G. W. GERLACH.

SAFETY BLOCK SIGNAL.

APPLICATION FILED MAY 6, 1913.

1,191,414. Patented July 18, 1916.

3 SHEETS—SHEET 1.

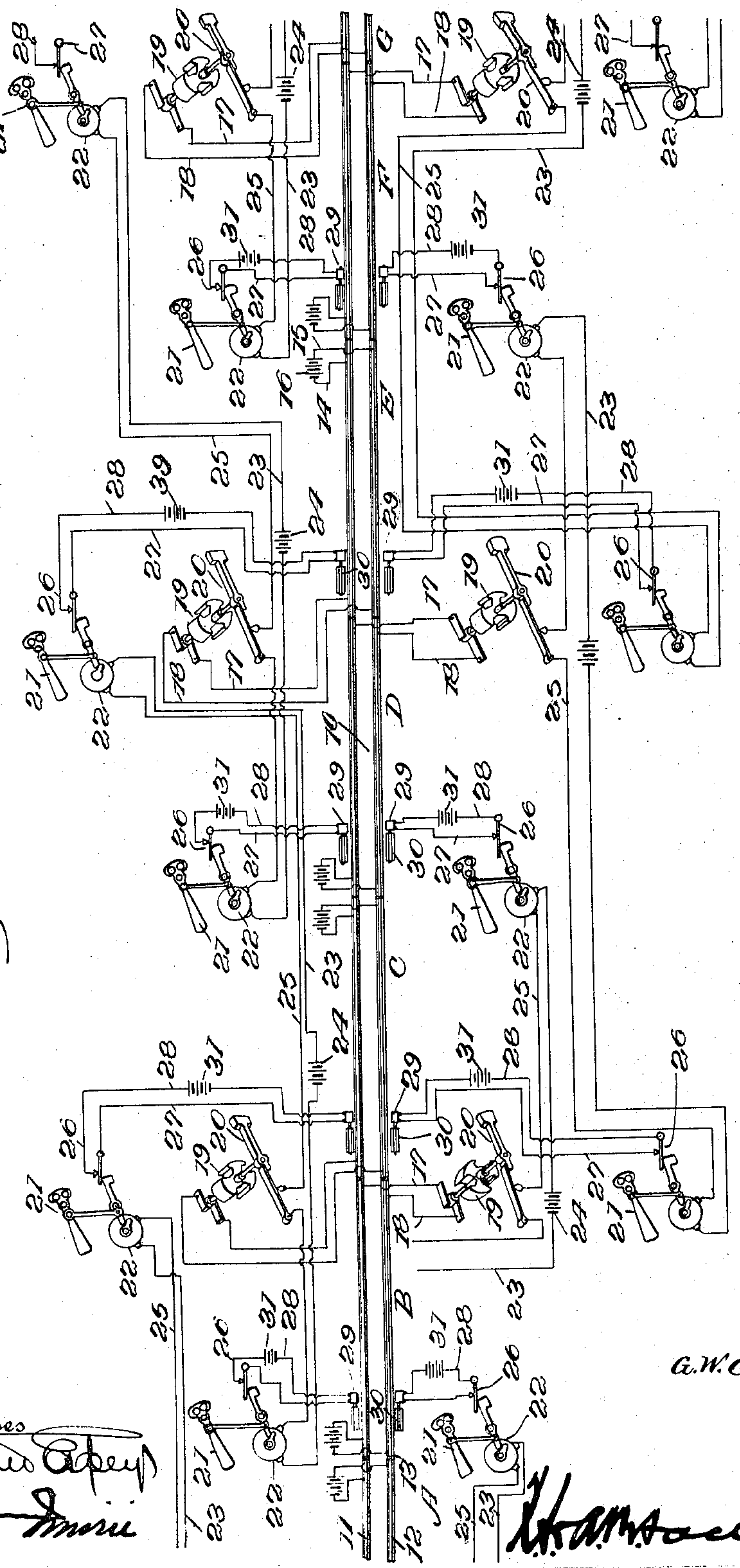

Fig. 1

Witnesses

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3 SHEETS—SHEET 2.

Fig. 2

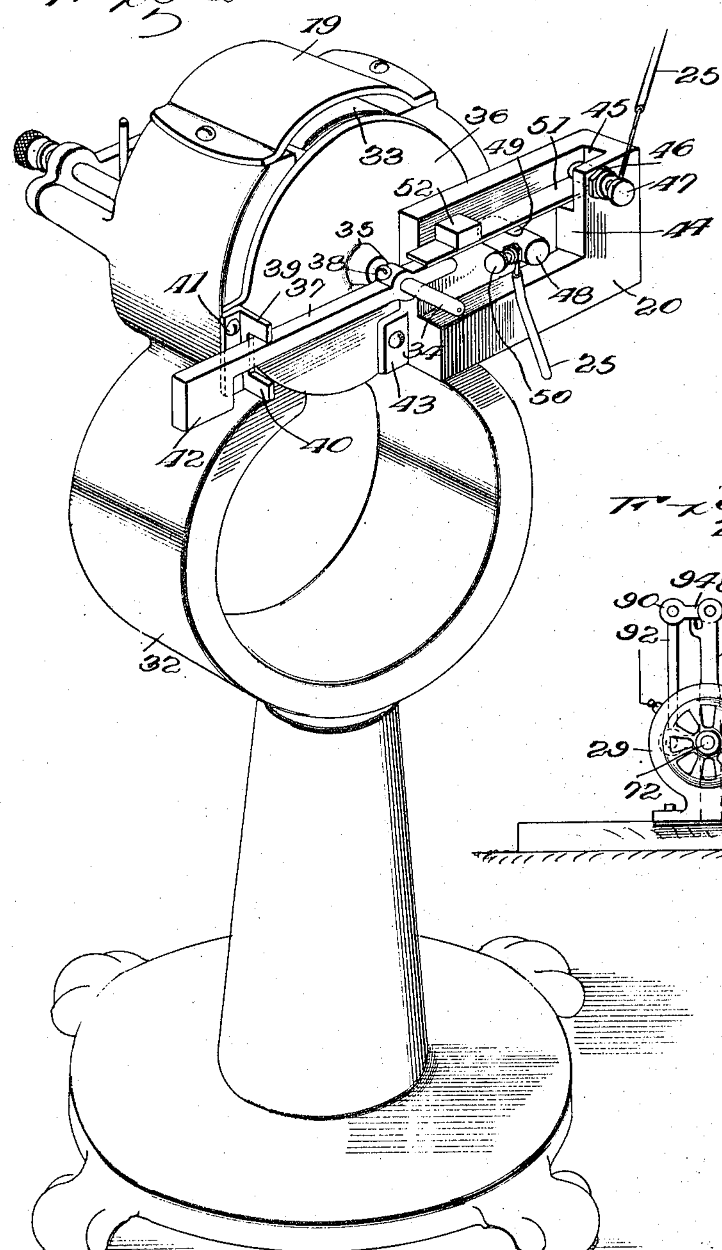
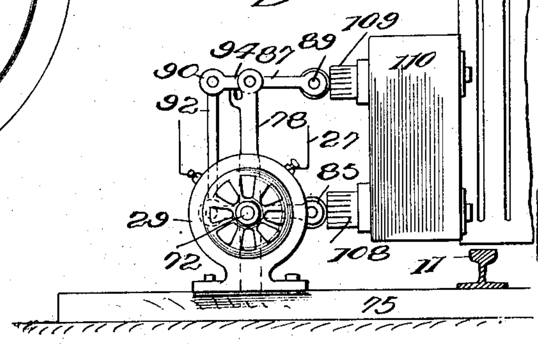


Fig. 6



Witnesses

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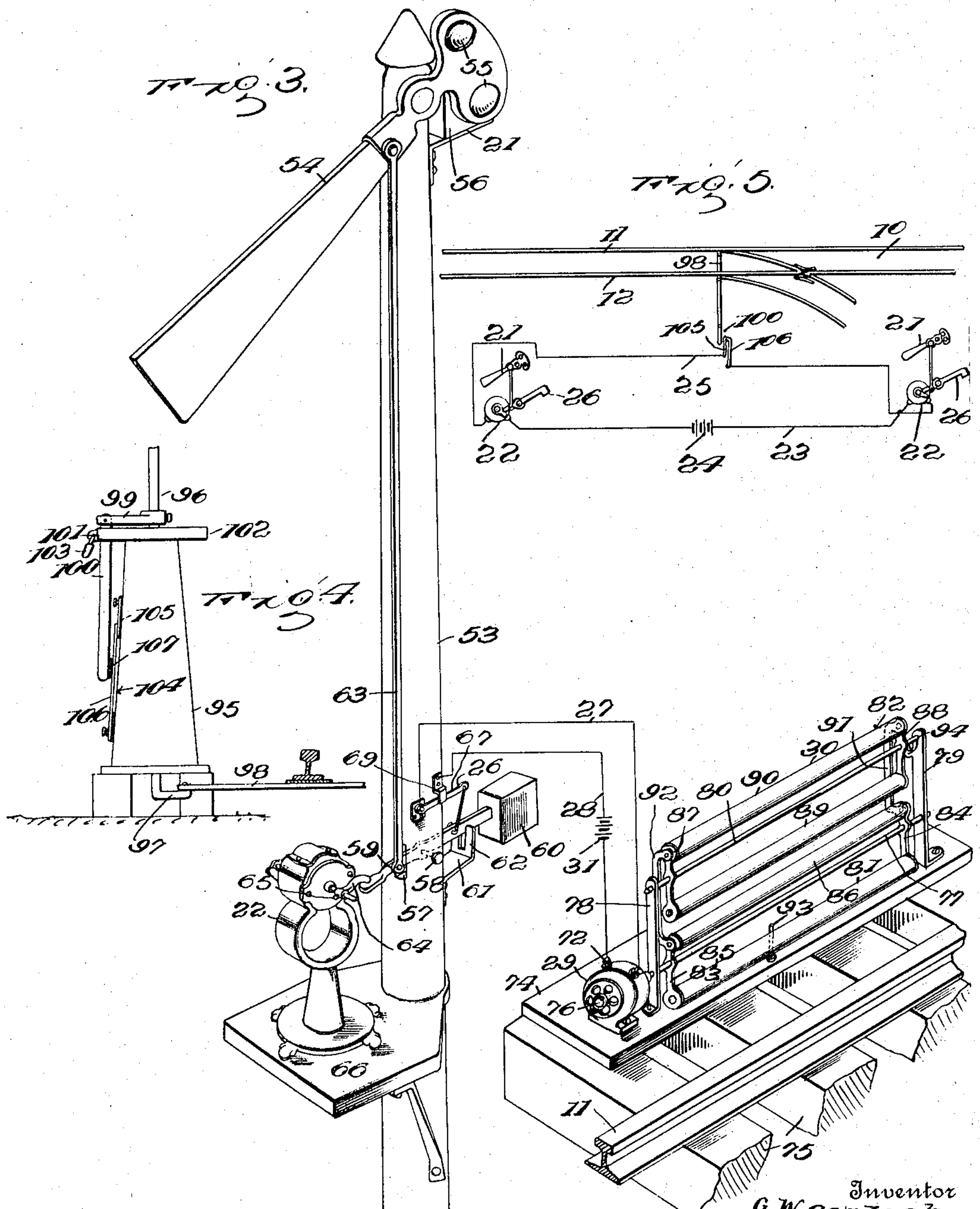
3 SHEETS—SHEET 3.



Witnesses

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UNITED STATES PATENT OFFICE.

GEORGE W. GERLACH, OF CUMBERLAND, IOWA.

SAFETY BLOCK-SIGNAL.

1,191,414. Specification of Letters Patent. **Patented July 18, 1916.**

Application filed May 6, 1913. Serial No. 765,859.

To all whom it may concern:

Be it known that I, George W. Gerlach, citizen of the United States, residing at Cumberland, in the county of Cass and State of Iowa, have invented certain new and useful Improvements in Safety Block-Signals, of which the following is a specification.

My present invention relates to new and useful improvements in block signaling systems for railways and the primary object of my invention is to provide a block signaling system which, when two trains approach each other too nearly, will not only display a danger signal to each train before the trains get dangerously close to each other, but which will also move into active position certain contacts which, when in active position, extend in the path of certain other contacts carried by the trains to close circuits on the trains controlling the air brakes, the throttle valve of the locomotive or other like mechanism, thereby serving to automatically stop the trains.

A further object of my invention is to provide a block signaling system in which the signals are thrown into danger position and the contacts into active position either by the breaking or cross-circuiting of a normally closed circuit which, in turn, breaks a second normally closed circuit in which the signal and contact actuating mechanisms are included.

In carrying out my invention the track is divided off into sections or blocks which are insulated one from the other and the track rails forming each block form portions of a normally closed track circuit which includes an operating mechanism for a normally closed switch contained in a normally closed signaling circuit.

A further object of my invention is therefore, to provide a switch operating mechanism for said switch which will cause the automatic opening of the switch upon any breaking or cross-circuiting of the track circuit, thereby opening the signaling circuit.

The signaling circuits of my improved block signaling system overlap each other and each signaling circuit includes a pair of signaling devices and a pair of co-acting contact actuating devices, one signaling device and contact actuating device being placed at the end of one block and the other at the opposite end of the second block beyond the first.

In this connection, a still further object of my invention is to construct a combined signal and contact actuating mechanism which, when electrically energized, will hold both the signal and contacts in inactive position and which, when deënergized by the opening of the signaling circuit, will permit both the signaling devices and the contacts to move to active position. And a still further object of my invention is to so arrange the signaling circuits that they may include an electrical switch carried by the switch stand controlling any track switch which may occur in any block and so arranged that unless the switch operating arm of the switch stand is properly locked, the circuit will be opened. With this arrangement it will be impossible for any train to approach the switch from either direction unless the switch is properly closed and locked.

With these and other objects in view, my invention will be more fully described, illustrated in the accompanying drawings, and then specifically pointed out in the claim which is attached to and forms a part of this application.

In the drawings: Figure 1 is a diagrammatic view illustrating the wiring of the various circuits for a number of successive blocks, clearly showing the arrangement and principle of operation of my improved system; Fig. 2 is a perspective view of a switch operating mechanism, one of which is included in each track circuit, and of the switch which said mechanism operates, this switch being included in the signaling circuit; Fig. 3 is a perspective view, partially diagrammatic, of one of the signaling devices and one of the contact devices, together with the mechanism for operating the latter, as well as the mechanism included in the signaling circuit and normally holding both the signaling device and the contact actuating device in inactive position; Fig. 4 is a fragmentary elevational view of a conventional form of track switch stand, showing the application of an electrical switch in such a manner that any improper setting of the track switch will leave the electrical switch open; Fig. 5 is a diagrammatic view, showing one method of electrically connecting the electrical switch of the track switch stand with the signaling circuit in such a manner that any improper setting of the track switch will result in the opening of the signaling circuit and the consequent movement of the signaling devices and contact devices of said circuit into active position. Fig. 6 is a fragmentary elevational view of one of the movable contact devices in operative position, showing contacts carried by the locomotive engaging the same.

Corresponding and like parts are referred to in the following description and indicated in all the views of the drawings by the same reference characters.

When installing my improved block signaling system the railway track 10, having rails 11 and 12, is divided into a plurality of successive blocks or sections of any suitable length, such as a mile, the rails of each section being electrically separated from the rails of adjacent sections or blocks by bridges 13 of non-conductive material such as fiber, rubber or the like.

In order to insure a clear understanding of the arrangement and operation of my improved system I have illustrated, in Fig. 1, a plurality of successive blocks which, for the sake of convenience, will be hereinafter referred to as block A, block B, block C, block D, block E, block F and block G. The rails 11 and 12 of each block form portions of separate and independent track circuits and are connected by conductor wires 14 and 15, respectively, to the poles of a battery 16 or to any other suitable source of electrical energy, the wires 14 and 15 being, in each instance, connected to adjacent portions of the rails at one extreme end of the block. The rails 11 and 12 at the opposite end of each block are electrically connected by conductor wires 17 and 18, respectively, to the binding posts of an electrical controlling device, indicated as a whole by the numeral 19 and arranged to control the opening and closing of an electric switch, indicated as a whole by the numeral 20. It will therefore be seen that the rails 11 and 12 of each block, together with the wires 14 and 15 and wires 17 and 18, form a normally closed track circuit including a source of electrical energy and an electrically actuated switch controlling device. If therefore, this circuit at any time becomes open, through breaking of a rail, or cross-circuited through the entry of a train upon the tracks forming part of the circuit, the switch actuating or controlling device will be deënergized.

A plurality of signaling devices, indicated as a whole by the numeral 21, are positioned, two adjacent the juncture of adjacent blocks and each of said signaling devices includes an electrically operated controlling mechanism 22. These signaling devices may be positioned both upon either side of the track or one upon each side as indicated in Fig. 1 of the drawings.

A conductor wire 23 connects one of the binding posts of each of the controlling devices with the opposite binding post of a controlling device located three blocks farther along the track. In other words, the conductor wire 23 which is connected to the controlling device between blocks A and B is connected by its opposite end to the controlling device between the blocks D and E. The wire 23 which is connected to one of the controlling devices at the juncture of the blocks B and C is connected at its opposite end to one of the controlling devices between the blocks E and F. The wire 23 which is connected to one of the controlling devices at the juncture of the blocks C and D is connected to one of the controlling devices at the juncture of the blocks F and G. Each of these conductor wires 23 includes a battery 24 or other suitable source of electrical energy. The controlling devices 22 which are connected to each other by the wire 23 are also connected to each other by a conductor wire 25 and this wire includes, in each case, one of the switches 20. It will therefore be apparent that the wires 23 and 25, together with their connected signaling devices and switch, form a signaling circuit which, as the switch is normally closed, is a normally closed circuit.

Each of the controlling devices includes an electric switch 26 and conductor wires 27 and 28 connect this switch with a contact actuating device 29, one of these devices being located adjacent each of the controlling devices and in juxtaposition to the track. Each of these contact controlling devices is operatively connected, in a manner which will be later explained, to a contact device 30. A battery 31 or other suitable source of electrical energy is included in the wire 28 to electrically energize the circuit through the switch 26 and contact actuating mechanism or device 29.

The foregoing completes the description of the signaling system proper but in order to understand the application and operation of the system a more complete description of the various operating mechanisms, together with the switches controlled thereby, is necessary.

The operating mechanism 19 for the normally closed switch or circuit breaker 20 includes, as best shown in Fig. 2 of the drawings, an electric motor of conventional type having a pedestal 32 which also forms a housing for the armature 33 carried by the armature shaft 34 which is rotatable in bearings, one of which, as shown at 35, is formed in the end bracket 36. A lever arm 37 is apertured adjacent one end to receive the free end of the armature shaft 34 and said lever is locked against turning movement independent of the shaft by a set screw 38. The longer end of this lever extends between the vertically spaced apart arms 39 and 40 of a bracket 41 carried by the pedestal 32 and is counterweighted as shown at 42. It will therefore be apparent that if the wires 17 and 18 of the track circuit are properly connected to the binding posts of the motor when said track circuit is closed, as it normally is, the armature shaft, as shown in Fig. 2 of the drawings, tends to turn in a clockwise direction and the weighted arm of the lever 37 therefore bears against the lower face of the arm 39 of the bracket. As soon, however, as the motor is deënergized by either the opening or short-circuiting of the track circuit, the weighted arm of the lever 37 will cause the same to turn in a counterclockwise direction until stopped by engagement with the upper face of the arm 40 of the bracket. Secured upon the end bracket 36 of the motor, is a second bracket 43 which carries the switch 20. This switch comprises a block of resilient material, such as vulcanized rubber, fiber or the like, the upper portion of which is cut-away as shown at 44 and further cut-away as shown at 45 to provide space for the switch mechanism proper. This switch mechanism includes a binding post 46, the body portion 47 of which is passed through the block to traverse the space provided by the cut-away portion 45 and a contact stud 48 having a flattened upper contact face 49 substantially in the plane of the binding post 47. This stud carries a second binding post 50 and the wires 25 of the signaling circuit are connected to the binding posts 46 and 50. Swingingly mounted by one end upon the body or shank of the binding post 46 and in the recess 45 of the block, is a contact arm 51 weighted adjacent its free end as shown at 52 in such a manner as to normally engage against the flattened face 49 of the contact stud 48 to close the circuit between the wires 25. This switch is so arranged relative to the bracket 41 that when the weighted end of the lever 37 is raised by the energizing of the motor, the contact arm 51 will engage the stud 48 and extend by its free end over the shorter end of the lever. As soon, however, as the motor is deënergized, the weighted end of the lever swinging downwardly will swing its shorter end upwardly to engage the free end of the contact arm 51 and raise the same out of engagement with the stud to break the signal circuit.

From the foregoing description, it will be apparent that the above described circuit breaker, together with its operating mechanism, constitutes one of the vital features of the signaling system in that said circuit breaker, having its operating mechanism included in the track circuit and its switch or circuit breaking mechanism included in the signaling circuit, forms the connecting link between the two, any failure of current in the track circuit deënergizing the motor to open the circuit breaker and consequently set the signals and contact shoes of said circuit in active position as will be later explained.

The signaling mechanisms or devices, of which there are two in each signaling circuit, each include a standard 53 positioned adjacent the track and carrying at its upper end a swingingly mounted semaphore arm 54. This semaphore arm is of the usual construction including a head provided with red and green bull's eyes 55 movable in front of the light carried by the casing 56. The standard or post 53 is provided at any suitable point with a diametrically extending slot 57 and swingingly mounted by its intermediate portion in this slot upon a pivot pin 58 in a lever 59, the longer arm of which is weighted as shown at 60. The downward swinging movement of the weighted arm of the lever is limited by a bracket 61 having upwardly directed spaced fingers 62 between which the said arm of the lever moves. Connected intermediate the length of the opposite or shorter arm of the lever 59, is a rod 63, the opposite end of which is operatively connected to the semaphore arm, this connection being such that when the weighted arm of the lever is in lowermost position, the semaphore arm will be held in raised or danger position.

As a means for normally holding the weighted arm of the lever in raised position and consequently for keeping the semaphore arm in safety or inoperative position, I have provided each of the signaling devices with an operating mechanism, previously designated by the numeral 22, and including an electric motor of the type illustrated in Fig. 2 and previously described. Instead, however, of the lever 37 there shown, the armature shaft of this motor carries a laterally directed operating arm 64 which is secured against turning movement independent of the armature shaft by a set screw 65. The wires 23 and 25 of the signaling circuit are connected to the binding posts of this motor and as the signaling circuit is normally a closed circuit, it will be apparent that under ordinary conditions, the motor will be energized. The circuit is so arranged with respect to the motors as to rotate the latter in a clockwise direction and the motors are each mounted upon a bracket 66 carried by the standard 53 in such a manner that when energized the operating arm 64 will engage upon the upper face of the shorter arm of the lever 59 to depress the same against the action of the weight 60 and hold the semaphore arm in lowered position. It will be apparent however, that as soon as the signaling circuit is opened through the opening of the circuit breaker 20, the motor forming the actuating device 22 will be deënergized to release the lever, the weighted arm of which will immediately swing downwardly to raise the semaphore arm. The movement of this lever arm 59 is not only utilized as a means for actuating the semaphore arm but is also employed as means for opening and closing the switch 26 which controls the movement of the contact shoes, the manner by which it controls said movement being hereinafter more fully explained. This switch 26 includes a contact arm 67 swingingly mounted upon the standard or other suitable support and having its free end pivotally connected to the intermediate portion of the longer arm of the lever 59 by a link 68. A fixed contact plate 69 is also carried by the standard or other support upon which the swinging contact 67 is mounted in such a position that when the weighted arm of the lever 59 is held in raised position, the swinging contact arm will engage the contact plate, while when the lever arm falls to lowermost position the swinging contact arm will be moved out of engagement with the contact plate. It will therefore be noted that as soon as the signaling circuit is opened, this switch 26 will also be opened.

The switch 26 is connected in circuit by wires 27 and 28 with the binding post 72 of an electric motor which constitutes the contact controlling device previously referred to by the numeral 29. One of these wires includes the battery 31, as previously described, or other suitable source of electrical energy. It will of course be understood that the signal controlling device 22, together with the lever 59 and connected parts, as well as the battery 31, may all be inclosed in a suitable housing built about the standard 53 and so protected from the weather.

The contact controlling mechanism or motor 29, on the other hand, is mounted upon a base or platform 74 carried by the ends of the ties 75 supporting one of the track rails. The armature shaft 76 of this motor 29 is rigidly coupled at one end to a shaft 77 journaled at its ends in spaced vertical standards 78 and 79 in such a manner that any rotation of the motor shaft will be transmitted to the shaft 77. The upper ends of these standards form bearings for a second shaft 80 disposed in parallel spaced relation to the shaft 77 and these shafts 77 and 80 carry the contact members 81 and 82, respectively.

The contact member 81 comprises spaced heads 83 and 84 secured against rotation upon the shaft 77 adjacent the standards, a cylindrical contact member 85 extending in parallel spaced relation to the shaft 77 and connected at its ends to the heads and a counter-weight 86 extending in parallel spaced relation to the shaft 77 and diametrically opposite the contact 85, this counter-weight also being secured by its ends to the heads. In like manner, the contact member 82 includes heads 87 and 88 carrying a contact member 89 and a counter-weight 90, these parts being identical in construction to the construction of the contact member, above described. The contacts 85 and 89 are properly insulated from the heads 83—84 and 87—88. A link 91 pivotally connects those portions of the heads 84 and 88 to which the counter-weights 86 and 90 are secured, while a similar link 92 similarly connects the heads 83 and 87. The base or platform 74 carries an upwardly directed pin 93 forming a stop to limit the turning movement of the contact members about the shafts 77 and 80.

It will be apparent that if the motor 29 is so connected in its circuit as to, when energized, normally hold the contact members in the position shown in Fig. 3 of the drawings with the contact 85 engaging against that face of the pin 93 adjacent the track and with each contact member lying in a plane inclined downwardly toward the track, as soon as the motor is deënergized by an opening of the switch 26, the counter-weights 86 and 90 will immediately act to simultaneously swing the contacts 85 and 89 upwardly and toward the track. The standards 78 and 79 carry stops 94 so arranged as to hold the contact members against further movement when the same lie in horizontal planes.

It of course need hardly be said that these contacts are positioned adjacent the tracks in order that they may be engaged by brushes, contact shoes or other suitable devices carried by each train, preferably by the locomotive of each train, in such a manner as to either close or break a circuit or circuits controlling the operation of safety appliances carried by the locomotive. For instance, they may either open or close a circuit in the locomotive and through the mechanism which it controls, either close the throttle valve, apply the air brakes of the train, or both.

One form of safety appliance and mechanism controlling the same adapted to be employed upon locomotives traveling over tracks guarded by the above described block signaling system, is fully illustrated and described in my copending application, but as such devices form no part of the present invention any further mention of the same is deemed unnecessary.

From the foregoing description, it will be apparent that any opening or short-circuiting of the track circuit of any block protected by my system will cause an immediate opening of the track circuit controlled circuit breaker included in the corresponding signaling circuit, that the opening of this signaling circuit will cause a simultaneous raising of the semaphore arms of the signaling devices of said circuit to danger position, and an opening of the switches 26 of the contact circuits, and further that the opening of these switches 26 in the contact actuating circuits will cause an automatic movement of the contacts into active position. In other words, any opening or cross-circuiting of the contact circuit of any block will result in the immediate movement of the signaling devices and contact devices of that block to active position. Furthermore, this will be accomplished by the opening of circuits rather than by the closing of circuits as is now customary, and any defect in the system, such as a broken wire, inoperative switch, weak batteries, and the like, instead of preventing the movement of the parts to danger position, will in themselves move both the signaling devices and contacts to active position, the system thus being a protection against faults in itself, as well as against approaching trains.

Having thus described the wiring of my improved block signaling system and also the specific construction of the circuit breakers, signaling devices and contact devices, as well as the various mechanisms for actuating the same, I will now describe the general operation of the system as a whole. In this connection it should be borne in mind that the rails of each block form a portion of an independent track circuit and that this track circuit controls the opening and closing of a circuit breaker in a signaling circuit in which there are two signaling devices and two contact mechanisms, one of each of these being positioned at the farther ends of the blocks adjacent that block, the tracks of which form a part of the controlling track circuit.

In operation, assuming that the entire track is clear all the various circuit breakers, switches, and controlling mechanisms will occupy the positions shown in Fig. 1, that is, all the signaling devices and contact devices will be in inactive position. If a train enters block B from block A it will at once short-circuit the track circuit of block B, causing the circuit breaker 20 of said block to open. The opening of this circuit breaker will cause the semaphore arm at the farther end of block C and also the semaphore arm at the farther end of block A to move to danger position and simultaneously with the movement of said semaphore arms the adjacent switches 26 will be opened, causing the contact devices at the farther ends of blocks C and A to move to active position. Under these conditions, it will be apparent that a train approaching the train in block B in either direction would be stopped before it could enter block A or C and all danger of collision thus avoided. As soon as the locomotive or advance end of the train passes from block B to block C it will short-circuit the track circuit of block C to throw the signaling devices and contact mechanism at the farther ends of the blocks B and D to active position and so continue to offer protection to the train. In the meantime the track circuit of block B will remain short-circuited as long as any portion of the train remains in the said block and for that reason no train can even enter block A until the entire train has passed from block B into block C. It will therefore be apparent that there is always at least one complete block between approaching trains that neither train can enter until the other train has passed a block farther on. The blocks are preferably of such length that the safety appliances on the locomotive need only gradually stop the car in the same manner in which it would be stopped by the engineer under normal conditions, that is, for instance, it may bring the train to stop by a service application of the air brakes.

As the maintenance in inactive position of both the signaling devices and the contact devices is dependent wholly upon closed circuits, it will be apparent that if any one of these circuits is either short-circuited or opened or if the current through any one of these circuits falls too low, the signaling devices and contact devices will at once move to active position to prevent entry upon that block in which these faults occur. For this reason, if a portion of the track is washed away, a rail broken, any of the wires of the various circuits broken or if the batteries become too weak, that is, if for any reason, conditions become such that the controlling circuits and mechanisms of any particular block cannot operate properly, that block will at once be protected by the movement of its signaling devices and contact devices to active position.

Because of the fact that the entire system is controlled by normally closed circuits rather than by normally open circuits, the system may also be employed to prevent trains entering a block in which there is an improperly set switch. This may be accomplished in a number of different ways, one of which is fully illustrated in Figs. 4 and 5 of the drawings.

Fig. 4 shows a conventional form of switch stand 95, the target rod 96 of which terminates at its lower end in a crank arm 97 operatively connected to the link 98 which shifts the switch points. This target rod 96 is adapted to be rotated by an arm 99 secured by one end to the rod and having a pivoted handle 100 at its opposite end which, when the switch is properly set, swings downwardly to engage in a seat 101 formed in the table 102 of the switch stand. In this position it is customary to secure the handle 100 by a pad lock or other fastening device 103. In order that this switch may be protected by my system I have provided the switch stand with a circuit breaker 104 including a contact 105 properly insulated from the switch stand and a second, spring contact 106 secured by one end to the switch stand and also insulated therefrom. The free end of this second contact extends between the handle 100 and contact 105 in such a manner that when the handle is locked in place it engages the contact 106 to hold it in engagement with the contact 105, the handle being provided with a bearing block 107 of insulating material to prevent the passage of the current from the circuit closer to the switch stand.

The spring contact 106 is preferably so proportioned and of such strength as to hold the handle in slightly outswung position and so remain out of engagement with the contact 105 unless the handle is actually locked in place. Because of this, it will be apparent that the circuit breaker 104 will be closed only when the switch is properly set and locked. In any block in which such a track switch is included the wires 25 of the signaling circuit not only include the circuit breaker 20 of said circuit, but also the circuit breaker 104 carried by the switch stand.

It will of course be apparent that if the circuit breaker 104 is opened the effect on the signaling mechanism and contact mechanism of the circuit will be the same as though the circuit breaker 20 of the circuit was opened by the opening or short-circuiting of the track circuit of said signaling circuit. Any further description of the operation of the circuit breaker 104 in connection with my block signaling system is therefore unnecessary.

In Fig. 6 I have illustrated the position occupied by the contact device when in active position and the manner in which they are engaged by the contacts carried by the locomotive or other portion of the train. In this figure the motor 29 has been deënergized and the counter weights 86 and 90 have swung downwardly to raise the contacts to active position. In this position, upon the arrival of a train equipped with the safety appliance for co-action with the block signaling system, said contacts will be engaged by contact brushes or shoes 108 and 109 which are supported by a housing 110 mounted in any suitable manner upon the locomotive, a part of which is shown at 111. Upon an inspection of Fig. 6, the reason for mounting the contact device upon the extended ends of ties supporting the track rails will be apparent for it will be seen that when so mounted any settling or shifting of the road bed and consequently of the rails and ties will not change the position of the contacts with respect to the rails and that for this reason the contacts will always be in position to be engaged by the contact brushes of the locomotive, when swung to active position, irrespective of the condition of the road bed.

Each locomotive will be equipped with two pairs of contact brushes or shoes mounted, one pair upon each side of the locomotive in order to insure the actuation of the safety appliance on the locomotive wherever the same passes a contact device in active position, irrespective of which side of the track the contact device may be on, and irrespective of which direction the locomotive may be passing along the track.

As the contact devices located at the ends of the block or blocks occupied by a train are never the ones in active position, due to the presence of a train, it will be apparent that the system will in no way hinder the operating of trains having locomotives at each end, but will, at the same time, give such trains every protection given other trains.

Although I have illustrated and described specific forms of circuit breakers, contact devices, switches and actuating mechanisms therefor, it will be of course understood that changes in construction of said devices may be made, or the equivalents thereof employed, if desired or found expedient, without in any way departing from the spirit of my invention as set forth in the appended claim. This is particularly true of the contact devices as the contact device illustrated in this case is one which has been constructed as adapted to operate with a specific form of safety appliance for locomotives, this form of safety appliance being fully described in a copending application filed by me. I do not wish however, of course, to limit my system to use wholly upon roads, the locomotives of which may be equipped with my safety appliance and for this reason do not limit myself to the specific type of contact devices illustrated in this application which might be totally unsuited in other instances.

Having thus described the invention, what is claimed as new is:

In a block signaling system, a track divided into a plurality of blocks, each insulated from the other, the rails of each block being electrically bonded and included in a normally closed circuit, a separate source of electrical energy for the circuit of each block, a circuit breaker in each circuit normally held in closed position by such circuit, a signaling circuit normally completed through each circuit breaker, a separate source of electrical energy in each signaling circuit, a pair of circuit breakers in each signaling circuit normally held in closed position by the energization of the signaling circuit, track contact controlling circuits normally closed one through each of said last mentioned circuit breakers of the signaling circuit, separate sources of electrical energy in each track contact controlling circuit, and track contacts in each track contact controlling circuit normally held in inactive position by energization of such circuit, the track contacts being so arranged that each block controls track contacts two blocks in advance and one block at the rear to provide an overlapping system.

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

GEORGE W. GERLACH. [L. S.]

Witnesses:

GEO. HOPKINS,

G. M. BOOTYER.