No. 780,120. PATENTED JAN. 17, 1905.

E. W. McGUIRE.

ELECTRIC RAILWAY SIGNAL.

APPLICATION FILED FEB. 6, 1904.

2 SHEETS—SHEET 1.

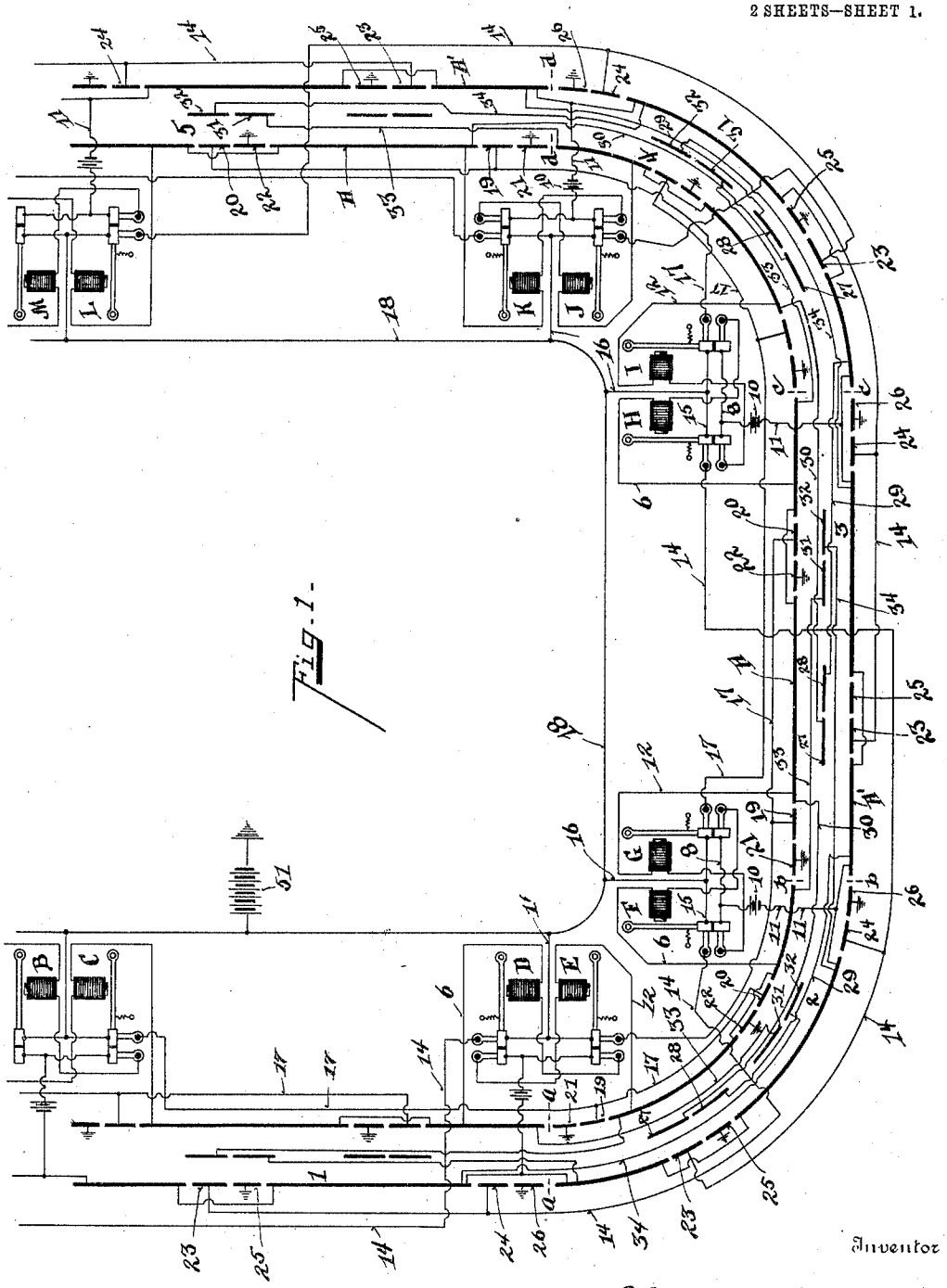

Fig. 1.

Witnesses
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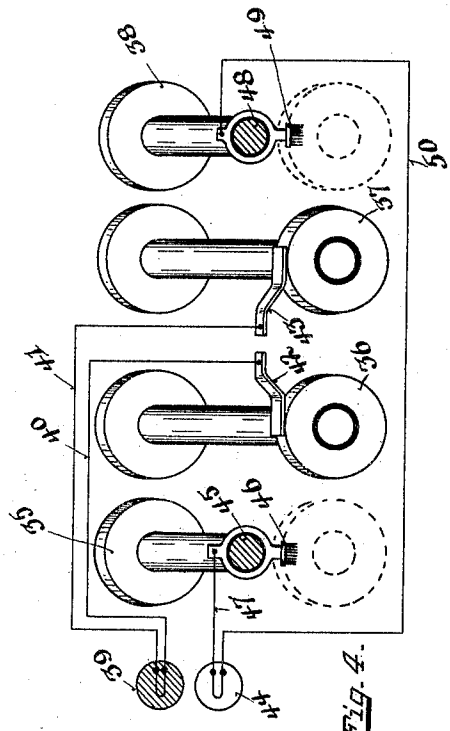

Fig. 4.

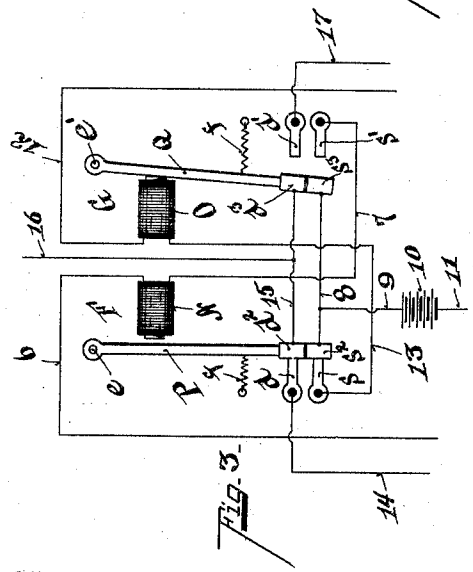

Fig. 3.

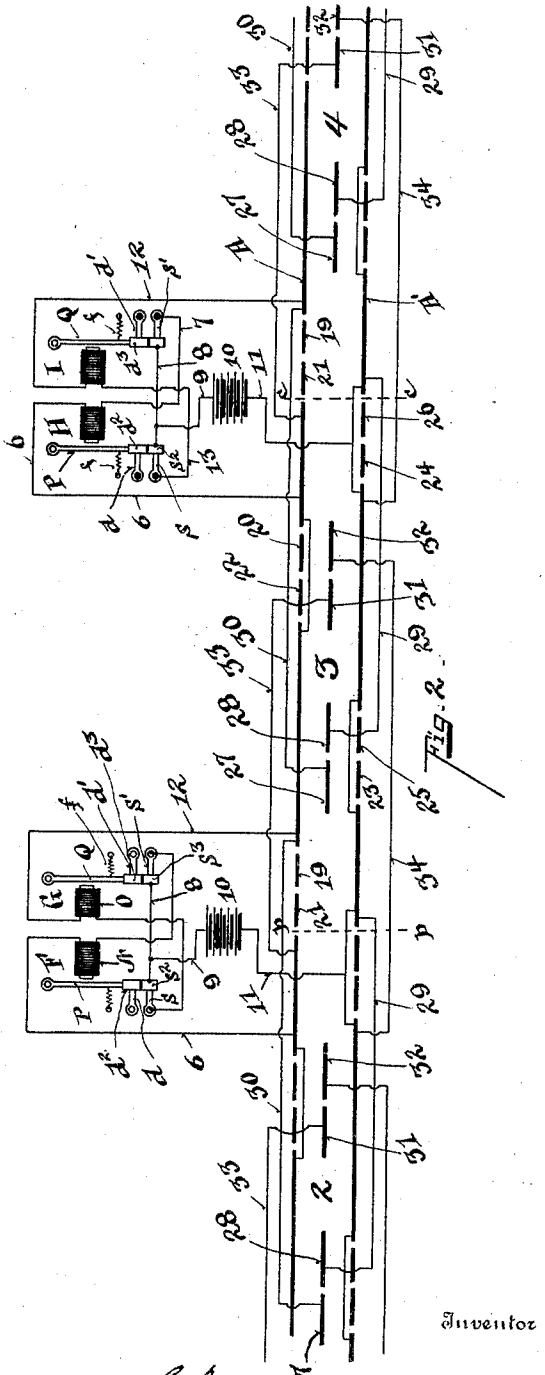

Fig. 2.

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No. 780,120. Patented January 17, 1905.

UNITED STATES PATENT OFFICE.

ELWOOD W. McGUIRE, OF RICHMOND, INDIANA.

ELECTRIC RAILWAY-SIGNAL.

SPECIFICATION forming part of Letters Patent No. 780,120, dated January 17, 1905.

Application filed February 6, 1904. Serial No. 192,283.

To all whom it may concern:

Be it known that I, ELWOOD W. McGUIRE, a citizen of the United States, residing at Richmond, in the county of Wayne and State of Indiana, have invented certain new and useful Improvements in Electric Railway-Signals, of which the following is a specification.

My invention relates to an electric-signal system for railways.

One of the objects of my invention is to provide contact-rails for each block and to equip the locomotive with coöperating contacts adapted to transmit an electric impulse into the locomotive-cab at selected points of each block, dependent upon the conditions of adjacent blocks.

Another object of my invention is to so connect the rails and contact-rails of a given block with the contact-rails and rails of adjacent blocks, respectively, that each block presents terminals of partial circuits controlled by adjacent blocks adapted to report the conditions of the adjacent blocks to the passing train.

Other features of the invention will be unfolded in the description of the accompanying drawings, forming a part of this specification, in which—

Figure 1 is a plan view of my railway-signal system in which five blocks are illustrated. Fig. 2 is a plan view showing one complete block and a partial block at each end thereof, in which the connections to the danger-signal rails are omitted. Fig. 3 is a diagrammatic view, enlarged, of one of the duplex instruments with its wire connections. Fig. 4 is a detail view, partly in section, of the tracks of a tender of a locomotive, illustrating the contacts and their connections.

The system is illustrated in Fig. 1 in its fullest development. I have shown the blocks 1, 2, 3, 4, and 5 subdivided by the dotted lines *a a*, *b b*, *c c*, and *d d*. For convenience of description we will denominate any travel from block 1 to 5 as "east going" and any travel in the direction from block 5 to 1 as "west going."

A represents the inside rails, and A′ the outside rails, for all five blocks. Between each two adjoining blocks are duplex instruments. B C represent the instruments at the west end of block 1 and the east end of the next adjoining block going west. D E represent the instruments at the east end of block 1 and the west end of block 2. F G represent the instruments at the east end of block 2 and the west end of block 3. H I represent the instruments at the east end of block 3 and the west end of block 4. J K represent the instruments at the east end of block 4 and the west end of block 5. L M represent the instruments at the east end of block 5 and at the west end of the next adjoining block eastward. The details of these duplex instruments will best be understood from Fig. 3, which, say, are instruments F and G. Each instrument is provided with its magnet-coil N O. Each coil has an armature switch-lever suitably pivoted to the instrument at *e e′*. P is the armature of coil N, and Q the armature of coil O. Each instrument has two independent electrodes or contact-posts, the posts of the instrument F being *d* and *s*, the contact-posts for the instrument G being *d′* and *s′*. Each armature-lever has two coöperating independent electrodes d^2 s^2, respectively, for the armature P of the instrument F, and d^3 and s^3, respectively, for the armature Q of the instrument G. It will be understood that the coöperating electrodes *d* and d^2 of the instrument F and *d′* and d^3 of the instrument G constitute danger-signal switches. The electrodes *s* and s^2 of the instrument F and the electrodes *s′* and s^3 of the instrument G constitute safety-signal switches or magnet operating-switches. These armature switch-levers are normally held with the switches closed by the springs *f*, and the switches on a given armature are adapted to be opened when the controlling-coil of the said given armature is energized.

6 is the wire connecting the inner rail A of a given block with one end of the magnet-coil N. 7 represents the wire connecting the other end of magnet-coil N with the stationary electrode *s′* of the instrument G. When the instrument G is deënergized, the safety-signal electrodes *s′* and s^3, it will be understood, are normally in contact. 8 represents the wire connecting the electrode s^3 of the armature Q with the electrode s^2 of the armature P. 9

represents the branch wire connecting wire 8 with the battery 10. 11 represents the return-wire from the battery 11 to the outer rail A′ of a given block. Likewise the coil O of the instrument G is connected by wire 12 to the inner rail A of a given block, the other end of the coil being connected by wire 13 to the electrode *s* of the instrument F. As previously explained, the return-circuit for the electrodes *s* and s^2 is also made through the wires 8 and 9, battery 10, and wire 11 to the outer rail A′.

The instrument at the east end of each block has its parts lettered and numbered to correspond with the lettering and numbering of the corresponding parts of instrument F, Fig. 3. The instrument at the west end of each block has its parts lettered and numbered to correspond with the lettering and numbering of the corresponding parts of instrument G of Fig. 3.

The instrument G in Fig. 3 is shown energized. That means a train in the block to which the instrument G belongs has closed the partial circuit through the magnet-coil O of instrument G and the safety-signal switch *s* and s^2 of the armature P of instrument F, thus opening the switches controlled by the armature switch-lever Q of the instrument G. Therefore as long as the instrument G is energized the switches of said instrument are opened, and it is manifestly impossible to energize the companion instrument F. Hence when one magnet-coil is energized it is impossible to energize its companion magnet-coil, and consequently the opening of one set of switches on one armature locks in closed position the set of switches controlled by the companion armature.

The contact-post d of the instrument F is connected by wire 14 to the danger-signal contact rail or rails if they be more than one of a selected block. The other contact-post, d^2, on the armature P of the instrument F is connected by wire 15 to the contact-post d^3 of armature Q of the instrument G. 16 represents the return-wire, connecting wire 15 with one pole of the battery as a source of electric supply, the other pole of the battery being grounded. Thus wire 16 constitutes a return-wire for the danger-signal switches of both armatures. The instrument G is likewise provided with wire 17, connecting the electrode d' with a selected contact rail or rails of a selected block. For this danger-signal circuit I have shown as a source of electric supply a main distributing-wire 18, from which the wires 16 branch to the several instruments.

It will be understood that the wires 14 run westward from the danger-signal switches of the instruments L, J, H, F, D, and B to certain contact-rails on the outer side A′ of the track. It will be understood that the wires 17 run eastward from the danger-signal switches of the instruments C, E, G, I, K, and M to connect with selected danger-signal contact-rails on the inner side A of the track. Preferably each block has two contact-rails upon each side, and each contact-rail has a grounded rail. Preferably, also, these contact and grounded rails are constituted insulated sections of the main rails of the block to which they belong for the purposes of greater precision and certainty in securing contact with the locomotive-contacts. On track A (the inner side of the track) rails 19 and 20 represent the danger-signal contact-rails connected by branch wires to wires 17. 21 and 22, respectively, represent the coacting grounded rails for said contact-rails. On track A′ (the outer side of the track) 23 and 24 represent the danger-signal contact-rails connected by branch wires to the wire 14. 25 and 26 represent the coacting grounded rails, respectively, for said contact-rails.

From the description above it will be understood that the main rails of a given block are in partial circuit with the magnet-coils belonging to said given block and to the safety-signal switches of the armatures of the companion instruments. For instance, in block 3 the main rails A and A′ are in partial circuit with the magnet-coils of the instruments G and H at the west and east end of block 3, respectively, and with the safety-signal switches of the respective armatures of the companion instruments F and I at the east end of block 2 and at the west end of block 4, respectively. The partial circuit of which the terminals are the rails of a given block when closed energize the magnets. Looking at Fig. 2, blocks 2, 3, and 4 are shown; but the danger-signal partial circuits and connections are omitted. In each block are preferably two safety-signal contact-rails, preferably alined between the main rails, as shown. Starting with block 3, 27 and 28 represent two safety-signal contact-rails, the rail 28 being connected by wire 29 with the rail A′ of block 4. Rail 27 is connected by wire 30 with the opposing rail A of block 4. The other pair of safety-signal contact-rails of block 3 are 31 and 32, rail 32 being connected by wire 34 to rail A′ of block 2. The rail 31 is connected by wire 33 to the opposing rail A of block 2. In turn the rail A of block 3 is connected in similar manner by wire 30 with contact-rail 27 of block 2, the opposing rail A′ of block 3 being connected by wire 29 with the safety contact-rail 28 of block 2. In like manner the rail A at the east end of block 3 is connected by wire 33 to contact-rail 31 in block 4 and rail A′ of block 3 by wire 34 to safety-signal contact-rail 32 of block 4. Thus a given block presents a pair of safety-signal contact-rails included in the partial circuit of the main rails of an adjacent block to the east and a pair of safety-signal contact-rails included in the partial circuit of the main rails of an ad-

jacent block to the west. Also the main rails of said given block include in their partial circuit a pair of safety-signal contact-rails belonging to an adjacent block to the east and a pair of safety-signal contact-rails belonging to an adjacent block to the west.

As thus far described the system presents in each block a pair of danger-signal contact-rails controlled by the danger-signal switch of the instrument of any selected block to the east and also a pair of danger-signal contact-rails controlled by the danger-signal switch of the instrument of any selected block to the west. Thus a locomotive must have contacts for closing the open circuits presented by the main rails and the various contact-rails in each block. For the purposes of illustration herewith I have shown these locomotive connections in Fig. 4. 35, 36, 37, and 38 represent four pairs of wheels, say, belonging to the trucks of the locomotive-tender. The two middle wheels on one side, 36 and 37, are insulated from their axles. 39 represents a danger-signal device, assumed to be in the locomotive-cab, connected by the wires 40 and 41 to the contacts 42 and 43 of the wheels 36 and 37, respectively. 44 represents a safety-signal device assumed to be in the locomotive-cab. The front axle 45 is provided with a centrally-depending brush 46 in position to make contact with the safety-signal contact-rails in the middle of the track. This brush 46 is connected by wire 47 with one pole of the device 44. 48 represents the rear axle with a similar brush 49, which is connected by wire 50 with the other pole of the device 44. Of course this device is practically a diagram, and the safety-signal devices are assumed to be any instrument capable of responding to an electric impulse.

$x\,x$ represent the wires for bonding the main rails of a given block around the interposed and insulated danger-signal contact-rails and their coacting grounded rails.

The system in its simplest exemplification is illustrated in Fig. 2. With this system there is no danger-signal, the operation of the safety-signal or its non-operation serving to indicate upon the locomotive in each block the condition of the track in both directions.

Assume a train present in block 3, Fig. 2. The safety-circuit will be closed through the following course for the west end of the block: starting with rail A through the wire 12 to the coil O of instrument G, across through the wire 13 to the safety-switch $s\ s^2$ of the armature P of the instrument F, back through the wires 8 9 to the battery 10, from the battery 10 by wire 11 to the opposite rail A′, and through the wheels and axle of the locomotive to the initial rail A. This circuit energizes coil O, opening the switches controlled by the electrode Q of the instrument G, thus rendering it impossible for any circuit to be completed through the armature-switch of the instrument G at the west end of block 3. The same circuit is formed at the east end of block 3—that is, starting with rail A, wire 6 goes to the coil end of the instrument H, through the coil by wire 7 to the safety-switches $s'\ s^3$ of the armature Q of the instrument I, through the wires 8 and 9 to the battery 10, from the battery by wire 11 to the opposing rail A′, through the wheels and axle back to the initial rail A. Therefore at the east end of the block the instrument H is energized, its armature P is attracted, opening the switches controlled by armature P. This renders it impossible for the instrument I at the west end of block 4 to be energized. Thus while a train is in block 3 instruments G and H are energized and the instruments F and I are locked with the switches closed. Since the adjacent block 2 has the safety-signal contact-rails 27 and 28 included in the partial circuit of the rails A and A′ of block 3, it follows that while there is a train in block 3 a second train approaching in block 2 would not get a safety-signal when passing over rail 27 and 28 of block 2, which would be orders to stop. Since the rails A and A′ of block 3 also include in their partial circuit the insulated safety-signal contact-rails 31 and 32 of block 4, it follows that as long as there is a train in block 3 a train approaching over block 4 would not receive the safety-signal in passing over rails 31 and 32 of block 4, which would be orders to stop. If the track be clear and a west-going train enters block 4 at the time the brush 46 engages the contact-rail 31 and the brush 49 engages the contact-rail 32, a circuit would be formed over the following course: from rail 31 through the wire 33 to the main rail A of block 3. It must be remembered that if a train is in block 4 the switches on the armature Q of the instrument I are opened, and hence no current can be passed through the magnet-coil N of the instrument H; but the instrument G at the west end of block 3 is free to be operated by the closing of the circuit-terminals formed by the rails 31 and 32 at the east end of block 4, therefore continuing the course of the circuit from the rail A of block 3 through the wire 12 of the instrument G, through the magnet-coil O, through the wire 13 to the safety-signal switch $s\ s^2$ of the armature-lever P of the instrument F, by wires 8 and 9 to the battery 10, thence through wire 11 to the opposing rail A′ of block 3, thence by the wire 34 to the rail 32 at the east end of block 4, thence through the brush 49, wire 50, safety-signal device 44, wire 47 to brush 46, returning to the initial contact-rail 31. As the train passes onto the rails 27 and 28 toward the west end of block 4 it would receive a similar signal, showing the condition of the track to the eastward. To illustrate this, assume a west-going train on the rails 27 and 28 of block 2. At the time the brush 46

engages rail 27 and brush 49 engages the rail 28 a circuit would be formed over the following course: starting with the rail 27, eastward through wire 30 to track-rail A of block 3 to the wire 6, to the coil N of the instrument H, through the wire 7 to the safety-signal switch $s' s^3$ of the armature Q of the instrument I, through the wires 8 and 9 to battery 10, through wire 11 to opposing rail A′ of block 3, thence by wire 29 to contact-rail 28 of block 2 through the brush 49, wire 50, safety-signal 44, wire 47, and brush 46 back to the initial rail 27. Thus as an east-going train enters a block if it gets a safety signal on entering the block it indicates that the track is clear ahead for a predetermined distance. If it fails to get the circuit, it indicates the presence of a second train or other abnormal conditions. As the east-going train passes over the block if it receives a second signal at the proper place it indicates that the track is clear to the rear for a predetermined distance, and likewise the absence of a signal at the proper position indicates abnormal conditions.

While the system thus described is complete and perfect in itself, I prefer for general railroad purposes the complete counter-controlling system illustrated in Fig. 1. In this system, broadly speaking, the circuit or current which energizes the instruments of a given block locks closed the danger-signal switches of an adjoining block in either direction. At the same time with the system of Fig. 1 the presence of a train in a given block short-circuits the instruments of that given block, so that the safety-signal contact-rails of an adjacent block, which are included in the partial circuit of the main rails of the block, cannot be closed by a train in said adjacent block, and hence a train in an adjacent block would not only not receive the safety-signal circuit from a given block, but it would receive a danger-signal through the switch of the instrument, which would be locked closed by the train in said given block. In addition to this, the said given block having danger-signal contact-rails, it follows that if the track be clear the receipt of the safety-signal in a given block indicates the working of the instrument in an adjacent block, therefore proving that the danger-signal switch of the adjacent block is in operative condition.

I will illustrate the operation of the system as exemplified in Fig. 1 by the following propositions:

First. Given a train in block 3, the adjacent blocks being clear, the locomotive will pick up a safety-signal from rail 31 and 32, showing that all is clear ahead if the train is west-going. If the train is east-going, it will pick up a safety-signal from the rails 27 and 28, showing that all is clear ahead. As the west-going train contacts rails 27 and 28 it will pick up a signal indicating the condition of block 4 to the rear. As the east-going train contacts rails 31 and 32 it will get a safety-signal indicating the condition of block 2 to rear. At the same time the contact of the wheels with the main rails A and A′ energizes the instrument G at the west end and H at the east end of block 3. Therefore in an adjacent block to the west whatever danger-signal contact-rails are controlled by the danger-signal switch of the instrument F will be locked in operative position so long as the train is in block 3. Likewise whatever danger-signal contact-rails of an adjacent block to the east are controlled by the danger-signal switch of the instrument I at the west end of block 4 are locked in operative position.

The danger-signal contact-rails 19 and 20 of block 3 are controlled through the danger-signal switch of the instrument E at the west end of block 2. Therefore it is necessary as a west-going train passes over the contact-rails 19 and 20 of block 3 that there should be in close proximity some means for energizing the said instruments E at the west end of block 2; otherwise the train would pick up the danger-signal circuit while the track is clear. This means consists in the insulated safety-signal contact-rails previously described. As the train is passing over danger-signal contact-rail 20 and grounded rail 22 at the east end of block 3 the brushes 46 and 49 are contacting the safety-signal contact-rails 31 and 32, and therefore energizing the instrument E at the west end of block 2, as previously described, and so by opening the armature-switch of instrument E taking the danger-signal circuit from the rail 20 as the train is passing. As the west-going train is leaving block 3 before the truck-wheels of the locomotive-tender, through which the danger-signal is made, contact the danger-signal contact-rail 19 and grounded rail 21, the front wheels of the locomotive are upon the east end of block 2, and consequently have energized the instrument E at the west end of block 2, opening its danger-signal switch and cutting off the current from the rail 19 at the west end of block 3.

Second proposition. The train being present in block 3, the armature of instrument F at the east end of block 2 is locked closed. The danger-signal contact-rails of block 1 on the side A′ are connected by wire 14 to the armature-switch of the instrument F, and therefore an east-going train entering block 1 would receive a danger-signal as it passed over rails 23 and 25 at the west end of block 1 and again as it passed over rails 24 and 26 toward the east end of block 1.

Third proposition. Given a train in block 1 the second train west-going enters block 3. The train in block 1 would lock closed the armature-switch of the instrument E at the west end of block 2. The danger-signal contact-rails 19 and 20 of block 3 are connected by

wire 17 to the danger-signal switch of the said instrument E, and hence the west-going train would receive a signal through the rails 20 and 22 at the east end of block 3 and also the rails 19 and 21 at the west end of block 3. The circuit would be as follows: starting with the contact-rail 20 at the east end of block 3, through the wire 17 to the danger-signal switch d' and d^3 of the instrument E, through the wires 15 and 16 to the supply-wire 18, thence to the main supply-battery 51 for the danger-signal circuits. The other end of the pole is grounded. Also the wheel 37 contacts the rail 20, completing the circuit through contact 43, wire 41, danger-signal 59, thence returning by wire 40 to contact 42, through wheel 36 to the grounded rail 22. The wheels 36 and 37 are insulated to keep the current from short-circuiting through the axle. If the train is in block 3 at the time the east-going train enters block 1, the train in block 1 would get the danger-signal from the rails 23 and 25, 24 and 26 without respect to the direction in which the train in block 3 was traveling. If the train in block 3 was traveling in the same direction as the train in block 1—that is, eastward—the train in block 3 could not pick up the danger-signal, because its insulated wheels traveling over the side of the track A′ could only pick up the danger-signal from a block to the eastward. The train entering block 1 should stop upon receipt of the danger-signal; but if by any chance it does not and it enters block 2 before the second east-going train leaves block 3 then the train in block 2 would cut out the current from the safety-signal contact-rails 31 and 32 at the east end of block 3, so that the east-going train leaving block 3 would fail to receive a safety-signal, which would apprise him that an east-going train had entered block 2.

Having described my invention, I claim—

1. In an electric block-signal system for railways, comprising a subdivision of rails into insulated blocks, a pair of insulated contact-rails alined parallel to the track in each block, the contact-rails of a given block being respectively connected to the opposing main rails of an adjacent block, the said main rails of the given block being connected to respectively the pair of insulated contact-rails of an adjacent block, the main rails of each block being connected in partial circuit with a source of electric supply which open circuit is adapted to be closed by the wheels of the locomotive, a locomotive equipped with contacts alined to respectively engage the pairs of contact-rails and with circuit connections adapted to close the partial circuit of the main rails of the adjacent block to which said contact-rails are connected and a signal device on the locomotive adapted to be actuated by the electric impulse transmitted through the contact-rails.

2. An electric block-signal for railways comprising a subdivision of rails into insulated blocks two pairs of contact-rails for each block alined parallel with the track, one pair of contact-rails of a given block being connected respectively to the opposing rails of an adjacent block upon one side of the given block, the other pair of contact-rails of said given block being connected respectively to the main rails of an adjacent block upon the other side of said given block, the main rails of said given block being connected respectively to one pair of contact-rails belonging to an adjacent block upon one side of the given block, and to a second pair of contact-rails belonging to an adjacent block upon the other side of said given block, the main rails of each block being connected in partial circuit with a source of electric supply, which open circuit is adapted to be closed by the wheels of the locomotive, a locomotive equipped with alined contacts adapted to respectively engage the pair of the contact-rails, and with circuit connections adapted to close the circuit through the main rails of the block to which the contacted rails belong, and a signal device on the locomotive adapted to be actuated by the electric impulse transmitted through said contact-rails.

3. An electric signal system for railways comprising a subdivision of rails into insulated blocks, a danger-signal contact-rail and a safety-signal contact-rail for each block, the danger-signal contact-rails being disposed as insulated sections of the main-track rails, the safety-signal contact-rails being disposed in alinement parallel of the main-track rails, a magnet-coil and its armature switch-lever in each block each switch-lever having a danger and a safety signal switch normally closed when the controlling-magnet is deënergized, the main rails of a given block being connected in partial circuit with the safety-signal switch of an adjoining block, through the magnet-coil of said given block, the main rails of said given block including in their partial circuit the safety-signal contact-rail of an adjacent block, the safety-signal contact-rail of said given block being included in the partial circuit of the main rails of an adjacent block, the danger-signal contact-rail of a given block being connected in partial circuit with the danger-signal switch of a selected block, sources of electric supply for the two independent circuits, a locomotive equipped with contacts adapted to respectively engage said contact signal-rails, and with independent circuit connections adapted to alternatively close said partial circuits, said locomotive also having a danger and safety signal device adapted to be respectively actuated by the currents transmitted through their respective contact-rails.

4. An electric signal system for railways, comprising a subdivision of rails into insulated blocks, a danger-signal contact-rail and a safety-signal contact-rail for each block, the danger-signal contact-rails being comprised of

the main track, and the safety-signal contact-rails being alined between the track-rails, one of said contact-rails being an insulated section of the main track, and the other said contact-rails being oppositely arranged parallel therewith, each block having an instrument comprising a magnet-coil, its armature-lever, an independent danger and safety signal switch for each armature, normally closed when the coil be energized, the main rails of a given block being connected in partial circuit with the safety-signal switch of an adjoining block through the magnet-coil of said given block, the main rails of said given block including in their partial circuit, the safety-signal contact-rail of an adjacent block, the safety-signal contact-rail of said given block being included in the partial circuit of the main rails of an adjacent block, the danger-signal contact-rails of said given block being connected in partial circuit with the danger-signal switch of the said adjacent block, sources of electric supply for the two independent circuits, a locomotive equipped with contacts adapted to respectively engage said contact signal-rails, and with independent circuit connections adapted to alternatively close said partial circuits, said locomotive also having a danger and a safety signal device adapted to be respectively actuated by the currents transmitted through their respective contact-rails.

5. An electric signal system for railways, comprising a subdivision of rails into insulated blocks, a danger-signal contact-rail and a grounded rail in each block and opposing safety-signal contact-rail and return contact-rail therefor in each block, the danger-signal contact-rails and grounded rails therefor being disposed in insulated sections of the track-rails, and the safety-signal contact-rails and their return contact-rails, being alined parallel with the track, and an instrument for each block comprising a magnet-coil, armature-lever and independent danger and safety signal switches on the lever normally closed when the controlling-coil is deënergized the main rails of a given block being connected in partial circuit with the safety-signal switch of an adjoining block through the magnet-coil of said given block, the main rails of said given block including in their partial circuit the safety-signal contact-rail and its return contact-rail of an adjacent block, the safety-signal contact-rail and its return-rail of a given block being respectively connected to the main rails of said adjacent block, the danger-signal contact-rail of a given block being connected in partial circuit with the danger-signal switch of an adjoining block, sources of electric supply for the two independent circuits, a locomotive equipped with contacts adapted to respectively engage said contact signal-rails, and with independent circuit connections adapted to alternatively close said partial circuits, said locomotive also having a danger and a safety signal device adapted to be respectively actuated by the currents transmitted through their respective contact-rails.

6. An electric block-signal system for railways comprising a subdivision of rails into insulated blocks, two danger-signal contact-rails and two grounded rails therefor in each block, two oppositely-arranged safety-signal contact-rails and their return contact-rails in each block, the safety-signal contact-rails and return-rails being alined parallel with the track, there being in each block two instruments each comprising a magnet-coil, armature-lever and a danger and safety signal switch on the lever normally closed when the coil is deënergized, the main rails of a given block being connected in partial circuit with the safety-signal switches of two instruments upon opposite sides of the given block, through the magnet-rails of the instruments of said given block, the main rails of said given block being connected to a safety-signal contact-rail and its return-rail of an adjacent block upon each side of said given block, the safety-signal contact-rails and return-rails of said given block being respectively connected to the main rails of adjacent blocks, upon each side of said given block, the danger-signal contact-rails of said given block being respectively connected in partial circuit independently to the danger-signal switches of the said adjacent blocks upon opposite sides of said given block, sources of electric supply for the two independent circuits, a locomotive equipped with contacts adapted to respectively engage said contact signal-rails, and with independent circuit connections adapted to alternatively close said partial circuits, said locomotive also having a danger and a safety signal device adapted to be respectively actuated by the currents transmitted through their respective contact-rails.

7. In an electric block system for railways, comprising a subdivision of rails into blocks, given blocks 1, 2, 3, 4 and 5, block 3 having the instruments G and H, block 2 having instruments E and F, block 4 having the instruments I and J, block 1 having the instruments C and D, and block 5 the instruments K and L, each instrument comprising a magnet-coil, an armature-lever, an independent danger-signal and safety-signal switch thereon normally closed when the coil is deënergized, a danger-signal contact-rail and its grounded rail upon each side of the track for each block, two safety-signal contact-rails and their return-rails in each block, the main rails of block 3 being connected in partial circuit to the coils of the instruments G and H, of said given block 3, and to the safety-signal switches of their respective companion instruments F and I of blocks 2 and 4, the main rails of block 2 being connected in partial circuit to the coils of the instruments E and F of block 2 and to the safety-signal switches of

their respective companion instruments D and G of block 1 and 3 respectively; the main rails of block 4 being connected in partial circuit to the coils of the instruments I and J of block 4 and to the safety-signal switches of their respective companion instruments H and K of block 3 and 5 respectively, one safety-signal contact-rail and its return-rail of block 3 being included in the partial circuit of the main rails of block 2, the other safety-signal contact-rail and its return-rail of block 3 being included in the partial circuit of the main rails of block 4; one safety-signal contact-rail and its return-rail of block 2 being included in the partial circuit of the main rails of block 3, the other safety-signal contact-rail and its return-rail of block 2 being included in the partial circuit of the main rails of block 1; one safety-signal contact-rail and its return-rail of block 4 being included in the partial circuit of the main rails of block 3, the other safety-signal contact-rail and its return-rail of block 4 being included in the partial circuit of the main rails of block 5; one of the danger-signal contact-rails of block 3 being connected in partial circuit with the danger-signal switch of the instrument E of block 2, the other danger-signal contact-rail of block 3 being connected in partial circuit with the danger-signal switch of the instrument J of block 4; one of the danger-signal contact-rails of block 2 being connected in partial circuit with the danger-signal switch of the instrument C of block 1, the other danger-signal contact-rail of block 2 being connected in partial circuit with the danger-signal switch of the instrument H of block 3; one of the danger-signal contact-rails of block 4 being connected in partial circuit with the danger-signal switch of the instrument G of block 3, the other danger-signal contact-rail of block 4 being connected in partial circuit with the danger-signal switch of the instrument L of block 5; the safety-signal contact-rails are arranged opposite to the danger-signal contact-rails so that when the track is clear the locomotive will close a given safety-signal contact-rail circuit, thereby energizing the instrument of an adjacent block and opening the danger-signal switch of the said instrument controlling the danger-signal contact-rail which is opposite to the said given safety-signal contact-rail, sources of electric supply for the two independent circuits, a locomotive equipped with contacts adapted to respectively engage said contact-signal rails, and with independent circuit connections adapted to alternatively close said partial circuits, said locomotive also having a danger and a safety signal device adapted to be respectively actuated by the currents transmitted through their respective contact-rails.

8. In combination with an electric block-signal for railways, comprising blocks having danger and safety signal contact-rails and grounded and return rails therefor, the danger-signal and ground contact-rails being insulated sections of the main track upon one side, the safety-signal and return contact-rails being alined parallel to the track's contact-rails and opposite thereto, a locomotive having insulated wheels adapted to engage the contact-rails of the track, a signal device, connections on locomotive from one insulated wheel to the signal and back to the other insulated wheel, two alined contacts on the locomotive for engaging the alined contact-rails parallel with the track, another signal on the locomotive, and connections from the locomotive-contact to said second signal and back to the other locomotive-contact.

9. In combination with an electric block-signal system for railways comprising two sets of signal contact-rails, one disposed at insulated sections of the main rails and the other disposed parallel to the main rails, a locomotive equipped with two signal devices, there being four pairs of wheels, two of which are insulated, one of the insulated wheels being connected in circuit through one signal device to the other insulated wheel, there being depended from the truck two alined electrodes, one being connected in circuit with the other signal device and with the second electrode, substantially as described.

10. In combination with an electric block-signal system for railways comprising danger-signal contact-rails, and ground-rails therefor disposed in alinement, and safety-signal contact-rails and return-rails therefor also disposed in alinement, a locomotive equipped with two sets of signals and having four pairs of wheels, the middle two wheels on one side being insulated from their axles, one of the insulated wheels being connected with one of the signal devices by wire and return-wires to the other insulated wheel, there being depended from the axles of the two outside pair of wheels, two alined electrodes connected in circuit with the other signal and adapted to contact the signal-rails alined parallel with the track, substantially as described.

In testimony whereof I have hereunto set my hand.

ELWOOD W. McGUIRE.

Witnesses:

OLIVER B. KAISER,

LUISE BECK.