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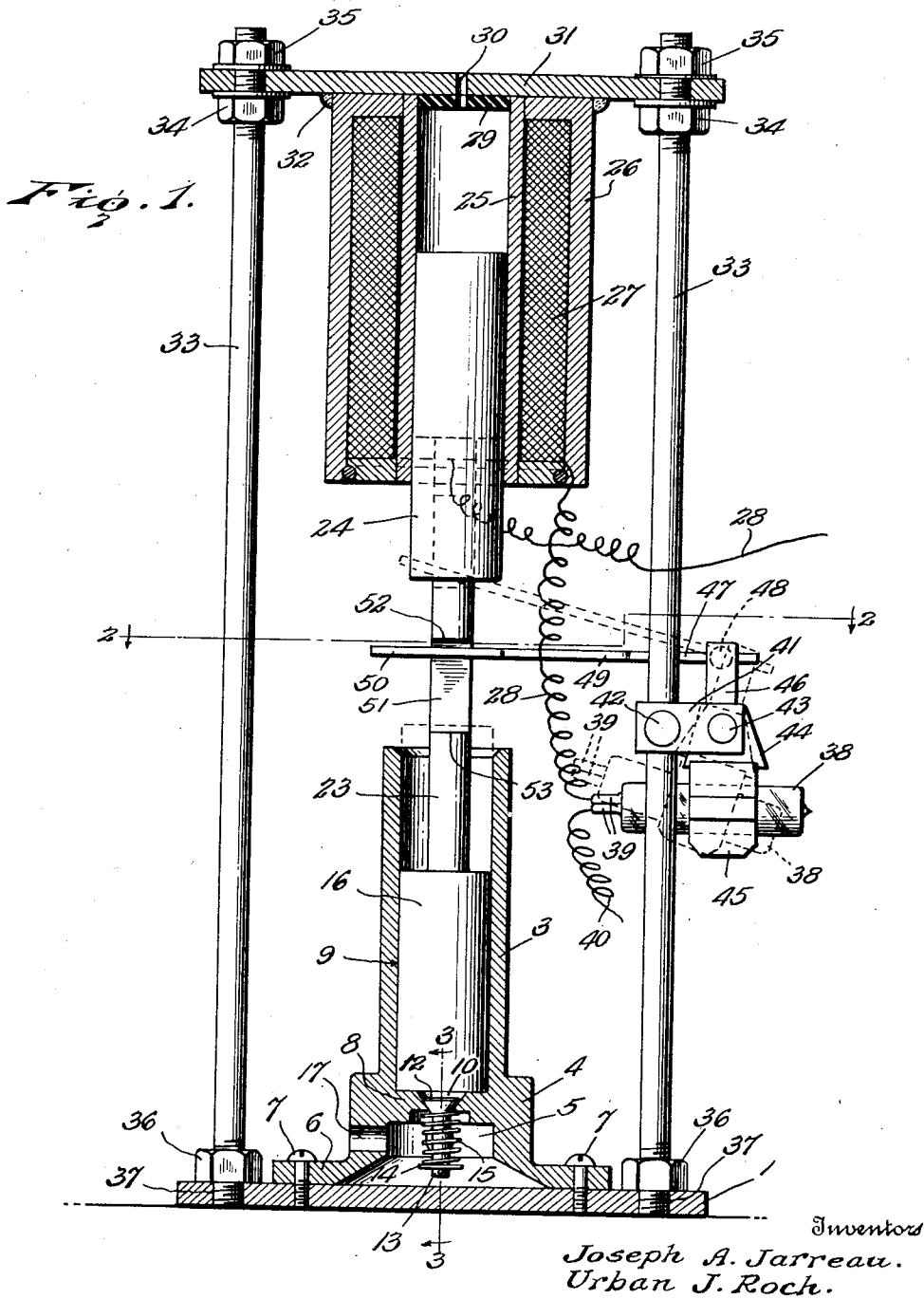
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TIME LIMIT SWITCH

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2 Sheets-Sheet 1



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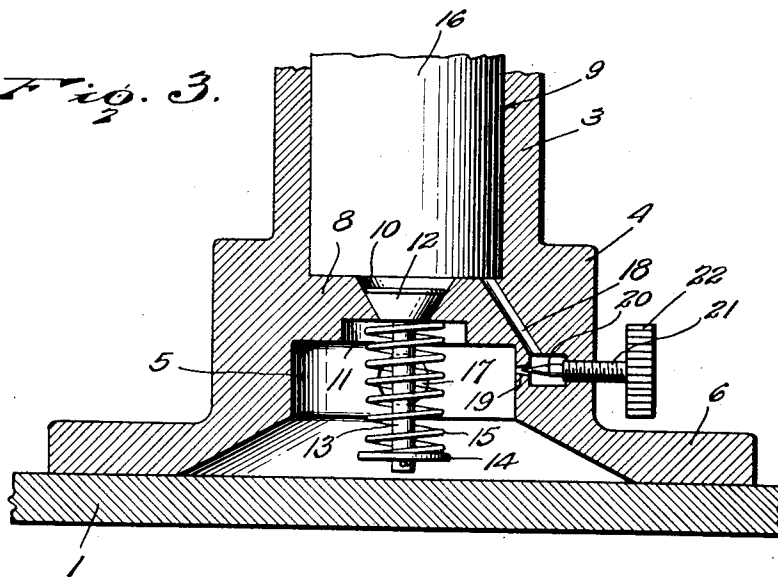
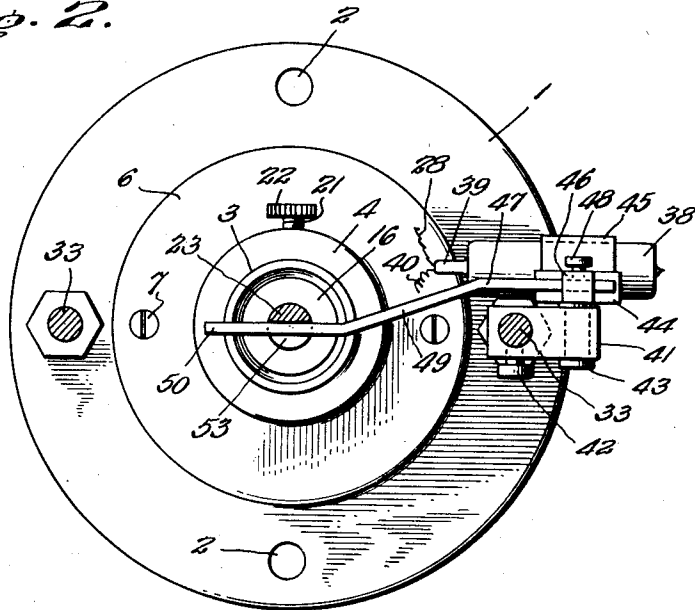
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UNITED STATES PATENT OFFICE

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TIME LIMIT SWITCH

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1 Claim. (Cl. 200—97)

This invention relates to a switch for use in an electric circuit for controlling the length of time the circuit will remain in a closed condition, and one object of the invention is to provide a switch so constructed that, when the circuit is closed by another switch not shown, an apparatus actuated by electricity may be shut off after a predetermined length of time.

Another object of the invention is to provide a time-controlled switch including a plunger working in a dash-pot and moved to open a mercury switch when a solenoid coil is energized by initial closing of the apparatus circuit, means being provided for controlling the length of time it takes for the plunger to return to its initial lowered position in the dash-pot and re-close the mercury switch.

Another object of the invention is to provide the dash-pot with improved valve means for allowing air to quickly enter as the plunger moves upwardly and regulate flow of air out of the dash-pot as the plunger moves downwardly and thus regulate the length of time required for downward movement of the plunger.

Another object of the invention is to provide a device of this character wherein the dash-pot is mounted upon a base directly under a solenoid coil supported in axial alinement with the dash-pot by standards rising from the base and one of which carries the mercury switch. It will thus be seen that a compact structure has been provided which can be easily set in place and lead wires of the solenoid coil cut into the circuit for the apparatus to be controlled.

It is another object of the invention to provide a device of this character wherein the mercury switch may be adjusted vertically upon the standards carrying the same and thus dispose an operating arm of the switch to be disposed in proper cooperating relation to shoulders formed upon the shank of the plunger.

The invention is illustrated in the accompanying drawings, wherein.

Figure 1 is a view showing the improved time limit switch partially in vertical section and partially in elevation,

Figure 2 is a sectional view taken along the line 2—2 of Figure 1, and

Figure 3 is a sectional view upon an enlarged scale taken along the line 3—3 of Figure 1.

The base 1 of this improved time limit switch is formed of metal and may be formed with openings 2 to receive securing screws or bolts or secured upon a support in any other desired manner. A dash-pot 3 is disposed centrally of the

base and is formed with an enlarged lower portion 4 defining a pocket 5 when the collar 6 at the bottom of the enlarged lower portion is secured upon the base by machine screws 7. A partition 8 divides the chamber 5 from the cylindrical chamber 9 of the dash-pot and through this partition is formed a centrally located downwardly tapered valve seat 10, the lower ends of which communicate with a recess or spring seat 11 formed in the under face of the partition. An upwardly opening valve 12 controls flow of air from the chamber 5 into the lower portion of the cylindrical chamber 9 of the dash-pot, and this valve is provided with a stem 13 which extends downwardly into the chamber 5 and at its lower end carries an abutment disk or washer 14 for engagement by the lower end of a helical spring 15 which surrounds the valve stem 13 and has its upper end seated in the recess or spring seat 11. The spring yieldably holds the valve in the closed position, shown in Figures 1 and 3, but when suction is created in the lower portion of the chamber 9 of the dash-pot by upward movement of the plunger 16, the valve 12 will be drawn upwardly off the valve seat and air which enters the chamber 5 through the inlet port 17 thereof may flow quickly into the dash-pot under the plunger. As soon as upward movement of the plunger ceases, the spring will close the valve and the air in the lower portion of the dash-pot can then only escape through the reduced outlet port 18. The port 18 is of small diameter compared to the inlet port 17 and the passage through the partition 8, and at its lower end this outlet passage or exhaust port communicates with the chamber 5, as shown at 19, where it is formed with a valve seat to receive the tapered end 20 of a needle valve 21. This needle valve 21 is threaded through the thickened lower portion 4 of the dash-pot and at its outer end carries a turning head 22 so that it can be easily turned to move the needle valve toward or away from the valve seat 19 and thus control the speed at which air may flow through the discharge port 18. It will thus be seen that the speed at which the plunger 16 moves downwardly can be regulated.

The plunger 16 which is slidable vertically in the cylindrical chamber of the dash-pot is of less length than the depth of the chamber in which it operates and at its upper end carries a shank 23. This shank 23 is of sufficient length to project well above the upper end of the dash-pot when the plunger is in the lowered position, shown in Figure 1, and at its upper end carries a cylindrical head 24 of greater length than

the plunger. The head 24 is slidably received in the tubular spool or sleeve 25 of the solenoid 26 and constitutes a core for the solenoid. This core or piston 24 will be drawn upwardly when the coil 27 of the solenoid is energized by electric current flowing through the coil and its lead wires 28 and as the piston is drawn upwardly the plunger 16 will be drawn upwardly in the dash-pot to the position indicated by dotted lines in Figure 1. A cushioning disk 29 of rubber or equivalent material is provided for engagement by the upper end of the piston to absorb shock as the piston is drawn upwardly, and in order to permit air to enter or leave the chamber in which the piston operates, there has been provided an air port 30. It will thus be seen that formation of a vacuum or an air cushion in the upper end of the chamber in which the piston operates will be prevented and free movement of the piston will not be interfered with. At its upper end the solenoid is brazed or otherwise secured to a head plate 31, as shown at 32, and this head plate is formed with openings near its margin to receive the threaded upper end portions of standards 33. The standards are formed of strong metal rods or tubing may be used if so desired and the threaded upper end portions of the standards carry nuts 34 and 35 serving to firmly grip the portions of the head plate through which the threaded upper ends of the standards pass. The lower end portions of the standards are also threaded and carry nuts 36 so that, when the threaded lower ends of the standards are screwed into the openings 37 formed in the base 1, the nuts may be tightened to firmly hold the standards in place.

The mercury switch 38 is of the usual tubular formation and preferably formed of glass so that it can be seen whether or not mercury in the tube is caused to have the proper movement longitudinally of the tube into and out of bridging engagement with the contacts 39 at the rear or inner end of the tube. One of these contacts has one of the lead wires 28 connected with it and to the other contact is secured the lead wire 40, and from an inspection of Figure 1, it will be readily appreciated that, when the switch 38 is in the substantially horizontal position shown in full lines, a circuit through the solenoid coil 27 may be closed, whereas, when the tube is tilted to the position indicated by dotted lines in this figure, the mercury will move longitudinally of the tube out of bridging engagement with the contact 39 and the circuit through the solenoid coil will be broken.

In order to mount the mercury tube, there has been provided a bracket 41 formed adjacent one end with an opening through which one of the standards 33 passes and a set screw 42 has been provided to grip the standards and secure the brackets in a vertically and circumferentially adjusted position thereon. Adjacent the outer end of the brackets, there has been formed a horizontally extending passage which rotatably receives a pin or shaft 43. This shaft 43 is formed with a head at one end, as shown in Figure 2, and its other end portion passes through the clamp 44, the jaws 45 of which engage about and grip the mercury tube. It will thus be seen that the mercury tube will be mounted for swinging movement about the shaft or pin 43 from a substantially horizontal position to a tilted position, as shown by full lines and dotted lines in Figure 1. At its upper end the clamp is formed with a shank 46 bored transversely to receive

one end of the actuating arm or lever 47, a set screw 48 being provided to firmly hold the arm or lever in connection with the shank of the clamp. This arm or lever extends inwardly of the apparatus from the shank of the clamp at one side of the standard carrying the bracket 41 and has its intermediate portion 49 bent diagonally so that its end portion 50 will be disposed diametrically of the shank 23. This free end portion 50 of the lever extends through a recess 51 formed intermediate the length of the shank 23 between upper and lower shoulders 52 and 53, and from an inspection of Figures 1 and 2, it will be readily appreciated that during movement of the shank the shoulders 52 and 53 will be alternately moved into engagement with the free end portion of the arm or lever and the lever moved to swing the clamp about its pivotal mounting to dispose the mercury tube in either the horizontal or the inclined position.

When this improved time limit switch is in use, the base 1 is secured upon a suitable support and the lead wires 28 and 40 connected in the circuit controlling an apparatus which it is desired to have operate for a predetermined length of time and may be of the coin-controlled type. In its normal condition the plunger 16 of the time limit switch is at the bottom of the dash-pot and the mercury switch is in the substantially horizontal position with the mercury bridging the contact 39. When a switch constituting an element of the main circuit for the apparatus to be controlled is closed by the insertion of a coin or in any other desired manner, a circuit will be completed through the coil 27 of the solenoid and the core or piston 24 will be drawn upwardly and carry with it the shank 23 and the plunger 16. Air is drawn into the cylindrical chamber 9 of the dash-pot under the plunger as the plunger moves upwardly and as the plunger approaches the limit of its upward movement, the shoulder 53 will engage the free end portion 50 of the arm or lever 47 and swing this lever upwardly to tilt the mercury switch to the inclined position, indicated by dotted lines in Figure 1. Therefore, the mercury will flow towards the lower end of the tube out of bridging engagement with the contacts 39 and the circuit through the solenoid coil will be broken. When this occurs, the core 24 and the plunger may then move downwardly. Downward movement will be yieldably resisted by air trapped in the lower portion of the dash-pot and this air will be gradually forced through the discharge port 18. By setting the needle valve 21 the speed at which the air may flow through the discharge port can be controlled and thus the length of time required for the plunger to reach the lower end of the dash-pot regulated. During downward movement, the lever will move through the recess 51 until the plunger and its shank approach the limit of their upward or downward movement at which time the shoulder 52 will engage the lever and restore the mercury switch to the horizontal position. The mercury switch will then again be in the closed position until another coin is inserted when the apparatus can be again started.

Having thus described the invention, what is claimed as new is:

A device of the character described comprising a base, standards rising from the base, a dash-pot upon said base, a solenoid supported by said standards over said dash-pot, a plunger operating in said dash-pot, a core for said solenoid, a shank connecting the core and plunger and pro-

5 vided with abutments spaced longitudinally of the shank, a bracket carried by one standard and adjustable longitudinally and circumferentially thereon, a mounting pivoted to said bracket with its upper portion extending above the bracket, clamping jaws carried by said mounting below the bracket, a horizontal mercury switch carried by said jaws, and a rod carried by the upper portion of said mounting and extending laterally there-

from transversely across the shank between the abutments for alternate engagement by the abutments during longitudinal movement of the shank in opposite directions whereby the switch may be alternately opened and closed as the shank approaches limits of its longitudinal movement. 5

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