

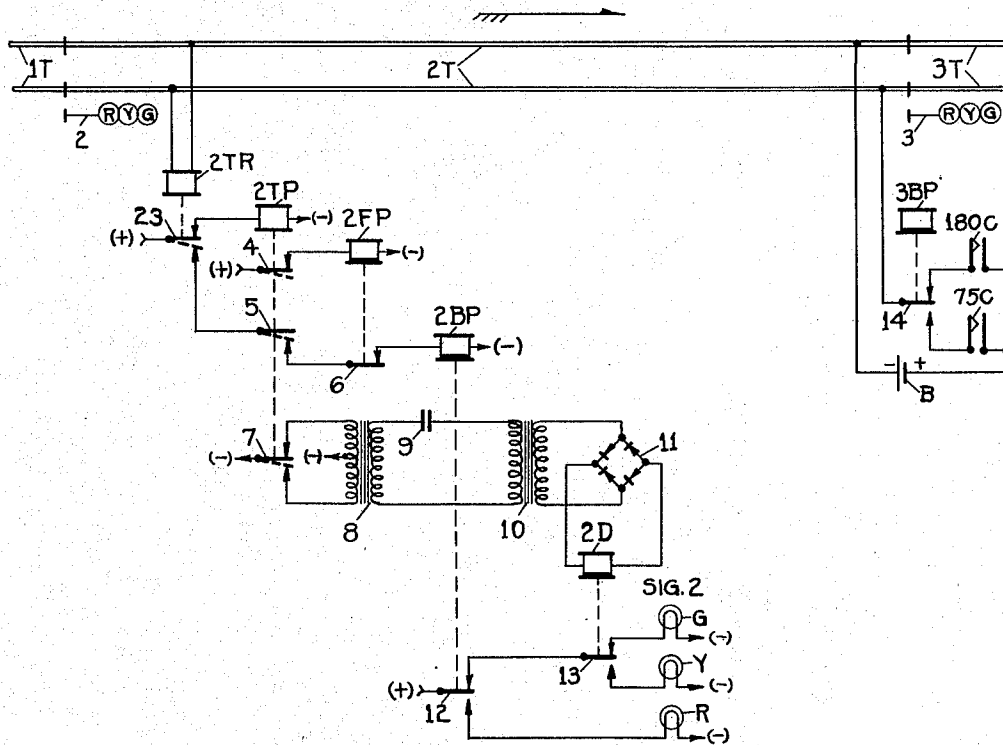
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CODED TRACK CIRCUIT SIGNALING SYSTEM

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CODED TRACK CIRCUIT SIGNALING
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The present invention relates to block signalling systems on railroads using coded track circuits, and more particularly pertains to the improvement of the code receiving apparatus employed in such signalling systems.

The various blocks of a signalling system employing coded track circuits usually comprise a single track circuit for each block, each track circuit being provided with suitable code transmitting apparatus at one end of the track circuit and suitable code responsive means at the other end of the track circuit. The code transmitting apparatus usually applies code pulses at selected distinctive rates in accordance with traffic conditions. The code receiving apparatus is thus usually organized to have means which is responsive to all the code rates including the lowest code rate and the other higher code rates, together with means which is distinctively responsive to each of the higher code rates.

In such a system, as above briefly mentioned, a code following track relay is usually provided with contacts for governing the code receiving apparatus, and it is desirable to have a minimum number of contacts on this relay in order to have the relay as sensitive as possible to the code pulses of the associated track circuit. These contacts on the code following track relay in controlling the decoding apparatus may under certain adverse conditions become misplaced or fused and it is desirable to have the decoding apparatus so organized that under such circumstances any failure is on the side of safety.

Generally speaking and without attempting to define the exact nature and scope of the present invention, it is proposed to provide two slow acting relays, one of which is energized when the code following track relay is picked up, and the other of which is energized when the code following track relay is released providing the other slow acting relay is then picked up. If these two relays were provided in this particular relationship without further modification, it might happen, if the contacts of the code following track relay should become misplaced or fused together or the like, that both of the slow acting relays would become steadily energized even though the code following track relay had ceased its operation. This would give an erroneous signal indication.

However, the present invention provides that the slow acting repeater relay governed in accordance with the operated condition of the code following track relay shall have its control provided through the front contact of a quick acting

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front contact repeating relay which must be picked up in order for such slow acting relay to be energized; and in addition, the control for the slow acting back contact repeating relay includes a back contact of the quick acting repeater relay. In this way, the quick acting repeater relay must respond to coding operation of the code following track relay in order to pick up either of the slow acting repeater relays. If the contacts become fused or misplaced with this organization, the most that can happen is that the quick acting repeater relay and the slow acting front contact repeating relay may be picked up steadily, but under such a condition the slow acting back contact repeating relay can not be energized due to the picked up condition of the quick acting repeater relay.

It is a further object of the invention to provide that the decoding apparatus which is distinctively responsive to the different code rates shall be governed from contacts of the quick acting repeater relay so as to minimize the number of contacts on the code following track relay and also to prevent operation of the decoding means if the code following track relay ceases operation.

Other objects, purposes and characteristic features of the present invention will be in part obvious from the accompanying drawings; and in part pointed out as the description progresses.

In describing the invention in detail, reference will be made to the accompanying drawing, in which those parts having similar features and functions are designated by like letter reference characters which are generally made distinctive by reason of distinctive preceding numerals representative of their location or association with other devices having reference characters with like numerals, and in which:

The single figure of the drawing illustrates one section of a coded track circuit signalling system embodying the code receiving means of the present invention.

For the purpose of simplifying the illustration and facilitating the explanation, the various parts and circuits constituting the embodiment of the invention have been shown diagrammatically and certain conventional illustrations have been employed, the drawing having been made more with the purpose of making it easy to understand the principles and mode of operation than with the idea of illustrating the specific construction and arrangement of parts that would be employed in practice. Thus, the various relays and their contacts are illustrated in a con-

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ventional manner, and symbols are used to indicate the connection of terminals to batteries or other suitable sources of electric current instead of showing all of the wire connections to these terminals.

The symbols (+) and (−) are employed to indicate the positive and negative terminals respectively of suitable batteries or other sources of direct current; and the circuits with which these symbols are employed are assumed to always have current flowing in the same direction, although it is to be understood that in some cases alternating current might be substituted for the direct current, and in such cases the (+) and (−) are to be used as indicating the relative instantaneous polarities of the alternating current.

With reference to the single figure of the drawing, a stretch of track has been shown divided into track sections by suitable insulated joints of which the track section 2T has been shown completely and the track sections 1T and 3T in part only. Color light type signals 2 and 3 are shown at the entrance ends of the track sections 2T and 3T respectively, assuming a normal direction of traffic from left to right as indicated by the traffic direction arrow. These signals can of course be of any suitable type desired.

At the exit end of each track section (such as section 2T), suitable code transmitting apparatus is located to transmit driven codes of different distinctive rates in accordance with traffic conditions in advance as governed by the code receiving means for the entrance end of the next adjoining track section.

At the entrance end of each track section (such as section 2T), a suitable decoding apparatus is located for receiving the different driven codes and decoding them so as to properly control the associated signal (such as color light signal 2).

Although this typical track section might in some cases have code transmitting and receiving apparatus for inverse codes, such apparatus has not been shown for the sake of simplicity in the illustration, but it should be understood that the decoding apparatus illustrated as employed in connection with driven codes may also be employed in connection with the decoding of inverse codes.

As typical of all such track sections above briefly described, reference may be made to the track section 2T in which coding contacts 180C and 75C are illustrated as associated with the signal location 3. For convenience it is assumed that these contacts will continuously operate, and when the decoding relay, conveniently termed slow acting back contact repeating relay 3BP and governed in accordance with the codes in track section 3T, is picked up closing front contact 14, a code of the 180 code rate is applied to the track section 2T with the energy for such pulses being supplied from the battery B. When the relay 3BP is deenergized closing its back contact 14, code pulses of the 75 code rate are applied to the track section 2T from the battery B. It is to be understood that the relay 3BP is picked up whenever a code is received over the track section 3T, but is deenergized whenever the track section 3T is occupied by a train or the reception of code ceases for some other reason. The usual clear and caution code rates of 75 and 180 pulses per minute have been selected for the coders 75C and 180C for the purposes of this disclosure, but it should be understood that other suitable code rates might be employed if desired. Also, this simplified illustration of the application of dif-

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ferent codes is employed merely for the purposes of simplifying the present disclosure, it being understood that various organizations for transmitting code pulses of different code rates may be employed as desired.

At the entering end of the track section 2T, and associated with the signal 2, is a track relay 2TR which is connected across the track rails of the track section so as to follow the code pulses transmitted over the rails. This relay 2TR picks up its contact 23 for each code pulse and releases its contact 23 between successive code pulses. This code following track relay 2TR may be of the neutral type as assumed for the purposes of this disclosure, or it may be of the polarized type, that is, its contacts may be biased to one position by gravity or suitable resilient means, and operated to a picked up or actuated position in response to energization by only a particular polarity.

A quick acting repeater relay 2TP is provided with an energizing circuit including a front contact 23 of the code following track relay 2TR. Also a slow acting front contact repeating relay 2FP is provided with an obvious energizing circuit including the front contact 4 of the quick acting repeater relay 2TP.

A slow acting back contact repeating relay 2BP is provided with an energizing circuit closed from (+), and including back contact 23 of the code following track relay 2TR, back contact 5 of quick acting repeater relay 2TP, front contact 6 of slow acting front contact repeating relay 2FP, and windings of relay 2BP, to (−).

With this organization, it can be seen that each time the code following track relay is initiated into operation for any particular code rate, it will close its front contact 23 on the first code pulse which will be repeated by the quick acting repeater relay 2TP, and the closure of its front contact 4 will energize the front contact repeating relay 2FP. If the slow acting front contact repeating relay 2FP is too slow acting to be picked up on its first energization, it will pick up on some subsequent energization such as the second or third, and after it has once been picked up, it will remain picked up between successive code pulses.

As soon as the front contact repeating relay 2FP has picked up and closed its front contact 6, the next following deenergization of the code following track relay 2TR will close its back contact 23 followed by the closure of back contact 5 so that the relay 2BP will be energized for that space between two successive code pulses. If the relay 2BP does not pick up on the first such energization, it will upon a subsequent energization such as the second or third.

Once the relays 2FP and 2BP have both been picked up in response to the reception of a code, they remain picked up so long as that code rate or any other code rate is continuously received; but if the operation of the code following track relay 2TR ceases, these relays will successively drop away in accordance with their slow releasing characteristics.

Under conditions of no code in the track section 2T, the relays 2FP and 2BP are both dropped away closing back contact 12, so that the red lamp R of signal 2 is energized causing such signal to display a stop indication. On the other hand, when the relay 2BP is picked up during the reception of a code, regardless of its particular rate, the front contact 12 is closed so that the yellow or green lamps of signal 2 are ener-

gized depending upon the particular rate of the code being received. This is determined by suitable decoding means including a decoding transformer 8 which is energized in opposite directions alternately as contact 7 of the quick acting track repeater relay 2TP is operated to its opposite positions. The secondary winding of the transformer 8 is connected to the primary of the transformer 10 through a condenser 9 in such a manner as to be tuned for the 180 code rate but to pass substantially no energy or a very small amount of energy in response to the 75 code rate. This energy induced in the secondary of the transformer 8 and caused to flow in the tuned circuit including the primary of the transformer 10, is supplied through the secondary of the transformer 10 through a suitable rectifier 11 to convert the alternating current to direct current which is supplied to the slow acting distant relay 2D.

In brief, the relay 2D is caused to pick up only when the code received by the code following track relay 2TR and repeated by its quick acting repeater relay 2TP is of the 180 code rate. It should of course be understood that other code rates might be employed either separately or in addition to the ones shown, and that decoding means distinctively tuned for these other rates may be employed as desired for additional signal indications.

In the particular embodiment of the invention, the reception of a 75 code rate means that the relay 2D is released so that the yellow signal Y is energized through front contact 12 and back contact 13; but the reception of a 180 code rate results in the energization of the relay 2D so that the green signal G is energized through front contacts 12 and 13.

While the section 2T is occupied by a train it will be apparent that no code will be repeated by the code following track relay 2TR because the track rails are shunted. But when the train passes into the track section 3T and out of the track section 2T, the relay 3BP is deenergized and a 75 code rate is applied to the track section 2T and to the relay 2TR. When the train passes from the track section 3T into the track section 4T (not shown), then a 75 code rate will be applied to the track section 3T causing the relay 3BP to be picked up so that a 180 code is applied to the track section 2T.

Although the apparatus employed with coded track circuits for signalling systems is usually very reliable, and will operate over long periods of time without failure, it may happen that a static charge or some other condition may occur such that the front and back points of the contact 23 become fused. In such a circumstance, the relay 2TP would be steadily energized, and in turn would cause the steady energization of the relay 2FP. However, even though energy is supplied through the back point of contact 23, this energy cannot energize the relay 2BP because of the open condition of back contact 5. Thus, it is obvious that such a failure does not result in the erroneous control of the signal but rather causes such signal to indicate danger or stop regardless of whether a code is being received or not.

Should it happen that the circuit for the relay 2TP fails to close, then it is apparent that the relay 2FP would not be energized and the continued open condition of front contact 6 would likewise cause the slow acting back contact 2BP to be steadily deenergized. It can be seen that under such a condition the signal 2 would be held

at stop for two reasons, i. e., the relay 2BP would be deenergized closing back contact 12, and the failure of operation of contact 7 to a 180 code would cause the relay 2D to be deenergized. For these reasons, it is believed that the present invention provides a reliable and safe decoding organization for codes used in a coded track circuit signalling system.

Having described one form of coded track circuit block signalling system employing novel decoding apparatus to give a safe and reliable decoding organization as one embodiment of the present invention, it is desired to be understood that the invention is shown in this connection for the purpose of facilitating its disclosure, and that it can be applied to systems of various other types; and it is to be further understood that other specific embodiments and modifications of the invention may be made, and that various adaptations and alterations may be required to meet the problems of practice without in any manner departing from the spirit or scope of the present invention.

What I claim is:

1. In a decoding organization for checking the opening and closing of the contacts of a code following relay, a quick acting relay energized each time the code following relay is operated to one position and deenergized each time it is operated to its opposite position, a slow acting repeater relay energized each time said quick acting relay is energized only after its contacts have been picked up, said repeater relay being sufficiently slow acting to maintain its contacts picked up if said quick acting relay is energized and deenergized at relatively frequent intervals, and another slow acting relay energized each time the code following relay is operated to its said opposite position only providing said quick acting relay is deenergized with its contacts released and said slow acting repeater relay has its contacts picked up, whereby the cessation of the operation of said quick acting relay either because of the cessation of the operation of said code following relay or the failure of its contacts to open and close results in the continued deenergization of said another slow acting relay.

2. In a coded track circuit signalling system, a section of track having coded pulses applied thereto at different code rates dependent upon traffic conditions, a signal for governing traffic over said section, a code following track relay adjacent said signal and responsive to the code pulses in said section, a quick acting repeater relay for said code following relay, a slow acting signal repeater relay for said quick acting relay, a slow acting control relay controlled through a front contact of said slow acting repeater relay and back contacts of said code following track relay and said quick acting repeater relay, whereby said signal control relay is energized whenever said code following track relay is responsive to different codes but is deenergized whenever said code following track relay ceases operation, other signal control means governed by the operation of said quick acting repeater relay only in response to a particular one of said different code rates, and circuit control means for said signal governed by said slow acting signal control relay and said other signal control means so as to govern said signal distinctively in accordance with the different codes and to clear said signal only providing said quick acting repeater relay is actually following the response of said code

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following track relay to the different codes on
said track section.

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The following references are of record in the
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