in series with the energized winding of the relay SR¹. When the contact arm A², on the other hand, engages the stationary contact 24 the following similar circuit is closed for the lower winding of the relay SR³:—beginning at the terminal B of said battery, wire 54, contact 73, wire 111, contact A² and 24, wire 113, through the lower winding of the relay SR³ to the other terminal C of said battery. The flow of current in this latter circuit is of a polarity to cause the contact 63 of the relay SR³ to be moved to the left, thereby momentarily interrupting the circuit heretofore traced including the contacts 63—64 of the relay SR³, the winding of the relay SR¹ and the upper winding of the relay SR² in series, so that the relay SR¹ will drop, but the relay SR² will remain energized, because the stick circuit for its lower winding is still intact.

The contact arms A¹, A² and A³ are, of course, moved another step back to the zero position, since the contact 47 of relay SCR is still closed, and the relay 70 is again energized for reasons heretofore given, which energization of relay 70 is followed by the dropping of the relay 80, so that the pickup circuit for the relay SCR, heretofore traced, is again completed, and the synchronous selector will operate through another cycle of operation, rotating the arms A¹, A² and A³ through an entire revolution to a point where all of these arms engage the zero contact.

The synchronous selector in the dispatcher's office as it operates through this second cycle or second revolution deenergizes the relay SR². This deenergization of the relay SR² is caused by the contact arm A² engaging the stationary contact 23, resulting in the operation of the contact 63 of the relay SR³ toward the right, thus opening the stick circuit for the lower winding of the relay SR² and effecting deenergization of this relay SR². With the relay SR³ deenergized, and its contact 78 opened, the relay 70 cannot again be picked up, and therefore the relay SCR will remain deenergized, its energizing circuit for the upper coil being opened when the contact arm A³ moved off of the stationary contact 24. It is thus seen that the synchronous apparatus in the dispatcher's office is returned to its normal condition and brought to rest when the arms A¹, A² and A³ have made two complete revolutions.

Let us now see what transpires at the way station apparatus shown at the west end of the passing siding PS (see Fig. 1B), during the two revolutions of operation of the dispatcher's synchronous selector. It will be remembered that during each cycle of operation of the synchronous selector apparatus in the dispatcher's office twenty-four successive negative impulses were transmitted to each of the various way stations. These negative impulses operate the various line relays such as line relay LR¹, toward the left once for each impulse, thus effecting repeated energization of the electro-magnet 38¹ of the ratchet mechanism, thereby causing the arm 37¹ to be attracted by this magnet 38¹ and allowing it to again return to normal, through the medium of the spring 35¹, thus causing the ratchet wheel 33¹ to operate one tooth for each deenergization of the electro-magnet 38¹, and thereby causing the arms A⁴ and A⁵ at the way station to operate in synchronism with the arms A¹, A² and A³ at the dispatcher's office. The electro-magnet 38¹ is intermittently energized, as just explained, through the following circuit:—beginning at the terminal B of a suitable battery, contact 120 of

the relay LR¹, wires 121 and 122, winding of the electro-magnet 38¹ to the other terminal C of such battery.

Intermittent movement of the contact 120 of the relay LR¹ toward the left, also intermittently energizes the slow acting relay SLR, and since this slow acting relay is sufficiently slow dropping, its contact 123 will remain in its attracted position during this intermittent energization of the line relay LR¹. It is thus seen that the synchronous selector RS¹ located at the west end of the passing siding PS is operated one step for each operation of the synchronous selector RS in the dispatcher's office.

It is, however, conceivable that the selector at the way station may lose one step or possibly gain one step, due to foreign causes such as a lightning discharge and in this event the contacts A⁴ and A⁵ would not assume the zero position engaging the contact O when the synchronous selector apparatus in the dispatcher's office reaches its normal zero position. In other words, the arms A⁴ and A⁵ would engage one of the stationary contacts 1 to 24 inclusive, with the contact 120 of the relay LR¹ in its normal biased position. A period of time after the line relay LR¹ comes to rest from its intermittent operation, the slow acting relay SLR is deenergized thereby closing its back contact 123. This closure of the back contact 123 of the relay SLR enables the ratchet mechanism of the selector RS¹ to intermittently energize itself through its own back contact (a contact closed when the mechanism is deenergized), through the following circuit:—beginning at terminal B of a suitable battery, wire 125, contact 39 closed only when the arm 37¹ assumes its normal position, but having sufficient wipe to allow the arm 37¹ to get in motion, wire 126, one of stationary contacts 1 to 24, inclusive engageable by the arm A⁵, arm A⁵, wire 127, back contact 123 of the relay SLR, wires 128 and 122, winding of the electro-magnet 38¹, to the terminal C of such battery.

With this circuit available, it is obvious that the ratchet mechanism, including the pawls 36¹ and 34¹, the ratchet wheel 33¹ and the electro-magnet 38¹, will be operated intermittently to effect step by step rotation of the ratchet wheel 33¹, until the circuit just traced is opened, which occurs when the contact arm A⁵ reaches the zero contact O. In other words, when intermittent operation of the line relays, such as line relay LR¹, of each of the various way stations ceases, the synchronous selector apparatus at such way station is automatically brought to the zero position, if it does not already assume the zero position. Putting it another way, each synchronous selector unit located at a way station is self synchronizing, and returns to its normal position when operation of the line relay for controlling the same ceases its intermittent operation.

Let us now observe how the operation of the lever L associated with the miniature passing siding ps can effect clearing of the signal S located at the west end of the passing siding PS. As the synchronous selectors at the dispatcher's office and at the way station illustrated operate in synchronism, the following circuit is closed when the contact arms A¹ and A⁴ engage their respective stationary contacts 3:—beginning at the positive terminal of the battery 100, wires 101 and 130, lever L in its dotted position, wire 131, stationary contact 3, contact arm A¹, wire 132, pendulum contact 104, line wire 46,

wire 132 (see Fig. 1B), contact arm A⁴, stationary contact 3, wires 133 and 134, winding of the signal relay KR¹, wire 135, line wire 45, pendulum contact 103, wires 136 and 137, to the negative terminal of the battery 100.

The direction of current flow in this circuit is such, that it may be said to be of positive polarity, and causes the relay KR¹ to be operated toward the right, and in so doing closes the following pick-up circuit for the relay KR²:—beginning at the terminal B of a suitable battery, wire 140, contact 141 of the relay KR¹, wires 142 and 143, winding of the relay KR², wire 144, back contact 145 of the cancelling relay CR, wire 146, to the terminal C of said battery. The momentary closure of this circuit picks up the relay KR², and this relay KR² is then struck up through the following stick circuit:—beginning at the terminal B of said battery, wire 147, stick contact 148 of the relay KR², wires 149 and 143, winding of the relay KR², wire 144, contact 145, wire 146 to the other terminal C of said battery.

With the relay KR² energized, and assuming that traffic conditions in advance as manifested by the relay H are clear, and that the switch machine SM is in its normal straight track position, the signal S is operated to its clear proceed position through the following circuit:—beginning at the terminal B of suitable battery, wire 150, front contact 151 of the relay KR², wire 152, switch machine contact 153 closed only when the switch machine is in its normal straight track position, wire 154, front contact 155 of the home relay H, wire 156, operating mechanism of the signal S to the other terminal C of said battery.

Let us now observe how the dispatcher by returning his lever L to the normal position may again place the signal S at stop. Return of the lever L to its normal position causes momentary closure of the lever contacts 55—56—57, thereby causing the way station apparatus to be initiated, all in a manner as already described hereinbefore, thus setting the contact arms A¹, A², A³, A⁴ and A⁵ into motion and rotating them in synchronism. As the arms A¹ and A⁴ engage the stationary contact 3, and with the pendulum 49 assuming its right hand position, the following circuit for the alternating current relay CR (see Fig. 1B) is closed:—starting at the secondary winding of the transformer 160 (the primary side of which transformer is connected to a suitable high frequency alternating current source), wire 161, lever contact L, wire 131, stationary contact 3, contact arm A¹, wire 138, pendulum contact 104, line wire 46, wire 132 (see Fig. 1B), contact A⁴, stationary contact 3, wires 133 and 162, winding of the cancelling relay CR, wire 163, condenser 164 (this condenser tuning the inductance of the relay CR to permit the free flow of the particular frequency transmitted, and preventing the flow of direct current through the relay CR), wires 165 and 166, line wire 45, pendulum contact 103, wires 136, 167 and condenser to the other terminal of the transformer. The momentary flow of alternating current in the cancelling relay CR causes it to momentarily open its contact 145, thereby opening the stick circuit for the signal relay KR² and effecting deenergization of this relay KR², so that the signal S is again put to stop. It may be pointed out here, that this alternating current relay CR is preferably one of the tuned reed type, in which the contact 145 is vibrated at the frequency of the alternating current source 160, so that this contact 145 is open

practically constantly during flow of current from said source. The relays IR^1 and FSR^1 are of similar construction.

Let us now observe how the dispatcher is informed of the passage of a train by the signal S. Let us assume that a train has approached and has trodden upon the detector track circuit containing the track relay T^1 . This movement of this train upon this track circuit will of course deenergize the track relay T^1 , the dropping of which closes the following circuit for the interrupter ITR:—beginning at the battery 40, wire 170, primary winding of the interrupter ITR, interrupter armature and contact 171, wire 172, back contact 173 of the track relay T^1 , wire 174, back to battery 40. The closure of this circuit will cause the armature 171 to be intermittently attracted, thereby opening the circuit intermittently at a rate dependent upon the tuned characteristic of the armature 171. This armature 171 is preferably tuned to cause the current to be interrupted at a predetermined rate to produce alternating current in the secondary winding 175 of a particular desired frequency.

With the various synchronous selectors assuming their normal positions, as they ordinarily will, unless the system has been initiated by the movement of a lever or the dropping of another track relay, either of which may initiate the system, the alternating current generated in the secondary winding 175 may flow through the field starting relay FSR^1 , (see Fig. 1A) through the following circuit:—beginning at the winding 175 (see Fig. 1B), wire 176, condenser 177, wires 178 and 179, stationary contact O, contact arm A^4 , wire 132, line wire 46, pendulum contact 104, wire 138, contact arm A^1 , stationary contact O, wire 189, condenser 181, wire 182, winding of the relay FSR^1 , wires 183, 188, 137 and 136, pendulum contact 103, line wire 45, wires 166 and 184, back to the secondary winding 175 of the interrupter ITR. The flow of current in this circuit opens the contact 186 of the relay FSR^1 , thereby effecting deenergization of the relay FSR^2 and causing closure of its contact 187.

With the contact 187 of relay FSR^2 closed, the following pickup circuit for the relays SR^1 and SR^2 is completed:—beginning at the terminal B, back contact 187 of the relay FSR^2 , wires 188, 60 and 61, winding of the relay SR^1 , wire 62, upper winding of the relay SR^2 , to the other terminal C of such battery. The closure of this pick-up circuit will, of course, initiate the system in the same way that movement of the lever L, as heretofore explained, initiates the system, and this synchronous selector system will remain in operation for two complete cycles after which it will be brought to stop, all in a manner as already explained heretofore.

As the contact arms A^1 and A^4 assume a position to engage their respective stationary contacts 2, the following alternating current circuit is established, including the winding 175 of the interrupter ITR and including the indicating relay IR^1 :—beginning at the winding 175, wire 176, condenser 177, wires 178 and 190, stationary contact 2, contact arm A^4 , wire 132, line wire 46, pendulum contact 104, wire 138, contact arm A^1 , stationary contact 2, wire 191, condenser 192, wire 193, winding of the relay IR^1 , wires 194, 107 and 108, 137 and 136, pendulum contact 103, line wire 45, wires 166 and 184, back to the winding 175 of the interrupter ITR.

The flow of alternating current in the circuit just traced, causes the indicating relay IR^1

to pick up its back contact 196, thereby interrupting the following circuit for the indicating relay IR^2 :—beginning at the terminal B of a suitable battery, resistance unit 197 (this resistance unit having a resistance sufficient in value to prevent the relay IR^2 from picking up through this resistance but having a low enough resistance, so that if the relay IR^2 is once picked up it will remain in its attracted position), wire 198, winding of the indicating relay IR^2 , wire 199, back contact 196 of the relay IR^1 , to the other terminal C of said battery. For reasons just explained, if the relay IR^2 is once deenergized closure of its circuit just traced and including the resistance 197 will not again effect energization of the relay IR^2 , and with this relay IR^2 deenergized the indicating lamp I associated with the miniature passing siding ps is illuminated by reason of closure of the following circuit:—beginning at the terminal B of a suitable battery, back contact 200 of the relay IR^2 , wire 201, indicating lamp I, to the other terminal C of said battery.

If now, the train in question passes off of the detector track circuit containing the track relay T^1 , thereby effecting reenergization of this track relay T^1 , the interrupter ITR is rendered inactive, and alternating current is no longer generated in the secondary winding 175 of this interrupter. And under these conditions, the synchronous selector apparatus of course being in operation at this time, it remaining in operation for two cycles of operation after interruption in the alternating current generated by the interrupter ITR, alternating current will no longer flow to the relay IR^1 . As the contact arm A^2 engages its associated stationary contact 2 and during the period of time when the pendulum 49 assumes its right hand position, the following pick-up circuit for, and one not including the resistance 197 of the indicating relay IR^2 , is completed:—beginning at the terminal B of a suitable battery, wire 54, pendulum contact 73, wire 111, contact arm A^2 , stationary contact 2, wires 203 and 198, winding of the indicating relay IR^2 , wire 199, back contact 196 of the relay IR^1 , common return wire C. Momentary flow of current in the circuit just traced causes the indicating relay IR^2 to assume its attracted position, and with its armature once assuming the attracted position, the magnetic circuit of the relay IR^2 has been improved to an extent where this relay IR^2 remains energized through its normal circuit including the resistance unit 197.

As soon as the synchronous selector system now again comes to rest, the entire apparatus again assumes its normal condition, from which it appears, that the system may transmit control impulses from the dispatcher's office to the distant way stations and may receive indication impulses at the dispatcher's office, from any one of such way stations, and that the synchronous apparatus may be initiated from the dispatcher's office by the movement of a lever and may be initiated from the field in response to the dropping of a track relay. Also, it is clear that the pendulum device PTD allots substantially half of the time for the transmission of direct current of negative polarity for controlling the various synchronous selectors at the various way stations, and allots the remaining time for the purpose of transmitting message impulses over the same line wires 45—46.

Although only one way station has been illustrated specifically, way station No. 2 having been

illustrated conventionally and designated "Way Station 2", it is desired to be understood that in practice a large number of way stations will be used, and that in practice all of the remaining message channels may be used all in a manner readily understood from the drawings and the description heretofore given. Attention is directed to the fact that although only the station contacts O, 2 and 3 have been shown used for the message circuits heretofore described, each of the remaining stationary contacts 1 and 4 to 24, inclusive, may be used for controlling other signals and indicating the occupancy of other track circuits.

Having thus shown and described only a portion of a system illustrating a rather specific embodiment of the present invention, it is desired to be understood that the particular embodiment selected has been selected for the purpose of illustrating the nature of the invention and its operating characteristics and has not been selected for the purpose of showing the scope of the invention or the exact construction preferably employed in practicing the invention; and that various changes, modifications and additions may be made to adapt the invention to the particular problem encountered in practicing the same, all without departing from the spirit or scope of the invention or the idea of means underlying the same, except as demanded by the scope of the following claims.

What I claim as new is:—

1. In a train dispatching system of the synchronous selector type, in combination, a single line circuit connecting a dispatcher's office and a plurality of way stations, a synchronous selector in said dispatcher's office and a synchronous selector at each of said way stations, means for operating all of said synchronous selectors through the medium of said line circuit by current of a particular character, a plurality of sequentially closed message circuits each including said line circuit and contacts controlled by certain of said selectors, and electro-responsive means included in said message circuits responsive only to current of a different character.

2. In a train dispatching system of the type in which a large number of devices is distinctively controlled over the same line circuit through the medium of a large number of sequentially selected message circuits, an electro-responsive means controlled over one of said message circuits, said electro-responsive means being actuated to one of its positions in response to the flow of direct current and being actuated to its other position in response to the flow of alternating current over said message circuit, a timing device, and means controlled by said timing device for delaying the flow of current over said message circuit after it is selected.

3. In a train dispatching system of the synchronous selector type, the combination with a dispatcher's office and a plurality of way stations of a railway system, of a synchronous selector at said dispatcher's office and at each of said way stations, starting means for normally holding said selectors at rest, means at each way station for applying alternating current to said starting means to initiate said synchronous selectors into operation in response to the approach of a train to such way station, and indicating means responsive to said alternating current at a particular instant in a cycle of operation of said selectors for informing the dispatcher of the approach of such train.

4. In a train dispatching system of the synchronous selector type, the combination with a dispatcher's office and a plurality of way stations of a railway system, of a synchronous selector at said dispatcher's office and at each of said way stations, starting means for normally holding said selectors at rest, means at each way station for applying alternating current to said starting means to initiate said synchronous selectors into operation in response to the approach of a train to such way station, indicating means responsive to said alternating current at a particular instant in a cycle of operation of said selectors for informing the dispatcher of the approach of such train, and means for rendering said indicating means inactive just prior to said particular instant in such cycle of operation.

5. In a centralized traffic controlling system for railroads, a control office, a plurality of way stations having traffic controlling devices, two line wires extending from said control office through said way stations, means for placing a series of time-spaced impulses of distinctive characters upon said line wires, synchronous selector means at the control office and at each way station responsive to take one step for each alternate impulse of said series beginning with the first impulse, whereby a cycle of operation is completed in response to said series of impulses, means governing said traffic controlling devices in accordance with the character of each alternate impulse of said series, which is always different from the immediate preceding impulse, beginning with the second impulse, and means operable to selectively determine the character of each alternate impulse of said series beginning with the second impulse.

6. In a centralized traffic controlling system for railroads, a control office, a plurality of way stations having traffic controlling devices, two line wires extending from said control office through said way stations, means in part automatic and in part manually operable for placing a series of impulses of distinctive characters upon said line wires, synchronous selector means operated through a cycle of operation by said series of impulses, and means responsive to the character of certain of said impulses, which are always different from the immediate preceding impulse, to distinctively operate said traffic governing devices, said means being responsive to the order of said impulses in a manner to determine which of said traffic governing devices is to be distinctively operated, whereby said devices are manually governed from said control office.

7. In a centralized traffic controlling system for railroads, a dispatcher's office, a plurality of way stations having traffic governing devices, two line wires extending from the dispatcher's office through the several way stations, means at the dispatcher's office for applying a series of time-spaced impulses of a particular distinctive character to said line wires, step-by-step means at the dispatcher's office and at each way station responsive to take one step for each of said time-spaced impulses, means at the dispatcher's office and at each way station for completing a plurality of message channels over said line wires, one for each step, said means including in part said step-by-step means, electro-responsive means on certain of said message channels responsive to impulses always of certain other distinctive characters, whereby said traffic governing devices may be controlled and their condition indicated in the dispatcher's office.

8. In a train dispatching system, a plurality of devices, a single line circuit for connection to the devices, means for connecting the line circuit to the devices through sequentially selected message circuits, an electro-responsive means included in one of the message circuits, said electro-responsive means being distinctively actuated in response to the flow of direct current and being distinctively actuated in response to the flow of alternating current over said message circuit, a timing device, and means controlled by said timing device for delaying the flow of current over said message circuit after it is selected.

9. In a train dispatching system of the type in which a large number of devices are distinctively controlled over the same line circuit through the medium of a large number of sequentially selected message circuits, an electro-responsive means included in a message circuit, said electro-responsive means being caused to assume a distinctive condition in response to the flow of direct current and being caused to assume a distinctive condition in response to the flow of alternating current over said message circuit, a timing device, means controlled by said timing device for delaying the flow of current over said message circuit after it is selected, and means for storing one distinctive condition of said electro-responsive means until said electro-responsive means is caused to assume another distinctive condition.

10. In a train dispatching system of the synchronous selector type, the combination with a dispatcher's office and a plurality of way stations of a railway system, of a synchronous selector at said dispatcher's office and at each of said way stations, starting means for normally holding said selectors at rest, means at each way station for applying alternating current to said starting means to initiate said synchronous selectors into operation, and indicating means responsive to said alternating current at a particular instant in a cycle of operation of said selectors for informing the dispatcher of traffic conditions.

11. In a centralized traffic controlling system, in combination, synchronous apparatus at a central office and at a plurality of way stations, a single line circuit connecting the office and way stations, means for allotting alternate times to the line circuit for synchronous control and for message circuit purposes respectively, and means for initiating the synchronous operation from the central office and from any way station by respectively different characters of currents.

12. In a centralized traffic controlling system, in combination, synchronous apparatus at a central office and at a plurality of way stations, a single line circuit connecting the office and way stations, means for allotting alternate times to the line circuit for synchronous control and for message circuit purposes respectively, and means for initiating the synchronous operation from the central office and from any way station by direct current and alternating current respectively.

13. In a centralized traffic control system, in combination, synchronous apparatus at a central office and at a plurality of way stations, a single line circuit connecting the office and way station, means for allotting alternate times to the line circuit for synchronous control and for message circuit purposes respectively, means for initiating the synchronous operation from the central office and from any way station by respectively different characters of currents, means

at the way station controlled over the message circuit in a distinctive manner in accordance with current of a distinctive character, and means at the central office for indicating traffic conditions and controlled over the message circuit by current different from the stepping current.

14. In a centralized traffic controlling system, in combination, synchronous apparatus at a central office and at a plurality of way stations, a single line circuit connecting the office and way stations, means for allotting alternate times to the line circuit for synchronous control and for message circuit purposes respectively, and means for initiating the synchronous operation from the central office and from any way station by respectively different characters of currents, the different characters of currents being direct and alternating.

15. In a traffic control system, in combination with a control office and a plurality of way stations, a single line circuit connecting the central office and way stations; step-by-step means at the central office and the way stations, means for operating the step-by-step means over the line circuit by one character of current, control means at the way stations, means for operating the control means over the line circuit by another character of current, and means for initiating the step-by-step means and causing an indication in the central office, by still another character of current.

16. In a traffic control system, in combination with a control office and a plurality of way stations, a single line circuit connecting the central office and way stations; step-by-step means at the central office and the way stations, means for operating the step-by-step means over the line circuit by one character of current, control means at the way stations, means for operating the control means over the line circuit by either of two other characters of current, and means for initiating the step-by-step means and causing an indication in the central office, by still another character of current.

17. In a centralized traffic controlling system, in combination, step-by-step means at a central office and at a way-station being operable in synchronism when initiated, a single line circuit connecting the office and way-station, means for allotting alternate times for each step to condition the line circuit for different purposes, and means for initiating the step-by-step operation from the central office and from the way-station by respectively different characters of current.

18. In a train dispatching system of the synchronous selector type, in combination, a single line circuit connecting a dispatcher's office and a plurality of way stations, a synchronous selector in said dispatcher's office and a synchronous selector at each of said way stations, a device having a natural time period of operation, means including said device for energizing said line circuit with a plurality of time spaced impulses, means responsive only to certain of said impulses for operating all of said synchronous selectors, a plurality of sequentially closed message circuits each including said line circuit and contacts controlled by certain of said selectors, and means including said device for allotting the use of said line circuit alternately for the purpose of controlling said synchronous selectors and for the purpose of establishing such message circuits.

19. In a traffic control system, in combination with a control office and a plurality of way sta-

tions, a single line circuit connecting the central office and way stations; step-by-step means at the control office and the way stations, means for operating the step-by-step means over the line circuit by one polarity of current, control means at the way stations, means for operating the control means over the line circuit by the other polarity of current and by alternating current of one frequency, and means for initiating the step-by-step means and causing an indication in the central office by alternating current of a different frequency.

20. In a centralized traffic controlling system for railroads; a line circuit connecting a control office and a field station; impulsing means for energizing said line circuit with a series of time spaced impulses; a normally at rest step-by-step means at said control office and said field station operable in synchronism, when initiated, in response to impulses on said line circuit; means including said impulsing means for successively allotting said line circuit on each step of said step-by-step means for two different purposes; means for manually initiating said step-by-step means from said control office; and means effective over said line circuit for at times automatically initiating said step-by-step means.

21. In a centralized traffic controlling system for railroads; a line circuit connecting a control office and a field station; impulsing means for energizing said line circuit with a series of time spaced impulses; a normally at rest step-by-step means at said control office and said field station operable in synchronism, when initiated, in response to impulses on said line circuit; means including said impulsing means for successively allotting said line circuit on each step for two different purposes and including timing means wholly located at the control office for determining the respective periods of allotment; means for manually initiating said step-by-step means from said control office; and means effective for at times automatically initiating said step-by-step means.

22. In a centralized traffic controlling system for railroads; a line circuit connecting a control office and a field station; a normally at rest step-by-step means at said control office and said field station operable in synchronism, when initiated, in response to impulses on said line circuit; impulsing means for impressing a series of impulses on said line circuit; means including said impulsing means for successively allotting said line circuit subject to control by said control office and said field station respectively on each step, and including timing means wholly located at said control office for determining the respective periods of allotment; means for manually initiating said step-by-step means from said control office; and means for at times automatically initiating said step-by-step means from said field station.

23. In a train dispatching system of the synchronous selector type, a dispatcher's office and a plurality of way stations connected by a single line circuit, a selector at said office and a selector at each of said stations, a time control device,

means including said device for energizing said line circuit with series of time spaced impulses, a plurality of sequentially closed message circuits each including said line circuit and contacts of said selectors, and means controlled by said device for allotting alternate impulses of a series only for the control of said selectors and intervening impulses of said series only for the establishment of said message circuits.

24. In a remote control system, a line circuit having a plurality of series of time spaced stepping impulses impressed thereon, step-by-step mechanisms operable through a separate cycle for each of said series of stepping impulses, means controlled by said mechanisms for selecting local channel circuits for each step, means for interposing characteristic message carrier impulses on said line circuit between said stepping impulses, means for causing said mechanisms to take one step for each of said stepping impulses, and means for distinctively energizing said channel circuits in accordance with the character of said message carrier impulses.

25. In a remote control system, a line circuit having a plurality of series of time spaced stepping impulses of a first character impressed thereon, step-by-step mechanisms operable through a separate cycle for each of said series of stepping impulses, means controlled by said mechanisms for selecting local channel circuits for each step, means for selectively interposing message carrier impulses of a second or third character on said line circuit between said stepping impulses, means for causing said mechanisms to take one step for each of said stepping impulses, and means for distinctively energizing said channel circuits in accordance with the character of said message carrier impulses.

26. In a remote control system, a line circuit having a plurality of series of time spaced stepping impulses impressed thereon, step-by-step mechanisms operable through a separate cycle for each of said series of stepping impulses, means controlled by said mechanisms for selecting local channel circuits for each step, means for interposing characteristic message carrier impulses on said line circuit between said stepping impulses, means for preparing said mechanisms to take one step for each of said stepping impulses, means for causing said mechanisms to complete one step for each time space between said stepping impulses, and means for distinctively energizing said channel circuits in accordance with the character of said message carrier impulses.

27. Remote controlling apparatus comprising a line wire connecting an office and a station, manually controlled means at said office for at times initiating said apparatus, automatic means at said station for at times delivering a starting impulse to said line wire for initiating said apparatus, means operating in response to such initiation from said station to deliver a series of alternate control and indication impulses to said line wire, and means selectively controlled by said control and indication impulses.

RAY PLANK.