May 19, 1931. P. N. BOSSART 1,806,039

APPARATUS RESPONSIVE TO THE PASSAGE OF RAILWAY VEHICLES

Filed April 9, 1930

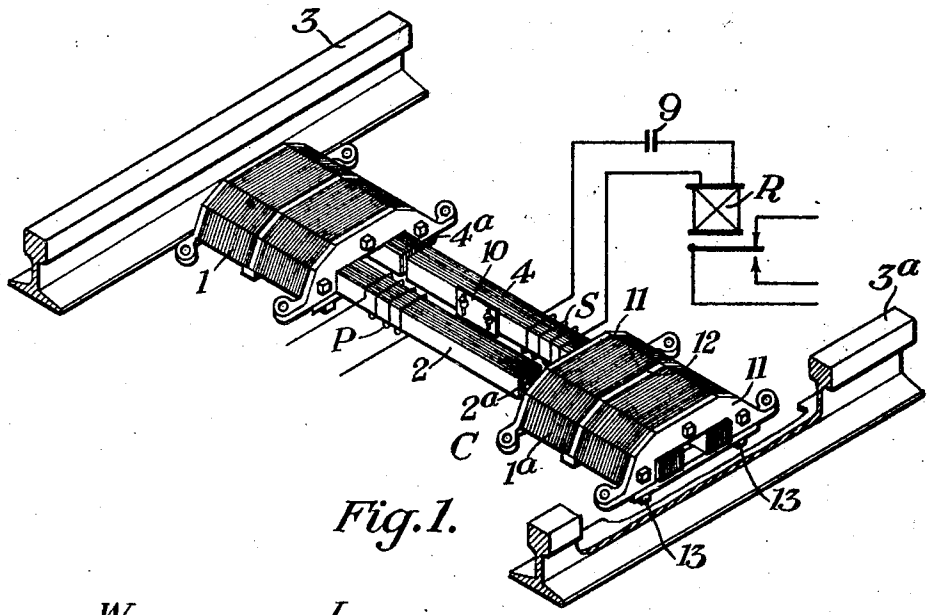


Fig. 1.

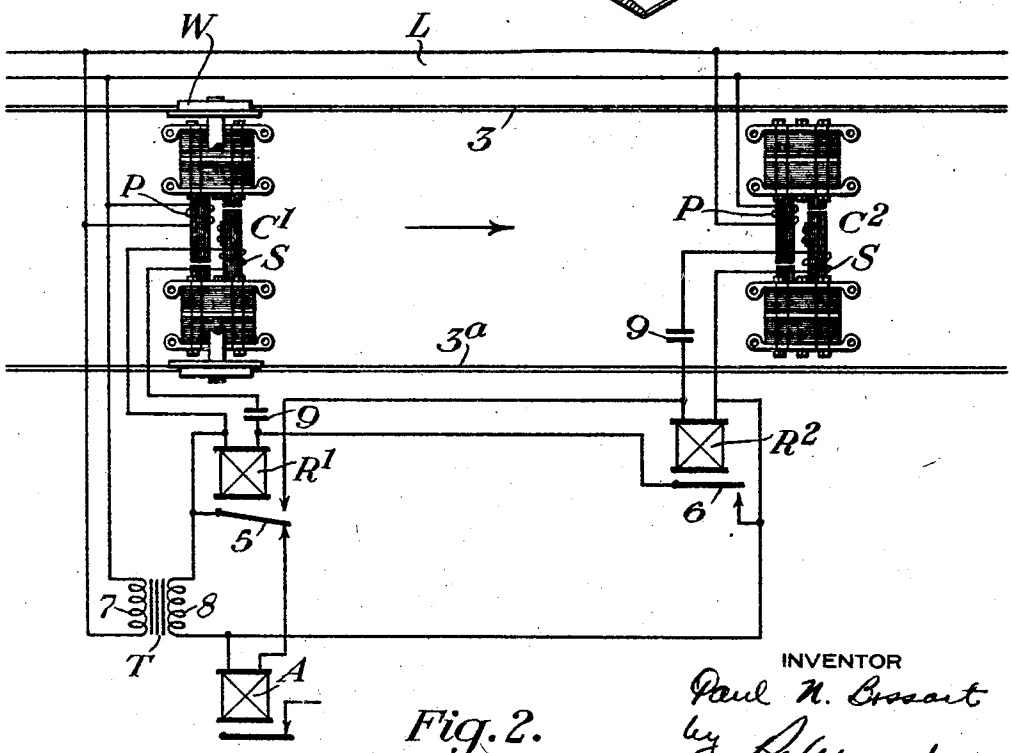


Fig. 2.

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UNITED STATES PATENT OFFICE

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APPARATUS RESPONSIVE TO THE PASSAGE OF RAILWAY VEHICLES

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My invention relates to apparatus responsive to the passage of railway vehicles, and has for an object the provision of apparatus of this character operating inductively and thereby avoiding the necessity for track circuits or for physical contact between an element on the train and an element in the track.

Apparatus embodying my invention is particularly well adapted for the control of highway crossing signals, but is not limited to this specific use.

I will describe one form of apparatus embodying my invention, and will then point out the novel features thereof in claims.

In the accompanying drawings, Fig. 1 is a perspective view showing one form of apparatus embodying my invention. Fig. 2 is a diagrammatic view showing one form of system using the apparatus shown in Fig. 1 and also embodying my invention.

Similar reference characters refer to similar parts in each of the views.

Referring first to Fig. 1, the reference characters 3 and 3^a designate the track rails of a railway track. Positioned between these rails is a magnetizable core C, comprising two pole pieces 1 and 1^a connected by two parallel bars 2 and 4. Bar 2 is provided with an air gap 2^a near the right-hand end, and bar 4 is provided with an air gap 4^a near the left-hand end of the bar. Mounted on the bar 2 at the left of the air gap 2^a and near the pole piece 1 is a primary winding P, which is constantly supplied with alternating current from a source not shown in the drawing. Mounted on the bar 4 to the right of the air gap 4^a and near the pole piece 1^a is a secondary winding S which is connected with the winding of a relay R through a condenser 9. The inner face of bar 4 is provided with a copper plate 10 which is attached to the bar in such manner that it may be adjusted vertically.

The magnetic flux created by the alternating current in the primary winding P has two paths. This flux may flow through the air gap between bars 2 and 4, then through the gap 4^a and the pole piece 1 back to bar 2. It may also flow through the bar 2, air gap 2^a, pole piece 1^a and then through the air to pole piece 1 and so back to bar 2. Each of these two paths has two air gaps in series, and it will be noted that bar 4 is at the mid-point of the former path, whereas the pole piece 1^a is at the mid-point of the latter path. If the magnetic bridge structure is balanced both as to magnetic potential drop and phase, there will be no flux through that portion of bar 4 which carries the secondary winding S, and, consequently, no voltage will be induced in this winding. If the bridge structure is not balanced, however, there will be a voltage induced in winding S, and, consequently, a current will flow in relay R. The bridge is balanced by adjusting the lengths of air gaps 2^a and 4^a for the amount of flux, and is balanced for the phase of the fluxes by shifting plate 10 up and down.

When a railway vehicle passes over the core C, the magnetizable parts of this vehicle, such as the wheels and axles, will reduce the reluctance of the air gap between pole pieces 1 and 1^a, and under this condition the magnetic bridge structure will be balanced, so that no voltage will be induced in the secondary winding S, with the result that relay R will be open. When the vehicle passes away from the core, C, however, the magnetic balance will be upset, a voltage will be induced in the secondary winding S, with the result that alternating current will be supplied to relay R.

The condenser 9 is desirable but is not essential. This condenser increases the sensitivity of relay R by reducing the copper loss, because it permits the use of fewer turns in the winding S with larger wire of better space factor and lower resistance, and it also permits these same characteristics for the winding of relay R.

Referring now to Fig. 2, the trackway is provided with two cores C^1 and C^2, each of which may be the same as the core C shown in Fig. 1. The primary windings P on these cores are constantly supplied with alternating current from a transmission line L, and the secondary windings S are connected with relays R^1 and R^2, respectively. The parts are so proportioned that when the cores are not influenced by vehicles, the current sup-

plied to each relay is above the release value and below the pick-up value of the relay, whereas when either core is influenced by a vehicle, the current supplied to the associated relay drops below the release value of such relay. Each relay is provided with a pick-up circuit which includes a contact of the other relay and an auxiliary source of current, which source, as here shown, is a transformer T the primary 7 of which is connected with the transmission line L. The pick-up circuit for relay R^1 is from the secondary 8 of transformer T, through back contact 6 of relay R^2, and the winding of relay R^1 to secondary 8. The pick-up circuit for relay R^2 is from secondary 8, through the front point of contact 5 of relay R^1 and the winding of relay R^2 to secondary 8.

The operation of the apparatus shown in Fig. 2, is as follows: Normally both relays R^1 and R^2 are closed, because sufficient current is supplied to each relay by its associated secondary S to keep it closed. When a vehicle passes over core C^1 it will deenergize relay R^1, and this relay will then remain deenergized because after the vehicle passes the core C^1 the current supplied to relay R^1 by its associated secondary S will be below the pick-up value of this relay, and the pick-up circuit will be open at contact 6. Similarly, when the vehicle pases core C^2 it will deenergize relay R^2, and the closing of the back contact 6 of relay R^2 will close the pick-up circuit for relay R^1, with the result that the latter relay will again become closed. When the vehicle passes away from core C^2, relay R^2 will, likewise, close, because its pick-up circuit will be closed at the front point of contact 5 of relay R^1.

Relay R^1 controls an auxiliary relay A, the circuit being from secondary 8 of transformer T, through the back point of contact 5 of relay R^1, and the winding of relay A to secondary 8. It follows that relay A will be energized when and only when relay R^1 is open. Relay A may be used for the control of any suitable apparatus, such for example, as a highway crossing signal.

Reverting to Fig. 1, each pole piece 1 and 1^a is made up of a plurality of laminations clamped between two cast end plates 11, and a third cast plate 12 is inserted at the middle of the pole piece to prevent the laminations from buckling. The bars 2 and 4 are located in slots in the under side of each pole piece, and are held in place by cross bars 13 which are bolted to the end plates 11 and middle plate 12.

Although I have herein shown and described only one form 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. Apparatus responsive to the passage of a railway vehicle, comprising two pole pieces so positioned in the trackway that the reluctance of the air gap between them is reduced by a magnetizable part of a passing vehicle, two parallel bars connecting said pole pieces and each provided with an air gap, a primary winding on one bar on one side of the air gap therein, a secondary winding on the other bar on the other side of the air gap therein, a source of alternating current connected with said primary winding and a relay connected with said secondary winding, said parts being so adjusted that in the absence of a vehicle sufficient current is induced in said secondary to keep said relay closed but that the effect of a passing vehicle is to reduce the current induced in the secondary below the release value of the relay.

2. Apparatus responsive to the passage of a railway vehicle, comprising a magnetizable core positioned in the trackway to have its magnetic characteristics momentarily changed by the magnetic action of a magnetizable part of a passing vehicle, a primary and a secondary winding on said core, a source of alternating current connected with said primary winding and a relay connected with said secondary winding, said parts being so adjusted that in the absence of a vehicle sufficient current is induced in said secondary to keep said relay closed but that the effect of a passing vehicle is to reduce the current induced in the secondary below the release value of the relay.

3. Apparatus responsive to the passage of a railway vehicle, comprising two magnetizable cores positioned in the trackway to be successively influenced by a passing vehicle, a primary and a secondary winding on each core, a source of alternating current connected with each primary winding, two relays connected with the secondary windings on said two cores respectively, said parts being so adjusted that the current normally induced in each secondary winding is above the release value but below the pick-up value of the associated relay whereas the effect of a passing vehicle is to reduce the current induced in the secondary winding below the release value of the associated relay, and a pick-up circuit for each relay including a back contact of the other relay and a source of current.

In testimony whereof I affix my signature.

PAUL N. BOSSART.