(No Model.)

2 Sheets—Sheet 1.

R. J. HEWETT.

ELECTRICALLY CONTROLLED BLOCK SIGNAL FOR RAILWAYS.

No. 594,471. Patented Nov. 30, 1897.

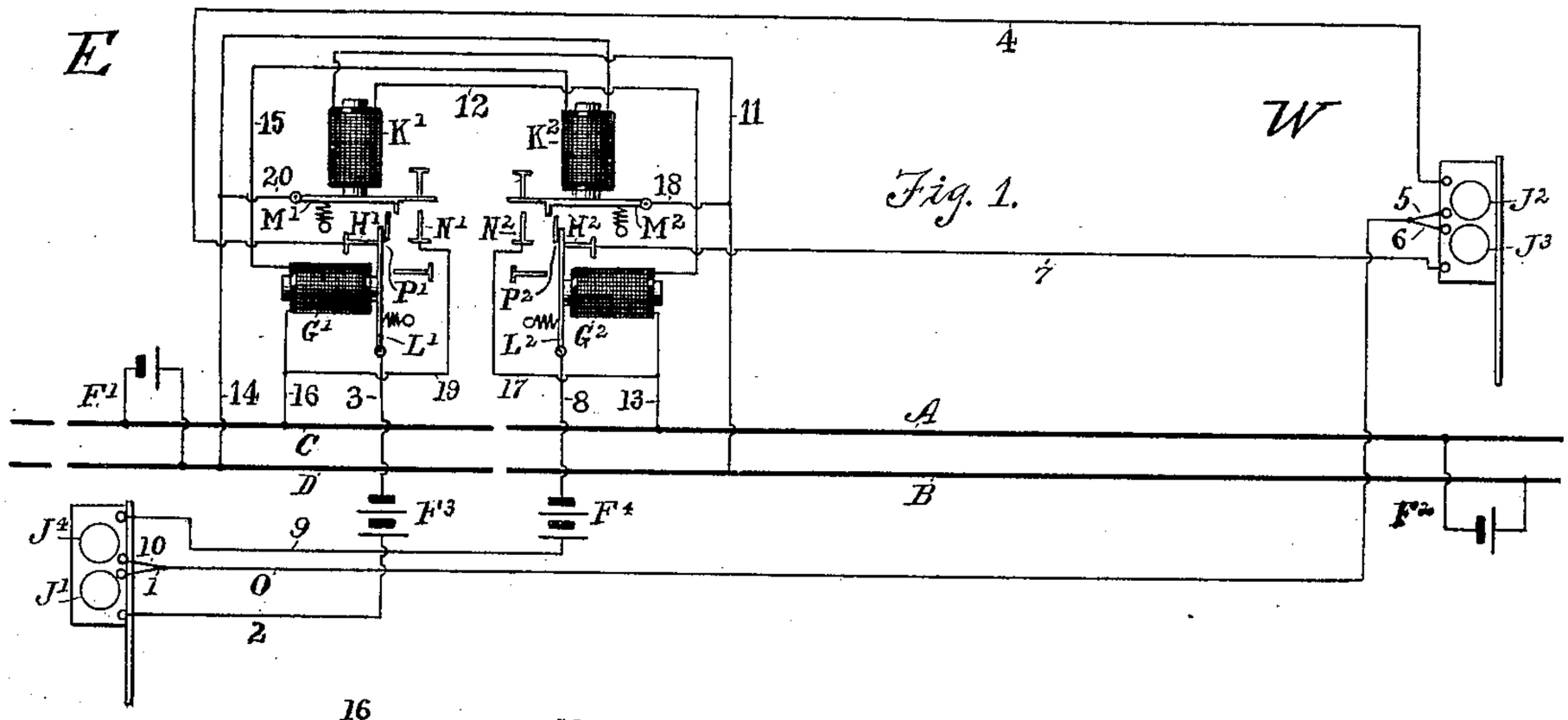

Fig. 1.

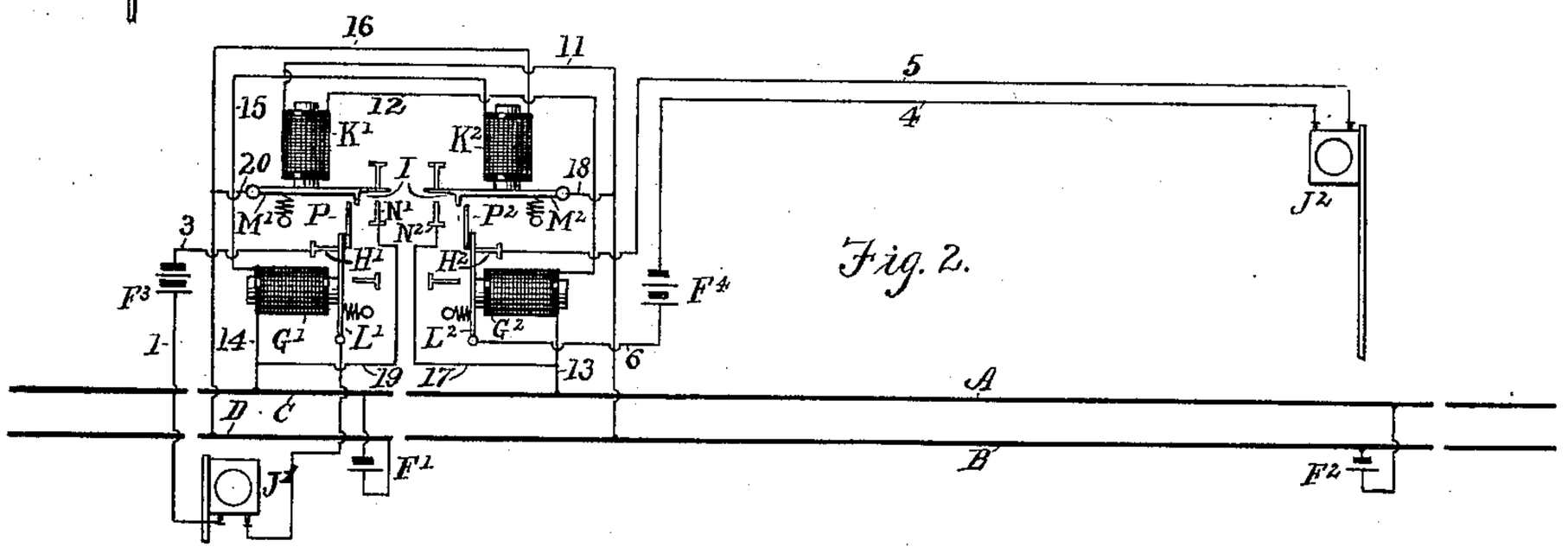

Fig. 2.

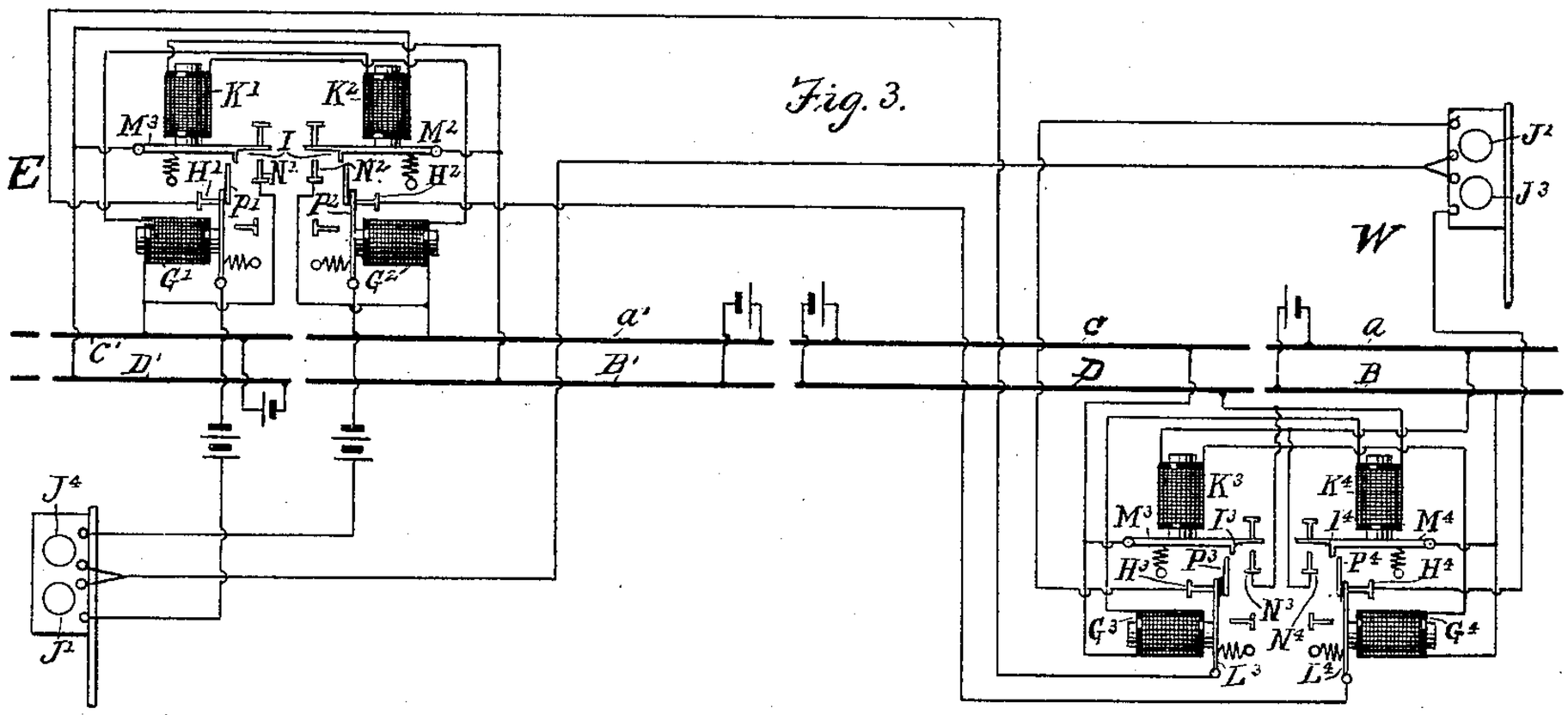

Fig. 3.

WITNESSES:

C. L. Belcher

Walter Dowe

INVENTOR

Robt J. Hewett

BY Rob't Read

his ATTORNEY

(No Model.)

2 Sheets—Sheet 2.

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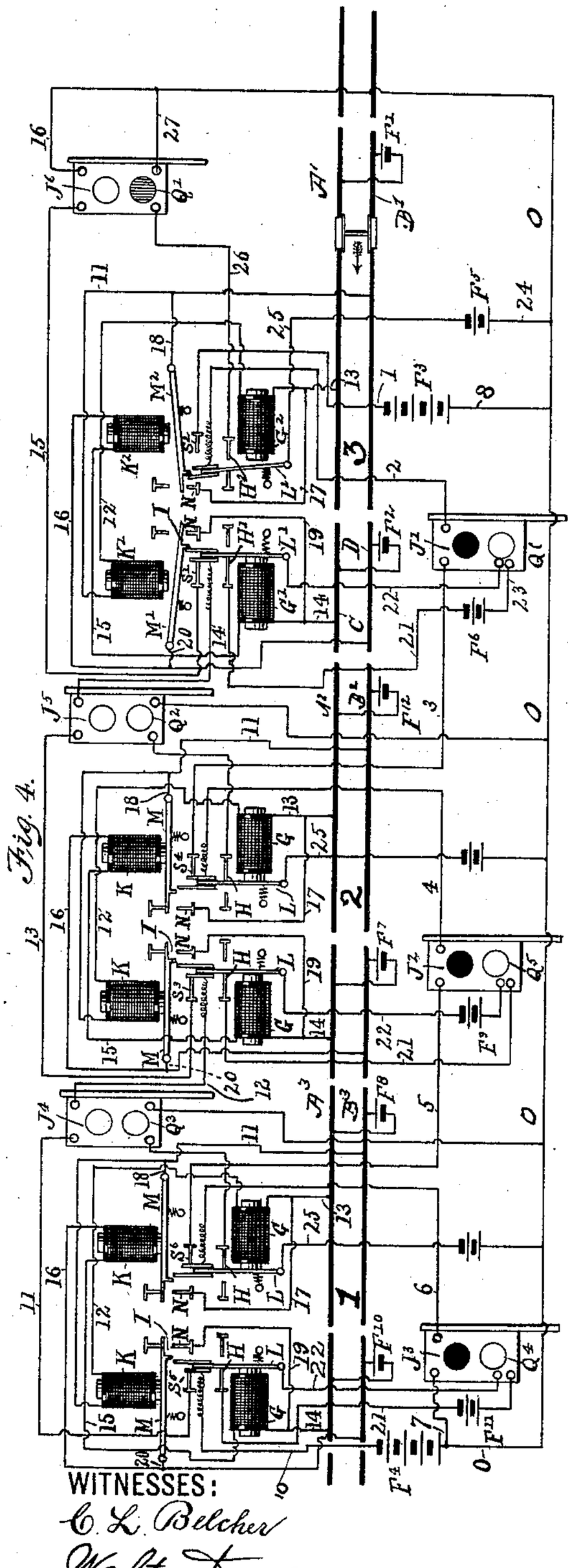

Fig. 4.

WITNESSES:
C. L. Belcher
Walter Dowe

INVENTOR
Robert J. Hewett
BY
Robert Read
Its ATTORNEY

UNITED STATES PATENT OFFICE.

ROBERT JOSEPHUS HEWETT, OF ST. LOUIS, MISSOURI.

ELECTRICALLY-CONTROLLED BLOCK-SIGNAL FOR RAILWAYS.

SPECIFICATION forming part of Letters Patent No. 594,471, dated November 30, 1897.

Application filed August 20, 1896. Serial No. 603,309. (No model.)

To all whom it may concern:

Be it known that I, ROBERT JOSEPHUS HEWETT, a citizen of the United States, residing in the city of St. Louis and State of Missouri, have invented certain new and useful Improvements in Electrically-Controlled Block-Signals for Railways, of which the following is a specification.

My invention relates to improvements in automatic electric block-signals for single-track railroads.

The object of my invention is to provide distinguishing signals to show the direction of movement of trains. Two separate sets of signals and signal-circuits—one set for each direction—are employed. A train moving in one direction—say westward—controls the west-bound protecting circuit and signals, but has no control over the east-bound circuit. So, also, an east-bound train controls only its own circuit and signals.

Briefly described, my invention comprises track-circuits, track-relays controlled thereby, and two or more signal-circuits so arranged that the passage of the train over the track-circuit in one direction—say west—will cause a track-relay to actuate the west-bound signal-circuit, and in like manner the passage of a train over the track-circuit in the other direction will cause another track-relay to actuate the east-bound signal-circuit. Each signal-circuit actuates two signals—a rear signal at the entering end of the block and an opposing signal at the forward end of the block. These two signals are made distinguishable from one another in any way and may be of a different color or shape, or both, and may preferably also have a recognized and understood difference of position or location, so as to provide as far as possible against mistaking the one for the other. The rear signal indicates to a following train that the block is occupied by a train moving in the same direction as itself, while the opposing signal indicates that a train is in the block moving toward the approaching train—that is to say, toward and against it. There are thus provided four signals to each block, two for each circuit. The two at each end may be mounted on the same post, if desired, and be contained in a common casing, the upper one, indicating opposing trains, being made more conspicuous in size, shape, and color. In order to permit the east-bound signals to be operated only by an east-bound train, I arrange the track-controlling devices so that they respond only to their appropriate trains and lock the other controlling devices of the block against action until the block is cleared.

My invention therefore comprises a signal system in which each block is provided with a plurality of independent track-circuits, each of which has a controlling device for a signal-circuit, and means for locking the other controlling devices of a block when one has been actuated by a train.

The several features of novelty will be more particularly hereinafter described, and will be definitely indicated in the claims appended to this specification.

In the accompanying drawings, which illustrate the invention, Figure 1 is a diagrammatic illustration of a system embodying my improvements. Fig. 2 illustrates a modification in which rear signals only are maintained. Fig. 3 shows a modification of the system shown in Fig. 1 and is capable of advantages in operation not offered by the latter, and Fig. 4 illustrates a system adapted to block opposing trains for several sections and yet display appropriate rear signals to permit trains to follow one another in close order.

Heretofore automatic electric block-signals for single-track roads have been designed and used for the special protection of dangerous localities, such as bridges, tunnels, curves, grades, junctions, and crossings.

My distinguishing-signal system provides a complete system of automatic blocking by means of which an entire division of single-track road can be put under block, not alone to protect a few dangerous localities, but to handle the traffic the same as is done by block-signals on double-track roads—that is, to handle a heavy single-track traffic and enable a large number of trains to be passed through in close order, always one block, at least, apart, and also fully protected by forward or opposing signals.

The signal device itself may be of any approved construction, a simple pivoted disk directly under magnetic control, such as is frequently used in signaling practice, being

suitable. In such a system normally the red disks in all four signals to a block are held up out of view in the openings of the signal-cases, each opening therefore presenting a white or clear signal. When a train approaches a block at either end, if both signals are white the train may proceed. If the upper signal be red, it indicates that there is a train on the block moving toward that end. If the lower signal be displayed, it indicates that there is a train on the block moving in the same direction as the approaching train. The approaching train must then stop and wait for the lower signal to change back to white, which indicates that the forward train has passed off the block. The approaching train is then at liberty to proceed. As the locomotive enters the block the engineer will see the lower signal change to red, which indicates to him that he has possession of the block and shows him also that the upper signal at the distant or forward end of the block has also been changed to red, thereby preventing a train from entering the block at the distant end. The lower signal at the entering end will protect his train in the rear. Both signals will be held in this position until the entire train passes off the block at the forward end, when both signals will pass back to white.

Referring now to the drawings, in Fig. 1 the rails A B constitute one track-circuit and the rails C D another, the two completing a block. The two subdivisions may be of any suitable length. One may be but one rail long and the other the balance of the block, or both may be of equal length. The two track-circuits are insulated from one another, each being composed on both sides of the track of bonded rails forming of each side of the track throughout the length of the section a continuous conductor. Each track-circuit is provided with a track-battery F' F^2 at one end and track-relays G' G^2 at the other end. The relays are normally on closed circuit and become deënergized when the rails are bridged by a pair of car-wheels. Relay G' controls the west-bound signal-circuit, which may be traced as follows: from wire O, connecting-wire 1, rear signal-magnet J', wire 2, battery F^3, wire 3, lever L' of track-relay G', forward contact H', wire 4, to opposing signal J^2 at W, through signal-magnet of J^2, short wire 5, to return-wire O. In like manner track-relay G^2 controls the east-bound signal-circuit, which may be traced as follows: from wire O at signal W, through signal-magnet of rear signal J^3, by wire 7, forward contact H^2 and lever L^2 of track-relay G^2, wire 8, signal-battery F^4, wire 9, through signal-magnet of opposing signal J^4 and wire 10, to return-wire O. Locking-magnet K' is in circuit with opposite track-relay G^2. Its lever M' is therefore normally held up and out of engagement with the upper end of L'. The latter is therefore free to move back or forward. When M' is released a detent on its outer end engages with and locks L' in whatever position it may happen to be. Similarly locking-magnet K^2 is in circuit with track-relay G' of the adjoining section and serves to lock relay G^2. This locking is mechanical on the forward position, but electrical on the back position. An east-bound train entering the block at, say, the west end W will short-circuit battery F^2 and deënergize relay G^2 and locking-magnet K'. Lever L^2 falls back, opening the east-bound signal-circuit and displaying rear signal J^3 and opposing signal J^4. Magnet K' drops its armature, the detent locking armature L' in its attracted position, thereby preventing the west-bound signal-circuit from being actuated when the train reaches the rail-section C D. The upper ends of levers L' L^2 have insulation between the lever and the contact-plates P' P^2, so as to insulate L' and L^2 from M' and M^2. When the wheels bridge the rails C D, magnets G' and K^2 are deënergized. Armature L' would fall back, but is prevented by the mechanical locking action just described. Armature M^2 of magnet K^2 drops off, closing a short circuit around magnets G^2 and K' at contact N^2 by way of wires 17 and 18, and this short circuit will be maintained as long as a single pair of wheels remain in the block, thus holding a signal set as long as a train or any portion thereof remains in the block. This is obviously of great importance in holding exposed the rear signal as well as the opposing one until all sources of danger are past. Thus the electrical lock effected by the short-circuiting action of the armature M' or M^2 preserves the same condition of the signals as obtained when the train occupied the neighboring section of the block. It will be observed that this electrical lock only takes place when the track-relay lever is on its back-stop. Levers M' or M^2 can then, and then only, make contact with the back contacts N' or N^2. When L' or L^2 is in the forward position, M' or M^2 in falling would be arrested by the insulated ends of L' or L^2 before reaching N' or N^2. These insulated ends are thin plates P' or P^2. After the train has passed entirely off the track-section A B all magnets except K^2 are inactive by reason of the mechanical and electrical locking just explained and K^2 cannot take current until section C D is cleared, when of course the lock is removed and all magnets are restored to their normal positions.

The signal-posts are set some three hundred or four hundred feet inside the block, so as to give the engineer ample opportunity to observe the opposing signal after having seen his rear signal turned on. In a case where two trains entered a block at opposite ends at approximately the same time one or the other of the opposing signals would be turned on and one train checked. If the two trains enter at precisely the same time, both opposing signals would be turned on and both trains checked. In this case, however, the interlocking relays would be thrown into a

dead-lock position, and would remain in such condition until restored by hand, and all four signals would be held at "danger" even after both trains had backed off the block. Obviously such a contingency would very rarely arise, and as the safety factor is not impaired the system would be found desirable in certain cases.

In Fig. 2 I have shown a modification in which only rear signals are displayed, the opposing signals being dispensed with. Such an organization contains features of novelty which might be found desirable in special cases where opposing signals are not needed. In this organization the arrangement of interlocking relays G′ G^2 and K′ K^2 is the same, but the signal-operating circuits include only one signal device—namely, the rear signal. A train on entering the block would set the signal against a following train, but would be unable to give an opposing signal. For example, when the front wheels of the engine bridged rails A B relay G^2 would drop off its armature, thereby opening the signal-circuit at H^2 and setting J^2 to "danger," but the other signal J′ would not be affected, as it is on another circuit. The rear signal J^2 would be held set until the last pair of wheels passes out of the block at the extreme end of track-circuit C D by means of the interlocking system of relays which have already been fully described.

A more complete plan, which obviates the possibility of the deadlock, is shown in Fig. 3. In this organization two complete local or subblock sections are employed in each main block. There being thus two independent local-block sections, both relaying into the two signal-circuits, both opposing signals will be displayed by the simultaneous entry of two trains at opposite ends of the block, and there can be no deadlock of the relays. In this organization each block comprises two pairs of track-sections A B, C D and A′ B′, C′ D′, and each signal-circuit includes two circuit-breaking armatures. A train entering A B, for example, at W would open the signal-circuit at H^4, and thus set the opposing and rear signals J^3 J^4. On passing into C D the contact at H^4 would be locked in its open position by lever M^4 of locking-magnet K^4, as already explained in connection with Fig. 1. On passing out of C D the lock would be opened. On passing into A′ B′ the signal-controlling circuit would be opened at a new point—namely, H^2—before the lock was removed at H^4, thus keeping the signals properly displayed. On passing into C′ D′ the lock at H^2 would be maintained until the entire train passed out of C′ D′. Now if two trains simultaneously entered at opposite ends of the block each sets its danger signals, but through the instrumentality of independent controlling devices, and said devices cannot possibly be shared in common at the same time, for the reason that both trains would be checked on entering the block and the one not holding the right of way must back into a siding. Any desired number of local-block sections may be arranged to relay into the signal-circuits in a similar manner, as will now be explained.

Fig. 4 is a diagram of a complete blocking system covering three local-block sections. Signal-cases containing opposing and rear signals are placed on the sides of the track, one set on the north, facing eastward, controlling the movements of west-bound trains, and the opposite set on the south side of the track, facing westward, controlling the movements of the east-bound trains. The east-bound protecting-signals are shown in action in the drawings. An east-bound train is passing over local-block section 3. Rear signal Q′ and all three opposing signals J′ J^2 J^3 are displayed. When the train touches local-block section 2, rear local-block signal Q^2 will change to red, and when the last wheel of the train leaves local-block section 3 rear signal Q′ will change back to white. In the same manner when the train touches A^3 B^3 of local-block section 1 rear signal Q^3 will change to red, and when the last wheel of the train leaves local-block section 2 rear signal Q^2 will change back to white. The opposing signals do not change in any way, but all remain at "danger" until all trains on the block have cleared off. Opposing signal J′ is of course useless after the train has passed into the next local-block section 2, but as it does no harm there is no objection to it. A number of trains can therefore follow each other through such a block. There may be a train in each local-block section. Each following train merely waits for the rear signal to clear, when it will proceed. After the first train has possession of the through-block and thereby turned on the west-bound opposing signals said signals will be held on until it and all other following trains have passed off at the other end of the through-block. The first train puts on the opposing signals, and the following trains merely continue the action. The last train off will permit all signals to clear. In brief, every local-block section and its rear signals must be clear before the opposing signals can clear. In complete blocking like this the several opposing signals displayed at the forward end of each local section prevents the simultaneous entry of two trains into the through-block. In fact, it is not necessary that there should be more than two opposing signals to do this, except where branch lines come in. A main opposing signal at each terminus of the through-block, with secondary or duplicate opposing signals on the same circuits and located some one thousand feet inside the block, will be sufficient. The secondary or inside signals being duplicates of the terminal signals will prevent the possibility of two trains entering simultaneously. In such a case while both engineers may have

passed the block terminal signals at the same instant, and therefore failed to see them changed, both will find the second or inside signals standing at "danger" and therefore know that two trains are on the through-block. By using only one inside signal one train only will be checked and the other train will run regardless. This virtually gives the right of way in one direction and is the better plan. The train which is brought to a stand by meeting the second or inside opposing signal merely backs into the siding it had started from, and this can be done with safety, because the train is protected by the terminal opposing signal as well as by its own rear signal. The rear signal is controlled entirely by the local-block section on which the train is moving.

Referring now particularly to Fig. 4, 1 2 3 represent three local blocks, each of which relays into two through-circuits controlling opposing signals. Wire O O O O is a common return-wire for the three circuits, two of which are through-circuits and one a local or rear block circuit. The west-bound protecting-circuit may be traced as follows: from wire O at battery F^4, wire 10, spring-contact and set-screw S^5, wire 11, opposing signal J^4, wire 12, spring-contact and set-screw S^3, wire 13, opposing signal J^5, wire 14, spring-contact and set-screw S', wire 15, terminal opposing signal J^6, wire 16 to return-wire O. Obviously the opening of any one of the contact-points S^5 S^3 S' will actuate this circuit, and as these contacts are attached to the relays which are actuated by west-bound trains only this circuit will be actuated by the passage of a west-bound train along the section. The east-bound protecting-circuit may be traced as follows: from wire O, by wire 8, battery F^3, wire 1, set-screw and spring-contact S^2, wire 2, opposing signal J', wire 3, set-screw and contact-spring S^4, wire 4, opposing signal J^2, wire 5, set-screw and spring-contact S^6, wire 6, opposing signal J^3, wire 7, to return-wire O. The opposing signals on this circuit are all shown displayed. Local block 3 is shown in action, the relays being in full lock position, the train having touched the first short rail-section C D. Let us suppose a train to be entering the block. On touching track-sections A' B' battery F' is short-circuited and track-relay G^2 is deënergized. Its armature drops off and opens the rear-signal circuit, which may be traced as follows: from wire O, by wire 24, battery F^5, wire 25, lever L^2, set-screw H^2, wire 26, rear signal Q', wire 27, back to return-wire O. The action of relay G^2 simultaneously opens the east-bound protecting-circuit at S^2, causing opposing signals J', J^2, and J^3 to be displayed, as shown. Lever M' of locking-magnet K' falls and detent I engages mechanically with plate extension of L', locking it in its normal or forward position and preventing it from opening. When the train bridges track-section C D, locking-magnet K^2 becomes demagnetized and its armature closes the short circuit at N^2 around magnet G^2 and K' by way of wires 17 and 18, thus holding on the signals as first set until the entire train has passed off section C D. When the train passes into local block 2, the same operation takes place in section A^2 B^2. Rear signal Q^2 will be displayed and the through or opposing signal-circuit will be opened at S^4. When the entire train clears the section C D, the first rear-block signal Q' will change back to white. Rear-block signals Q^2 and Q^3 will change in the same manner as the train passes from one local block to another, and when the train passes off at the eastern terminus rear-block signal Q^3 and all three of the opposing signals J', J^2, and J^3 will change back to white. In case a following train has entered the through-block it will actuate the signal-circuits in the same way. Each local block can be occupied by a train, and each train will be protected by rear-block signals independently actuated and all three trains will be protected in advance by the three opposing signals J' J^2 J^3.

The full equipment of a division of road with this system of block-signals would be effected in the following manner: Each road-space—that is to say, the track extending from one station or siding to another station or siding—would be equipped with the complete system shown in Fig. 4, and each station or yard space would be equipped with either of the blocks shown in Figs. 1 and 2 or 3. The road-block, Fig. 4, would terminate at the yard limits, so that a train switching at a station would not actuate the road-block signals. Where the road is curved as it enters the station, the road-block would be provided with both home and distant opposing signals, the home signal being placed a short distance (five hundred feet) inside from the end of the road-block track-circuit, while the distant opposing signal would be placed at the station. Where the track is straight and the line of vision unobstructed, the distant signal can be omitted.

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

1. In a railway signal system, a block having a plurality of insulated track-sections, each section being provided with an independent track-circuit and a forward and rear signal for the block for each direction, distinguishable in character, one in advance and the other in the rear of the controlling-train, each set being included in a circuit controlled by a relay in its governing track-circuit, and electromagnetic devices for locking the relay against change until the block is vacated.

2. In a railway signal system, a block having a plurality of insulated track-sections, each section being provided with an independent track-circuit, signals in independent signal-operating circuits for each direction

of travel, and interlocking magnetic devices controlling said signal-circuits and included in the track-circuits.

3. In a railway signal system a plurality of blocks, each having a plurality of insulated track-sections, each section being provided with an independent track-circuit, signals in normally-closed independent signal-operating circuits for each direction of travel, interlocking magnetic devices controlling said signal-circuits and included in the track-circuits, and circuit-changers controlled by said magnetic devices.

4. In a railway signal system a block having a plurality of insulated track-sections, each section being provided with an independent track-circuit, signals in independent signal-operating circuits for each direction of travel, magnetic devices in each track-circuit controlling the block-signals, and means for locking the signal-controlling device of a track-circuit when the corresponding device of an adjacent track-circuit operates, and holding it locked until the block is cleared.

5. In a railway signal system a block having a plurality of insulated track-sections, each section being provided with an independent track-circuit, a signal-operating circuit, controlling forward and rear signals at the block termini, a magnetic device in each track-circuit controlling the signal-operating circuit, and means for electromechanically locking the device of another track-circuit in a block when one has been actuated, and holding it locked until the block is cleared.

In testimony whereof I have hereunto subscribed my name this 14th day of August, A. D. 1896.

ROBERT JOSEPHUS HEWETT.

Witnesses:
SUZIE W. FEIGEL,
J. J. PATCHIN.