No. 869,531. PATENTED OCT. 29, 1907.

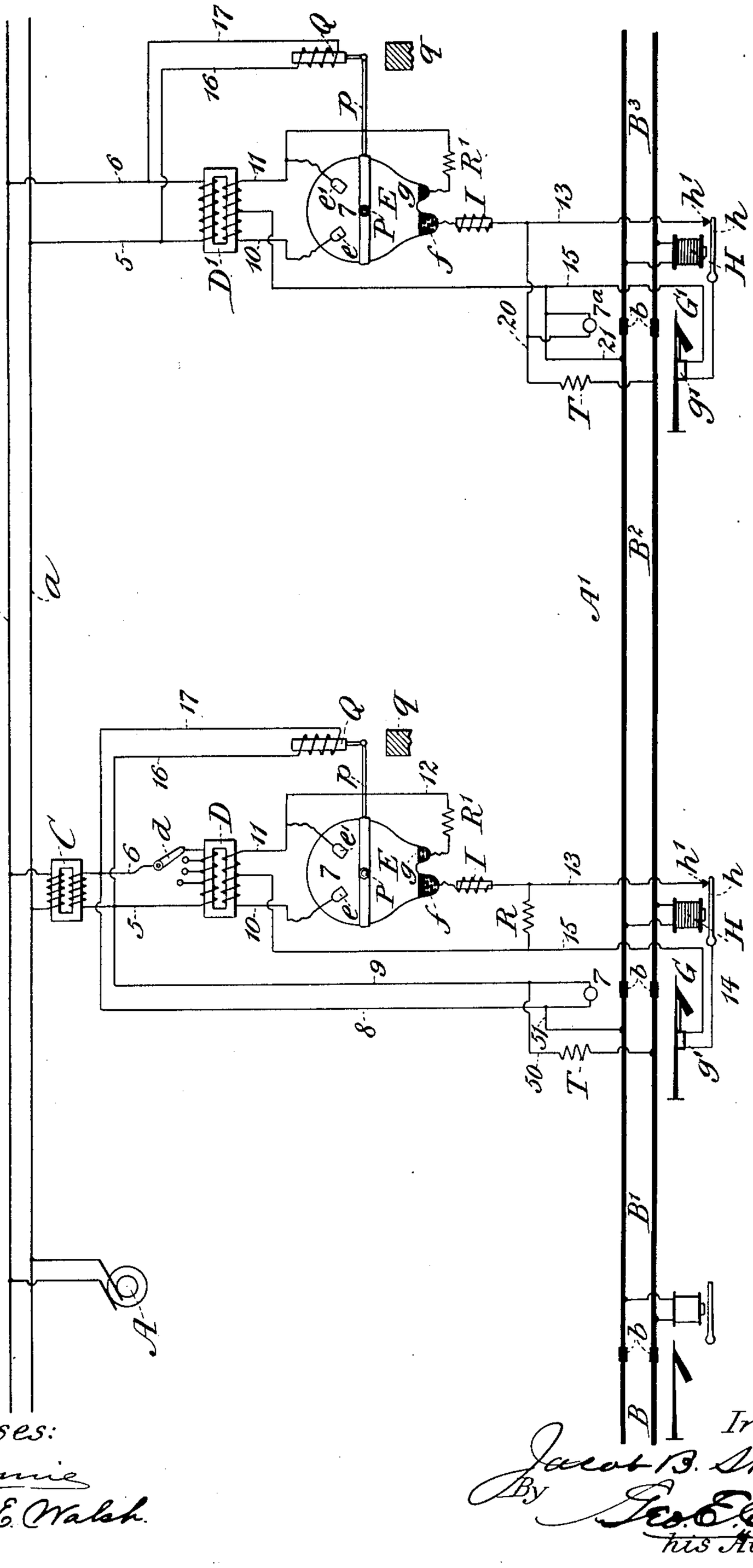
J. B. STRUBLE.

RAILWAY SIGNALING.

APPLICATION FILED JUNE 28, 1906.

2 SHEETS—SHEET 1.

Fig. 1.



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2 SHEETS—SHEET 2.

Fig. 3.

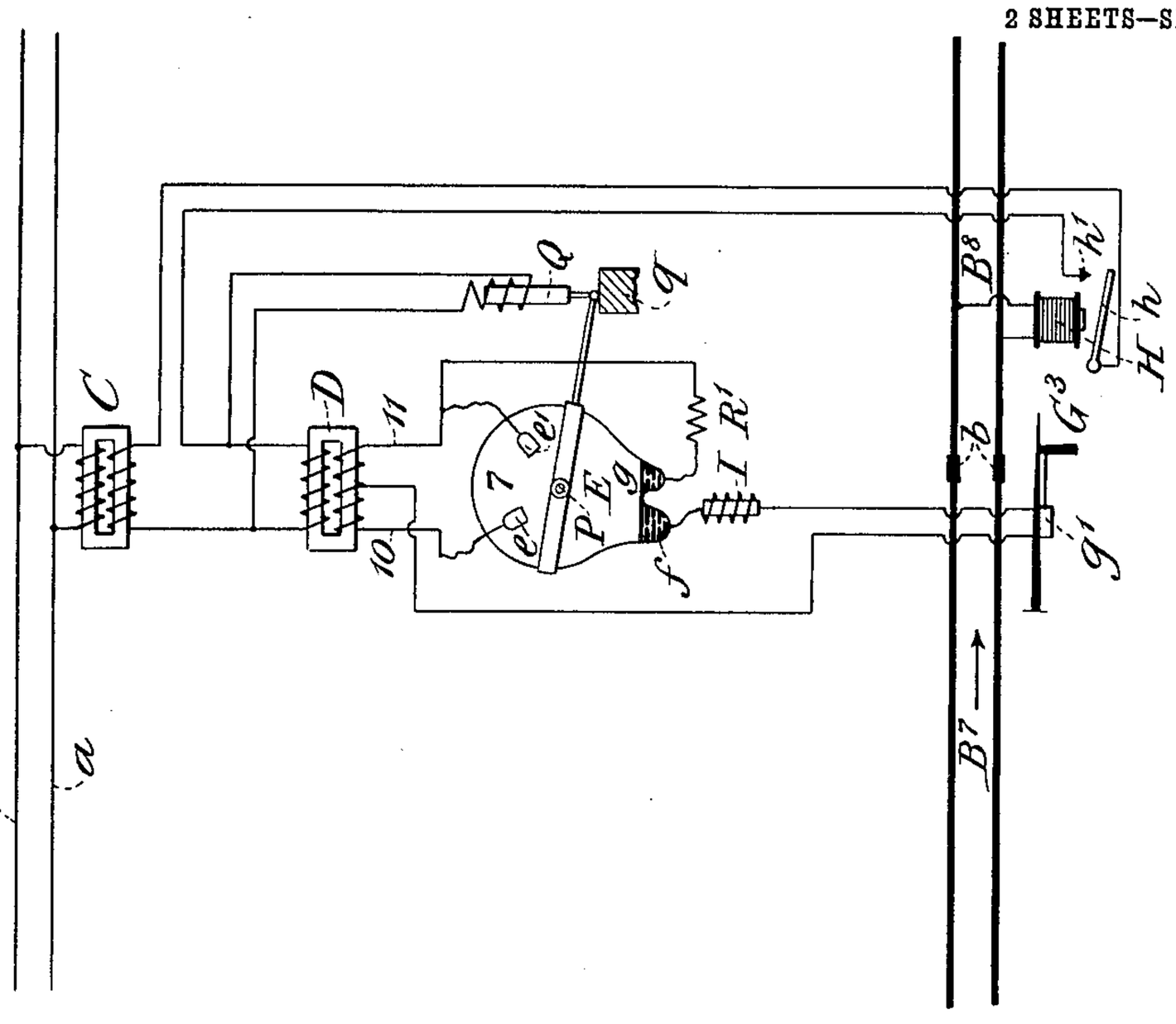
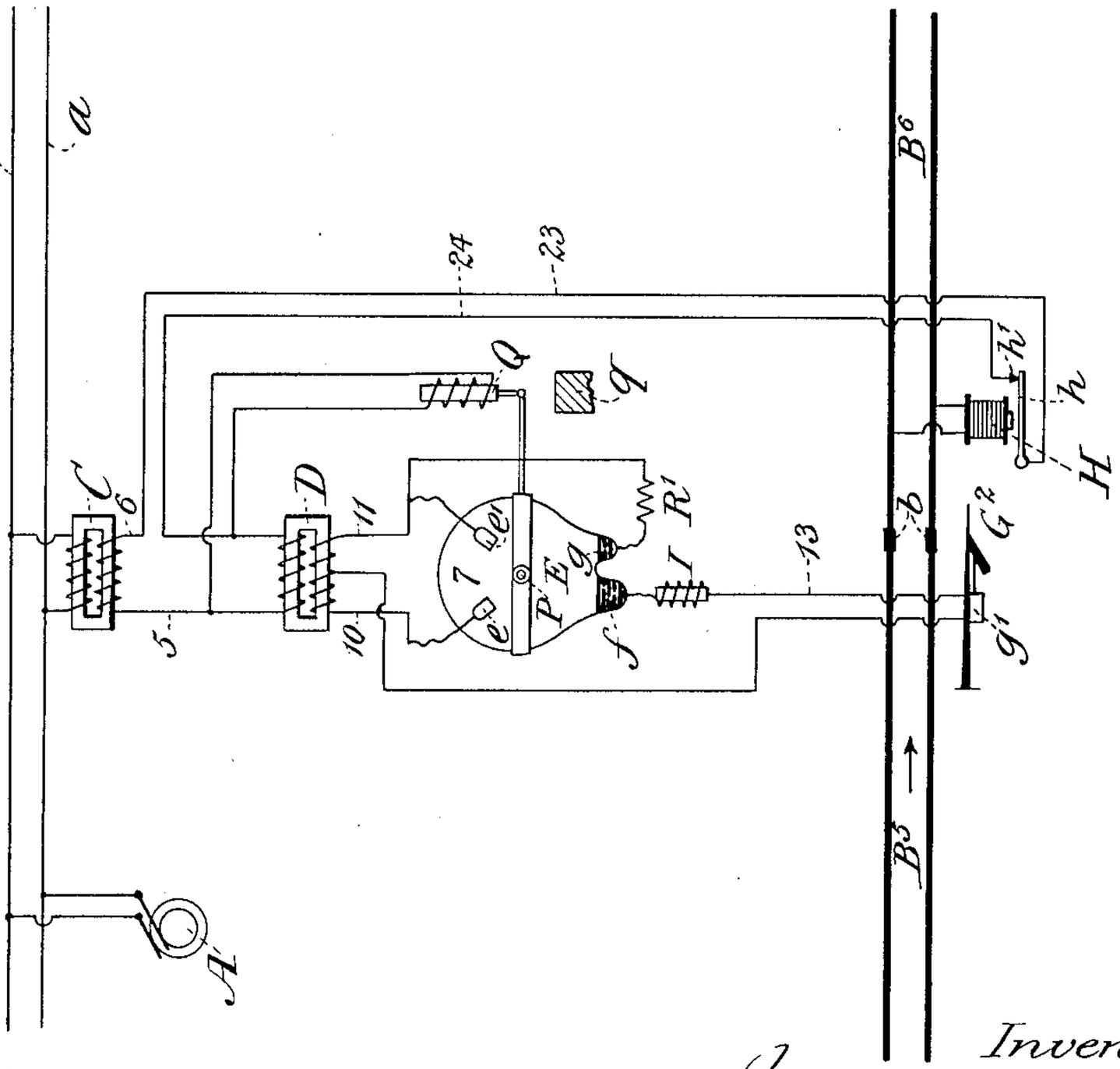


Fig. 2.



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UNITED STATES PATENT OFFICE.

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RAILWAY SIGNALING.

No. 869,531. Specification of Letters Patent. Patented Oct. 29, 1907.

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To all whom it may concern:

Be it known that I, JACOB B. STRUBLE, of the borough of Manhattan, city, county, and State of New York, have invented certain new and useful Improvements in Railway Signaling, of which the following is a specification.

My invention relates to railway signaling.

My invention has particular reference in railway signaling to the use of apparatus by means of which an alternating current impressed upon conductors extending along the railway, may be changed to direct current and the changed current (direct current) used in circuits and to operate apparatus and devices which may be employed for controlling the passage of cars or trains along a railway.

I will describe an embodiment of my invention and then point out the novel features thereof in claims.

In the accompanying drawings, Figure 1 is a diagrammatic view of a portion of a railway and railway signals arranged along the railway and showing the application of my invention. One portion of the figure illustrates the use of an alternating current in a track circuit, and another portion illustrates the use of a direct current in a track circuit. Figs. 2 and 3 are views showing the utilization of the rectifier as a circuit controller for operating a signal.

Referring now to Fig. 1, A designates an alternating current generator, and *a a* feed wires extending therefrom along the railway A^1. The railway A^1 is divided into block sections B, B^1, B^2, B^3, etc. by means of insulation *b* placed in one or both of the lines of rails of the railway. Each block section is provided with a track circuit formed in part by the opposite rails of the block section and including a suitable source of current and relay responsive to the current. The track circuit of block section B^1 includes a source of alternating current, while the track circuit of block section B^2 includes a source of direct current. At the entrance end of each block section a railway signal G, G^1, etc. of any of the well known automatic types may be employed. In the drawings I have diagrammatically illustrated the semaphore type of railway signal, g^1 designating the operating mechanism thereof.

C designates a transformer, the primary of which is in circuit with the feeders *a*, *a*. The secondary winding is connected with conductors 5, 6. 8, 9, designate conductors which are joined to the conductors 5, 6, and include a light 7 of the adjacent railway signal G. The conductors 8, 9, are also connected with the track rails of block section B^1 through conductors 50, 51, one of which includes a non-inductive resistance T, the purpose of which is to limit the flow of alternating current to the track circuit, when a car is on the track rails of the block section.

D designates a transformer, the primary of which is connected with the conductors 5, 6. A switch *d* may be employed on one side of the connection to cut out a portion of the primary of the transformer D and thus adjust the amount of current flowing through the primary winding.

E designates a mercury arc rectifier of any approved form, the anodes *e* and e^1 of which are connected by wires 10 and 11 to the secondary winding of the transformer D. The mercury cathode is indicated by *f*. Adjacent to the cathode *f* the rectifier is provided with a small pocket *g* containing mercury, which mercury is electrically connected to the secondary of the transformer D by a wire 12, for a purpose to be hereinafter referred to.

H designates a track relay for the block section B^2, the armature *h* of which is adapted, when the relay is energized, to engage a contact h^1 connected by a wire 13 with the mercury cathode *f*. A wire 14, leads from the armature *h* to the operating mechanism g^1 and a wire 15 leads from the operating mechanism to the middle of the secondary of the transformer D.

I is an induction coil which stores energy on increase of A. C. wave and gives it out as the wave crosses zero, thus maintaining the arc.

The action of the rectifier is well understood and need not be specifically described herein. Its purpose in the instance just described is to convert the alternating current from the feeder *a a* into a direct current, which direct current is intended for the operation of the operating mechanism of the railway signal G. It will be observed that as long as the relay H is energized, a circuit for the direct current from the rectifier will be maintained from the cathode *f*, through wire 13, armature *h*, wire 14, motor *g* and wire 15 to secondary of transformer D. Thence, in accordance with the direction of A. C. potential, by wire 10 or 11 and their respective anodes *e* or e^1 and by the mercury arc to cathode *f*. Under such conditions the signal G will be held at safety. As soon as a train enters onto the section B^2 containing the relay H the latter will be deënergized and its armature will fall away from contact h^1 and thus break the motor circuit at this point. In these rectifiers it is well known that if the arc is broken it is difficult to reëstablish it again, and to overcome this difficulty the wires 13 and 15 are bridged across by a resistance R. When, therefore, the circuit is broken at h^1 sufficient current will flow via *f*, 13, R, 15, and the secondary of transformer D to maintain the arc between the anodes and the cathode.

The rectifier is pivoted in any suitable manner at P and is connected by means of a bar *p* operated by a suitable form of motor. The bar is here shown as connected with the core of a solenoid Q, said solenoid being connected by wires 16 and 17 with the secondary

of the transformer C. As long as the current flows uninterruptedly through the main wires *a a*, the solenoid will maintain the rectifier in the position indicated in Fig. 1. Should the current be interrupted for any reason whatever, as frequently happens, the solenoid will be deënergized and the core will drop until arrested by a stop *q* and the rectifier will be tilted as indicated in Fig. 3. This will result in connecting the mercury in the pocket *g* with the mercury cathode *f* as indicated in Fig. 3. When the current again flows through the wires *a a* induced current will flow (see Fig. 1) through wire 12, resistance R^1, and the connected mercury to the wire 13 and thence to the secondary of transformer D. At the same time the solenoid will operate to restore the rectifier to normal position and the mercury will be again separated and the arc will be reëstablished between the anodes and the cathode. The resistance R^1 is for the purpose of preventing an excessive flow of current before the arc is established. The direct current employed for the track circuit of block section B^2, and also for the track circuit of block section B^3 is furnished by the rectifier E at the right of Fig. 1. This rectifier also furnishes direct current for the signal light 7^a of railway signal G^1, as well as for operating mechanism of the railway signal. In this case only one transformer is interposed between the main wires and the rectifier. D^1 designates such transformer. In this application of my invention, direct current is conveyed to the track rails by conductors 20 and 21 leading from the conductors 13 and 15, and the signal light 7^a is included in branches leading from these conductors. In this form of the invention the resistance R is not necessary as a circuit is maintained through the track rails even if the signal motor circuit is broken at h^1. The operation of the device is otherwise the same as previously described in connection with Fig. 1.

Referring now to Figs. 2 and 3, I have shown an arrangement of circuits by means of which the presence or absence of current through the rectifier is used to control the operation of the railway signal. In this case the source of the track current is not shown, for block section B^6 but it may be derived from any source and be either alternating or direct current. In this case two transformers C and D are employed, but the secondary of the transformer C is connected on one side to the primary of the transformer D by conductors 23 and 24, the former being connected to the armature *h* of the track relay H and the latter terminates in a contact h^1 which will be engaged by the armature *h* when the relay H is energized. The direct current from the rectifier passes through the conductor 13 directly to the operating mechanism g^1.

When the parts are in the position shown in Fig. 2, the operating mechanism g^1 is acting to hold the signal device at safety. When, however, a car passes on to the block section B^6 containing the relay H the current therefor will be short circuited and the armature *h* will disengage the contact h^1 and thus open the circuit of the secondary of the transformer D or to the solenoid Q, and thus prevent the operation of the rectifier E. This will cut off direct current to the operating mechanism g^1, and at the same time the rectifier will tilt to the position shown in Fig. 3. Thus the railway signal G^2 will indicate danger. As soon as the car passes off the section containing the relay H, the latter will again become energized and close the circuit at h, h^1, and current will then again flow from the transformer C to the transformer D and to the solenoid Q and the rectifier will be restored to normal position, the arc be again established between the anodes *e*, e^1, and the cathode *f* in the same manner as already described in connection with Fig. 1. The operating mechanism g^1 will also be again energized and will move the signal device of the railway signal G^2 to indicate safety.

Having thus described my invention, I claim:

1. In electric or other railway signaling, the combination of apparatus adapted to be operated by a direct current, a source of alternating current supply, a mercury arc rectifier for changing the alternating current to direct current, means for applying the direct current to the apparatus to be operated, a track circuit, and means operated by the track circuit for interrupting the supply of direct current to said apparatus.

2. In electric or other railway signaling, the combination of apparatus adapted to be operated by a direct current, a source of alternating current supply, a mercury arc rectifier for changing the alternating current to direct current, means for applying the direct current to the apparatus to be operated, a track circuit, and means operated by the track circuit for interrupting the supply of direct current to said apparatus while the current is maintained through the rectifier.

3. In railway signaling, the combination of apparatus adapted to be operated by direct current, a source of alternating current supply, a pivoted mercury arc rectifier for changing the alternating current to direct current, means for permitting the rectifier to tilt when the alternating current is interrupted, means for establishing a circuit through the rectifier when tilted, means operated by the alternating current for restoring the rectifier to normal position when the supply of alternating current is resumed, and means for applying the direct current to the apparatus to be operated.

4. In railway signaling, the combination of apparatus adapted to be operated by direct current, a source of alternating current supply, a pivoted mercury arc rectifier for changing the alternating current to direct current, a solenoid for controlling the position of the rectifier and to the core of which the rectifier is connected, said solenoid being operated by the alternating current, means for limiting the tilting of the rectifier when the solenoid is deenergized, means for establishing a circuit through the rectifier when in tilted position, and means for conveying direct current from the rectifier to the apparatus to be operated.

5. In railway signaling, the combination of a direct current motor for operating a signal, a source of alternating current supply, a mercury arc rectifier connected to the alternating current supply and to the motor to transmit direct current to the latter, a track relay for making and breaking the circuit between the alternating current supply and the rectifier, and means permitting the rectifier to move when said circuit is broken and for restoring it to normal position when the circuit is again closed.

6. In railway signaling, the combination of a direct current motor for operating a signal, a source of alternating current supply, a mercury arc rectifier connected to the alternating current supply and to the motor to transmit direct current to the latter, and means for moving the rectifier to control the supply of direct current to the motor.

7. In railway signaling, the combination of a direct current motor for operating a signal, a source of alternating current supply, a mercury arc rectifier connected to the alternating current supply and to the motor to transmit direct current to the motor, a solenoid operated by the alternating current and to the core of which the rectifier is connected to be moved by the movements of the core and thereby control the supply of direct current to the motor, and a track relay for making and breaking the circuits between the alternating current supply and the solenoid and the rectifier.

8. In railway signaling, the combination of apparatus to be operated by a direct current, a source of alternating current supply, a mercury rectifier for converting the alternating current into a direct current, and means for destroying and establishing the arc of the mercury rectifier whereby it is caused to cease operating and to again operate.

9. In railway signaling, the combination of apparatus to be operated by a direct current, a source of alternating current supply, a mercury rectifier for converting the alternating current into a direct current, and automatically operated means for destroying and establishing the arc of the mercury rectifier whereby it is caused to cease operating and to again operate.

10. In railway signaling, the combination of apparatus to be operated by a direct current, a source of alternating current supply, a mercury rectifier for converting the alternating current into a direct current, and train controlled means for destroying and establishing the arc of the mercury rectifier whereby it is caused to cease operating and to again operate.

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

JACOB B. STRUBLE.

Witnesses:
J. S. HOBSON,
W. H. CADWALLADER.