April 8, 1930. R. M. GILSON 1,753,699

RAILWAY TRAFFIC CONTROLLING APPARATUS

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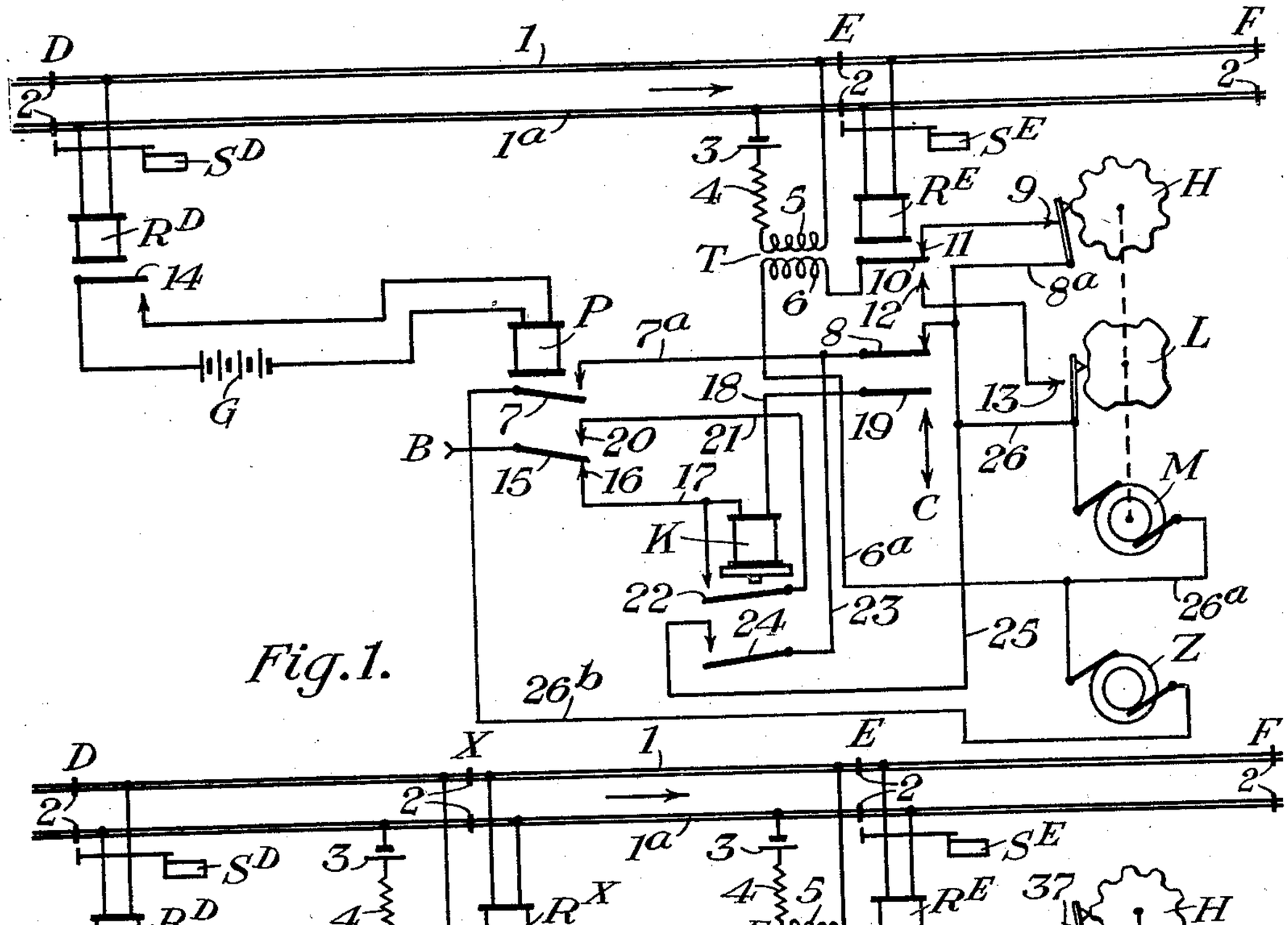



Fig. 1.

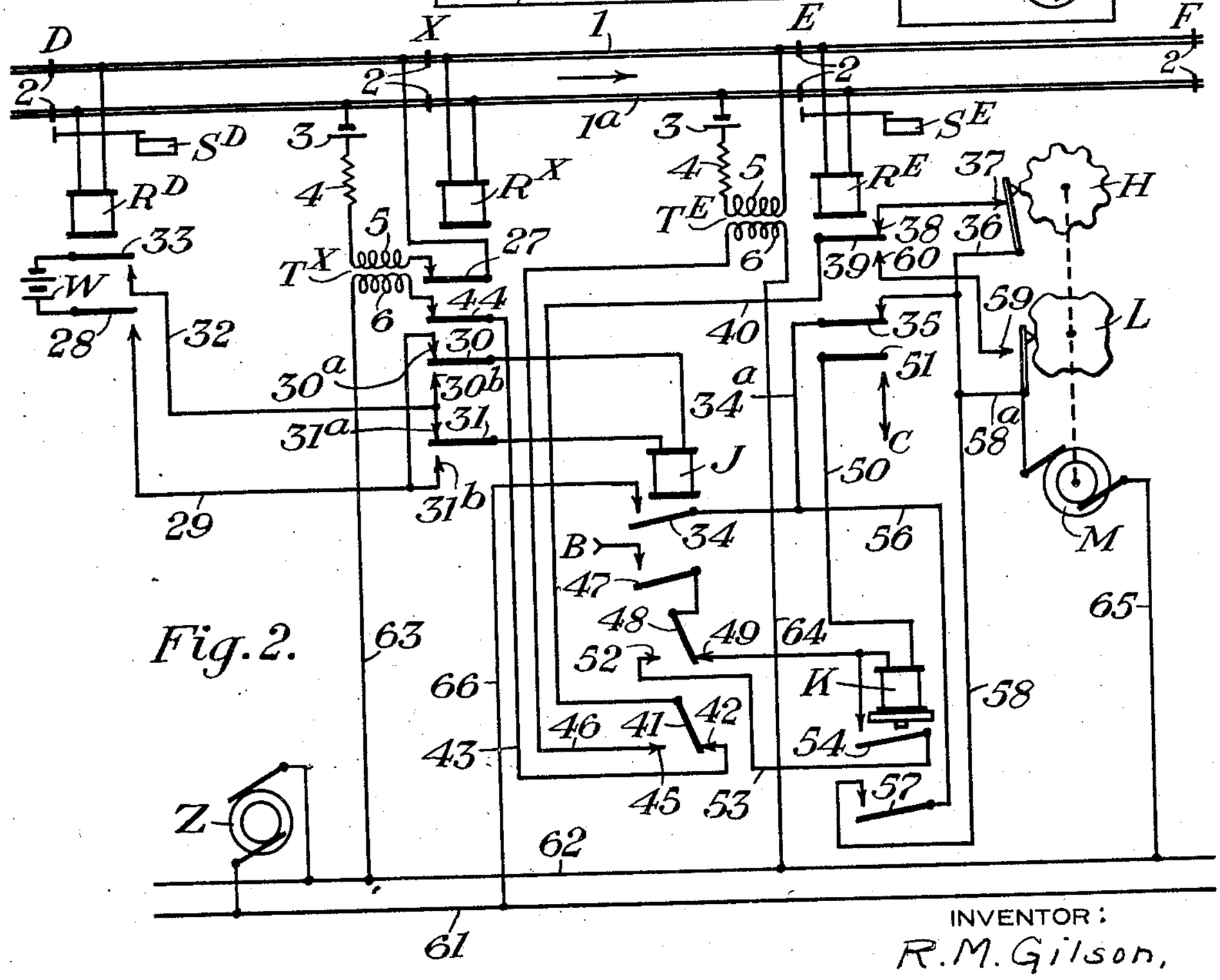



Fig. 2.

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# UNITED STATES PATENT OFFICE

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## RAILWAY-TRAFFIC-CONTROLLING APPARATUS

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My invention relates to railway traffic controlling apparatus, and particularly to apparatus in which train carried governing means is controlled by energy received from the trackway.

In apparatus of the type referred to, it is desirable to conserve energy and to reduce wear on the apparatus to a minimum by supplying energy to the trackway only at times when it is actually needed for the control of trains. One object of my invention is to provide apparatus for accomplishing this result.

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

In the accompanying drawing, Fig. 1 is a diagrammatic view of one form of railway traffic controlling apparatus embodying my invention. Fig. 2 is a diagrammatic view of a modified form of the apparatus shown in Fig. 1, and also embodying my invention.

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

Referring to Fig. 1, the reference characters 1 and $1^a$ designate the track rails of a stretch of railway track over which traffic normally moves in the direction indicated by the arrow. These rails are divided into sections D—E, E—F, etc., by means of insulated joints 2. Track circuit current is supplied to the trails of each section from a battery 3 through a limiting resistor 4 in the usual manner. The current from battery 3 also passes through the secondary 5 of a track transformer T. Connected across the rails of each section is a track relay designated by the reference character R with an exponent corresponding to the location.

Also associated with the section D—E is a relay P which is supplied with current from a battery G over a back contact 14 of relay $R^D$ whenever this relay is de-energized. A stick relay K is also associated with the section D—E and this relay has a pick-up circuit which passes from one terminal B of a suitable source of direct current, omitted from the drawing for the purpose of simplicity, over back contact 15—16 of relay P, wire 17, winding of relay K, wire 18 and back contact 19 of relay $R^E$ to the other terminal C of the source. This circuit is closed only when relays P and $R^E$ are de-energized. Relay K also has a stick circuit which passes from terminal B through contact 15—20 of relay P, wire 21, contact 22 of relay K, winding of relay K, wire 18 and back contact 19 of relay $R^E$ to the terminal C. This circuit is closed only when relay P is energized and relay $R^E$ is de-energized. Relay K has slow release characteristics to insure that its contacts remain closed while relay P is picking up.

Train controlling current is at times supplied to the rails of the section D—E through the track transformer T from a suitable source of energy, here shown as an alternator Z. The primary 6 of transformer T has a circuit which passes from one terminal of alternator Z over wire $26^b$, contact 7 of relay P, wire $7^a$, contact 8 of relay $R^E$, wire $8^a$, contact 9, contact 10—11 of relay $R^E$, primary 6 of transformer T and wire $6^a$ to the other terminal of alternator Z. This circuit is closed only when relays P and $R^E$ are both energized. Primary 6 also has a branch circuit which passes from one terminal of alternator Z over wire $26^b$ through contact 7 of relay P, wires $7^a$ and 23, contact 24 of relay K, wires 25 and 26, contact 13, contact 10—12 of relay $R^E$, primary 6 of transformer T and wire $6^a$ to the other terminal of alternator Z. This circuit is closed only when relays P and K are energized and relay $R^E$ is de-energized.

The train controlling current supplied to the track rails through the transformer T may be periodically varied by means of cams H and L which are driven at constant speed by means of a motor M supplied with current from the source which supplied the transformer T. The cam H operates the contact 9 for supplying high speed code to the rails of the section, and cam L controls the contact 13 for supplying low speed code to the rails of the section. High speed code can be supplied only when the track relay $R^E$ is energized, and low speed code can be supplied only when this relay is deenergized. It is to be understood that although I have shown

means for periodically varying the train controlling current at two rates my invention is not limited to this number.

Associated with the rails of each section are the usual signals each designated by the reference character S with an exponent corresponding to the location. These signals are controlled in any suitable manner, but this control has nothing to do with my present invention.

In describing the operation of the apparatus I shall first assume that a train moving from left to right enters the section D—E. Track relay $R^D$ will be de-energized and relay P will pick up, closing the contact 7 and completing a circuit for the motor M from one terminal of alternator Z over wire $26^b$, contact 7, wire $7^a$, contact 8 of relay $R^E$, wire 26, motor M, and wire $26^a$ to the other terminal of the alternator Z, thus setting the motor M into operation to periodically operate the contacts 9 and 13. Relay $R^E$ is energized, therefore high speed code will be supplied to the primary of transformer T over the contact 9.

When the forward axle of the train passes the insulated joint E in leaving the section D—E, the relay $R^E$ will be de-energized releasing the contact 8 to open the circuit of the code motor M and discontinuing the supply of train controlling current to the rails of the section D—E. When the rear axle of the train passes the point E as the train leaves the section D—E, relay $R^D$ will pick up de-energizing the relay P, but since the relay $R^E$ remains de-energized the contact 19 of relay $R^E$ will be closed so that the pick-up circuit of relay K will be closed and relay K will be energized closing its contacts 22 and 24. If now, while the train occupies the section E—F a second train enters the section D—E relay $R^D$ will be de-energized, causing relay P to pick up and to close its contact 7. Contact 15—20 of relay P will also close to complete the stick circuit for relay K which will therefore remain energized. Under these conditions low speed code will be supplied to the rails of the section D—E because, although the contact 8 of relay $R^E$ is open, the branch circuit over contact 24 of relay R is closed so that the circuit for the coding motor M is closed and contact 13 is periodically opened and closed to supply train controlling current to the primary 6 of transformer T over the back contact 10—12 of relay $R^E$. The circuit for the motor M is from alternator Z over wire $26^b$, contact 7 of relay P, wires $7^a$ and 23, contact 24 of relay K, wires 25 and 26, motor M and wire $26^a$ to alternator Z. When the train leaves the section E—F, relay $R^E$ will again become energized to close contact 10—11 and contact 8 so that high speed code will be supplied to the rails of section D—E.

It will be clear from the foregoing that train controlling current will be supplied to the section D—E when a train enters that section but will be discontinued as soon as the forward axle of the engine passes the insulated joint between sections D—E and E—F when the train leaves the section D—E, so that no unnecessary energy will be supplied to the section, and it will also be clear that the provision of the relay K insures that when the train enters the section E—F a following train entering section D—E will receive train controlling current.

In the modification shown in Fig. 2 the track section D—E is divided into sub-sections D—X and X—E by means of an insulated joint located at point X midway between signals $S^D$ and $S^E$. A track relay $R^X$ is provided for the sub-section X—E, and track circuit current is supplied to the sub-section D—X by a battery 3 over a front contact 27 of relay $R^X$ so that track relay $R^D$ cannot receive track circuit current when a train occupies the sub-section X—E. The track circuits are otherwise similar to those in Fig. 1.

Associated with the section D—E is a polarized relay J which may be at times supplied with current from a battery W over contacts 28 and 33 of track relay $R^D$, the polarity of this current being controlled by two-pole-changing contacts 30 and 31 on track relay $R^X$. When relay $R^D$ is de-energized and relay $R^X$ is energized, current of normal polarity is supplied to the relay J over a circuit from battery W, contact 28 of relay $R^D$, wire 29, contact 30—$30^a$ of relay $R^X$, winding of relay J, contact 31—$31^a$ of relay $R^X$, wire 32 and contact 33 of relay $R^D$ back to battery. When this circuit is closed the pole-changing contacts 41 and 48 of relay J are swung to the right. When both relays $R^D$ and $R^X$ are de-energized, current of reverse polarity is supplied to the relay J over a circuit from battery W over contact 28 of relay D, wire 29, contact 31—$31^b$ of relay $R^X$, winding of relay J, contact 30—$30^b$ of relay $R^X$, wire 32 and contact 33 of relay $R^D$ back to battery W. When this circuit is closed the pole-changing contacts 41 and 48 of relay J are swung to the left. The contacts 47 and 48 of relay J are included in the circuits of a stick relay K having a pick-up circuit which passes from one terminal B of a suitable source of direct current, over contact 47 and normal contact 48—49 of relay J, winding of relay K, wire 50 and back contact 51 of relay $R^E$ to the other terminal C of the source. This circuit is closed only when relay $R^E$ is de-energized and relay J is energized in the normal direction. Relay K also has a stick circuit passing from terminal B of the source, over contact 47 of relay J, reverse contact 48—52 of relay J, wire 53, contact 54 of relay K, winding of relay K, wire 50 and contact 51 of relay $R^E$ to the terminal C of the source, and

this circuit is closed only when relay $R^E$ is de-energized and relay J is energized in the reverse direction. The relay K has slow-release characteristics so that it will remain picked up while relay J is reversing its contacts in response to a reversal of the pole-changing contacts 30 and 31 of relay $R^x$.

A suitable source of alternating current is provided for supplying train controlling current to the track rails, and as here shown this source comprises an alternator Z supplying current over a pair of line wires 61 and 62.

For the purpose of periodically varying the train controlling current, I provide a coding motor M for operating two contacts 37 and 59, similar to contacts 9 and 13 of Fig. 1. The circuit for this motor is from line wire 61, wire 66, contact 34 of relay J, wire $34^a$, contact 35 of relay $R^E$, wire $58^a$, motor M and wire 65 to line wire 62; this circuit is closed only when relays J and $R^E$ are energized. Motor M also has a branch circuit from line wire 61 over wire 66, contact 34 of relay J, wire 56, contact 57 of relay K, wires 58 and $58^a$, motor M and wire 65 to line wire 62. This branch circuit is closed only when relays J and K are both energized.

Train controlling current is at times supplied to the sub-section D—X over a circuit from line wire 61, wire 66, contact 34 of relay J, wire $34^a$, contact 35 of relay $R^E$, wire 36, contact 37, contact 38—39 of relay $R^E$, wire 40, normal contact 41—42 of relay J, wire 43, contact 44 of relay $R^x$, primary 6 of transformer $T^x$, and wire 63 to line wire 62. This circuit is closed only when relays $R^x$ and $R^E$ are energized and relay J is energized in the normal direction. When relay $R^E$ is de-energized, train controlling current may be supplied to the sub-section D—X from line wire 61 over wire 66, contact 34 of relay J, wire 56, contact 57 of relay K, wires 58 and $58^a$, contact 59, contact 60—39 of relay $R^E$, wire 40, normal contact 41—42 of relay J, wire 43, contact 44 of relay $R^x$, primary 6 of transformer $T^x$ and wire 63 to line wire 62. This circuit is closed only when relay $R^x$ is energized, relay $R^E$ is de-energized and relay J is energized in the normal direction. It follows, therefore, that high speed code or low speed code respectively, is supplied to the sub-section D—X, according as relay $R^E$ is energized or de-energized.

Train controlling current may be supplied to the sub-section X—E over a circuit from line wire 61, wire 66, contact 34 of relay J, wire $34^a$, contact 35 of relay $R^E$, wire 36, contact 37, contact 38—39 of relay $R^E$, wire 40, reverse contact 41—45 of relay J, wire 46, primary 6 of transformer $T^E$, and wire 64 to line wire 62. This circuit is closed only when relay $R^E$ is energized and relay J is energized in the reverse direction. When relay $R^E$ is de-energized train controlling current may be supplied to the section X—E over a circuit from line wire 61, wire 66, contact 34 of relay J, wire 56, contact 57 of relay K, wires 58 and $58^a$, contact 59, contact 60—39 of relay $R^E$, wire 40, reverse contact 41—45 of relay J, wire 46, primary 6 of transformer $T^E$, and wire 64 to line wire 62. This circuit is closed only when relay $R^E$ is de-energized and relay J is energized in the reverse direction. It follows therefore, that high speed or low speed code respectively, may be supplied to the sub-section X—E according as relay $R^E$ is energized or de-energized.

In describing the operation of the circuits shown in Fig. 2, I will assume that the parts occupy the positions shown in the drawing and that a train moving from left to right enters the sub-section D—X. Relay $R^D$ is de-energized and since the contacts 30 and 31 of relay $R^x$ are in the normal position, relay J will be energized in the normal direction, swinging the contacts 48 and 41 to the right, completing a circuit for primary 6 of transformer $T^x$ over contact 37. Under these conditions high speed code will be supplied to the sub-section D—X over the contact 37. When the train enters the sub-section X—E relay $R^x$ is de-energized and contact 27 opens, cutting off the supply of track circuit current to sub-section D—X so that relay $R^D$ remains de-energized. Current of reverse polarity is therefore supplied to the relay J over back contacts 31—$31^b$ and 30—$30^b$ of relay $R^x$. Contact 41 of relay J is swung to the left closing contact 41—45 and connecting the supply of train controlling current to the primary 6 of transformer $T^E$ so that high speed code is supplied to the sub-section X—E over contact 37. As soon as the forward axle of the train crosses the insulating joint at point E, the relay $R^E$ is de-energized opening contact 35 and disconnecting the coding motor M from the source so that the supply of train controlling current to the section D—E is discontinued. Under these conditions back contact 51 of relay $R^E$ is closed so that if a second train enters the sub-section D—X while a train still occupies the section E—F, relay K will pick up closing its contact 57 and completing a branch circuit around the contact 35 of relay $R^E$ so that train controlling current may be supplied to the section D—E even though relay $R^E$ is de-energized, and in the following manner. When the second train enters the sub-section D—X, relay $R^D$ will be de-energized so that the current of normal polarity will be supplied to the relay J and contact 48 of relay J will be swung to the right hand position to complete the pick up circuit for relay K. Energization of relay K will close contact 57 and complete a circuit for the coding motor M from line wire 61 over wire 66, contact 34 of relay J, wire 56, contact 57 of relay K, wires 58 and $58^a$, motor M, and wire 65 to line wire 62 so as to supply train controlling current to section

D—E over contact 59. The operation of the parts will now be similar to that just described for a train passing from left to right through the sections under clear conditions, and will be understood without further explanation.

From the foregoing description, it will be clear that the means which I provide make it possible to supply train controlling current to the track rails only at times when it is actually necessary for the control of trains, and to disconnect the source of energy from the track rails at all other times.

Although I have herein shown and described only two forms of railway traffic controlling 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 forward and a rear section of railway track, a track relay for each of said sections, a source of train controlling current for the rear section, means for connecting the source to the rear section when the track relay of the forward section is energized and the track relay of the rear section is de-energized, a relay, and means controlled by said relay for connecting said source to the rear section when the track relays of the forward and rear sections, respectively, are de-energized in succession.

2. In combination, a first and a second section of railway track, a track relay for each section, a first relay controlled by the track relay of the first section, a second relay controlled jointly by said first relay and the track relay of the second section, a source of train controlling current for the first section, and means controlled by the first and second relays for supplying train controlling current to the first section when the track relays of both sections are de-energized.

3. In combination, a forward and a rear section of railway track separated by an insulated joint, a source of train controlling current for said rear section, means for connecting said source to the section when a train enters the section, means for disconnecting said source when the forward axle of a train passing from the rear to the forward section passes said insulated joint, and means for again connecting said source to the section if a second train enters the rear section before the first train leaves the forward section.

4. In combination, a forward and a rear section of railway track, a track relay for each section, a first relay controlled by the track relay of the rear section, a second relay controlled jointly by the first relay and by the track relay of the forward section, a source of train controlling current, means controlled by the first relay and the track relay of said forward section for connecting the source of train controlling current to one of said sections under one condition, and means controlled by the first relay and the second relay for connecting the source of train controlling current to said section under another condition.

5. In combination, a first and a second section of railway track, a track relay for each section, a first relay controlled by the track relay of the first section, and means controlled by the first relay and the track relay of the second section for supplying train controlling current to the first section when and only when the first section is occupied by a train, said means also being operative to disconnect said source of train controlling current when the forward axle of a train enters the second section.

6. In combination, a section of railway track divided into first and second sub-sections, a track relay for each sub-section, a first relay controlled jointly by the track relays of the sub-sections, a source of train controlling current for supplying the first sub-section when a train occupies such sub-section, and means controlled by the track relay of the second sub-section and by said first relay, for disconnecting the source from the first sub-section and connecting it to the second sub-section when the forward axle of a train passes from the first to the second sub-section.

7. In combination, a section of railway track divided into first and second sub-sections, a track relay for each sub-section, a source of train controlling current, a first relay controlled by the track relays for connecting said source to either of said sub-sections, and means controlled by the track relay of the second sub-section and by said first relay for disconnecting the source from the first sub-section and connecting it to the second sub-section when the forward axle of a train passes from the first to the second sub-section.

8. In combination, a section of railway track divided into a first and a second sub-section by an insulated joint, a source of train controlling current for supplying the first sub-section when a train occupies such sub-section, and means for disconnecting said source from the first sub-section and connecting it to the second sub-section when the forward axle of a train travelling from the first to the second sub-section passes the insulated joint between the sub-sections.

9. In combination a forward and a rear section of railway track, a first relay associated with the rear section and arranged to be energized when and only when such section is occupied, a track relay for the forward section, a stick relay having pick-up and stick circuits each controlled by said first

relay and the track relay, and means controlled by the stick relay for supplying train controlling current to the rear section.

10. In combination a forward and a rear section of railway track, said rear section being divided into two sub-sections, track relays for the forward section and for each of the sub-sections, a polarized relay, means controlled by the track relay for one sub-section for supplying the polarized relay with current of one polarity or the other depending upon the condition of the track relay for the other sub-section, a stick relay having pick-up and stick circuits controlled by the polarized relay and by the track relay of the forward section, and means controlled by the stick relay for supplying train controlling current to one sub-section when the polarized relay is energized in one direction and train controlling current to the other sub-section when the polarized relay is energized in the opposite direction.

11. In combination a forward and a rear section of railway track, said rear section being divided into two sub-sections, track relays for the forward section and for each of the sub-sections, a polarized relay, means controlled by the track relay for one sub-section for supplying the polarized relay with current of one polarity or the other depending upon the condition of the track relay for the other sub-section, a stick relay having a pick-up circuit controlled by a normal contact of the polarized relay and by the track relay of the forward section, and a stick circuit controlled by a reverse contact of the polarized relay and by the track relay of the forward section, and means controlled by the stick relay for supplying train controlling current to one sub-section when the polarized relay is energized in one direction, and train controlling current to the other sub-section when the polarized relay is energized in the opposite direction.

In testimony whereof I affix my signature.

ROBERT M. GILSON.