June 6, 1933. H. A. THOMPSON 1,912,923

RAILWAY TRAFFIC CONTROLLING APPARATUS

Original Filed Feb. 17, 1930 2 Sheets-Sheet 1

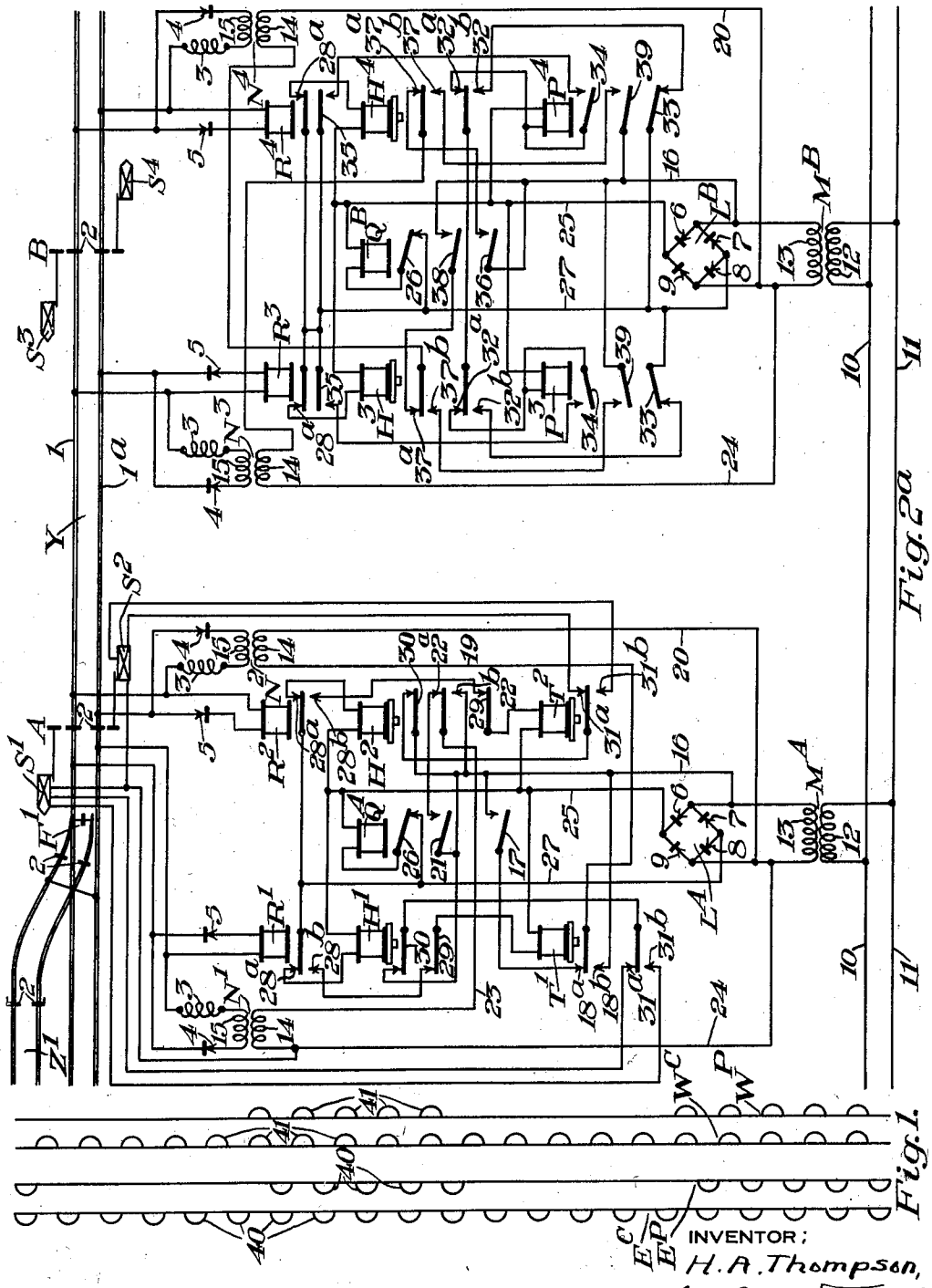


Fig. 2a

Fig. 1.

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RAILWAY TRAFFIC CONTROLLING APPARATUS

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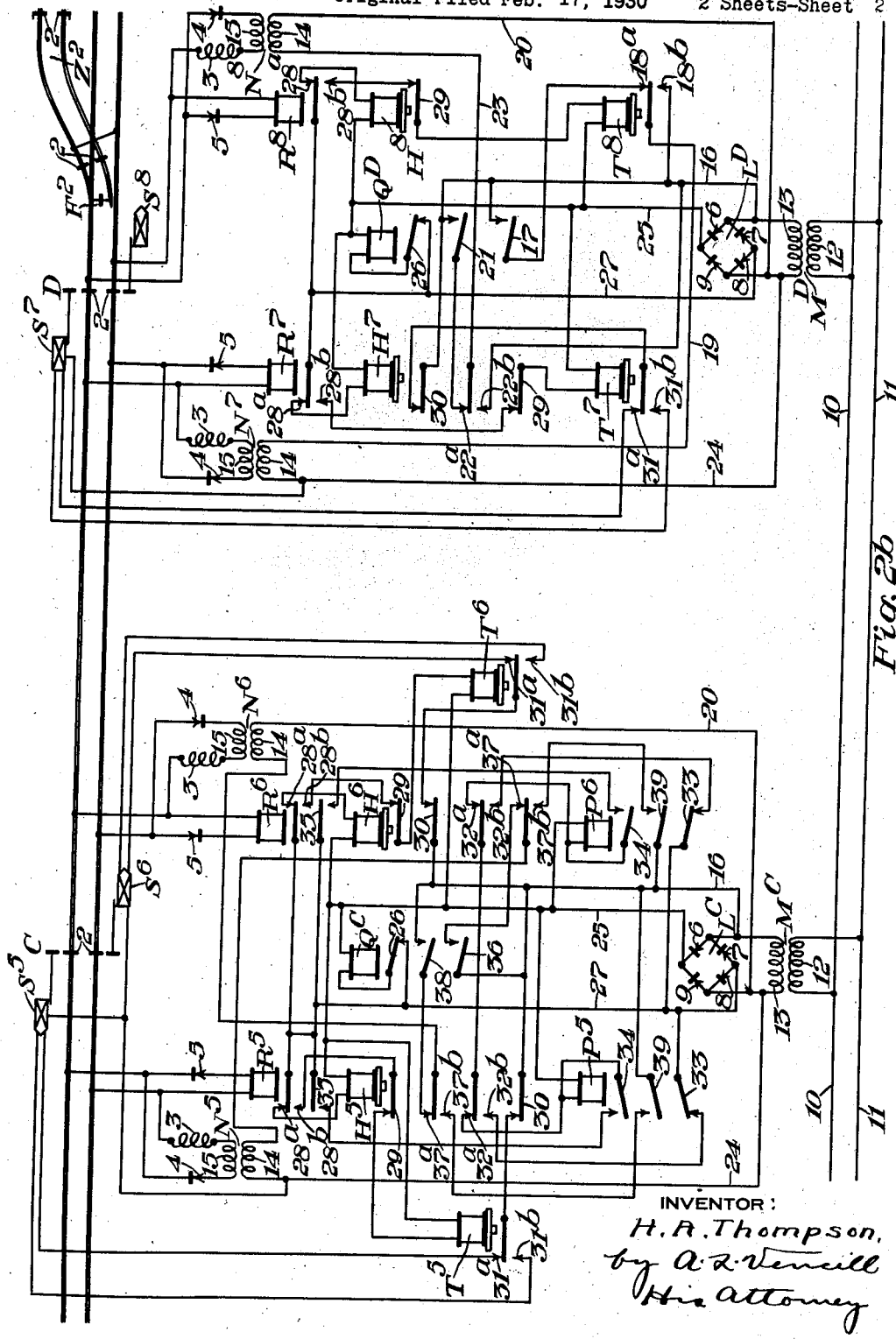


Fig. 2b

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UNITED STATES PATENT OFFICE

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RAILWAY TRAFFIC CONTROLLING APPARATUS

Application filed February 17, 1930, Serial No. 428,896. Renewed January 20, 1932.

My invention relates to railway traffic controlling apparatus, and particularly to apparatus of the type comprising traffic governing means for both directions of traffic controlled by current flowing in the same track rails.

One feature of my invention is the provision of means controlled by current of a given polarity supplied to the track rails for controlling traffic movements in one direction, and the provision of means controlled by current of the opposite polarity supplied to the same track rails for controlling traffic movements in the opposite direction.

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, Figs. 2^a and 2^b, when placed end to end with Fig. 2^a on the left, constitute a diagrammatic view showing one form of apparatus embodying my invention. Fig. 1 comprises sketches illustrating the current supplied to the track rails associated with apparatus embodying my invention.

Referring first to Figs. 2^a and 2^b, reference characters 1 and 1^a designate the track rails of a stretch Y of railway track over which traffic moves in both directions. Stretch Y is connected at intervals with passing sidings, two of which sidings, Z^1 and Z^2, are here shown in part. Sidings Z^1 and Z^2 are connected with stretch Y by means of switches F^1 and F^2, respectively. As shown in the drawings, the traffic direction from left to right is eastbound, whereas, that from right to left is westbound.

Rails 1 and 1^a are divided by means of insulated joints 2 into a plurality of track sections, only three of which sections, A—B, B—C and C—D, are shown complete in the drawings. Current is supplied to the rails of each of these sections by two track transformers, each of which is designated by the reference character N with a distinguishing exponent. These two transformers are connected across the rails adjacent opposite ends of each section. The transformers connected to the eastern ends of the sections supply current periodically, of what I will term "positive" polarity, to the rails through asymmetric units 4. This current is in the form of successive waves 40 as illustrated in the sketches E^C and E^P of Fig. 1. The transformers connected to the western ends of the sections supply current periodically, of what I will term "negative" polarity, to the rails through other asymmetric units 4. This current is also in the form of successive waves 41 as illustrated in sketches W^C and W^P of Fig. 1. The waves shown in sketches W^C and W^P alternate with the waves shown in sketches E^C and E^P so that each of the sections receives current of positive polarity at its eastern end, then receives current of negative polarity at its western end, and then receives current of positive polarity at its eastern end, and so on, alternately. A usual impedance device 3 is connected between each transformer N and the track rails.

Connected across the rails adjacent each end of each section is also a track relay designated by the reference character R with a distinguishing exponent. An asymmetric unit 5, connected between each track relay R and the rails, obstructs the flow of current through the relay from the adjacent transformer N but permits the flow of current through the relay from the transformer N which is connected across the rails at the opposite end of the section. It follows then that the relays connected with the two ends of each section are energized alternately with respect to each other by current supplied periodically by the track transformers at the opposite ends of the section, respectively.

Two signals, each of which is designated by the reference letter S with a distinguishing exponent, are placed adjacent each of the points A, B, C and D. One of these two signals governs eastbound traffic, and the other governs westbound traffic. As here shown, signals S are of the semaphore type, but various other types of signals could be similarly controlled by apparatus embodying my invention.

Each of the track relays R, by means of a front contact 28^a, controls a slow-release relay designated by the reference letter H with

an exponent corresponding to that for the relay R by which it is controlled.

A second slow-release relay T is also associated with each track relay R. Each relay T is controlled by a back contact of its associated relay R and by a front contact of the associated first slow-release relay H. Relays T^3 and T^4, adjacent point B, are controlled similarly to relays T^5 and T^6, adjacent point C, and hence relays T^3 and T^4 and their control circuits are omitted from the drawings.

Each signal S is controlled by a slow-release relay H and the associated second slow-release relay T. The operating circuits for signals S^3 and S^4 are similar to those for signals S^6 and S^5, respectively, and are hence omitted from the drawings. The operating circuits for signal S^8 are similar to those for signal S^1, and are hence also omitted from the drawings.

Adjacent each of the points B and C, two directional stick relays, designated by the reference letter P with distinguishing exponents, are provided. One of the relays P, adjacent each of the points B and C, is controlled by eastbound traffic, and the other relay P, adjacent each of the points B and C, is controlled by westbound traffic.

A coding device Q which, as here shown, is controlled by one of its own contacts, is associated with each signal location.

The current supplied to primary winding 14 of the track transformer N for one section adjacent points A and D is controlled by the slow-release relay H for the second section adjacent points A and D, respectively, and by the associated coding device Q. The current supplied to primary winding 14 of the transformer N for the second section adjacent points A and D is controlled by the slow-release relay T for the first section adjacent the same points and by the associated coding device Q. At each point B and C, the current supplied to primary winding 14 of the track transformer N for each section is controlled by the relay P for the other section adjacent the same point, as well as by the relay H for the other section adjacent the same point and by the associated coding device Q.

Current for energizing the primary windings 14 of the two track transformers N at each signal location point is supplied by a line transformer designated by the reference letter M with an exponent according to the location point. The primary winding 12 of each line transformer M is constantly supplied with current over line wires 10 and 11 from a source not shown in the drawings.

Current for energizing each of the relays H, P and T, and coding devices Q is supplied by a rectifier which is designated by the reference letter L with an exponent according to the location point. As here shown, each rectifier L comprises four asymmetric units 6, 7, 8 and 9. Alternating current is constantly supplied to rectifiers L^A, L^B, L^C and L^D by secondary winding 13 of transformers M^A, M^B, M^C and M^D, respectively.

Referring now to Fig. 1, it has already been pointed out that, as here shown, current is supplied to each end of each track circuit in successive waves. When the current supplied to a track transformer N passes through a contact of the associated code device Q, its series of waves 40 or 41 is interrupted at intervals as shown in sketches E^P and W^P, whereas, when the current which is being supplied to a transformer N does not pass through a contact of a code device Q, the series of current waves is constant as shown in sketches E^C and W^C. Each track relay R, when energized by a constant series of waves, as shown in sketches E^C and W^C, closes its front contacts and maintains them in that position, but each relay R, when energized by an interrupted series of current waves as shown by sketches E^P and W^P, opens its front contacts each time the series is interrupted.

Each relay H closes its front contacts when the associated relay R has closed its front contacts and, being slow-releasing, the relay H does not open its front contacts each time the associated relay R opens its front contacts due to an interruption of a series of waves as shown by sketches E^P and W^P. Each relay T becomes energized when and only when a back contact of the associated relay R is closed and a front contact of the associated relay H is closed. Since the associated relay H maintains its front contacts in the closed position when the relay R by which it is controlled is alternately opening and closing its front contacts due to a periodically interrupted series of current waves, each relay T maintains its front contacts in the closed position when and only when the associated relay R is alternately opening and closing its back contacts.

Having thus described, in general, the arrangement and location of the various parts comprising my invention, I will now trace in detail the operation of the apparatus.

As shown in the drawings, all parts are in their normal condition, that is, all track sections are clear and all signals are indicating "proceed". Each of the coding devices Q is constantly in operation alternately closing and opening its contacts 17, 21 and 26 or 36, 38 and 26, respectively. Each time its contact 26 closes, each device Q, as shown, becomes energized by its operating circuit which passes from the associated rectifier L, through a wire 25, the winding of the coding device Q, contact 26 of the same coding device Q, and a wire 27 back to the same rectifier L. Each coding device Q becomes de-

energized upon opening its contact 26. It follows, therefore, that each coding device Q is alternately energized and de-energized according as its contact 26 is closed or opened.

When traffic conditions east of signal S^8 are such as to cause signal S^8 to indicate proceed, as shown, relay R^8 is being supplied with an interrupted series of waves of current shown in sketch E^P. Relay R^8 is therefore closing its contacts 28^a and 28^b, alternately. Relay H^8 is hence periodically energized by its circuit passing from rectifier L^D, through wire 25, winding of relay H^8, contact 28^a of relay R^8, and wire 27 back to rectifier L^D. Relay H^8 thus maintains its contact 29 in the closed position, and hence relay T^8 is periodically energized by its circuit passing from rectifier L^D, through wire 25, winding of relay T^8, contact 29 of relay H^8, contact 28^b of relay R^8, and wire 27 back to rectifier L^D. Relay T^8, therefore, holds its contact 18^a closed.

With contact 18^a of relay T^8 closed, primary winding 14 of transformer N^7 is being supplied with periodically interrupted alternating current by its circuit passing from secondary winding 13 of transformer M^D, through wire 16, contact 17 of coding device Q^D, contact 18^a of relay T^8, wire 19, primary winding 14 of transformer N^7, and wire 24 back to secondary winding 13 of transformer M^D. Relay R^6 is therefore being supplied with a series of current waves, interrupted according to sketch E^P, by its circuit passing from secondary winding 15 of transformer N^7, through asymmetric unit 4, rail 1^a of track section C—D, asymmetric unit 5 at relay R^6, the winding of relay R^6, rail 1 of section C—D, and impedance 3 at transformer N^7 back to secondary winding 15 of transformer N^7.

With relay R^6 thus periodically energized, relay H^6 is periodically energized by a circuit which is similar to the circuit already traced for relay H^8. It follows that relay T^6 is also periodically energized by a circuit which is similar to the circuit previously traced for relay T^8. With relays H^6 and T^6 thus energized and retaining their contacts 30 and 31^a, respectively, in the closed position, signal S^6 is held in its proceed position by its circuit passing from secondary winding 13 of transformer M^C, through wire 16, contact 30 of relay H^6, contact 31^a of relay T^6, the mechanism of signal S^6, and wire 24 back to secondary winding 13 of transformer M^C.

With relay H^6 energized, primary winding 14 of transformer N^5 is being supplied with periodically interrupted alternating current by its circuit passing from secondary winding 13 of transformer M^C, through wire 16, contact 36 of coding device Q^C, contact 37^a of relay H^6, primary winding 14 of transformer N^5, and wire 24 back to secondary winding 13 of transformer M^C. Relay R^4 is therefore being supplied with a series of current waves, interrupted according to sketch E^P, by its circuit which is similar to the circuit already traced for relay R^6. Signal S^4 is held in its proceed position by its circuit which is similar to the circuit already traced for signal S^6.

Relay R^2 is being energized similar to relay R^4. Relays H^2 and T^2 are energized by circuits which are similar to the circuits already traced for relays H^6 and T^6, respectively, and signal S^2 is held in its proceed position by its circuit which is similar to the circuit already traced for signal S^6.

With traffic conditions west of signal S^1 such that signal S^1 is indicating proceed, relay R^1 is being supplied with a series of current waves interrupted according to sketch W^P. Relay R^1 is therefore closing its contacts 28^a and 28^b alternately. Relay H^1 holds its contacts 29 and 30 closed on account of being periodically energized by its circuit passing from rectifier L^A, through wire 25, winding of relay H^1, contact 28^a of relay R^1, and wire 27 back to rectifier L^A. Relay T^1 holds its contacts 18^a and 31^a closed on account of being periodically energized by its circuit passing from rectifier L^A, through wire 25, winding of relay T^1, contact 29 of relay H^1, contact 28^b of relay R^1, and wire 27 back to rectifier L^A.

Primary winding 14 of transformer N^2 is provided with periodically interrupted alternating current by its circuit passing from secondary winding 13 of transformer M^A, through wire 16, contact 17 of coding device Q^A, contact 18^a of relay T^1, wire 19, winding 14 of transformer N^2, and wire 20 back to secondary winding 13 of transformer M^A. Relay R^3 is therefore supplied with a periodically interrupted series of current waves according to sketch W^P by its circuit passing from secondary winding 15 of transformer N^2, through impedance 3, rail 1 of section A—B, winding of relay R^3, asymmetric unit 5, rail 1^a of section A—B, and asymmetric unit 4 at transformer N^2 back to secondary winding 15 of transformer N^2.

With relay R^3 thus periodically energized, relay H^3 is periodically energized by a circuit which is similar to the circuit already traced for relay H^1. Signal S^3 is held in its proceed position by a circuit which is similar to the circuit previously traced for signal S^6.

With relay H^3 energized, primary winding 14 of transformer N^4 is being supplied with periodically interrupted alternating current by its circuit passing from secondary winding 13 of transformer M^B, through wire 16, contact 38 of coding device Q^B, contact 37^a of relay H^3, primary winding 14 of transformer N^4, and wire 20 back to secondary winding 13 of transformer M^B. Relay R^5 is therefore being supplied with a periodically

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interrupted series of current waves, shown in sketch W^P, by its circuit which is similar to the circuit already traced for relay R^3. Relays H^5 and T^5 are energized by circuits which are similar to the circuits already traced for relays H^1 and T^1, respectively. Signal S^5 is held in its proceed position by its circuit which is similar to the circuit previously traced for signal S^6.

Relay R^7 is energized similar to relay R^5. Relays H^7 and T^7 are energized by circuits which are similar to the circuits already traced for relays H^1 and T^1, respectively, and signal S^7 is held in its proceed position by its circuit which is similar to the circuit already traced for signal S^6.

I will now assume that traffic conditions east of signal S^8 are such that relay R^8 becomes energized by an uninterrupted series of current waves shown in sketch E^C. Relay R^8, therefore, holds its contact 28^a closed and relay H^8 continues energized by its circuit previously traced. The circuit for relay T^8 is now continuously open at contact 28^b of relay R^8, and hence relay T^8 opens its contact 18^a and closes its contact 18^b. With relay T^8 de-energized while relay H^8 is energized, the arm of signal S^8 moves to the caution position similarly to signal S^6, the operation of which to the caution position will be hereinafter described.

Also with relay T^8 de-energized, primary winding 14 of transformer N^7 is supplied with uninterrupted alternating current by its circuit passing from secondary winding 13 of transformer M^D, through wire 16, contact 18^b of relay T^8, wire 19, primary winding 14 of transformer N^7, and wire 24 back to winding 13 of transformer M^D. Relay R^6 is therefore supplied with an uninterrupted series of current waves according to sketch E^C by its circuit previously traced.

Relay R^6, therefore, holds its contact 28^a in the closed position, and hence the primary winding 14 of transformer N^5 is supplied with alternating current which is interrupted at intervals by contact 36 of coding device Q^C in its circuit previously traced. Relay R^4 is therefore supplied with an interrupted series of current waves according to sketch E^P. Signal S^4, therefore, continues to display the proceed indication.

Meanwhile, the arm of signal S^6 moves to its caution position as controlled by its circuit passing from secondary winding 13 of transformer M^C, through wire 16, contact 30 of relay H^6, contact 31^b of relay T^6, mechanism of signal S^6, and wire 24 back to transformer M^C.

If, now, a westbound train enters section C—D, it will de-energize relays R^6 and R^7 which will in turn de-energize relays H^6 and H^7, respectively, causing signals S^6 and S^7 to indicate stop. When relay H^6 becomes de-energized, stick relay P^5 becomes energized by its pick-up circuit passing from rectifier L^C, through wire 25, winding of relay P^5, contact 32^a of relay H^5, contact 32^b of relay H^6, and contact 33 of relay P^6 to rectifier L^C. With relay R^6 de-energized, the circuit for primary winding 14 of transformer N^5 is opened at contact 37^a of relay H^6 and, although it is now closed at contact 37^b of relay H^6, it is open at contact 39 of relay P^6. Relay R^4 is therefore de-energized, causing relay H^4 also to become de-energized and signal S^4 to indicate stop. With relay H^4 de-energized, stick relay P^3 becomes energized by its pick-up circuit passing from rectifier L^B, through wire 25, winding of relay P^3, contact 32^a of relay H^3, contact 32^b of relay H^4, and contact 33 of relay P^4 back to rectifier L^B. Also with relay H^4 de-energized, the primary winding 14 of transformer N^3 is de-energized similarly to winding 14 of transformer N^5, and hence relay R^2 is de-energized, causing signal S^2 to indicate stop.

When the train enters section B—C, de-energizing relay R^5, a stick circuit for relay P^5 becomes closed passing from rectifier L^C, through wire 25, winding of relay P^5, contact 34 of relay P^5, contact 35 of relay R^5, and wire 27 back to recifier L^C. Signal S^5 now displays the stop indication on account of relay H^5 being de-energized by relay R^5.

When the train moves out of section C—D, relay R^6 becomes energized by an interrupted or a constant series of current waves according to traffic conditions east of signal S^8, as previously traced. Relay H^6 then also becomes energized. If relay R^6 is supplied with an interrupted series of current waves, relay T^6 is also energized. The arm of signal S^6 is moved to its proceed or its caution position according as relay T^6 is energized or is de-energized. The pick-up circuit for relay P^5 is opened at contact 32^b of relay H^6, but relay P^5 continues energized by its stick circuit previously traced. Primary winding 14 of transformer N^6 is now supplied with uninterrupted alternating current by its circuit passing from transformer M^C, through wire 16, contact 39 of relay P^5, contact 37^b of relay H^5, winding 14 of transformer N^6, and wire 20 back to transformer M^C. Relay R^7 is therefore energized by an uninterrupted series of current waves according to sketch W^C, supplied by transformer N^6. Relay H^7, therefore, becomes energized but relay T^7 continues de-energized since contact 28^b of relay R^7 stays open. The arm of signal S^7 is, therefore, operated to the caution position.

When the train enters section A—B, the arm of signal S^3 moves to the stop position. On account of relay R^3 being de-energized, a stick circuit for relay P^3, which is similar to that already traced for relay P^5 becomes closed.

When the train moves out of section B—C,

relay H^4 becomes energized similarly to relay H^6 as already described in connection with the departure of the train from section C—D. The arm of signal S^4 therefore moves to the caution or the proceed position. The pick-up circuit for relay P^3 is opened at contact 32^b of relay H^4, but relay P^3 continues energized by its stick circuit. Uninterrupted alternating current is now supplied to the primary winding of transformer N^4 by a circuit which is similar to the circuit for winding 14 of transformer N^6 as already traced through contact 39 of relay P^5. An uninterrupted series of current waves is, therefore, supplied by transformer N^4 over rails of section B—C to relay R^5 according to sketch W^C. Relay R^5, therefore, holds its front contacts in the closed position, causing relay T^5 to continue de-energized. With relay T^5 de-energized, the arm of signal S^5 is operated to the caution position by its circuit which is controlled by contact 30 of relay H^5 and contact 31^b of relay T^5. Winding 14 of transformer N^6 is now supplied with interrupted alternating current by its circuit through contact 37^a of relay H^5 and contact 38 of coding device Q^C. Relay R^7 is, therefore, supplied by transformer N^6, through the rails of section C—D, with an interrupted series of current waves according to sketch W^F. The arm of signal S^7 is, therefore, operated to its proceed position.

When the train enters the section just west of signal S^1, relays R^1, H^1 and T^1 become de-energized, and the arm of signal S^1 moves to the stop position.

When the train leaves section A—B, uninterrupted alternating current is supplied to winding 14 of transformer N^2 by its circuit passing from transformer M^A, through wire 16, contact 18^b of relay T^1, wire 19, winding 14 of transformer N^2, and wire 20 back to transformer M^A. Relay R^3 is, therefore, supplied with an uninterrupted series of current waves by transformer N^2. The arm of signal S^8 now moves to the caution position, and the arm of signal S^5 moves to the proceed position as already described in connection with signals S^5 and S^7 when the train moved out of section B—C. The arm of signal S^2 is now returned to the proceed position. As the train proceeds further, signal S^3 and, afterwards signal S^1 change to the proceed indication.

From the foregoing description and the accompanying drawings, it will be noted that, as here shown, I have applied apparatus embodying my invention to the control of signals in the type of signaling which is well known by the designation "absolute permissive block signaling". It should be pointed out, however, that my invention is not limited in its application to this system of signaling, but may be used equally well for other traffic controlling systems including, among others, those which embody the control of trains by train-carried governing means which are responsive to trackway apparatus.

Apparatus comprising my invention, as herein shown and described, is particularly suitable for controlling train-carried governing means comprising cab signals such, for example, as are shown and described in Fig. 2 of an application for Letters Patent of the United States, Serial No. 116,608, filed June 17, 1926, by Lloyd V. Lewis, for Railway traffic controlling apparatus. In that patent application, a given cab signal indication is controlled by periodically interrupted alternating current supplied to the track rails, a second cab signal indication is controlled by alternating current constantly supplied to the track rails, and a stop cab signal indication is displayed when the track in advance is shunted. In my present patent application, wayside signals are similarly controlled by periodically interrupted pulsating current, and by pulsating current constantly supplied to the track rails.

The train-carried apparatus of Fig. 2 of the Lewis application, to which I have just referred, could be similarly controlled by the periodically interrupted pulsating current and by the pulsating current which is constantly supplied to the track rails in apparatus comprising my invention. Cab signals could, if desired, be thus controlled in conjunction with the wayside signals, or the wayside signals could be omitted and the cab signals could alone be so controlled.

Although I have herein shown and described only one form 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 stretch of railway track, a track circuit including a track relay and the rails of said stretch, a second track circuit including a second track relay and the rails of said stretch, means for constantly energizing said first and second track circuits alternately, means controlled by said first track relay for governing traffic movements in one direction, and means controlled by said second track relay for governing traffic movements in the opposite direction.

2. In combination, a stretch of railway track, a track circuit including a track relay and the rails of said stretch, a second track circuit including a second track relay and the rails of said stretch, means for periodically energizing said first track circuit, means for at intervals energizing said second track circuit alternately with said first track circuit,

and traffic governing means controlled by said first and second track relays.

3. In combination, a stretch of railway track, two track relays each constantly connected with the rails of said stretch, means for energizing said track relays alternately by current from a source connected with said stretch, and means controlled by said track relays for governing traffic movements in both directions.

4. In combination, a stretch of railway track, a constantly closed track circuit for said stretch, a second constantly closed track circuit for said stretch, means for energizing said first and second track circuits alternately, and means controlled by said first and second track circuits for governing traffic movements in both directions.

5. In combination, a stretch of railway track, a track circuit for said stretch, a second track circuit for said stretch, means for periodically energizing said first track circuit, means for at intervals energizing said second track circuit alternately with said first track circuit, and traffic governing means controlled by said first and second track circuits.

6. In combination, a stretch of railway track, a constantly closed track circuit for said stretch, a second constantly closed track circuit for said stretch, means for at intervals energizing said first and second track circuits alternately, and traffic governing means controlled by said first and second track circuits.

7. In combination, a stretch of railway track, a track circuit for said stretch, a second track circuit for said stretch, means for periodically supplying said first track circuit with current flowing in one direction, means for periodically supplying said second track circuit with current flowing in the opposite direction, means controlled by said first track circuit for governing traffic movements in one direction, and means controlled by said second track circuit for governing traffic movements in the opposite direction.

8. In combination, a stretch of railway track, a track circuit for said stretch, a second track circuit for said stretch, means for energizing said first track circuit by current flowing in one direction, means for at intervals energizing said second track circuit alternately with said first track circuit by current flowing in the opposite direction, and traffic governing means controlled by said first and second track circuits.

9. In combination, a stretch of railway track, means controlled by traffic conditions adjacent one end of said stretch for supplying current to the rails of said stretch, means controlled by traffic conditions adjacent the other end of said stretch for simultaneously supplying current to the rails of said stretch alternately with said first current, and traffic governing means controlled by said first and second currents in said rails.

10. In combination, a stretch of railway track, means controlled by traffic conditions adjacent one end of said stretch for supplying current to the rails of said stretch, means controlled by traffic conditions adjacent the other end of said stretch for at intervals supplying current to the rails of said stretch alternately with said first current, and traffic governing means controlled by said first and second currents in said rails.

11. In combination, a stretch of railway track, means controlled by traffic conditions adjacent one end of said stretch for supplying pulsating current to said stretch, a track relay connected across the rails of said stretch, an asymmetric unit connected in series with said track relay for preventing said pulsating current from flowing through the winding of said relay but permitting current of opposite polarity to pass through said relay winding, means controlled by traffic conditions adjacent the other end of said stretch for supplying pulsating current of said opposite polarity to said stretch, a second track relay connected across the rails of said stretch, a second asymmetric unit connected in series with said second track relay for preventing current of said second polarity from reaching said second relay but permitting current of said first polarity to flow through said second relay winding, and traffic governing means controlled by said first and second relays.

12. In combination, a plurality of successive sections of railway track, means controlled by traffic conditions in each of said sections for supplying pulsating current to an adjoining section, means controlled by traffic conditions in each of said sections for supplying pulsating current of opposite polarity to the other adjoining section, and traffic governing means controlled by said pulsating currents in said adjoining sections.

13. In combination, a stretch of railway track divided into sections, means for periodically supplying each of said sections with electric current, means for periodically supplying current to each of said sections alternately with said first current, means controlled by said first current in each of said sections for governing traffic in one direction, and means controlled by said second current in each of said sections for governing traffic in the opposite direction.

14. In combination, a stretch of railway track, means for supplying current to said stretch, means for at times periodically interrupting said current, a track relay which closes its front contacts when said current is being supplied to said stretch and which closes its back contacts during each of the periodic interruptions of said current, a slow-release relay controlled by a front con-

tact of said track relay and which slow-release relay maintains its front contacts in the closed position during the open periods of said track relay's front contacts caused by said periodic interruptions of current, a second slow-release relay controlled by a circuit including a back contact of said track relay and a front contact of said first slow-release relay, said second slow-release relay closing its front contacts when said back contact of the track relay closes during a periodic interruption of current and maintaining its front contacts in the closed position while said track relay continues to open and close its back contact, a signal indication, a second signal indication, means controlled by a front contact of said first slow-release relay and by a back contact of said second slow-release relay for displaying said first signal indication, and means controlled by a front contact of said first slow-release relay and by a front contact of said second slow-release relay for displaying said second signal indication.

15. In combination, a section of railway track, a second section of railway track, a track circuit including a track relay for said first section, a second track relay for said second section responsive to current of a given polarity only, a third track relay for said second section responsive to current of the opposite polarity only, a stick relay, a pick-up circuit for said stick relay controlled by a front contact of said first track relay and a back contact of said second track relay, a stick circuit for said stick relay controlled by a back contact of said first track relay, means controlled by traffic conditions for supplying said second section with current of said given polarity for operating said second track relay, means controlled by said stick relay for supplying said second section with current of the opposite polarity for operating said third track relay, and traffic governing means controlled by said third track relay.

16. In combination, a section of railway track, a second section of railway track, a track circuit for said first section including a track relay, a second track circuit for said second section including a track relay responsive to current of a given polarity only, a third track circuit for said second section including a track relay responsive to current of the opposite polarity only, a stick relay controlled by said first and second track relays, and means controlled by said stick relay for supplying current of said opposite polarity to said third track circuit.

17. In combination, a section of railway track, a second section of railway track, a track circuit for said first section including a track relay, a second track circuit for said second section including a track relay responsive to current of a given polarity only, a third track circuit for said second section including a track relay responsive to current of the opposite polarity only, and means controlled by said first and second track relays for supplying current of said opposite polarity to said third track circuit.

18. In combination, a stretch of railway track divided into sections, an eastbound track relay for each section responsive to pulsating current of positive relative polarity but not to current of negative relative polarity, a westbound track relay for each section responsive to pulsating current of negative relative polarity but not to current of positive relative polarity, means operating when each eastbound track relay is energized to supply pulsating current of positive relative polarity to the track rails of the section next to the west of the associated section, means operating when each westbound track relay is energized to supply pulsating current of negative relative polarity to the rails of the section next to the east of the associated section, a normally de-energized stick relay associated with each track relay, means for energizing each eastbound stick relay when an eastbound train enters the section next to the west of the associated section provided the track relay for the associated section is energized at the time and for keeping such stick relay energized until the train leaves the associated section, means for energizing each westbound stick relay when a westbound train enters the section next to the east of the associated section provided the track relay for the associated section is energized at the time and for keeping such stick relay energized until the train leaves the associated section, means operating when each eastbound stick relay is energized to supply pulsating current of positive relative polarity to the rails of the section next to the west of the associated section, and means operating when each westbound stick relay is energized to supply pulsating current of negative relative polarity to the rails of the section next to the east of the associated section.

19. In combination, a stretch of railway track divided into sections, an eastbound track relay for each section, a westbound track relay for each section, means operating when each eastbound track relay is energized by current of positive relative polarity to supply current of positive relative polarity to the track rails of the section next to the west of the associated section, means operating when each westbound track relay is energized by current of negative relative polarity to supply current of negative relative polarity to the rails of the section next to the east of the associated section, an eastbound stick relay for each section controlled by eastbound traffic, a westbound stick relay for each section controlled by westbound traffic,

means controlled by each eastbound stick relay for supplying current of positive relative polarity to the rails of the section next to the west of the associated section, and means controlled by each westbound stick relay for supplying current of negative relative polarity to the rails of the section next to the east of the associated section.

20. In combination, a stretch of railway track divided into sections, means controlled by traffic conditions east of each section for supplying the section with current of a given polarity for controlling eastbound traffic, and means controlled by traffic conditions west of each section for simultaneously supplying the section with current of the opposite polarity for controlling westbound traffic.

21. In combination, a stretch of railway track divided into sections, a constantly closed eastbound track circuit for each section controlled by current of a given polarity, a constantly closed westbound track circuit for each section controlled by current of the opposite polarity, means controlled by the eastbound track circuits for controlling eastbound traffic, and means controlled by the westbound track circuits for controlling westbound traffic.

22. In combination, a stretch of railway track, means controlled by traffic conditions for simultaneously supplying the rails of said stretch with current of positive and negative relative polarity, eastbound traffic governing means controlled by current of positive relative polarity supplied from said rails, and westbound traffic governing means controlled by current of negative relative polarity supplied from said rails.

23. In combination, a stretch of railway track, means controlled by traffic conditions east of said stretch for supplying current of a given polarity to the rails of said stretch, means controlled by traffic conditions west of said stretch for simultaneously supplying current of the opposite polarity to the rails of said stretch, means controlled by current of the first polarity received from said rails for controlling eastbound traffic, and means controlled by current of the opposite polarity received from said rails for controlling westbound traffic.

24. In combination, a stretch of railway track, means controlled by current of a given polarity supplied to one end of said stretch for controlling traffic movements through said stretch, and means controlled by current of the opposite polarity simultaneously supplied to the other end of said stretch for controlling traffic movements through said stretch.

25. In combination, a stretch of railway track, a constantly closed track circuit including the rails of said stretch, a second constantly closed track circuit including the same rails, means for supplying said first track circuit with current of a given polarity for controlling traffic movements in a given direction, and means for supplying said second track circuit with current of the opposite polarity for controlling traffic movements in a second direction.

26. In combination, a stretch of railway track, a constantly closed track circuit including the rails of said stretch, a second constantly closed track circuit including the same rails, traffic controlled means for supplying said first track circuit with a current of a given polarity for controlling traffic movements in a given direction, and traffic controlled means for supplying said second track circuit with current of the opposite polarity for controlling traffic movements in a second direction.

27. In combination, a stretch of railway track, a constantly closed track circuit including the rails of said stretch, a second constantly closed track circuit including the same rails, means for supplying said first track circuit with current of a given polarity, means for supplying said second track circuit with current of the opposite polarity, and means controlled by said first and second track circuits for controlling traffic movements in a plurality of directions.

28. In combination, a section of railway track, a signal governing traffic movements in a given direction through said section, a second signal governing traffic movements in the opposite direction through said section, a track circuit including the rails of said section and supplied with current of a given polarity, means controlled by said track circuit for causing said first signal to display a proceed indication, a second track circuit including part of said first track circuit and supplied with current of the opposite polarity, and means controlled by said second track circuit for causing said second signal to display a proceed indication while the first signal is displaying a proceed indication.

29. In combination, a section of railway track, a traffic governing device, a second traffic governing device, a track circuit including the rails of said section and supplied with current of a given polarity, means controlled by said track circuit for causing said first traffic governing device to be in condition to permit a traffic movement, a second track circuit including part of said first track circuit and supplied with current of the opposite polarity, and means controlled by said second track circuit for causing said second traffic governing device to be in condition to permit a traffic movement while said first governing device is in condition to permit a traffic movement.

30. In combination, a section of railway track, a traffic governing device, a second traffic governing device, a track circuit including the rails of said section and supplied with

unidirectional current, means controlled by said track circuit for causing said first traffic governing device to be in condition to permit a traffic movement, a second track circuit including part of said first track circuit and supplied with unidirectional current, and means controlled by said second track circuit for causing said second traffic governing device to be in condition to permit a traffic movement while said first governing device is in condition to permit a traffic movement.

31. In combination, a stretch of railway track, traffic governing apparatus for said stretch, a track circuit for said stretch supplied with unidirectional current, means controlled by said track circuit for causing said apparatus to be in condition to permit a traffic movement, a second track circuit including part of said first track circuit and supplied with unidirectional current, and means controlled by said second track circuit for causing said apparatus to be in condition to permit a second traffic movement while said apparatus is in condition to permit said first traffic movement.

32. In combination, a stretch of railway track divided into sections, a constantly closed eastbound track circuit for each section controlled by unidirectional current, a constantly closed westbound track circuit for each section controlled by unidirectional current, means controlled by the eastbound track circuits for controlling eastbound traffic, and means controlled by the westbound track circuits for controlling westbound traffic.

33. In combination, a stretch of railway track, a constantly closed eastbound track circuit for said stretch controlled by unidirectional current, a constantly closed westbound track circuit for said stretch including a part of said eastbound track circuit and controlled by unidirectional current, means controlled by the eastbound track circuit for controlling eastbound traffic and means controlled by the westbound track circuit for controlling westbound traffic.

34. In combination, a stretch of railway track, a constantly closed track circuit for said stretch controlled by unidirectional current supplied to one end of said stretch, a second constantly closed track circuit including a part of said first track circuit and controlled by unidirectional current supplied to the opposite end of said stretch, and means controlled by said track circuits for controlling traffic movements in opposite directions in said stretch.

35. In combination, a stretch of railway track, a constantly closed track circuit for said stretch controlled by unidirectional current supplied to one end of said stretch, a second constantly closed track circuit including a part of said first track circuit and controlled by unidirectional current supplied to the opposite end of said stretch, and means controlled by said track circuits for controlling traffic movements in said stretch.

36. In combination, a stretch of railway track, a constantly closed track circuit for said stretch controlled by unidirectional current, a second constantly closed track circuit including a part of said first track circuit and controlled by unidirectional current, and traffic governing means controlled simultaneously by said first and second track circuits.

37. In combination, a stretch of railway track, means for at times supplying said stretch with constant pulsating unidirectional current and for at other times supplying said stretch with periodically interrupted pulsating unidirectional current, and traffic governing apparatus controlled by said constant and periodically interrupted currents.

38. In combination, a track section through which traffic may move in either direction, a first signal located at one end of the track section to govern traffic in one direction through the section, a master line relay responsive to code energy to control said first signal, a second signal located at the opposite end of the track section to govern traffic in the other direction through the section, a track relay responsive to coded energy to control said second signal, and traffic controlled means to supply coded energy in accordance with traffic conditions to said master line relay and said track relay.

39. In combination, traffic rails arranged in track sections, an alternating current transmission line, means for each section to receive alternating current from said transmission line, other means for each section to convert the alternating current received by the first mentioned means into coded unidirectional current and to supply said coded current to the traffic rails of the section, a track relay for each section responsive to coded unidirectional current in the traffic rails, a decoding relay for each section, means associated with each track relay to energize the decoding relay in response to the track relay operated by coded unidirectional current, and a signal for the section controlled by the decoding relay.

40. The method of simultaneously signaling in both directions between two remote stations over a single communication channel which consists in providing a receiving circuit at each station adapted to pass current in one direction and substantially block the flow of current in the opposite direction and causing a control current from a source at one station to flow in the same direction in the communication channel as a control current from a like source at the other station.

In testimony whereof I affix my signature.

HOWARD A. THOMPSON.