C. CRANDALL.

ELECTRICAL SIGNALING SYSTEM FOR RAILWAYS.

APPLICATION FILED JULY 2, 1908.

924,968.

Patented June 15, 1909.

2 SHEETS—SHEET 1.

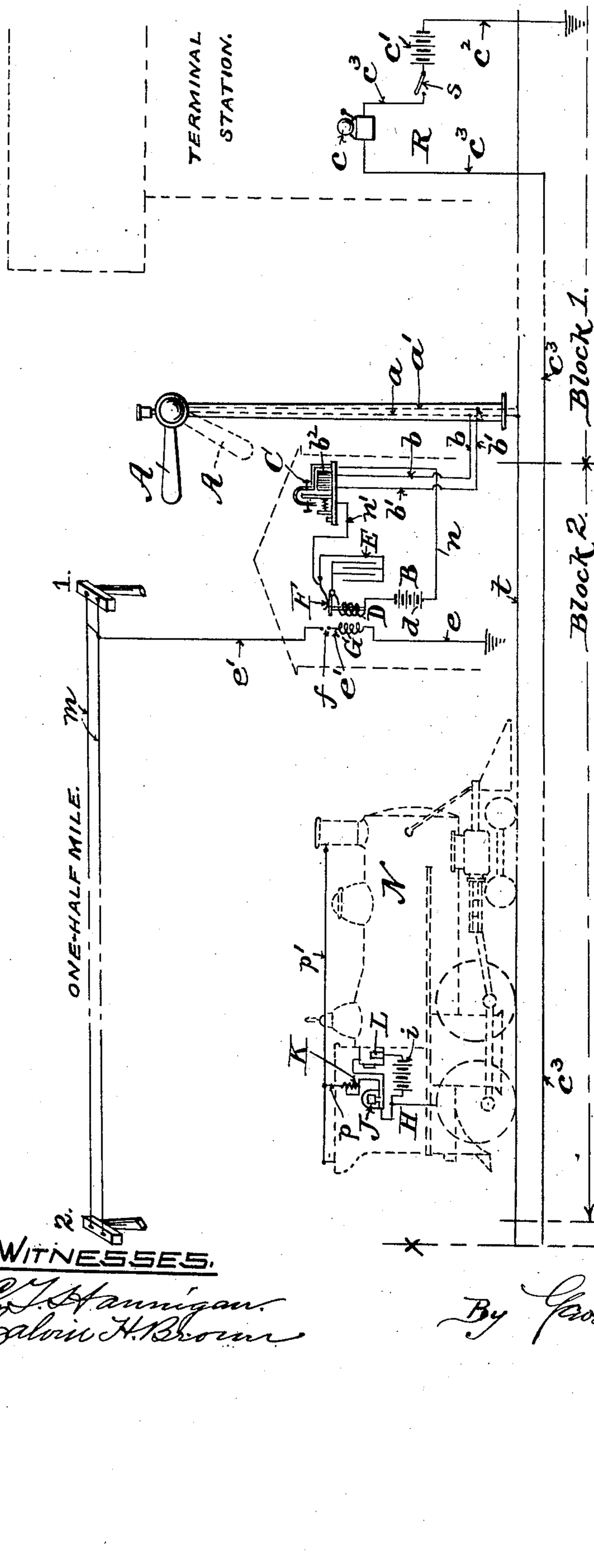

FIG. 1.

WITNESSES.

C. J. Flannigan.

Calvin H. Brown

INVENTOR.

Charles Crandall.

By Geo. H. Remington.

Attorney.

C. CRANDALL.

ELECTRICAL SIGNALING SYSTEM FOR RAILWAYS.

APPLICATION FILED JULY 2, 1908.

924,968.

Patented June 15, 1909.

2 SHEETS—SHEET 2.

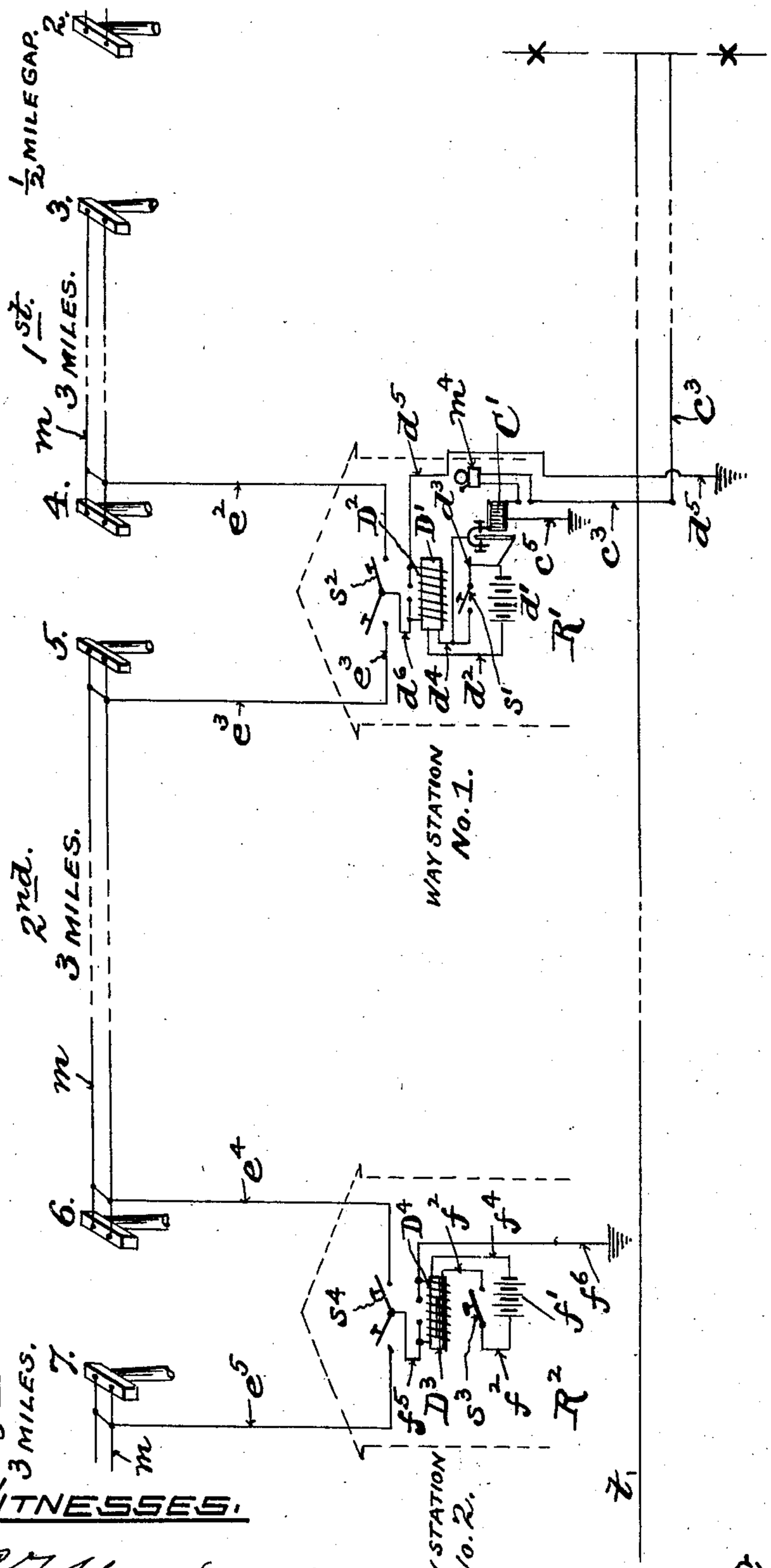

FIG. 2.

WITNESSES.

C. J. Hannigan.

Calvin H. Brown

INVENTOR.

Charles Crandall.

By Geo. H. Remington.

Attorney.

UNITED STATES PATENT OFFICE.

CHARLES CRANDALL, OF NEWPORT, RHODE ISLAND.

ELECTRICAL SIGNALING SYSTEM FOR RAILWAYS.

No. 924,968. Specification of Letters Patent. Patented June 15, 1909.

Application filed July 2, 1908. Serial No. 441,521.

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 Electrical Signaling Systems for Railways, of which the following is a specification.

My present invention relates to a new and improved system of signaling to engineers of locomotives of railway trains, and having the signals electrically controlled through the medium of suitable apparatus associated or combined with aerial current-conductors and also with a block system, and disposed so that it constitutes what may be termed an auxiliary signaling system. That is to say, the system is constructed and adapted to be controlled in a mechanical manner by an operator so as to set the signals, as for example the semaphores of one or more blocks, and also adapted to be actuated by a suitably equipped train or locomotive, as in entering and leaving the block section. It is further arranged so that a plurality of independent sections of aerial conductors may be energized from suitably equipped way-stations whereby the signaling apparatus of one or more correspondingly equipped locomotives upon entering the thus energized zone, or zones, become operative and set the signals to indicate danger, all as more fully hereinafter set forth and claimed.

Some of the objects sought to be attained by my invention are the following: To employ independent electrical means located in one or more way-stations and electrically connected to and capable of being controlled by apparatus mounted in a central or terminal station, and also so arranged that the sections of aerial conductors may be energized so that certain other electrical devices of a complementary equipped locomotive will upon arriving within the zone of the said conductors become correspondingly energized and set a visual danger or cautionary signal in the cab. As thus arranged the engineer may at all times and under the most obscure conditions positively receive signals within the cab while the engine is in the zone of the said conductors. The aerial conductors are not adapted to be energized by the action of a semaphore except at the terminal station only. To provide means whereby a plurality of said equipped locomotives running on the tracks protected by independent sections of the aerial conductors may have the latter energized through the medium of electrical apparatus controlled by an operator in one of the way-stations thereby setting the danger signals in the respective cabs in a practically simultaneous manner. To energize the aerial conductors from terminals, and also from way-stations or signal-towers in either direction by electrical apparatus, including the employment of double-throw switches. To set the signal upon a train by the telegraph operator after the train has left the terminal or a way-station by simply throwing the switch to close the circuit so as to energize the aerial conductors of the blocks or sections on which said train, or trains, may then be running. At the same time any other train or trains entering the blocks will also receive the signal. The operator may if desirable transmit precautionary signals, as per an accepted code, by opening and closing the electric circuit, thereby correspondingly deënergizing and energizing the aerial conductors. To provide the aerial conductors of the system with an open space or gap at or near the terminal station, or stations, thus preventing the action of any foreign or independent electrical influence from being transmitted to and energizing the section of aerial conductors immediately contiguous to the terminal. The latter is energized by the action of the semaphore, as before stated. The aerial wires between each pair of equipped way-stations are continuous.

In the two accompanying sheets of drawings, Figures 1 and 2 represent both in side elevation and diagrammatically an electrically controlled railway-signal system embodying my invention. It may be added that said Fig. 2 is a continuation of Fig. 1; the line *x x* indicating the junction point. Fig. 3 is a transverse sectional view taken say at the intersection of blocks 2 and 1 of Fig. 1, showing the rails and the electrical circuit conductors connected thereto and to the semaphore.

I would state here that in a co-pending application filed by me in the United States Patent Office I have illustrated and described an improved automatic electrical signaling system for railways. In my present application for patent some of the electrical devices and connections as employed in said former system are embodied in and are

adapted to operate in association with certain other constructions or elements set forth and claimed in this later invention. I will first briefly describe the illustrated devices of the said earlier case which also to some extent are reproduced in the drawings herewith: A, Fig. 1, indicates a semaphore signal of a block section (1) constructed, located and adapted to be actuated in any suitable or well-known way. The member A is connected in a normally open electric circuit having conductors a a^1 leading therefrom to the respective suitably insulated track-rails t of the section, (conductor a being joined say to the front rail and a^1 to the back or rear rail, substantially as indicated in Fig. 3; the arrangement being such that when a properly equipped advance locomotive enters the said block section the contact of the wheels with the rails operates to close the electric circuit, the thus energized connections, then causing the semaphore A to swing upwardly from the clear (or dotted line position) to the horizontal position, indicating danger. The said circuit includes a suitably housed relay C having wires b b^1 tapped into the said conductors a a^1 and connected with the poles of the coils of the relay's magnet b^2. A local circuit B (which is practically a vibratory transformer or alternating-current producer) is energized and controlled by the relay. The latter circuit comprises a battery d, connected by wire n to the relay, its other pole being connected to the relay via a primary induction-coil D, a vibrator or transformer F, a condenser E and wire n^1. A secondary coil G in fact surround coil D as usual and is grounded via wire e. For the sake of clearness in the drawing the said coils are shown separated. The other end of coil G is connected by an interrupted upwardly extending conductor e^1 (provided with a spark-gap f) to the suitably mounted aerial conductors m extending parallel with the track-rails any suitable distance. Thus it is obvious that the conductors m will be automatically and simultaneously energized whenever the circuit B is closed.

A locomotive, as N, when properly equipped electrically embodies a local electric circuit H, comprising a battery i, a receiver or coherer J, a tuning-coil K a cab indicator or visual signal L, one or more exposed conductors p^1 secured to, extending longitudinally of but insulated from the engine, and a conductor p joined to said elements K and p^1. The electrical apparatus of a similarly equipped following locomotive will, upon entering the zone or block section (2) protected by the energized aerial conductors, become correspondingly energized by means of the induced current flowing from the wires m to wires p^1, thereby setting the cab signal L to indicate danger.

Obviously the danger or cautionary signal continues visible or positioned while the conductors m remain energized, or until the advance locomotive (which had just previously set the semaphore to indicate danger) passes from its block section (1), thereby deënergizing the conductors m and consequently opening the circuit H of the following engine and indicating clear track ahead. The passing of the locomotive or train also causes the semaphore to fall in its normal or safety position, indicated by dotted lines in Fig. 1.

In the present invention the aerial conductors are disposed at suitable intervals longitudinally of the tracks to form a plurality of independent sections, one of which (block 2 adjoining block 1 of the terminal station, see Fig. 1) is capable of being electrically charged by the passing of a locomotive from block 2 when entering block section 1, substantially as before described. All the aerial sections m, with the exception of the one located in block 2, are constructed, connected and arranged so as to be electrically energized and deënergized through the medium of manually controlled electrical apparatus or devices located in a terminal and way stations of the railroad. The charging of the respective conductors m of the thus equipped way stations may also be manually controlled from the way stations in either direction at will. I would state that the aerial conductor section of said block 2 may extend continuously say one-half mile, its end poles or supports being indicated at 1 and 2. See Fig. 1. The second continuous section of current-conductors m communicates with the way-station No. 1, and may be say three miles long, its end poles being 3 and 4. This section is separated from that of block 2, before described, by a gap having a length of one-half mile. The way-stations Nos. 1 and 2 are connected by a continuous aerial section three miles long, its end supports being indicated at 5 and 6. The way-station No. 2 is connected with another continuous aerial three-mile section, one of its supports being indicated at 7. The last-named section may also be connected with another way-station equipped electrically the same as way-station No. 2, or the section may terminate substantially like the above named one-half mile section. It is obvious that the length of the several sections of conductors m may be varied from the distances named. All the said sections are independent of one another and arranged to be energized singly.

In the present invention the charging of the aerial conductors is controlled from way-stations and a terminal station. The latter contains say a local circuit R, comprising a battery c^1, ground wire c^2, a conductor c^3 leading from the battery to a relay-switch C^1 located in way-station No. 1, a primary switch, or key, s, and signal-bell c; the two

latter elements being located or tapped into said conductor c^3.

The way-station No. 1 may be provided with the relay-switch, just referred to and grounded by wire c^6, a local circuit R^1 comprising a battery d^1, a key or primary switch s^1, a double-throw switch s^2, and a primary induction coil D^1 connected by conductor d^2 to one pole of said battery. A secondary coil D^2 surrounding said coil D^1 is grounded via wire d^5, its other pole being connected to wire d^6 in continuous electrical communication with the said double-throw switch s^2. One arm of the latter is adapted to contact with the right conductor, e^2, leading upwardly and joined to the corresponding section of aerial wires; the other or left arm being adapted to contact with a similar conductor, e^3, joined to its section of aerial conductors. See Fig. 2. Thus it will be observed that an electric current flowing via conductor c^3 from the closed circuit R at the terminal station to the relay-switch C^1 will operate to automatically energize the latter, ring the bell m^4 and close circuit R^1, thereby charging said primary and secondary induction coils. The electric current is conducted from the latter and diverted to either section of the adjacent aerial wires as desired by manually swinging the corresponding arm of the switch s^2. In the drawing the latter is represented as being in the normal or central position, the two aerial sections then being uncharged. The said signal-bell m^4 is tapped into the conductor c^3 or pole of the relay C^1; thus the bell is made automatically operative whenever the wire c^3 is energized. As drawn the bells c and m^4 ring simultaneously, thus signaling the operators in the terminal and No. 1 way-stations.

The way-station No. 2 is shown as being equipped with electrical apparatus substantially as just described with respect to way-station No. 1, except that the relay-switch C^1 and energizing conductor c^3 are omitted. The station No. 2 is provided with a local circuit R^2 having a battery f^1, and a primary induction-coil D^3, the latter being connected with the poles, f^2, f^4, of said battery. A secondary winding or coil D^4 surrounding coil D^3 is grounded via wire f^6; its other pole being connected to wire f^5 in continuous electrical connection with the double-throw switch s^4. The last-named switch is adapted to be swung to the right and left as desired so as to contact with and energize the respective conductors e^4 and e^5, joined to the corresponding independent sections of aerial conductors, as clearly shown in Fig. 2.

It may be added that in practice the switch s^2 of way station No. 1 may if desired be in normal contact with the conductor e^2, whereby the latter is adapted to transmit current to the 1st 3-mile section of aerial conductors. Now, in order to energize said section the operator in the terminal station depresses the key s, thereby closing the circuit R; the current then passes via conductor c^3 to certain of the electrical apparatus connected therewith in station No. 1 and energizes the 1st 3-mile section, the bell m^4 meanwhile sounding an alarm. The local key s^1 does not have to be closed when the said 3-mile section is being energized from the terminal station.

The energizing of the second 3-mile aerial section is manually controlled by an operator in No. 1 way-station who first deflects switch s^2 to the left to contact with the conductor e^3, followed by closing the local key s^1. This action closes circuit R^1 and energizes the respective elements connected therewith, the current at the same time passing via wire e^3 to and energizing the aerial conductors of the 2nd 3-mile section.

The 3rd 3-mile section, and also the 2nd 3-mile section, are energized from station No. 2. The switches s^3 and s^4 in the latter station are normally open except when they are closed by the operator in said station to effect the energization of the aerial conductors of said sections. That is to say, in the latter event the operator first depresses the double-throw switch s^4 to the right or left as desired, so as to contact with the corresponding conductor e^4 or e^5 communicating respectively with the aerial conductors of the 2nd and 3rd 3-mile sections, followed by depressing the local key s^3, thus closing the circuit. Therefore if the switch has been moved to the right the 2nd 3-mile section will be energized, and if to the left the 3rd 3-mile section of aerial conductors will be correspondingly charged.

It will now be apparent that in case a properly equipped locomotive, as N, enters either of the sections of energized aerial conductors, the current or electrical impulses emanating from the latter will instantly cross the intervening space and energize the conductor p^1 of the engine, which in turn excites and closes its normally open local circuit H and the receiving apparatus connected therewith for controlling and exposing the danger signal L, the color of which is red. Whenever the operator in the way station opens the circuit controlling the thus energized 3-mile aerial section or zone the circuit H of the engine is thereby opened or broken, the cab signal L then automatically changing to yellow, indicating safety.

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

1. The combination, in an electrical signaling system for railways, of a normally open local electric circuit provided with a manually controlled key-operating switch, an induction-coil, a relay located at a compara-

tively remote distance from said switch, the relay being arranged for closing the circuit through the primary of the said induction-coil so as to produce in the secondary member of the coil highly energized electrical impulses, a section of aerial conductors disposed along the railway provided with a feed wire, and a manually-controlled double-throw switch, all constructed and arranged whereby upon closing the switch or key of said local circuit the resulting current flows to and is converted by the transforming means into electrical impulses which pass via said double-throw switch and feed-wire to the aerial conductors.

2. In an electrical signaling system for railways, a terminal station, a normally open electric circuit provided with a manually-controlled key, a way-station, a relay located therein connected in said normally open circuit, a plurality of independent aerial sections of current conductors extending along the railway in opposite directions from the way-stations and at a comparatively remote distance from the terminal station, a local electric circuit, current-transforming means connected in said circuit and to said relay, and a manually-controlled multiple-throw switch arranged with relation to said transforming means whereby upon manipulating the switch either of said aerial sections may be energized at will.

3. In an electrical signaling system for railways, a pair of independent longitudinally extending sections of aerial conductors separated from each other by a considerable distance, two correspondingly separated way-stations each being located at or near the terminal of the adjacent section and provided with a feed wire connected to the section, an independent section of aerial conductors interposed between said stations having a feed wire leading therefrom into each station, a normally open electric circuit for each station, means for transforming the electric current of each circuit into highly energized electrical impulses, and a suitably connected manually-controlled multiple-throw switch in each station arranged whereby the transformed current may be diverted to either of the feed wires of the station at will to energize the corresponding aerial section, for the purpose hereinbefore set forth.

Signed at Providence, R. I., this 30th day of June, 1908.

CHARLES CRANDALL.

Witnesses:

GEO. H. REMINGTON,

HENRY P. STONE.