

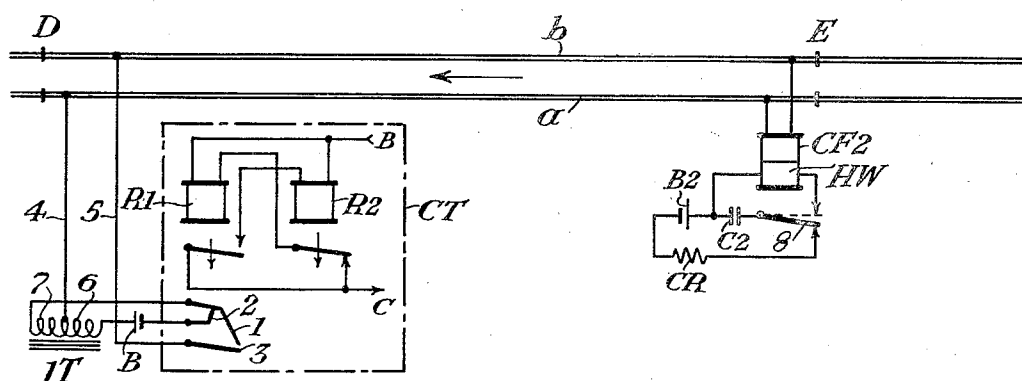
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W. P. PLACE

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RAILWAY SIGNALING APPARATUS

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INVENTORS
Willard P. Place and
BY Andrew J. Sorensen.
Andrew J. Sorensen
THEIR ATTORNEY

UNITED STATES PATENT OFFICE

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RAILWAY SIGNALING APPARATUS

Willard P. Place, Wilksburg, and Andrew J. Sorensen, Edgewood, Pa., assignors to The Union Switch & Signal Company, Swissvale, Pa., a corporation of Pennsylvania

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6 Claims. (Cl. 246—34)

Our invention relates to railway signaling apparatus and more specifically to apparatus of this character in which periodically interrupted or coded current is supplied to the track circuit for controlling wayside and/or cab signaling apparatus.

One object of our invention is to improve the shunting sensitivity of a track circuit. Another object is to decrease the track circuit power input and to maintain this input substantially uniform irrespective of weather conditions. Other objects and advantages will become clear as the description progresses.

The present application is a division of our copending application Serial No. 60,240, filed on January 22, 1936, for Railway signaling apparatus.

We shall describe one form of apparatus embodying our invention, and shall then point out the novel features thereof in claims.

The accompanying drawing is a diagrammatic view showing one form of apparatus embodying our invention.

In attempting to obtain satisfactory shunting of the track by light weight rail cars or by cars of standard weight on stretches of track not frequently used, it has been found that track circuits of the usual type cannot be reliably shunted by such vehicles because of the presence of a thin coating or film of relatively high resistance frequently present on the rail surface. The voltages usually employed in track circuit work are ordinarily insufficient to puncture this film. If higher voltages are employed, then the track circuit power input tends to become excessive and other disadvantages are also introduced. The accompanying drawing shows apparatus by means of which track voltages of sufficient value to insure reliable track shunting may be used without at the same time rendering the power required for operating the track circuit excessive.

Referring to the drawing, we have shown a section of railway track D—E in which traffic moves from right to left as indicated by the arrow. The apparatus designated by the reference character CT within the dotted rectangle at the left-hand end of the figure is conveniently termed a code transmitter and comprises a pair of slow-acting relays R1 and R2 which are energized from a suitable source of current having the terminals B—C. Relay R1 controls the energization of relay R2 over a front contact, and relay R2 controls the energization of relay R1 over a back contact in a manner which will be

obvious from the drawing. Consequently, as long as current continues to be supplied from the source B—C, relays R1 and R2 will continue to operate at a rate which is determined by the retardation period of these two relays. In this manner, intermittent or coding operation of contact finger 3 of relay R1 is obtained. Obviously, the relays R1 and R2 can be replaced by any suitable type of code transmitter, the essential requirement being that contact finger 3 operate periodically at the desired rate. This rate can, for purposes of illustration, be assumed to be of the order of 60 operations per minute.

The reference character IT designates an input transformer or reactor, the full winding of which is periodically energized from a suitable source of current which may be a battery B, by means of a circuit which will be clear from the drawing and which includes the back contact 1—2 of relay R1. A portion of the winding of transformer IT is connected to the track rails by means of wires 4 and 5, contact 3—1 being included in the rail circuit, as will also be clear from the drawing. Each time that contact 1—2 becomes closed, energy is stored in the magnetic circuit of the transformer IT, and each time contact 1—2 is opened, the magnetic energy rapidly collapses and causes the transmission of a relatively short impulse of relatively high peak voltage from winding 7 of transformer IT to the track rails.

It will be noted that the contacts operated by contact finger 3 of relay R1 are of the so-called "continuity transfer" type. That is, front contact 1—3 closes before back contact 1—2 opens. The reason for this is to insure that the output circuit to the track rails will be closed before any discharge from the transformer IT takes place, thus insuring that the full effect of the output voltage is obtained in the track circuit. Since the initial decay of the flux in transformer IT takes place at a very rapid rate and consequently, the high output voltage peak appears almost instantly, the full benefit of this peak cannot be obtained if the connections to the track are made at some later instant, after the input circuit to the transformer is opened. However, if the full peak voltage output is not necessary, the continuity transfer feature of the contacts 1—2 and 1—3 can be dispensed with.

The apparatus is preferably so designed with respect to the time constant of the circuit which includes the input winding of transformer IT that the current to winding 6 supplied from battery B requires about one second to reach its

maximum value. Obviously, this time can be varied widely by suitable proportioning of the apparatus and is used here for illustrative purposes only, in order to provide a more clear understanding of the invention.

The operation of the apparatus so far described is as follows. When relay R1 releases after a completed operation, the circuit through the battery B and the coil 6 becomes closed. The current through this coil gradually increases until at the end of the release period of relay R2 it will have just reached its maximum value. When relay R2 releases, relay R1 is immediately picked up over the back contact of relay R2 and relay R1 now operates the contact finger 3, first closing the circuit from the coil 6 to the track and immediately thereafter opening the battery circuit so that the electrical energy stored in the transformer during the previous second becomes discharged into the track. Meanwhile, relay R2 again becomes energized, releasing relay R1 which opens the circuit to the track and again closes the battery circuit to resume the charging of the transformer for the next impulse.

The track relay CF2 at the right-hand end of the track section is of the code-following type and is capable of responding to very short impulses of current. This relay may be used to control wayside signals or any other suitable signaling apparatus by means of suitable and well-known control apparatus not shown in the drawing. Due to the shortness of the impulse, it is desirable to maintain the relay CF2 in its energized position for a longer period of time to prevent a pressure release of this relay. Unless special provision is made, the usual code-following relay closes its front contacts for an instant only, and during the remainder of the time the back contacts remain closed. In the arrangement shown in the drawing, the relay CF2 is of the double-wound type, having the usual operating winding and also a holding winding HW. When relay CF2 is released, the contact finger 8 closes a circuit through an auxiliary battery B2, a charging resistor CR, and a condenser C2 of large capacity, thus causing this condenser to become charged. When the track current impulse flows through the operating winding of the relay for causing the relay to pick up, contact finger 3 closes a circuit through the auxiliary or holding winding HW and the condenser C2 in series. The electrical energy stored in condenser C2 will now flow through the winding HW, causing the relay to remain energized for a period of time longer than the duration of a signal impulse, thus preventing a premature release of the relay. If the code is fast, the back contact is closed for a short time only. Consequently, the condenser C2 acquires only a small charge and winding HW is able to hold the relay picked up for only a short time. On the other hand, if the code is slow, condenser C2 acquires a greater charge and winding HW is effective to hold the relay picked up for a correspondingly longer time. By properly proportioning the parts, the time during which the front contacts of relay CF2 remain closed can be made approximately equal to the time during which the back contacts of this relay are closed, for any suitable range of frequencies of the impulses which the code transmitter CT may be called upon to supply.

Although we have shown the apparatus embodying our invention as being applied to the

control of wayside signaling apparatus only, it will be apparent that locomotive-carried apparatus can similarly be controlled. That is, the track current impulses can be picked up inductively, or in any other suitable and well-known manner, for operating a locomotive-carried relay similar to the code-following relay CF, by means of such impulses.

The foregoing description makes it apparent that we have provided apparatus which applies a succession of relatively short impulses of sufficiently high peak voltage to aid in breaking down the resistance film on the rail surface, thus making it possible for light weight rail cars to shunt a track circuit, and improving the shunting sensitivity, in general, for all rail vehicles. Furthermore, since the current flow to the track circuit in our system is intermittent in character, the track circuit power is substantially decreased over that which is ordinarily required. Since no current-limiting resistors or reactors are necessary, all of the power taken from the track battery is available for being discharged into the track itself. Another advantage is that with our system peak voltages of 30 volts or more, for example, can be transmitted to the track from a two-volt track battery.

Although we have herein shown and described only one form of apparatus embodying our 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 our invention.

Having thus described our invention, what we claim is:

1. In combination with a section of railway track, a transformer, means including a source of direct current for supplying a magnetization to the core of said transformer, means for periodically interrupting said magnetization to induce voltage impulses of relatively high peak value in the output winding of said transformer, a circuit for applying said voltage impulses across the rails of said section, a code-following track relay for said section responsive to said voltage impulses and having an operating winding receiving energy from the rails of said section as well as an auxiliary winding for aiding said operating winding, a condenser, a charging circuit for said condenser including a source of direct current and a back contact of said track relay, and a discharge circuit for said condenser including said auxiliary winding and a front contact of said track relay.

2. In combination with a section of railway track, a transformer, means including a source of direct current for supplying a magnetization to the core of said transformer, means for periodically interrupting said magnetization to induce voltage impulses of relatively high peak value in the output winding of said transformer, a circuit for applying said voltage impulses across the rails of said section, a code-following track relay for said section responsive to said voltage impulses and having an operating winding receiving energy from the rails of said section as well as an auxiliary winding for aiding said operating winding, a condenser; a charging circuit for said condenser including a source of direct current, a resistor, and a back contact of said track relay; and a discharge circuit for said condenser including said auxiliary winding and a front contact of said track relay.

3. Apparatus for providing substantially equal

pick-up and release times over a range of code frequencies applied to the operating winding of a code-following relay, comprising, in combination, an auxiliary winding for aiding said operating winding, a condenser, a charging circuit for said condenser including a source of direct current and a back contact of said code-following relay, and a discharge circuit for said condenser including said auxiliary winding and a front contact of said code-following relay.

4. Apparatus for providing substantially equal pick-up and release times over a range of code frequencies applied to the operating winding of a code-following relay, comprising, in combination, an auxiliary winding for aiding said operating winding, a condenser; a charging circuit for said condenser including a source of direct current, a resistor, and a back contact of said code-following relay; and a discharge circuit for said condenser including said auxiliary winding and a front contact of said code-following relay.

5. Apparatus for maintaining a substantially uniform pickup-release time ratio over a range

of code frequencies applied to the operating winding of a code-following relay, comprising, in combination, an auxiliary winding for aiding said operating winding, a condenser, a charging circuit for said condenser including a source of direct current and a back contact of said code-following relay, and a discharge circuit for said condenser including said auxiliary winding and a front contact of said code-following relay.

6. Apparatus for controlling the pickup-release time ratio of a code-following relay having an operating winding energized by means of coded current, comprising, in combination, an auxiliary winding for aiding said operating winding, a condenser, a charging circuit for said condenser including a source of direct current and a back contact of said code-following relay, and a discharge circuit for said condenser including said auxiliary winding and a front contact of said code-following relay.

WILLARD P. PLACE.
ANDREW J. SORENSEN.