

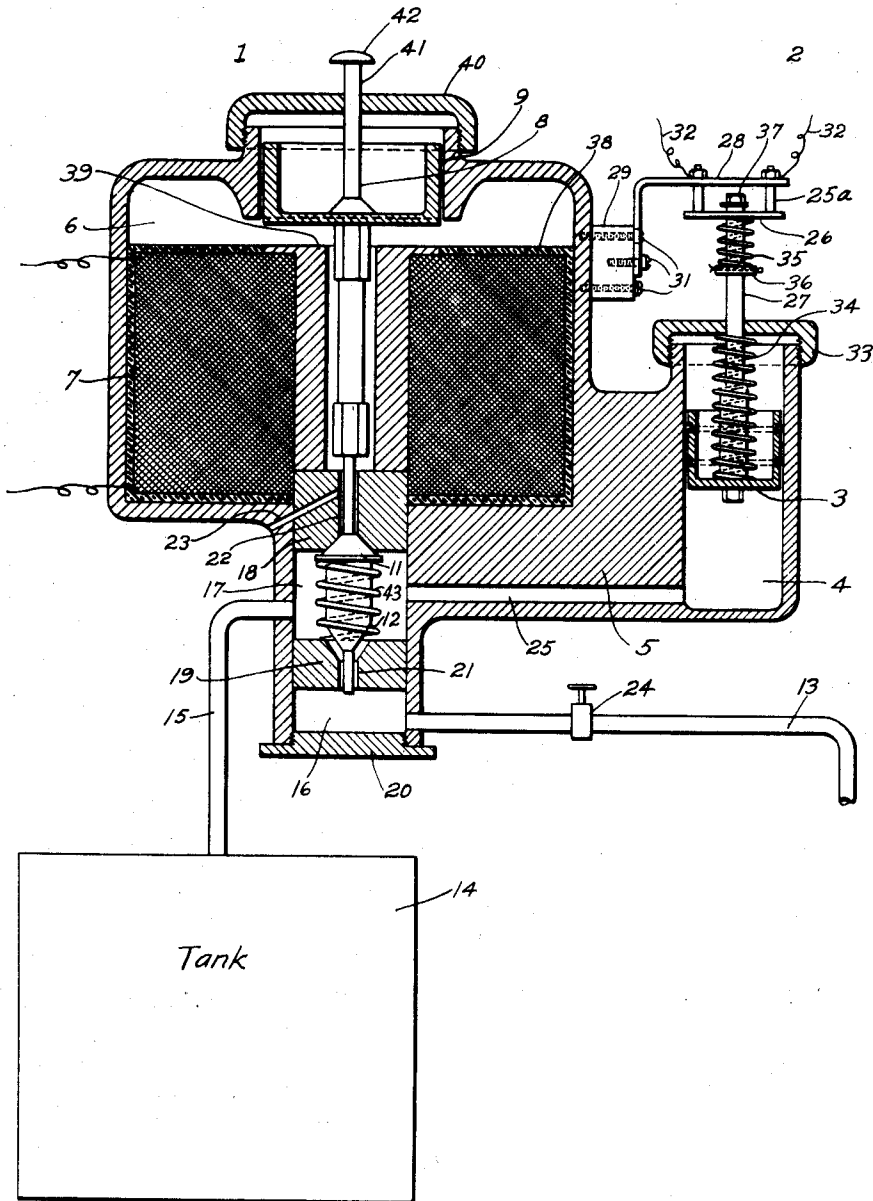
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ELECTROPNEUMATIC TIME ELEMENT RELAY

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WITNESSES:

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ELECTROPNEUMATIC TIME-ELEMENT RELAY

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Our invention relates to time-element relays and it has particular relation to relays that are electrically governed and pneumatically actuated.

5 One object of our invention is to provide a relay that will have a definite time interval between the instant the actuating coil of the relay is energized, or de-energized, (according to the construction of the relay), and the
10 time the contact member of the relay moves.

Another object of our invention is to provide means for regulating the speed at which a time-element relay operates to open or close a circuit.

15 A further object of our invention is to provide a relay that shall be simple and economical in construction and positive and reliable in operation.

20 Briefly speaking, our invention comprises providing a time-element relay with a piston that is movably mounted in a hollow cylinder and having this cylinder pneumatically connected to a fluid reservoir, whereby the time required to bring the pressure upon the piston to a predetermined value is governed by
25 the size of the reservoir, which is simultaneously filled with fluid from the same fluid source as is the cylinder. The speed of operation of the relay is also governed by
30 the size of its parts and the pressure of the fluid employed in its operation.

For a better understanding of our invention, reference may be now made to the single figure of the accompanying drawing, in
35 which is illustrated a time element relay that is constructed in accordance with our invention, the relay being illustrated partly in section and partly in side elevation.

40 Our electro-pneumatic time element relay 1 comprises an electrical switching device 2, which is mechanically connected to a piston 3. The piston 3 is movably mounted in a hollow cylindrical chamber 4, which constitutes a part of the main body portion 5 of the relay 1.
45 The body portion 5 of the relay 1 is also provided with a relatively large cylindrical cavity 6, in which an annular solenoid 7 is positioned.

50 A movable valve stem 8, having a magnetizable armature member 9 loosely mounted

thereon, is also provided with an outlet valve member or plug 11 and an inlet valve member or plug 12 at its lower end for governing the flow of fluid into and out of the hollow chamber 4 of the relay 1. Fluid under pressure is
55 supplied, from a suitable source, by a pipe 13, to operate the piston 3 of the time element relay 1, in a manner hereinafter more fully described. A reservoir or tank 14 is permanently connected to the time element relay 1
60 by means of a fluid conveyor or pipe 15.

A plurality of relatively small chambers 16 and 17 are formed by means of a plurality of annular metallic members or valve seats 18 and 19 and a bottom cap 20, which are positioned in the lower part of the cavity 6 of
65 the body portion 5 of the relay 1. The annular metallic member 19 is provided with a centrally positioned hole or inlet port 21, through which a portion of the valve stem 8 travels. The annular member 18 is provided
70 with a centrally positioned hole 22 for the valve stem 8, and with a diagonal outlet or port 23, which opens directly into the hole 22.

The supply pipe 13, which is directly connected to the inlet chamber 16 of the relay 1,
75 is provided with a manually operable valve device 24 for controlling the rate of flow of fluid into the inlet chamber 16. The reservoir pipe 15 is connected directly to the
80 middle chamber 17 of the relay 1. A fluid conveyor or duct 25 is employed for pneumatically connecting the piston chamber 4 to the middle chamber 17 of the relay 1.

The switching device 2 of the relay 1 comprises a plurality of stationary control fingers 25^a and a movable contact member 26,
85 which is slidably mounted upon a rod 27 that constitutes a part of the piston member 3.

The stationary control fingers 25^a are
90 securely mounted upon a suitable bracket 28. The bracket 28, which is made of any suitable insulating material, such, for example, as micarta, is mounted upon the body portion
95 5 of the relay 1, by means of a block 29 and a plurality of tap bolts 31. The control fingers 25 are connected directly to a circuit 32 only a small portion of which is illustrated.

An annular cap or cover plate 33 is provided for the open end of the piston chamber
10

4. The piston 3 is biased to its illustrated lower position by means of a resilient member or coil spring 34 that surrounds the rod 27.

5 The contact member 26 of the switching device 2 is resiliently positioned upon the rod 27 by means of a coil spring 35, a washer 36 and a nut 37, which are employed to limit the travel of the contact member 26.

10 Referring again to the annular solenoid 7, it is insulated from the body portion 5 of the relay 1 by means of a covering of suitable insulating material 38, such, for example, as rubber. An annular magnetizable metallic member or stationary core 39 is positioned within the solenoid 7, in such a manner as to loosely surround the valve stem 8.

An annular metallic cap 40 is detachably mounted upon the top of the body portion 5 of the relay 1, thus serving to close the cavity 6. A pin 41, which is provided with a protruding knob portion 42, serves as a push button when it is desired to manually operate the relay 1.

25 The valve stem 8 is biased to its upper position by means of a resilient member or spring 43, which is located between the valve plug 11 and the annular metallic member 19, to maintain the inlet port 21 normally open and the outlet port 23 normally closed.

30 The operation of our time element relay is normally effected by the resilient member or spring 43 actuating the valve stem 8 to its illustrated upper position, thereby causing the outlet valve member 11 to close the hole 22, which leads to the outlet port 23, and the inlet valve member 12 to be actuated to its open position. Upon the opening of the inlet member 12, fluid under pressure from the supply pipe 13 passes through the lower chamber 16 and the inlet port or hole 21 into the middle chamber 17 of the relay 1. A portion of the fluid under pressure then passes from the middle chamber 17 through the fluid conveyor or pipe 15 to the tank or reservoir 14 and another portion passes from the middle chamber 17 through the fluid conveyor or duct 25 into the piston chamber 4.

35 The pressure upon the piston 3 is governed by the pressure of the fluid in the tank or reservoir 14. When fluid under pressure enters the middle chamber 17, the pressure in the reservoir 14 and the piston chamber 4 simultaneously rises until the pressure upon the piston 3 is sufficient to overcome the opposing force stored in the resilient member 34. When the pressure upon the piston 3 is sufficient to overcome the spring 34, the piston 3 is actuated upwardly to effect the engagement of the movable contact member 26 with the stationary control fingers 25^a of the switching device 2 of the relay 1, thereby closing a gap in the circuit 32.

40 Whenever the solenoid 7 is energized, the armature 9 is actuated downwardly against

the metallic core 39, thereby causing the inlet valve 12 to be actuated to its closed position. Upon the closing of the inlet valve 12, the supply of fluid from the supply pipe 13 is prevented from flowing into the reservoir 14 and the piston chamber 4 of the relay 1.

70 The simultaneous opening of the outlet valve 11 permits fluid from the chamber 4 and the reservoir 14 to escape through the hole 22 and the outlet port 23 to the outer atmosphere. The pressure of the fluid upon the piston 3 will gradually decrease until the pressure of the spring 34 upon the piston 3 is sufficient to actuate it to its lower position, thereby causing the movable contact member 26 to disengage the stationary control fingers 25^a of the switching device 2 of the relay 1, thus interrupting the circuit 32. It is possible to increase the speed at which the relay 1 operates by decreasing the size of the reservoir 14, or to decrease its speed by making the reservoir 14 larger.

85 As long as the solenoid 7 remains energized, the switching device will occupy its open position. Upon the deenergization of the solenoid 7, the valve stem 8 is actuated upwardly by the spring 11, thereby closing the outlet part 23 and opening the inlet port 21. The opening of the inlet port 21 will cause fluid pressure to again be applied to the piston 3 in the manner hereinbefore fully described.

90 The rapidity of operation of the relay 1 may also be varied by means of the valve device 24, which controls the flow of fluid from the supply pipe 13 into the lower chamber 16 of the relay 1. If so desired, the valve device 24 may be omitted, its purpose being to give a greater range of time in the operation of the relay.

105 From the above description it is apparent that we have provided means for effecting the operation of a switching device at a predetermined period subsequent to the change in energization of a solenoid constituting part of a relay.

110 While we have shown our invention in a preferred form, it is apparent that minor modifications may be made in the arrangement and shape of the parts of the relay without departing from the spirit of our invention. We desire, therefore, to be limited only by the scope of the appended claims.

We claim as our invention:

1. In a time-element relay, in combination, 120 a spring biased circuit-controlling member, means adapted for operation by air pressure for actuating the circuit-controlling member, an inlet valve and an outlet valve to control the flow of air to and from the actuating means, electromagnetically controlled means for actuating the valves, and an air reservoir connected between the valves to provide for the diversion of a portion of an inwardly flowing stream of air from the actuating 130

means to delay the operation of the circuit-controlling member.

2. In a time-element relay, in combination, a spring-biased circuit-controlling member, means adapted for operation by air pressure for actuating the circuit-controlling member, an inlet valve and an outlet valve for controlling the flow of air to said actuating means, said valves being disposed on a common stem, an air chamber in which the valves are located, means for connecting the air chamber to said actuating means, electromagnetically controlled means for operating the valves, an air reservoir connected to the air chamber to delay the operation of the circuit-controlling member when the inlet valve is opened, and manual means for opening the outlet for emergency operation.

3. In a time-element relay, in combination, a circuit-controlling member, means for biasing the circuit-controlling member to a predetermined position, means adapted for operation by air pressure for actuating the circuit-controlling member, an inlet valve and an outlet valve to control the flow of air to and from the actuating means, said valves being disposed on a common stem, electromagnetically controlled means for actuating the valves, and an air reservoir connected between the valves to provide for the diversion of a portion of an inwardly flowing stream of air from the actuating means to delay the operation of the circuit-controlling member.

In testimony whereof, we have hereunto subscribed our names this 16th day of February, 1925.

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