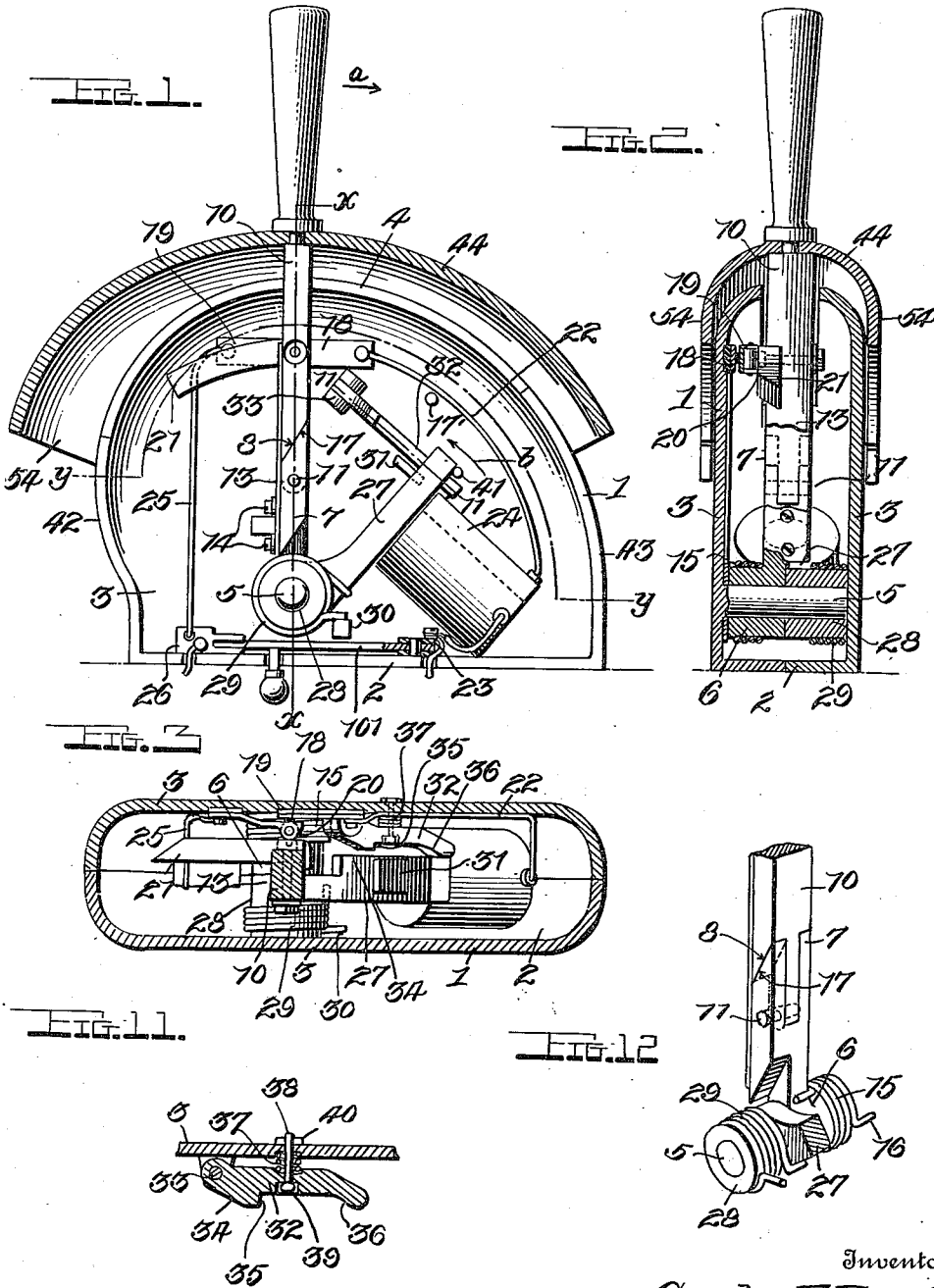


C. F. FRANK.
ELECTRIC SIGNALING SYSTEM.
APPLICATION FILED NOV. 1, 1911.

1,046,765.

Patented Dec. 10, 1912.

3 SHEETS-SHEET 1.



Witnesses

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Inventor
Crosby F. Frank.

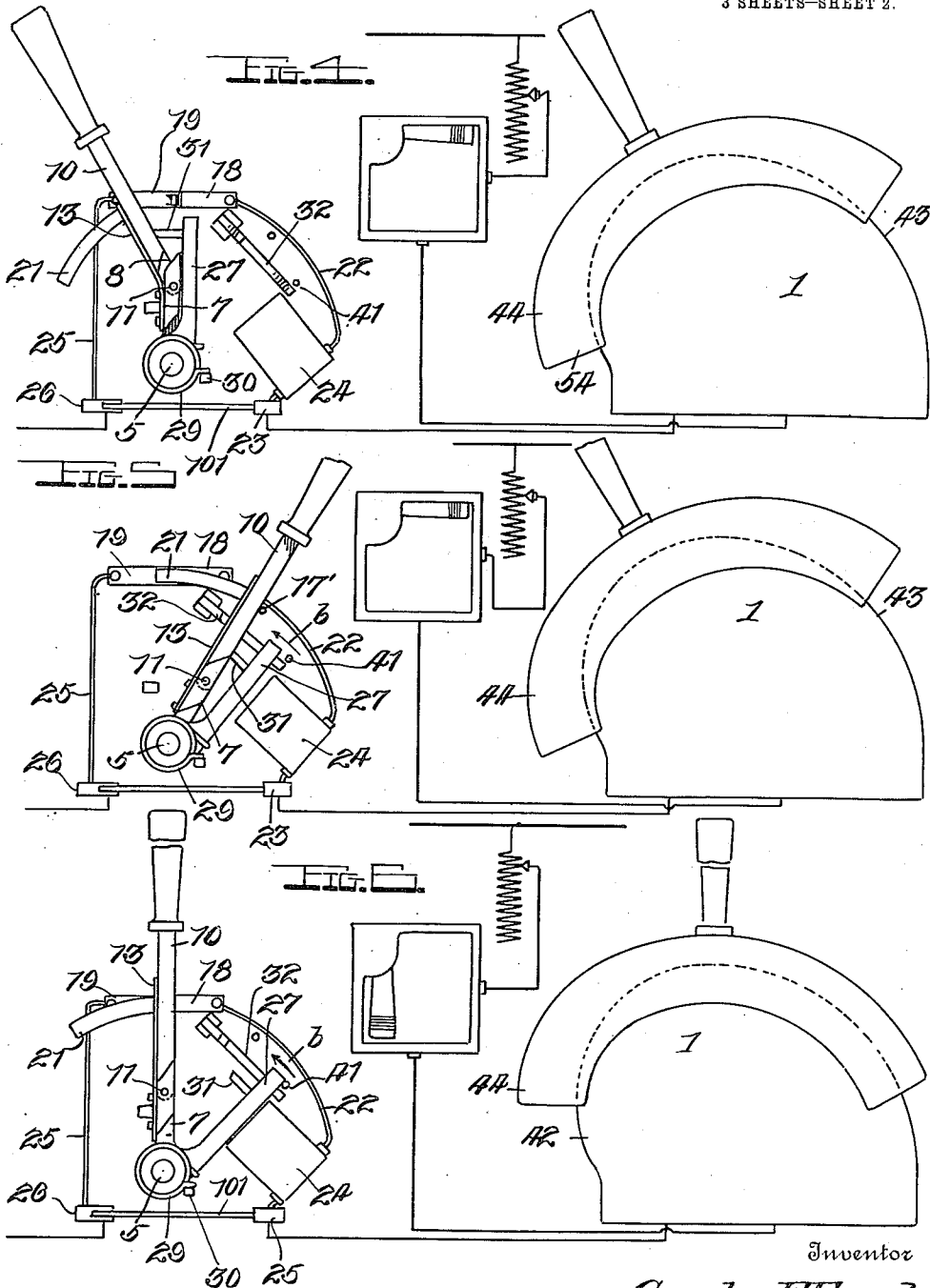
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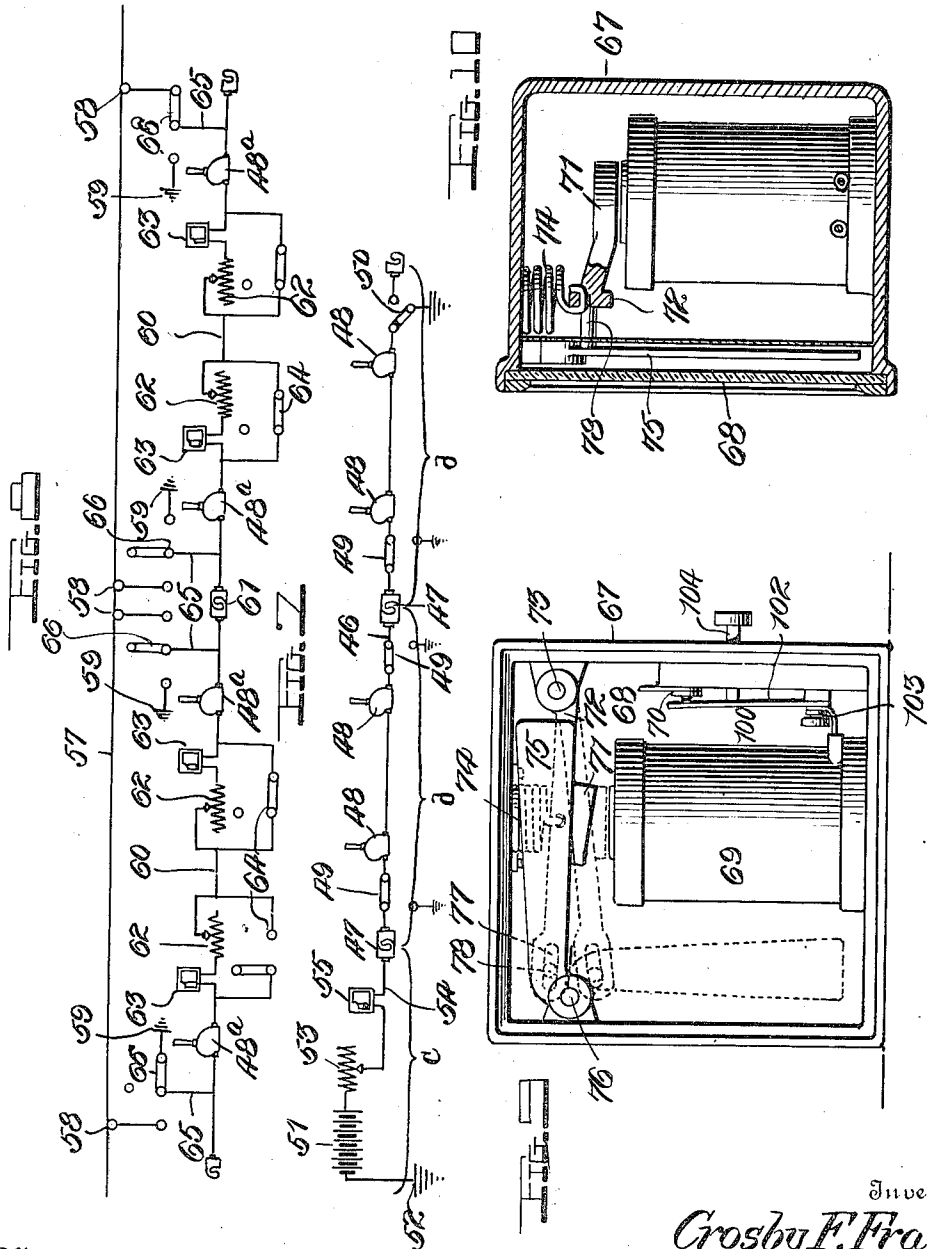
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3 SHEETS-SHEET 3.



Witnesses

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UNITED STATES PATENT OFFICE.

CROSBY FIELD FRANK, OF NEW YORK, N. Y.

ELECTRIC SIGNALING SYSTEM.

1,046,765.

Specification of Letters Patent.

Patented Dec. 10, 1912.

Application filed November 1, 1911. Serial No. 657,985.

To all whom it may concern:

Be it known that I, CROSBY F. FRANK, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Electric Signaling Systems, of which the following is a specification, reference being had to the accompanying drawings.

10 This invention is an improved electric signaling system for use on railway trains and also on ships, elevators and in other similar connections whereby a signal is to be given at one point, say to the driver at the forward end of a train, when a series circuit extending through the train has been completed at a number of other places, as for instance, at the doors or gates of the cars constituting the train, whereby the driver at the forward end of the train will be notified when all the gates or doors of the cars of the train have been closed and that he may then safely start the train.

My improved signaling system provides a means by which all the guards are informed when the driver has received the signal to "start." My improved system also enables the driver to be signaled to "stop" by a guard or conductor at either end of any of the cars of the train, in the event of an accident. My improved signaling system also, when signaling the driver to "stop," gives a similar signal at each end of each car in the train, thus notifying all the guards that the driver has been so signaled.

My signaling system may employ a signaling device only at the front and rear of a train or it may, as may be preferred, employ a signaling device at each end of each car in the train. My signaling system provides means whereby the signaling device in the intermediate cars may be included in the circuit series or shunted and rendered inoperative, as may be desired.

My invention includes, as a part of my improved signaling system in which an electric conductor is employed, a plurality of switches of novel construction, each of which comprises a circuit closer, a circuit breaker and electrically operated means included in the series circuit to normally restrain the circuit breaker from operating while the series circuit is charged with current. Hence, in the event of a derangement of the signaling system, whereby the circuit is broken, the guards on the car platforms

throughout the train are notified. My signaling system remains inoperative until each guard of the train or operator at a distant station has performed his specified duty and requires each of them to perform his duty before a signal can be transmitted to the driver.

My invention consists, essentially, in a signaling system comprising a conductor having a gap, a movable closer for the gap, a circuit breaker, electrically operated means included in the circuit to restrain the circuit breaker from operating and means to open the circuit, thereby causing the said circuit breaker to operate.

My invention further consists in the construction, combination and arrangement of devices hereinafter described and claimed.

In the accompanying drawings: Figure 1 is partly an elevation and partly a vertical longitudinal sectional view of the same on the plane indicated by the line $x-x$ of Fig. 1; Fig. 3 is a detail sectional view of the same on the plane indicated by the line $y-y$ of Fig. 1; Fig. 4 is a diagram of a unit of my improved signaling system in which one of the signaling switches is in "stop" position; Fig. 5 is a similar view of the same in which one of the signaling switches is in "start" position; Fig. 6 is a similar view of the same in which both of the signaling switches are in "running" position; Fig. 7 is a diagrammatic view of my improved signaling system as in use on a steam railway train; Fig. 8 is a similar view of the same modified as required for use on an electric railway train; Figs. 9 and 10 are sectional views of a signaling device constructed for operation as a part of my signaling system; Fig. 11 is a detail sectional view of the detent for holding the lever arm in starting position; and Fig. 12 is a detail perspective view of the switch lever, a portion of the circuit breaker and the actuating springs of the switch lever and circuit breaker.

I will first describe a signaling switch especially adapted for use in connection with my improved signaling system.

Where my signaling system is in use on a train, each car or unit of the train will be provided at each end with one of the switches. Hence when my system is in use on a steam railway train one of the switches

will be in the cab of the locomotive for use by the engineer and one will be at each end of each car of the train for use by a conductor or guard and when my system is in use on an electric railway train the switch at the front end of the front car will be used by the motorman and the others by the guards or car door or car gate closers. As it may not be convenient always to locate the switch within the motorman's cab, this switch may be short circuited, by means hereinafter described, when the motorman shall make use of the contact switch 100 within his signaling device.

A suitable box or casing 1 is here shown as comprising a base 2 and vertical side walls 3. The upper sides of the said side walls are curved as indicated at 4. In this box or casing is mounted an arbor 5 on which is mounted the hub 6 of an arm 7. This arm extends upwardly, and its upper end is beveled on one side as at 8. The said arm is also provided, near its lower end, with a bevel 9 which extends in the same direction as the bevel 8. A switch lever or handle 10 is pivotally connected, as at 11, to the arm 7 and has a bevel shoulder 17 on one side to engage the bevel 8 when the switch arm or lever is in line with the arm 7. Hence the said switch lever may move in one direction in the present instance to the right, as indicated by the arrow *a*, together with the arm 7 and may be turned in the reverse direction on its pivot 11 independently of the said arm as will be understood. To normally keep the lever 10 in line with the arm 7 I provide a comparatively weak spring 13 which bears against one side of the arm and one side of the lever and the inner end of which is secured to the arm as indicated at 14. A coil spring 15, which is stronger than the spring 13, has its coiled portion disposed on the hub 6, one end of the spring being attached to the arm 7 and the other end thereof to the casing or boxing 1, as at 16, or by any suitable means, and this spring acts to exert tension on the arm 7 to turn the latter, and hence also the switch lever 10, in the direction indicated by the arrow *b*, in the present instance to the left. A stop 17' is provided to limit the extent of movement of the arm 10.

A pair of electrodes are indicated at 18 and 19. The electrode 19 is a spring and moves normally from the electrode 18, to open or break the circuit and the said electrode 19 is preferably provided on one side near its free end with an anti-friction roller 20. The switch lever 10 has a circuit closing device, here shown as a segment arm 21. This segment arm is insulated from, but is secured to, the switch lever for movement therewith. The electrode 19 is disposed in the path of movement of the circuit closer or segment arm 21 and when the switch lever

10 is vertical or is moved to the right toward the stop 17' the electrode 19 is, by the action of the circuit closer 21, closed against the electrode 18 so as to establish electrical connection between the said electrodes. The electrode 18 is connected, by a conductor 22, to a binding post or connector 23, the said conductor including the windings of an electromagnet 24. The electrode 19 is connected by a conductor 25 to a binding post or connector 26. The switch also includes a device which I call a circuit opener and which comprises an arm 27 which is provided with a hub 28 which is mounted for partial rotation on the arbor 5. A spring 29 has a coiled portion which is disposed on the projecting end of the hub 28. One end of the spring bears on a stop or projection 30 in the box or casing and the other end of the spring is connected to the outer side of the arm 27. This spring is coiled and exerts tension to move the circuit opener in the direction indicated by the arrow *b*. This spring 29 is much more powerful than the spring 13 and the arm 27 of the circuit opener is provided on the side next the arm 7 with a striker or hammer 31. The arm 27 of the circuit opener is movable angularly on the pivot 5 toward and from one pole of the electromagnet 24, and the said arm is made of iron and also forms an armature.

In one side of the casing is a detent 32 which extends into the paths of the lever arm 10 and arm 27, is pivotally mounted at one end, as at 33, and is provided on its outer side, near its pivotal end, with a cam surface 34 and a shoulder 35, the detent being provided at its terminal or free end with a cam 36. A spring 37 is mounted on a pin 38 and bears between one side of the casing and the inner side of the detent, the said pin being connected flexibly to the detent, as at 39, and being connected to the side of the box or casing, as at 40, for slight longitudinal movement so that the detent is adapted for pivotal movement, the spring 37 serving to project the detent into the paths of the lever arm 10 and the circuit opener arm 27.

When the switch is included in the signal circuit, hereinafter described, its operation is as follows. The initial position of the switch is indicated in Fig. 4 in which the arms 7 and 27 are vertical and the arm 10 is inclined to the left, against the tension of the spring 13, so that the closer 21 carried by the said arm is out of contact with the electrode 19 and the latter is therefore, by its spring action, out of contact with the electrode 18, the signaling circuit being broken between the said electrodes, and the arm 10 being at the extreme left at "stop" position. When the lever arm 10 is moved to the right, as shown in Fig. 5, it carries the arm 7 with it, after having first turned

on its pivot 11 into alinement with said arm 7 and engaged its shoulder 8 with the shoulder 17 of said arm. Such movement of the arm 10 and the arm 7 also, by reason of the engagement of the arm 10 with the hammer 31 of the arm 27, causes said arm 27 to also move to the right. The extent of such movement of the arm 10 is limited by the stop 17' and such movement of the arm 10 causes the same to pass over the cam face 34 of the detent 32 so that the arm 10 becomes engaged by the shoulder 35 of the detent, the detent serving to lock the arm 10 in such position. When the arm 10 is in this position the arm 27 is near the cam 36 of the detent and its hammer 31 remains in engagement with the arm 10, this movement of the arm 27 with the arms 10 and 7 disposing the arm 27, which is an armature, within the field of force of the electromagnet 24. When the electromagnet becomes energized, by the means and in the manner hereinafter described, it attracts the armature 27 and causes said arm to ride over the cam 36 of the detent and thus turn the detent on its pivot 33 a sufficient distance to disengage its shoulder 35 from the lever arm 10 so that the said lever arm becomes released from the detent and thereupon the spring 15, which was put under tension by the movement of the lever arm 10 to the right, operates to turn the said lever arm to the left until it reaches a vertical position as shown in Fig. 6. Such movement of the arm 10 to a vertical position, however, does not open the circuit between the electrodes 18 and 19, as the segmental circuit closer 21 still remains in contact with the electrode 19 and continues to press the latter against the electrode 18. The armature arm 27 is held in inclined position to the right by the attraction of the electromagnet 24, which remains energized. Hence when the switch is in "running" position as shown in Fig. 6, the arms 7 and 10 are vertical and the armature arm 27 is in an inclined position, attracted by the electromagnet and spaced with its hammer 31 some distance from the arm 10, and the armature arm is held by the attraction of the electromagnet in such position, against the tension of the spring 29, which tends to throw said armature arm, with its hammer 31, to the left or in the direction indicated by the arrow *b*. When thus held in attracted position, the armature arm of the circuit opener bears against the stop 41. When the signal circuit is broken at any point the electromagnet becomes deenergized and thereupon the spring 29 throws the circuit opener to the left, causing the hammer 31 to strike the switch arm 10 and turn the latter to the left on its pivot 11, against the tension of the spring 13, thus disposing the switch in "stop" position, shown in Fig. 4, and causing the circuit

closer 21 to disengage the electrode 19 so that the latter opens from the electrode 18 and hence the circuit is broken or opened and a gap formed between the said electrodes.

The side walls of the box or casing are each curved at one end, as at 42, concentrically with the pivot 11, when the arm 7 is in vertical position and at the opposite end, as at 43, concentrically with the pivot 5. A cover 44 is secured to and movable with the lever 10, above the box or casing to house the latter and prevent rain water or the like from entering the same through the space between the side walls, and this cover is curved to correspond with the shape of the side walls of the box or casing, as shown and is provided with depending side flanges 54 which bear on the outer sides of the side walls of the box or casing.

In the diagram, Fig. 7, I illustrate my improved signaling system as in use on a steam railway train, the locomotive being indicated at *c* and each car, constituting a unit of the system at *d*. Each car has a conducting wire 46 running from end to end thereof, the conducting wires of the cars being connected together at the ends of the cars by suitable flexible couplers 47. At each end of each car is one of my signaling switches 48, hereinbefore described, the conductors 22 and 25 of which are connected to and inserted with the conductor 46. Also at each end of each car is a double throw switch 49, each of which has one point connected to the conductor 46 and the other point with the ground, at 50, or with the car wheels running on the track rails. A battery or other source of electric current is indicated in the locomotive at 51, one pole of which is connected to the ground at 52. A resistance, which may be employed if necessary, is indicated at 53 and the conducting wire 54 which leads from the battery to the coupler 47 of the front car includes a signaling device, which may be any suitable device, such as a bell, or a semaphore signal, at 55. When the signaling system is in running order the switches 49 are all closed excepting the one at the rear end of the last car which will be thrown to the ground point 50, as shown. When any one of the signaling switches 48 is opened, the signal circuit is broken and, hence, all of the signal switches will be moved to initial, "stop" position by the means and in the manner hereinbefore described. As the guard at each end of each car closes the gates or doors under his charge he manually turns the lever 10 of the signaling switch to the circuit closing position shown in Fig. 5. No current flows through the signaling circuit until all of the signaling switches are in circuit closing position, but the instant the last guard, in point of time, closes his gates or doors and sets the

signaling switch to circuit closing position current flows through the electromagnets of all of the signaling switches, thereby disposing them in the "running" position shown in Fig. 6, as hereinbefore described, and the signaling device or translating device (Fig. 5) in the cab of the locomotive is also actuated, thereby notifying the engineer that the gates or doors of every car of the train are closed and that it is safe for him to proceed. The signaling circuit remains charged with current all the time the train is running, the signaling switches being held in "running" position by the magnetic action of the electromagnet on the armature arms of the circuit closers. In the event of an accident a guard at either end of any car of the train may instantly signal to the engineer to stop, by manually turning the switch lever 10 of the signal switch to "stop" position (Fig. 4) thereby breaking the signal circuit and hence causing all the signaling switches of the train to move to "stop" position and also causing the translating device 55 in the locomotive cab to give the stop signal, and, hence, not only the engineer of the locomotive, but the guards of all the cars of the train are notified.

In the diagram, Fig. 8, I illustrate my improved signaling system as in use on an electric railway train. Two car units are shown. 57 is the trolley line or third rail conductor, 58 is the traveling shoes or trolleys and 59 is the ground points which may be the car wheels running on the conductor rails. The conductors 60 of the car units are connected together between the cars by the couplers 61 and each conductor 60 includes a variable resistance 62 and a signaling device 63, and also includes a short circuiting switch 64, by means of which the signals and the variable resistances may be shunted. At each end of each car one of my signaling switches 48* is included in the signaling circuit, and branch conductors 65 lead from the conductors 60 and each includes a double throw switch 66, whereby either end of each conductor unit 60 may be connected either to the trolley or the ground, as may be necessary, or disconnected from both of them. It will be understood that all of the signaling switches, signaling devices 63 and the variable resistances may be connected in a series from end to end of the train, or the signaling device and variable resistance of any one of the cars may be shunted, according to the position of the short circuiting switches 64. In the diagram the signaling devices and variable resistances of the front and rear cars of the train are shown connected in a series with all of the signaling switches, and the signaling devices and variable resistance of the intermediate cars are shown shunted. In the operation of the system each guard, as he closes his gate or

gates, moves the handle or lever of his signaling switch to the intermediate position shown in Fig. 5, thereby closing the signal circuit at his point and when the last guard closes his gate or gates and correspondingly operates the lever of his signaling switch, the signaling circuit is completed and supplied with current and all of the signaling switches, including that at the front end of the front car, where the motorman is stationed, are set to "running" position and at the same time all of the signaling devices included in the circuit are operated, and the motorman is thereby notified that all the doors or gates of the train are closed and that he may proceed without danger.

As my improved signaling system provides two signaling switches to each guard, one on the rear platforms of the forward car and the other on the front platform of the rear car, I have provided a switch 101, to connect the binding posts 25 and 26. Normally this switch 101 is open, but when it is closed, it cuts out of service the entire signaling switch in the box of which it is located, by shunting across its terminals, as will be understood.

One of the advantages of my signaling system is that by its means each and every guard or conductor of a train is in direct communication with the motorman or engineer when the signal to start has been given. By proper connections, when any one signaling switch is at "stop", the brakes may be put in operation. Furthermore, my signaling system puts the motorman or engineer in charge of the doors or gates of the cars. It enables him to pull slowly into a station following another train which is just going out without any danger of any one of the guards opening a gate until after he brings the train to a stop and signals the guards.

While I have herein shown and described my signaling system as for use on railway trains I would have it understood that it may be used wherever simultaneous action is desired between two or more persons at a distance from one another or where a signal is to be transmitted by the most rapid means from one or more persons or places before an operation is to be performed by one person at another place. It may be adapted for use at race courses, toboggan slides, on ships, elevators, or lifts, on scenic railways and in other connections.

In Figs. 9 and 10 I show, in detail, a suitable construction of the signaling device 63. The casing 67 is provided at one side with a wall 68 of glass or other suitable transparent material. In this casing is mounted an electromagnet 69, the windings of which are, in practice, included in circuit with the conductor 60, binding posts 70 being here shown for this purpose. The armature 71

has an arm 72 which is pivoted at 73 and a spring 74 is attached to the armature arm and serves to normally raise the same above the upper pole of the electromagnet. A semaphore arm 75 is also provided which is pivotally mounted in the casing, near the glass cover or wall 68, the pivot of the semaphore arm being indicated at 76. The armature arm is provided, in its free end, on one side, with a slot 77, which is indicated in dotted lines in Fig. 9, and this slot is engaged by a pin 78 which projects from the semaphore. Hence, when the armature is in normal, elevated position supported by the spring 74, the semaphore is raised. When the circuit is closed and the signaling system is in "running" condition the electromagnet 69 is energized and, the armature, being depressed, causes the semaphore to stand in vertical position as indicated in the diagram Fig. 6 and as also indicated in dotted lines in Fig. 9 and in full lines in Fig. 10. The instant that the circuit is broken, by the means and for the purposes hereinbefore described, the electromagnet becomes deenergized and the semaphore is raised to horizontal position as shown in diagrams Figs. 4 and 5 and also in full lines in Fig. 9. A switch 100 is included in circuit with the electromagnet 69. This switch is composed of a contactor 102, secured at one end as at 103, and which normally rests at the other end against one of the binding posts 70, which forms the other electrode, keeping the switch normally closed. An insulating plunger or handle 104 rests on the spring contact. By pressing this plunger the switch may be opened and the circuit thus broken, as will be understood.

I would have it understood that any suitable signaling instrument may be used, within the scope of my invention as defined by the appended claims.

Having thus described my invention, I claim:

1. In an electric signaling system, a circuit including a translating device and a plurality of switches, means in connection with each switch to lock the same in closed position, and electrically controlled means acting when energized to unlock the switch and when deenergized, to move the switch to open position.

2. In an electric signaling system, a circuit including a translating device and a plurality of switches connected in series, mechanical means in connection with each switch to lock the same in closed position, the switch tending, when unlocked, to move toward but short of open position, and electrically controlled means included in the circuit and acting, when energized, to unlock the switch and when subsequently deenergized, to move the switch to open position.

3. In an electric signaling system, a circuit including a translating device and a plurality of switches connected in series, each switch including a circuit closer and a switch lever, a detent arranged to lock the switch lever and circuit closer in closed position, an electromagnet included in the circuit, means including an armature disposed in the locked position of the lever in the field of the magnet and arranged when the magnet is energized to operate the detent to release the lever, and means acting upon said armature when the magnet is deenergized to cause the same to move the lever and circuit closer to open position.

4. A signaling system of the class described, comprising a circuit including a plurality of switches, each switch including a movable circuit closer, locking means for securing the circuit closer in closed position, means including an armature for unlocking the circuit closer and moving the same to open position, and an electromagnet acting upon the armature to restrain the same and to move it in a direction to unlock the circuit closer, the said electromagnets being included in the switch circuit.

5. A signaling system of the class described, having a circuit, including a translating device and a plurality of switches, each switch including a movable circuit closer, locking means for securing the circuit closer in closed position, means including an armature for unlocking the circuit closer and for moving the same to open position, and an electromagnet acting upon the armature to restrain the same and to move the armature in a direction to unlock the circuit closer, the said electromagnets being included in the switch circuit.

6. A signaling system of the class described including a conductor having a gap and also including a switch having a movable circuit closer to close the gap, an electromagnet in circuit with the conductor, a pivotally mounted arm, a lever arm carried by and pivotally connected to the first mentioned arm and to which the said circuit closer is attached, a spring to turn the first mentioned arm and the lever arm in one direction, a spring to normally keep the lever arm in line with the first mentioned arm and yet permit the lever arm to turn at an angle thereto into circuit opening position, a detent to lock the lever arm in circuit closing position and a circuit breaker comprising a pivotally mounted arm forming an armature for attraction by the electromagnet and having a hammer to strike the lever arm, said armature arm acting to release the detent from the lever arm when the armature arm is attracted and a spring to actuate the armature arm and cause the hammer thereof to turn the lever arm to circuit opening position when the circuit

through the conductor is broken at any point.

7. A signaling system, comprising a circuit having a gap, a movable closer for the gap, mechanical means for locking the circuit closer in closed position, electrically operated means included in the circuit, which when energized, is arranged to unlock the circuit closer, and when deenergized, is arranged to move the circuit closer to open position, and means for opening the circuit.

8. A signaling system of the class described comprising a conductor including a switch, said switch including a movable circuit closer, locking means to secure the circuit closer in closed position, means including an armature release to the circuit closer from the locking means and to move the circuit closer to open position, an electromagnet included in the circuit with the conductor, and means to open the circuit and thereby cause the electromagnet to be deenergized and permit the armature to act.

9. In an electric signaling system, a circuit including a translating device and a plurality of switches connected in series, each switch including a jointed switch lever, a circuit closer carried by the switch lever,

yielding means tending to maintain the switch lever sections in alinement with the circuit closer in operation and the circuit closed, a detent disposed at one side of the normal position of the switch lever and arranged to lock the switch in closed position, an electromagnet included in the circuit, an armature pivotally mounted to move in the path of the switch lever from a position in the field of the magnet in the direction of the opening movement of the switch lever, said armature arranged to be brought in the locking position of the switch lever into the field of the magnet and to bear upon the detent, said armature arranged when the magnet is energized to release the switch lever from the detent and permit the same to assume its normal position and arranged when the magnet is deenergized by the breaking of the circuit at any point in the system to swing upon its pivot and strike against the switch lever to move the same into open position.

In testimony whereof I hereunto affix my signature in the presence of two witnesses.

CROSBY FIELD FRANK.

Witnesses:

HENRY H. NORRIS,

JOHN F. H. DOUGLAS.