No. 771,030. PATENTED SEPT. 27, 1904.

E. W. VOGEL.

RAILROAD SIGNAL CIRCUITS.

APPLICATION FILED SEPT. 20, 1901.

NO MODEL.

Fig. 1.

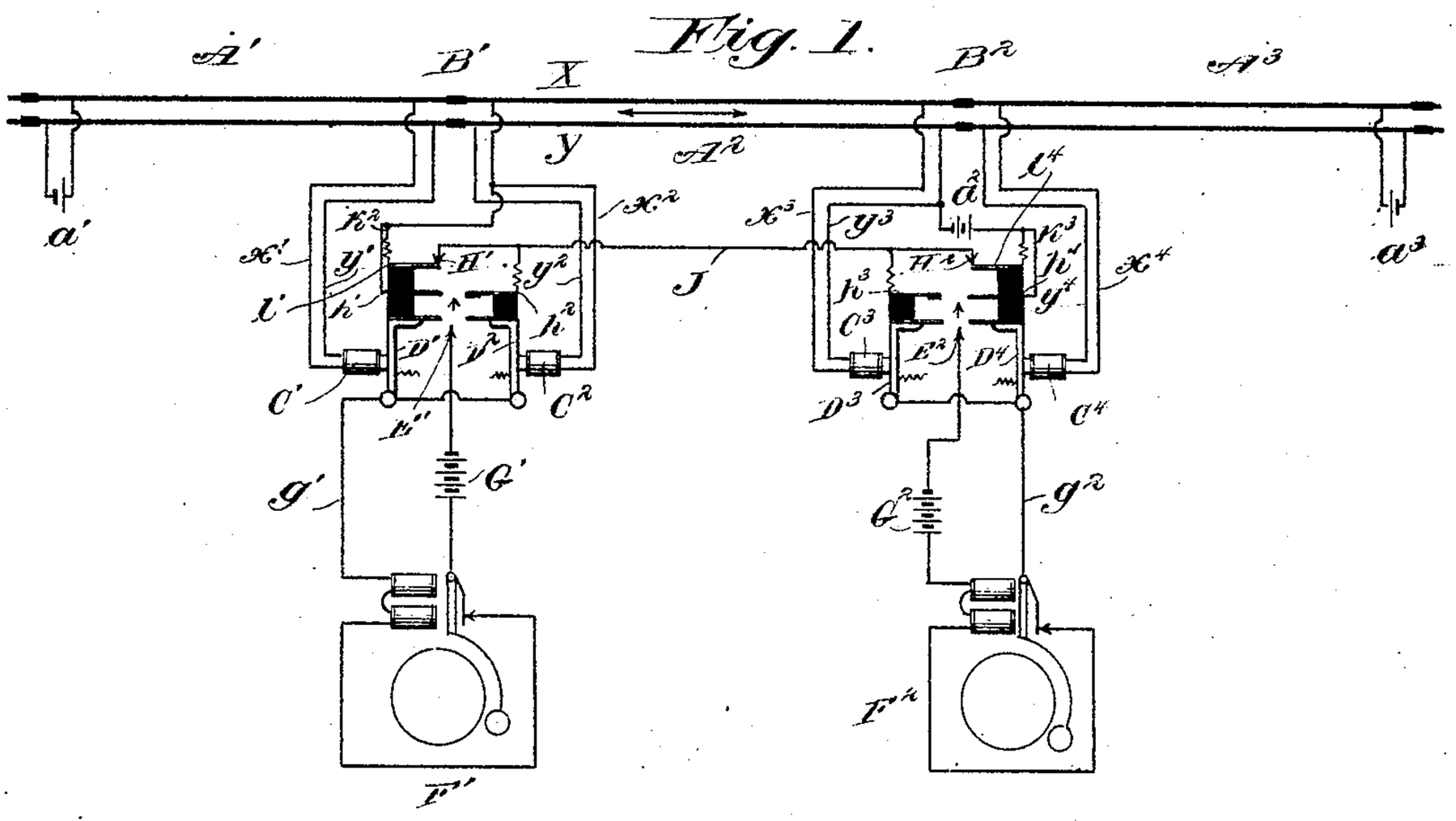
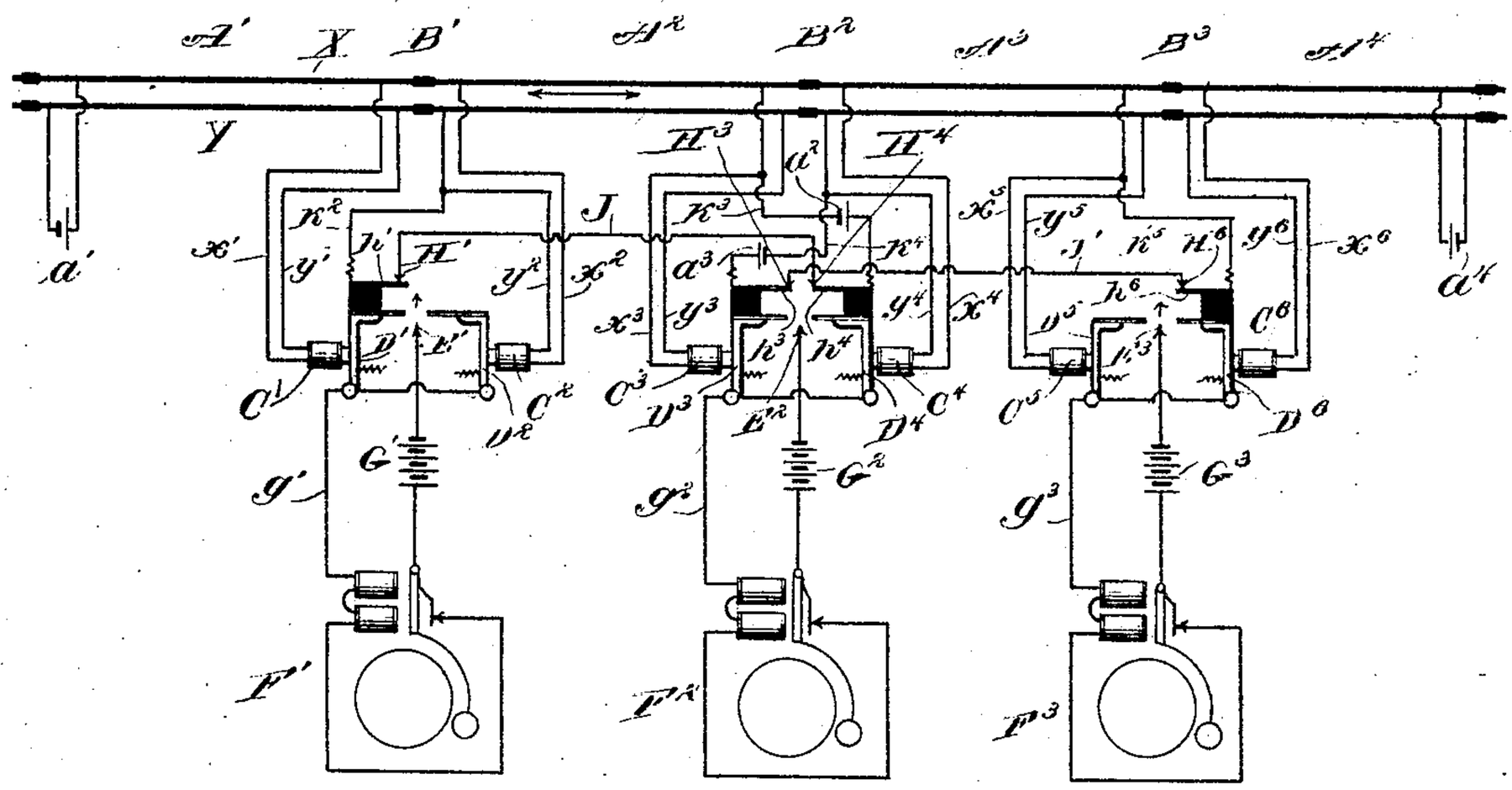


Fig. 2.



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No. 771,030. Patented September 27, 1904.

UNITED STATES PATENT OFFICE.

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RAILROAD SIGNAL-CIRCUITS.

SPECIFICATION forming part of Letters Patent No. 771,030, dated September 27, 1904.

Application filed September 20, 1901. Serial No. 75,929. (No model.)

To all whom it may concern:

Be it known that I, EUGENE W. VOGEL, a citizen of the United States, residing at Chicago, county of Cook, State of Illinois, have invented a certain new and useful Improvement in Railroad Signal-Circuits; and I declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it pertains to make and use the same, reference being had to the accompanying drawings, which form a part of this specification.

My invention relates in general to electrical signals, and more particularly to an arrangement of the controlling-circuits whereby a plurality of signals located at different points are simultaneously operated upon a train approaching one of the signals and are successively discontinued as the train passes by.

It is frequently necessary that a number of signals located at different points along the track—as, for instance, at a series of highways—should all be actuated upon the approach of a train from either direction; but it is undesirable that any one of the signals should be continued after the train has passed the point where it is located. Previous to my invention, so far as I am aware, the arrangements of the circuits for effecting the operation above described have necessitated the use of two wire conductors between the several signals, which has added materially to the expense of such systems, as the signals are frequently located at a considerable distance apart.

The object of my invention is to provide an arrangement of circuits for effecting the simultaneous operation of a plurality of signals when a train approaches one of them and for effecting the successive discontinuance of the signals as the train passes each one in which only one wire conductor without a ground-return between the several signals is required, thereby economizing the cost of construction and also avoiding the liability of short-circuiting the system by the crossing of conductors which exist when two wires are employed.

My invention, generally stated, consists in a single wire conductor extending between adjacent signals, the terminals of the conductor being connected at each signal to the same rail of an insulated track-section, and means included in such conductor controlled by the operation of one signal to actuate a second signal, which in turn when actuated may control a second circuit for effecting the actuation of a third signal.

My invention will be more fully described hereinafter with reference to the accompanying drawings, in which the same is illustrated as embodied in a convenient and practical form, and in which—

Figure 1 is a diagrammatic view illustrating my invention applied to two signals, and Fig. 2 a diagrammatic view illustrating the application of my invention to three signals.

Similar reference characters are used to indicate similar parts in the figures of the drawings.

Reference-letters X and Y indicate the rails of a railroad-track, the latter being divided into a number of insulated sections A', A^2, and A^3. These insulated track-sections extend from points B' and B^2, at which it is desirable to locate signals—as, for instance, highways or crossings.

F' and F^2 indicate signals located at the points B' and B^2, which may be of any desired type or construction. Normally open circuits, including batteries G' and G^2, are provided for operating the signals F' and F^2, respectively. These circuits are controlled upon the approach of a train to operate the signal and continue the operation thereof while the train is passing the given point, and upon the rear end of the train reaching such given point the circuit is controlled to discontinue the signal. The means which I have shown for controlling each of the signal-circuits is an interlocking relay, which for convenience is shown of the Hovey type, covered by Patent No. 552,181, dated December 30, 1895.

Track-circuits extend from the insulated track-sections at the point B', operatively connected to the magnets C' and C^2, respectively. The magnet C' is normally energized by the track-battery a', and thereby retains

its armature D′ out of engagement with the fixed contact-point E′. The armature D^2 is retained out of engagement with the contact E′ by the energization of the magnet C^2. The interlocking relay controlling the signal F^2 is provided with magnets C^3 and C^4, which when energized retain the armatures D^3 and D^4 out of engagement with the fixed contact E^2. The magnet C^4 is energized by means of the track-battery a^3, which is connected to the insulated track-section A^3, to the rails of which are also connected leads x^4 and y^4, forming a track-circuit, including the magnet C^4. A contact h' is mounted upon the armature D′ and insulated therefrom. A lead k^2 connects the contact h' with the lead x^2, which extends from the magnet C^2 to the rail X of the track-section A^2. A second spring-contact l' is also connected to lead k^2 and is carried by the armature D′ and supported by insulating material above the spring-contact h'. A spring-contact h^2 is mounted upon and insulated from the armature D^2 and is connected, by means of a lead, with a conductor J. The under side of the end of the spring-contact h^2 is provided with insulating material—such, for instance, as bone or ivory. The conductor J extends from a fixed contact H′, which is engaged by the spring-contact l' when the magnet C′ is energized. The conductor J terminates in a second fixed contact H^2, located at the second signal and engaged by a spring-contact l^4, mounted upon and insulated from the armature D^4. A second spring-contact h^4 is also carried by and insulated from the armature D^4. The armature D^3 also carries a spring-contact h^3, which is insulated therefrom and connected by a lead to the conductor J. The under side of the end of the spring-contact h^3 is provided with insulating material. A lead k^3 extends from the spring-contacts l^4 and h^4 to the lead y^3, which connects the magnet C^3 with the rail Y of the insulated track-section A^2. A battery a^2 for supplying current to the conductor J may be located at any desired point—as, for instance, in the lead k^3. The magnets C′ and C^4 are normally energized by means of the track-batteries a' and a^3, respectively, and consequently the armatures D′ and D^4 are normally held in the positions indicated in Fig. 1, thereby establishing the following circuit, which energizes the magnet C^2, thereby retaining the armature D^2 in the position indicated: from one pole of the battery a^2 to lead k^3, to movable contact l^4, to fixed contact H^2, to conductor J, to fixed contact H′, to movable contact l', to lead k^2, to lead x^2, to magnet C^2, to lead y^2, to track Y, thence through a portion of the lead y^3 to the other pole of the battery a^2. The magnet C^3 is energized when the armatures D′ and D^4 are held in the positions indicated by means of the energization of the magnets C′ and C^4 by the following circuit: from one pole of the battery a^2 to lead k^3, to movable contact l^4, to fixed contact H^2, to conductor J, to fixed contact H′, to movable contact l', to lead k^2, to rail X of the insulated track-section A^2, thence to lead x^3 through magnet C^3, to lead y^3, to the other pole of the battery a^2.

The operation of the application of my invention illustrated in Fig. 1 is as follows: When a train approaching from the left enters the insulated section A′, the track-battery a' is short-circuited, thereby deënergizing the magnet C′ and permitting the armature D′ to fall into engagement with the fixed contact E′, thereby closing the signal-circuit and actuating the signal as follows: contact E′ to battery G′, through the signal mechanism F′ to lead g', to armature D′, thence to contact E′. The dropping of the armature D′ removes the contact l' from engagement with the fixed contact H′, thereby breaking the circuits which energize the magnets C^2 and C^3. Consequently the signal F^2 is also operated through the following circuit: contact E^2, battery G^2, through the signal mechanism F^2, to lead g^2, to armature D^3, to contact E^2, with which the armature engages upon the deënergization of the magnet C^3 through the breaking of its controlling-circuit. When the rear truck of a train has passed from the insulated track-section A′, the track-battery a' is no longer short-circuited, and consequently the magnet C′ is energized and the armature D′ lifted from engagement with the contact E′, thereby breaking the circuit of the signal F′ and discontinuing such signal. The signal at F^2 would continue, however, as the magnet C^3 would be short-circuited by the train upon the insulated track-section A^2, to the opposite rails of which its controlling-circuit, which includes the battery a^2, is connected. When the rear of the train passes the point B^2, the magnet C^3 is again energized, and thereby lifts the armature D^3 out of engagement with the contact E^2 and discontinues the signal at F^2 by breaking the signal-circuit. It should be noted that when a train has passed the point B^2, but still occupies the insulated track-section A^3, the magnet C^4 is deënergized, which permits the armature D^4 to fall, breaking the engagement between the movable contact l^4 and fixed contact H^2, which would deënergize the magnet C^2 and operate the signal at F′ were it not for the fact that the spring-contact h^4 engages the top of the spring-contact h^3 by reason of the armature D^3 having fallen previous to the fall of the armature D^4, thereby closing the circuit through the lead k^3, spring-contact h^4, to spring-contact h^3, to conductor J, and continuing the energization of the magnet C^2, which prevents the fall of armature D^2 and avoids the operation of the signal at F′.

The operation when a train approaches from the right is similar to the operation above explained and need not be described in detail. It might, however, be mentioned that when a

train has passed the point B′ going to the left the signal at F² is prevented from being actuated by the circuit which energizes the magnet C³ being closed around the break which occurs between fixed contact H′ and spring-contact l', owing to the armature D′ being in its fallen position owing to the short-circuiting of the magnet C′ by the train. The circuit around the contact H′ is as follows: k^2 to spring-contact h', to spring-contact h^2, through the connecting-lead to conductor J. By providing insulating material at the under sides of the ends of spring-contacts h^2 and h^3 the falling of the armatures D′ and D⁴ previous to the falling of the armatures D² and D³, respectively, does not complete the circuit to the conductor J around the contact-points H′ and H².

In Fig. 2 I have illustrated my invention as applied to three signals instead of two, and it will be obvious from the following description that it may be applied to any desired number of signals. The arrangement of the circuits at the signals F′ and F² is the same as where only two signals are operated except that the armature D³ is provided with an insulated contact h^3 for controlling a second circuit leading to the third signal F³, such circuit comprising a conductor J′, extending from a fixed contact H³, engaged by the movable contact h^3, to a fixed contact H⁶, located at the third signal F³. A lead k^4 extends from the contact h^3 to the lead y^4, which connects the magnet C⁴ with the track Y of the insulated track-section A³. The arrangement of the circuits at the third signal F³ is in all respects similar to the arrangement of the circuits at the signal F′ except that the contact H⁶ is mounted upon and insulated from the right-hand armature D⁶ of the interlocking relay, whereas the corresponding contact h' is mounted upon the left-hand armature of the interlocking relay in the arrangement at the signal F′.

The operation of the arrangement of circuits illustrated in Fig. 2 is as follows: The magnets C′ and C⁶ are normally energized by the track-batteries a' and a^4, connected to the insulated track-sections A′ and A⁴, to the rails of which are connected track-circuits including the magnets C′ and C⁶, respectively. Magnet C² is energized by the following circuit: from one pole of the battery a^2 to movable contact h^4, to fixed contact H⁴, to conductor J, to fixed contact H′, to movable contact h', to lead k^2, to lead y^2, through magnets C², to lead x^2, to rail X of the insulated track-section A², thence through a part of lead x^3, to lead k^3, to the other pole of the battery a^2. The magnet C³ is normally energized by the following circuit: from one pole of the battery a^2 to movable contact h^4, to fixed contact H⁴, to conductor J, to fixed contact H′, to movable contact h', to lead k^2, through a portion of the lead y^2, to rail Y of the insulated track-section A², thence to lead y^3, through magnet C³, to lead x^3, to lead k^3, back to the other pole of the battery a^2. The magnet C⁴ is normally energized by the following circuit: from one pole of the battery a^3 to movable contact h^3, to fixed contact H³, to conductor J′, to fixed contact H⁶, to movable contact h^6, to lead k^5, to rail X of the insulated track-section A³, to lead x^4, through magnet C⁴, to lead y^4 to lead k^4, thence back to the other pole of the battery a^3. The magnet C⁵ is normally energized by the following circuit: from one pole of the battery a^3 to movable contact h^3, to fixed contact H³, to conductor J′, to fixed contact H⁶, to movable contact h^6, to lead k^5, to lead x^5, through magnet C⁵, to lead y^5, to rail Y of the insulated track-section A³, through a part of lead y^4 to lead k^4, back to the other pole of the battery a^3.

When a train approaches from the left in Fig. 2 and enters the insulated track-section A′, the track-battery a' is short-circuited, thereby deënergizing the magnet C′, which permits the armature D′ to fall into engagement with the contact E′, thereby closing the signal-circuit through the battery G′ and signal mechanism F′. The armature D′ when it falls through the deënergization of the magnet C′ breaks the engagement between the movable contact h' and fixed contact H′, and thereby deënergizes the magnet C³, which permits the armature D³ to fall into engagement with contact E², closing the signal-circuit through the local battery G² and signal mechanism F². When the armature D³ falls through the deenergization of the magnet C³, the engagement between contacts h^3 and H³ is broken, and thereby deënergizing magnet C⁵, which permits armature D⁵ to fall into engagement with contact E³, thereby establishing a local circuit through battery G³ and signal mechanism F³. It is therefore evident that the signals at points B′, B², and B³ are simultaneously actuated when a train approaches point B′. When a train passes the point B′, the track-battery a' is no longer short-circuited, and consequently energizes the magnet C′, which lifts the armature D′ out of contact with point E′, thereby discontinuing the signal F′ located at such point B′. The signal mechanism located at B² and B³, however, continues, inasmuch as the train upon the insulated track-section A² short-circuits the battery a^2, thereby continuing the deënergization of the magnet C³, and consequently continuing the interruption of the circuit through magnet C⁵. When the rear of a train has passed the point B², the battery a^2 is no longer short-circuited and then energizes magnets C² and C³, thereby elevating the armatures D² and D³, respectively, out of contact with the points E′ and E². The signal mechanism F² located at the point G² is therefore discontinued. The signal at point B³, however, continues as long as any portion of the train

is upon the insulated track-section A^3, owing to the battery a^3 being short-circuited thereby, and the magnet C^5 continues deënergized. When the rear truck of the train has passed the point B^3, the magnet C^5 is energized and attracts its armature D^5, thereby breaking the circuit through the signal mechanism F^3 located at the point B^3.

The operation of the application of my invention illustrated in Fig. 2 when a train approaches from the right is similar in all respects to that above explained as occurring when a train approaches from the left and need not be described in detail.

Contacts similar to l', l^4, h^2, and h^3 for preventing the interruption of the circuit between pairs of signals when the train has passed each signal are employed in the arrangement shown in Fig. 2, in which the invention is shown as applied to three signals. Such contacts have been, however, omitted from Fig. 2 to avoid confusion.

It is obvious that my invention is applicable to practically any number of signals, it being merely necessary to continue the arrangement of circuits illustrated in Fig. 2.

From the foregoing description it is evident that I have provided an arrangement of circuits comprising only one wire conductor extending between the signals whereby a series of signals located at distant points may be simultaneously operated when a train approaches either of such signals and whereby each signal may be discontinued when it is passed by the train.

While I have illustrated the Hovey type of relay for controlling the signal-circuits, it is obvious that interlocking relays of other types could be employed equally as well.

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

1. In a railroad signal system, the combination with a plurality of signals, of controlling means for each of said signals, a normally closed circuit comprising a wire conductor extending between pairs of such signals and an insulated track-rail also extending between pairs of such signals, means actuated simultaneously with the operation of the controlling means for each signal for breaking said circuit, and means actuated by said circuit at each signal for controlling the operation thereof, substantially as described.

2. In a railroad signal system, the combination with a plurality of signal-circuits, of signals included in and operated by said circuits, circuit-controllers for said signal-circuits, a normally closed circuit including said circuit-controllers comprising a wire conductor extending between pairs of such signals and an insulated rail also extending between pairs of such signals, means operated by said circuit-controllers for controlling said normally closed circuit whereby said normally closed circuit is adapted both to be actuated by and to actuate the circuit-controllers at each of said pairs of signals, substantially as described.

3. In a railroad signal system, the combination with a plurality of signal-circuits, of signals included in and operated by said circuits, interlocking relays controlling said circuits, track-circuits operatively connected to said interlocking relays, a circuit comprising a wire conductor extending between pairs of such signals and an insulated track-rail operatively connected to the interlocking relays at each of said signals, contacts carried by said relays adapted to engage contacts in said circuit whereby one relay when actuated by the approach of a train controls said circuit and thereby actuates the other relay, substantially as described.

4. In a railroad signal system, the combination with a plurality of signal-circuits, of signals included in and operated by said circuits, interlocking relays controlling said signal-circuits, track-circuits operatively connected to said interlocking relays, a wire conductor extending between pairs of signals and terminating in fixed contacts, insulated movable contacts carried by armatures in said interlocking relays adapted to engage said fixed contacts, means connecting said insulated movable contacts with the leads of said track-circuits which extend to the opposite rails of an insulated track-section, and a source of electricity in the circuit through said conductor, substantially as described.

5. In a railroad signal system, the combination with a plurality of signal-circuits, of signal mechanism included in and operated by said circuits, interlocking relays controlling said signal-circuits, track-circuits connecting the magnets of said relays to the pairs of rails in adjoining track-sections, a wire conductor extending between pairs of signals and terminating in fixed contacts, an insulated contact carried by an armature in each relay adapted to engage one of said fixed contacts, a lead at each relay connecting the insulated contact on the armature with the track-circuit leading through the magnet of the other armature of said relay, said leads at the two relays being connected to the track-circuits at points adjacent to opposite rails of an insulated track-section, and a source of electricity included in the circuit through said conductor, substantially as described.

6. In a railroad signal system, the combination with a plurality of signal-circuits, of signals included in and operated by said circuits, circuit-controllers for said signal-circuits, a normally closed circuit comprising a wire conductor extending between pairs of such signals and an insulated rail also extending between pairs of such signals, said circuit adapted both to be actuated by and to actuate the circuit-controllers at each of said pairs of signals, and track-circuits operatively including

said circuit-controllers connected to an insulated track-section which comprises said insulated rail, whereby the same insulated section of track forms a part of the usual track-circuits and also a part of the circuit for simultaneously controlling separate signals, substantially as described.

7. In a railroad signal system, the combination with a plurality of signal-circuits, of a signal included in and operated by said circuits, electromagnetic circuit-controllers for said signal-circuits, a normally closed circuit comprising a wire conductor extending between pairs of such signals and an insulated rail also extending between pairs of said signals and including said electromagnetic circuit-controllers, whereby said normally closed circuit is adapted both to be controlled by and to actuate the circuit-controllers at each of said pairs of signals, and a battery located in said normally closed circuit for energizing the electromagnetic circuit-controllers at both signals, substantially as described.

In testimony whereof I sign this specification in the presence of two witnesses.

EUGENE W. VOGEL.

Witnesses:
GEO. L. WILKINSON,
CLARA C. CUNNINGHAM.