

[54] **MONITORING DEVICE FOR FLUID PRESSURE SYSTEMS**

[72] Inventors: Fritz Scheele, Munich; Josef Frania; Walter Ortmann, both of Hannover, all of Germany

[73] Assignee: Westinghouse Bremsen-und Apparatebau G.m.b.H., Hannover, Germany

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Primary Examiner—Duane A. Reger

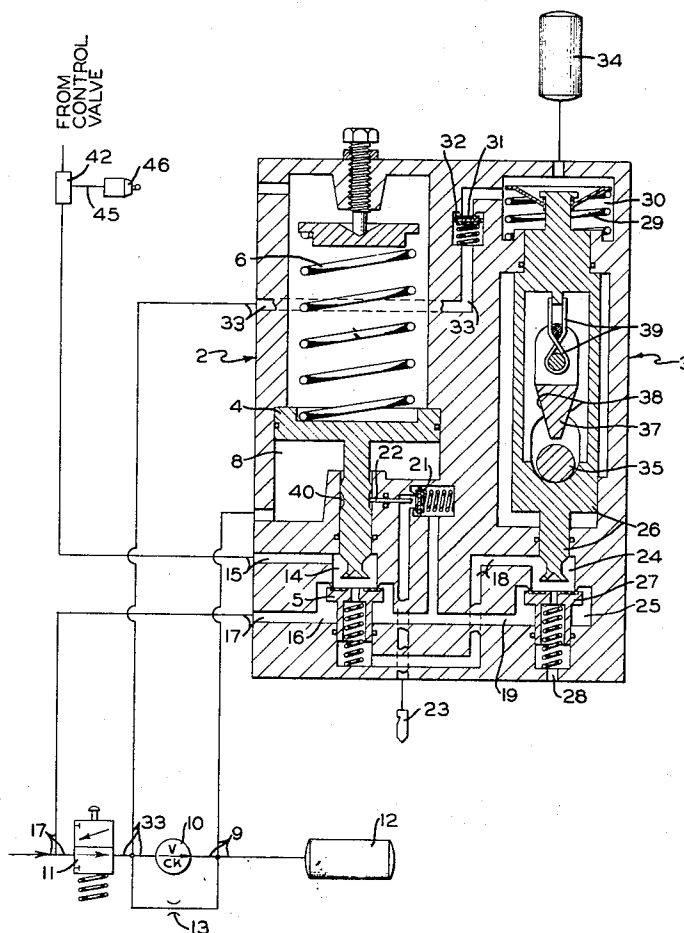
Attorney—Ralph W. McIntire, Jr.

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ABSTRACT

This invention relates to fluid pressure operable railway locomotive safety control apparatus which requires certain periodic acknowledging operations by the locomotive engineer to forestall a penalty brake application which will be automatically effected should the engineer fail to perform the required acknowledging operation within a certain time subsequent to the sounding of an alarm signal or whistle. This apparatus, when installed on locomotives having only an engineer in the cab, requires that he, following each sounding of the alarm signal, either after a certain time interval or subsequent to a chosen distance traveled, manually operate an acknowledging valve to prevent a brake application which will automatically occur should he become incapacitated.

12 Claims, 2 Drawing Figures



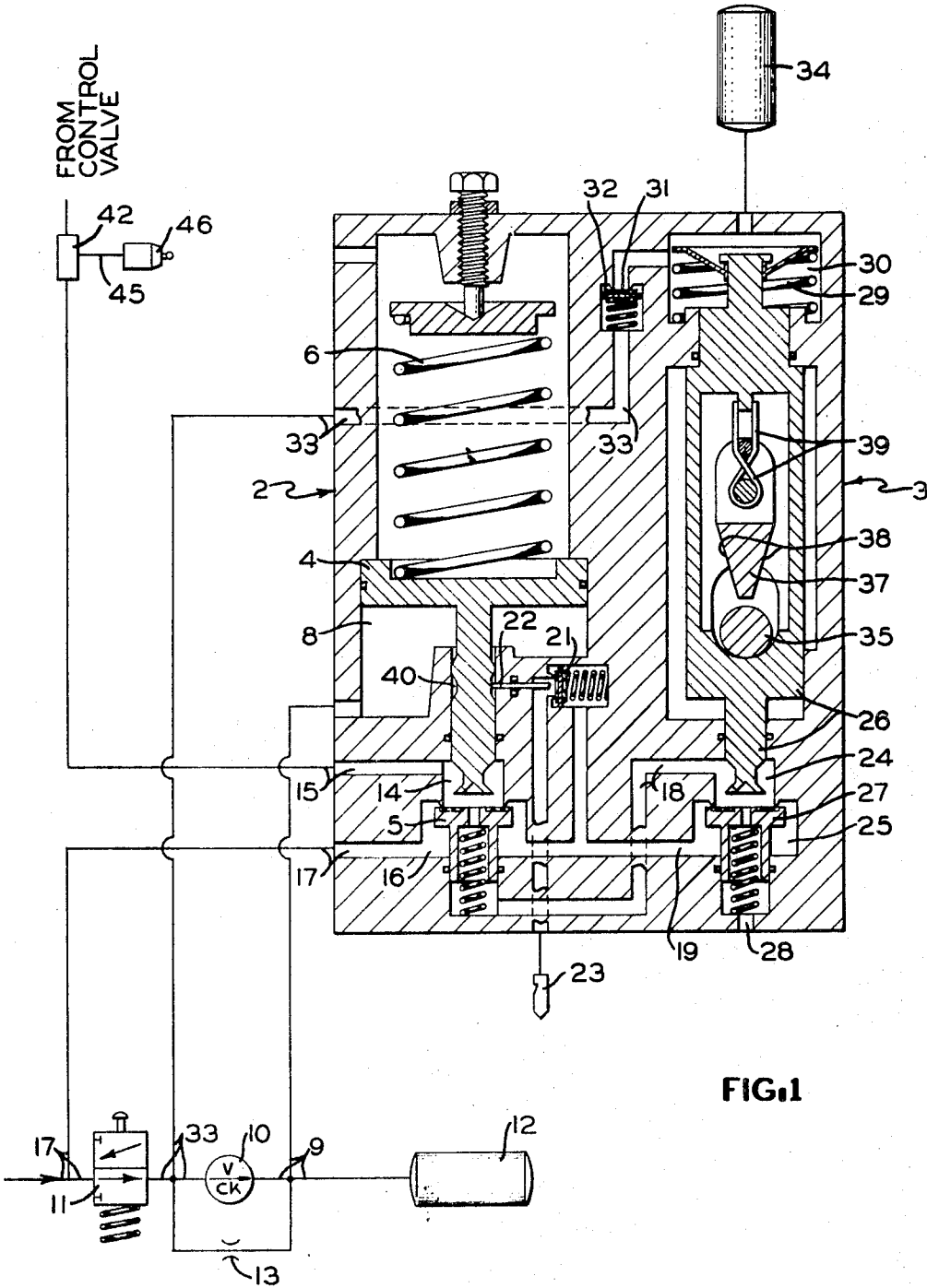


FIG. 1

INVENTORS
FRITZ SCHEELE
JOSEF FRANIA
WALTER ORTMANN
BY
Ralph W. McIntire, Jr.
ATTORNEY

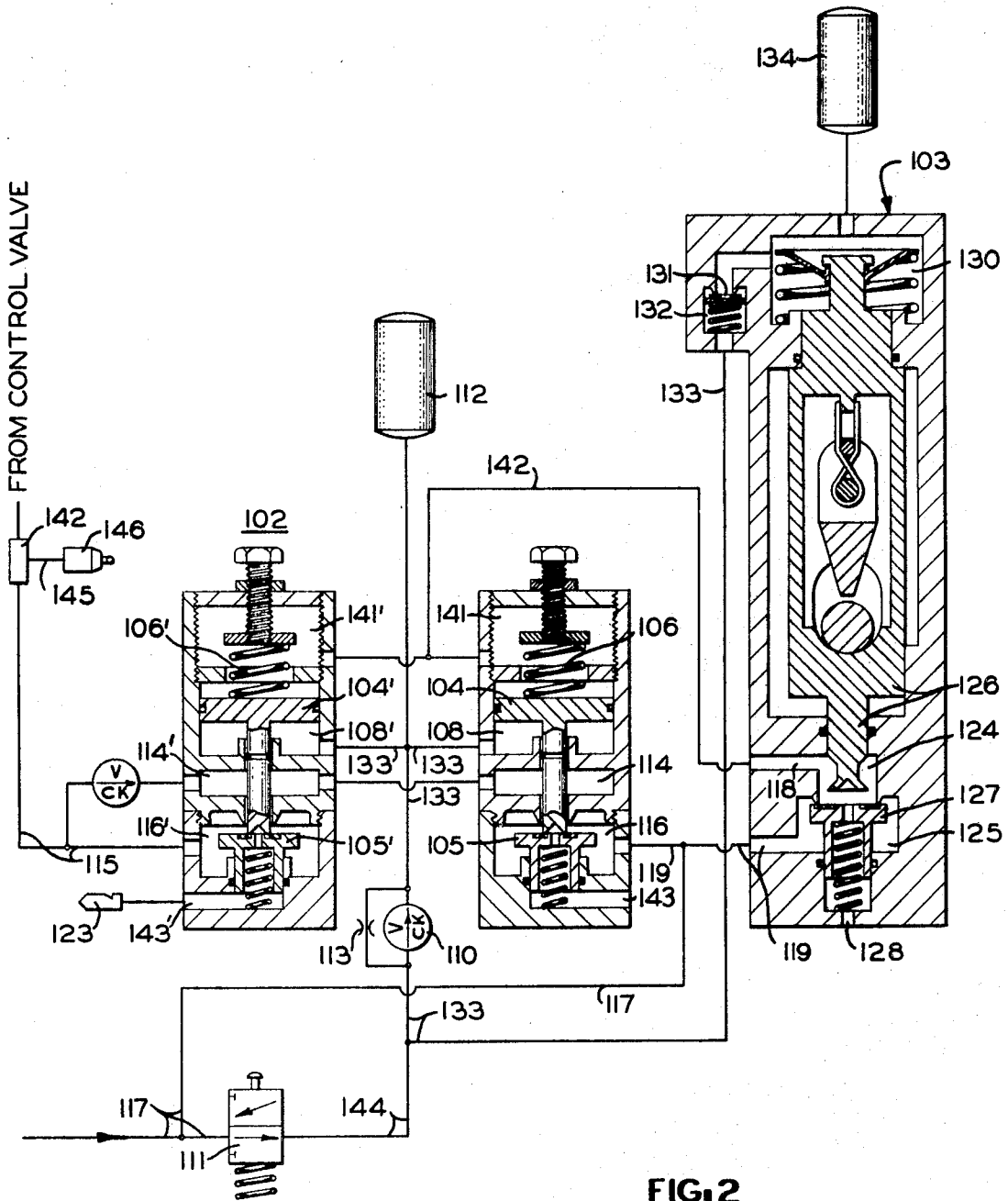


FIG. 2

INVENTORS.
FRITZ SCHEELE
JOSEF FRANIA
WALTER ORTMANN
BY
Ralph W. McIntire
ATTORNEY

MONITORING DEVICE FOR FLUID PRESSURE SYSTEMS

BACKGROUND OF THE INVENTION

Some of the conventionally known safety control systems operate either entirely pneumatically or are of the combined electro-pneumatic type and utilize centrifugal governors to detect that the train is either stopped or in motion. These governors are unsatisfactory while a train is traveling at a slow rate of speed since they are operable to effect opening or closing of valves only upon train speed exceeding a chosen value.

SUMMARY OF THE INVENTION

According to the present invention, a safety control apparatus of the periodic acknowledging type embodies a change-over valve device and a zero speed indicator device each having a supply valve and an exhaust valve so interlocked with a safety control pipe that, while the supply valve of each device is closed and its corresponding exhaust valve is open, the safety control pipe is vented to atmosphere. The supply of fluid under pressure to the change-over valve causes operation thereof to effect closing of its supply valve and opening of its exhaust valve.

The zero speed indicator device is so interlocked with a vehicle axle that the supply of fluid under pressure thereto causes operation thereof to effect closing of its exhaust valve and opening of its supply valve only if the train is moving.

The safety control apparatus of the present invention further includes an acknowledging valve manually operable by the engineer between a normal or supply position and a different or release position in a chosen timed sequence to, in the supply position, supply fluid under pressure to the change-over valve device at a fast rate and to the zero speed indicator device at a restricted rate, and, in the release position, release fluid under pressure from the change-over valve at a restricted rate, and from the zero speed indicator at an unrestricted rate. Consequently, with the train standing, the simultaneous supply of fluid under pressure by the acknowledging valve to both devices maintains the safety control pipe vented. Therefore, while both devices are so supplied with fluid under pressure, the zero speed indicator device is operable in response to subsequent train movement to close its exhaust valve and open its supply valve which thereby would cause flow of fluid under pressure to the change-over valve device and thence to the safety control pipe.

Accordingly, just prior to starting a train, to prevent the supply of fluid under pressure to the safety control pipe when the train starts to move, the engineer must manually operate the acknowledging valve from its supply position to its release position.

Moreover, while a train is moving, to prevent the supply of fluid under pressure to the safety control pipe and thereby suppress a safety control brake application, the engineer must, in a limited period of time, manually operate the acknowledging valve from its supply position to its release position prior to the slow or restricted rate of supply of fluid under pressure to the zero speed indicator device building up a sufficient pressure to cause this device to open its supply valve so that in this release position of the acknowledging valve, fluid under pressure will be simultaneously released from the zero speed indicator device at the above-mentioned fast rate and from the change-over valve device at the above-mentioned slow rate thus preventing operation of the zero speed indicator device to effect closing of its exhaust valve and opening of its supply valve which would, if opened, effect the supply of fluid under pressure to the safety control pipe to cause a safety control brake application.

If the slow rate of release of fluid under pressure from the change-over valve device continued for a certain period of time, this valve device would be operated by a spring in response to the release of fluid under pressure therefrom to effect seating of its exhaust valve and unseating of its supply valve to thereby effect the supply of fluid under pressure to the safety control pipe to cause a safety control brake applica-

tion. Accordingly, it will be understood that the acknowledging valve must be successively operated from each of its positions to the other in the proper timed sequence to suppress a safety control brake application.

In order to appraise the engineer of the fact that the acknowledging valve should be shifted from one of its positions to another the change-over valve device is so interlocked with a whistle valve that the whistle valve is opened to cause the supply of fluid under pressure to an alarm device or a whistle in response to initial operation of the change-over valve and prior to opening of its supply valve. Consequently, if the engineer effects shifting of the acknowledging valve from one of its positions to the other upon sounding of the whistle, the supply valve is not unseated and no fluid under pressure is supplied to the safety control pipe to cause a brake application.

In the accompanying drawings:

FIG. 1 shows a schematic arrangement, partly in section, of a safety control apparatus associated with a fluid pressure brake system for a railway locomotive and constituting a first embodiment of the invention.

FIG. 2 shows a schematic arrangement, partly in section, of a safety control apparatus associated with a fluid pressure brake system for a railway locomotive and constituting a second embodiment of the invention.

Assume that a locomotive provided with the safety control apparatus shown in FIG. 1 of the drawings is stopped and that an acknowledging valve 11 occupies a fluid pressure supply position, as shown. Therefore, fluid under pressure will flow from a supply reservoir (not shown) to a control chamber 8 below a control piston 4 of a change-over valve device 2 via a pipe 17, the acknowledging valve 11, a pipe 33, a check valve device 10, and a pipe 9 which has a branch connected to a volume reservoir 12. Accordingly, piston 4 is moved upward against the yielding resistance of a spring 6 to the position shown in FIG. 1 in which the lower end of the piston rod integral with piston 4 is moved away from the double valve 5.

Furthermore, fluid under pressure is supplied from the supply reservoir to a valve chamber 16, the right-hand side of a signal or whistle valve 21 and a valve chamber 25 via the pipe 17 and a corresponding passageway in the change-over valve 2 so that the whistle valve 21, the double valve 5 in the chamber 16 and a double valve 27 disposed in the chamber 25 are constantly subjected to main reservoir pressure.

Moreover, while the acknowledging valve 11 occupies the position shown in FIG. 1, fluid under pressure is supplied at a slow or restricted rate from the supply reservoir to a control chamber 30 in a zero speed indicator device 3 and to a volume reservoir 34 connected to the chamber 30 via the pipe 17, acknowledging valve 11, pipe 33 and a corresponding passageway in the change-over valve device 2, and a choke 31 in a check valve 32 the size of this choke 31 being such that the chamber 30 and reservoir 34 are charged to supply reservoir pressure in from 4 to 6 seconds. This pressure in the chamber 30 moves a piston 26 in the zero speed indicator device 3 downward against the yielding resistance of a spring 29 until a friction shoe 37 contacts the top surface of a shaft 35 which is rotatable with an axle of the locomotive. As long as the locomotive is stopped and not moving, the piston 26 remains in the position in which the friction shoe 37 contacts the top surface of the shaft 35, and the double valve 27 is maintained seated by the spring interposed between it and the casing of the zero speed indicator device 3.

Now assume that power is supplied for moving the locomotive in a forward or reverse direction thereby causing rotation of the shaft 35. The friction shoe 37 is capable of sliding or tilting movement in response to rotation of the shaft 35 in either direction. Consequently, the friction shoe 37 is swung sidewise by the rotation of the shaft 35 whereupon fluid under pressure in the chamber 30 will move the piston 26 downward to that one or the other of the sloped surfaces 38 on the friction shoe 37 abuts the rotating shaft 35. This further downward movement of the piston 26 first moves the lower end of the piston rod integral with the piston 26 against the upper side of the

double valve 27 thereby closing off a delivery chamber 24 from an exhaust port 28 and then unseats the double valve 27 so that a communication is established between the chambers 25 and 24. Fluid under pressure from the supply reservoir present in the chamber 25 may now flow to the chamber 24 and thence to a brake cylinder 46 via a passageway 18, a port in the valve 5, a chamber 14, a passageway and corresponding pipe 15, a double check valve device 42 and a pipe 45 to thereby cause a safety control brake application if not suppressed by the engineer in a manner hereinafter described.

It may be noted that fluid under pressure supplied to the pipe 15 can also be used for the purpose of operating a hydraulic transmission to disconnect the diesel engine from the driving axles and for effecting a power knockout.

To suppress the above-described safety control brake application, the engineer, just prior to starting the train, will depress the button of the acknowledging valve 11 to move this valve 11 from its first position shown in FIG. 1 in which fluid under pressure is supplied from the supply reservoir to the pipe 33 via the pipe 17 and the acknowledging valve 11 to its second position in which the pipe 33 is open to atmosphere thereby releasing fluid under pressure at a fast rate from the volume reservoir 34 and chamber 30 in the zero speed indicator device 3 via the check valve 32 which is unseated from its seat.

Upon the release of fluid under pressure from the chamber 30 to atmosphere, the spring 29 is rendered effective to move the piston 26 upward to the position shown in FIG. 1 whereupon the friction shoe 37 is rotated to the vertical position in which it is shown by a spring 39. As piston 26 is thus moved upward to the position shown in FIG. 1, the spring beneath the double valve 27 seats it on its seat to cut off flow of fluid under pressure to the passageway 18 which is then open to atmosphere via the port in the double valve 27 and the exhaust port 28. Thus, the brake cylinder 46 is open to atmosphere thereby releasing the brakes.

At the time the acknowledging valve 11 is moved to its second position, the fluid under pressure in the control chamber 8 and in the volume reservoir 12 is released to atmosphere at a slow or restricted rate via a choke 13 connected in bypassing relation to the check valve device 10. The volume of the reservoir 12 is such that after approximately 40 seconds the pressure in the control chamber 8 and the reservoir 12 has reduced sufficiently for the spring 6 to move the piston 4 downward far enough for a cam surface 40 formed on the piston rod integral with the piston 4 to move a stem 22 in the direction of the right hand to unseat the whistle valve 21 whereupon fluid under pressure will be supplied to a whistle 23 to sound an alarm.

The sounding of this alarm is notice to the engineer to return acknowledging valve 11 to the position shown in FIG. 1 to cause fluid under pressure to be again supplied from the supply reservoir to the chamber 8 so that the piston 4 is returned to the position shown in FIG. 1 before it is moved downward far enough for the piston rod integral therewith to effect unseating of the double valve 5 which would cause the flow of fluid under pressure from the supply reservoir to the brake cylinder 46 thereby effecting a safety control brake application.

By providing for a short period of time between moving the acknowledging valve 11 from one of its positions to the other, not sufficient pressure is built up in the chamber 30 by flow thereto via the choke 31 in the check valve 32 to cause the piston 26 to move down and unseat double valve 27.

If the acknowledging valve 11 were allowed to remain in the position shown in FIG. 1 for too long a period of time due to, for example, the engineer becoming incapacitated, sufficient pressure would be built-up in the chamber 30 to move the piston 26 downward, and since the train is moving thereby causing rotation of the shaft 35, the double valve 27 would be unseated to cause the supply of fluid under pressure to the brake cylinder 46 to effect a safety control brake application.

If, on the other hand, for any reason the acknowledging valve 11 is not returned to the position shown in FIG. 1 upon sounding of the whistle 23, then the piston 4 will be moved downward by the spring 6 far enough to effect unseating of the double valve 5 so that fluid under pressure would flow from the supply reservoir to the brake cylinder 46 via the chambers 16 and 14, passageway and pipe 15, double check valve 42, and pipe 45 to cause a safety control brake application.

By returning the acknowledging valve 11 to the position shown in FIG. 1, fluid under pressure is again supplied to the chamber 8 to thereby move the piston 4 and the piston rod integral therewith upward to the position shown. Consequently, the cam surface 40 on this piston rod is moved away from the whistle valve stem 22 whereupon the whistle valve 21 is seated by a spring to cut off flow of fluid under pressure to the whistle 23.

From the foregoing, it should be noted that, unless the train is standing, a safety control brake application is effected if the engineer fails to move the acknowledging valve 11 from either of its two positions to its other position after remaining in either position a chosen length of time. It may be mentioned that the whistle valve 21 can be operated by a pressure switch or any suitable fluid pressure operated device in accordance with variations of pressure in the control chamber 8.

In FIG. 2 of the drawings, a second embodiment of a safety control apparatus is shown which is somewhat similar to the safety control apparatus shown in FIG. 1 but differs therefrom in that a change-over valve device 102 is separate from a zero speed indicator device 103 it being noted that the structural elements or parts that correspond to those shown in FIG. 1 are denoted by reference numerals that are higher than those shown in FIG. 1 by 100. The change-over valve device 102 shown in FIG. 2 consists of two valve devices that are substantially the same in construction as the single change-over valve device shown in FIG. 1 with the difference that two additional spring chambers 141 and 141' are supplied with fluid under pressure via a pipe 142 and a passageway 118 that opens into the chamber 124 in the zero speed indicator device 103. A passageway and corresponding pipe 119 connects a valve chamber 125 in the zero speed indicator device 103 to a valve chamber 116 and opening into this pipe 119 intermediate its ends is one end of a pipe 117 that has its opposite end connected to a supply reservoir (not shown). An exhaust port is denoted by the reference numeral 143.

A pipe 133, one end of which leads to a control chamber 130 in the zero speed indicator device 103 via a check valve 132 having a choke 131 therein, is connected to the chambers 108 and 108' in the change-over valve device 102 and also to a volume reservoir 112. A pair of valve chambers 114 and 114' in the two valve devices that comprise the change-over valve 102 are connected to each other by a pipe and corresponding passageway, and a whistle 123 is connected to an exhaust port 143' in the left-hand valve device shown in FIG. 2. Furthermore, a valve chamber 116' in this valve device is connected by a pipe 115 to one end of a double check valve device 142 that has its side outlet connected by a pipe 145 to a brake cylinder 146.

The operation of the safety control apparatus shown in FIG. 2 of the drawings is as follows:

While the locomotive is stopped and an acknowledging valve 111 occupies the position shown in FIG. 2, both of the control chambers 108 and 108' are supplied with fluid under pressure from the supply reservoir via the pipe 117, acknowledging valve 111, a pipe 144, pipe 133 and a check valve device 100 disposed in the pipe 133 and having a choke 113 connected in by-passing relation thereto, so that the control pistons 104 and 104' are moved upward from the position shown in FIG. 2 whereupon double valves 105 and 105' are closed by corresponding springs.

Should an undesired movement of the locomotive now occur, a piston 126 of the zero speed indicator device 103, which is subject to the pressure of fluid in the control chamber 130 will be moved downward, in the manner described for the first

embodiment of the invention, to first close the exhaust port 128 and then unseat a double valve 127 to establish a communication between the chambers 125 and 124 so that fluid under pressure can flow to the chamber 124 and thence via passageway 118 and pipe 142 to the spring chambers 141 and 141' in the two valve devices that comprise the change-over valve device 102.

A spring 106 in the right-hand valve device of the change-over valve device 102 is precompressed more than a spring 106' in the left-hand valve device. Consequently, the control piston 104 in the right-hand valve device will move downward to close the exhaust 143 and open the double valve 105 prior to the piston 104' closing the exhaust 143' and opening the double valve 105'.

When the double valve 105 is opened, fluid under pressure supplied to the valve chamber 116 via the pipes 117 and 119 from the supply reservoir flows to the chamber 114 and thence to the chamber 114' in the left-hand valve device. Since the exhaust 143' in this valve device has not been closed by the piston 104', fluid under pressure supplied to the chamber 114' flows to the whistle 123 to sound an alarm. However, if a safety control brake application is not suppressed by the engineer before the piston 104' is moved downward to cut off flow of fluid under pressure to the whistle 123 and unseat double valve 105' then, upon the unseating of double valve 105', the fluid under pressure present in the chamber 114' will flow therefrom to the chamber 116' and thence to the brake cylinder 146 via pipe 115, double check valve device 142 and pipe 145 to cause a safety control brake application.

The engineer can suppress a safety control brake application by moving the acknowledging valve 111 from the position shown in FIG. 2 to its second or lower position before the valve 105' is unseated. It may be seen that when the acknowledging valve 111 is thus moved to its lower position, the chamber 130 in the zero speed indicator device 103 as well as the chambers 108 and 108' are vented to atmosphere, it being noted that the check valve 132 opens to provide a rapid rate of flow of fluid under pressure from the chamber 130, and that the choke 113 provides a slow or restricted rate of flow of fluid under pressure from the chambers 108 and 108'. Accordingly, it will be understood that the double valve 127 in the zero speed indicator device is reseated by its corresponding spring prior to the unseating of the valves 105 and 105' so that a safety control brake application does not occur.

Since the spring 106 is precompressed more than the spring 106', the piston 104 will be moved down to unseat double valve 105 to supply fluid under pressure to the whistle 123 before the piston 104' moves down to unseat double valve 105' to cause flow of fluid under pressure to the brake cylinder 146. Therefore, when the whistle 123 sounds an alarm, the engineer will return the acknowledging valve 111 to the position shown in FIG. 2 to prevent a safety control brake application.

From the foregoing it is apparent that the engineer by moving the acknowledging valve 111 successively from its first position to its second position and then back to its first position in the proper timed sequence can suppress a safety control brake application, it being noted that if he leaves the acknowledging valve 111 in either of its two positions for too long a period of time, a safety control brake application will be automatically effected.

Having now described the invention, what we claim as new and desire to secure by Letters Patent, is:

1. In a safety control brake apparatus for a locomotive having at least one axle rotatable only in response to movement of the locomotive, in combination:

- fluid pressure operated braking means,
- fluid pressure controlled valve means for effecting the supply of fluid under pressure to said braking means,
- fluid pressure operated valve means for controlling the supply of fluid under pressure to said braking means,
- interlocking means between said axle and said fluid pressure operated valve means for rendering said valve means

while subject to fluid under pressure operable to control the supply of fluid under pressure to said braking means only in response to rotation of said axle,

- means providing for a rapid rate of flow of fluid under pressure to said fluid pressure controlled valve means and a restricted rate of flow of fluid under pressure therefrom,
- means providing for a restricted rate of flow of fluid under pressure to said fluid pressure operated valve means and a rapid rate of flow of fluid under pressure therefrom, and
- manually operative valve means having a normal position in which fluid under pressure is supplied to said fluid pressure operated valve means and to said fluid pressure controlled valve means at said rapid rate and operative to a different position in which fluid is released from said fluid pressure operated valve means at said rapid rate and from said fluid pressure controlled valve means at said restricted rate, said manually operable valve means being manually operable between said normal position and said different position in such a timed sequence as to control the flow of fluid under pressure to and from said fluid pressure controlled valve means and said fluid pressure operated valve means that said fluid pressure controlled valve means and said fluid pressure operated valve means are so controlled as to forestall the supply of fluid under pressure to said braking means.

2. In a safety control brake apparatus for a locomotive having at least one axle rotatable only in response to movement of the locomotive, in combination:

- fluid pressure operated braking means,
- a fluid pressure operated valve means for effecting the supply of fluid under pressure to said braking means,
- interlocking means between said axle and said fluid pressure operated valve means for rendering said valve means while subject to fluid under pressure operable to supply fluid under pressure to said braking means only in response to rotation of said axle,
- a fluid pressure controlled valve means for effecting the supply of fluid under pressure to said braking means independently of said fluid pressure operated valve means, said fluid pressure controlled valve means being interposed between said fluid pressure operated valve means and said braking means and so interlocked therewith as to render said fluid pressure operated valve means effective to supply fluid under pressure to said braking means only while said fluid pressure controlled valve means is ineffective to supply fluid under pressure to said braking means,

- means providing for a restricted rate of flow of fluid under pressure to said fluid pressure operated valve means and a rapid rate of flow of fluid under pressure therefrom,

- means providing for a rapid rate of flow of fluid under pressure to said fluid pressure controlled valve means and a restricted rate of flow of fluid under pressure therefrom, and

- manually operative valve means having a normal position in which fluid under pressure is supplied to said fluid pressure operated valve means at said restricted rate and to said fluid pressure controlled valve means at said rapid rate and operative to a different position in which fluid under pressure is released from said fluid pressure operated valve means at said rapid rate and from said fluid pressure controlled valve means at said restricted rate, said manually operable valve means being manually operable between said normal position and said different position in such a timed sequence as to so control the flow of fluid under pressure to and from said fluid pressure operated valve means and said fluid pressure controlled valve means that both are rendered ineffective to effect the supply of fluid under pressure to said braking means.

3. A safety control brake apparatus, as recited in claim 2, further characterized in that said means for providing a restricted rate flow of fluid under pressure to said fluid pres-

sure operated valve means provides a less restricted rate of flow of fluid under pressure than said means for providing a restricted rate of flow of fluid under pressure from said fluid pressure controlled valve means.

4. A safety control brake apparatus, as recited in claim 2, further characterized by a fluid pressure operated alarm device, and a supply valve operable in response to operation of said fluid pressure controlled valve means to effect the supply of fluid under pressure to said alarm device to cause operation thereof to sound an alarm.

5. A safety control brake apparatus, as recited in claim 2, further characterized in that said fluid pressure operated valve means comprises:

- a. a supply and release valve mechanism for controlling a supply of fluid under pressure to and the release of fluid under pressure from said braking means,
- b. structure movable out of a normal position in either of two directions upon engagement with said axle while rotating in one direction or in an opposite direction,
- c. fluid pressure operated means for actuating said structure into engagement with said axle and, upon rotation of said axle in either direction, subsequently actuating said valve mechanism to effect the supply of fluid under pressure to said braking means only while said fluid pressure controlled valve means is ineffective to supply fluid under pressure to said braking means,
- d. means for disengaging said structure from engagement with said axle and subsequently actuating said valve means to effect the release of fluid under pressure from said braking means only while said fluid pressure controlled valve means is ineffective to supply fluid under pressure to said braking means, and
- e. spring means cooperable with said structure upon disengagement from said axle to maintain said structure in said normal position.

6. A safety control brake apparatus, as recited in claim 4, further characterized in that said fluid pressure controlled valve means comprises:

- a. a supply and release valve mechanism for controlling the supply of fluid under pressure to and the release of fluid under pressure from said braking means,
- b. fluid pressure operated piston means for actuating said valve mechanism to effect the release of fluid under pressure from said braking means,
- c. spring biasing means effective upon a release of fluid under pressure from said piston means to cause said piston means to actuate said valve mechanism to effect the supply of fluid under pressure to said braking means, and
- d. means for varying the bias of said spring biasing means.

7. A safety control brake apparatus, as recited in claim 6, further characterized by a cam means for effecting operation of said supply valve, said cam means being integral with said piston means.

8. In a safety control brake apparatus for a locomotive having at least one axle rotatable only in response to movement of the locomotive, in combination:

- a. a fluid pressure operated braking means,
- b. a pair of different fluid pressure controlled valve devices arranged in series and each having an operating abutment subject on opposite sides to fluid under pressure, said pair of fluid pressure controlled valve devices, upon operation of one subsequent to the operation of the other effecting conjointly the supply of fluid under pressure to said braking means,
- c. a fluid pressure operated valve means for effecting the supply of fluid under pressure simultaneously to one side of the abutment of both of said fluid pressure controlled

valve devices,

d. interlocking means between said axle and said fluid pressure operated valve means for rendering said valve means while subject to fluid under pressure, operable to supply fluid under pressure to said one side of the abutment of both of said fluid pressure controlled valve means only in response to rotation of said axle,

e. means providing for a simultaneous rapid rate of flow of fluid under pressure to the other side of the abutment of both of said fluid pressure controlled valve devices and a restricted rate of flow of fluid under pressure therefrom,

f. means providing for a restricted rate of flow of fluid under pressure to said fluid pressure operated valve means and a rapid rate of flow of fluid under pressure therefrom,

g. manually operative valve means having a normal position in which fluid under pressure is simultaneously supplied to said other side of the abutment of both of said fluid pressure controlled valve devices at said rapid rate and to said fluid pressure operated valve means at said restricted rate and operative to a different position in which fluid under pressure is simultaneously released from said other side of the abutment of both of said fluid pressure controlled valve devices at said restricted rate and from said fluid pressure operated valve means at said rapid rate, said manually operable valve means being manually operable between said normal position and said different position in such a timed sequence as to so control the flow of fluid under pressure to and from the other side of the abutment of both of said fluid pressure controlled valve devices, and to and from said fluid pressure operated valve means that both said pair of different fluid pressure controlled valve devices and said fluid pressure operated valve means are rendered ineffective to effect the supply of fluid under pressure to said braking means.

9. A safety control brake apparatus, as recited in claim 8, further characterized in that said means for providing a restricted rate of flow to said fluid pressure operated valve means provides a less restricted rate of flow of fluid under pressure than said means for providing a restricted rate of flow of fluid under pressure from the other side of the abutment of both of said fluid pressure controlled valve devices.

10. A safety control brake apparatus, as recited in claim 8, further characterized in that abutment of the fluid pressure controlled valve device most remote from said braking means is subject on its one side to a biasing means of one value, and the abutment of the other of said pair of fluid pressure controlled valve devices is subject on its one side to a biasing means of a lesser value whereby upon the simultaneous release of fluid under pressure from the other side of the abutment of said pair of valve devices, said most remote valve device is operated to supply fluid under pressure to the other valve device of said pair prior to operation of said other valve device to supply fluid under pressure to said braking means.

11. A safety control brake apparatus, as recited in claim 10, further characterized by a fluid pressure operated alarm device so interlocked with said pair of valve devices as to sound an alarm upon the operation of said most remote valve device to supply fluid under pressure to said other valve device prior to operation of said other valve device to supply fluid under pressure to said braking means.

12. A safety control brake apparatus, as recited in claim 10, further characterized by a first volume reservoir connected to the other side of the abutments of said pair of fluid pressure controlled valve devices, and by a second volume reservoir connected to the outlet side of said means for providing a restricted rate of flow of fluid under pressure to said fluid pressure operated valve means.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,656,814 Dated April 18, 1972

Inventor(s) Fritz Scheele, Josef Frania and Walter Ortmann

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 6, line 14, after "fluid", first occurrence, insert
--under pressure--

line 75, after "rate" insert --of--

Column 7, line 63, after "other" insert a comma --,--

Signed and sealed this 30th day of January 1973.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patent: