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CODED TRACK CIRCUIT SIGNALLING SYSTEM FOR RAILWAYS AND THE LIKE

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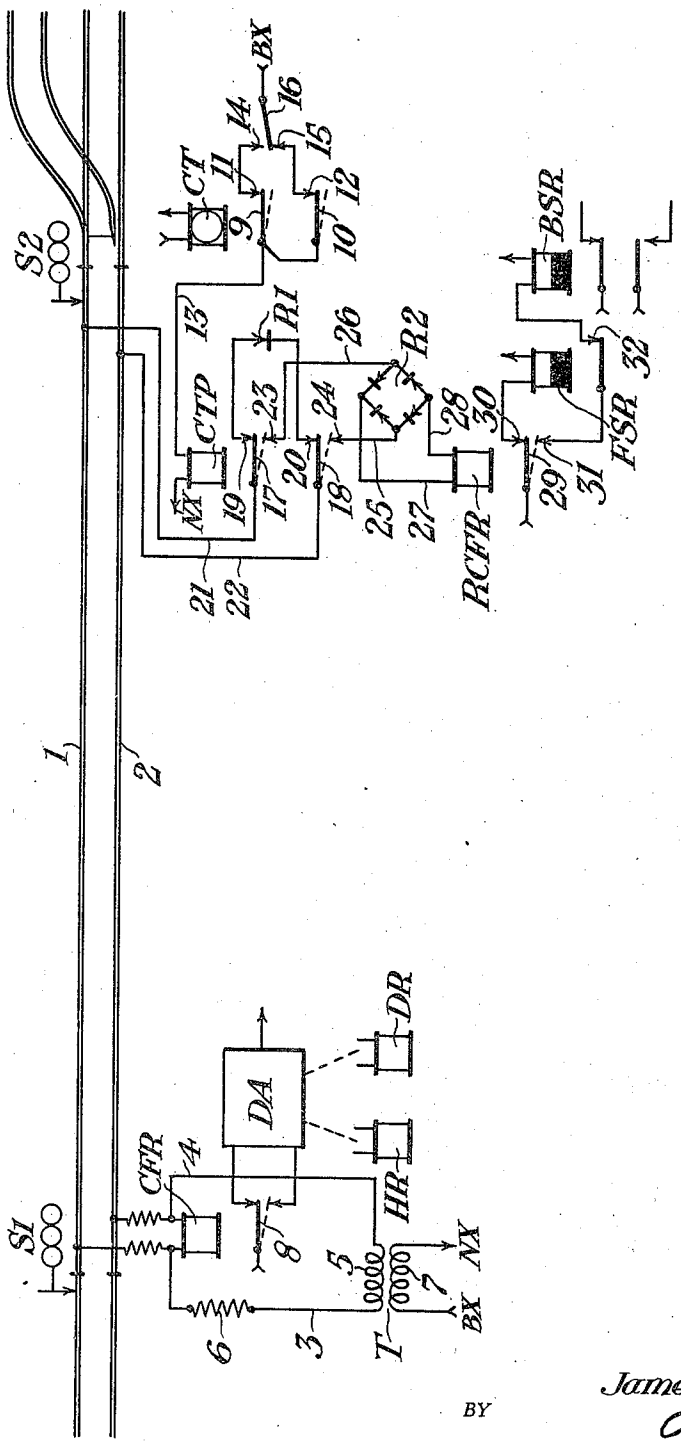

BY

INVENTOR
James Perrin Coley.
A. R. Verrill
HIS ATTORNEY

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CODED TRACK CIRCUIT SIGNALLING SYSTEM FOR RAILWAYS AND THE LIKE

James Perrin Coley, London, England, assignor, by mesne assignments, to The Union Switch and Signal Company, Swissvale, Pa., a corporation of Pennsylvania

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This invention relates to track circuit signalling systems of the kind in which the track rails of a block section are arranged to be supplied with coded signalling current consisting of current impulses separated by intervals the frequency of these impulses being controlled in accordance with traffic conditions in advance, a track relay at the entrance end of the section being responsive to this coded current and arranged to control a signal at this end of the section.

The invention furthermore relates to systems of the character above described in which, during the intervals between the current impulses, signalling current impulses are arranged to be fed to the track rails at the entrance end of the section to operate a relay at the exit end, this relay being arranged correspondingly to control approach locking or other control circuits.

Signalling systems of this kind have previously been proposed, but, as hitherto arranged, are open to the disadvantage that, to ensure safety in operation, the coded signalling current impulses operating the relay at the entrance end of the section (hereinafter termed the master code current) must be supplied to the track rails at the exit end of the section. Since the other current impulses for controlling the relay at the exit end of the section (hereinafter termed the feed back current) are, for the same reasons, necessarily supplied to the track rails at the entrance end, a supply of current is required at both ends of the section.

The present invention has for its object to avoid this disadvantage and to simplify the apparatus required and according to the principal feature of the invention a supply of signalling current is connected to the track rails at the entrance end only of the track section (in parallel with the track relay at that end), the rails at the exit end of the section being connected together through a rectifier at intervals with a frequency controlled in accordance with traffic conditions in advance, so as to provide master code current impulses in the track rails which, also at the exit end of the section, are arranged to be connected to the relay responsive to the feed back current during the intervals separating the master code impulses. These connections are preferably effected by a relay, the energising winding of which is supplied with current impulses at the master code frequency, this relay when energised effecting the connection of the track rails together through the rectifier and, when released, effecting the connection of the feed back relay to the track rails.

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The invention is illustrated by way of example in the accompanying drawing the single figure of which is a diagrammatic view of a simple signalling system for a single track section embodying one form of the invention.

Referring now to the drawing it will be seen that the track section comprises a pair of track rails 1, 2 insulated from one another and from the rails of the sections ahead and to the rear of the section in the usual manner, a signal S1 adjacent to the entrance end of the section while a signal S2 adjacent to the exit end controls the admission of traffic into the track section ahead.

At the entrance end of the section a code following track relay CFR is connected across the track rails 1, 2 which are also connected at this point through conductors 3, 4 to the terminals of the secondary winding 5 of a transformer T, a suitable limiting resistance or impedance 6 being connected in this circuit. The primary winding 7 of the transformer T is connected to the terminals BX, NX of a suitable source of alternating current supply and the track relay contacts 8 control the operation of decoding apparatus DA adapted in the usual manner to control in turn relays HR, DR controlling the signal S1 at the entrance end of the track section.

The code following relay CFR is a direct current relay and preferably of the bias polar type but other types can be used. The arrangement is such that relay CFR picks up its armature contact member 8 when the relay is energised by direct or rectified current of a given polarity such as positive polarity, and the contact member 8 is released to its biased position when the relay is energised by direct current of negative polarity or is deenergised and also when alternating current is supplied to the relay because the relay does not respond to alternating current.

At the exit end of the section a master code transmitting relay CTP is provided adapted to be supplied with energising master code current impulses in the usual manner at a frequency dependent upon traffic conditions ahead. For example these current impulses may have a frequency of 180 or 75 per minute dependant upon when the signal S2 adjacent to the exit end of the section and controlled from a signal cabin is indicating "clear" or "caution."

As shown in the drawing this action is effected by means of an electro-magnetically operated code transmitter CT comprising armatures 9 and

10 cooperating with contacts 11 and 12 respectively and adapted when the transmitter CT is energised to oscillate the armature 9 at a frequency of 180 per minute and the armature 10 at a frequency of 75 per minute. The armatures 9, 10 are electrically connected together and to a conductor 13 leading to the energising winding of the relay CTP.

The front contacts 11, 12 of the transmitter CT are connected respectively to the front and back contacts 14, 15 of a relay (not shown) controlling the signal S2 and having an armature 16 adapted to cooperate with the contacts 14, 15. Operating current for the relay CTP is supplied through the circuits indicated on the drawing from supply terminals BX and NX.

The transmitting relay CTP is provided with armatures 17 and 18 adapted to cooperate with front contacts 19, 20 respectively which, when the relay CTP is energised, connect the track rails 1, 2 of the section together through conductors 21, 22, the armatures 17, 18, front contacts 19, 20 and a rectifier R1. The relay CTP is also provided with back contacts 23, 24 which when the relay CTP is released connect the track rails 1, 2 to the output terminals 25, 26 of a bridge connected rectifier R2 the output terminals 27, 28 of which are connected to the energising winding of a feed back relay RCFR. The latter is provided with an armature 29 cooperating with a front contact 30 which when the relay RCFR is energised effects the supply of energising current to a slow-releasing relay FSR while when the relay RCFR is released, energising current is fed through a back contact 31 to a second slow-releasing relay BSR through a front contact 32 of the relay FSR. The relay BSR is arranged to control in any desired manner approach locking or other circuits for the track section ahead as indicated conventionally in the drawing.

The operation of the system is as follows:

Assuming that the track section is unoccupied by a train or vehicle and that master code current impulses are being supplied by the transmitter CT to the transmitting relay CTP at the exit end at a frequency of 180 or 75 per minute according the the setting of the signal S2 adjacent to this end of the section and the corresponding position of the armature 16, it will be evident that during a current impulse when the transmitting relay CTP is energised, a circuit will be completed from one terminal of the secondary winding 5 of the transformer T at the entrance end through track rail conductor 3 and resistance 6, the track rail 1, conductor 21, armature 17 of relay CTP, front contact 19, the rectifier R1, front contact 20, armature 18 conductor 22, the other track rail 2 and conductor 4 to the other terminal of the transformer winding 5.

The rectifier R1 is poled to pass in its forward or low resistance direction one half cycle, say, the negative half cycle, of the alternating current and to substantially block the other or positive half cycle of the current. Thus during the code interval the relay CTP is picked up connecting rectifier R1 across the rails the negative half cycles of the alternating current are shunted away from relay CFR and the positive half cycles are not, and relay CFR is energised to pick up its armature contact member 8 by such impulses of rectified current. During the code interval relay CTP is released to disconnect rectifier R1 and to connect relay RCFR to the rails through rectifier R2, both half cycles of the alternating current are applied to relay CFR and that relay is

deenergised to release its contact member 8 since the relay CFR is non-responsive to alternating current.

The code following relay CFR at the entrance end will accordingly be energised and deenergised at the frequency of the master code and, through the decoding apparatus DA, and the relay HR or DR will cause a corresponding indication to be given by the signal S1 at the entrance end of the track section.

During the intervening periods or intervals when the transmitting relay CTP is deenergised, current from the secondary winding 5 of the transformer T will be supplied through the track rails 1, 2 conductors 21, 22, armatures 17, 18 and back contacts 23, 24 of relay CTP, the rectifier R2 to the feed back relay RCFR at the exit end. Relay RCFR is a direct current relay and is energised and picked up in response to this impulse of rectified current supplied through the rectifier R2. That is, relay RCFR and rectifier R2 form a code following means responsive to the impulses of alternating current. It is clear that other forms of alternating current relays can be used. When relay RCFR is energised, the slow-releasing relay FSR will also be energised, through a circuit including armature 29 and front contact 30 of relay RCFR but relay FSR will not release as relay RCFR is deenergised when relay CTP again picks up. Accordingly the other slow-releasing relay BSR will be energised through a circuit including armature 29 and back contact of relay RCFR and front contact 32 of relay FSR when relay RCFR is deenergised. These two relays FSR and BSR will remain picked up so long as master code current is supplied to the track rails 1, 2. The approach locking or other circuits controlled by the slow releasing relays FSR and BSR will accordingly be energised or deenergised.

In the event of a train or vehicle entering the track section the track rails 1, 2 and the code following relay CFR at the entrance end of the section will be short-circuited so that the signal S1 will be caused to indicate "danger" while since current is no longer supplied through the track rails 1, 2 to the feed back relay RCFR at the exit end of the track section even during the intervals when the transmitting relay CTP is released, the feed back relay RCFR will be permanently deenergised and the slow-releasing relays FSR and BSR will, consequently, eventually release with a corresponding effect on the approach locking or other circuits controlled thereby.

The invention is evidently not limited to the particular system above described and illustrated. For example, the master code transmitting relay CTP may, if desired, be dispensed with, the connections effected by this relay being effected by contacts provided for this purpose on the code transmitter CT or its equivalent instead of through the action of the relay CTP.

Having now described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In a track circuit for a track section, the combination comprising, a source of alternating current and a direct current code following relay connected in multiple across the rails at one end of said section, a rectifier, an alternating current code following relay means, and a coding device operable to alternately connect said rectifier and said alternating current code following relay means across the rails at the other end

of the section to operate both said direct current code following relay and said alternating current code following relay means at the code rate predetermined by the rate of operation of said coding device.

2. In a track circuit for a track section, the combination comprising, a source of alternating current, a first code following relay, said source and relay connected in multiple across the rails at one end of the section, a second code following relay, a rectifier, coding means operable to a first and a second position, and means to connect said rectifier and said second relay to the rails at the other end of the section through first and second position contacts respectively of said coding means, whereby said first code following relay is energised by rectified current each code interval said rectifier is connected to the rails and said second relay is energised by alternating current each code interval that relay is connected to the rails when the section is unoccupied.

3. In a track circuit for a track section through which traffic normally moves in a given direction, the combination comprising, a source of alternating current and a direct current code following relay connected in multiple across the rails at

the entrance end of the section, a half wave rectifier, an alternating current code following relay means, and a coding device operable to alternately connect said rectifier and said alternating current code following relay means across the rails at the exit end of the section to operate both said direct current code following relay and said alternating current code following relay means at the code rate predetermined by the rate of operation of said coding device when the section is unoccupied and such operation is discontinued when the section is occupied due to the shunting of the rails.

JAMES PERRIN COLEY.

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