No. 743,852. PATENTED NOV. 10, 1903.

I. H. FRANCISCO.

BLOCK SIGNAL SYSTEM.

APPLICATION FILED MAY 20, 1902.

NO MODEL. 3 SHEETS—SHEET 1.

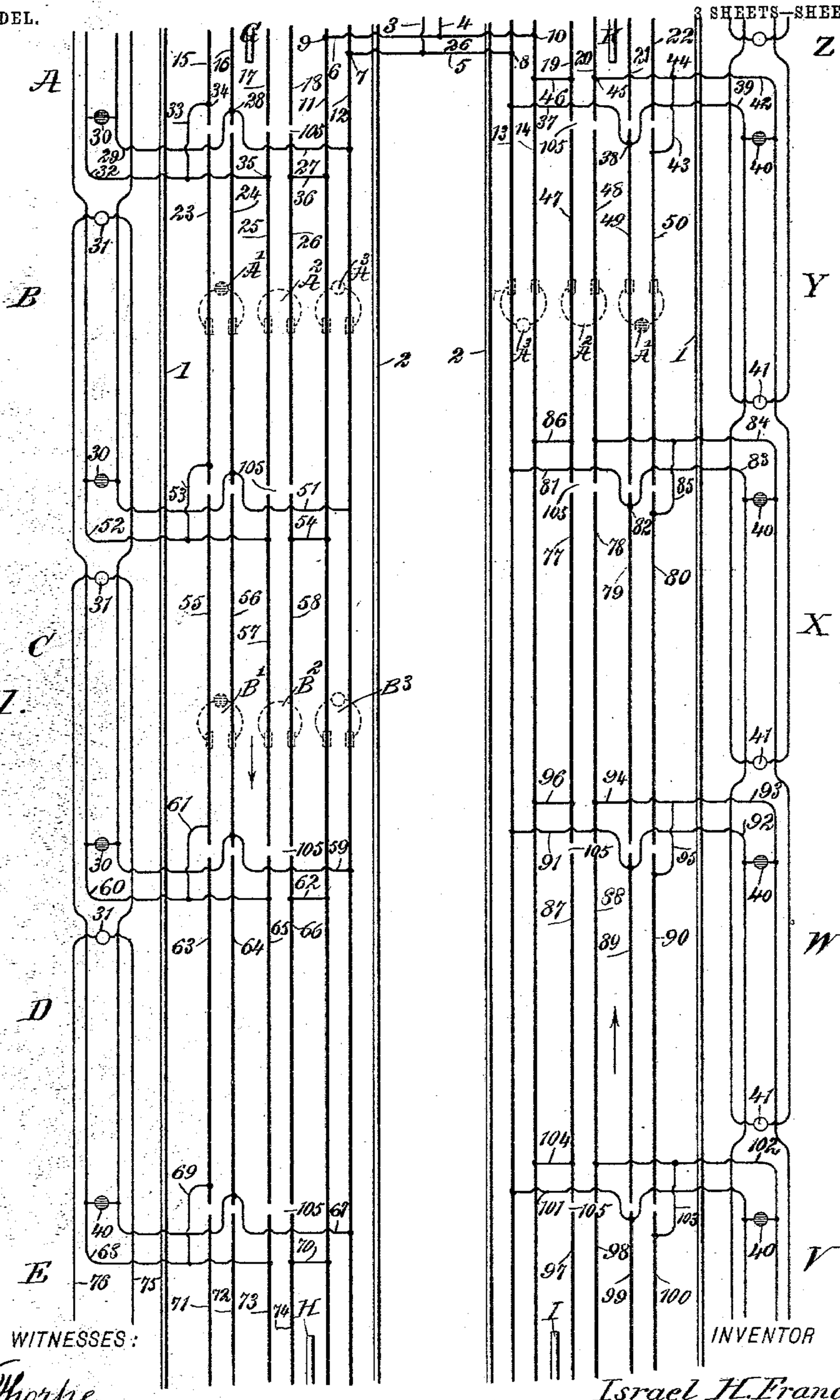



Fig. 1.

Israel H. Francisco
BY Munn & Co.
ATTORNEYS

No. 743,852. PATENTED NOV. 10, 1903.

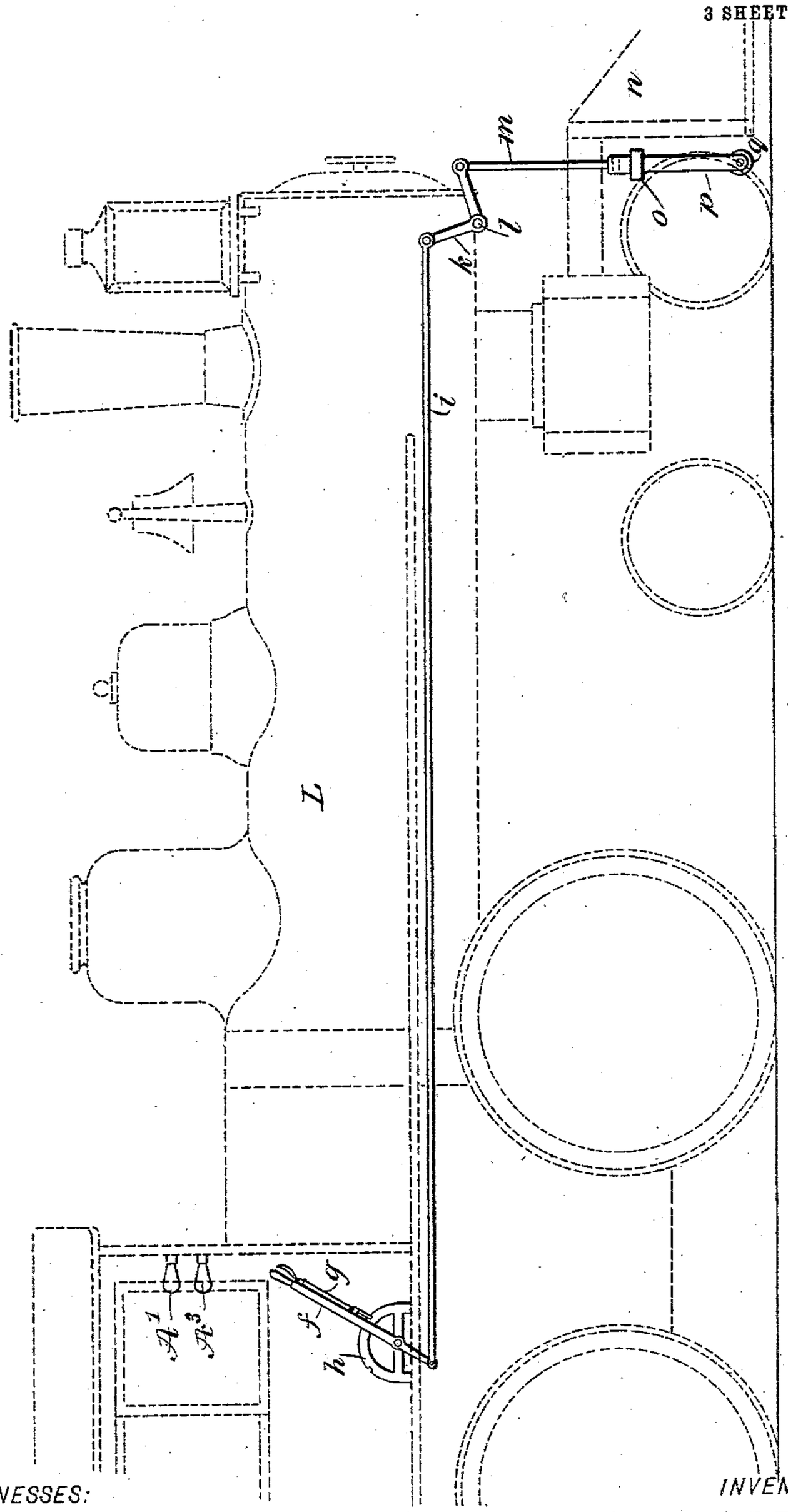
I. H. FRANCISCO.

BLOCK SIGNAL SYSTEM.

APPLICATION FILED MAY 20, 1902.

NO MODEL. 3 SHEETS—SHEET 2.

Fig. 2.




WITNESSES:

Edward Thorpe

Walton Harrison

INVENTOR

Israel H. Francisco

BY

ATTORNEYS.

No. 743,852. PATENTED NOV. 10, 1903.

I. H. FRANCISCO.

BLOCK SIGNAL SYSTEM.

APPLICATION FILED MAY 20, 1902.

NO MODEL. 3 SHEETS—SHEET 3.

Fig. 3,

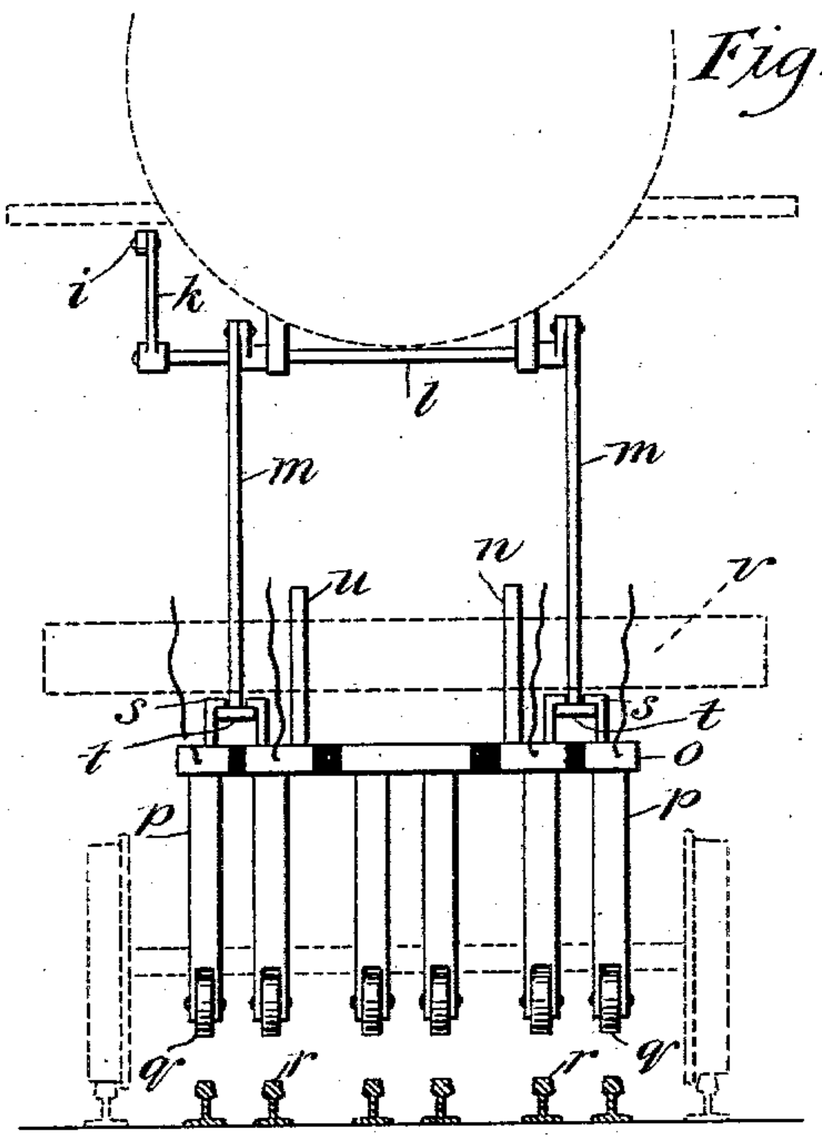



Fig. 4,

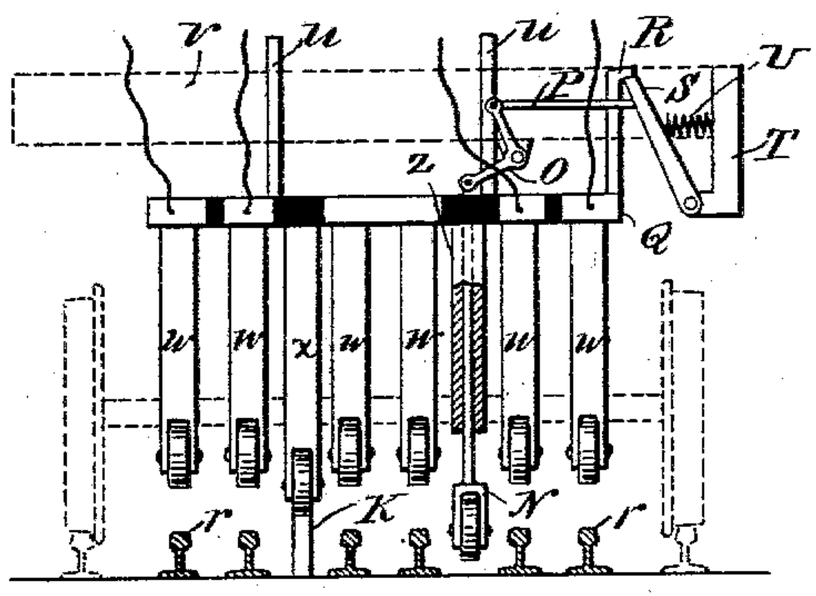



Fig. 6,

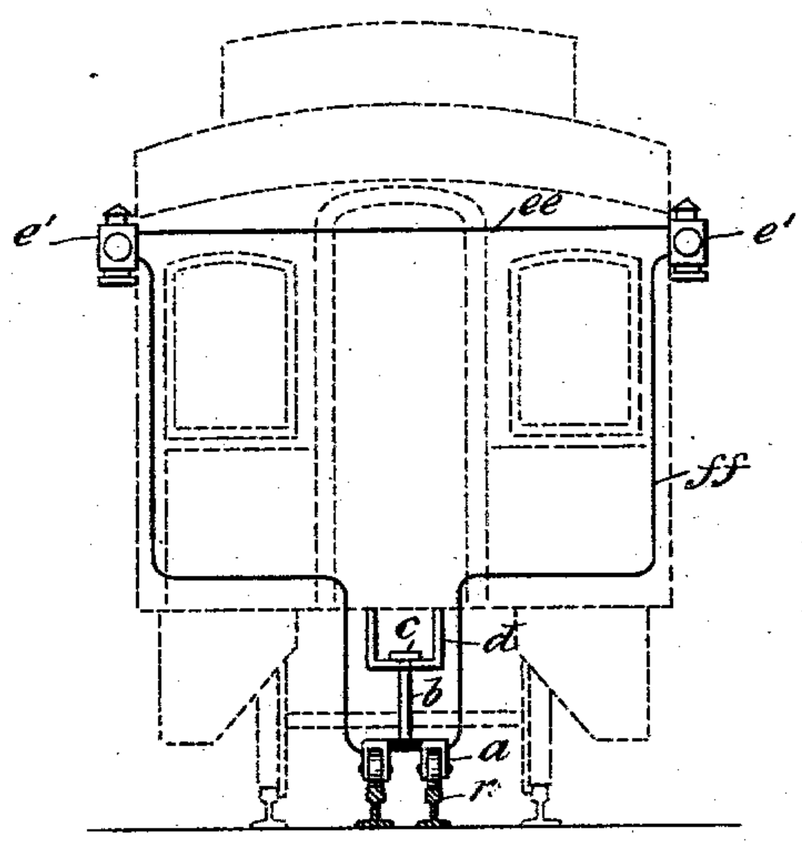
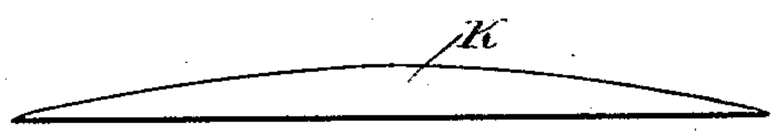



Fig. 5,




WITNESSES:

Edward Thorpe.

Walton Harrison

INVENTOR

Israel H. Francisco

BY Munn & Co.

ATTORNEYS.

No. 743,852. Patented November 10, 1903.

# UNITED STATES PATENT OFFICE.

ISRAEL HOLMES FRANCISCO, OF RUTLAND, VERMONT.

## BLOCK-SIGNAL SYSTEM.

SPECIFICATION forming part of Letters Patent No. 743,852, dated November 10, 1903.

Application filed May 20, 1902. Serial No. 108,209. (No model.)

*To all whom it may concern:*

Be it known that I, ISRAEL HOLMES FRANCISCO, a citizen of the United States, and a resident of Rutland, in the county of Rutland and State of Vermont, have invented a new and Improved Block-Signal System, of which the following is a full, clear, and exact description.

While I show my system as applied to a double-track railway, I do not limit myself to double-track railways. Obviously by omitting certain duplicated parts the system can be used with single-track railways.

With my system either the entire road or so much of it as is to be protected in the manner indicated is divided into blocks, as usual.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the figures.

Figure 1 is a diagrammatic plan view showing my system as applied to a double-track road. Fig. 2 is a side elevation of a locomotive equipped for use upon my system. Fig. 3 is a detail front elevation showing the contacting device when operated by hand. Fig. 4 is a modification of the same, showing the contacting device to be operated automatically. Fig. 5 shows a cam-like member for actuating the contacting device, and Fig. 6 is a rear elevation of a car provided with a shunt-circuit and with lights actuated by my system.

In Fig. 1 the tracks are provided with ordinary rails 1 2 in the usual manner and are divided into blocks, which for convenience are here designated as A B C D E for the southbound trains and V W X Y Z for the northbound trains. The mains 3 4 are connected by wires 5 6 with the junctions 7, 8, 9, and 10, thus connecting the contact-rails 11 and 12 of one track with the source of electrical supply and independently connecting contact-rails 13 14 of the other track with the same source of electrical supply. A plurality of other contact-rails are divided into distinct sections 15, 16, 17, 18, 19, 20, 21, and 22, disposed adjacent to the tracks, as indicated in the upper portion of Fig. 1. Abutting the rail-sections 15 16 17 18, but insulated therefrom, are other rail-sections 23 24 25 26. The contact-rails 11 12 13 14 extend throughout the part of the track to be protected. If this be a tunnel, they extend from one end of the tunnel to the other. They may be of any desired length, limited only by convenience. From the contact-rails 12 a wire 27 is connected through the signal-light wires 29 and 32, extending along the two preceding blocks and thence to the wire 25 at the upper end of block B, this wire 27 being also connected at 28 with the rail-section 16 in block A. From the junction 28 a wire 29 leads to a red lamp 30 and a green lamp 31. From these lamps a wire 32 leads back and is connected at 35 with the rail-section 25 in block B. A short wire 36 connects the contact-rail 11 with the contact-rail 26 in the upper portion of block B. Upon the other track the wiring is quite analogous to that just described. From the contact-rail 13 a wire 37 leads to the junction 38, and from this junction a wire 39 leads to the red lamp 40 in the block designated Y, and from this block said wire leads to a lamp 41 at the far end of block X. From these lamps a wire 42 leads back to the rail-section 20 in block Z, to which it is secured at the junction 45. A short wire 43 taps the wire 42 at the junction 44, thereby connecting the wire 42 in block Z with the rail-section 50 in block Y. A short section of wire 46 connects the contact-rail 14 with the rail-section 19 at the far end of block Z. The rail-sections 47, 48, 49, and 50 are arranged similarly to the sections 23, 24, 25, and 26.

The connection between the blocks B and C is in all respects similar to that between A and B just described. The wire 51 is connected with the contact-rail 12 and with the rail-section 24, from which it leads to one of the red lamps 30 and green lamps 31. From these lamps a return-wire 52 is connected at 53 with the rail-section 23 of block B and is joined directly to the rail-section 57 of block C. The short wire 54 connects the contact-rail 11 with the rail-section 58 of block C. The rail-sections 55, 56, 57, and 58 of blocks C are similar to the rail-sections 23, 24, 25, and 26 of block B.

The connections between block C and block D and also between block D and block E is similar to that just described. The wires 59, 60, 61, and 62, connecting blocks C and D, are arranged as above described, as may be seen by reference to Fig. 1. The rail-sections 63, 64, 65, and 66 correspond with the four sections just described. The wires 67 68 69

70 and the rail-sections 71 72 73 74 75 76 are likewise modeled after the analogous parts of those above described.

Upon the other track, made for the northbound trains, the arrangement is practically the same as that just described, with the exception that the wiring is suitable for trains traveling in the opposite direction. The rail-sections 77, 78, 79, and 80 in block X correspond with the rail-sections 47, 48, 49, and 50 in block Y. The wire 81 is joined at 82 to the rail-section 79, and from this junction a wire 83 leads to one of the red lamps 40 and thence to one of the green lamps 41. From these lamps a return-wire 84 is provided with a branching wire 85 of block X, connected with the rail-section 80, and is itself connected directly with the rail-section 48 of block Y. The short wire 86 of block Y is similar to the short wire 46 of block Z.

The connection between blocks W and X is identical with that just described. The rail-sections 87, 88, 89, and 90 of block W correspond with the rail-sections 77, 78, 79, and 80 of block X. The wires 91, 92, and 93 are analogous to the wires 81, 83, and 84, while the wires 95 and 96 are analogous to the wires 85 and 86. The rail-sections 97, 98, 99, and 100 in block B correspond to the rail-sections 87, 88, 89, and 90 of block W. Wires 101, 102, 103, and 104 correspond, respectively, to wires 91, 93, 95, and 96.

It will thus be seen that each block is a duplication of the one immediately preceding it. At the respective ends of the part of the road to be protected are placed cam-like blocks G H or I K between the main rails and in the positions indicated in Fig. 1. These blocks are for the purpose of actuating the contact mechanism carried upon the train, as hereinafter described. The rail-sections of each block are separated by the spaces 105 from the rail-sections immediately adjacent or otherwise insulated therefrom.

The body of a locomotive is represented at L. Upon this locomotive is mounted a hand-lever *f*, provided with a manually-operated pawl *g*, which engages the sector *h* for the purpose of maintaining the contact device in a predetermined position either up or down. To the lower part of the lever *f* is connected a longitudinal rod *i*, connected with a bell-crank *k*, which is pivoted at *l* upon a convenient part of the locomotive. To the bell-crank are connected longitudinal rods *m*, which pass downward and are employed for raising and lowering the frame *o*. Upon the frame *o*, located adjacent to the pilot *n*, are mounted a number of depending trolley-posts *p*, provided with trolley-wheels *q* for the purpose of engaging the contact-rails *r*, these rails being preferably six in number and being the rails indicated diagrammatically in Fig. 1. The rods *m* move vertically through guides *s* and are provided with bearing-plates *t* for the purpose of maintaining the parts in a positive relation to each other. Guide-pins *u u* pass upward through holes in the framework *v*, thereby making the action of the moving parts still more positive.

In the modification of the contact mechanism shown in Fig. 4 the cam-like contact-plate K has the form indicated more particularly in Fig. 5 and is one of the series of contact-plates indicated upon Fig. 1 by the letters G H I K. One of the trolleys N is slidably mounted upon a rod which passes loosely through a hollow sleeve *z* in the frame Q. This rod is connected with a bell-crank O, said bell-crank being connected by a pitman P with the pawl S. The pawl is pivoted upon the frame T and is normally pressed inward by the spiral spring U. Upon the frame Q is mounted a hook R for the purpose of engaging the end of the pawl S.

The operation of the contact-frame by hand will be readily understood from an inspection of Fig. 2. The lever *f* being rocked forward or backward and the manually-operated pawl being placed in a suitable position to maintain the lever at a proper angle, the bell-crank *k*, acting through the agency of the rods *m m*, raises or lowers the frame *o*, thus causing the trolley-wheels to make contact with the rails or raising them from contact with the same, as desired. The automatic device shown in Fig. 4 is a distinct structure. Upon arriving at the part of the road protected, as above described, the trolley N makes contact with the cam-shaped contact-plate I and is thereby thrown upward, rocking the bell-crank O and by means of the pitman P pushing the pawl S away from the hook R, thus allowing the frame to rock. When the locomotive arrives at the exit of the part of the road to be protected, the trolley *x*, which is longer than the other trolleys *w*, makes contact with the plate K, thus raising the frame directly upward. The guide-pins *u u* cause the frame to move in a true plane. Upon being thus raised the pawl S, being forced inward by the spiral spring U, locks itself under the hook R and maintains the frame temporarily in its raised position.

Whether the locomotive be equipped with the manually-operated device or with the automatic device, the general result is the same—to wit, that all six of the trolleys are placed upon the contact-rails at the same instant.

In Fig. 6 is shown a car which is lighted upon its rear extremity by my system. This car is provided with contact-wheels *a*, insulated from each other and resting upon the two middle rail-sections *r*. These rail-sections are in all respects similar to the two middle rail-sections above described—say sections 25 26 or 57 58. A stem *b*, surmounted by a head *c*, is free to move slightly within the guide *d*, so as to compensate irregularly upon the surfaces of the rails. The glow-lamps *e' e'* are connected by wires *e e* and *f f* with the contact-wheels and are energized by

the current passing through the short circuit thus extending from one of the contact-rails to the other. This rear-end attachment may be rendered portable, if desired, so as to readily be secured upon or detached from a particular car. When attached, as shown in Fig. 6, the car acts in substantially the same way as a locomotive, for the reason that the trolley-wheels *a* of the car perform a function similar to that of the bridge $A^2$. (See Fig. 1.) The absence from the rear car of a lamp analogous to the pilot-lamp $A^3$ or of a danger-lamp A′ (see Fig. 1) on the locomotive is immaterial, as neither of these lamps has any effect upon any train coming up from the rear. This device will make it impossible for a car detached from the train to be left behind without giving warning to following trains. It a so renders it out of the question for a train to stop in such a position at the block intersections—as, for instance, half upon one block and the balance in the preceding one—as to leave any portion unprotected. The train or any part of it is always, coupled or uncoupled, moving or at a standstill, its own and all following trains' protection.

As shown in Fig. 6, the trolleys *a* are insulated from each other and connected with the guide-rod *b*, which is provided with a head *c*, moving upward through the hollow member *d*. The lights are shown at *e′* and may be of any color desired. The wires *e e f f* connect these lamps with the trolleys. It will be observed that the lamps *e′ e′* are energized directly from the middle rail-sections—say 25 26—the current through them being analogous to that through the bridge $A^2$ or $A^3$, as above described.

Upon the cab of the locomotive are mounted a red or danger lamp A′ and a white or pilot lamp $A^3$. The pilot-lamp should be illuminated continuously during the entire time while the train is upon the part of the track to be protected. The red or danger lamp is only flashed intermittingly. The red lamp A′ is connected with the pair of trolleys shown to the left in Fig. 1 or Fig. 4, and the lamp $A^3$ is connected to the pair of trolleys shown to the right of Fig. 3 or Fig. 4. The wiring of each of these lamps is exceedingly simple, consisting merely of a single loop of wire terminating in trolley-shoes and constituting a sort of bridge, in the middle of which the lamp is inserted, as indicated in Fig. 1. The middle pair of trolleys in either of these figures is connected by a wire $A^2$, which is not provided with a lamp and merely serves to complete the circuit between two central rails, as indicated in Fig. 1.

The general operation of my device is as follows: A train having entered the part of the road to be protected, as above described, all of the trolleys are brought into contact with the contact-rails. The current from the mains 3 and 4 now flows into the long contact-rails 11 12 and 13 14. Suppose that a train is standing in block Y. The pilot-lamp $A^3$ is burning continuously, because it forms a part of the shunt-circuit between the contact-rails 13 14, this circuit being as follows: 3, 5, 8, 13, $A^3$, 14, 10, 4. The electric connection is now complete to the junction-point 38 in block Y, thence through the red lamp 40 in block Y and the green lamp 41 in block X, passing through these lamps in parallel, thence back through the wire 42, junction 44, and wire 43 to contact-rail section 50, and also from the junction 44 to junction 45 upon rail-section 20 in block Z. The circuit, however, is not complete unless the rail-sections 19 and 20 in block Z have an electric connection between them caused by the presence of a train upon the block Z. If now another train is in the block Z, so that the rail-sections 19 20 are connected by the trolleys $A^2$ of that train, the circuit is complete and is as follows: main 3, wire 5, junction 8, contact-rail 13, junction 38, lamp 40 at the entrance of block Z, lamp 41 at the entrance of block X, wire 42, junction 45, section-rail 20, bridge or middle trolley of train in block Z, rail-section 19, wire 46, contact-rail 14, junction 10, wire 6, and main 4, thus lighting the lamp 40 at the exit of block Y and the lamp 41 at the entrance of the block X. From the circuit just described a shunt-circuit is formed, beginning with junction 38, thence proceeding through rail-section 49 and lamp A′, rail-section 50, wire 43 to junction 44, this circuit lighting the lamp A′ by placing the same in shunt with the lamps 40 in block Y and 41 in block Z. The engineer upon the train in block Y is therefore apprised of the existence of another train in block Z. His pilot-lamp $A^3$ burning continuously merely shows that the system is in working order. His bridge $A^2$, being connected with the two central trolleys, completes the circuit in case another train arrives in the block X, thereby giving warning to that train.

The general arrangement is such that if a block—say the block Y—is occupied by a train, as indicated in Fig. 1, a train approaching from the rear (represented by the bottom of the drawing) passes first a green lamp 41 adjacent to the entrance of block X, the next passes a red or danger lamp 40 adjacent to the entrance to block Y. Meanwhile the danger-lamp A′ in the cab of the locomotive flashes a danger-signal directly in the engineer's face. In order to run into a train in the block ahead, it is necessary for the engineer to disregard three signals—the green or cautionary lamp, which is visible for some distance before he reaches the train in question, the red or urgent danger-signal, which he sees upon arriving in close proximity to the block where the other train stands, and, lastly, the glare of the red lamp in the cab. As no engineer is likely to disregard all three of these signals, the chance for collisions is necessarily reduced to a minimum.

Let us now consider the case of a south-

bound train upon the left-hand track. (Indicated in Fig. 1.) Suppose that a train is standing upon block C and that another train approaches from the rear (indicated by the top of the drawing) and runs into block B. The result is as follows: The engine of the train which is standing upon block C is provided with electric lamps, as above described, which lamps for convenience we will here denominate B′ $B^3$, and with an electrode $B^2$, which connects the two middle trolleys together. With this train resting in block C the contact-rail sections 57 58 are simply connected; but the lamp B′ is in an open circuit, indicating "safety." Prior to the arrival of the rear train in block B, whether said train be stationary or moving, the same conditions obtain as those just described with reference to the train standing in block C—that is to say, the lamp A′ is not lighted, the pilot-lamp $A^3$ is always burning, and the electrode $A^2$ merely forms a bridge from the rail-section 25 to the rail-section 26 without completing a circuit. The presence of another train is necessary to render the circuit complete. Now when this rear train arrives in the block B the engineer of this train is immediately apprised of the presence of the other train in block C. The bridge $B^2$ completes the circuit between the rail-sections 57 58 for the lamp 30, located adjacent to the entrance of block B, and a lamp 31, located at the other end of block A. These lamps are therefore never lighted except when a train is upon one of the blocks no farther removed from the train than the length of two blocks.

The circuit through the danger-lamp upon the cab for the train in block B is as follows: main 3, junction 7, contact-rail 12, wire 51 to lamps in parallel, thence through wire 52 to contact-rail 57, thence through electrode $B^2$ to rail-section 58, thence through short wire 54 to contact-rail 11, thence from junction 9 to main 4. The contact-rails 23 and 24 are thus oppositely energized by the current, so that the lamp A′ is lighted and gives warning to the engineer of the train in block B. The electrode $A^2$ of his engine in connecting the rail-sections 25 and 26 of block B make it possible for another train entering block A from the rear to be warned in its turn.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. A block-signal system, comprising a plurality of sectional conductors insulated from each other and placed along the track in pairs so as to form a series of distinct blocks, a pair in one block being out of alinement with a pair in another block, a pair of continuous conductors of a length commensurate with several blocks and insulated from each other, means for energizing said continuous conductors, a plurality of electric signal-circuits corresponding to said blocks, each of said signal-circuits containing signals and being connected with both of said sectional conductors of a pair located in one of said blocks, said signal-circuits being also connected with an individual rail of a pair located within a different block and with one of said continuous conductors, the other of said continuous conductors being connected with the remaining individual rail of said pair within said different block, and trolley mechanism mounted upon a movable vehicle and free to temporarily connect together the individual rails of one of said pairs located within one of said blocks for the purpose of completing the circuit through said signals.

2. A block-signal system comprising feed members of opposite sign, a plurality of rail-sections insulated from each other and placed in pairs so as to form a series of distinct blocks, a pair in one block being disposed out of alinement with a pair in another block, electric signal-circuits corresponding to said blocks, each of said signal-circuits containing signals and being connected with both of the rail-sections of a pair located within one of said blocks, said signal-circuits being also connected with an individual rail-section of said pair located within said different block and with one of said feed members, the other of said feed members being connected with the other individual rail-section of said pair located within said different block, and separate trolley mechanisms mounted upon a vehicle and free to temporarily connect together the individual rail-sections of each of said pairs.

3. A block-signal system comprising feed members of opposite sign, a plurality of rail-sections insulated from each other and placed in pairs of opposite sign so as to form a series of distinct blocks, a pair in one block being disposed out of alinement with a pair in another block, a plurality of signal-circuits corresponding to said blocks, each of said signal-circuits containing signals and being connected with both of the rail-sections of a pair located within one of said blocks, said signal-circuits being also connected with an individual rail-section of said pair located within said different block and with one of said feed members, the other of said feed members being connected with the other individual rail-section located within said different block, trolley mechanisms mounted upon a vehicle and free to temporarily connect together the individual rail-sections of each pair, and another trolley mechanism located upon a second vehicle and provided with an electric signal to be energized by said feed members only.

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

ISRAEL HOLMES FRANCISCO.

Witnesses:
M. J. FRANCISCO,
E. F. WOTKINS.