Aug. 29, 1933. F. H. NICHOLSON 1,924,215

RAILWAY TRAFFIC CONTROLLING APPARATUS

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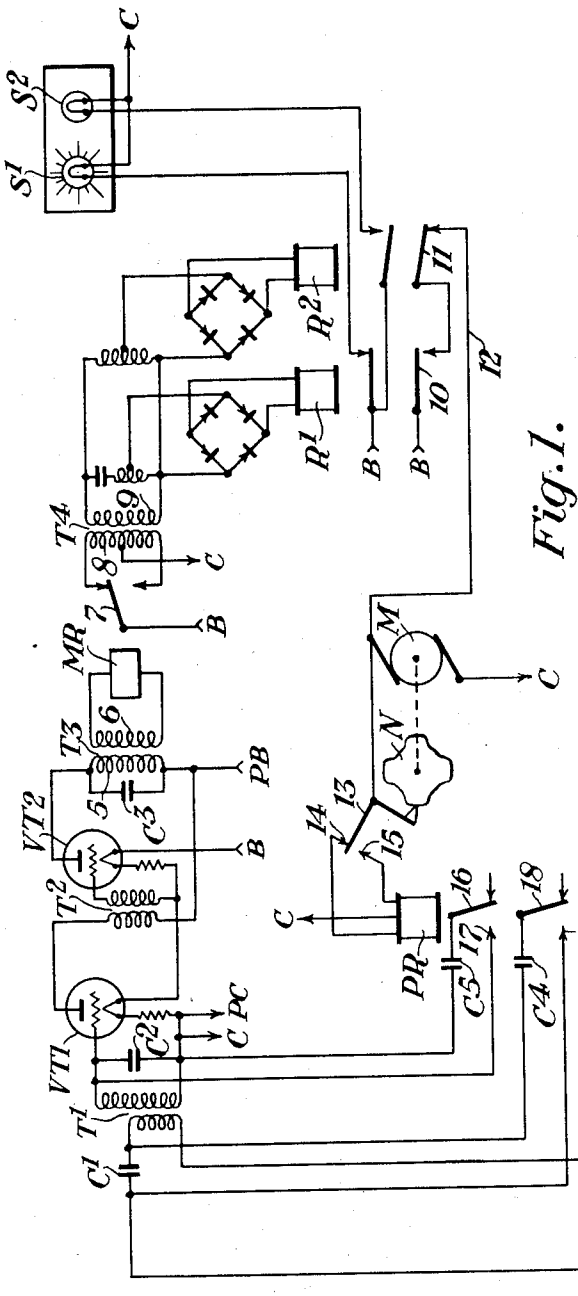


Fig. 1.

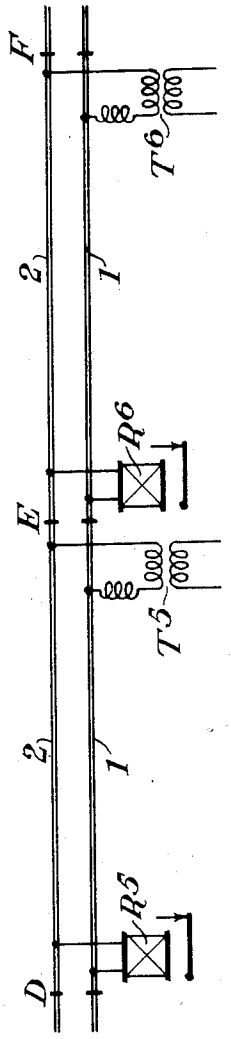


Fig. 2.

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RAILWAY TRAFFIC CONTROLLING APPARATUS

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7 Claims. (Cl. 246—63)

My invention relates to railway traffic controlling apparatus of the type employing alternating current track circuits and locomotive-carried cab signaling equipment, and more particularly to apparatus for automatically changing the electric tuning of the train-carried cab signaling equipment when the locomotive leaves a track section supplied with current of a given frequency and enters a track section supplied with current of a different frequency.

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

Fig. 1 of the accompanying drawing is a diagrammatic view of the train-carried portion of the cab signaling equipment, showing one form of automatic tuning-change apparatus embodying my invention. Fig. 2 is a diagrammatic view of a section of railway track showing a portion of the wayside signaling equipment.

In train control systems of the coded track circuit type, it is the usual practice to employ a track circuit current having a frequency in the order of 60 or 100 cycles per second, referred to as the carrier frequency, this current being interrupted periodically at different rates which are determined by traffic conditions in advance of the train, these rates or code speeds being translated by the train-carried equipment into appropriate cab signals aboard the locomotive.

In non-electrified territory, or in territory where direct propulsion current or alternating propulsion current comparatively free from harmonics is used, a carrier frequency of 100 cycles per second has been found to be highly satisfactory from the standpoint of safe and reliable train operation. However, where the alternating propulsion current contains prominent harmonics of the even series, or of the usual odd series, or both, there is danger of interference with the display of proper cab signal indications caused by beat frequencies arising from modulation of the carrier current by the above harmonics, these beat frequencies approaching the code speeds normally used for initiating cab signal indications. The even harmonics may arise from direct current saturation of the locomotive transformers caused by direct propulsion current in territory where both alternating current and direct current propulsion are used. If the propulsion current is 25 cycles, and the third and fourth harmonics are prominent, a carrier frequency of 87½ cycles, for example, half-way between these harmonics, may provide a high degree of immunity from interference, the beat notes arising from the use of this frequency being sufficiently far removed from the code speeds to prevent translation into cab indications by the decoding equipment.

In order that the same locomotive may operate over certain track circuits supplied with code carrier current of one frequency, as well as over other track circuits in which the carrier current frequency is different, it becomes desirable to provide automatic tuning-change apparatus, one form of which will now be described. It will, of course, be understood that the tuning-change apparatus embodying my invention can be used as well in connection with a given track circuit which is capable of being supplied at different times with carrier current of one or another frequency.

Referring to Figs. 1 and 2 of the drawing, it will first be assumed that the locomotive occupies section D—E in which the rails 1 and 2 are supplied with periodically interrupted or coded current of 100 cycle carrier frequency from a transformer T^5. The rail flux set up by this current will induce cumulative voltages in the receiver windings 3 and 4, the resultant voltage being applied by means of step-up transformer T^1 to the grid of the first stage amplifier tube VT1. The output of tube VT1 passes through interstage transformer T^2 and is applied to the grid of detector tube VT2, so that unidirectional output current pulses, corresponding to the "on" code impulses in rails 1 and 2, will exist in the primary winding 5 of master relay transformer T^3, to induce periodically reversed voltages, in step with the code, in winding 6 of transformer T^3. Therefore, armature 7 of polarized master relay MR will operate to and fro, applying direct current from a source B—C, alternately first to one and then to the other half of primary winding 8 of transformer T^4. As a result, an alternating voltage of the track circuit code frequency will be induced in the secondary winding 9 of this transformer, and, depending upon the particular code speed as determined by traffic conditions, one or the other of the code-selective relays R^1 or R^2 will become energized to energize cab signal S^1 or S^2, respectively.

The condensers C^1 and C^2 are used to tune the receiver circuit involving receiver windings 3 and 4 and transformer T^1, so that 100 cycle carrier current will be passed freely into tube VT1, currents of other frequencies being effectively blocked, in order to eliminate interference from stray power sources.

Assume now that the locomotive enters the

track section E—F and that section E—F is supplied from transformer T^6 with current of a code carrier frequency of 87½ cycles instead of 100 cycles, or that the frequency of the carrier current supplied to section D—E is changed from 100 to 87½ cycles, by suitable means not shown, while the locomotive occupies section D—E. Since this frequency will be blocked by the receiver circuit in the condition illustrated, both relays R^1 and R^2 will become deenergized, and a circuit for operating motor M will become closed at back contacts 10 and 11 of relays R^1 and R^2. In operating, motor M will rotate cam N which, in turn, will cause contacts 13—14 and 13—15 to close alternately, energizing first one and then the other of the two opposed windings of the polarized relay PR, so that contacts 16—17 and 18—19 of relay PR will become closed, and will tend to close and open alternately, in step with the movement of the projections on cam N.

The closing of contacts 16—17 and 18—19, which are designed to remain in the last operated position until relay PR is reversed, connects condensers C^4 and C^5 in multiple with receiver tuning condensers C^1 and C^2, respectively, thereby changing the tuning of the receiver so that it will pass freely currents of 87½ cycle frequency, but will effectively block currents of other frequencies. If the time interval during which contacts 16—17 and 18—19 remain closed is made sufficiently long as compared with the time required for a code impulse in rails 1 and 2 to become translated into an operating impulse in one or the other of relays R^1 or R^2, the result will be that contact 10 or 11 of relay R^1 or R^2 will open, whereas, contacts 16—17 and 18—19 of relay PR will remain closed in the 87½ cycle position because operating energy has been disconnected from relay PR and the contacts of this relay will remain in the last operated position. When this occurs, the apparatus will have become automatically conditioned for operation by rail current of 87½ cycle carrier frequency.

When the locomotive reenters upon a track section supplied with current of 100-cycle frequency, or the frequency is restored from 87½ to 100 cycles, relays R^1 and R^2 will again both become deenergized, and motor M will operate to cause contacts 16—17 and 18—19 of relay PR to open, thereby restoring the receiver to the condition in which it will respond to 100 cycle current. Relay R^1 or R^2 will then pick up, disconnecting the source of energy for relay PR and contacts 16—17 and 18—19 will remain open.

The use of the two frequencies of 100 and 87½ cycles is merely illustrative, as the tuning-change apparatus embodying my invention can be adapted for use with any pair of suitable frequencies. Also, it is not necessary that the effective capacity of both condensers C^1 and C^2 be changed, as a change in one or the other of these capacities, by the addition of either multiple or series capacity, as may be required by the particular carrier current frequency being used, may be sufficient. Furthermore, instead of introducing capacity into the receiver circuit, the contacts 16—17 and 18—19 may be used to introduce reactance or resistance into the receiver circuit, or to short-circuit portions of the existing receiver-tuning impedances, or rearrange the connections of the tuning elements.

It is not essential that the relay PR be employed, as contact 13, or a pair of such contacts insulated from wire 12, can be used to replace contacts 16—17 and 18—19 of relay PR. Also, instead of motor M and cam N, a reciprocating or flashing relay of any suitable type, having a pair of contacts which become alternately closed and opened at a relatively slow rate, when the relay becomes energized by the release of both relays R^1 and R^2, can be used to connect the condensers C^4 and C^5 into the receiver circuit. The advantage obtained by using a polarized relay such as PR is that contacts 16 and 17 will remain in the last operated position.

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. In combination, a stretch of railway track the rails of which are supplied with current of a first frequency, a train control receiver in inductive relation with said rails and tuned for admitting induced current of said first frequency, a train governing device controlled by current induced in said receiver in such manner as to assume a first or a second condition in accordance with the presence or absence of said induced current, and means controlled by said device when the device assumes said second condition for automatically altering the electric tuning of said receiver to admit induced current of a second frequency for controlling said device.

2. In combination, a stretch of railway track the rails of which are at times supplied with current of a first frequency and at other times with current of a second frequency, a train control receiver in inductive relation with the rails of said track and capable of being tuned for admitting induced current of either said first or said second frequency, a train governing device controlled by current of either said first or said second frequency induced in said receiver which assumes a first or a second condition in accordance with the presence or absence respectively of induced current of said first or said second frequency, and means controlled by said device when the device assumes said second condition for automatically altering the electric tuning of said receiver to admit induced current of said second or said first frequency according as the rails were supplied with current of said first or said second frequency respectively immediately before said device assumed said second condition.

3. In combination, a stretch of railway track the rails of which are normally supplied with current of a first frequency and are at times supplied with current of a second frequency, a frequency selective train governing device normally controlled by rail current of said first frequency and capable of assuming a first or a second condition in accordance with the presence or absence respectively of current of said first frequency in the rails, and means governed by said device when the device assumes said second condition for automatically conditioning said device for selective control by rail current of said second frequency.

4. In combination, a train control receiver capable of being adjusted to one or another of two conditions of tuning to pass induced current of one or another of two rail current frequencies respectively, a traffic governing device controlled by the current induced in said receiver in such manner as to assume a first condition when induced current of either of said two frequencies is present in the receiver and to assume a second

condition when said induced current is absent, and means governed by said device when the device assumes said second condition for automatically and alternately adjusting the tuning of said receiver from said one to said other condition at predetermined time intervals until the frequency for which said receiver is tuned corresponds to the rail current frequency whereupon said device will assume said first condition.

5. In combination, a stretch of railway track the rails of which are at times supplied with current of a first frequency and at other times with current of a second frequency, a frequency selective train governing device controlled by rail current of said first or said second frequency in such manner as to assume a first condition according as said device is conditioned for selective control by rail current of said first or said second frequency respectively, said device assuming a second condition when the rail current is interrupted for a prolonged time interval, and means governed by said device when the device assumes said second condition for alternately conditioning said device for selective control by rail current of said first and of said second frequency respectively.

6. In combination, a stretch of railway track the rails of which are supplied with current of a first frequency, a train control receiver in inductive relation with the rails of said track and having an electric filter capable of selectively passing induced current of said first frequency, a traffic governing device controlled by said induced current which assumes an energized or a deenergized condition according as said induced current is present or absent, a contact controlled by said device which becomes closed periodically when the device is deenergized, and means controlled by said contact in its closed position for altering the electric tuning of said filter to pass induced current of a second frequency thereby conditioning said receiver for control of said device by induced current of said second frequency.

7. In combination, a stretch of railway track the rails of which are supplied with current of a first frequency, a train control receiver in inductive relation with the rails of said track and having an electric filter capable of selectively passing induced current of said first frequency, a traffic governing device controlled by said induced current which assumes an energized or a deenergized condition according as said induced current is present or absent, a motor controlled by said device which becomes energized when said device is deenergized, a polarized relay having a contact which becomes closed when the relay is energized with current of a given polarity and remains closed thereafter until said relay is pole-changed, said contact acting when closed to change the electric tuning of said filter for selectively passing induced current of a second frequency to control said device, and a pole-changer governed by said motor and effective for periodically pole-changing said relay while said motor is energized.

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