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L. DAY

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CONTROL SYSTEM

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3 Sheets-Sheet 1.

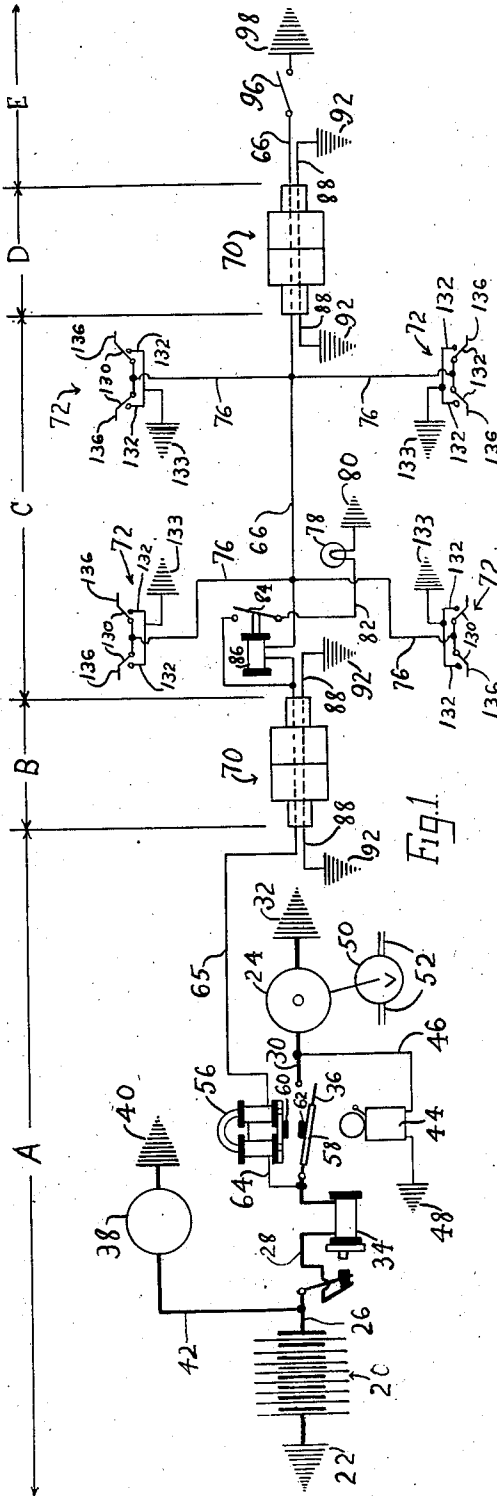


Fig. 1.

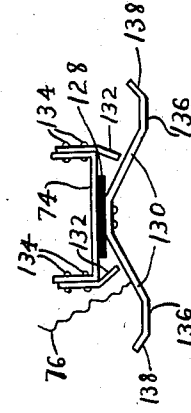


Fig. 2.

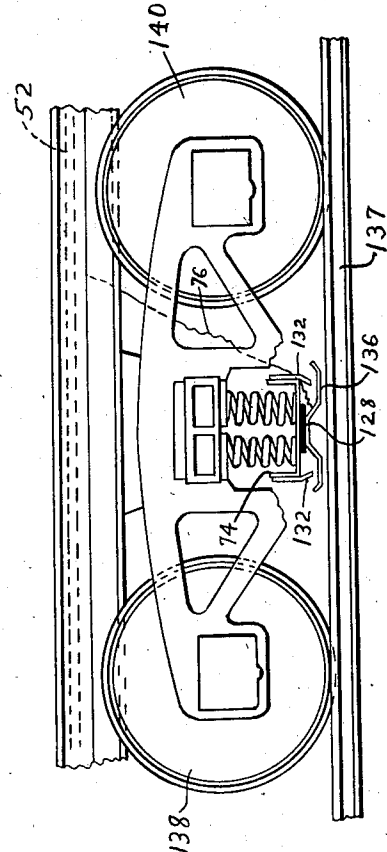


Fig. 3.

INVENTOR
BY *LESLIE DAY*
John C. Baish
ATTORNEY

UNITED STATES PATENT OFFICE

2,391,228

CONTROL SYSTEM

Leslie Day, Chicago, Ill., assignor of one-half to
Lamar L. Day, St. George, Staten Island, N. Y.

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14 Claims. (Cl. 246—170)

This invention relates generally to electrical control systems and more particularly to electrical systems for controlling the brakes of railroad trains and the like. Certain subject matter disclosed herein is being claimed in my copending divisional application for an Electric switch, Ser. No. 623,812, filed October 22, 1945; and my copending continuation in part application for Connectors for electric circuits, Ser. No. 623,813, filed October 22, 1945.

It is an important object of the invention to provide an electrical control system for applying the air brakes or the like on railroad trains upon derailment of the train or upon the derailment of one or more of the cars thereof.

Another object of the invention is to provide a system of this character for the automatic application of the brakes of a train when derailment occurs.

Still another object of the invention is to provide a system of this character wherein the action is positive and certain.

A further object of the invention is to provide a system of this character that may be readily installed on existing or old equipment as well as on new equipment.

A still further object is to provide a system of this character wherein a single wire is used, the return circuit being through the track and/or through the under frame of the cars.

A further object is to provide a system of this character wherein the train air line is opened first on the engine at the head of the train.

Further objects of the invention are to provide a system of this character that is easily operated by the various train and yard crews so that there will be a minimum of time consumed in train assembly and switching operations by said train crews; that is easily tested; that is free from accidental operation or errors in operation; that will use a minimum amount of current when the "open circuit" arrangement is used; that will insure prompt operation under various operating conditions even when cars with loose draw-bars and coupling pins are passing over an insulated joint in the track at the time of derailment; that includes a signal to the engineer indicating that the brakes are being set; that is relatively inexpensive to produce, install and maintain; that has relatively few parts; that may include an emergency stop arrangement which may be operated manually by a member of the crew or the like; that may include a signal on the respective cars to indicate that the system is in operation; and that includes a hermaphrodite split plug adapted

to insure proper connections between the cars, said plug being such that the parts may be connected with a single operation and disconnected at the right place without assistance of the train crew or other personnel, and which will not "short" when wet by rain or the like.

Other objects and advantages of the invention will be apparent to those skilled in the art from the following description or may be ascertained from a study of the accompanying drawings in which certain modifications of the invention have been shown. It will be evident that the principles of the invention may be incorporated in various forms and I contemplate the employment of any structures, arrangements, or modes of operation that are properly within the scope of the appended claims.

In the drawings:

Figure 1 is a diagrammatic view of the entire electrical system embodying my invention;

Figure 2 is an enlarged diagrammatic side view of one of the control switches for actuating the system upon derailment;

Figure 3 is a diagrammatic elevational view of a car truck showing a control switch for actuating the system upon derailment;

Figure 4 is a partial end view of the car truck showing said switch from one end thereof;

Figure 5 is a plan view of the hermaphrodite plug with portions cut away in one part to show the interior construction thereof;

Figure 6 is a view of the plug taken on line 6—6 of Figure 5;

Figure 7 is a diagrammatic view of the plugs to show the arrangement thereof on the cars;

Figure 8 is a diagrammatic view of a portion of the electrical circuit to show a modification of the invention;

Figure 9 is a diagrammatic view of another portion of the electrical system showing a modification thereof;

Figure 10 is a diagrammatic view of still another portion of the electrical system showing a modification;

Figure 11 is an end view, partly in section, of a modification of the control switches;

Figure 12 is a view of same, partly in section, taken at right angles relative to Figure 11; and

Figure 13 is a sectional view taken on line 13—13 of Figure 11.

Throughout the drawings similar reference characters represent similar parts although where such parts are modified in structure or operation they are given a further differing reference character.

Referring more particularly to Figure 1 the portion of the electrical system indicated by the character A is preferably installed on the engine; that portion indicated by C is installed on each car; and the portion indicated by the character E is preferably on the last car of the train. B and D indicate the couplings between the cars which connect the cars together electrically.

Throughout the drawings it is to be understood that all grounds are grounded to the frame of the respective train units. All grounds are preferably welded to the frame or such part as they are connected to.

The primary electrical system preferably includes a storage battery 20 having its negative terminal grounded at 22. The positive terminal is adapted to be connected to a motor 24 by insulated wires 26, 28 and 30, the motor being grounded at 32. Interposed in this connection between the battery and the motor is a delayed action circuit breaker 34 and a main control switch 36. An electrical generator 38, operated by any suitable means such as a steam turbine or the like, is grounded at 40 and connected with wire 26 by a wire 42, said generator being adapted to supply current for operating the electrical control system and/or for charging the storage battery 20. A signal bell 44 may, if desired, be included on the engine and is connected to wire 30 by a wire 46, said bell being grounded at 48. The motor 24 is connected by any suitable well known means, such as gearing or the like, to an air valve 40 controlling the pipe line 52 of the air brake system.

It should be borne in mind that the wires of the main circuit which carry a heavy load are relatively large to eliminate undue resistance and possible overheating when the battery delivers full power.

The control circuit includes a magnet 56 for actuating the switch 36, said magnet acting on a hinged bar 58 of iron or other suitable material which comprises part of said switch. Buttons 60 and 62 of insulating material may be attached to the magnet and the bar 58 respectively, said buttons being arranged to form a stop for limiting movement of the bar. The magnet is connected to wire 28 by a wire 64 which leaves the magnet at 65 and is adapted to be connected to an insulated wire 66 on the adjacent car by means of a hermaphrodite split plug 70 which will be hereinafter fully described.

Wire 66 runs the full length of the car and is adapted to be connected to the wire 66 of the next car by a similar plug 70. The wires 66 of the cars may be relatively small if desired thus holding the cost thereof to a minimum.

Each car is provided with switches 72, there being a switch 72 secured adjacent the respective ends of the usual spring plates 74 of the car trucks at each end of the cars, said switches 72 being connected by wires 76 to wires 66 and are grounded at 133. A more detailed description of the switches 72 will be given hereinafter.

For passenger cars a signal light 78 may be installed, said signal being grounded at 80 and connected to wire 66 by means of a wire 82 which has a switch 84 interposed therein, said switch 84 is shown as being controlled by a solenoid 86 although a magnet or other suitable means may be used to actuate same.

In order to insure an electrical connection between the frames of adjacent cars wires 88 are grounded at 92 to the respective frames and said wires connected together through the plugs 70. This connection provides a positive flow of cur-

rent throughout the control circuit. This arrangement is particularly desirable to insure an electrical connection between the cars should cars having loose draw-bars and coupling pins be passing over an insulated joint in the tracks when derailment occurs. If such an arrangement were absent under such circumstances there might be a delay in the setting of the brakes and severe damage to equipment or personnel and passengers might result.

As shown in the drawings the car at the rear of the train is provided with a switch 96 adapted to connect wire 66 of said car to a ground 98. If desired such a switch and ground may also be included in the control circuit of other cars. This switch is to permit manual closing of the control circuit to effect setting of the brakes in case the engineer fails to see a hand signal or should such setting of the brakes be desirable for any other reason. The switch 96 may also be closed to test the control circuit and it therefore provides a simple and effective means for making such a test. It is to be understood, of course, that the rear car circuit preferably also includes the switches 72 as shown for the cars at C.

Referring more particularly to Figures 5, 6 and 7 the hermaphrodite split plugs 70 each comprise a pair of mating or matching parts 100 and 102. Each part comprises a body of any suitable insulating material such as Bakelite or the like and each body is formed of opposed portions 104 and 106 secured together as by bolts 108. A rounded prong R and a square prong S extend longitudinally in each body and said prongs are provided with a rounded head adjacent the inner ends having screws 110 for securing respective wires 110a thereto. Adjacent the prongs S and R are longitudinally extending passages 114 and 116 respectively having cross sections corresponding to the cross sections of the adjacent prongs.

Adjacent the prong R is a spring 118 suitably anchored in the body of the plug and having a head 120 normally entering the passage 116 and so formed as to permit entrance of the mating prong R of the other part of the plug. The head 120 is shown as being round although any other suitable shape may be provided and when the mating prong R is inserted in the passage 116 the head 120 is displaced, entering a recess 122 provided therefor. The head 120 is adapted to frictionally bear against the adjacent prong to prevent accidental separation of the plug parts. It is to be understood, of course, that a similar spring 118 is provided for the prong S and plug 102 is similar in construction to plug 100.

The passages 114 and 116 of each part of the plug extend along corresponding sides of the respective prongs and receive corresponding prongs of the other part. Thus the parts of the plug can only be connected together in one way and it is impossible to connect them together improperly.

A gasket 121 may be provided between the parts 104 and 106 of each part of the plug to prevent rain or the like from penetrating into the interior of the body and causing a short circuit, and if desired a flexible sheath 126 of metal or the like may be provided to protect the wires adjacent each plug. It has also been found desirable to provide recesses or notches 200 in the abutting ends of the matched parts of the plugs, said notches aiding in preventing "shorting" between the prongs S and R should the plugs become wet from rain or snow.

Referring to Figure 7 the arrangement of the plug parts at the ends of the cars is shown. The

construction of the plugs is such that the part at the end of one car will always match or mate with the part at the end of an adjacent car. It should be noted that the plug parts have flexible connections 126 with their respective cars so that said parts may be rotated or turned, if necessary, to match the respective plug parts of the adjacent cars.

The switches 72 each comprise a resilient winged member secured to the under side of the spring plate 74 and insulated therefrom by a block 138 of any well known type of electrical insulating material such as Bakelite or the like. The winged member includes wings 130 which are oppositely disposed and downwardly inclined and are adapted, when deformed upwardly, to contact switch members 132 fixed to opposite sides of the spring plate 74 by any suitable means such as rivets 134 or the like. Each part 130 has a horizontal portion 136 which normally lies parallel with rails 137 and such parts may terminate in upwardly inclined free end portions 138. It is to be understood that the members 132 are grounded to the spring plates 74 which form part of the underframe of the respective cars, the grounding of said members being shown at 133 in Figure 1. The winged member of each switch 72 is connected to wire 66 by a wire 76.

The spring plates are customarily installed between the front and rear wheels 138 and 140 respectively of each truck of a car, as shown in Figure 3, the trucks being disposed adjacent the respective ends of the cars. An end view of a spring plate of a truck, with the switches 72 mounted thereon, is shown in Figure 4 and it will be noted that said switches are disposed outwardly of and above the top plane of the adjacent rails 137.

The above described system is an open circuit arrangement wherein normally there is no current flowing therethrough and the operation thereof is as follows:

The delayed circuit breaker 34 is normally closed and the switch 36 is normally open as well as the switches 72 and the manual control switch 96. However, should a derailment occur the wheels of one side of one or more car trucks will fall outside the rails while the wheels on the other side will drop between said rails. The lower horizontal parts 136 of the switch 72 disposed between the latter set of wheels will strike the adjacent rail and will be thereby forced upward into contact with the members 132 of said switch thus closing the control circuit and causing magnet 56 to draw bar 58 toward it so as to close the main circuit switch 36. Upon closing of said switch 36 the motor 24 is supplied with current and is caused to operate, thereby opening valve 50 of the air brake system. The brakes are thus set and as the valve 50 is located on the engine at the head of the train the brakes at said head are set first which is the most desirable arrangement, the brakes on the rest of the cars being set progressively toward the rear end of the train.

At the time the control circuit is closed the solenoid 86 is energized to close switch 84, thus turning on the warning light 78. If such a light is installed in each car of a passenger train the passengers of the respective cars are given a warning signal that an emergency setting of the brakes is being made. The warning bell 44 is also caused to operate, said bell being energized when the switch 36 is closed. Thus the engineer is automatically given a signal to shut off the motive power of the engine. It is to be noted that the

signal light 78 is primarily intended for passenger trains and may be eliminated if desired, particularly from freight cars.

However, if desired, the motor 24 may also be connected by gearing or the like with the motive power control whereby said motive power, whether steam, electricity, or an internal combustion engine or the like, is shut off automatically and simultaneously with the setting of the brakes. It is also to be understood that if desired substitutions may be made for various parts of the system. For example a solenoid may be used instead of magnet 56; a light may be used instead of the bell 44; or a magnet may be used in place of solenoid 86. Other similar substitutions may also be made for these and other parts.

The delayed circuit breaker 34 is interposed in the main circuit to break said circuit after the valve 50 has been opened by the motor and the brakes of the train have been applied. An alternative arrangement may include a self-protected motorized valve for the air line control and such a valve may be so designed and constructed as to break the main circuit when the valve is opened, thus effecting de-energizing of the magnet 56 and allowing the switch 36 to return to its normal open position. The circuit breaker 34 could then be dispensed with.

In order to convert the system into a closed circuit arrangement the parts shown in Figures 8, 9 and 10 would be added. In Figure 8 an ammeter 150 is adapted to be connected by switch 152 to wire 65 on the engine and behind the switch 152 by wire 154. There would also preferably be a variable resistance unit 156 which is adapted to be attached to wire 65 by a switch 162 and wire 158, said unit 156 being grounded at 160. A switch 162 is interposed in wire 65 for controlling the current through the variable resistance unit. In Figure 9 means is shown for grounding wire 65 and/or wire 66 by means of a wire 164, the current through said wire being controlled by a switch 166. It is to be understood that each car may include such an arrangement which would be adapted to ground the wire 66 of the car adjacent to a "cut" in the train or at the end of the train. In Figure 10 an ammeter 168 is adapted to be connected by a wire 170 to wire 66 by the switch 96, said ammeter being grounded at 172.

In the closed circuit system the delayed circuit breaker 34 and switches 72 and 96 would normally be closed. The switches 72 would be hooked up in series on each car and also would be in series with the switch 96 on the rear car of the train which is normally the caboose on a freight or the observation car of a passenger train. Switches 152 and 162 would be positioned to complete the circuit through wire 65 (Figure 8). Switch 36 would be constructed and arranged to be in the open position while current flowed through magnet 56. The switches 72 would then be opened by striking a rail so that the control circuit would be broken upon derailment of a car or cars. The magnet 56 becomes de-energized with the breaking of the control circuit thus causing switch 36 to close and complete the main circuit for operation of motor 24. The motor then opens the air valve 50 and effects application of the brakes as already described.

When a car is to be switched or the train cut in two, one of the switches 166, Figure 9, is closed to prevent breaking of the control circuit when a posterior car is detached from the train assembly, although normally the switches 166 are open

when the train is moving.

The ammeters, one on the engine and one on the rear unit or car of the train, when properly constructed and connected, indicate to crewmen whether or not the current in the control circuit is uninterrupted. If desired galvanometers or the like may be used instead of the ammeters.

To connect the ammeter 150 into the circuit, switch 152 is positioned to connect with wire 153, the current returning to wire 65 beyond said switch through wire 154, and in order to render the variable resistance unit effective switch 162 is positioned to connect wire 65 with wire 158.

The normal position of switch 162 is such as to provide a continuous circuit through wire 65 but it may be positioned to connect the variable resistance unit with the source of electrical power by the engineer or fireman before the train is cut to set out or pick up a car or for other operating reasons. This will divert the flow of current to ground 160 through the variable resistance unit 156, which is adapted to be manually regulated and graduated in units of cars in a train to render the resistance equivalent to the train being handled. Thus an undesired application of the brakes will be avoided when the train is cut.

Figures 11, 12 and 13 show a modification of the switches 72. Opposed U-shaped frame members 210 are secured to the spring plate 74 by bolts 212. The members 210 are spaced apart and receive therebetween a movable switch member including a body portion 214 having laterally extending shafts 216 pivoted in respective frame members 210. The end portion of each shaft 216 is provided with a sleeve 218 of electrical insulating material such as Bakelite or the like. Within the member 214 is a pipe 219, each end of which is threaded and projects outwardly longitudinally of said body 214. Caps 220 and 222 are screwed on the upper and lower ends respectively of said pipe and said caps abut against respective adjacent ends of the body 214. Cap 220 closes the upper end of body 214 and cap 222 is provided with a square opening in which is slidably received a rod 224 square in cross section, said rod having a head 226 within the pipe 219 and is adapted to slide freely therein. A spring 228, reacting against cap 220 and head 226 yieldingly urges rod 224 outwardly. The lower end of rod 224 is provided with a block 230 of steel or other suitable material, which is received on a reduced portion 232 of rod 224. The free end of the reduced portion 232 is overturned at 234 for retention of said block on rod 224.

Semi-circular electrical contact members 236 are disposed adjacent opposite sides of the movable switch member. The semi-circular members 236 include lateral arms 238 adjacent the respective ends thereof, said arms having end portions 240 secured to respective frame members 210 by bolts or screws 242, thus holding said contact members in position and grounding them to the frame of the car through frame members 210 and spring plate 74.

The contact members 236 are disposed in parallel planes between which the switch member is adapted to swing and the radius of said contact members 236 coincide with the radius of the path of the upper end of said switch member. The positioning and spacing of the contact members 236 is such that when the switch member swings from a vertical position the upper end thereof, which is shown as comprising the cap 220, will contact same. However, to prevent contact between the switch member and the contact members when the former is in a vertical posi-

tion, said contact members are provided with central U-shaped portions which extend outwardly and in which blocks 244 are secured by screws 246 or by any other suitable means. The blocks 244 are of Bakelite, fiber or other suitable electrical insulating material and have opposed concave portions 245 in which the cap 220 is received. The resilience of the contact members urges the blocks 224 against the cap 220 and normally retains the switch member in its vertical position.

The wire 76 is secured to the body 214 by a screw 248. Inasmuch as the switch member is insulated by sleeves 218 from the frame members 210 no electric current will flow through the switch when the switch member is in the vertical position wherein the cap 220 is held against contact with the contact members 236 by blocks 244.

The switches of the embodiment shown in Figures 11, 12 and 13 are located on the spring plates similarly to the switches 72 shown in Figure 2, with the blocks 230 located above the top plane of the rails and outwardly thereof. Considering a single switch, upon derailment of a car the block of said switch adjacent the wheels which drop between the rails will strike the top or ball 250 of the adjacent rail. The rod 224 is forced upwardly compressing spring 228 which absorbs the resulting shock. At the same time the forward motion of the car will cause the movable switch member to swing as indicated by the dotted line 252 in Figure 11. The upper end of the switch member will swing into contact with the contact members 236 and complete the circuit through the switch thus closing the control circuit which in turn effects operation of the main circuit and the application of the brakes of the train.

In order to use a switch of this character in a closed circuit system it would be necessary to arrange the contact members so that when the movable switch member is vertical there would be electrical contact between members 236 and said movable switch member and when said switch member is swung out of the vertical position the electrical contact would be broken.

If desired, a casing or cover 254 may be provided to enclose the switch and said casing may be secured by indentations 256 therein which engage the upper edge of the lower horizontal portions of the frame members 210. A slot 258 is provided in the bottom side of the casing in which the depending portion of the movable switch member is received, said slot being wide enough to prevent contact of the switch member with the sides thereof and long enough to permit swinging of the switch member for completion of the circuit through the switch.

It will be understood that many variations of the invention can be made from the disclosed embodiments and it is not intended that the scope thereof shall be limited to the forms shown and described, nor otherwise than by the terms of the appended claims.

I claim:

1. In an electrical system for controlling the application of the brakes of a railroad train having an air brake system with a valve therefor, a main control system including a battery having a ground, an electric motor having a ground and operably connected to the air valve, a main circuit wire adapted to connect the battery and motor together, a delayed action circuit breaker and a normally open main control switch interposed in the main circuit wire, a control circuit

wire extending throughout the length of the train and connected to the main circuit wire between the circuit breaker and the main switch, a magnet interposed in the control circuit and adapted to close the main switch when energized by current flowing through the control circuit, and an auxiliary switch having one part connected to the control circuit wire and the other part grounded, said switch being normally open and so positioned on a car of the train that same will strike a rail and be closed upon derailment of said car.

2. The invention defined by claim 1 wherein an electric signal having a ground is connected to the main control circuit wire between the main switch and the motor.

3. The invention defined by claim 1 wherein there is included an electric signal on a car of the train, said signal having a ground, a connection for said signal with the control wire of said car, a normally open switch interposed in said connection, and electrical means having a ground and adapted to close said switch when energized, said electrical means being connected with the control circuit wire.

4. The invention defined by claim 1 wherein the cars of the train are provided with auxiliary switches at each side adjacent the ends thereof, said switches being disposed adjacent the respective rails of the railroad track on which the train is operated.

5. The invention defined by claim 1 and including hermaphrodite plugs connecting the portions of the wire of the control circuit on respective cars, said plugs being between the respective cars.

6. In an electrical system for controlling the application of the brakes of railroad trains and the like having an air brake system including an air valve whereby the air line may be opened, a main control system including a source of electric power, electrically operable means for actuating the air valve, means including a main switch adapted to connect the electrically operable means with the source of power, a control circuit including a normally open control switch, and electrically actuated means connected with the control circuit and adapted to be energized by current flowing through said circuit, said electrically actuated means being so constructed and arranged as to close the main switch when energized, and said control switch being so positioned on a unit of the train that it will be closed by derailment of said unit.

7. The invention defined by claim 6 including a manually operable switch which is operable at times only for closing the control circuit.

8. In an electrical system for controlling the application of the brakes of railroad trains and the like having an air brake system including an air valve whereby the air line may be opened, a main control circuit including a source of electric power, electrically operable means for actuating the air valve, means including a main switch adapted to connect the electrically operable means with the source of power, a control circuit including a normally open control switch, electrically actuated means connected with the control circuit and adapted to be energized by current flowing through said circuit, said electrically actuated means being so constructed and arranged as to close the main switch when energized, and said control switch being so positioned on a unit of the train that it will be closed by derailment of said unit, and a delayed action

circuit breaker in the main control circuit connected in series with the control switch and adapted to operate after a predetermined interval for breaking the main and control circuits.

9. The invention defined by claim 6 wherein the train comprises a plurality of separable units and each unit includes a portion of the control circuit, a hermaphrodite plug between the respective units of the train for connecting together the portions of the control circuit of said units, and flexible connections between the plugs and the units to which they are attached.

10. In an electrical system for automatically controlling the application of the brakes of a railroad train having an air brake system, electrically operable means, an air valve adapted to be operated thereby and located adjacent the head of the train for controlling the air brake system whereby the brakes at the head of the train are set first upon brake applying actuation of said valve, a main electrical control system including a source of power connected with the electrically operable means, a normally open main switch in said main control system, a control circuit, electrical means connected with the control circuit and adapted to close the main switch when energized, and a normally open control switch for the control circuit so positioned on a unit of the train that it will be closed by derailment of said unit.

11. In an electrical system for controlling the application of the brakes of railroad trains and the like having an air brake system including an air valve whereby the air line may be opened, a main control system including a source of electric power, electrically operable means for actuating the air valve, means adapted to connect the electrically operable means with the source of power, a normally open switch for controlling the current to the electrically operable means, a normally open control circuit, means connected with the control circuit adapted to be energized by current flowing through the control circuit, a normally open switch means adapted to close said control circuit, said last mentioned means being so positioned on a unit of the train that it will be closed upon derailment of said unit, and a delayed action circuit breaker for the control circuit and main circuit whereby both circuits are broken after the electrically operable means has actuated the air valve to set the brakes.

12. In an electrical system for controlling the application of the brakes of a railroad train comprising a plurality of separable units and having an air brake system with a valve therefor, a main control system including a source of electrical power, electrically actuated means operably connected to the air valve, a main circuit adapted to connect the electrically actuated means with the source of power, a normally open main control switch interposed in the main circuit, a control circuit extending throughout the length of the train with portions thereof on the respective train units, an electrical device adapted to close the main switch when energized by current flowing through the control circuit, a normally open auxiliary switch for the control circuit so constructed, arranged and positioned on a train unit that it will be closed upon derailment of said unit, and hermaphrodite plugs between the train units and adapted to connect together the portions of the control circuit carried by said units, said plugs being so constructed and arranged that the parts thereof can be connected together in but one way.

13. In an electrical system for controlling the application of the brakes of a railroad train having a plurality of separable units and having an air brake system, electropneumatic means controlling the air brake system, a main circuit for said means, electrical means controlling the main circuit, a control circuit for the last mentioned means, said control circuit extending throughout the length of the train, at least one control circuit switch on each unit of the train adapted to be actuated upon derailment of said unit, and at least one manually operable control circuit switch on each unit of the train adapted to be actuated at times only.

14. In an electrical system for controlling the application of the brakes of railroad trains and the like having an air brake system including an air valve controlling the air line, said train comprising a plurality of separable units: a main control system including a source of electric

power, electrically operable means for actuating the air valve, means including a main switch adapted to connect the electrically operable means with the source of power, a control circuit extending substantially the length of the train with portions of said circuit on said units, a control switch in the control circuit, electrically actuated means connected with the control circuit and adapted to be controlled thereby, said electrically actuated means being so constructed and arranged as to actuate the main switch, said control switch being so positioned on a unit of the train that it will be actuated by derailment of said unit, a hermaphrodite plug for connecting together the control circuit between the train units, said plug being adapted to be connected together in but one way, and flexible connections between the plugs and the respective units to which they are attached.

LESLIE DAY.