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W. J. BELL.

AUTOMATIC SAFETY CROSSING SYSTEM FOR RAILWAYS.

APPLICATION FILED JUNE 1, 1905.

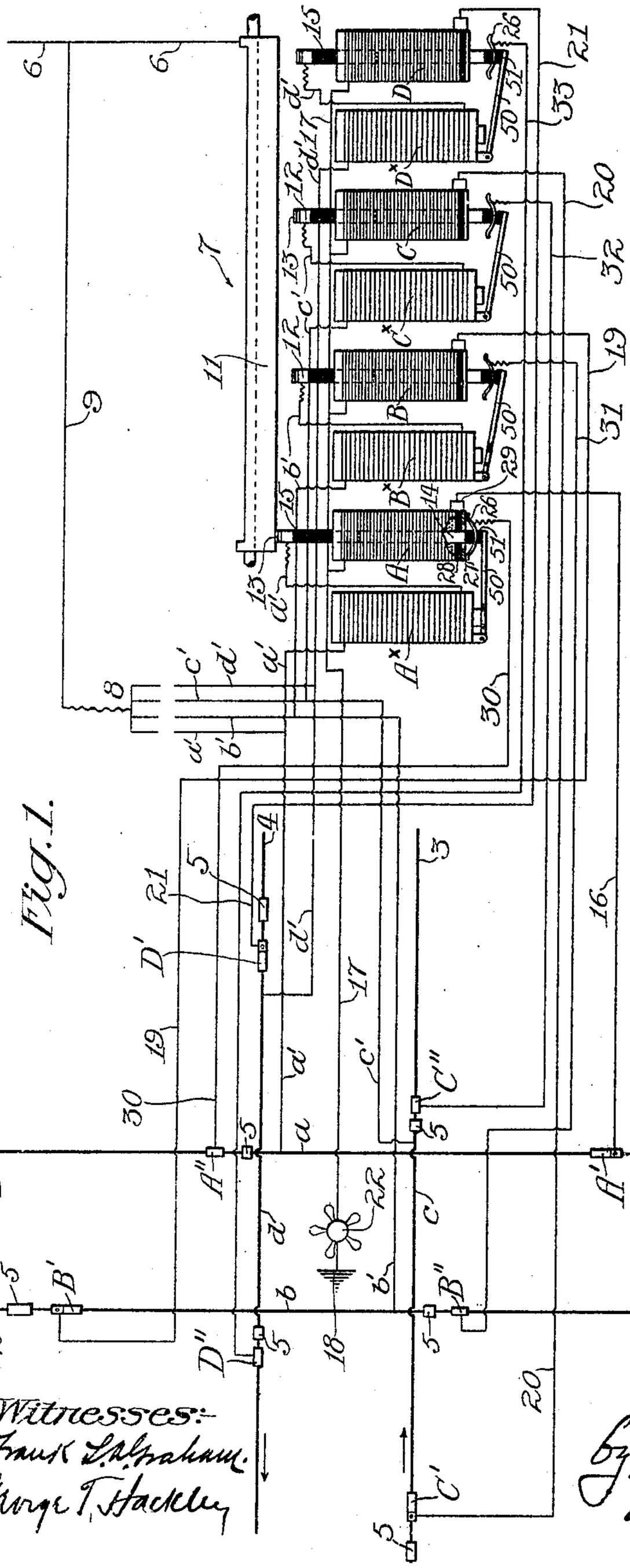

Fig. 1.

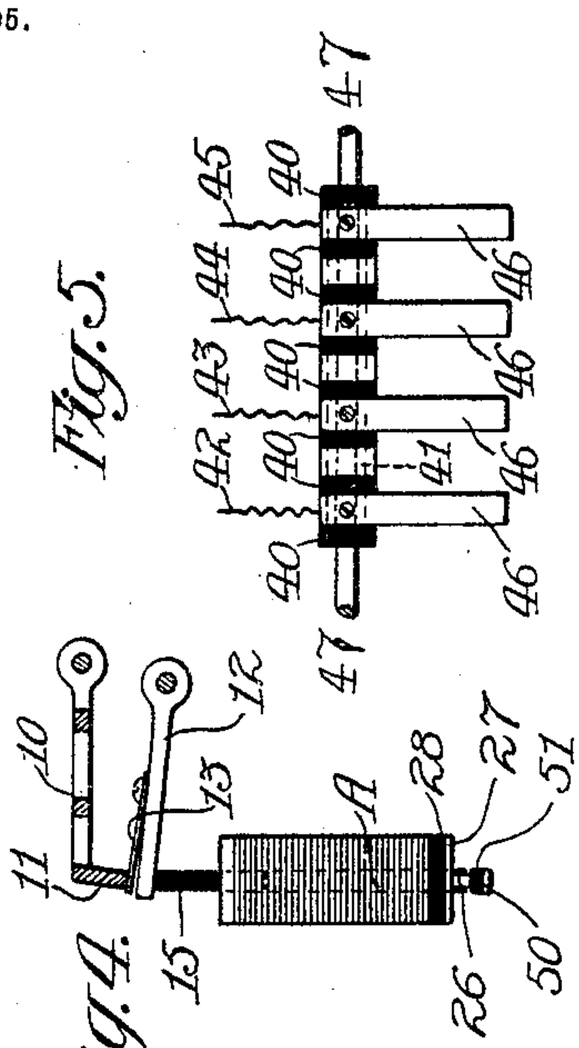

Fig. 4.

Fig. 5.

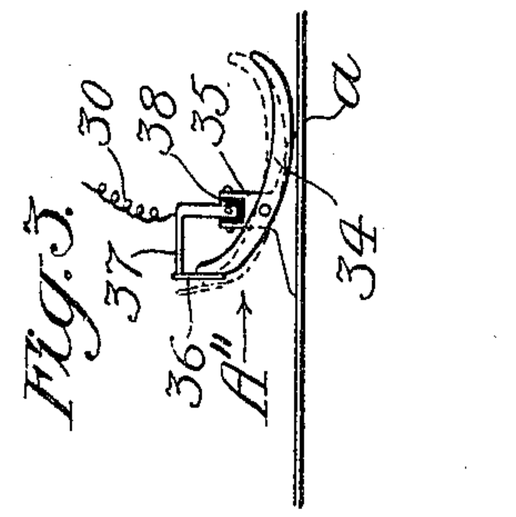

Fig. 3.

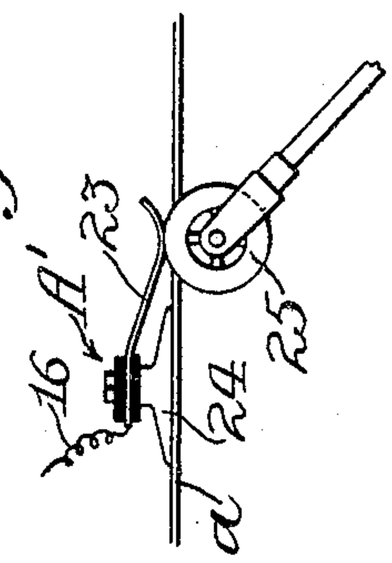

Fig. 2.

Witnesses:
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UNITED STATES PATENT OFFICE.

WALTER J. BELL, OF LOS ANGELES, CALIFORNIA, ASSIGNOR OF ONE-HALF TO LEON F. MOSS, OF LOS ANGELES, CALIFORNIA.

AUTOMATIC SAFETY CROSSING SYSTEM FOR RAILWAYS.

No. 804,298. Specification of Letters Patent. Patented Nov. 14, 1905.

Application filed June 1, 1905. Serial No. 263,306.

To all whom it may concern:

Be it known that I, WALTER J. BELL, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented a new and useful Automatic Safety Crossing System for Railways, of which the following is a specification.

This invention relates to an improvement over a previous invention of mine for a safety crossing system for railways described and claimed in a former application, filed May 15, 1905, Serial No. 260,416.

The present invention is coextensive with the former invention in so far as it relates to preventing collisions between cars at the intersecting point of the crossed lines by automatically signaling all cars which may be approaching the point of intersection when any one car is about to cross over and to automatically stop all cars within a certain radius of the intersection except the car which is nearest the intersection. In the former invention a car which is about to cross over may pass onto its safety-block and render the other block or blocks dead; but in the meantime other cars may have drifted onto their respective blocks. As soon as the first car has left its block current is automatically supplied to all of the safety-blocks, as hereinafter described, and therefore the other cars which are waiting on their safety-blocks for current may then start up, and collisions might thus easily occur.

The object of the present invention is to avoid collisions in such cases and permit one car only of those which may be on the safety-blocks to cross.

The accompanying drawings illustrate the invention, and, referring thereto, Figure 1 is a diagrammatic view of the system. Fig. 2 is a side elevation of a circuit-closer for the magnet-actuating circuit, showing a trolley-wheel in connection therewith. Fig. 3 is a side elevation of a circuit-breaker for the magnet-sustaining circuit. Fig. 4 is a side elevation, partly in section, of the feeder-switch and magnets for operating the same. Fig. 5 is a front elevation of another form of feeder-switch which is adapted for crossing systems in which the respective lines operate with different systems or directions of current.

The invention is particularly useful on electric railways with the overhead trolley-wire, but is not restricted to such types.

The invention comprises, in combination with the crossed operating-lines along which the cars travel, means for automatically preventing cars on the intersecting lines from simultaneously approaching and colliding at the intersection.

The invention also embraces means for automatically signaling the cars on all of the crossing lines when a car on either line is about to cross.

The invention further comprises means for permitting the operation of one car only of two or more which may have gathered within a certain distance of the intersection.

In order to explain the present invention, an understanding of the former invention referred to will be necessary.

Referring to Fig. 1, 1 and 2 designate trolley-wires forming a double line which are intersected by trolley-wires 3 and 4 of another double line. Each line has a safety-block extending across the intersection formed by insulators 5, thus forming safety-blocks *a b c d* in the respective lines 1 2 3 4. The arrows adjacent each line indicate the direction of travel of cars thereover. Each safety-block is normally alive and receives current from a main feeder 6, the safety-blocks *a b c d* being respectively connected with the main feeder 6 by branch wires *a′ b′ c′ d′*, the latter wires being all normally connected with the main feeder 6 by a normally closed feeder-switch 7, and the four safety-blocks are thus each normally alive. The feeder-switch 7 and its associated elements may, when desired, be cut out of operation by a four-pole switch 8, the latter when closed connecting the main feed-wire 6 through a shunt 9 with the branch feeders *a′ b′ c′ d′*. The feeder-switch 7 may comprise a pivoted frame 10, having a universal bar 11, which normally rests upon a series of pivoted contact-arms 12, the latter being preferably provided with spring-tongues 13 for securing the necessary electrical contact with the universal bar 11 and for compensating for any unevenness in the relative positions of the arms with respect to the bar, so that when the bar is in normal position a good contact is assured between it and all of the contact-arms 12. The branch feeders *a′ b′ c′ d′* are respectively connected to auxiliary magnets $A^{\times}$ $B^{\times}$ $C^{\times}$ $D^{\times}$, the other poles of these magnets being respectively connected with

the respective contact-arms 12, so that as the frame 10 normally lies in its lowest position with the universal bar 11 contacting with each of the contact-arms 12 and as the frame 10 is electrically connected with the main feeder 6 current may be supplied to the branch feeders *a' b' c' d'* and to the safety-blocks *a b c d*, respectively. The other sections of the operating-lines 1 2 3 4 may be supplied by the usual feeders. (Not shown.) Arranged below the feeder-switch 7 are magnets A B C D, each having an armature 14, the upper end of which has an extension 15, formed of insulating material, and the respective contact-arms 12 rest at all times upon the ends of the insulated extensions 15. The magnets $A^{\times}$ $B^{\times}$ $C^{\times}$ $D^{\times}$ are each provided with a pivoted armature 50, the ends of the armatures 50 lying under the respective armatures 14 of the magnets A B C D, each armature 50 having a block 51 of insulating material for preventing contact between its swinging armature 50 and the reciprocatory armature 14.

It is obvious that when any one of the magnets A B C D is energized its armature will lift the associated contact-arm 12, or that when any one of the auxiliary magnets $A^{\times}$ $B^{\times}$ $C^{\times}$ $D^{\times}$ is energized its armature 50 will lift the associated armature 14 and contact-arm 12, and that when any one contact-arm 12 is raised it will lift the frame 10 and the universal bar 11 out of contact with the other three contact-arms 12, and that the latter will remain resting upon the armature extensions of their respective magnets. When three contact-arms 12 are in either of these two ways disconnected from the universal bar 11, current from the feed-wire may be delivered only to the branch feed-wire which is connected to the raised contact-arm 12, and hence only one of the safety-blocks *a*, *b*, *c*, or *d* will be supplied with current, the three others being dead. As soon as the magnet which sustains the raised contact-arm is deënergized the frame 10 is allowed to drop, so that the universal bar again makes electrical connection with all of the contact-arms 12, whereupon current from the feed-wire 6 is again delivered to all of the safety-blocks *a b c d*.

In order to energize the magnets A B C D, each is connected by a magnet-actuating circuit with one of the safety-blocks. Thus one pole of the magnet A is connected by a wire 16 with a circuit-closer A' on the block *a*, the other pole of the magnet A being connected by a wire 17 with the ground 18. One pole of the magnet B is connected by a wire 19 with a circuit-closer B' on the block *b*, the other pole of the magnet B being connected to the wire 17 and thence to the ground 18. One pole of the magnet C is connected by a wire 20 with a circuit-closer C' on the block *c*, the other pole of the magnet C being connected by a wire 17 with the ground 18. One pole of the magnet D is connected by a wire 21 with a circuit-closer D' on the block *d*, the other pole of the magnet D being connected by a wire 17 with the ground 18. A signal, such as a lamp 22, may be connected in the wire 17, as shown, suspended at the center of the crossing, so as to be discerned from a considerable distance along either of the operating-lines.

The circuit-closers A' B' C' D' are all similar in construction, each comprising a spring contact-tongue 23, supported by and insulated from a bracket 24, which may be fastened to the trolley-wire in any approved manner.

Fig. 2 illustrates the circuit-closer A', a trolley-wheel 25 being shown moved into contact with the spring-tongue 23 and closing the circuit through the circuit-closer A' between the wire 16 and the safety-block *a*.

The circuit-closers A' B' C' D' are located, preferably, near the entrance-limit of the safety-blocks and relatively close to the insulators 5, so that a car will operate one of the circuit-closers immediately upon entering the safety-block. Assuming the circuit-closer A' to have been so operated, current flows from circuit-closer A' through wire 16 to magnet A, energizing the latter, thence through wire 17 to the ground 18.

Mounted on the lower end of each armature 14, but insulated therefrom, is a spring-clip 26, which is adapted to make contact with a ring 27, arranged on the lower end of the magnet, but insulated therefrom by insulation 28. Each ring 27 is connected by a short branch wire 29 with the magnet-actuating circuit. Thus the ring 27 of magnet A is connected with the wire 16, the ring 27 of the magnet B is connected with the wire 19, the ring 27 of the magnet C is connected with the wire 20, while the ring 27 of the magnet D is connected with the wire 21. The contact-clips 26 of the magnets A B C D are respectively connected with the circuit-breakers A'' B'' C'' D'' by wires 30 31 32 33.

Fig. 3 illustrates the circuit-breaker A''. The circuit-breakers B'' C'' D'' are similarly constructed, each comprising a contact-rocker 34, pivoted to a bracket 35, which may be fastened to the trolley-wire, the rocker 34 having a contact-blade 36, which normally makes connection with a blade 37, the latter being supported by a block 38 of insulation attached to bracket 35. When the trolley-wheel 25 rides under the rocker 34, it tips the latter into the position shown in dotted lines in Fig. 3, separating the blades 36 and 37, the rocker dropping by gravity again as soon as the trolley-wheel has passed thereunder, bringing the blade 36 back against the blade 37.

The circuit-breakers A'' B'' C'' D'' are respectively connected with the magnets A B C D by what may be termed "magnet-sustaining circuits," each magnet-sustaining cir-

cuit being normally broken at its associated magnet when the latter is deënergized by reason of the spring 26 being then out of contact with the ring 27. When, however, the magnet is energized by the closing of the magnet-actuating circuit, as before described, the spring 26 is moved up by the armature 14 and, making contact with the ring 27, closes the magnet-sustaining circuit. Thus, as shown in Fig. 1, the magnet-actuating circuit of the magnet A has just been closed by the trolley-wheel and the magnet-sustaining circuit has been closed by reason of the spring 26 making contact with the ring 27. The magnet-sustaining circuit may be traced as follows: from the trolley-wire of safety-block *a* through the closed-circuit breaker A″, through wire 30 to spring 26 of magnet A, through ring 27 and wire 29, through magnet A, and through wire 17 to ground 18. This latter circuit, being thus closed by the contact of the spring 26 with the ring 27, is maintained unbroken even after the trolley-wheel has left the tongue 23 of the circuit-closer, and therefore the magnet A continues energized, the current being cut off from the other blocks, as before described, during this period. As soon as the trolley-wheel rides under the rocker 34, however, the circuit-breaker A″ is operated, and the magnet-sustaining circuit through the magnet A is broken, whereupon the magnet A is deënergized, its armature drops, together with the associated contact-arm 12 and universal bar 11, thus restoring the feeder-switch and admitting current to the four safety-blocks *a b c d*.

Assuming that before the car on the safety-block *a* has left that block a car drifts onto the safety-block *b* and another car drifts onto the safety-block *c*, these two cars will be unable to operate while the car is on block *a*, because their safety-blocks *b c* are dead. When, however, the car has passed off the safety-block *a* and operated the circuit-breaker A″, the magnet A is deënergized and the feeder-switch is restored to normal condition, so that current is supplied to all of the safety-blocks. Either of the two cars on blocks *b* and *c*, but not both, may now operate. The first car in point of time to turn on its controller will elevate the feeder-switch and render all of the other blocks dead. Assuming the first car to thus turn on its controller to be the car on block *b*, as soon as the circuit through the car is made by turning on the controller the auxiliary magnet $B^{\times}$ is energized, current from the main feeder 6 flowing through the universal bar 11, through the contact-arm 12, through the wire *b′* and auxiliary magnet $B^{\times}$ to safety-block *b* and through the trolley and car to the ground. If the car on the block *c* had been the first to operate its controller, the auxiliary magnet $C^{\times}$ would have been energized in like manner through its associated connections, before described, and the car on the block *c* would have been given the exclusive operating power. Thus it is obvious that the car on either of the safety-blocks which is the first car to operate its controller will be the first car to cross, the other cars being prevented from crossing until that car has passed out of its block, and as soon as a car has passed out of its block the feeder-switch again returns to normal position and the four safety-blocks are again in connection with the main feeder 6, so that other cars which may have gathered in the meantime at the crossing may proceed to cross singly and in the order in which they take the current.

It is evident that after either one of the magnets A B C D has been energized by reason of a car passing onto a safety-block if the car takes current from its safety-block the associated magnet $A^{\times}$, $B^{\times}$, $C^{\times}$, or $D^{\times}$ will be operated incidentally, but that with two or more cars on the safety-blocks with their controllers off and the safety-blocks being all alive the first car to open its controller will primarily excite the related auxiliary magnet $A^{\times}$, $B^{\times}$, $C^{\times}$, or $D^{\times}$, and the latter in moving up the vertical armature 14 will by means of the clip 26 close the magnet-sustaining circuit through the related magnet A, B, C, or D, so that both mechanically-associated magnets will each operate electrically to sustain the universal bar 11 and render all but one of the safety-blocks dead until the car on the live safety-block operates the circuit-breaker thereof.

The great advantage of this system is that it is entirely automatic, requiring no special manipulation of the controller nor manual operation of switches. When two or more cars have gathered on the safety-blocks at the crossing, even though a car starts to cross out of the usual prescribed order the other cars cannot move until that car passes off from its block.

Fig. 5 shows a form in which a series of electrically-independent arms 46 are employed instead of the universal bar 11, the arms 46 being insulated from each other by collars 40, the arms being all rigidly mounted on a sleeve of insulation 41, (shown in dotted lines,) which is free to turn on the shaft 47. The arms 46 each normally rests upon the respective contact-arms 12; but when either of the contact-arms 12 is raised it lifts the arm 46 which rests upon it and also the other three arms 46, so that the latter three are thus disconnected from their three contact-arms 12. Each arm 46 is connected directly to its own feeder 42, 43, 44, or 45, thus segregating the four lines so that each may operate with its

own direction of current and otherwise independently of the others. Thus this crossing system may be applied to independent lines without requiring any change in their systems and without causing any confliction between them while in use.

What I claim is—

1. A safety crossing system for railways comprising operating-lines having intersecting safety-blocks, means controlled by the first car which passes onto any of the blocks for automatically rendering the other blocks inoperative while the car is on that block, and means for allowing any one of other cars on the blocks to proceed after the said first car has passed off its block.

2. A safety crossing system for railways comprising operating-lines having intersecting safety-blocks which are normally operative, means including a main circuit for automatically rendering the safety-blocks, except one, inoperative, and auxiliary means including an auxiliary circuit for rendering the safety-blocks, except one, inoperative.

3. A safety crossing system for railways comprising crossed operating-circuits, each operating-circuit having an insulated safety-block, a feeder connected with each safety-block, means operated by a car when it enters a block for automatically cutting out the feeders connected with the other blocks, means for automatically restoring the feeders after the car has left the block, and auxiliary means for cutting out all feeders but one, operable from a car on a live block.

4. A safety crossing system for railways comprising crossed operating-circuits, each operating-circuit having an insulated safety-block, a feeder connected with each safety-block, a feeder-switch adapted to disconnect all but any one of the feeders, a plurality of independent magnets for operating the switch, a plurality of auxiliary magnets for operating the switch, means operated by a car for energizing one of the first-named magnets when the car passes onto a block, and means controlled by a car on a live block for actuating one of the auxiliary magnets.

5. A safety crossing system for railways comprising crossed operating-circuits, each circuit having an insulated safety-block, a feeder connected with each safety-block, a feeder-switch adapted to disconnect all but any one of the feeder connections, an auxiliary magnet connected in each feeder for operating the feeder-switch when a car is taking current from the safety-block associated with that feeder.

6. A safety crossing system for railways comprising operating-circuits, each circuit having an insulated safety-block, a feeder connected with each safety-block, a feeder-switch adapted to disconnect all but any one of the feeder connections, a plurality of independent magnets for operating the switch, means operated by a car when it passes onto a safety-block for energizing the magnet associated with that block and thus operating the feeder-switch, an auxiliary magnet connected in each feeder for operating the feeder-switch, any one only of the auxiliary magnets being operated when the car on its related safety-block is drawing current from its feeder.

7. A safety crossing system for railways comprising operating-circuits, each operating-circuit having a safety-block, a feeder connected with each safety-block, a feeder-switch adapted to disconnect all but any one of the feeder connections, a plurality of independent magnets for operating the switch, a magnet-actuating circuit for each magnet and its related safety-block, a magnet-sustaining circuit for each magnet and its related safety-block, a plurality of auxiliary magnets connected in the respective feeders for operating the feeder-switch, means operated by a car for closing the magnet-actuating circuit, and means operated by a car for breaking the magnet-sustaining circuit.

8. A safety crossing system for railways comprising operating-circuits, each operating-circuit having a safety-block, a feeder connected with each safety-block, a feeder-switch adapted to disconnect all but any one of the feeder connections, a plurality of independent magnets for operating the switch, a magnet-actuating circuit for each magnet and its related safety-block, a magnet-sustaining circuit for each magnet and its related safety-block, a plurality of auxiliary magnets connected in the respective feeders for operating the feeder-switch, means operated by a car for closing the magnet-actuating circuit, and means operated by a car for breaking the magnet-sustaining circuit, and a signal connected in the magnet actuating and sustaining circuits.

9. In combination with operating-lines, each having an insulated safety-block, feeders for the respective safety-blocks, a feeder-switch comprising a series of contact devices, each contact device being connected to its associated feeder, a universal bar normally in contact with the contact devices, means for supplying current to the universal bar, means for operating any of the contact devices singly to move the universal bar out of connection with the contact devices not actuated, a plurality of auxiliary magnets connected in the respective feeders between the feeder-switch and the safety-blocks, and means operated by each auxiliary magnet for moving the universal bar out of connection with all but one of the contact devices.

10. A safety system for railways comprising operating-lines having intersecting safety-blocks, automatic means including a main circuit for rendering dead all the safety-blocks

except the one on which a car first runs, and manual means including an auxiliary circuit applied through the car-controller of any car which may run past the automatic means for rendering exclusively alive the safety-block upon which the last-mentioned car lies.

In testimony whereof I have hereunto set my hand, at Los Angeles, California, this 27th day of May, 1905.

WALTER J. BELL.

In presence of—
GEORGE T. HACKLEY,
ARTHUR P. KNIGHT.