

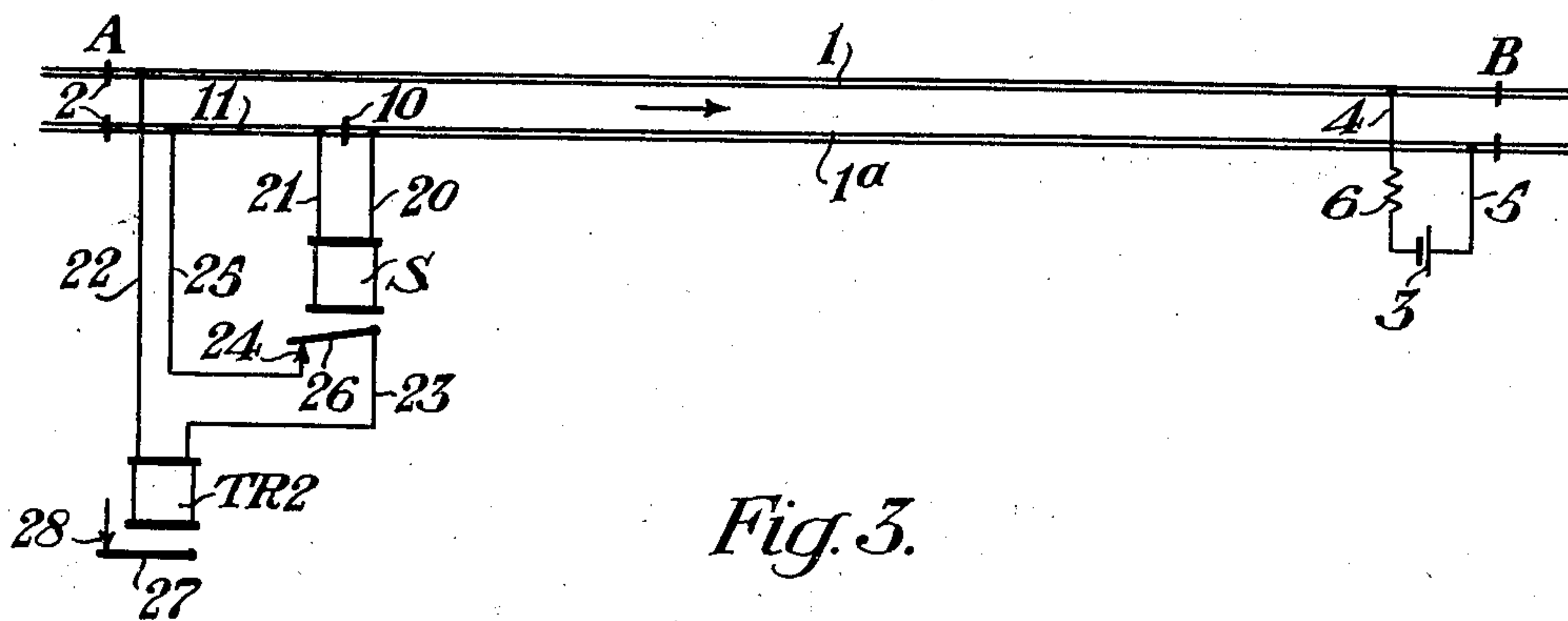
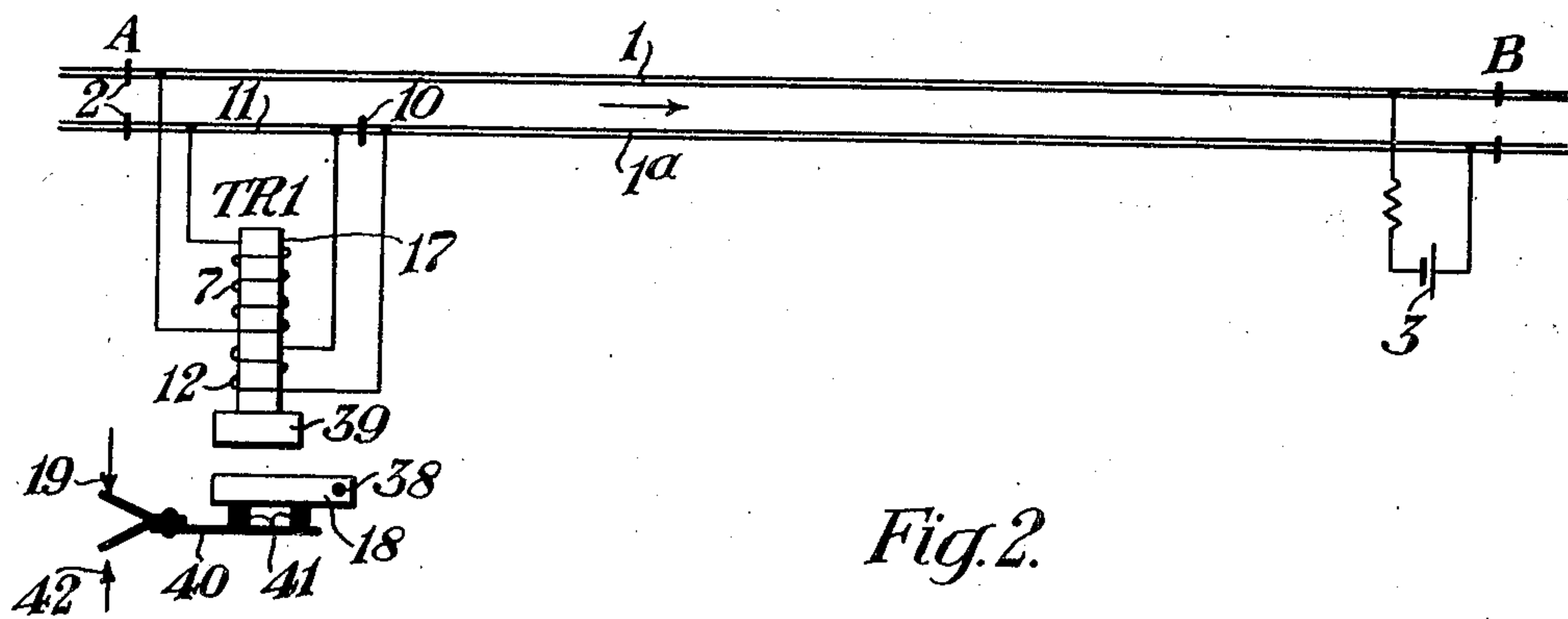
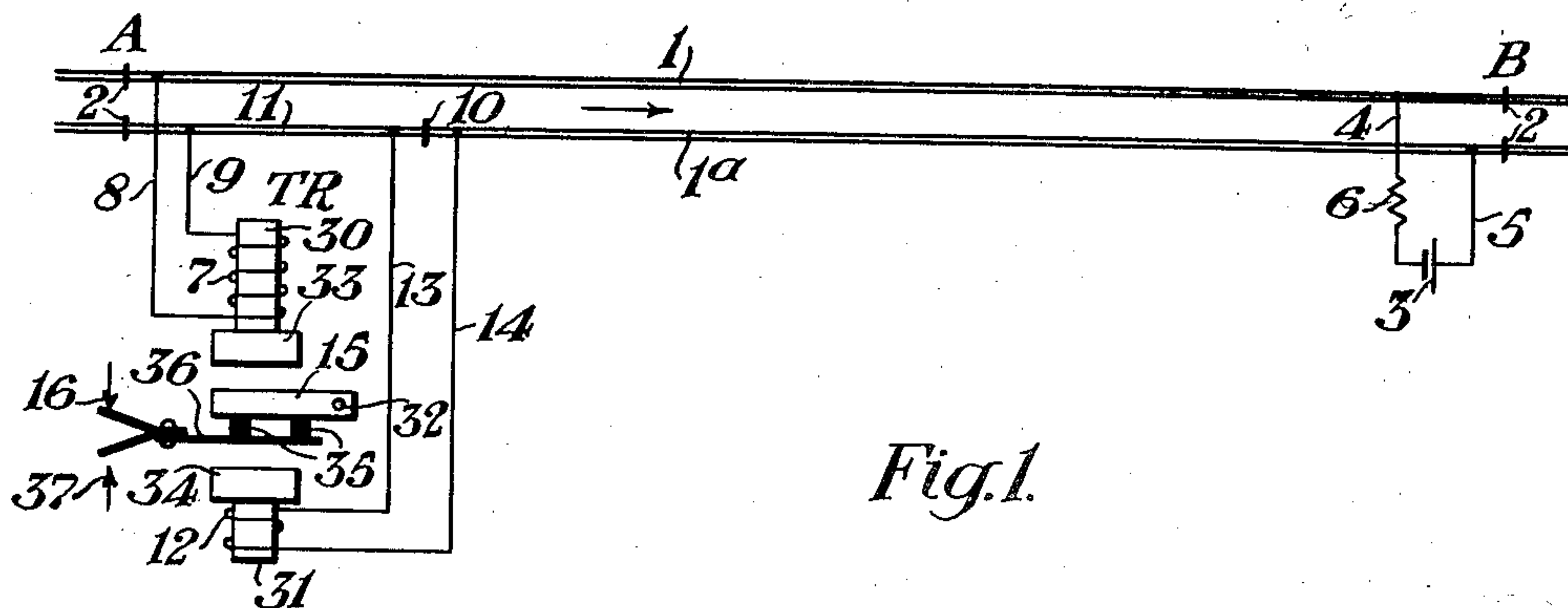
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RAILWAY TRACK CIRCUIT APPARATUS

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RAILWAY TRACK CIRCUIT APPARATUS

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12 Claims. (Cl. 246—41)

My invention relates to railway track circuit apparatus, and has for an object the provision of novel and improved apparatus for expediting the release of the track relay armature when a vehicle enters the section of track with which the relay is associated.

I will describe three 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 showing one form of track circuit apparatus embodying my invention. Figs. 2 and 3 are views similar to Fig. 1, but each showing a modified form of relay combination also embodying my invention.

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

Referring to Fig. 1, the reference characters 1 and 1^a designate the traffic rails of a stretch of railway over which traffic normally moves in the direction indicated by the arrow, and which are arranged by insulated rail joints 2 to form a track section A—B. The track section A—B is provided with a track circuit which comprises as its essential elements the traffic rails 1 and 1^a bonded in the customary manner, a source of current connected across the rails at one end of the section and a track relay connected across the rails at the other end of the section. The source of current may be any convenient source of electrical energy, such for example, as a battery 3, the opposite terminals of which are connected with the rails 1 and 1^a at the outgoing end of the section A—B by conductors 4 and 5, respectively, a current-limiting resistor 6 being interposed in the connection with rail 1.

TR designates the track relay for the section A—B, and, as shown in Fig. 1, is a direct current neutral relay preferably having a main winding 7 of a relatively large number of turns and an auxiliary winding 12 of a relatively small number of turns. The main winding 7 of track relay TR is mounted on a magnetizable core 30 and the auxiliary winding 12 is mounted on a second magnetizable core 31. The relay TR is provided with the usual tractive armature 15, pivotally mounted at 32 for swinging movement between the pole pieces 33 and 34 of the cores 30 and 31, respectively. It is clear, therefore, that the armature 15 is included in the magnetic circuit of both cores 30 and 31. Armature 15 is biased by the force of gravity or otherwise toward the pole piece 34. Secured to the armature 15 by insulating members 35 is a contact finger 36 which, when armature 15 is swung toward the pole piece 33,

engages a fixed front contact 16 to close a circuit controlling contact 16—36. When armature 15 is swung toward the pole piece 34, the contact finger 36 engages a fixed back contact 37 to close a circuit controlling contact 37—36. It follows that the armature 15 is attracted toward the pole piece 33 by the magnetic flux created by the energizing of the winding 7, and, when so operated, the contact 16—36 is closed; and is attracted toward the pole piece 34 by the magnetic flux created when the winding 12 is energized, and, when so operated, the contact 37—36 is closed. Furthermore, the biasing force of gravity continuously tends to operate the armature 15 to the position for closing the contact 37—36. The manner of connecting the windings 7 and 12 of relay TR with the track circuit for the section A—B will shortly appear.

An additional insulated rail joint 10 is placed in the rail 1^a slightly in advance, say, one-half rail length, of the insulated rail joint 2 at the entrance of the section to form a short insulated rail section 11. The main winding 7 of relay TR is connected with rail 1 and with the insulated rail section 11 by conductors 8 and 9, respectively. That is to say, the winding 7 is connected across the traffic rails 1 and 1^a at the entrance of the section to the rear of the additional insulated rail joint 10. The auxiliary winding 12 of the relay TR is connected around the insulated rail joint 10 by conductors 13 and 14 as will be readily understood by an inspection of Fig. 1.

With the section A—B unoccupied, the windings 7 and 12 of the track relay TR are energized in series by current supplied from the track battery 3. The circuit can be traced from one terminal of the track battery 3 over resistor 6, conductor 4, traffic rail 1, conductor 8, winding 7, conductor 9, insulated rail section 11, conductor 13, winding 12, conductor 14, traffic rail 1^a and conductor 5 to the opposite terminal of the battery 3. The magnetic flux created by the energizing of the winding 7 attracts the armature 15 upward as viewed in the drawing, and the magnetic flux created by the energizing of winding 12 attracts the armature 15 downward as viewed in the drawing. That is to say, the windings 7 and 12 normally oppose each other in their attraction of armature 15. As pointed out above, the winding 7 is preferably one of a relatively large number of turns, while the winding 12 is one of a relatively small number of turns, and, consequently, the magnetic flux created by the winding 7 greatly predominates over that created by the winding 12 under the normal unoccupied

condition of section A—B, inasmuch as current of like magnitude flows in each winding 7 and 12. The parts are so proportioned that under this condition just described the armature 15 is operated toward the pole piece 33 to close the front contact 16 and is retained in this position as long as the section A—B remains unoccupied.

When a train traveling in the normal direction of traffic first enters the section A—B and its leading pair of wheels and axle span the rail 1 and the insulated rail section 11, the main winding 7 of relay TR will be shunted and the current flowing therethrough will be greatly reduced in value, and the magnetic flux of the core 30 will gradually die away to a relatively small value. Current will now flow from the battery 3 over resistor 6, conductor 4, rail 1, train shunt, insulated rail section 11, conductor 13, winding 12, conductor 14, rail 1^a and conductor 5 back to the battery 3, and the auxiliary winding 12 will still remain energized. The train shunt resistance being materially less than the resistance of the winding 7, the flow of current in the winding 12 will now be increased over the normal flow of current and, consequently, the attraction of the armature 15 due to the magnetic flux created by winding 12 will be increased accordingly. The result will be that the armature 15 will not only fall away from engagement with the front contact 16 due to the biasing force of gravity, but will also be pulled away by the magnetic flux created by the winding 12. It is clear, therefore, that the release of the armature 15 of the track relay TR of Fig. 1 will be expedited over that obtained with track relays of the type depending upon the shunting of the energizing winding only.

When the train advances to the right and its leading pair of wheels and axle span the rails 1 and 1^a to the right of the insulated rail joint 10, the winding 12 will be shunted and the magnetic field created thereby will be reduced to a relatively small value, the armature 15 being held in engagement with the back contact 37, however, by the biasing force. When the train vacates the section A—B, the normal flow of current will be reestablished in the two windings 7 and 12 in series, and the armature 15 will be picked up.

Referring now to Fig. 2, the track section A—B is provided with a track circuit having a current source connected across the traffic rails at the outgoing end of the section and an additional insulated rail joint 10 located in the rail 1^a slightly in advance of the entrance of the section the same as in Fig. 1. In this form of apparatus embodying my invention, the track relay TR1 is preferably a direct current neutral relay having the main winding 7 and the auxiliary winding 12 both mounted on the same magnetizable core 17. The main winding 7 is preferably of a relatively large number of turns and is connected across the rail 1 and the short insulated rail section 11 the same as in Fig. 1. The auxiliary winding 12 is preferably of a relatively small number of turns and is connected around the additional insulated rail joint 10. The relay TR1 is provided with a tractive armature 18, pivotally mounted at 38 for swinging movement toward and away from the pole piece 39 associated with the core 17, being biased away from the pole piece 39 by the force of gravity. A contact finger 40 is attached to the armature 18 by means of insulating members 41 and is adapted to engage a fixed front contact 19, or to engage a fixed back contact 42.

As long as the section A—B of Fig. 2 is unoccupied, the track battery 3 supplies current which flows in the windings 7 and 12 in series in the same manner as described for Fig. 1. Both main winding 7 and the auxiliary winding 12 of track relay TR1 being mounted on the same magnetizable core 17, each creates a magnetic flux therein when energized. The windings 7 and 12 are so positioned on the core 17 that the magnetic fluxes created thereby oppose each other with the result that the armature 18 is attracted by a force corresponding to the resultant magnetic flux. Due to the unequal number of turns, the winding 7 predominates over winding 12 and the resultant magnetic flux is in a direction corresponding to the winding 7. The parts are so proportioned that the resultant magnetic flux is sufficient to attract the armature 18 to the position for closing the front contact 19 as long as the windings 7 and 12 are energized by the normal flow of current.

When a train advances from the left and its leading pair of wheels and axle pass the insulated rail joints 2 at the entrance of the section A—B, the winding 7 of the relay TR1 will be shunted and the flow of current therethrough will be greatly reduced. The winding 12, however, remains energized by current flowing through the train shunt and this flow of current will be greater in value than the normal flow of current, and, consequently, the magnetic flux created by the winding 12 will be increased accordingly. There will result, therefore, a rapid dying away of the normal magnetic flux which was in the direction corresponding to the winding 7, and as the resultant field approaches the value of zero, the armature 18 will be released very quickly. It is clear, therefore, that the time required to release the armature 18 of the track relay TR1 will be much less than that ordinarily required when the track relay is shunted only. It is to be noted that the magnetic flux will die down to zero and then build up to the opposite direction, that is, in the direction corresponding to winding 12, to again provide attraction for the armature 18. Winding 12 is so proportioned, however, that the magnetic flux created thereby, even when a pair of wheels span the rail 1 and the insulated rail section 11, will not be sufficient to pick up the armature 18. When the train has advanced a few feet to the right in Fig. 2 and its leading pair of wheels and axle span the rails 1 and 1^a to the right of the insulated rail joint 10, the winding 12 will be shunted, the armature 18 being held in the position for engaging the back contact 42 by the biasing force of gravity. When the train vacates the section A—B, the normal flow of current will be reestablished and both windings 7 and 12 will be reenergized with the result that the armature 18 will be picked up to close the front contact 19.

In Fig. 3, the traffic rails 1 and 1^a are arranged into a track section A—B, which is provided with a track circuit having a source of current connected across the rails at the exit end of the section the same as in Fig. 1. The additional insulated rail joint 10 is likewise placed in the rail 1^a a few feet in advance of the insulated rail joint 2 at the entrance end of the section the same as in Fig. 1. An auxiliary relay S has its winding connected around the insulated rail joint 10 by conductors 20 and 21. The relay S is a direct current neutral relay preferably having a relatively low resistance winding. The main track relay TR2 has one terminal of its winding connected

with the rail 1 by a conductor 22 and the other terminal of its winding connected with the insulated rail section 11 by conductor 23, armature 26 of relay S, back contact 24 and conductor 25.

5 With the section A—B of Fig. 3 unoccupied, current flows from the battery 3 over resistor 6, conductor 4, rail 1, conductor 22, winding of track relay TR2, conductor 23, armature 26 of relay S, back contact 24, conductor 25, insulated rail section 11, conductor 21, winding of relay S, conductor 20, traffic rail 1^a and conductor 5 back to battery 3, and the relays TR2 and S are energized in series. The relay S is so proportioned and adjusted that the energization resulting from the normal flow of current through its winding is not sufficient to lift the armature 26 out of engagement with the back contact 24. The track relay TR2 is so adjusted that when its winding is energized with the normal flow of current, its armature 27 is held in engagement with the front contact 28.

When the leading pair of wheels and axle of a train moving to the right pass the insulated rail joints 2 at the entrance of the section A—B and span the insulated rail section 11 and rail 1, the track relay TR2 will be shunted and the flow of current through its winding will be reduced to a very low value. At the same time current will flow in the winding of the relay S through the train shunt and this flow of current will be increased in value over the normal flow of current with the result that the relay S will now be energized sufficiently to pick up its armature 26 and open the back contact 24. When the back contact 24 is opened, all current will be removed from the winding of the relay TR2 and the magnetic field of that relay rapidly falls to zero, resulting in a very quick release of its armature 27. It is to be seen, therefore, that the apparatus of Fig. 3 provides a release of the armature of the track relay which will be quicker than obtained by the shunting of the winding of the track relay only. When the train advances to the right far enough to span the rails 1 and 1^a to the right of the insulated rail joint 10, the relay S will be shunted and its armature 26 will drop into engagement with the back contact 24. As the rear of the train vacates the section A—B and the normal flow of current is reestablished in the track circuit, the track relay TR2 will be reenergized and its armature 27 lifted into engagement with the front contact 28. It is clear that a quick and positive release of the track relay TR2 will be obtained in response to a train entering the section A—B.

Although I have herein shown and described only three forms of 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 with a stretch of railway track, insulated rail joints located in the traffic rails to form a track section, a source of current connected across the traffic rails at the exit end of the section, another insulated rail joint located in one rail slightly in advance of the entrance of the section, a first winding connected around said other insulated rail joint, a second winding connected across the traffic rails of the section to the rear of said other insulated rail joint whereby said windings are serially energized by current from said source when the section is unoc-

cupied and the first winding only is energized as a train first enters the section, and a circuit controlling armature having a biased position and an operated position jointly controlled by said windings.

2. In combination with a stretch of railway track, insulated rail joints located in the traffic rails to form a track section, a source of current connected across the traffic rails at the exit end of the section, another insulated rail joint located in one rail slightly in advance of the entrance of the section, a first winding connected around said other insulated rail joint, a second winding connected across the traffic rails of the section to the rear of said other insulated rail joint whereby said windings are serially energized by current from said source when the section is unoccupied and the first winding only is energized as a train first enters the section, a circuit controlling armature having a closed position and an open position and biased by the force of gravity to said open position, a magnetic field created by said second winding when energized effective to attract said armature to the closed position, and a magnetic field created by said first winding when energized effective to assist the force of gravity in moving said armature to the open position.

3. In combination with a stretch of railway track, insulated rail joints located in the traffic rails to form a track section, a source of current connected across the traffic rails at the exit end of the section, another insulated rail joint located in one rail slightly in advance of the entrance of the section, a first winding connected around said other insulated rail joint, a second winding connected across the traffic rails of the section to the rear of said other insulated rail joint whereby said windings are serially energized by current from said source when the section is unoccupied and the first winding only is energized as a train first enters the section, a circuit controlling armature having a closed position and an open position, and a magnetic field created by said windings when serially energized effective to operate the armature to said closed position and when said first winding alone is energized effective to move the armature to the open position, whereby said armature is quickly actuated from the closed to the open position as a train first enters the sections.

4. In combination with a stretch of railway track, insulated rail joints located in the traffic rails to form a track section, a source of current connected across the traffic rails at the exit end of the section, another insulated rail joint located in one rail slightly in advance of the entrance of the section, a relatively low resistance winding connected around said other insulated rail joint, a relatively high resistance winding connected across the traffic rails of the section to the rear of said other insulated rail joint whereby said windings are serially energized by current from said source when the section is unoccupied and the first mentioned winding only is energized as a train first enters the section, and a circuit controlling armature having a biased position and an operated position jointly controlled by said windings and arranged in such a manner as to be actuated to the operated position by the energization of the second mentioned winding and to have its movement toward the biased position expedited by the energization of the first mentioned winding alone.

5. In combination with a stretch of railway track, insulated rail joints located in the traffic rails to form a track section, a source of current connected across the traffic rails at the exit end of the section, another insulated rail joint located in one rail slightly in advance of the entrance of the section, a relay having an armature biased by gravity to an open position and a main winding for closing said armature as well as an auxiliary winding for assisting the force of gravity in opening said armature, means for connecting said main winding across the traffic rails between the said other insulated rail joint and the insulated rail joints at the entrance of the section, and means for connecting said auxiliary winding around said other insulated rail joint.

6. In combination with a stretch of railway track, insulated rail joints located in the traffic rails to form a track section, a source of current connected across the traffic rails at the exit end of the section, another insulated rail joint located in one rail slightly in advance of the entrance of the section, a relay having a magnetizable core and a circuit controlling armature in attractive relationship with said core, said armature biased by gravity to the open position and attracted by said core to the closed position; a main winding having a relatively large number of turns and an auxiliary winding having a relatively small number of turns mounted on said core and arranged to oppose each other, means for connecting said main winding across the traffic rails between the said other insulated rail joint and the insulated rail joints at the entrance of the section, means for connecting said auxiliary winding around said other insulated rail joint, whereby the magnetic field created in said core by the current flowing in said windings when the section is unoccupied is rapidly annulled and the armature quickly released in response to the current flowing in the auxiliary winding as a train enters the section.

7. In combination with a stretch of railway track, insulated rail joints located in the traffic rails to form a track section, a source of current connected across the traffic rails at the exit end of the section, another insulated rail joint located in one rail slightly in advance of the entrance of the section, a relay having a single magnetic circuit including an armature biased by gravity to the open position, said magnetic circuit being provided with a main winding for closing said armature as well as an auxiliary winding for creating in said magnetic circuit and in said armature a flux which opposes and is weaker than the flux created therein by said main winding, means for connecting said main winding across the traffic rails between the said other insulated rail joint and the insulated rail joints at the entrance of the section, and means for connecting the auxiliary winding around said other insulated rail joint.

8. In combination with a stretch of railway track, insulated rail joints located in the traffic rails to form a track section, a source of current connected across the traffic rails at the exit end of the section, another insulated rail joint located in one rail slightly in advance of the entrance of the section, a relay having a first and a second magnetic circuit and a circuit controlling armature biased to the open position and included in both of said magnetic circuits, a main winding mounted on the first magnetic circuit for creating a magnetic flux in said armature to operate the armature to the

closed position, an auxiliary winding mounted on the second magnetic circuit for creating a magnetic flux in said armature which opposes and is weaker than the flux created by the main winding, means for connecting said main winding across the traffic rails of the section between said other insulated rail joint and the insulated rail joints at the entrance of the section, and means for connecting said auxiliary winding around said other insulated rail joint.

9. In combination with a stretch of railway track, a pair of insulated rail joints located in each traffic rail to form a track section, a source of current connected across the traffic rails at the exit end of the section, another insulated rail joint located in one rail slightly in advance of the entrance of the section, a main relay and an auxiliary relay, circuit means for connecting the winding of the main relay across the traffic rails of the section between said other insulated rail joint and the insulated rail joints at the entrance of the section and including a back contact of the auxiliary relay, other circuit means for connecting the winding of the auxiliary relay around said other insulated rail joint, and a circuit controlling armature operated by said main relay.

10. In combination with a stretch of railway track, insulated rail joints located in the traffic rails to form a track section, a source of current connected across the traffic rails at the exit end of the section, another insulated rail joint located in one rail slightly in advance of the entrance of the section, a relatively low resistance winding connected around said other insulated rail joint, a relatively high resistance winding connected across the traffic rails of the section to the rear of said other insulated rail joint whereby said windings are serially energized by current from said source when the section is unoccupied and the first mentioned winding alone is energized as a train first enters the section, a circuit controlling armature having a closed position and an open position and biased by gravity to the open position, means rendered effective with said windings serially energized to operate said armature to the closed position, and means rendered effective when said first mentioned winding alone is energized to assist gravity in operating said armature to the open position.

11. In combination with a stretch of railway track, a pair of insulated rail joints located in each traffic rail to form a track section, a source of current connected across the traffic rails at the exit end of the section, another insulated rail joint located in one rail slightly in advance of the entrance of the section, a main relay and an auxiliary relay, circuit means for connecting the winding of the main relay across the traffic rails of the section between said other insulated rail joint and the insulated rail joints at the entrance of the section and including a back contact of the auxiliary relay, other circuit means for connecting the winding of the auxiliary relay around said other insulated rail joint whereby said auxiliary relay will receive current from said source when a train enters the section, and a circuit controlling armature operated by said main relay.

12. In combination, a section of railway track comprising the usual track circuit including the traffic rails and insulated rail joints at the entrance and exit ends of the section, a source of

current connected across the rails at the exit end of the section, an auxiliary insulated rail joint in one rail of the section, an auxiliary relay having its winding connected across said auxiliary rail joint, a main relay connected across the rails at the entrance end of the section over a back contact of said auxiliary relay whereby when a train enters said section the main

relay will first become shunted and will subsequently have its winding disconnected from the track through the energization of said auxiliary relay caused by the entry of the train into said section, and a circuit controlling armature operated by said main relay.

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