No. 820,413. PATENTED MAY 15, 1906.

H. W. GRIFFIN.

RAILWAY SIGNALING SYSTEM.

APPLICATION FILED FEB. 28, 1905.

4 SHEETS—SHEET 1.

Fig: 1.

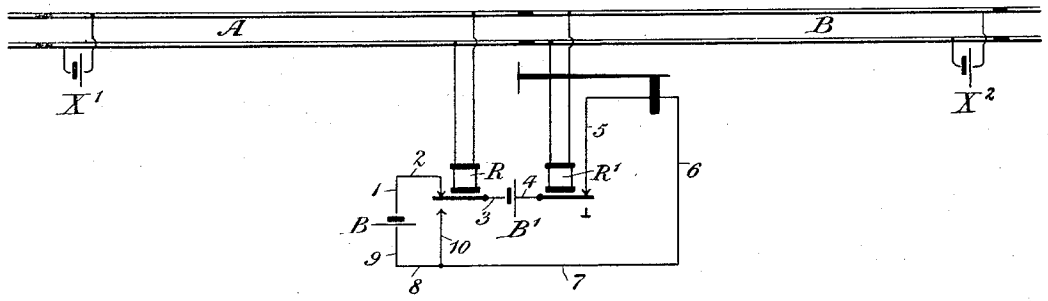


Fig: 2.

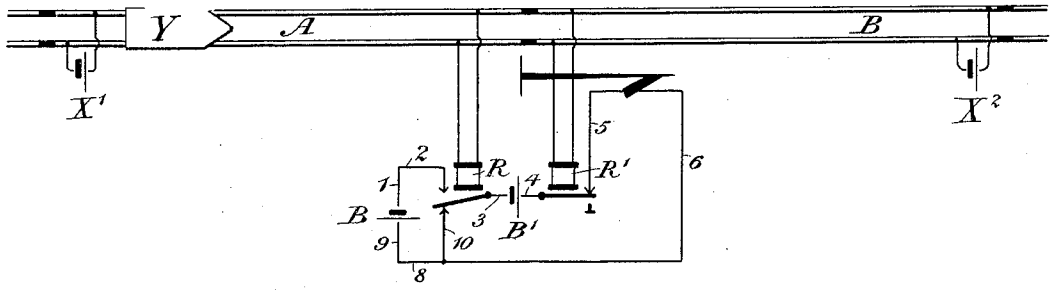
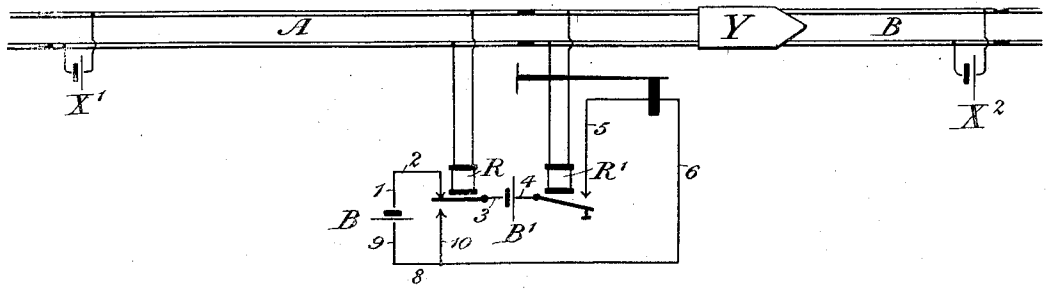


Fig: 3.



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4 SHEETS—SHEET 2.

Fig: 4.

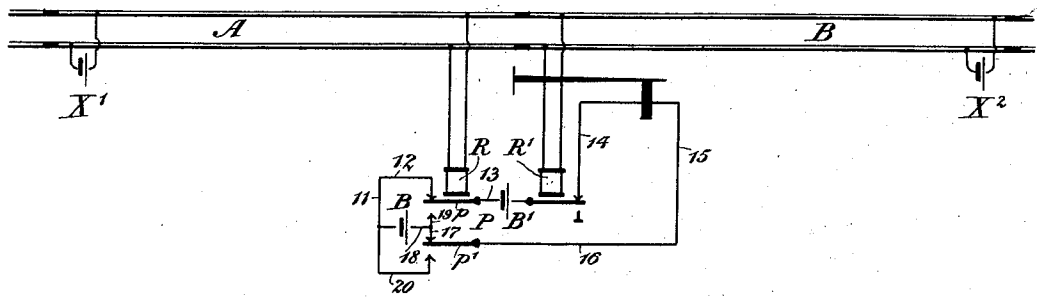


Fig: 5.

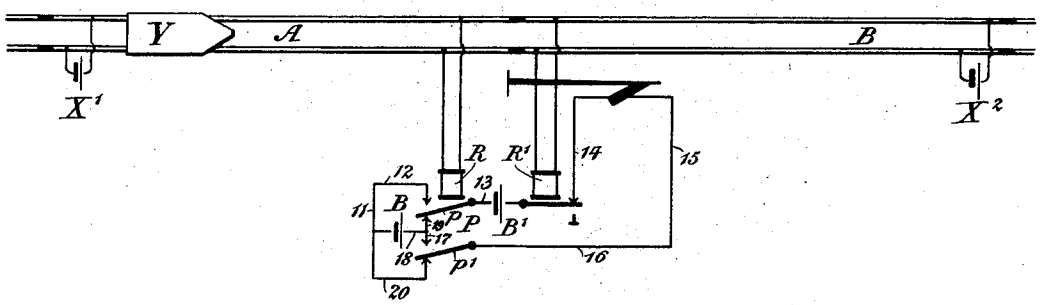
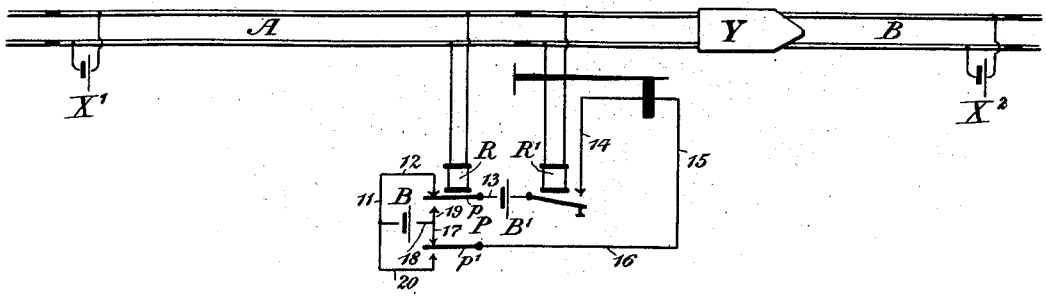


Fig: 6.



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4 SHEETS—SHEET 3.

Fig. 7.

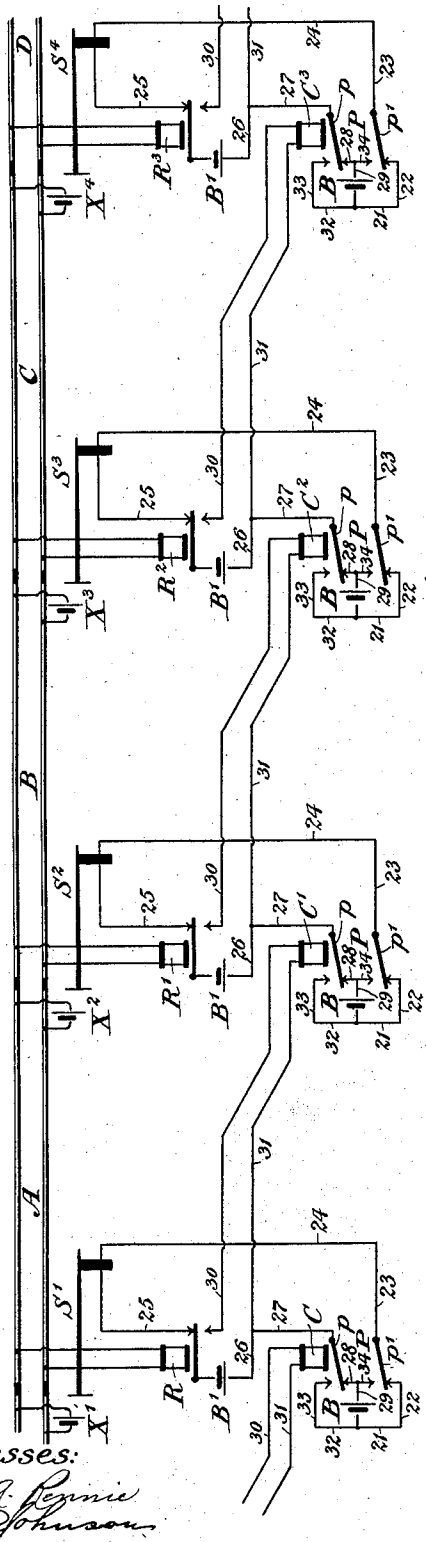
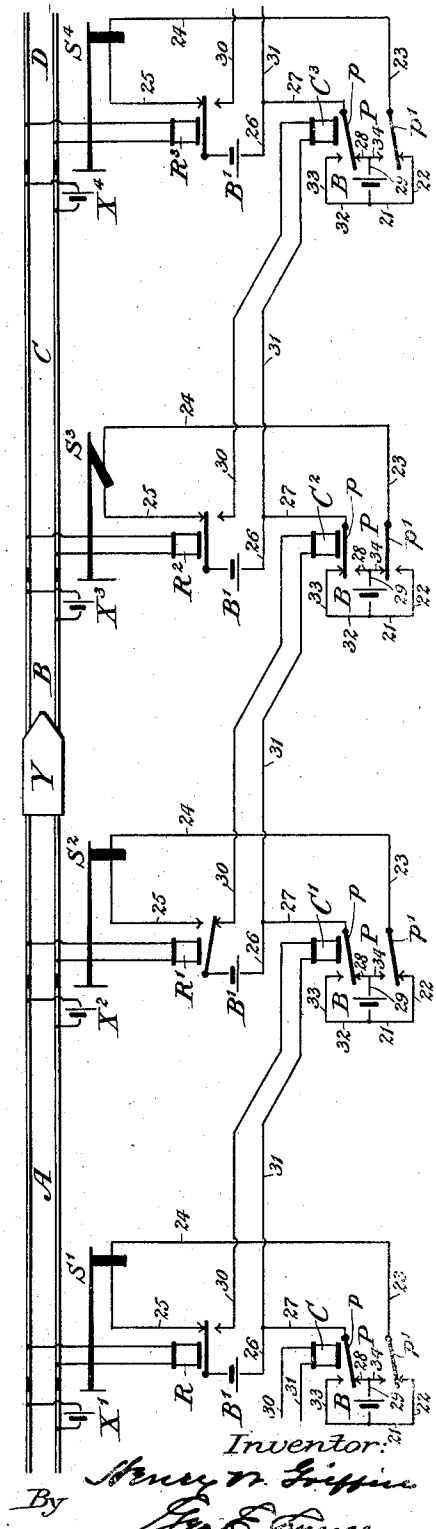


Fig. 8.



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No. 820,413. PATENTED MAY 15, 1906.

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RAILWAY SIGNALING SYSTEM.

APPLICATION FILED FEB. 28, 1905.

4 SHEETS—SHEET 4.

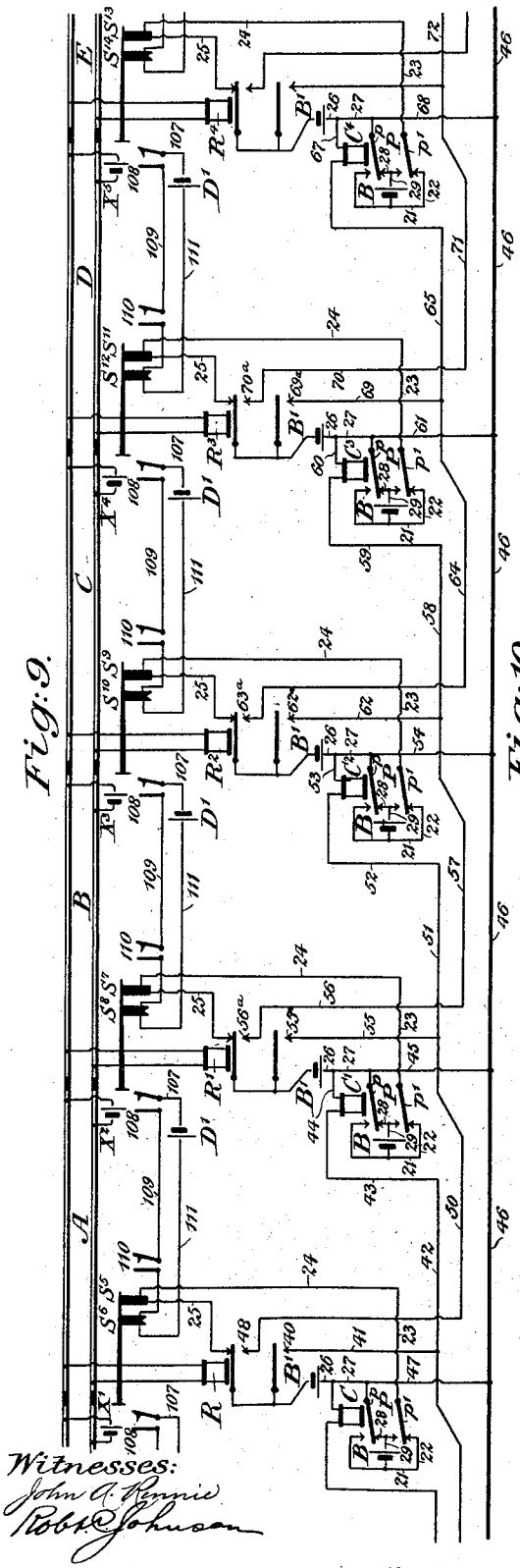

Fig. 9.

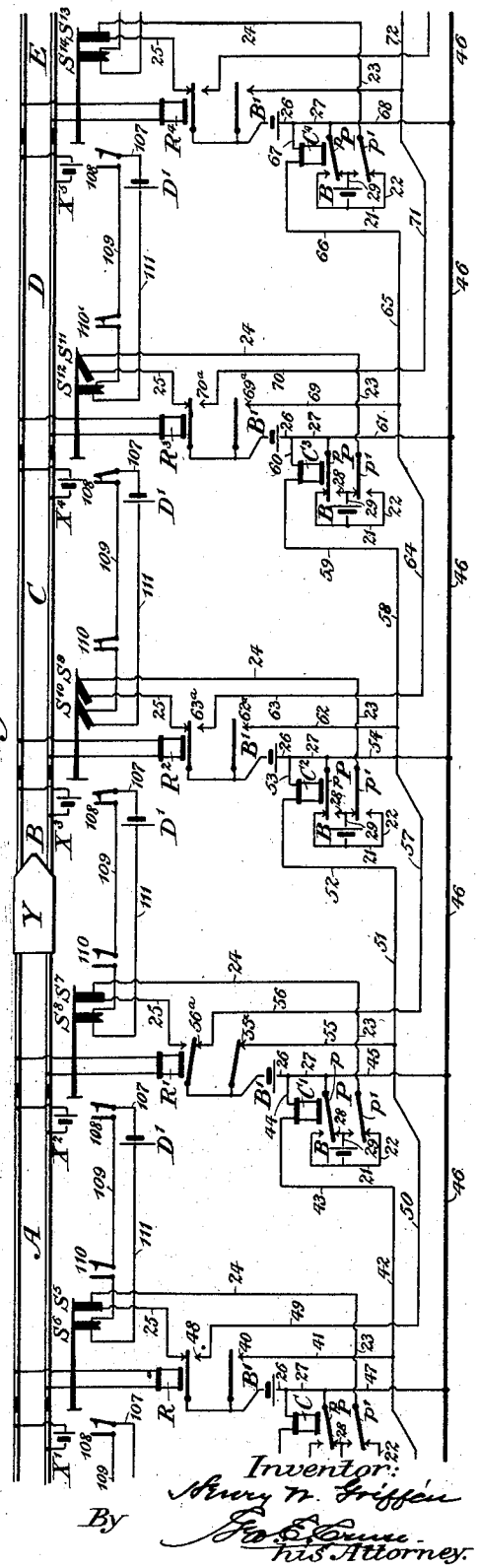

Fig. 10.

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UNITED STATES PATENT OFFICE.

HENRY W. GRIFFIN, OF NEW YORK, N. Y., ASSIGNOR TO THE UNION SWITCH AND SIGNAL COMPANY, OF SWISSVALE, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

RAILWAY SIGNALING SYSTEM.

No. 820,413. Specification of Letters Patent. Patented May 15, 1906.

Application filed February 28, 1905. Serial No. 247,726.

To all whom it may concern:

Be it known that I, HENRY W. GRIFFIN, a citizen of the United States, residing in the borough of Manhattan, city, county, and State of New York, have invented certain new and useful Improvements in Railway Signaling Systems, of which the following is a specification.

My invention relates to railway signaling systems.

I will describe a railway signaling system embodying my invention and a variation or modification of the signaling system also embodying my invention and then point out the novel features thereof in claims.

In the accompanying drawings, Figure 1 is a diagrammatical view illustrating a portion of a railway, a signal, and applied thereto an arrangement of circuits for controlling the movements of the signal device and embodying my invention. Figs. 2 and 3 are views similar to Fig. 1, but showing different conditions of the circuits due to the presence of a train. Fig. 4 is a view similar to Fig. 1, but showing a variation or modification of the invention shown in Fig. 1. Figs. 5 and 6 are views similar to Fig. 4, but showing different conditions of the circuits due to the presence of a train. Fig. 7 is a diagrammatical view of a portion of a railway and applied thereto a signaling system embodying my invention. Fig. 8 is a view similar to Fig. 7, but showing a different condition of the system due to the presence of a train. Fig. 9 is a diagrammatical view of a portion of a railway and applied thereto a signaling system embodying my invention. Fig. 10 is a view similar to Fig. 9, but showing a different condition of the system due to the presence of a train. Figs. 9 and 10 illustrate a different system of signaling from that illustrated in the other figures.

Similar characters of reference designate corresponding parts in all of the figures.

By the term "system" as herein used and contemplated by my invention I mean an arrangement or combination of electrical circuits so arranged that a change in condition of a circuit produces or causes a change in one or more other circuits, and thereby control or effect the operation of apparatus that may be embodied or included in the system.

My invention has especial reference to automatic block-signaling systems, which, as generally understood, consists of the automatic operation and automatic control of the signaling devices located at successive points along a railway. The automatic control is obtained through the arrangement or combination of circuits forming the system, the arrangement being such that a train acts, primarily, on one or more circuits to produce a change in condition thereof, and thus effect other circuits simultaneously or in succession or apparatus included in such circuits.

The signaling devices of the railway-signals embodied in the system usually give a danger indication—that is to say, a train or car approaching a railway-signal will, if the conditions warrant, act to affect certain circuits to cause the mechanism of that railway-signal to operate its signal device to have it indicate "safety," and the train or car after passing the railway-signal acts again on other circuits to have the signal device display a danger indication to succeeding cars or trains. In other words, my invention relates to what is known in the art as a "normal danger system of signaling."

Referring now to the drawings, T designates a portion of a railway the track-rails of which are, by means of insulation *t*, placed at suitable points, divided into track-sections. I have illustrated a plurality of such track-sections A B C D, &c. There may be any number of such track-sections, and they may be of any desired length. For convenience I will hereinafter refer to the sections A B, &c., as block-sections, it being understood, however, that there may be any number of track-sections in a block-section. At the entrance end of each block-section is located one or more railway-signals, each of which may be of any of the well-known types of railway-signals. Each railway-signal is provided with a suitable form of signal device, such as a semaphore, disk, banner, &c., and an automatically-operating mechanism for moving it, preferably from a position or color indicating "danger" to a position or color indicating "safety." Each signal device is weighted or biased in such manner as to always tend to move to the danger position or display a danger color. Preferably the semaphore type of signal device is employed and, as

stated, any type of automatically-operating mechanism. As examples of what types of railway-signals may be used reference may be had to the following United States Patents, to wit: No. 600,385, granted March 8, 1898, to V. K. Spicer; No. 611,943, granted October 4, 1898, to J. G. Schreuder, and No. 745,309, granted November 24, 1903, to J. P. Coleman. Each of these patents describes and illustrates a railway-signal the signal device of which is in the form of a semaphore and comprising a spectacle acting as a counterweight and a blade and an automatically-operating mechanism for moving the signal device from its danger position to its safety position.

Each block-section is provided with a track-circuit which, as is well known, comprises a source of current, the track-rails of the block-section, and a relay. X' X^2 X^3, &c., designate sources of current for the track-circuits of the block-sections, and R R' R^2, &c., relays for the track-circuits of the block-sections, which may be of any desired type, according to the signaling system employed. Each track-circuit has the usual condition of being closed, and in this condition each relay attracts its armature against what is generally termed its "front" contact. When, however, a train is in a block-section, the wheels and axles thereof or any pair of wheels and their axle act as a path of low resistance to the current flowing in the track-rails of the track-circuit of that block-section, and thus shunt the current from the track-relay and permit it to drop or have its armature and the springs carried thereby moved by a spring. Each relay may be provided with a plurality of front contacts, (see Figs. 9 and 10,) which are included in different circuits. This is diagrammatically illustrated in these figures by a plurality of armatures each moving between a front and back contact. The construction of these relays is well known. The front and back contacts are supported in insulation and the springs carried by the armature and which move between the front and back contacts are supported in insulation, so that a cross between springs or contact-points is avoided.

Referring now to Figs. 1 to 3, which illustrate the principle involved in my invention, I have shown a single railway-signal and the necessary circuits for its control—that is, the necessary circuits which cause it first to be moved from its danger position (its usual or normal position) to its safety position and again back to its danger position. The signal-circuit, or, as it is sometimes called, the "local circuit" thereof, is usually or normally closed and comprises two sources of current B B', (shown as being batteries,) which are so arranged in this circuit as to oppose, balance, or neutralize each other, so that no current will flow, or if there should be a flow of current it will be insufficient to operate the signal of that circuit. Consequently there will be no current from either of the sources flowing in the circuit, and therefore the operating mechanism of the railway-signal will be inert. As soon, however, as one of the sources is cut out of the circuit current from the other source will energize an electromagnetic device comprised in the mechanism, and thus have the apparatus move the signal device from its danger position to its safety position. (See Fig. 2.) The signal-circuit for the railway-signal (which in this instance is local to the railway-signal) may be traced as follows: starting from the + pole of battery B, wires 1 2, front contact and armature of relay R, wire 3, + pole of battery B', wire 4, armature and front contact of relay R', wire 5, operating mechanism of the railway-signal, and wires 6, 7, 8, and 9 to − pole of battery B. No current will flow in this circuit, because the batteries B B' oppose each other. As soon, however, as a train Y enters the block-section A or other block-section preceding the railway-signal it acts to short-circuit the relay R of that section, which being deënergized drops its armature onto its back contact, thus cutting out one of the batteries (the battery B, see Fig. 2) and closes another circuit, (which is also local to the railway-signal,) which may be traced as follows: battery B', wire 4, armature and front contact of relay R', wire 5, operating mechanism of the railway-signal, wires 6, 7, and 10, back contact and armature of relay R, and wire 3 to battery. As soon as this circuit is established and if no train is in the block-section B the signal device of the railway-signal will be moved from its danger position to its safety position. Should, however, a train be in the block-section B, the signal device will not be moved from its danger position, as the train in the block-section B will have short-circuited the battery from the relay R' of that section, and thus have it open the local circuit by its armature moving onto its back contact. Assuming that the signal device was moved from its danger position to its safety position and the train Y to have entered the block-section B, then the signal device will again move or be moved to its danger position under the influence of its counterweight, due to the opening of the circuit by which the signal was cleared, by the relay R' dropping its armature onto its back contact. (See Fig 3.) The relay R' drops its armature by reason of the train shunting its battery.

In Figs. 4, 5, and 6 precisely the same conditions exist as in Figs. 1, 2, and 3. The only difference between these two sets of figures is that in Figs. 1, 2, and 3 the relay R when deenergized cuts out one battery in the signal-circuit and establishes another signal-circuit, while in Figs. 4, 5, and 6 the relay R operates a pole-changing device P, so that both bat-

teries B B′ may be included in the signal-circuit. The pole-changing device P and its operation by a relay or any other means is so well known in the art as not to require further description. In Fig. 4 the batteries are opposed, the circuit being from + pole of battery B, wires 11, 12, arm *p* of pole-changer P, wire 13, + pole of battery B′, armature and front contact of relay R′, wires 14, operating mechanism of railway-signal, wires 15, 16, arm *p′* of pole-changer, and wires 17, 18 to — pole of battery B. In Fig. 5 the batteries are in series, the circuit being from — pole of battery B, wires 18, 19, arm *p*, wire 13, + of battery B′, armature and front contact of relay R′, wire 14 operating mechanism of railway-signal, wires 15 16, arm *p′* of pole-changer, and wire 20 to + pole of battery B. In Fig. 6 both batteries are cut out of the signal-circuit by reason of the short-circuiting of the relay R′ by a train in its block-section and its dropping its armature, just as in Fig. 3 the single and remaining battery B′ is cut out of the signal-circuit by the action of the train on the relay R′. It will be seen, therefore, that each signal-circuit is usually or normally closed and includes opposing batteries and that one of the batteries is cut out of the signal-circuit or brought into series with the second battery by the action of a train on a block-section preceding or in advance of a railway-signal in order that the railway-signal may move its signal device from its danger position to its safety and be retained in that position and that after the train has proceeded past the signal in its safety position the signal-circuit is opened by the action of the train to permit the signal device to again return to its danger position.

It will be understood, of course, that what I have herein termed the "signal-circuit" is that circuit which causes the signal device to be moved from its danger position to its safety position, and it may or may not be used for holding or retaining the signal device in its safety position. In the event that it is not used for holding or retaining the signal device in its safety position a special holding-circuit may be used. What I intend to be covered by the term "signal-circuit" is a circuit which will cause the signal device to be moved from its danger position to its safety position by the action of a train on one track-circuit and which is opened or disabled by the action of a train on another track-circuit. This circuit in accordance with my invention is usually closed, but no current is flowing therein, and current is made to flow therein by the action of a train on one track-circuit and to be opened by the action of a train on another track-circuit. Usually in the signaling art when no current is flowing in the signal-circuit the signal device of the railway-signal of that signal-circuit is in its danger position, and when current is flowing in the signal-circuit the signal device is caused to be moved and sometimes held in its safety position.

Referring now to Figs 7 and 8, each block-section A B C, &c., is provided with a track-circuit which, as shown, is closed and with a railway-signal S′ S^2 S^3, &c., at its entrance end. Each railway-signal is provided with a closed signal-circuit, which may be traced as follows: Starting from + pole of battery B it is wires 21 22, arm *p′* of pole-changer P, wires 23 24, operating mechanism of railway-signal S′ S^2, &c., as the case may be, wire 25, armature and front contact of track-relay R R′, &c., as case may be, + pole of battery B′, wires 26 27, arm *p* of pole-changer P, and wires 28 29 to battery B. The batteries B B′ are opposed to each other, so that no current will be flowing in any signal-circuit and the mechanism of the railway-signal will be inert. As soon as pole-changer P is operated by the action of a train on a preceding block-section the batteries B B′ are brought into series with each other, so that current will flow and the mechanism of the railway-signal included therein energized. Such a circuit as last referred to will be traced in a description of the operation of the system illustrated in Figs. 7 and 8. The pole-changer P in these figures instead of being operated directly by a track-relay are operated by a clearing-relay the circuit of which is preferably controlled from a track-relay. C C′ C^2, &c., designate such clearing-relays. A circuit for each clearing-relay may be traced as follows, and it may be designated a "clearing-circuit:" starting from + pole of battery B′, (or it may be some other battery,) armature of a track-relay R R′, &c., as case may be, back contact for such armature, wire 30, clearing-relay C C′, &c., as case may be, and wires 31 26 to battery B′. This circuit is usually or normally open and is closed by the armature of a track-relay moving onto its back contact when the track-relay is deënergized.

The operation of the system illustrated in Figs. 7 and 8 is as follows: Fig. 7 illustrates the usual or normal conditions of the circuits and apparatus controlled thereby. Assuming now that a train Y has just entered the block-section B, it having previously affected certain circuits to have the signal device of the railway-signal S to move to its safety position from its danger position and to have short-circuited the relay R′. In doing this two operations occur, first, that of opening the signal-circuit of the railway-signal S^2, and, second, the closing of the circuit on clearing-relay C^2. As soon as the circuit of the clearing-relay C^2 is closed it operates the pole-changer P adjacent it to bring the battery B into series circuit with the battery B′, so that both batteries will supply current for the signal-circuit for railway-signal S^3. This circuit—that is, the circuit with the bat-

teries B B′—in series may be traced as follows: From the + pole of battery B, it is wires 32 33, arm *p* of pole-changer P, wires 27 26, — pole of battery B′, armature and front contact of relay R^2, wire 25 operating mechanism of railway-signal S^3, wires 24 23, arm *p′* of pole-changer, and wires 34 29 to battery B. With current flowing in this circuit the signal device of railway-signal S^3 will be moved from its danger position to its safety position. As soon as the train enters the block-section C the relay R^2 is short-circuited and its armature drops onto its back contact, performing two operations—first, the opening of the signal-circuit on the railway-signal of its block-section, and, second, the closing of the circuit for the clearing-relay next in advance, so that if conditions warrant the next succeeding railway-signal may be operated. It is apparent that if any block-section is occupied by a train or any portion of the train the railway-signal for that block-section cannot be operated to move its signal device, owing to the signal-circuit being opened at the relay for that block-section. It will be seen, therefore, that as a train proceeds along the railway it automatically affects circuits in the system, which if conditions warrant act to cause the railway-signal in advance to move its signal device from its danger position to its safety position.

Referring now to Figs. 9 and 10 of the drawings, the signaling system therein illustrated is what is technically termed in the art a "home and distant" signaling system, a home and distant signal being located at the entrance end of each block-section. The home signal is arranged above the distant signal, and both are preferably mounted on the same support. Each home signal controls the entrance of trains into its block-section, and each distant signal acts as an indicator for the home signal of the succeeding block-section. Each distant signal is controlled as to its position by its home signal, due to a requirement that a distant signal should never give a safety indication unless its home signal gives a safety indication. At the entrance end of each block-section I have located a home and a distant signal S^5 S^6, being, respectively, the home and distant signal at the entrance end of block-section A; S^7 S^8, respectively, the home and distant signal at the entrance end of block-section B, and so on for the several block-sections comprised in the railway. The signals S^5 S^6 S^7, &c., may be any desired—that is, they may be semaphore-signals, disk signals, banner-signals, or any other of the well-known types. Each signal is provided with a suitable form of automatically-operating mechanism for moving it from, preferably, a position indicating or displaying "danger" to a position indicating or displaying "safety." Each signal also is weighted or biased in such manner as to always tend to move to a position indicating or displaying "danger." Preferably the semaphore type of signal is employed, and, as stated, any type of automatically-operating mechanism may be used. Each block-section is provided with a track-circuit, as hereinbefore described, and each home signal S^5 S^7 S^9, &c., is provided with a signal-circuit precisely like that in Figs. 7 and 8, the same reference characters being used to designate such circuits. The signal-circuit for a distant signal may be any desired, provided it contains a circuit-controller operated by the movements of its home signal. As shown in the drawings, each signal-circuit for a distant signal is independent from all other circuits and may be traced as follows: From one pole of a battery D′ it is wire 107, circuit-controller 108 operated by the home signal for the distant signal, wire 109, circuit-controller 110, operated by the home signal above the distant signal, operating mechanism of the distant signal, and wire 111 to the other pole of the battery D′. These circuits and their method of control are well understood in the art and will not be described further. In fact, the system of circuits illustrated in Figs. 9 and 10 is precisely like that illustrated in Figs. 7 and 8 with the exception of the signal-circuits for the distant signals and that each track-relay R R′, &c., controls not only the clearing-relay of the next block-section in advance, but also the clearing-relay of the second block in advance. For example, the track-relay R of block-section A controls the circuit of the clearing-relay C′ and also the circuit of the clearing-relay C^2, and similarly the track-relay R′ controls the circuit of the clearing-relay C^2 and the circuit of the clearing-relay C^3. By this arrangement a train on any block-section automatically affects circuits which causes the signal devices of the next two home railway-signals to be moved from their danger position to their safety position and the signal device of the next distant railway-signal to be moved from its danger position to its safety position. For example, a train Y in block-section B causes, if conditions warrant, the signal devices of the railway-signals S^9 S^{10} to move from their danger position to their safety position and the signal device of railway-signal S^{11} to move from its danger position to its safety position. If desired, each track-relay may be made to control the circuits of more than two clearing-relays.

In the system illustrated in Figs. 9 and 10 it is possible to use a wire of one circuit in another circuit—in other words, one wire may be common to a number of circuits. Therefore to completely understand the system in Figs. 9 and 10 I will use the same reference characters for the signal-circuits of the

home signals as in Figs. 7 and 8, but will use different reference characters to describe each circuit for a clearing-relay and describe a number of such circuits. The circuits of the clearing-relays controlled by the track-relay R may be traced as follows: Starting from battery B′ local to the signal S^5 (or it may be another battery) one clearing-circuit is armature and back contact 40 of relay R thereof, wires 41 42 43, clearing-relay C′, wires 44 27 45, common return 46, and wires 47, 27, and 26 to battery. Another clearing-circuit is starting from same battery-armature and back contact 48 of track-relay R, wires 49 50 51 52, clearing-relay C^2, wires 53 27 54, common return 46, and wires 47 27 26 to battery. It will be seen, therefore, that when the relay R is short-circuited from its battery by a train in its block-section its armature falling onto its back contacts closes the circuits on the clearing-relays C′ C^2, and they in turn operate their pole-changers P to have them bring both batteries in their signal-circuits in series with each other, and thus cause the signal devices of railway-signals S^7 and S^9 to be moved from their danger position to their safety position. The movement of these two signal devices to their safety position closes the signal-circuit for the distant railway-signal S^8 to have it move its signal device to its safety position. The circuits of the clearing-relays controlled by the track-relay R′ may be traced as follows: Starting from battery B′ local to the signal S^7 (or it may be another battery) one circuit is armature and back contact 55^a of relay R′, wires 55 51 52, clearing-relay C^2, wires 53 27 54, common return 46, and wires 45, 27, and 26 to battery B′. Another circuit is armature and back contact 56^a of relay R′, wires 56 57 58 59, clearing-relay C^3, wires 60 27 61, common return 46, and wires 45, 27, and 26 to battery. With the train in the block-section B the armature of relay R′ will close the circuits just described and will result in the movement of the signal devices of railway-signals S^9 and S^{11} from their danger position to their safety position. The signal device of railway-signal S^{10} will also be moved from its caution position to its safety position. The circuits of the clearing-relays controlled by the track-relay R^2 may be traced as follows: Starting from battery B′ local to the signal S^9 (or it may be another battery) one circuit is armature and back contact 62^a of relay R^2, wires 62 58 59, clearing-relay C^3, wires 60 27 61, common return 46, and wires 54, 27, and 26 to battery B′. Another circuit is armature and back contact 63^a, wire 63 64 65 66, clearing-relay C^4, wires 67 27 68, common return 46, and wires 54 27 26 to battery B′. These circuits when closed act in precisely the same manner as hereinbefore described in connection with the signals S^7, S^8, S^9, S^{10}, and S^{11}. The circuits of the clearing-relays controlled by the track-relay R^3 may be traced as follows: Starting from battery B′ local to the signal S^{11} (or it may be another battery) one circuit is armature and back contact 69^a, wires 69 65 66, clearing-relay C^4, wires 67 27 68, common return 46, and wires 61, 27, and 26 to battery. Part of another circuit is armature and back contact 70^a, wires 70 71 72 to next clearing-relay in advance and back onto common return 46, and wires 61 27 26 to battery B′. These circuits when closed act in precisely the same manner as hereinbefore described in connection with similar circuits.

What I claim is—

1. A signaling system, the signal devices in which are normally in their "danger" position of indication, comprising a series of closed track-circuits, a series of closed signal-circuits, one for each signal device, in which are included opposing batteries so that no current will flow therein, said signal-circuits each including means controlled from one track-circuit to cause current to flow in said signal-circuit, and means controlled from another track-circuit for opening said signal-circuit.

2. A signaling system, the signal devices in which are normally in their "danger" position of indication, comprising a series of closed track-circuits, a series of closed signal-circuits, one for each signal device, in which opposing batteries are included and in which no current is flowing, means in each of said signal-circuits for affecting one of said batteries to have current flow, a clearing-circuit and relay controlled from one of the track-circuits for operating said means, and means also included in each signal-circuit operated by the action of a train on a track-circuit for opening its signal-circuit.

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

HENRY W. GRIFFIN.

Witnesses:
A. HERMAN WEGNER,
JOHN G. HONEY.