J. B. STRUBLE.

SIGNALING SYSTEM FOR ELECTRIC RAILWAYS.

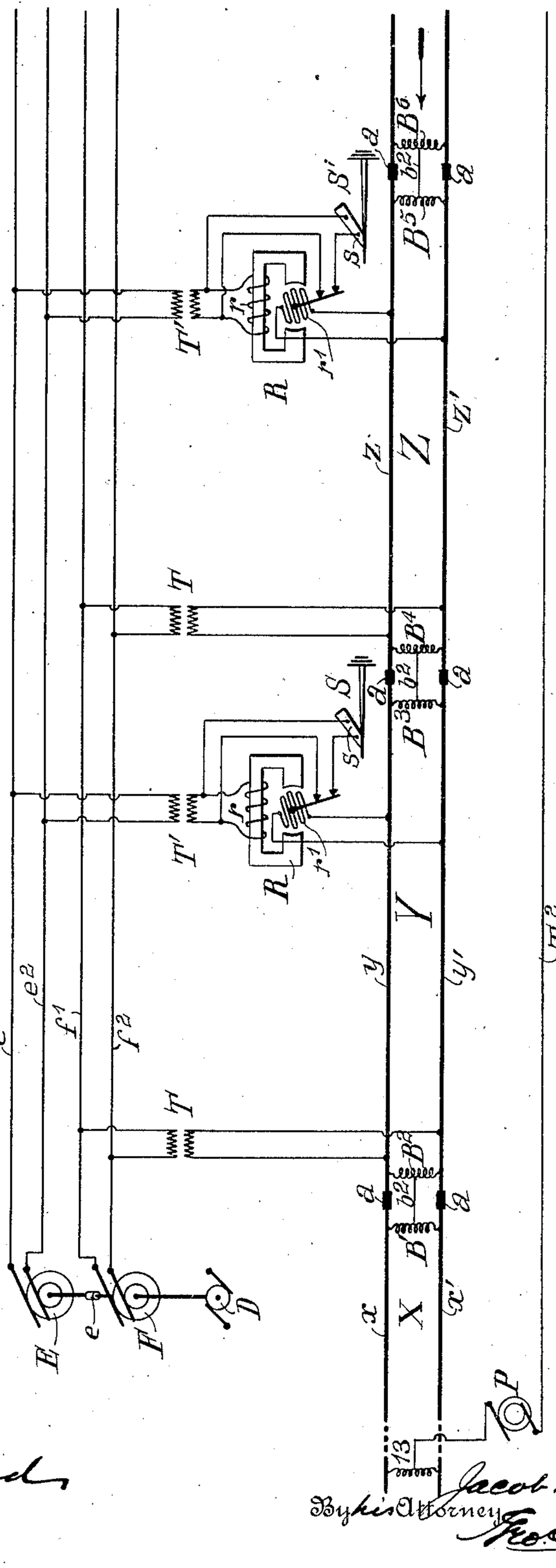
APPLICATION FILED MAR. 11, 1909.

997,215.

Patented July 4, 1911.

2 SHEETS—SHEET 1.

Fig. 1



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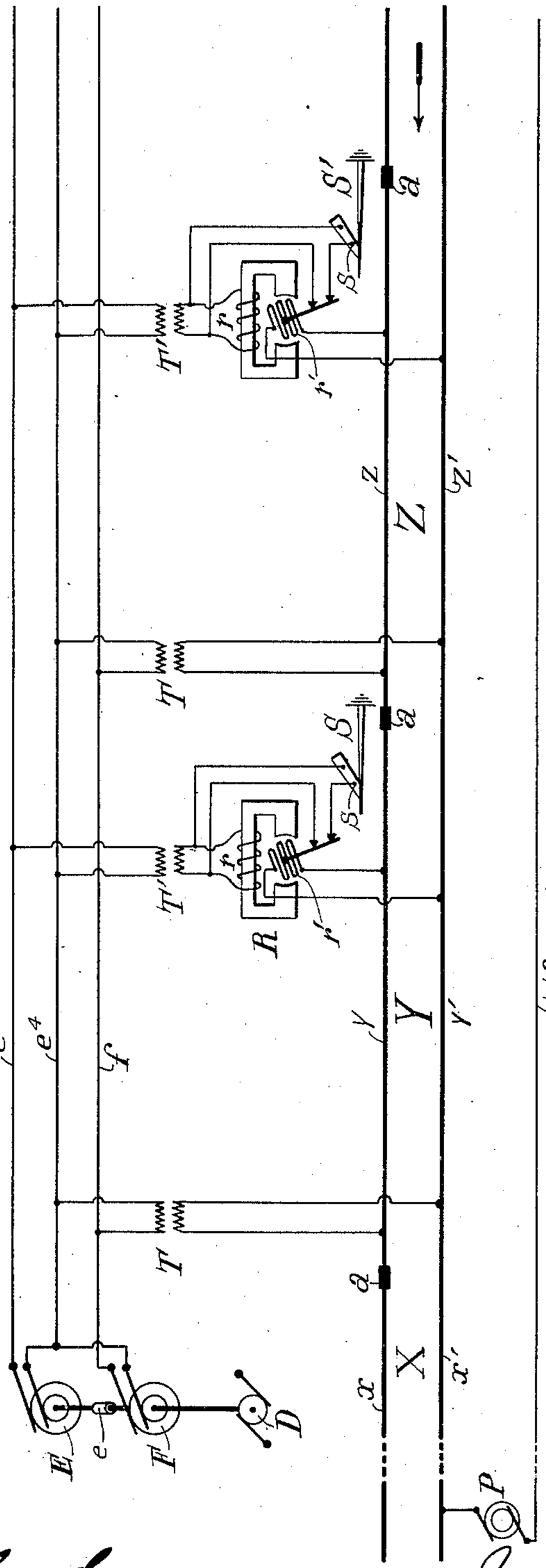
2 SHEETS—SHEET 2.

Fig. 2



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UNITED STATES PATENT OFFICE.

JACOB B. STRUBLE, OF WILKINSBURG, PENNSYLVANIA, ASSIGNOR TO THE UNION SWITCH & SIGNAL COMPANY, OF SWISSVALE, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

SIGNALING SYSTEM FOR ELECTRIC RAILWAYS.

997,215. Specification of Letters Patent. Patented July 4, 1911.

Application filed March 11, 1909. Serial No. 482,762.

To all whom it may concern:

Be it known that I, JACOB B. STRUBLE, a citizen of the United States, residing at Wilkinsburg, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Signaling Systems for Electric Railways, of which the following is a specification.

My invention relates to signaling systems for electric railways, and especially for electric railways using an alternating current for propelling the cars along the railway.

I will describe a signaling system embodying my invention and then point out the novel features thereof in claims.

In the accompanying drawing, Figure 1 is a diagrammatical view of a portion of an electric railway employing both rails for the return of the car propulsion current and having applied thereto a signaling system embodying my invention. Fig. 2 is a view similar to Fig. 1, but showing a modification in the track arrangement of the railway and in the signaling system.

Similar letters of reference designate corresponding parts in all of the figures.

Referring now to the drawings, a portion of a railway track is shown which is divided into sections, X, Y, Z, etc. These sections are generally termed "block or track sections" and I will hereinafter refer to them as "block sections." These block sections are formed by inserting insulation *a* in some form at determined points in one or both of the traffic rails, the one arrangement being the equivalent of the other so far as block sectioning is concerned, and both being well known in the art. I have shown insulation *a* inserted in both of the traffic rails in Fig. 1 and in only one rail in Fig. 2.

x, x^1, designate the track rails of block section X; y, y^1, the track rails of block section Y; and so on.

P designates a current generator, here shown as an alternating current generator, the current from which is used for propelling motor cars along the railway.

T^2 designates a trolley or third rail connected with one pole of the power generator and extending along the railway in a usual and well-known manner, and with which shoes or other contact devices carried by the cars make contact. A direct current generator may be used instead of the alternating current generator P.

As the rails of the railway (one or both) are to form part of the return path or conductor for the alternating propulsion current employed for the motor cars and still contain insulation to form block sections, I make provision, especially where both of the rails are to form return paths, for conducting the propulsion current from the rails of one block section to the rails of the adjacent block section around the points of insulation. This I accomplish by means of inductive bonds, located at the insulated points, each of which inductive bonds comprises a core and a winding or windings surrounding the core. Each inductive bond is of such construction and arrangement as to afford a path of low ohmic resistance for the propulsion current, from the rails of one block section to the rails of another block section. A form of bond which I preferably employ is described and illustrated in U. S. Patent No. 838,916, granted December 18, 1906. These inductive bonds are diagrammatically illustrated except that the cores are omitted. These inductive bonds each comprise a winding of several turns, the ends of which are connected with the two rails of the block section, while a conductor extends from the middle of the winding and which conductor is arranged to be connected to the middle of the winding on an adjacent bond.

B, B^1, B^2, B^3, etc., designate the inductive bonds, and b^2 the conductors joining the middle points of the windings on adjacent bonds.

It will be seen that the propulsion current in its passage through the winding of an inductive bond flows in at its ends and out at its middle point or in at its middle point and out at its ends in reverse or opposite directions, the result being that the core of the inductive bond is not appreciably magnetized by the propulsion current and that the propulsion current traversing the winding half in one direction and half in the other will therefore be non-inductive as far as the propulsion current is concerned, but will be inductive to the track current that traverses the winding in the same direction, so that the bond may be used as an impedance for

alternating signaling currents used in the track circuits.

The foregoing, it will be seen, is directed more particularly to the arrangement of the track in the return path or conductor of power circuit whereby the propulsion current flows along it yet it is divided into insulated sections to form the block or track sections of the signaling system.

In Fig. 2, it will be understood that only one rail of the track is available for the return of the car propulsion current.

I will now proceed to describe the signaling system.

S, S^1, etc., designate railway signals for controlling the movements of cars or trains into and along the block sections. As shown, one railway signal is provided for each block section. Of course, other arrangements of railway signals may be used, according to the type of signaling system employed. The railway signals are preferably of any of the automatic types well known in the art. Each railway signal comprises a signal device *s* preferably in the form of a semaphore and an operating mechanism. The operating mechanism is employed to move the signal device from one position, generally its horizontal (danger) position to an inclined position, and hold it in such inclined position, when no car or train is in a block section. When a car or train enters a block-section the signal device automatically moves to its danger position. This operation is well understood, and the movement of the signal device is automatically controlled by a car or train through relays which are included in track circuits forming part of the signal system. The track circuits and the apparatus used therein form an essential part of my invention.

Each block section is provided with a track circuit which, as usual, comprises a source of current, a relay and the rails of the block section or portions of them. I preferably employ an alternating current in each track circuit and of a frequency higher than the alternating current used for propulsion purposes.

T designates transformers, one being provided for each track circuit, for supplying the alternating signaling current to the track circuits.

R designates relays, one being provided for each track circuit. Each relay comprises a field or stationary coil *r*, and an armature or movable coil r^1 which, of course, is rotatably mounted within the magnetic field set up by the coil *r*. The relay for each track circuit is arranged to have one coil connected across the trackway, and in the drawings I have shown the armature coils r^1 of the relays connected across the rails of the track circuits. The other coils *r* of the relays are connected across signaling mains of an alternating current transmission system about to be described.

D designates a suitable motor, the armature of which drives two alternating current generators E, F, which generate alternating currents of the same frequency. Their armatures are shown as being coupled together, an adjustable coupling *e* being preferably employed in order that the proper phase relations will be maintained in the currents in the field and armature windings of the track relay R.

Referring now more particularly to Fig. 1, e^1, e^2, designate the mains extending from the generator E, and f^1, f^2 the mains extending from the generator F. The track circuit transformers T have their primaries connected in multiple across the mains f^1, f^2 and their secondaries in multiple across the track rails. T^1 designates transformer, the windings of which have, preferably, a step-down ratio. The primary windings of these transformers are connected in multiple across the mains e^1, e^2, while their secondaries are connected with the windings *r* of the relays R. The secondary windings of these transformers may also be used to supply the necessary operating current for the signal operating mechanisms of the railway signals.

In Fig. 2, instead of having two independent sets of mains, e^1, e^2, f^1, f^2, but three mains are employed, one e^4 being common to both generators. Otherwise the arrangement of the parts and apparatus is the same as in Fig. 1.

It will be seen from the foregoing that the signaling currents in the track circuits are supplied from one generator and the currents for the windings *r* of the relays are supplied from a second generator, and that there is no possibility of the current supplied to the track circuits, and therefore the coils r^1, in any way reaching the coils *r*. Nor is there any way for any other current due to any unbalancing of any kind of current, especially alternating propulsion current, affecting the coils *r*. As the relays R are of a type requiring the same kind of current in both coils *r* and r^1 to produce a motor torque of the armature it will be seen at once that this type of relay, being comparatively cheap to construct, can be used in systems where there is likely to be an unbalancing of the car propulsion current in the track rails, provided, of course, that there is no way in which the unbalanced current can affect both coils *r* and r^1 simultaneously. This is only made possible by keeping the apparatus or devices for supplying the current to one of the coils (coils *r*) entirely separated from the track rails.

Having thus described my invention, what I claim as new is:

1. In a signaling system for railways, the

combination with the track circuits formed in part by the rails of the railway, a transformer for each track circuit, a relay for each track circuit comprising a field coil and an armature coil, one of which is connected across the rails of its track circuit, an alternating generator for the transformers for the track circuits; a second alternating generator for the other coil of the respective relays, driving means for said generators, and an adjustable coupling between the two generators.

2. In an electric railway system, a source of power current of one character, vehicles operated thereby, a circuit for said power current comprising two conductors with which the cars make moving contact, one of which is formed by the track; track circuits formed in part by the rails of the railway, a transformer for each track circuit, a relay for each track circuit comprising a field coil and an armature coil, one of which is connected across the rails of its track circuit, an alternating generator for the transformers for the track circuits; a second alternative generator for the other coil of the respective relays, driving means for said generators, and an adjustable coupling between the two generators.

In testimony whereof, I have signed my name to this specification in the presence of two subscribing witnesses.

JACOB B. STRUBLE.

Witnesses:
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W. H. CADWALLADER.