J. F. CLARK.

AUTOMATIC ELECTRIC INTERLOCK SYSTEM.

APPLICATION FILED JULY 27, 1307.

924,735. Patented June 15, 1909.

3 SHEETS—SHEET 1.

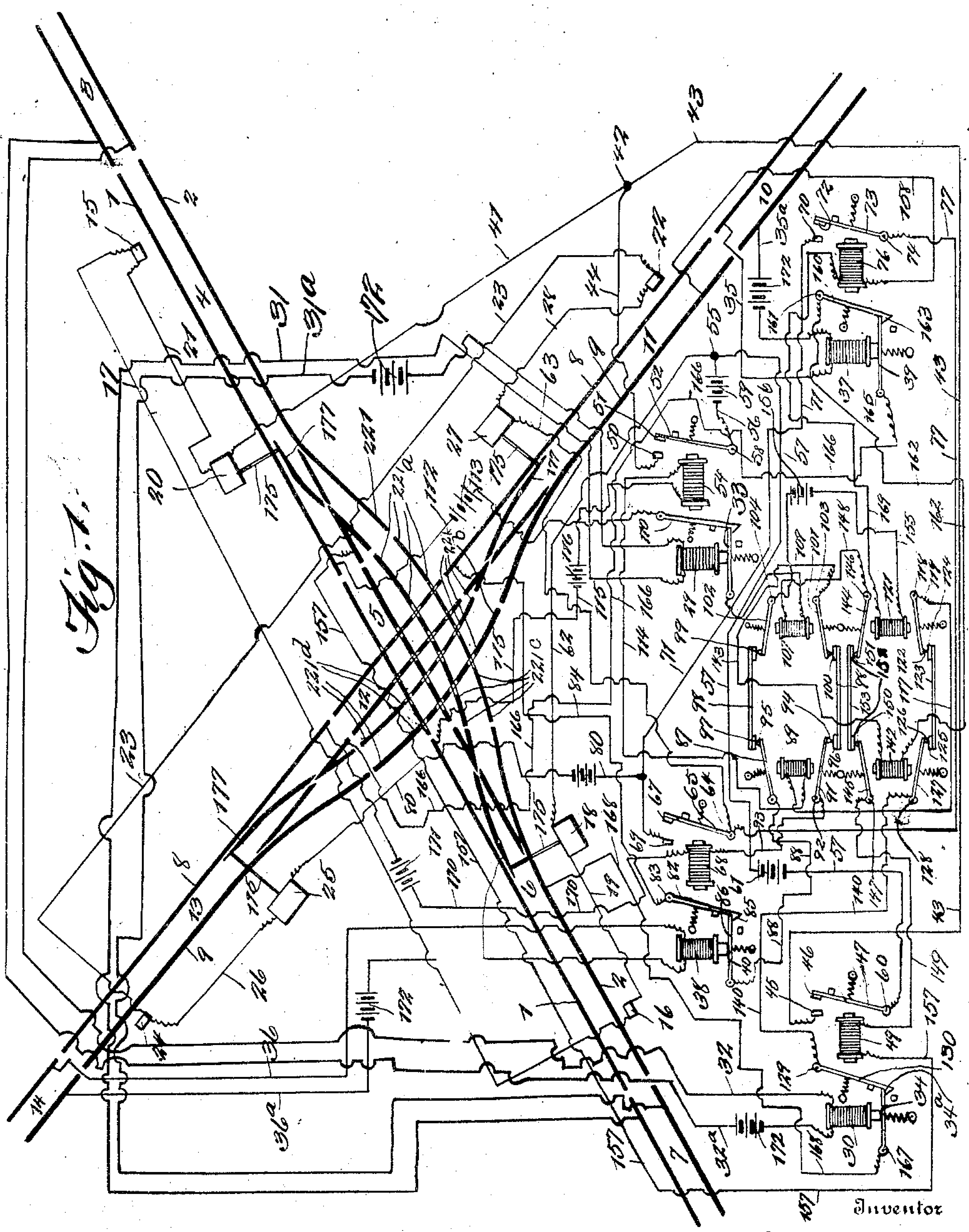

Fig. 1.

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Witnesses

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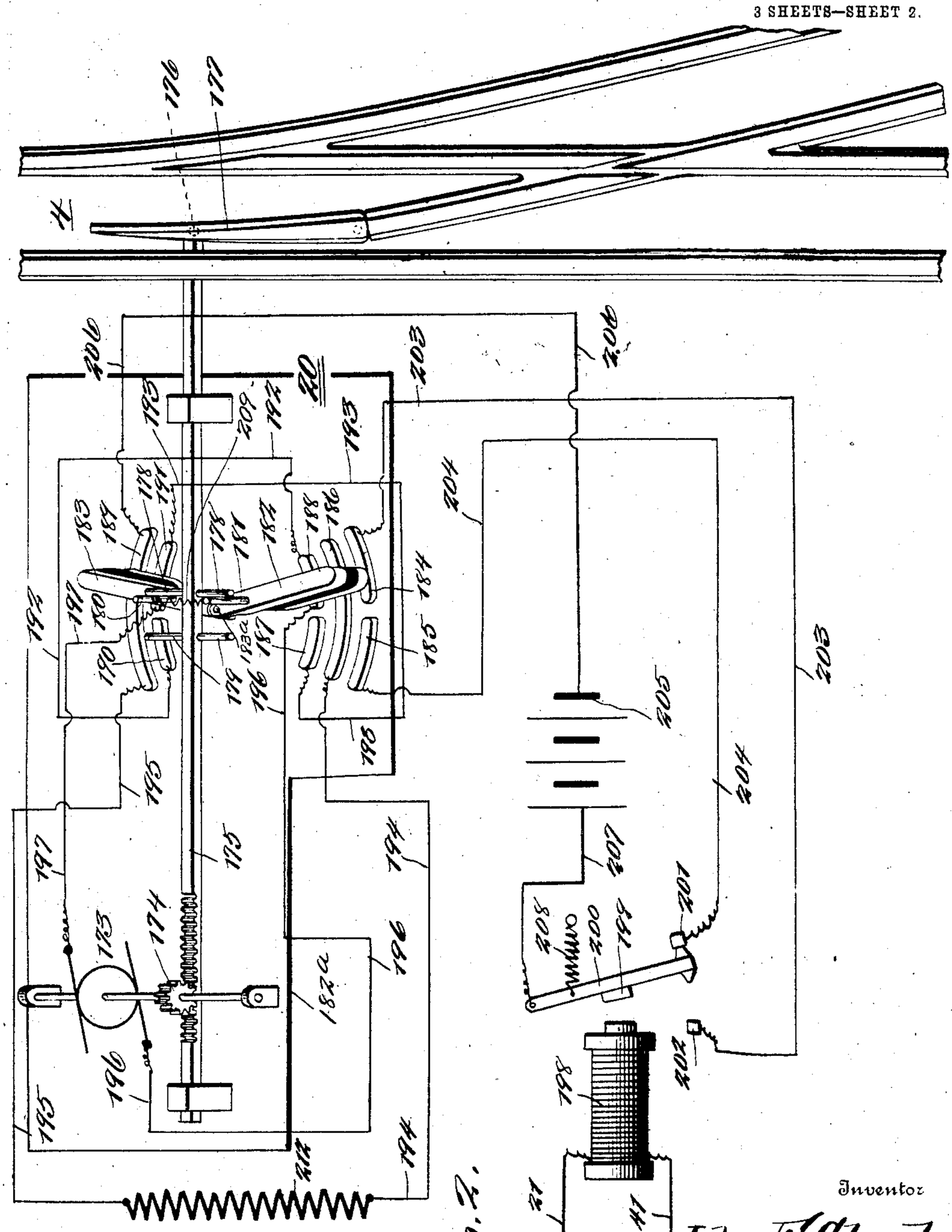

Fig. 2.

Witnesses

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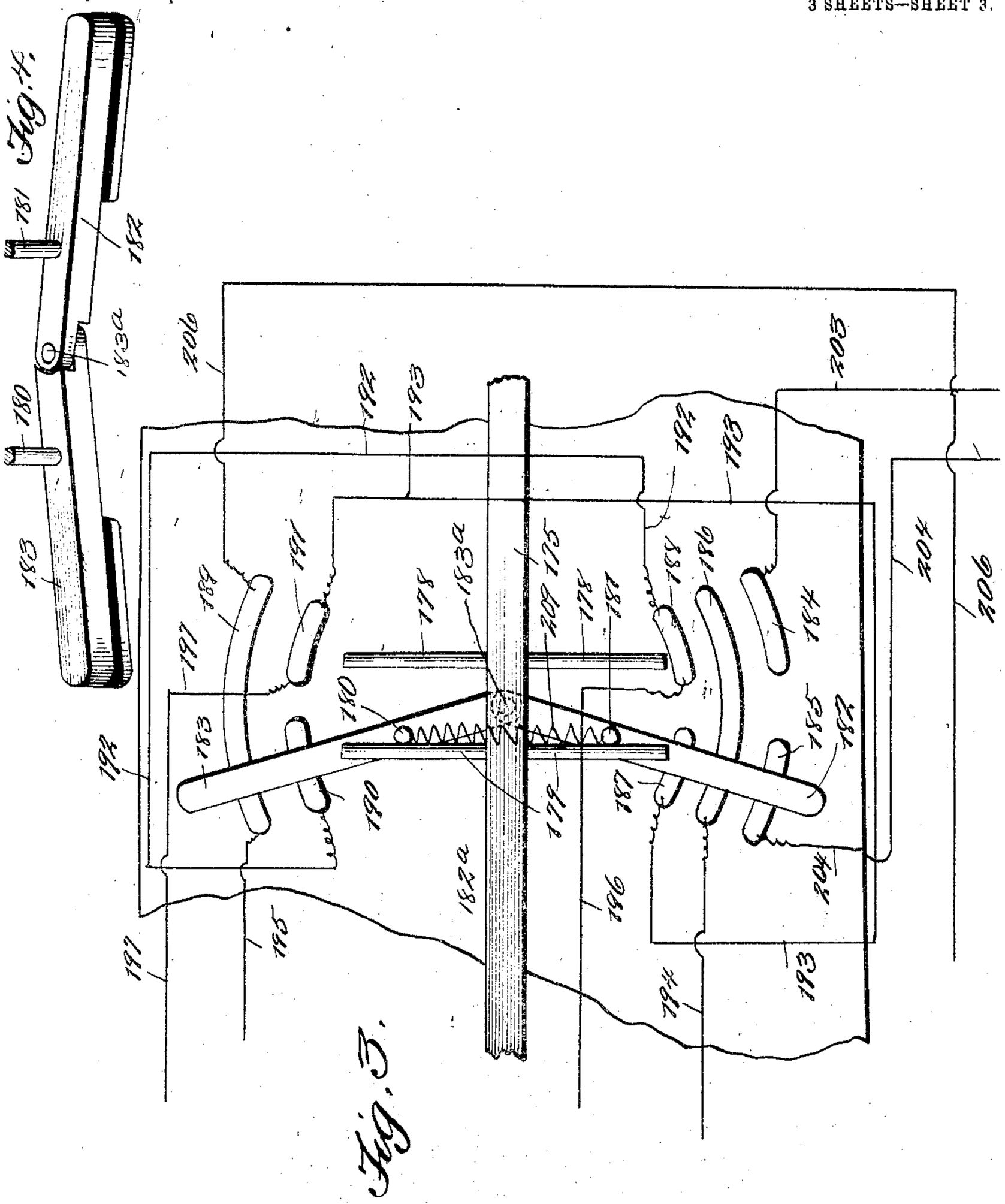

Fig. 3.

Witnesses

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UNITED STATES PATENT OFFICE.

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AUTOMATIC ELECTRIC INTERLOCK SYSTEM.

No. 924,735.

Specification of Letters Patent. Patented June 15, 1909.

Application filed July 27, 1907. Serial No. 385,841.

To all whom it may concern:

Be it known that I, JOHN F. CLARK, a citizen of the United States, residing at Christopher, in the county of Franklin and State of Illinois, have invented certain new and useful Automatic Electric Interlock Systems, of which the following is a specification, reference being had therein to the accompanying drawing.

This invention pertains to a new and useful automatic electric interlock system for railways, which comprises a track running north and south, which is crossed approximately at right angles thereto by an east and west track; this system is applicable to a single track, running in any desired direction, as will be clearly manifest.

In its broadest aspect, the invention comprises a system of this character by which a south-bound or north-bound train may be switched upon a side-track, while the train going in the opposite direction may pass through on the main track, after which the south or north-bound train may continue on its course; while a south or north-bound train is switched upon the side track, signals are exhibited to trains bound east or west, thus notifying the engineer on east or west bound train that danger is ahead. The signals are automatically and electrically operated by the different trains bound in all directions, prior to being switched upon the side-track and, as the trains leave the side-tracks, the signals are returned to their normal state, as will be readily understood from a thorough examination of the drawings, in connection with the hereinafter description.

One rail of the track running north and south is insulated from the other rail as is also one rail of the track running east and west, and the side-tracks consist of three sections, two end sections and an intermediate section, one rail of each of the end sections is insulated from the ground to correspond to the insulated rail of each track running north or south, east or west, while the intermediate sections of the side-tracks, that is to say, both rails thereof have no electrical connections and are isolated from the surrounding blocks. When a train is on the intermediate section of the side-track, the signals of the tracks running at right angles thereto, are in condition to be operated.

The invention comprises further objects and combinations of elements which will be hereinafter more fully described, defined by the appended claims, and disclosed by the accompanying drawings, in which,

Figure 1 is a view illustrating, diagrammatically, the outlay of the system, also illustrating conventionally the switch mechanism. Fig. 2 is a view illustrating, diagrammatically, the switch mechanism which discloses its local circuit. Fig. 3 is a view, illustrating parts of the elements as disclosed in Fig. 2. Fig. 4 is a view of the oscillating elements 182 and 183.

Referring to the annexed drawings, 1 and 2 designate the rails of the track running north and south, the rail 2 being insulated from the other rail. These rails are in sections, as shown, thus dividing the track into blocks 3, 4, 5, 6 and 7.

8 and 9 indicate the rails of the track running east and west, which rails are in sections, as illustrated, thus providing blocks 10, 11, 12, 13 and 14. A signal 15, of the usual form, is positioned adjacent the block 4 of the track running north and south; this signal is electrically connected to an opposing signal 16, similar to the signal 15, by means of the lead 17, as clearly shown.

The signal 16 is electrically connected to the switch mechanism 18, through the medium of the lead 19; and the signal 15 is electrically connected to the switch mechanism 20 by the lead 21, as is also disclosed by the drawings. These signals are operated when a train bound north or south enters blocks 4 or 6, which will be hereinafter more fully described.

Attention is directed to the track running east and west, the wiring of which is approximately similar to that of the track running north and south, and which is referred to as follows: A distant signal 22 is located adjacent the block 11 of the east and west track which is electrically connected by a lead 23 to a similar distant signal 24 of the block 13, which signal 24 is electrically connected to the switch mechanism 25, by the lead 26, as shown in the drawings, while the distant signal 22 is provided with electrical connections with the switch mechanism 27, through the lead 28, as is also disclosed by the drawings.

Blocks 7 and 3, are electrically connected to the magnets 29 and 30, by the leads 31, 31^a, and 32 and 32^a, as clearly shown; these magnets 29 and 30 attract the usual armatures 33 and 34. Blocks 10 and 14 have connected thereto leads 35, 35^a, 36 and 36^a,

which form electrical connections with the magnets 37 and 38, which are provided with the usual armatures 39 and 40, as clearly illustrated in Fig. 1.

A lead 41 is connected to the switch mechanism 20, as clearly shown, and which forms a junction 42 with leads 43 and 44; the leads 43 being connected to the contact point 45, which is coöperated with by means of the armature 47, which also coöperates with magnet 49, as clearly shown in Fig. 1; while the lead 44 is connected to a contact 50, with which an armature 52 coöperates; this armature 52 co-acts with the magnet 54, as clearly shown.

A junction 55 is formed by the leads 56 and 57, as shown; the lead 56 is connected to the pivot of the armature 52, as at 58, which lead 56 is provided with a suitable battery 59; while the lead 57 is connected to the pivot 60 of the armature 47, and in which lead 57, a suitable battery 61 is provided, so as to provide current therefor. The switch mechanism 18 is connected to the junction 55, by the lead 62, as clearly shown.

The switch mechanism 27 is electrically connected by means of a lead 63 to the pivot 64 of the armature 65, which is designed to coöperate with the magnet 68 and the contact 69, to which the contact 70 is electrically connected by means of the lead 71, with which contact 70 the armature 73 pivoted at 74 coöperates. This armature 73 is designed to co-act in conjunction with the magnet 76, as will be clearly understood. The pivot of the armature 73 is electrically connected by means of the lead 77, with the pivot 64 of the armature 65, as clearly shown. The switch mechanism 25 of the block 13 is electrically connected with the contact 69, by means of the lead 80. Coöperating with the magnet 68 is an armature 82, which is pivoted, as at 83, which pivot 83 is electrically connected to the insulated rail 8 of the track running east and west, by means of the lead 84, as shown; the armature 82 is provided with a beveled hook device 85 which supports, at certain times, the armature 86. To the pivot of the armature 86, the pivot of the armature 87 is electrically connected by the lead 88, as clearly shown in Fig. 1.

The armature 87 is designed to coöperate with the magnet 89, with which an armature 91 also co-acts; the armature 91 is pivoted, as at 92, which pivot 92 is electrically connected to the magnet 68 by means of the lead 93, as disclosed by the drawings. The armatures 87 and 91 are provided with members 94 and 95 which coöperate with the contacts 96 and 97 of the plates 98. These plates 98 are provided with additional members 99 and 100 which are coöperated with, by the armatures 101 and 102, which are pivoted, at 103 and 104, said armatures being for the purpose of coöperating in conjunction with the magnet 107, as illustrated; this magnet is electrically connected with an armature 33, by means of the lead 109, which armature 33 co-acts with the magnet 29. As before stated, this armature 33 is supported by means of the armature 110, which is provided with a beveled element, to engage the end of said armature 33.

The armature 110 is attracted, at certain times, by the magnet 54, as will be clearly manifest. The pivot of the armature 110 is electrically connected by means of the lead 112 with the rail 1 of the block 4, as clearly shown; this lead 112 is provided with a suitable battery 113 for the purpose of supplying current therefor. The magnets 89 and 54 are electrically connected by means of the lead 114 and said magnet 54 is also electrically connected to the rail 1 of the block 6, by means of the lead 115, in which a suitable battery 116 is provided for the purpose of supplying current therefor. The magnet 89 has connected thereto a lead 117, which is also connected electrically with the pivot 118 of the armature 119, which co-acts in conjunction with the magnet 121, as clearly disclosed by the drawings. This armature 119 is provided with a member 122 which forms an electrical connection with a plate 123, through the medium of the member 124, carried thereby; this plate is provided with an additional member 125, to be coöperated with by the armature 127, the pivot 128 of which is electrically connected with the pivot 129 of the armature 130, by means of the lead 140; this armature 130 is designed to support the outer free end of the armature 34, that is to say, when the magnet 49 is deënergized. As clearly illustrated, pivot 103 of the armature 101 and the magnet 142 are electrically connected by means of the lead 143. Coöperating with magnets 121 and 142 are armatures 144 and 145, which are pivoted, as at 146 and 147, as clearly shown. The pivot 146 is electrically connected with the magnet 107, by the lead 148, while the pivot 147 is electrically connected to the magnet 49, through the medium of the lead 149, as will be readily understood from the drawings. The outer free ends of the armatures 144 and 145 are provided with members 150 and 151, which coöperate with members 152 of the plate 153, as will be observed. These armatures are also attracted by the magnets 142 and 121, when energized.

The insulated rail 2 of the block 4 and the magnet 49 are electrically connected by the lead 157, as is readily traced on the drawings. The rail 9 of the block 11 and the magnet 76 are electrically connected by the lead 158; this magnet 76 is coöperated with by the armature 160, the pivot 161 of which is electrically connected with the magnet 142,

by the lead 162, as will be observed. This armature 160 is provided with a beveled element 163, for the purpose of supporting the free end of the armature 39, that is, when the said armature 160 is not attracted by the magnet 76. The pivot 165 of the said armature 39, and the rail 9 of the block 13 are electrically connected by means of a lead 166, as is clearly shown. The pivot 167 of the armature 34 is electrically connected with the insulated rail 2 of the block 6, by means of the lead 168. The magnets 76 and 121 ~~are~~ electrically connected by a lead 169, as clearly shown in Fig. 1. The rail 8 of the block 13, and the magnet 68, are electrically connected by means of the lead 170, in which a suitable battery 171 is located, for the purpose of supplying current therefor.

The leads 31^a and 36^a, 35^a and 32^a are provided with batteries 172, for the purpose of supplying current to the system, as will be readily manifest.

Each one of the switch mechanisms is constructed and wired electrically, approximately similar to that shown in Fig. 2 of the annexed drawings, and is operated approximately similar when a train is bound north or south, east or west upon any of the blocks 4, 6, 11 and 13, as will be hereinafter set forth. These switch mechanisms comprise a conventional form of motor 173, the shaft of which is provided with a pinion 174, designed to engage a rack 175, which is pivotally connected, as at 176, to the point rail of the switch. This rack is provided with two sets of lateral projecting arms 178 and 179, designed to engage arms 180 and 181 of the oscillating members 182 and 183, which are moved over the segments 184, 185, 186, 187, 188, 189, 190, and 191, that is, when the said rack is reciprocated. The said oscillating members are pivoted to a base 182^a, as at 183^a. The segments 188 and 190 are electrically connected by the wire 192, and the segments 191 and 187 are electrically connected by the wire 193. The segment 186 is electrically connected to the field of the motor by the lead 194, which field is electrically connected with the segment 189, by the lead 195, as clearly disclosed by Fig. 2. The segment 188 is provided with an electrical connection with one brush of the motor, such as the lead 196, while the segment 191 is connected to the motor's other brush, by the lead 197. A magnet of conventional form is disclosed in Fig. 2, designated by the numeral 198, with which the armature 199 of the lever 200 cooperates. This lever oscillates between two contacts 201 and 202, the contact 202 is electrically connected with the segment 184 by the lead 203, while the contact 201 is electrically connected with the segment 185 by the lead 204, as is also disclosed by Fig. 2. Also in conjunction with the elements of the switch mechanism, a suitable storage battery 205 is provided, which is in circuit with the segment 189 and the said lever 200, through the medium of the leads 206 and 207, as clearly illustrated. When the magnet 198 is deënergized, a spring 208 returns the lever 200 in contact with the contact 201.

When a train enters block 4 and is bound south, the circuit is closed on magnets 49 and 198, thus setting in operation the motor 173, as hereinafter described, which motor, in turn, moves the said rack 175, so as to throw the point rail 177 in a position to allow the said train to be switched upon the side track. When the said rack is moving to close the point rail, the said lateral projecting arms 178 are moving the oscillating members 182 and 183 over the said segments and just as soon as the said elements are in the act of passing the center of the segments, the spring 209 draws them in a position, as shown in Fig. 3 of the drawings, thus stopping the action of the motor, which will cause the point rail to be moved to an open position.

The circuit, while the oscillating elements are in a position, as shown in Fig. 2, is traced as follows: current leaving the storage batteries 205, through the wire 207 to the lever 200 and through the contact 202 and the wire 203, that is, when the lever 200 is attracted by the magnet 198; the current then enters the segment 184 and the metallic conductor of the oscillating member 182, as will be understood; the current divides at this point, one flow of which enters the field 212 through the medium of the segments 186 and the lead 194. The current, leaving the field 212, enters the segment 189, through the medium of the lead 195; at the point where the current enters said segment 189, it reunites with that part of the current divided therefrom on the oscillating element 182 and continues through the lead 206 back to the storage battery 205; the portion of current which is divided from that going through the lead 194, continues through the segment 188, along the lead 196 to one of the motor's brushes, then leaving the motor's other brush along the lead 197 to the segment 191, through the oscillating element 183 and the segment 189, thus reuniting with the current entering the said segment 189, through the lead 195, as it continues to the said storage battery.

The circuit of the switch mechanism is traced as follows: that is to say, while the oscillating elements are in a position, as shown in Fig. 3, current leaves the battery 205 through the lead 207 to the lever 200, and through the contact 201, that is, when the magnet 198 is deënergized by the opening of the circuit of block 4, to the segment 185, by means of the lead 204. The current continues to the segment 186 through the medium of electrical conductor of the oscillating element 182; this conductor is insu-

lated from said element, as will be observed. The current divides, one portion of which enters the field 212, through the wire 194; the current then advances to the segment 189, by means of the wire 195; while the other portion of the said current advances to the segments 187 and 191 through means of the conductor of the element 182 and the wire 193, from which segment 191 the current forwards to one of the motor's brushes, by the wire 197. The current then continues on through the lead 196, from the other of the motor's brushes to the segment 188 and through the same, to the segment 190, by means of the wire 192, from whence it advances through the conductor of the element 183 to the segment 189, where it reunites with the current entering the said segment 189 from the lead 195 and advances on its course to the said batteries through the connection 206, as will be readily conveyed to the mind of the reader versed in this particular art.

When the oscillating elements are, as shown in Fig. 3, the current forwards to the motor's brushes in an opposite direction to the advancement of the current when the oscillating elements are as shown in full lines in Fig. 2; the direction of the armature's current being reversed, but that of the fields remaining the same, the motor is reversed, which, in turn, closes the point rails of the switch, as will be readily observed.

Each one of the switch mechanisms and the signals are similar in their operation, and for that reason only one of each is disclosed. Suppose a train to be moving along block 3, so soon as it shall have passed onto block 4 (one rail of which block is insulated from the ground) the circuit of the magnets 107 and 49 is closed through the medium of the engine's driving wheels and axles, and current proceeds from the battery 113, through wire 112 armature 110, armature 33 and wire 109 to magnet 107, then through wire 148, through the armature 144, which coöperates with the magnet 121, then through the member of the plate 153, through the armature 145, thus continuing on its course through the wire 149, to magnet 49, from whence it advances through the wire 157 to the insulated rail, returning to the battery 113, through the engine's driving wheels and axles, and that portion of the wire 112 which connects the rail 1 of the block 4.

When the magnet 107 is energized, the armatures 101 and 102 are attracted thereto; the function of this movement will be disclosed later. On being energized, magnet 49 attracts its armature 47 and also the armature 130, establishing a local circuit, the current of which begins at battery 61, moves along the wire 57, to the junction 55, thus continuing along the wire 62 to the switch mechanism 18, to the distant signal 16, by means of the wire 19, then through the wire 17 to the distant signal 15, along wire 21 to the switch mechanism 20, through the wire 41, to the junction 42, then continuing through the wire 43, to the contact 45, through the armature 47, and back to the battery 61. There is obviously only one path for the current at junctions 55 and 42, because the magnet 54 is deënergized and the armature 53 is not in operation.

The operation just above disclosed sets forth the circuit at the time when the southbound train is switched, so as to allow the train going north to pass, as will be readily manifest, the normal positions of the east and west signals being at danger, and an oncoming east or west train cannot operate the signals because the circuits of blocks 11 and 13 are open, at the points where the armatures 101 and 102 coöperate with their magnets, that is to say, when a south bound train is on the section of the side track indicated by the numeral 221. A north bound train will proceed right through rails 1 and 2, and will not operate electrically the switch mechanism, because the circuit of the blocks is open at point 34^a, by the action of the magnet 49. After a north bound train has passed, a south bound train may proceed, in which act the flanges of the wheels of the train force over the point rails of the switch of block 6, the returning of said point rail, resulting from the mechanical movement of the oscillating elements, to the position shown in Fig. 3, thus closing the motor circuit through segment 185, the magnet 198 at this time being deënergized. When the train has passed, the switch is electrically returned to an off position. When the south bound train has passed over the block 6, it closes the circuit on block 7, which attracts its armature 33, re-connects it with the armature 110, thus putting the circuit of block 4 in condition to operate the signals and switch mechanisms for any train bound south. When a south bound train has passed off of block 4 to isolated track 221^a, intermediate between blocks 4 and 6, the magnet 107 is deënergized, its armatures 101 and 102 being returned to their normal positions, thus putting blocks 11 and 13 in condition to be operated by east and west bound trains.

The isolated sections 221^a, 221^b, 221^c, and 221^d are each of sufficient length, that is, in an actual reduction to practice, to accommodate the longest train used on this system, the length of these sections being indicated by the leader lines to the above reference characters of the drawings.

Assuming this condition of structure, it would be possible for a southbound train, on reaching block 4 to operate the switch mechanism, taking siding and stop on section 221^a. This would leave block 6 electrically inoperative, its circuit having been opened at point

34ª, this would allow a north bound train to pass. The same cycle of actions would be performed on the east and west bound tracks, by trains running respectively east and west, when one train would take the siding and the other would pass through on the main track.

The features and elements and the arrangement thereof, for accomplishing the objects of the system may be changed and varied, that is to say, in an actual reduction to practice, with an understanding that the changes and variations accruing from said reduction to practice are limited to the scope of the appended claims.

Having thus described the invention, what is claimed as new and useful is:—

1. In a system as set forth, railway tracks, side tracks having switches therefor, switch mechanisms automatically and electrically operated by an approaching train to operate said switches, comprising oscillating members and coöperative segments and motor operated spring tensioned reciprocating bar for operating said members.

2. In a system as set forth, railway tracks intersecting at right angles to one another, side tracks having switches, switch mechanisms automatically and electrically operated by an approaching train to operate said switches, comprising oscillating members and coöperative segments and motor operated spring tensioned reciprocating bar for operating said members, signals operated thereby, a plurality of magnets and their armatures, and batteries to provide an electric current, as and for the purpose specified.

3. In a system as set forth, railway tracks, side tracks and signals therefor, said side tracks having switches, switch mechanisms, magnets and their respective armatures and batteries to provide electric current for the said switch mechanisms, said switch mechanism adapted to be operated by an approaching train which closes the circuit of the said magnets and their armatures and batteries for operating the switches so as to switch the approaching train upon the side track, the said switch mechanisms being adapted after the switched train has left the side track to cause said switches to be electrically returned to their open positions.

4. In a system as set forth, railway tracks intersecting at right angles to one another, side tracks and signals therefor, said side tracks having switches, said railway tracks having adjacent thereto and beyond their intersection switch mechanisms, an electric circuit for each switch mechanism adapted to be closed by an approaching train to cause the switch mechanisms to operate the switches so as to switch the said approaching train to allow a train approaching in an opposite direction to pass.

5. In a system as set forth, intersecting railway tracks one running north and south and the other running east and west, the north and south track having a side track, switches therefor, signals for the north and south track, switch mechanisms having their respective electric circuits which are adapted to be closed by an approaching train which operates one of said switches, the east and west track having a side track and switches, signals, switch mechanisms having local electric circuits and comprising oscillating members and coöperative segments.

6. In a system as set forth, intersecting railway tracks, one running north and south and the other running east and west, the north and south track having a side track, switches therefor, signals for the north and south track, switch mechanisms having their respective electric circuits which are adapted to be closed by an approaching train which operates one of said switches, the east and west track having a side track and switches, signals, switch mechanisms having local electric circuits and comprising oscillating members and coöperative segments and a motor operated bar for operating the said members.

7. In a system as set forth, intersecting railway tracks, one running north and south and the other running east and west, the north and south track having a side track, switches therefor, signals for the north and south track, switch mechanisms having their respective electric circuits which are adapted to be closed by an approaching train which operates one of said switches, the east and west track having a side track and switches, signals, switch mechanisms having their respective local circuits and comprising oscillating members and coöperative segments, the switching of the approaching train putting the signals of the east and west track in condition to be operated by an east or west approaching train.

8. In a system as set forth, intersecting railway tracks, side tracks and switches therefor, signals, switch mechanisms having their respective circuits which are closed by an approaching train to operate said switches so as to side track the said train, and after the same has left the side track the said switches are returned to their normal positions.

9. In a system as set forth, intersecting railway tracks, side tracks and switches therefor, signals, switch mechanisms having their respective circuits which are closed by an approaching train to operate said switches, the switching of the said train electrically restoring the said switches to their open position, said switch mechanisms having an electric circuit adapted to be reversed upon the switching of the said train which reverses the action of the motor of the said switch mechanisms to restore the said switches to their open position and a motor in the circuit of the said switch mechanisms.

10. In a system as set forth, a railway track, a side track having switches, signals, switch mechanisms having their respective circuits adapted to be closed by an approaching train, the said circuits being reversible by the switching of the said train, said switch mechanisms having motor circuits which are reversible by the first-named circuits which restores the said switches to their open position.

In testimony whereof I hereunto affix my signature in presence of two witnesses.

JOHN F. CLARK.

Witnesses:
JOHN W. DYE,
C. W. BURK.