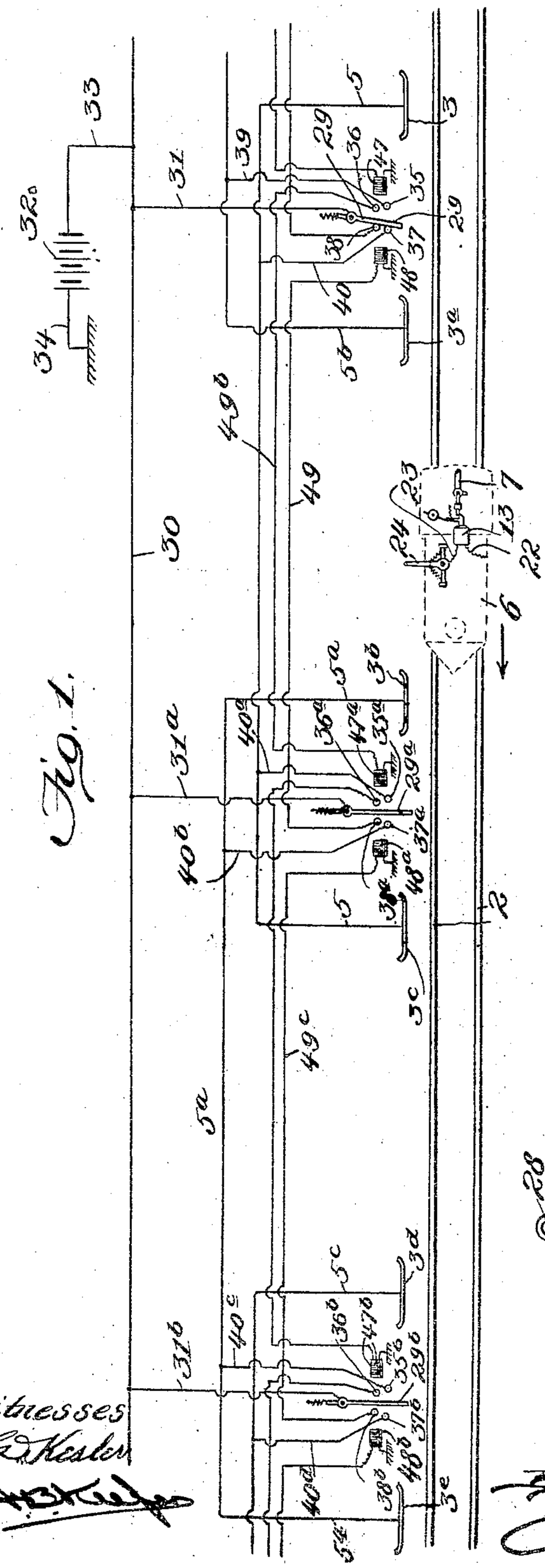
No. 891,779. PATENTED JUNE 23, 1908.

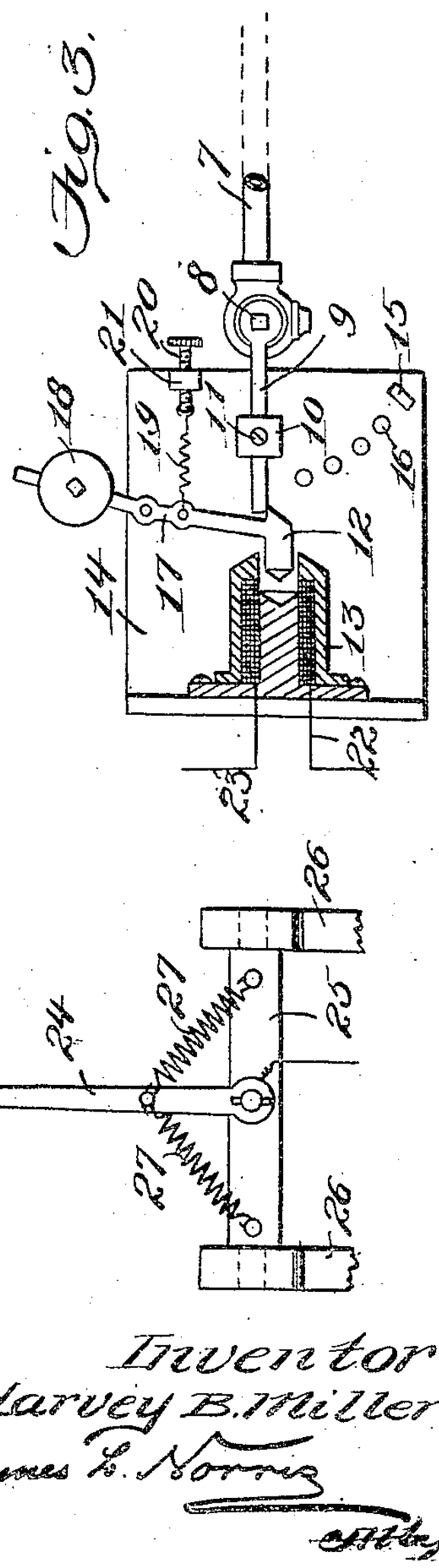
H. B. MILLER.

ELECTRICALLY GOVERNED AUTOMATICALLY OPERABLE TRAIN CONTROLLING SYSTEM.

APPLICATION FILED OCT. 10, 1907.

2 SHEETS—SHEET 1.





Witnesses
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2 SHEETS—SHEET 2.

Fig. 4.

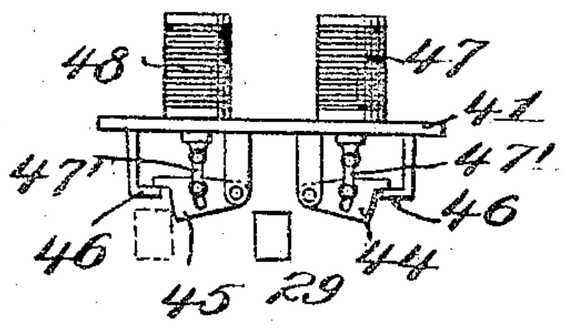


Fig. 5.

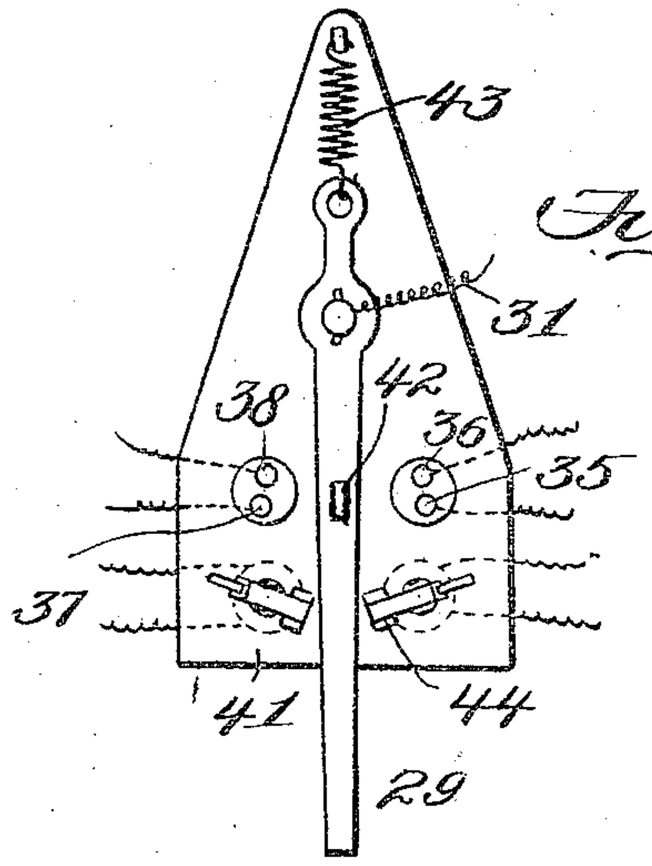


Fig. 6.

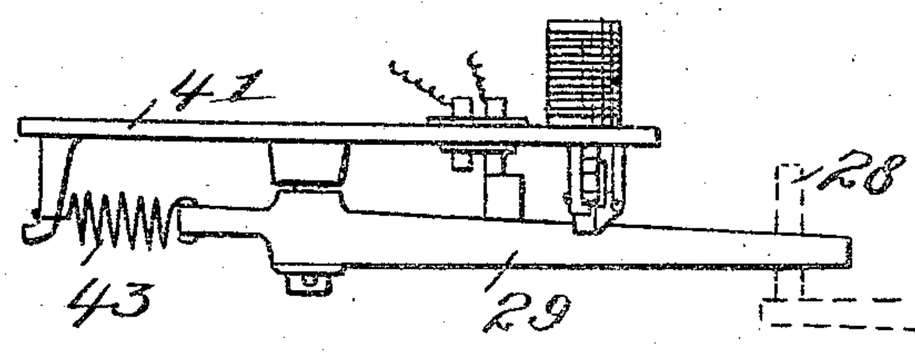


Fig. 7.

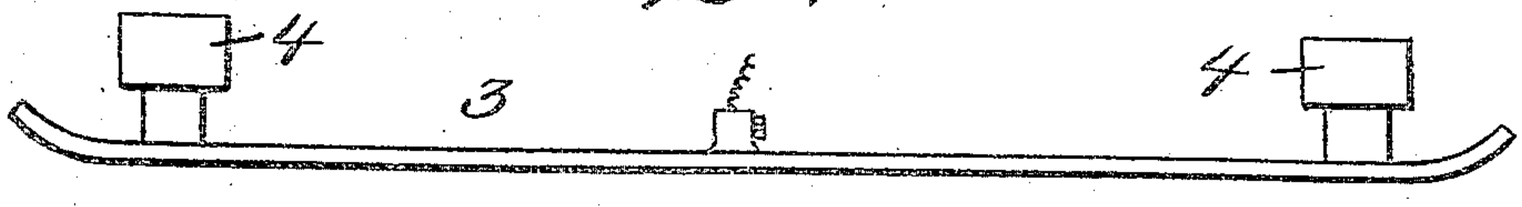
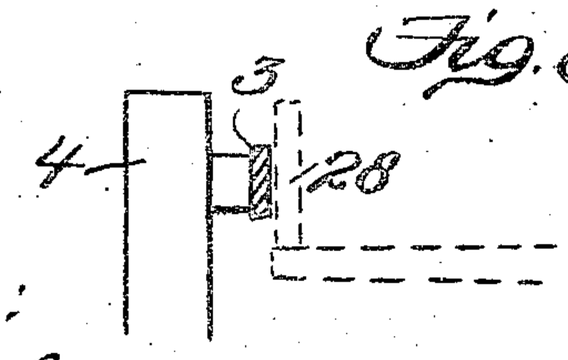


Fig. 8.



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UNITED STATES PATENT OFFICE.

HARVEY B. MILLER, OF STAUNTON, VIRGINIA, ASSIGNOR OF ONE-HALF TO JAMES A. BELL, OF STAUNTON, VIRGINIA.

ELECTRICALLY-GOVERNED AUTOMATICALLY-OPERABLE TRAIN-CONTROLLING SYSTEM.

No. 891,779. Specification of Letters Patent. Patented June 23, 1908.

Application filed October 10, 1907. Serial No. 396,807.

To all whom it may concern:

Be it known that I, HARVEY B. MILLER, a citizen of the United States, residing at Staunton, in the county of Augusta and State of Virginia, have invented new and useful Improvements in Electrically-Governed Automatically-Operable Train-Controlling Systems, of which the following is a specification.

This invention relates to electrically-governed, automatically-operable, train controlling systems.

A system involving my invention is capable of successful and advantageous use in connection with railways whereon the vehicles are propelled by steam, electricity, or otherwise.

In the drawings accompanying and forming part of this specification I show in detail one simple and effective form of embodiment of the invention which, to enable those skilled in the art to practice the same, will be set forth in detail in the following description, while the novelty of the invention will be included in the claims succeeding said description. In said description I shall for convenience describe the system in conjunction with a steam railway and the same is of such a character as to give to an engineer or other trainman notice of danger or of the proximity of two trains. In the form of embodiment of the invention illustrated it is my intention to apprise two engineers of their adjacence. The system, however, as will be clear from what has been stated, can be used in many ways, for example, for preventing an accident in case of an open switch or a bridge washed away, or other such like and similar causes. Preferably two trains are simultaneously stopped or caused to slow down automatically or wholly independently of the trainmen in charge thereof when such trains are within dangerous proximity to each other and the amount of distance between such trains in such a contingency may be as determined or to suit particular conditions. I prefer to effect the stoppage or slowing down of trains in such a case by reducing the air pressure in the braking apparatus thereof. It is well understood that, on the reduction of air pressure in an air-pipe or train-line, the train carrying the same is caused to slow down or to stop in accordance with the amount of reduction of pressure. This stoppage of the trains is accomplished automatically and, if an engineer should perceive that his train has been slowed down or caused to stop without his agency or that of any one on his train, this will positively indicate to him danger. If he has been slowed down in the manner indicated he can thereafter run under reduced speed until possibility of danger has been eliminated and this can be indicated by signals or otherwise. The system involves in its make-up certain electrical connections and means for energizing the same and, while in the present case these connections are employed for controlling the movement of a train or trains, they can without change or possibly by slight modifications be adapted for signals. It will therefore be clear that, when I use the title which I have selected for designating my invention, I can use the invention for controlling trains in various ways, but I preferably accomplish this by reducing train-pipe or train-line pressure. The different parts are so arranged, as will be hereinafter obvious, that the system is self testing; that is to say, should there be a failure of a switch, for example, to operate, this will be made evident to an engineer.

Referring to said drawings: Figure 1 is a diagrammatic plan view of a system involving my invention. Fig. 2 is a detail view of a combined actuator and contact device. Fig. 3 is a diagrammatic elevation of portion of a train-pipe, valve, magnet for operating the valve, and certain co-acting parts. Fig. 4 is a detail view of latching mechanism. Fig. 5 is a detail view in elevation of a switch, contacts, and latches coöperative with said switch. Fig. 6 is a side elevation of the parts shown in Fig. 5 and illustrating by dotted lines said combined actuator and contact device. Fig. 7 is a top plan view of a contact rail. Fig. 8 is a sectional view of said contact rails, the said actuator and contact device being partially shown by dotted lines in said figure.

Like characters refer to like parts throughout the several figures.

In Fig. 1 of the drawings I have shown a portion of a railway track, the same being composed of the rails 2. These rails 2 serve at times as conductors, as will hereinafter appear. Coöperative with the railway rails are conductor rails. There may be any number

of these conductor rails and they may be associated with the track rails in any desirable way. As a matter of fact said conductor rails need not strictly speaking be rails, so long as they serve as conductors. Said conductor rails are generally arranged in pairs and they may be separated any desirable distances, the spaces or intervals between the same depending upon the length of the blocks, and they may be placed in any desired relation with respect to the railway rails. For convenience of illustration I have shown six of these conductor rails and denote them by 3, 3^a, 3^b, 3^c, 3^d, and 3^e, respectively. Said conductor rails may be mounted on posts or standards denoted in each case by 4 and shown clearly in Figs. 7 and 8. It is my custom to insulate said conductor rails from the ground. The conductor rail shown in detail in Figs. 7 and 8 may be any one of those shown in Fig. 1, for instance, the rail 3, as in the present case they are all the same in construction and function. The conductor rails 3 and 3^c coöperate, while the conductor rails 3^b and 3^e coöperate. The conductor rails which coöperate with the rails 3^a and 3^d are not shown in Fig. 1, although it will be understood that they are located to the right and left respectively of said rails 3^a and 3^d.

I have shown as extending between the conductor rails 3 and 3^c a conductor as 5 and this conductor may consist of wire. Between the rails 3^b and 3^e is a conductor or wire as 5^a. The wire or conductor leading from the rail 3^a and the coöperative rail, not shown, is denoted by 5^b, while the conductor or wire leading from the rail 3^d to the coöperating conductor rail, also not shown, is designated by 5^c. Connections such as those I have described can be used when properly energized for operating a signal, a brake-controlling device, or anything else, although in the present case they are, as will be clear, utilized for effecting the reduction of pressure in an air brake apparatus.

In Fig. 1 of the drawings 1 have shown at 6 the locomotive of a train. This locomotive is provided with an air-brake apparatus or system including in its make-up a train-pipe or line as 7 (see Fig. 3.) This train-pipe is equipped with a valve as 8 which, when opened, will cause a reduction of pressure in the train-pipe sufficient to cause a slackening of speed of or stoppage of the train hauled by said locomotive 6. To the stem of said valve 8 is connected an automatically operative arm as 9. The arm is shown as operated by a weight as 10 adjustably secured thereto by a set-screw as 11. The valve 8 is held in its closed position normally by means of a detent or catch as 12 which in the present case constitutes the armature of a magnet as 13, said magnet being suitably mounted upon the plate or board 14 and being insulated therefrom. Normally, of course, the magnet is deënergized. When it is energized, however, it attracts its armature 12 sufficiently so as to carry the same from under the valve operating member or arm 9, thereby releasing the latter so that said arm can, by the power of the weight 10, be caused to drop for opening the valve 8. The length of opening movement of the valve can be regulated by a pin as 15 adapted to be placed in any one of the several holes 16 arranged on an arc concentric with the axis of motion of the arm 9. The pin 15 is removably fitted in the lowermost hole 16. By placing said pin in the uppermost hole the opening movement of the valve 8 will be quite restricted. These holes are shown as being formed in the board or plate 14. The armature-detent 12 is illustrated as carried at the lower end of a rocking-lever as 17 shown as fulcrumed between its ends to the board or plate 14. The upper arm or branch of the lever 17 is illustrated as provided with a weight as 18 whereby I obtain a balanced lever; that is to say, there is an equal amount of weight in the lever at opposite sides of its center of motion so that the lever in itself has no tendency to operate. To the lower arm or branch of the lever 17 I have shown as connected one end of a light coiled pull spring 19, the other end of said spring being connected with a screw as 20 tapped through a projection as 21 on the plate or board 14. By the manipulation of said screw 20 the tension of the spring 19 can be regulated. This spring 19 serves normally and positively to hold the armature-detent 12 in its effective position so that said armature-detent cannot possibly be accidentally disengaged or freed from the arm 9. The core of the magnet 13 is shown as having its outer end provided with a substantially conical counter-bore to receive the correspondingly shaped portion of said armature-detent when the said magnet attracts said armature-detent. From one pole of the magnet 13 a conductor as 22 extends, said conductor being connected with some metallic part of the locomotive 6 which is in electrical connection with one of the rails 2. From the other pole of said magnet a wire as 23 extends, said wire being also connected with the swinging arm as 24 represented as pivoted to a rock-shaft as 25 carried by bearings as 26 on the locomotive (see Fig. 2, for example.) Said swinging arm 24 serves two purposes, one, as a contact device, and the other, as a switch-actuator. Said arm therefore is really a combined switch-actuator and contact device. In the embodiment of the invention shown said arm 24, when in its operative position, is horizontally disposed, although, by virtue of its connection with the shaft 25, it can be swung up out of the way when occasion requires to a vertical position. Normally also said arm 24 stands approximately at right-

angles to its support or rock-shaft 24 and it is maintained in this its neutral position in some positive but yieldable manner, for instance, by spring means. I have shown two springs each denoted by 27 for such purpose. The outer ends of these springs are connected in some suitable way with the arm 24 at a point removed from the center of motion thereof, said springs extending divergingly from their connection with the arm to and being connected with the support or rock-shaft 25. The arm therefore is yieldingly mounted so that it can operate switches without possibility of deranging or injuring any of the switches or the arm itself.

The arm 24 has at its outer end an upright pin as 28 which constitutes the effective or working part of said arm, and this pin is adapted to successively engage the several conductor rails hereinbefore described and to also operate switches as 29, 29^a, and 29^b. These switches are adapted to be supplied with the necessary operating electric current in any desirable manner, for example, from the main or feed conductor 30, branch wires or conductors as 31, 31^a, and 31^b leading from said main or feed conductor 30 to the respective switches 29, 29^a, and 29^b. In Figs. 5 and 6 I have shown one of said switches, for instance, the switch 29, and the parts immediately associated therewith, including the branch conductor 31. The main conductor or feed-wire 30 may be supplied in turn with the necessary current by any suitable form of generator, for instance, by a battery as 32 one terminal of which is connected with said wire 30 by a wire as 33, while the other terminal is connected to ground by a wire as 34. There may be any desired number of batteries employed along the railway, assuming that such generators are used, but batteries are not essential for this purpose, as will be clear from what has been stated. The lever 29 swings between and coöperates with the pairs of contacts 35 and 36 and 37 and 38, the lever 29^a coöperating with contacts 35^a, 36^a, 37^a, and 38^a, while the lever 29^b coöperates with contacts 35^b, 36^b, 37^b, and 38^b arranged exactly like the contacts 35, 36, 37, and 38. The contact 35 is connected by a wire as 39 with the wire 5^b. The contact 37 is connected by a wire as 40 with the wire 5 which, it will be remembered, connects the conductor rails 3 and 3^c. The contact 35^a is connected by a wire as 40^a with said wire 5, while the contact 37^a is connected by a wire 40^b with the wire 5^a which, it will be understood, connects the contact rails 3^b, and 3^e. The contact 35^b is connected by a wire as 40^c with said wire 5^a, while the contact 37^b is connected by a wire as 40^d with the wire 5^c. The contacts 35, 37, 35^a, 37^a, 35^b, and 37^b are therefore electrically connected with coöperating conductor rails so as to provide for blocks.

In Figs. 5 and 6 now to be described I have shown one of the switch levers 29 and the parts immediately coöperative therewith. These parts may be mounted upon a support as 41. It will be understood that the two pairs of contacts 35 and 36 and 37 and 38 are respectively insulated from each other, although said contacts are adapted to be respectively bridged in alternation by the switch lever 29, said lever having for this purpose a part or projection as 42 to directly engage the respective pairs of contacts. The lever 29 which, of course, is the same in construction as the levers 29^a and 29^b, is normally held in a central or neutral position in some positive manner, for example, by means of a spring as 43 connected with the outer end thereof and also with the support 41. The several parts carried by the support 41 are insulated therefrom in any suitable way.

I provide positive means for temporarily holding the switch lever 29 and the other switch levers in their shifted positions and, although said means may be of any suitable character, I find that illustrated as quite satisfactory. At opposite sides of the lever 29, when the same is in its neutral position, I have located latches as 44 and 45, said latches being in the present case of the gravity type and being supported by suitable bearings upon the support 41 (see Fig. 4, for example.) The downward motion of the latches 44 and 45 is limited by suitable stops as 46 on said support. The lever 29 is shown as occupying its neutral position in Fig. 4. It will be assumed that said lever 29 is swung to the left in said figure. When it has moved a sufficient distance it will elevate the latch 45 and, when it has cleared said latch, the latter will drop behind the lever, so as to prevent for the time being the return of the lever to its original position by the power of the spring 43.

The latches 44 and 45 are tripped through the medium of magnets as 47 and 48 which are energized as will hereinafter appear, the armatures of said magnets having links as 47′ pendent therefrom and loosely connected with the latches 44 and 45 whereby the latches can have a movement upward independently of the magnets so as to permit the lever 29 to be moved to its extreme shifted positions under the action of a suitable device which may be the part 24 on the train. It will be assumed as before that the latch 45 is holding the lever 29 in its dotted-line position in Fig. 4. When the magnet 48 is energized it attracts its armature and the latter, acting through the link 47′, lifts the latch 45 and thereby releases the lever 29 so that the latter can be instantly shifted to its neutral position by the power of the spring 43. The magnets coöperative with the latches for the switch levers 29^a and 29^b are denoted by 47^a and 48^a and 47^b and 48^b, respectively.

One terminal of the magnet 48 is connected by the wire 49 with the contact 38^a. The corresponding terminal of the magnet 47^a is connected by a wire as 49^b with the contact 36. The corresponding terminal of the magnet 48^a is connected by a wire as 49^c with the contact 38^b. The other terminals of said three magnets 48, 47^a, and 48^a are connected to ground. It is needless, it is believed, to describe the connections between the magnets 47 and 48^b and their coöperating contacts. The ground connections for said magnets 47 and 48^b are clearly shown in Fig. 1 of the drawings.

It will be assumed that a train or locomotive as 6 is traveling in the direction of the arrow in Fig. 1. When the arm 24 on the locomotive struck the switch lever 29 it swung said switch lever 29 over so that the projection 42 engaged the contacts 37 and 38 and electrically bridged the space between these contacts, the lever when shifted having been held in its shifted position by the action of the latch 45. Said lever 29 will be held shifted until the magnet 48 is energized. Said lever 29 will be held in its shifted position until the arm 24 strikes and correspondingly shifts the lever 29^a so as to cause said lever 29^a to bridge the contacts 37^a and 38^a. As soon as the lever 29^a is thus shifted the contact 38^a, wire 49, and magnet 48 are put into electrical connection with the switch 29^a which, as is understood, receives energy from the battery 32, by virtue of which the magnet 48 will be energized to release the switch 29 and permit the latter to be brought to its neutral position by the power of its spring 43. Should the train, locomotive, or other vehicle be traveling in the opposite direction the operation described will be reversed. It is therefore evident that, as soon as a train leaves a block, it affects, through certain instrumentalities, such as those hereinbefore described, the switch in the following block, this, of course, applying whether the vehicle be traveling from the left toward the right in said Fig. 1 or vice versa, so long as the right of way is open. It will be assumed that the train 6 is proceeding toward the left in Fig. 1 and further that a train, not shown, is traveling toward the right in said figure. It will be understood that, when the lever 29 was thrown over as previously described, the contact rails 3 and 3^c are connected in multiple and are in uninterrupted electric connection with the battery 32 so that, when the contact member as 24 on the train moving toward the right strikes the contact rail 3^c, the magnet 13 thereon will be put into connection with the battery 32 and also with ground so as to effect the opening of the air-reducing valve 8 on said train moving toward the right, which will result in stopping or slowing down said train. Should there be a train following the train 6, said following train will be stopped as soon as the contact member as 24 thereon strikes the contact rail 3. The train in the block therefore is protected from opposite directions. While I prefer that a train be stopped outright by the reduction of the air pressure it will be apparent that such train might be slowed down.

It will be assumed that the train 6 has passed the switch 29 without operating the same. The switch 29 thereby having failed to work the switch (not shown) at the right of said switch 29 is effective for holding the contact rail 3^a in electrical connection with the battery 32 so that, when the contact member 24 strikes the contact rail 3^a, the train 6 will be stopped or caused to slow down. This makes the system therefore self testing.

What I claim is:

1. In a system of the class described, the combination of several pairs of contacts, a switch coöperative with each two pairs of contacts and adapted to simultaneously bridge the contacts of each pair, a source of electrical energy connected with the switches, conductor rails connected with certain of the contacts, magnets electrically connected with the remainder of the contacts, and switch-locking means controlled by said magnets.

2. In a system of the class described, the combination of several pairs of contacts, a switch coöperative with each two pairs of contacts and adapted to simultaneously bridge the contacts of each of such pairs, means for normally holding each switch out of engagement with its several coöperating contacts and for returning the same to a neutral position after having been shifted, a source of electrical energy connected with the switches, conductor rails connected with certain of the contacts, magnets electrically connected with the remainder of the contacts, and switch-locking means controlled by said magnets.

3. In a system of the class described, the combination of several pairs of contacts, a vibratory switch coöperative with each two pairs of contacts and adapted to simultaneously bridge the contacts of each of such pairs, a source of electrical energy connected with the switches, conductor rails connected with certain of the contacts, magnets electrically connected with the remainder of the contacts, and switch-locking means controlled by said magnets.

4. In a system of the class described, rails, a vehicle to travel on said rails, a conductor rail, a contact electrically connected with said conductor rail, a switch, a source of electrical energy connected with said switch, and electrical connections on said vehicle, involving a yieldingly mounted combined actuator and contact device, and a magnet, said combined actuator and contact device being adapted to operate said switch to throw the

same against said contact and to also make electrical connection with said conductor rail for energizing said magnet.

5. In a system of the class described, rails, a vehicle to travel on said rails, a conductor rail, a contact electrically connected with said conductor rail, a switch, a source of electrical energy connected with said switch, and electrical connections on said vehicle, involving a combined actuator and contact device, and a magnet, said combined actuator and contact device being adapted to actuate said switch to throw the same against said contact and to also make electrical connection with said conductor rail for energizing said magnet, and being also movable into an inoperative position where it will not operate the switch nor engage said conductor rail.

6. In a system of the class described, a switch operable by a moving train, a contact engageable by said switch, a conductor rail electrically connected with said contact, a source of electrical energy connected with said switch, a circuit involving a switch and a magnet, the latter switch when operated serving to close said circuit to energize said magnet, and a latch movable into an inoperative position by said magnet and into an operative position independently of said magnet, said latch, when in its operative position, serving to hold the first-mentioned switch in its shifted position.

7. In a system of the class described, a switch operable by a moving train, a contact engageable by said switch, a conductor rail electrically connected with said contact, a source of electrical energy connected with said switch, a circuit involving a switch and a magnet, the switch when operated serving to close said circuit to energize said magnet, and a latch operable by said magnet and loosely connected with the core thereof whereby the latch is capable of movement independently of the magnet and the latch serving, when in its operative position, to hold the first-mentioned switch in a shifted position.

8. In a system of the class described, the combination of several pairs of contacts, a switch to coöperate with each two pairs of contacts and adapted to simultaneously bridge the contacts of each of such pairs, said switches being oppositely shiftable from a neutral position for such purpose, latches for holding the several switches in their opposite shifted positions, magnets for controlling the latches, a source of electrical energy, and means for causing the successive energization of said magnets.

9. In a system of the class described, the combination of railway rails, two electrically connected conductor rails adjacent to and separated longitudinally of the railway rails, two electrically connected switches, means for supplying electrical energy to said switches, a vehicle to travel on said railway rails, means on the vehicle for shiftng the switches and for also making electrical connection with said conductor rails, a circuit controlled by one of the switches and including a magnet, a latch for the latter switch controlled by said magnet, the other switch being operable, when shifted, to close said circuit, and an electrically operative part on the vehicle, electrically connected with the means on said vehicle which makes electrical connection with said conductor rails.

10. In a system of the class described, the combination of several pairs of contacts, a switch coöperative with each two pairs of contacts and adapted to simultaneously bridge the contacts of each of such pairs, means for supplying the said switches with electrical energy, conductor rails connected with certain of the contacts, magnets electrically connected with the remainder of the contacts, and means for holding the switches in two opposite shifted positions, controlled by said magnets.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

HARVEY B. MILLER.

Witnesses:

R. W. BLACKFORD,

J. W. CRIDER.