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AUTOMATIC ELECTRICAL SIGNALING SYSTEM FOR RAILWAYS.

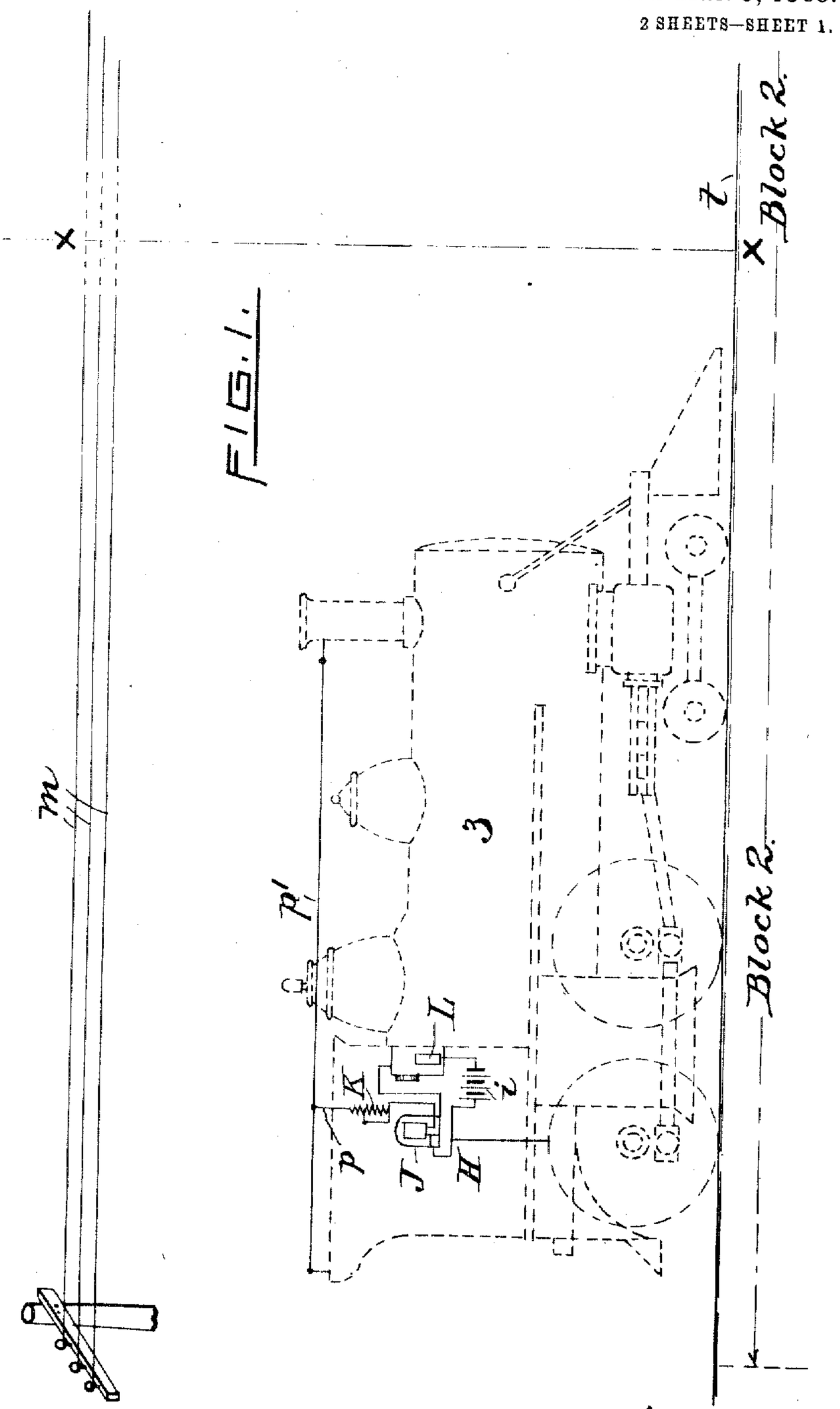
APPLICATION FILED OCT. 12, 1907. RENEWED SEPT. 2, 1908.

914,801.

Patented Mar. 9, 1909.

2 SHEETS—SHEET 1.

FIG. 1.



WITNESSES.

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2 SHEETS—SHEET 2.

FIG. 3.

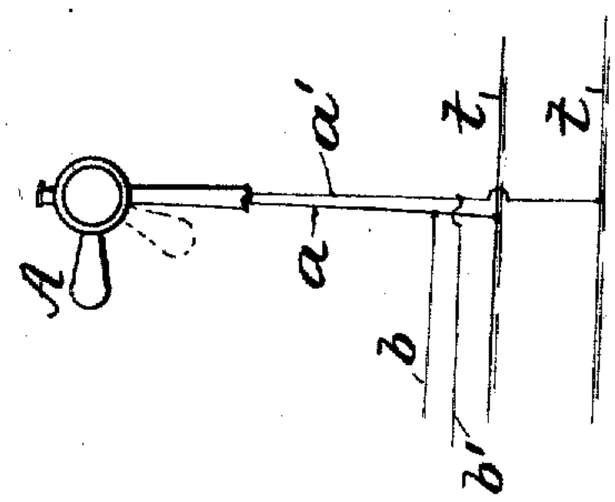
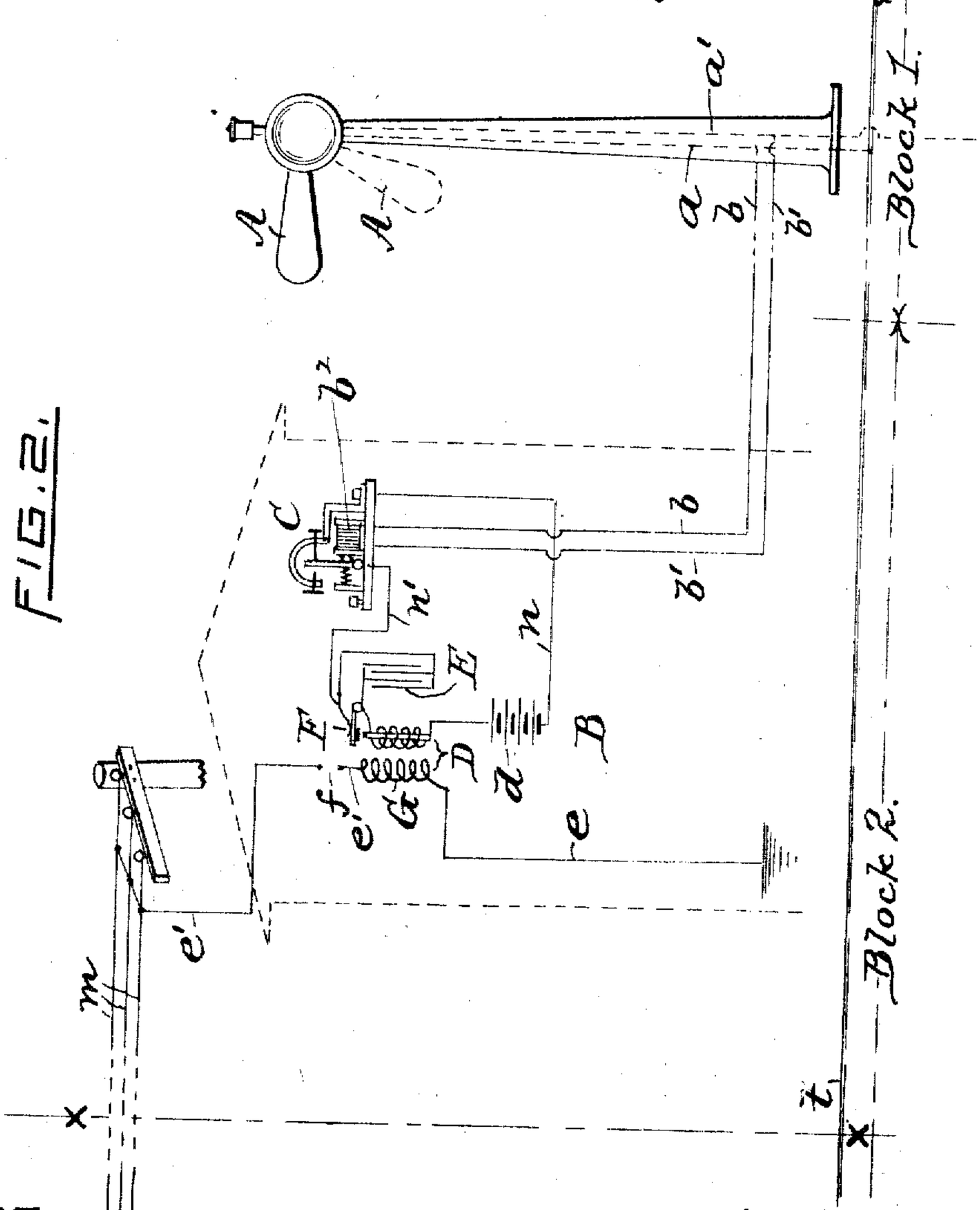


FIG. 2.



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UNITED STATES PATENT OFFICE.

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AUTOMATIC ELECTRICAL SIGNALING SYSTEM FOR RAILWAYS.

No. 914,301. Specification of Letters Patent. Patented March 9, 1909.

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To all whom it may concern:

Be it known that I, CHARLES CRANDALL, a citizen of the United States of America, and a resident of Newport, in the county of Newport and State of Rhode Island, have invented certain new and useful Improvements in Automatic Electrical Signaling Systems for Railways, of which the following is a specification.

The invention forming the subject of my present application for Letters Patent relates to automatic railway signaling systems, and more particularly to the class termed electrically controlled block-signal systems.

The invention is well adapted to be successfully employed as an auxiliary or supplemental safety system in association or combination with manually controlled signal systems, and also in systems in which the signals or semaphores of the "block" are mechanically actuated or "set" by the passing train or locomotive.

The general object of the invention herewith is to provide signaling systems of the types referred to with novel and improved means whereby the engineer of a suitably equipped locomotive may at all times and under the most obscure conditions (such for example, as the presence of fogs and snow storms) positively and accurately receive signals upon and within the cab of his engine before arriving at the first semaphore of the block system and in fact before the latter becomes visible.

I am well aware that devices have been employed for increasing the accuracy and safety of the usual track-signals or semaphores of the block system of signaling, said devices including in their construction an electric circuit connected with a located signal member and provided with a normally open electric switch arranged to be automatically closed to set the signal to indicate "danger" by the movements of the semaphore itself; the latter being manually actuated from a signal-tower or other station in a well-known way, or by suitable connections made operative by the engagement therewith of the passing locomotive thereby moving the semaphore and closing said electric switch or circuit, substantially as just stated. In such former devices or systems, and more especially in cases where the electric circuit is closed and the signal is set or controlled by the action of the moving locomotive contiguous thereto, the operation is not effected until the train or locomotive itself enters the "block." It is not arranged and adapted to set a signal in the cab of the immediately following locomotive. I am also aware that systems have been devised for maintaining telegraphic or telephonic communication between instruments located on independently moving railway trains, and also between railway trains and fixed stations; the apparatus in such cases being constructed and adapted to utilize electric induction, the principles of which are well-known to electricians.

My invention differs from prior electrical signaling systems or devices in that the semaphore of the block-system section is or may be connected in an electric circuit having a relay tapped therein and disposed contiguous to suitably supported non-grounded current-conducting aerial wires extending rearwardly or beyond the first or main block section any desired or practicable distance and parallel with the track, and forming what may be termed the second section. The arrangement being such that as the wheels or other member of the advance locomotive enters the first block-section the said circuit is thereby closed, the result being to automatically elevate the semaphore say from the normal dropped or "clear" position to the horizontal or "danger" position. At the same time, too, the semaphore's movement or closing of the circuit energizes the coil of the relay and closes a normally open local current-generating circuit having apparatus adapted to transform it into an alternating current; the latter after passing through an induction coil is converted into a secondary or direct high-tension pulsating current and flows to the aerial conductors and ground. Now, in case a following locomotive enters the zone of the said second section before the first locomotive passes from the main or first block-section the electrical impulses from the then charged aerial conductors immediately energizes suitably insulated conducting wires on the second locomotive, the latter being further equipped with a normally open local electric circuit provided with receiving apparatus having the cab indicator or signal in circuit, thereby automatically closing said circuit to actuate its indicator; the latter being in full view of the engineer at all times.

The semaphore signal remains in the ele-

vated or danger position until the operating circuit or mechanism thereof is acted upon in any well-known way by the forward engine as it passes out of the said block-section, thus again normally opening the circuit at which instant the semaphore automatically drops back to the normal inclined position, indicating "safety". At the same time, too, the aerial conductors and also the electrical apparatus on the following locomotive become deënergized, the indicator then denoting safety or track clear. It may be added that obviously the several electrical devices or accessories contiguous to the semaphore are suitably housed and conveniently located with respect to the semaphore and the aerial conductors. The normal or "clear" color shown upon the indicator of the said following or current-receiving engine is green, but when influenced by the electric current passing from the aerial wires the color changes to red, or "danger". These colors being the conventional ones adopted by the railway associations.

In the accompanying two sheets of drawings, Figures 1 and 2 represent in side elevation and also diagrammatically an electrically controlled railway-signal system embodying my invention. As drawn, Fig. 2 is in fact a continuation of Fig. 1. *x x* indicate the junction line. Fig. 3 is a detached view, in reduced scale, showing the manner of electrically connecting the semaphore signal with the track-rails and with the branch conductors adapted to connect with the relay of the current-transforming circuit.

The following is a more detailed description of the invention and including the manner of its operation:

In the drawings the separated semaphores or banjo signals A (one only being shown) of block section number 1 may be constructed, located and actuated in any well-known way. That is to say, the member A is suitably connected in or with a normally open electric circuit (said member then being in the dropped or "clear" position) having conductors, *a*, *a*^{1}, leading therefrom to the suitably insulated track-rails *t* of said section (see also Fig. 3), the arrangement being such that when the locomotive enters the said section 1 the contact of the wheels with the rails automatically closes the circuit, the thus energized connections or conductors, &c., then causing the signal A to swing upwardly from the clear, or dotted line position, to the horizontal position, indicating danger. The circuit as drawn also includes a relay C adapted to be energized through the medium of the current flowing through the conductors *a a*^{1} and the respective branch conductors *b b*^{1} connected therewith and with the poles of the coils of the magnet *b*^{2} of the relay. See Fig. 2. Another portion of the railroad, which portion may be termed an auxiliary block or section, indicated at 2, is provided with one or more suitably supported aerial current-conductors *m*, the same being disposed parallel with the track-rails and extending longitudinally thereof from said section 1 any desired practical distance, being in fact the length of section 2. This section of the track is arranged to be entered and passed over by the locomotive before it enters block 1.

The aerial conductors *m* are charged or energized by currents of electricity generated by the local circuit B and coöperating apparatus, the latter being located and suitably housed say contiguous to the semaphore A or other analogous signal device. The said circuit B is practically a vibratory transformer or alternating current producer, and as drawn consists of a battery *d* having one pole connected to said relay by a conductor *n;* the other pole being connected to the relay via a primary induction coil D, a vibrator or transformer F, a condenser E and conductor *n*^{1}. The arrangement being such that when the relay closes circuit B the said devices D, F and E convert the normal current into an alternating one. A secondary coil G surrounds the said primary coil D of the induction coil. (I would state here that for the sake of clearness in the drawing the two coils are shown separately side by side.) The coil G is grounded via the conductor *e*, the other end of the coil as drawn being connected with the interrupted conductor *e*^{1}. The latter extends upwardly and is joined to the aerial conductors *m*, and is severed at any suitable point to form a spark-gap *f* in a well-known manner. The other electrical devices for coöperating with the above described members are mounted on the locomotive itself. That is to say, the electrical apparatus of the properly equipped engine, 3, will upon entering the zone or section 2 be rendered operative by reason of the induced current flowing from the charged wires *m* across the space separating them from the locomotive. The latter is provided with a local electric circuit H having a battery *i*, to the poles or conductors of which are connected suitable current-receiving apparatus for controlling the cab indicator or signal L. Said circuit, as drawn, includes also a receiver or coherer J, a tuning-coil K or other analogous device and a conductor *p* joined to one or more suitably supported exposed conductors *p*^{1} secured to, extending longitudinally of but insulated from the locomotive. See Fig. 1.

The operation may be briefly described as follows: In the present invention the two sections or "blocks", 1 and 2, are so mechanically and electrically connected that one becomes a part of the other, since it is the action of the devices of block 1 that causes the devices of block 2 to operate. Now,

upon the entrance of the advance locomotive (which is electrically equipped like the following locomotive 3) into block 1 it automatically closes the circuit or mechanism controlling the signal A, thereby elevating the latter and causing the current to flow through the wires b b^1, thus energizing the relay C. The action of the latter immediately closes the local generating circuit B, thereby by means of the electrical devices connected therein transforming the current into an alternating one, which in passing to the secondary coil G is converted into an induced or high-tension alternating current and by means of the spark-gap conductor transformed into a direct pulsating current, the latter then flowing to and charging the aerial conductors m. While block 1 is thus closed and until the engine passes therefrom the aerial conductors remain energized. Now, in case a properly equipped following locomotive, as 3, enters block section 2 the electrical impulses from the aerial conductors cross the intervening space and energize the conductors p^1 of the engine, which in turn excites and closes the normally open local circuit H and the receiving apparatus connected therewith for controlling the cab signal L, the color of the latter then exposed to view being red. When the forward locomotive leaves block 1 the signal or semaphore A will automatically drop to the dotted line position, indicating safety or line clear, thereby breaking the electric circuit B and correspondingly deënergizing the aerial conductors, &c., at which instant the local circuit H of the locomotive 3 then traveling over block section 2 also becomes broken, the indicator L automatically changing to green, or safety. When the last named engine enters block 1 it in turn causes the signal A to again swing upwardly to the "danger" position, thereby at the same time closing circuit B and electrically charging the aerial conductors m, so that upon the entrance of a properly equipped locomotive on the auxiliary block section, 2, the circuit H and receiving apparatus of the latter engine will become energized and automatically set its indicator L to denote danger, corresponding with the distant signal A, all substantially as before described.

What I claim as my invention and desire to secure by United States Letters Patent is:—

1. In a signaling system for railways, the combination with the track-rails having a section thereof equipped with block-signals constructed and arranged to be actuated by the passing of a locomotive over said section or by other suitable means, of supported aerial current conductors disposed along the railway with respect to and in advance of said block-section, a normally open electric circuit and current-transforming devices connected therewith, a locomotive or vehicle traveling on said track, a normally open local electric circuit provided with current-receiving apparatus and a signal or indicator mounted on the last-named locomotive, all arranged whereby the act of setting said block-signal to denote danger automatically closes the first-named electric circuit and charges the aerial conductors so that when the last-named electrically equipped locomotive enters the thus protected zone the current from the aerial wires then passes to the said current-receiving apparatus and automatically closes the said local circuit and sets the cab signal to indicate danger or line blocked.

2. In a signaling system for railways, the combination with block-signal mechanism having a semaphore arranged to indicate danger when a locomotive passes over the tracks of the block section, of a relay, an alternating-current circuit connected with the relay, aerial conductors extending along the railway from a terminal of the block-section, electrical devices for converting said alternating current into a direct pulsating current having high tension and charging said aerial conductors therewith, and a locomotive traveling on the track-rails of the system equipped with an electric circuit including an indicator or signal and receiving apparatus made operative by electrical impulses flowing from the aerial conductors when the engine enters the latter's zone.

3. In an automatic electric signaling system for railways, the combination with the main block-section of the track having a signal or semaphore whose movements are automatically controlled by a locomotive traveling on the track-rails of said section, and a second or auxiliary block-section having suitably located aerial conductors, of an electric circuit provided with an induction-coil, means operatively connected with said semaphore for closing and opening said circuit, a secondary coil energized by the current flowing in said induction-coil, suitable conductors connected with the secondary coil for charging the aerial wires, and a locomotive provided with an indicator or signal and suitable coöperating electrical apparatus arranged to be energized by electric impulses received from said aerial conductors when the last-named locomotive enters said auxiliary block-section.

4. In an automatic electrical signaling system for railways, the combination with a section of the track-rails and suitably supported aerial conductors extending parallel therewith, of an electrically equipped locomotive mounted on said rails provided with a normally-open electric circuit having a signal and electrical apparatus disposed in said circuit, a current-receiving conductor mounted on the locomotive and connected in said cir-

cuit, a main block-section, a movable semaphore or signal, and electrical conductors connected with said aerial wires and with a suitable source of electric force, all constructed and arranged whereby the act of moving the semaphore to indicate danger at the same time automatically energizes the aerial conductors, the impulses passing therefrom closing the electric circuit of said locomotive and setting its signal to indicate danger.

5. In an automatic electrical signaling system for railways, the track-rails, aerial conductors disposed parallel therewith, a semaphore or signal arranged to be actuated by a locomotive traveling on said rails, and a normally-open electric circuit located with respect to said aerial conductors and semaphore provided with current-transforming apparatus made operative by the semaphore's movements thereby closing the circuit and charging the aerial conductors, in combination with a following locomotive or car on said rails provided with suitably insulated conductors arranged to receive by induction electrical waves or impulses flowing from the aerial wires, a normally-open local electric circuit and coöperating electrical devices connected therewith and with said insulated conductors for closing the circuit also mounted on the last-named locomotive, and an indicator or signal suitably disposed in said local circuit arranged to denote danger when the latter is closed.

Signed at Newport, R. I. this 9th day of October, 1907.

CHARLES CRANDALL.

Witnesses:
SOREN MIKKELSEN,
JAMES C. WALSH.