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C. E. BASTON

2,437,991

CONTROL APPARATUS

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Fig. 1.

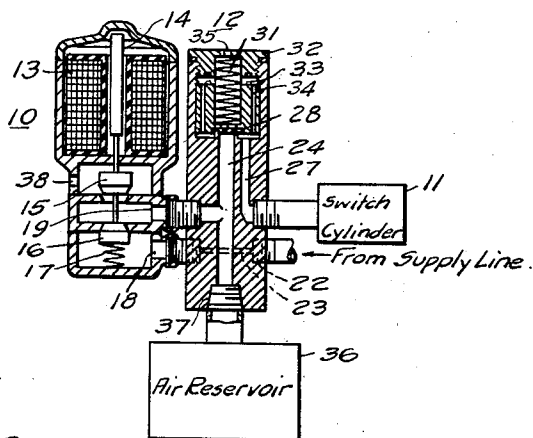


Fig. 2.

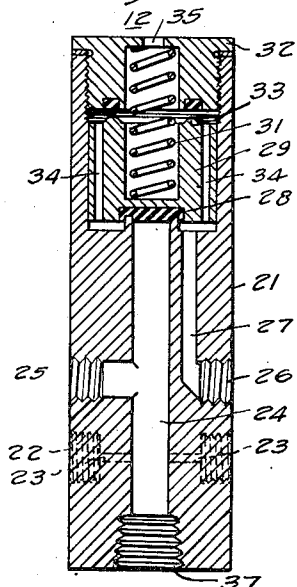


Fig. 3.

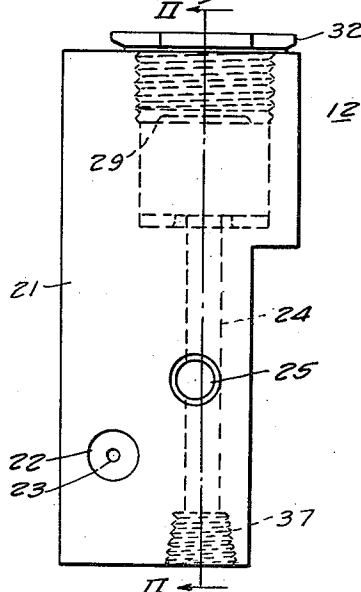


Fig. 5.

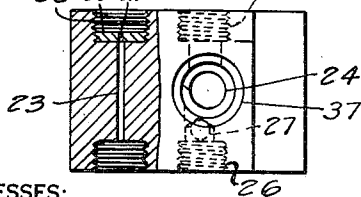
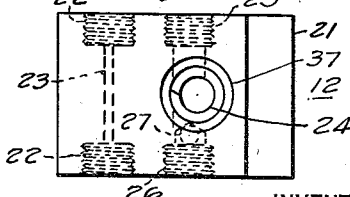


Fig. 4.



WITNESSES:

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CONTROL APPARATUS

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4 Claims. (Cl. 121—38)

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My invention relates, generally, to control apparatus, and more particularly, to apparatus of the electro-pneumatic type utilized in the control of electric locomotives and vehicles.

The proper control of electric locomotives often requires the interposition of a time interval between two successive operations, such as between the closing of a relay and the closing of the switch controlled by the relay. One method of securing the desired time interval is to interpose a time-delay device between the initiating device, such as a relay, and the controlled device, such as a switch. Time-delay devices of various types, such as magnetic, electro-mechanical or pneumatic, have been utilized. However, all of these devices with which I am familiar are rather complicated in structure and expensive to manufacture. Furthermore, their installation necessarily requires additional space and either air or electrical connections or both.

An object of my invention, generally stated, is to provide a simplified and improved means of obtaining a predetermined time interval between successive operations of control apparatus.

A more specific object of my invention is to provide a time-delay device which may be utilized with an electro-pneumatic switch without requiring any additional wiring or piping.

Another object of my invention is to provide a time-delay device having a variable timing feature.

Other objects of my invention will be explained fully hereinafter or will be apparent to those skilled in the art.

In accordance with my invention, a relatively small adapter with a connected air reservoir may be inserted between the magnet valve and the cylinder of an electro-pneumatic switch, thereby converting it to a switch which will close its contact members a desired time interval after its magnet valve is energized.

For a fuller understanding of the nature and objects of my invention, reference may be had to the following detailed description, taken in conjunction with the accompanying drawing, in which:

Figure 1 is a view, in section, of a magnet valve and time-delay device embodying my invention;

Fig. 2 is an enlarged view, in section, of the time-delay device, the section being taken along the line II—II of Fig. 3;

Figs. 3 and 4 are enlarged views, in front and end elevation, respectively, of the time-delay device; and

Fig. 5 is an enlarged view, in end elevation, of

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a modification of my invention, a portion being broken away for clearness.

Referring to the drawing, and particularly to Fig. 1, the structure shown therein comprises a magnet valve 10 which is utilized to control the flow of a fluid, such as air, to a cylinder 11 of an electro-pneumatic switch, or other fluid-operated device. A time-delay device or adapter 12 is disposed between the magnet valve 10 and the switch cylinder 11 for delaying the operation of the switch a predetermined time interval after the operation of the magnet valve 10. The magnet valve 10 may be of the electro-magnetic type having a solenoid coil 13 and a solenoid member 14 for actuating valve members 15 and 16 against the force of a compression spring 17. The magnet valve is provided with openings 18 and 19 which are connected to corresponding openings in the adapter 12.

As shown more clearly in Figs. 2, 3 and 4, the time-delay device or adapter 12 comprises a body member 21 having openings 22 therein joined by a restricted passage 23 leading transversely through the body member 21. A passage 24 extends longitudinally through the body member, and an opening 25 in one side of the body member is connected to the longitudinal passage 24. A similar opening 26, disposed oppositely from the opening 25, is connected to the longitudinal passage 24 through a passage 27 and a valve 28 disposed at one end of a piston 29 slidably disposed within the body member 21. The valve 28 is normally closed by a compression spring 31 which is retained in the body member 21 by a plug 32 threaded into the one end of the body member 21. A valve 33 at the opposite end of the piston 29 from the valve 28 is closed when the spring 31 is compressed by the action of the pressure fluid, as will be explained more fully hereinafter.

Relatively small openings or ports 34 extend through the piston 29. An opening 35 is provided in the plug 32 to permit the pressure fluid to escape to atmosphere under predetermined conditions. An enclosed reservoir 36 is connected to the longitudinal passage 24 through an opening 37 provided in the end of the body member 21 opposite the plug 32.

When the solenoid 13 of the magnet valve 10 is energized, the pressure fluid, such as compressed air, enters the adapter 12 from the supply line through the opening 22 in the adapter 12 and flows through the restricted passage 23 and the opening 18 into the magnet valve 10. The air flows through the valve 16 and out of the

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magnet valve through the opening 19 into the passage 24 of the adapter 12 through the opening 25. The air then passes into the reservoir 36 through the opening 27. The air is prevented from entering the switch actuating cylinder 11 by the inner valve 28 on the piston 29 until the air pressure built up in the reservoir 36 reaches a value well above the minimum required to close the switch. By a proper correlation between the volume of the reservoir 36 and the size of the restricted passage or choke 23 in the adapter, any desired time interval between the operation of the magnet valve 10 and the closing of the switch may be obtained.

As soon as the reservoir 36 has become charged to the required pressure, the piston 29 is lifted against the force exerted by the spring 31, thereby opening the valve 28. As soon as the valve 28 is unseated, the air pressure is effective against the larger area of the piston 29, even though some air is allowed to escape to atmosphere through the ports 34 in the piston 29 and the opening 35 in the plug or cap 32. The increased force on the piston 29 moves it rapidly against the outer valve seat 33, thereby stopping the escape of air to atmosphere. The opening of the valve 28 permits the air to flow from the reservoir 36 through the passage 27 and the opening 26 into the switch cylinder 11, thereby closing the switch. Since all of the passages from the reservoir to the switch are relatively large, and the volume of the reservoir is large as compared to the volume of the switch cylinder, the switch piston moves rapidly and positively through its full stroke irrespective of the size of the choke 23 utilized.

When the magnet valve 10 is deenergized, the valve 15 is opened and the valve 16 closed by the spring 17. The air is permitted to flow from the switch cylinder 11 and the reservoir 36 through the large openings in the adapter 12 to the magnet valve and thence to atmosphere through an opening 38 in the magnet valve, and does not have to pass through the restricted passage 23. In this manner, the switch is permitted to open with its normal opening speed.

Since the area of the entire piston 29 is much larger than the area of the inner valve seat 28, the piston will remain in contact with the outer valve seat 33 until the air pressure has dropped to a much lower value than that required to actuate the piston to open the valve 28. In fact, with properly proportioned valve seats, this pressure will be below that at which the switch opens. When the piston 29 finally moves to close the valve 28, the remaining air in the switch cylinder discharges to atmosphere through the ports 34 and the opening 35 in the cap 32.

As illustrated in Fig. 5, the size of the restricted passage or choke 23 may be readily changed by providing an insert 39 which may be threaded into the opening 22. The insert 39 is provided with an opening or jet 41 which is still smaller than the restricted passage 23. In this manner, a still further time delay in the operation of the switch may be obtained. It will be understood that inserts 39 having opening 41 of different sizes may be provided, thereby providing means for readily varying the time interval between the operation of the magnet valve 10 and the operation of the switch or other device controlled by the magnet valve.

From the foregoing description, it is apparent that I have provided a time-delay device which may be readily adapted to any electro-pneumatic switch or other fluid-operated device. Further-

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more, the time interval between the operation of the controlling magnet valve or relay and the operation of the controlled device may be readily adjusted within predetermined limits. The installation of the present device does not require any additional electrical wiring or fluid piping, since the adapted may be readily inserted between a standard magnet valve and the operating cylinder of an electro-pneumatic switch. Normal operation of the switch is not interfered with and the current-carrying and rupturing capacity of the switch is not changed.

Since numerous changes may be made in the above-described construction and different embodiments of the invention may be made without departing from the spirit and scope thereof, it is intended that all matter contained in the foregoing description or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

I claim as my invention:

1. In control apparatus, in combination, a fluid-operated device, an electromagnetically operated valve for controlling the flow of a fluid to and from said device, and valve means disposed between said magnet valve and said device for delaying the operation of said device for a predetermined time interval after the operation of said magnet valve, said valve means having an enclosed reservoir of a fixed volume detachably connected thereto and a pressure-operated valve member for controlling the flow of fluid from said reservoir to said device and from said device to atmosphere.

2. In a control apparatus, in combination, a fluid-operated device, an electromagnetically operated valve for controlling the flow of a fluid to and from said device, and valve means disposed between said magnet valve and said device for delaying the operation of said device for a predetermined time interval after the operation of said magnet valve, said valve means having a restricted passage therethrough for controlling the flow of fluid to the magnet valve and an enclosed reservoir of a fixed volume detachably connected thereto and a pressure-operated valve member for controlling the flow of fluid from said reservoir to said device and from said device to atmosphere.

3. In control apparatus, in combination, a main valve for controlling the flow of fluid to and from a fluid-operated device, and auxiliary valve means disposed between the main valve and said device and cooperating with said main valve to delay the operation of said device for a predetermined time interval after the operation of said main valve, said auxiliary valve means having a restricted passage connected to one opening in the main valve and an enclosed reservoir of a fixed volume detachably connected to another opening in the main valve, and a fluid-operated valve member disposed within said valve means for controlling the flow of fluid from said reservoir to the fluid-operated device and from said device to atmosphere.

4. In control apparatus, in combination, a main valve for controlling the flow of a fluid to and from a fluid-operated device, auxiliary valve means disposed between the main valve and said device and cooperating with said main valve to delay the operation of said device for a predetermined time interval after the operation of said main valve, said auxiliary valve means having a restricted passage connected to one opening in the main valve and an enclosed reservoir of a

fixed volume detachably connected to another opening in the main valve, a fluid-operated valve member slidably disposed within said valve means for controlling the flow of fluid from said reservoir to the fluid-operated device and from said device to atmosphere, and means for varying the size of said restricted passage.

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