A. MINNICK.

AUTOMATIC BRAKE APPLYING MEANS FOR RAILWAYS.

APPLICATION FILED AUG. 20, 1909.

1,029,210. Patented June 11, 1912.

3 SHEETS—SHEET 1.

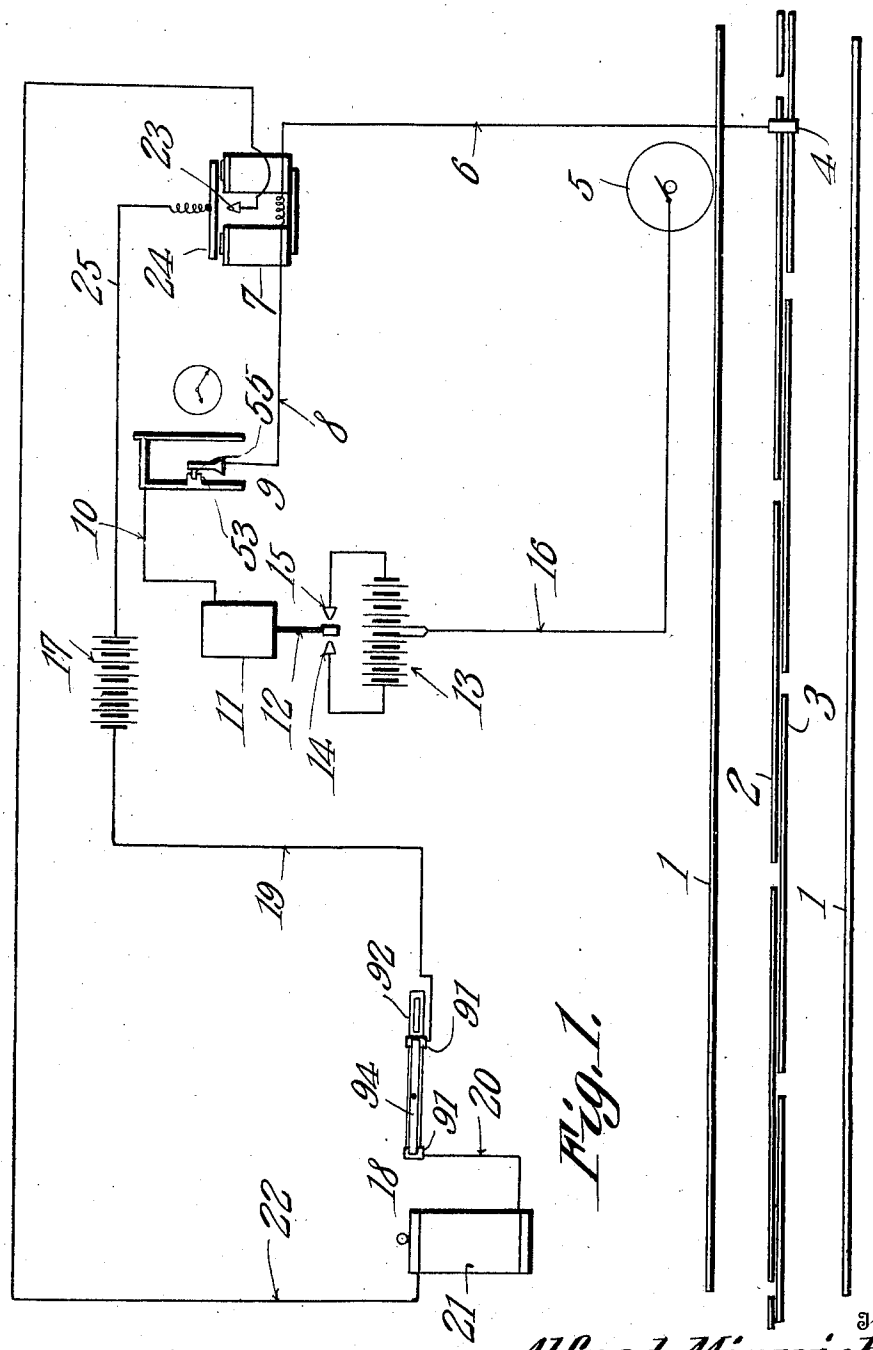

Fig. 1.

Witnesses

E. J. Stewart

F. T. Chapman

Inventor

Alfred Minnick.

By C. A. Snow & Co.

Attorneys

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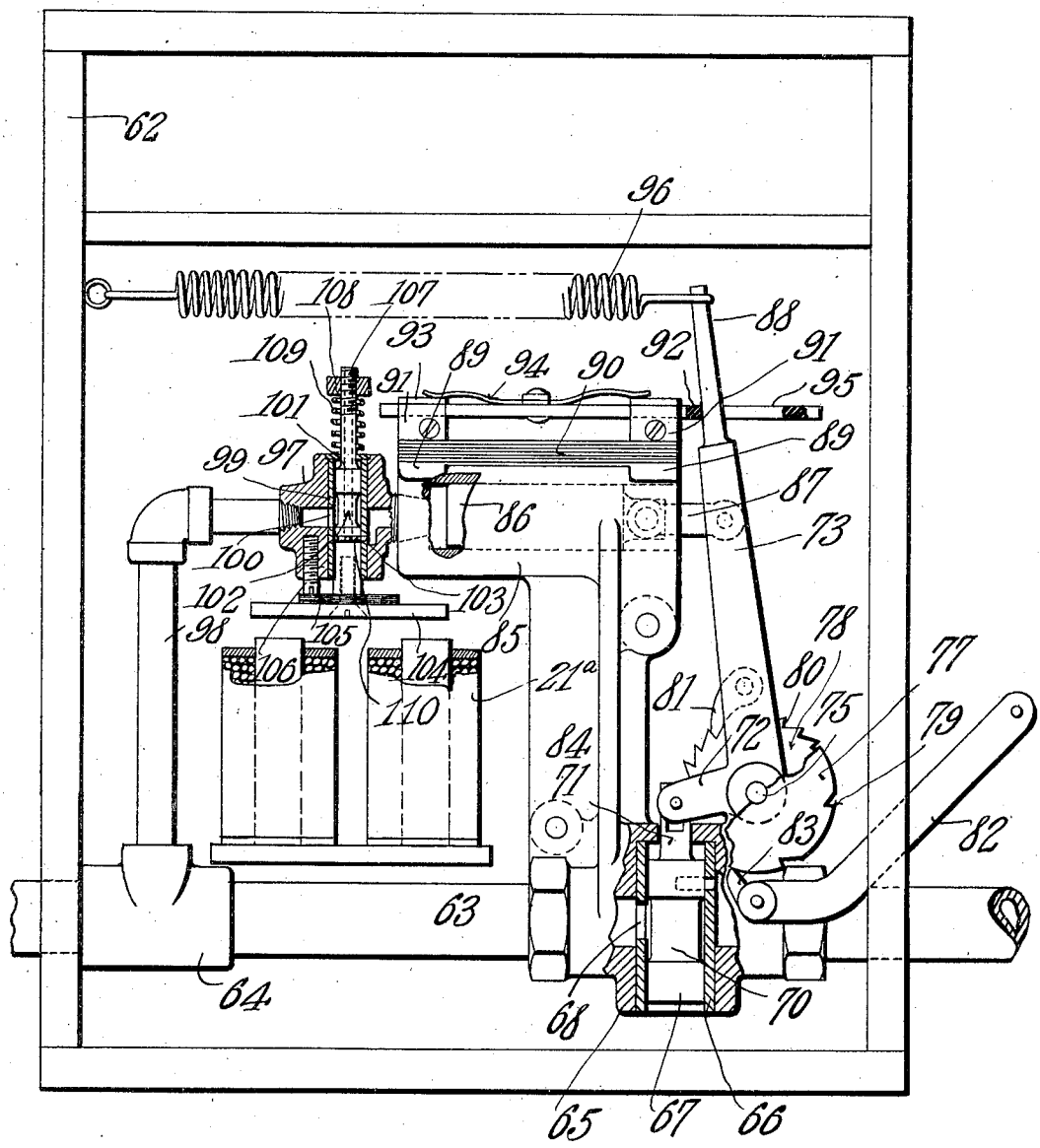
3 SHEETS—SHEET 2.

Fig. 2.



Inventor

Alfred Minnick.

Witnesses,

E. J. Stewart

F. T. Chapman

By C. A. Snow & Co.

Attorneys

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3 SHEETS—SHEET 3.

Fig. 3.

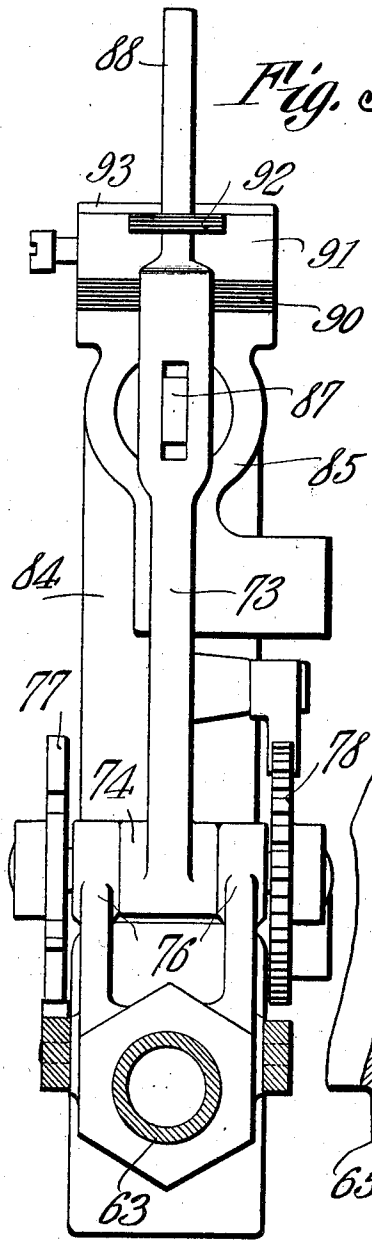


Fig. 4.

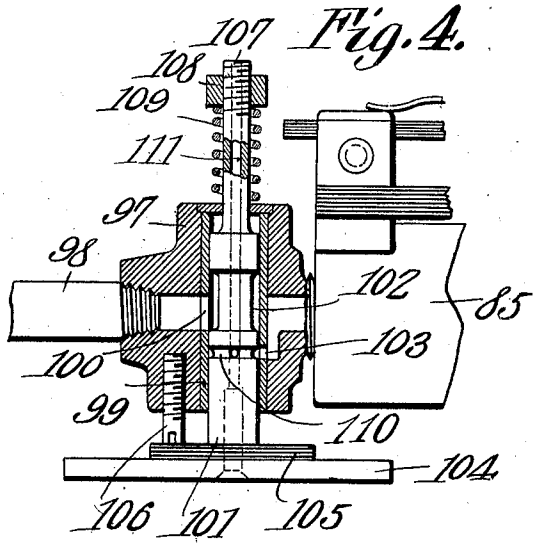
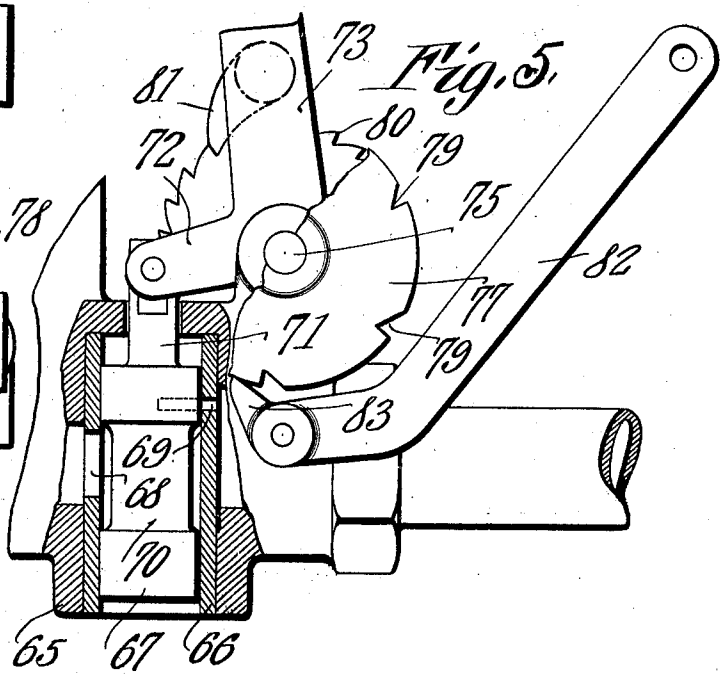


Fig. 5.



Witnesses

E. F. Edwards

F. T. Chapman

Inventor

Alfred Minnick.

By Crosby & Co.

Attorneys

UNITED STATES PATENT OFFICE.

ALFRED MINNICK, OF COEUR D'ALENE, IDAHO, ASSIGNOR TO MINNICK AUTOMATIC TRAIN CONTROLLER COMPANY, A CORPORATION OF UTAH.

AUTOMATIC BRAKE-APPLYING MEANS FOR RAILWAYS.

1,029,210. Specification of Letters Patent. Patented June 11, 1912.

Application filed August 20, 1909. Serial No. 513,840.

To all whom it may concern:

Be it known that I, ALFRED MINNICK, a citizen of the United States, residing at Coeur d'Alene, in the county of Kootenai and State of Idaho, have invented a new and useful Automatic Brake-Applying Means for Railways, of which the following is a specification.

This invention has reference to improvements in automatic brake applying means for railways and its object is to provide a means which under normal running conditions and in the absence of dangerous conditions is inactive but which automatically becomes active on the approach of a train or car, equipped with the brake applying means, to a danger zone, so that such car or train will be brought to a standstill before entering the danger zone beyond a limited distance.

The invention is such that two approaching trains or cars whether going in the same direction or in opposite directions will be brought to a standstill when in dangerous proximity.

In accordance with the present invention there are provided two adjacent sectional conductors along the line of way either on the surface or overhead or underground as may be desired and these two sectional conductors are laid side by side but insulated one from the other with the sections of one conductor alternating with the sections of the other conductor. Upon each car or train there is carried a trolley or brush or other collector capable of making contact with both conductors simultaneously and this contact is in a car or train carried charged circuit, the other side of which terminates at one or both of the traffic rails which latter should be electrically continuous throughout the system.

In the train carried circuit there is included a relay and also a time switch which will maintain the circuit open for a predetermined time and then automatically close the same, although provision is made for the closing of the circuit at will. The train carried circuit also includes an automatic pole-changer capable of reversing the direction of current flow to the train carried circuit at frequent and preferably regular intervals, although the pole changer on one car or train should not be in synchronism with the pole changer on another car or train liable to come into dangerous proximity to the first car or train.

The relay is provided to control another charged circuit upon the car or train in which last named circuit there is included mechanism controlled by the circuit primarily energized in a manner to cause repeated partial applications of the brakes of the car or train with progressively increasing force for a predetermined number of times and finally resulting in the full application of the brakes and the consequent stoppage of the train with the requisite rapidity to prevent close approach to the point of danger but without shock or jar to the equipment or to the occupants of the car or train.

The invention will be best understood from a consideration of the following detail description taken in connection with the accompanying drawings forming a part of this specification, in which drawings,—

Figure 1 is a diagrammatic representation of the equipment of a car or train with the present invention. Fig. 2 is a side elevation, with parts in section and with a part of the casing removed, of the brake applying mechanism. Fig. 3 is an end view of the same with the casing removed. Figs. 4 and 5 are detail views of the structure of Fig. 2.

In the following description reference will be made first to the showing of Fig. 1 and later when necessary, to the more detailed showing of the other figures.

The system of the present invention presupposes the equipment of the train or car with an air brake system of any suitable type.

The system of the present invention is applicable to railroads of either the steam or electric type and either to trains made up of a locomotive and a number of cars or a motor car and a number of trailers, either of which may be termed a train, or to single motor cars such as are commonly used in city and suburban traffic.

For convenience of description the term "train" will be used in the following description with the understanding that the term is to include either a steam or electric train or a single motor car or locomotive.

In Fig. 1 there are shown two traffic rails 1 which may be considered as the rails of a single track and illustrative of any suitable

track, and intermediate of the rails there are shown two conductors 2 and 3.

The traffic rails 1 are assumed to be electrically continuous for as great a distance as may be found necessary while the conductors 2 and 3 are sectional conductors electrically discontinuous in block lengths with the meeting ends of any two adjacent sections of one conductor intermediate of the sections of the other conductor so that the conductor sections overlap one another alternately throughout the system. The conductors 2 and 3 may be suitably supported upon the road bed intermediate of the rails 1 and also suitably insulated one from the other and from the traffic rails, or they may be in the form of overhead conductors, or they may be located in a suitable subway. Whatever be the disposition of the conductors 2 and 3 they should be close enough one to the other to be readily bridged by a trolley or collector 4, which, since it may be of any suitable type, and many known forms are adapted for the purpose, is merely indicated in Fig. 1 without any attempt to illustrate any particular structure.

The particular car or locomotive upon which the equipment indicated in Fig. 1 is assumed to be carried, is simply indicated in Fig. 1 by a wheel 5 running upon one of the traffic rails, but it will be understood that any suitable connection with the traffic rails by means of which an electric circuit may be established with the traffic rails, may be utilized.

Connected to the collector 4 is a conductor 6, it being understood that the collector 4 and the conductor 6 and other parts shown in Fig. 1 and also shown more in detail in the other figures, are carried upon the moving structure, whether it be a locomotive or car, indicated by the wheel 5.

The conductor 6 leads to a relay 7, which may be of the ordinary type and therefore requires no detailed showing or description, and from this relay there leads a conductor 8 to a time switch 9 which latter will be described more in detail hereinafter, but it may be stated at this place, that the circuit may be manually opened at the time switch and will then remain open for a predetermined time period to then automatically close the circuit at the time switch. Furthermore the time switch is provided with means, as will hereinafter appear, for causing the closing of the circuit at the switch at will if it be desirable to close the switch before the predetermined time period has elapsed.

Extending from the time switch 9 is a conductor 10 leading to an automatic device 11 controlling a pole changing lever 12, or other pole changing mechanism whereby opposite poles of a suitable current source 13 may be alternately connected up into the circuit as rapidly as may be desired and in regular succession.

The time switch 9, as shown in Fig. 1, has two contact points 53 and 55 in circuit with the conductors 8 and 10, thereby establishing the proper circuit at proper time as above set forth.

There are numerous known devices for this purpose operating by either mechanical or electrical motors and consequently it is not deemed necessary to illustrate any of the devices which may be utilized for the purpose. In the particular illustration of Fig. 1 the lever 12 is assumed to move between two circuit terminals 14 and 15 connected to opposite ends of the current source 13, a central point of which latter is connected by a conductor 16 to the wheel 5, the conductor 16 and wheel 5 being taken as illustrative of any suitable means of connecting the current source to the traffic rails 1.

When the lever 12 is in contact with the circuit terminal 14 there is then established a circuit from the brush 4 the conductor 6 and the relay 7, then by conductor 8 to the time switch 9, then by conductor 10 to the lever or pendulum 12, thence by the contact 14 to one terminal or end of the current source 13 and from thence by the conductor 16 and wheel 5 to either one or both of the traffic rails 1. When the lever or pendulum 12 is moved into contact with the circuit terminal 15 there is then established a circuit through the same path as before described except that the source of the current may be traced from the traffic rail 1, wheel 5, conductor 16, current source 13, terminal 15, lever or pendulum 12, conductor 10, time switch 9, conductor 8, relay 7, and by conductor 6 to the brush 4.

In the drawings the current source 13 is illustrated as a battery, and may be either a storage battery or a suitable primary battery, or it may be any other source of electric energy, the battery being simply typical of any electrical source.

The showings of the drawings with respect to the current source 13 and the means for changing its polar relation to the circuit is to be taken as largely indicative and as not confined to the particular arrangement shown.

The pole changer 11 is designed to operate at frequent intervals, say at intervals of one or two seconds, but it will be understood that any suitable or desired time periods of operation may be chosen as conditions may warrant.

The relay 7 controls a local circuit including a battery 17 or other suitable source of electric energy and a brake controlling means 18 arranged for electromechanical operation in a manner to be described with

reference to other figures of the drawings, but it may be stated that this operation is such that the air is admitted to the brake cylinders in successive quantities for a predetermined time period and a predetermined number of times so that the brakes may be applied first by a light service application then by successively heavier service applications until finally the full service application is reached and the train is brought to a standstill.

The circuit controlled by the relay 7 and including the battery or other current source 17 and the brake operating mechanism 18 is shown in Fig. 1 as comprising a conductor 19 leading from the battery 17 to the controller 18 and thence by another conductor 20 to a solenoid 21 forming a part of the controller 18 and from the solenoid 21 by way of a conductor 22 to a terminal 23 forming part of the relay 7 and this terminal 23 is in the path of the armature or armature lever of the magnet of the relay 7 in the usual manner, this armature or lever being indicated at 24 and is connected by a conductor 25 to a battery 17.

Let it be assumed that two trains are approaching each other either head on or when moving in the same direction or that one train is standing still and the other train is approaching it. As soon as the trains are close enough together, which distance will never be less than one-half the length of a section of the conductor 2 or 3 nor more than the length of a section of a conductor 2 or 3, there is then established a circuit between the traffic rails and the section of the conductor 2 or 3 with which the collectors 4 of the two trains are then in contact. If at the instant of the establishment of the circuit the particular polar relation of the current sources 13 upon the two trains be such as to bring these two current sources in opposition then no current will flow through the circuit thus established. But in a very short time, say within one or two seconds, the polar relation of one of the current sources 13 has changed so that the current sources are now in agreement and both sending current in the same direction through the circuit of the two trains, it being understood that the current changing mechanisms 11 of the two trains are not in synchronism, this being purposely so arranged. As soon as the current passes over the circuit thus established both relays 7 are energized, it being understood that under the conditions assumed the train carried primary circuits are closed at the time switches 9, these latter switches only being in service to maintain the circuit open under conditions which will be described further on. The energization of the relay 7 causes the closure of the local or secondary circuit upon each train charged by the battery or current source 17, this causing the energization of the solenoids 21 upon each train. Now, in a manner to be hereinafter described, the air brake system is put into operation to cause a succession of cumulative brake applications, ultimately resulting in the full service application of the brakes and the stoppage of the trains gently and without shock or jar but so timed that the trains are stopped before approaching within dangerous proximity, this stoppage of the trains being entirely outside the volition of the engine men, or in the case of electric cars, of the motormen.

By providing two adjacent conductors of the sectional type with the sections of one conductor in overlapping alternate relation to the sections of the other conductor and the adjacent ends of the sections of each conductor brought closely together and only separated far enough to insure good insulation, two trains approaching each other or one approaching the other cannot come into closer proximity than substantially half the length of a section of a sectional conductor without the circuit through the controlling train carried circuit being completed, the time controlled switch 9 being assumed to be in the closed circuit position under such conditions. The inability of the trains approaching closer than half the length of a section of the sectional conductors is due to the relation of the sections of the two sectional conductors 2 and 3, though the circuit may be completed while the trains are separated a distance approximately that of the length of a section of the sectional conductors.

By providing each train carried primary circuit with a pole changer operating at short intervals there is always the assurance of the current sources on the two approaching trains being coupled to the completed circuit in the same sense before the trains have entered the danger zone or been brought into dangerous proximity to any material extent. It is an easy matter to adjust the pole changing mechanisms on the several trains to operate at different time periods so that the possibility of synchronism is avoided. Furthermore the time period of operation of the pole changer should be as short as may be so that the trains will progress but a very short distance into the danger zone before the current sources on the two trains are brought into the proper relation to cause the operation of the safety devices on both trains.

The length of the sections of the sectional conductors will depend upon the conditions present or liable to be present and hence no particular example can be given.

Under some circumstances, as, for instance, when an engine equipped with the present invention is switching back and

forth in a yard it is desirable that the brake controlling mechanism should be out of service, but it is also desirable that it should return to the serviceable condition without depending upon the engine man, this return to service being at the end of a predetermined time.

The time switch 9 provides for these conditions and when the engine arrives at a yard or at some other point where it is desirable that the automatic brake operating mechanism should be out of service the engine man may open the circuit at the time switch and proceed to use the engine in the desired manner without further attention to the time switch which latter will operate to again close the circuit at the time switch after the expiration of the predetermined time. The period of time during which the circuit may be maintained open by the time switch will depend upon circumstances, but in practice it will be found that fifteen minutes will usually be ample for the purpose. Should the time during which the engine is to be out of the control of the automatic brake operating mechanism be materially less than the time period of inactivity of the time switch then the engine man may set the time switch into operation to close the circuit at will, but under no circumstances will the time switch fail to close the circuit longer than the predetermined time. If the engine man finds that it is desirable to hold the circuit open longer than the predetermined time, he may again shift the time switch to the open circuit position to be there maintained for the predetermined time or to be released at the will of the engine man at an earlier time.

It is preferred to include the brake operating mechanism in a local or a secondary circuit upon the engine or train or car to avoid the use of too large a current source in the primary circuit of the train. The battery 13 or other suitable source of current need only be of such character as to cause the actuation of the relays 7 on the two trains, when the circuit is completed through them.

If it be assumed that the lapse of time provided for by the time switch 9 is longer than necessary then the engine man or other authorized person may manually close the circuit before this is accomplished automatically by the mechanism of the time switch. By the time switch the engine man may cut out the circuit and the parts controlled thereby so that the brake mechanism will not be operated for a predetermined interval of time or for a shorter time if the engine man so desires, this being valuable when it is necessary to have the engine moving to and fro in a yard where the movements of trains are usually so slow as to be under full control at all times.

For the operation of the air brake there is provided a structure which may be made as shown in Figs. 2 to 5 inclusive, or may be otherwise constructed to operate in like manner. The showing of Figs. 2 to 5 may be taken, so far as the details of construction are concerned, as illustrative of any suitable means for the purpose.

Referring to Figs. 2 to 5 both inclusive, there is shown a casing 62 designed to inclose the structures directly controlling the air brake side of the system, which structures are rendered inaccessible by said casing except that provision is made for the release of the brakes in a manner to be hereinafter described.

Traversing the casing 62 is a pipe 63 which is assumed to be connected at one end to the train pipe of the air brake system and at the other end may open to the atmosphere either directly or through a whistle or through other signal if such be desired.

In the pipe 63 within the casing 62, there is included a T coupling 64 and a valve casing 65 traversed by a sleeve 66 in which is housed a piston valve 67. On the side of the sleeve 66 matching the portion of the pipe 63 coming from the train pipe is a port 68 and the opposite side of the sleeve, that is the side matching the portion of the pipe 63 leading to the external atmosphere or to a suitable signal, is provided with another port 69 out of line with the port 68. The valve 67 has a reduced portion 70 of such length as to connect the ports 68 and 69 when the valve is at one extreme of its movement and to blank the port 69 when the valve is at other extreme of its movement. The valve 67 has a stem 71 to which is connected the short arm 72 of a lever 73 provided with a hub 74 mounted on a pin 75 traversing ears 76 erected on the valve casing 65. The lever 73 moves independently of the pin 75 and the latter carries exterior to the ears 76 two disks 77 and 78 fastened on the said pin 75. One of the disks, say the disk 77 is provided with spaced notches 79 about its periphery, while the disk 78 is provided with a continuous peripheral series of ratchet teeth 80. The lever 73 carries a pawl 81 in operative relation to the teeth 80.

Pivoted to the valve casing 65 is another lever 82 having one end extending to the exterior of the casing 62 and the other end formed into a tooth 83 adapted to the notches 79 and in operative relation to the disk 77.

Erected on the valve casing 65 is a standard 84 carrying at its free end a cylinder 85 having its bore parallel with the length of the pipe 63 and appropriately removed therefrom. Within the bore of the cylinder 85, which cylinder is open at one end, is a piston 86 which may be of the displacement

type and the outer end of this piston is connected to the lever 73 by a link 87, the said lever being extended beyond the connection therewith of the link 87, as indicated at 88.

Formed on the ends of the cylinder 85 are two lugs 89 carrying a strip 90 of insulating material and mounted on this insulating material in spaced relation are two blocks 91. The blocks 91 are recessed on their outer surfaces and there receive a slide 92. Cap plates 93 are applied to the blocks 91 to maintain the slide 92 in place. The slide 92 may be made of insulating material such as vulcanized fiber or it may be made of metal and appropriately insulated from the blocks 91. Between these blocks the slide 92 carries a spring blade 94 attached to the slide at the middle of the blade so that the two ends are free. The length of the blade 94 is such as to bridge the two blocks 91 and it is made of good conducting material so as to establish a circuit between the two blocks when in contact with both at the same time. The slide 92 extends beyond one of the blocks 91 adjacent to the lever 73 and is there slotted as indicated at 95 for the passage of the end 88 of the lever 73. The outer end of the extension 88 is connected to one end of a spring 96, shown as a coiled spring, and the other end of the spring is connected to the casing 62 or other fixed portion of the structure. The tendency of the spring 96 is to maintain the lever in a position where the spring 94 will bridge the two blocks 91 with the piston 86 in the innermost position within the cylinder 85.

The closed end of the cylinder 85 is connected to a valve casing 97, the other end of which latter is connected by a pipe 98 to the T 64 so that the said end of the valve casing 97 is in constant communication with the train pipe side of the pipe 63. Traversing the valve casing 97 is a sleeve 99 provided with a port 100 in constant communication with the pipe 98. Housed within the sleeve 99 is a cylindrical valve 101 having a central reduced portion 102. Extending through the sleeve 99 on the side opposite the port 100 but out of line therewith is another port 103 in direct communication with the interior of the cylinder 85. The valve 101 is sufficiently long to project beyond the lower end of the sleeve 99 and has attached thereto an armature plate 104 with an insulating strip 105 interposed. Attached to the valve casing 97 is a set screw 106 in the path of the insulating strip 105 and designed to determine the movement of the valve 101 in one direction of its travel.

That end of the valve 101 remote from the armature 104 is formed into a valve stem 107 projecting beyond the casing 97. Applied to the outer end of the stem 107 which is appropriately threaded, is a nut 108 and confined between this nut and the casing 97 is a spring 109 surrounding the stem 107. The tendency of this spring is to maintain the valve 101 at one extreme of its travel with the armature 104 against the stop pin 106.

In the extension of the valve 101 to one side of the reduced portion 102 there is formed a circumferential groove 110 matching the port 103 when the valve is moved to one extreme of its travel by the spring 109 and this groove is in communication with the external atmosphere through an axial passage 111 through the valve and its stem 107.

In operative relation to the armature 104 there is located an electromagnet 21^a which may replace the solenoid 21 indicative of the brake operating mechanism in Fig. 1, it thus being clear that either a solenoid or an electromagnet may be utilized for operating the structure shown in Fig. 6 in detail.

Let it be assumed that an electric current is sent through the magnet 21^a, then the armature 104 is attracted against the action of the spring 109 and the valve 101 is moved so its portion 102 will put the ports 100 and 103 in communication and train pipe pressure is thereby transmitted from the pipe 63 through the pipe 98 to the interior of the cylinder 85 back of the piston 86 thus causing the latter to be projected outward from the cylinder 85 and causing a movement of the lever 73 in a like direction. This will cause the pawl 81 to ride idly over the ratchet teeth 80 and at the same time will move the valve 67 so that the reduced portion 70 will connect the ports 68 and 69 thus allowing the escape of air from the train pipe with a commensurate reduction of train pipe pressure. Before the lever 73 has reached the extreme of its movement under the action of the piston 86 and against the action of the spring 96 the extension 88 engages the end wall of the slot 95 and causes a movement of the slide 92 for a distance sufficient to carry one end of the spring 94 away from the corresponding block 91. The magnet 21^a being the same as the solenoid 21 of Fig. 1, is included in the circuit extending through the blocks 91 and the spring 94 by way of the conductors 19 and 22 of Fig. 1 so that as soon as the spring 94 moves away from the corresponding block 91 the circuit including the current source 17 and charging the magnet 21^a is broken and the magnet is thereby deënergized, but this does not happen until the lever 73 has reached the end of its travel under the action of the piston 86. The reduction of train pipe pressure has been but moderate and consequently the brakes have been applied only lightly.

The deënergization of the magnet 21^a releases the armature 104 and the spring 109

immediately returns the valve 101 to its normal position blanking the port 100 and thus cut-off the train pipe pressure from the cyinder 85, but this movement of the valve has brought the groove 110 into coincidence with the port 103 and the air within the cylinder 85 now finds escape to the atmosphere through the passage 111, thus permitting the spring 96 to return the lever 73 to its normal position. This return movement of the lever 73 causes the pawl 81 to engage a tooth of the ratchet disk 78 and rotates the same a distance of, say, one tooth, and at the same time the valve 67 is moved to a position blanking the port 69 so that the train pipe pressure is no longer being reduced. Just before the lever 73 reaches its normal position the extension 88 engages the end wall of the slot 95 opposite that first engaged and the slide 92 is returned to its first position with the spring 94 in engagement with both of the blocks 91 and the circuit is again established, whereupon the magnet 21^a is again energized and the cycle of operation is repeated with a further reduction of train pipe pressure resulting in a more pronounced application of the brakes. These operations follow one another in succession until finally a notch 79 is brought into coincidence with the tooth 83 which thereupon enters the notch and stops further rotative movement of the disks 77 and 78 so that on the next movement of the lever 73 against the action of the spring 96, the pawl on engaging a tooth 80 of the disk 78 will prevent any further return movement of the said lever 73. Under these circumstances the valve 67 is locked in a position permitting a reduction of pressure of the train pipe sufficient to cause a full service application of the brakes and the arresting of the movement of the train, but this arresting of the movement of the train has been progressing slowly so that the train is brought to a standstill without shock or jar but long before the train can move dangerously into the danger zone.

When it is desirable to again start the train and release the brakes, the lever 82 may be manipulated by the engineman or other authorized person to release the disk 77 when the spring 96 will return the lever 73 to its first or normal position and the train pipe will be closed against further escape of air. If the dangerous conditions still prevail, the lever will once more be moved to the position opening the train pipe for the escape of air, but if the dangerous conditions no longer exist the local circuit charged by the battery 17 will be cut out at the relay 7 and consequently the magnet 21^a will not again be energized. The pressure in the train pipe may be restored in the usual manner and the train may proceed on its journey, the parts being all in readiness to again respond automatically to dangerous conditions.

The examples hereinbefore given will be sufficient to show the great latitude of the present invention for all manner of dangerous conditions which may arise along a railroad and it is deemed unnecessary to give more examples.

What is claimed is,—

1. In a system of train control, an air brake applying means on each train comprising a train pipe connection provided with an air outlet valve, two electric circuits on each train and means controlled by one of the electric circuits and in turn controlling the air outlet valve to move the latter to open and closed positions successively at short intervals for a predetermined number of times.

2. In a system of train control, an air brake applying means on each train comprising a train pipe connection provided with an air outlet valve, an electric circuit on the train, means controlled by the electric circuit and in turn controlling the air outlet valve to move the latter to open and closed positions successively at short intervals for a predetermined number of times and then to lock open, and manual means for causing the closing of the valve after being locked open.

3. In a system of train control, an air brake applying means on each train comprising a train pipe connection provided with an air outlet valve, and means for actuating the valve comprising a cylinder, a piston therein, a connection between the air pipe connection and the cylinder on the train pipe side of the air outlet valve, a valve in said cylinder connection, an actuating means for the air outlet valve controlled by the piston, an electrically actuated controlling means for the valve in the cylinder connection and circuit controlling means in the circuit of the electrically actuated valve controlling means in turn controlled by the air outlet valve controlling means.

4. An automatic service application brake mechanism for an air brake system, having a spring closed lap valve, and means automatically actuated to impart to the lap valve intermittent opening and closing thereof.

In testimony that I claim the foregoing as my own, I have hereto affixed my signature in the presence of two witnesses.

ALFRED MINNICK.

Witnesses:

WM. A. SMITH,

S. BRUCE CHASE.