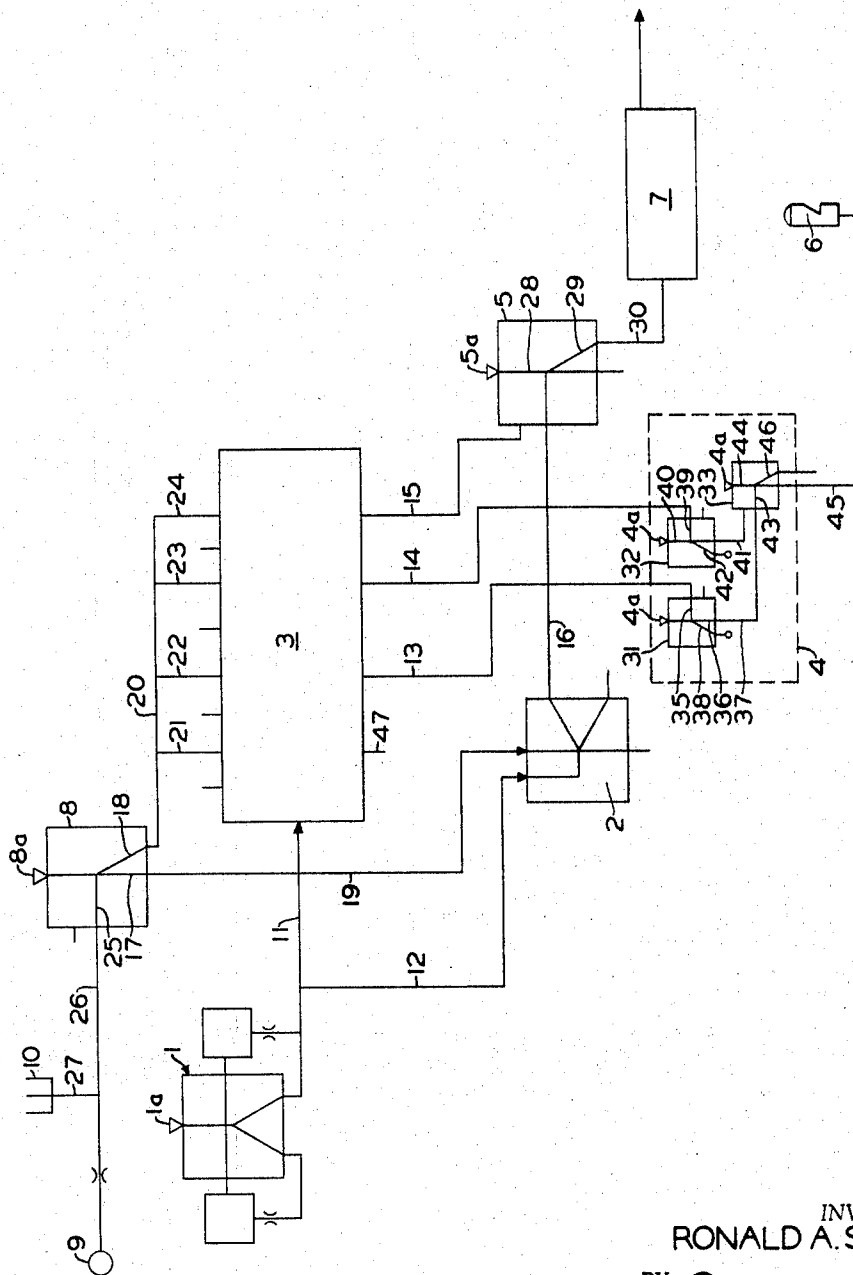


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SAFETY CONTROL SYSTEM

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SAFETY CONTROL SYSTEM
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ABSTRACT OF THE DISCLOSURE

A safety control system for a railway car or train, embodying fluidic circuitry including multiple stage and single stage binary counters cooperatively related to provide a periodic warning signal requiring some momentary physical acknowledgment by the engineman, affecting the circuitry in order to prevent a subsequent automatic brake application.

Background of the invention

The field of the invention is fluidic safety control systems whereby "or," "and" and "bistable" functions are utilized in the circuits to incorporate reliability in the system.

The prior art includes mechanical equipment called the "dead man" type control having a foot pedal or other manually operated lever that must be operated periodically to prevent automatic initiation of a brake application from taking place.

The prior art also comprises safety control apparatus, including electric or electronic circuits which set up a magnetic field that requires the engineman to either contact or break contact with a metal surface periodically to prevent a brake application from being automatically initiated.

The object of this invention is to utilize a novel, simple, reliable fluidic component arrangement in combination with a conventional safety control and warning system that will not only require the engineman to perform some physical act of acknowledgement at predetermined time intervals but also that requires that the acknowledgement be a momentary one.

Summary of the invention

A fluidic binary system comprising a bistable circuit that conveys pneumatic pulsations simultaneously to a one-stage counter and a four-stage counter. At the same time a control circuit continually resets the one-stage counter by way of an "or" gate in the circuit. A manual reset circuit, having a separate pneumatic power source, is channeled through said "or" gate and is adapted to control the fluid from said control circuit to the one-stage counter or the four-stage counter. In the four-stage counter, fluid from the bistable circuit proceeds through an "and" gate to a warning actuator and then the four-stage counter releases more fluid to go through another or a second "or" gate to a penalty actuator or the fluid goes initially to the one-stage counter and then directly to the said second "or" gate and to the said penalty actuator by way of the said second "or" gate. The control source from the "or" gate is continually resetting the one-stage counter, but the four-stage counter must be reset manually by the engineman by covering a vent, which is located in the manual reset circuit, in response to the warning signal.

If the engineman holds the vent closed longer than an instant, the single-stage counter will not automatically be reset by the control source from the "or" gate and the penalty actuator will again be tripped by the second "or" gate and high pressure fluid will be actuated to initiate a brake application.

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Brief description of the drawings

The single figure of the drawing shows schematically the fluidic safety control system comprising an embodiment of the invention.

Description of the preferred embodiment

The safety control system contains four main circuits. The first circuit is a bistable input circuit comprising a bistable or flip-flop element 1, having a fluid source 1a, which sends pulsations to a single-stage counter 2 and a four-stage counter 3 which in turn supplies control fluid to an "and" gate 4 and an "or" gate 5 to determine whether or not a warning signal or whistle 6 and a penalty actuator 7 are actuated.

The second circuit is an automatic reset control circuit which conveys fluid from an "or" gate 8 to the single-stage counter 2 continually resetting it. The automatic reset circuit is also adapted to reset the four-stage counter 3 also by way of "or" gate 8.

The third circuit is a manual reset circuit having a power source 9, which could be fed from the engine compressor, and a vent 10 that is adapted to be momentarily plugged as by the engineman's finger and cause fluid to flow into "or" gate 8 and deflect the flow in the gate from the one-stage counter to the four-stage counter.

A fourth circuit is an indicator circuit and supplies fluid under pressure to the second "or" gate 5 at 5a and the "and" gate 4 at 4a. This fluid is vented at each gate but is adapted to be directed, by fluid from the bistable circuit to the penalty actuator 7 and the warning whistle 6, respectively.

The first circuit or bistable circuit further comprises a tube 11 connecting the said bistable element with the four-stage counter 3 and a tube 12 connecting the bistable element with the single-stage counter 2. From the four-stage counter the bistable control circuit has two tubes 13 and 14 connected between the four-stage counter and the "and" gate 4. The circuit also has a tube 15 connected between the four-stage counter and the "or" gate 5. The circuit also comprises a tube 16 which connects the single-stage counter 2 and the "or" gate 5.

The second circuit or the automatic reset circuit comprises within "or" gate 8 input source 8a and channels 17 and 18. Channel 17 is connected by tube 19 to the single-stage counter 2. The channel 18 is connected to a manifold tube 20 which has four tubes 21, 22, 23 and 24 leading from manifold tube 20 to the four-stage counter 3. The automatic reset circuit has another channel within "or" gate 8, channel 25, which communicates with tube 26 leading to the third circuit or manual reset circuit.

The third circuit or manual reset circuit which comprises the power source 9 is connected to the "or" gate 8 by tube 26 as mentioned above and the vent 10 is connected to tube 26 by another tube 27.

The fourth circuit, the indicator circuit, is a supply circuit to "and" gate 4 and "or" gate 5 and further comprises channel 28 within "or" gate 5, which is vented to atmosphere, and channel 29 within "or" gate 5 which is connected to pipe 30 leading to the penalty actuator 7. The fourth circuit further comprises three separate "or" gates 31, 32 and 33 within the "and" gate 4. The "or" gate 31 has tube 13 leading into channel 35 within the "or" gate 31 and also a channel 36 which connects to pipe 37 and channel 38 which is vented to atmosphere. Within "or" gate 32 is channel 39 which is connected to incoming tube 14. Also within gate 32 is channel 40 which connects to pipe 41 and channel 42 which is vented to atmosphere. The pipes 37 and 41 are connected to "or" gate 33 with pipe 37 connected to channel 43 within the "or" gate 33. Also within "or" gate 33 is a

channel 44 connected to a tube 45 leading to the warning whistle 6. Also within "or" gate 33 is a channel 46 that is vented to atmosphere.

Operation

Initially let it be assumed that the car or train is traveling at its normal rate of speed and no brake application is being automatically applied nor is one about to be intentionally applied by the trainman. The safety control system is operating and fluid from power source 9 is being directed through pipe 26 into tube 27 and exhausted through vent 10 since the trainman is not blocking the mouth of the vent 10. Simultaneously fluid is flowing into "or" gate 8, at 8a, through channel 17 into tube 19 and into the single-stage counter 2 continually resetting the counter. At the same time fluid is flowing from bistable element 1 through tubes 11 and 12 into the respective four-stage counter and the single-stage counter. Since the single-stage counter 2 is being continually reset, the incoming fluid in tube 12 is being exhausted and not conveyed through the counter into tube 16; however, since the four stage counter is not being automatically reset continually, because all the fluid in "or" gate 8 is being conveyed into channel 17 and not into channel 18, the fluid from tube 11 flows into tube 13 and then into tube 14 and then into tube 15 as the four-stage counter continues to run.

Simultaneously as fluid is coming from power source 9 and being exhausted at vent 10 and fluid is coming from bistable element 1 and "or" gate 8 fluid is also coming into the "or" gate 5 and the "and" gate 4 at 5a and 4a respectively. The fluid in "or" gate 5 comes through channel 28 and passes directly to atmosphere since there is no incoming fluid in tube 16 to divert the internal flow from channel 28 to channel 29. Also within the "and" gate 4 the three individual "or" gates 31, 32 and 33 have incoming fluid into channels 36, 40 and 44 respectively. The incoming fluid in channels 36 and 40 flows directly through into tubes 37 and 41 respectively and from there into "or" gate 33 diverting the initial flow in channel 44 into channel 46 and venting to atmosphere; therefore, no fluid is flowing into tubes 30 and 45 as the train progresses along its route. This is the stage operation for a period of about four seconds. After four seconds have elapsed, the four-stage counter continues to run and fluid is directed through channel 13 into "or" gate 31, the incoming fluid in the tube 13 flows into channel 35 within the gate and diverts the flow in channel 36 into channel 38 venting it to atmosphere; therefore, no fluid is flowing through channel 36 at this particular second. However, within the "and" gate 4 fluid is still flowing through tube 41 into "or" gate 33 and the fluid in channel 44 continues to be directed into channel 46 and to atmosphere. An instant later incoming fluid in four-stage counter 3, which is entering the counter through tube 11 is directed to tube 14 and into "or" gate 32 by way of channel 39. This then directs the flow of fluid within the gate in channel 40 into channel 42 and vents it to atmosphere. There is no flow of fluid at this time through tubes 37 and 41. With no flow of fluid into "or" gate 33 the initial flow in channel 44 will not be diverted to channel 46 but will flow to tube 45, and there will then be a fluid flow to the warning actuator which will cause the warning whistle to blow. A couple of seconds later fluid will be directed to tube 15 and into "or" gate 5 and divert the flow of fluid within the gate from channel 28 to channel 29 which is connected to tube 30. Fluid will flow through tube 30 into the penalty actuator 7.

To stop the impending penalty actuator 7 from activating, the alert trainman must stop the four-stage counter from completing its fourth count which directs fluid from tube 11 to tube 15. To do this, he must reset the counter manually.

To reset the counter, the trainman must momentarily plug vent 10. When he does this, it automatically resets

the four-stage counter and stops the counter from reaching its fourth stage. This happens as follows:

The trainman plugs the vent 10 which stops fluid flow from power source 9 through tube 26 to tube 27. The fluid continues, however, through tube 26 into channel 25 of "or" gate 8 and diverts the fluid in channel 17 into channel 18 which is connected to manifold tube 20 and tubes 21, 22, 23 and 24. When fluid flows through the manifold tube 20 and the auxiliary tubes into four-stage counter 3, the counter is automatically reset, recycling the counter thus starting it over again, and communication to tube 15 is cut-off for the present. When the four-stage counter is reset, the incoming flow from tube 11 to the counter is vented to atmosphere by way of tube 47. About four seconds later the incoming flow is directed to tube 13 and then into tube 14 actuating the warning whistle 6 which tells the trainman in about four seconds the four-stage counter will emit fluid into tube 15 and the penalty actuator will apply a light service application to the car or train as described above. If the trainman hears the warning whistle, he must again manually close vent 10. If during this entire 20 second cycle he held the vent 10 closed, he would automatically continuously reset the four-stage counter, the warning whistle would never blow and the penalty actuator would never actuate. However, if he were to hold the vent closed more than one second, he would immediately cause a service brake application.

The application would come about as follows:

When the trainman plugs vent 10 after he hears the warning whistle, the fluid in tube 26 flows into channel 25 of the "or" gate 8 diverting fluid in channel 17 to channel 18. When this occurs, the fluid flow in tube 19 ceases and the single-stage counter is no longer reset automatically; therefore, it continues to run. As this counter runs, fluid from incoming tube 12 flows into exit tube 16 and into "or" gate 5 diverting fluid in channel 28 to channel 29, to tube 30, into penalty actuator 7 and immediately, without a warning whistle, initiates a service brake application on the car or train. The trainman must upon closing vent 10 and diverting the fluid within "or" gate 8 from channel 17 to 18 immediately release vent 10 so that fluid can again flow into channel 17, tube 19 and single-stage counter 2 to reset the counter and stop fluid from flowing through the counter into tube 16, "or" gate 5 and penalty actuator 7. This means that fluid must only be permitted to flow for a second into channel 18; however, this is time enough and fluid enough to reset the four-stage counter 3.

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

1. A safety control system comprising, in combination:
 - (a) a penalty actuator,
 - (b) a warning signal device,
 - (c) means for effecting operation of said signal device including an "and" gate,
 - (d) means for effecting operation of said penalty actuator including an "or" gate,
 - (e) a multi-stage counter for effecting sequential operation of said "and" gate and said "or" gate, and
 - (f) means including "or" gate means for controlling said multi-stage counter to effect resetting of said counter upon operation of said warning signal to prevent operation of said penalty actuator.
2. The safety control system of claim 1 wherein said means for effecting operation of said penalty actuator includes a single-stage counter interposed between said "or" gate means and said "or" gate to effect operation of said penalty actuator under the control of said "or" gate means.
3. The safety control system of claim 2, further comprising a common input means for providing a signal to both said multi-stage counter and said single-stage counter.
4. The apparatus of claim 3 wherein said input means comprises a bistable means having its own power source,

adapted to transmit a signal simultaneously to said multi-stage counter and said single-stage counter.

5. A brake control apparatus for railway cars including a safety control system, comprising:

- (a) a penalty actuator means,
 - (b) an indicator means,
 - (c) an input means,
 - (d) a counter means and another counter means, both of which are operatively connected to said input means for control of said penalty actuator means, and said counter means being operatively connected to said indicator means to effect actuation of said indicator means,
 - (e) a control means for setting said counter means and for continually resetting the said another counter means,
 - (f) a reset means adapted to reset said counter means at any time and particularly when said indicator means indicates that said counter means has not been reset, whereby said penalty actuator means is adapted to be actuated under control of the said counter when said indicator means is ignored and said reset means is not actuated and under control of said another counter means when said reset means is actuated and not immediately released.
6. A brake control apparatus for railway cars, as recited in claim 5, in which said input means comprises a bistable means having its own power source, adapted to transmit a signal simultaneously to said counter means and said another counter means.
7. A brake control apparatus for railway cars, as recited in claim 5 in which, said counter means is a four-stage binary counter and in which said reset means is manually operated.
8. A brake control apparatus for railway cars, as recited in claim 6, in which said another counter means is a single-stage counter connected to and adapted to actuate said penalty actuator when said four-stage counter is reset manually and said reset means is not released at a predetermined preset time interval.
9. The apparatus of claim 8, wherein said reset means

includes an "or" gate and wherein said "or" gate communicates with said four-stage counter and said single-stage counter.

10. The apparatus of claim 9, wherein said "or" gate is also part of said control means for setting said counter means.

11. The apparatus of claim 10, wherein said reset means includes a manually operated vent adapted to be momentarily plugged to divert the flow of fluid in said "or" gate from resetting said single stage counter to set said four-stage counter.

12. A brake control apparatus for railway cars including a safety control system recited in claim 6, wherein said indicator means comprises an indicator and three "or" gates comprising an "and" gate, said "and" gate is connected between said counter means and said indicator to establish fluid flow between said counter means and said indicator, whereby said indicator is actuated to provide a warning signal when said counter means is not reset.

13. The apparatus of claim 5, wherein said penalty actuator means includes a penalty actuator and an "or" gate between said penalty actuator and said counter means adapted to establish fluid flow from said counter means to said penalty actuator whereby when said counter means has not been reset said penalty actuator initiates a brake application on a railway car.

14. The brake control apparatus of claim 5, wherein said brake control apparatus is a fluid pressure brake control apparatus.

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