March 5, 1929. C. M. OSTERHELD 1,704,627

AUTOMATIC SWITCH OPERATING MECHANISM

Filed May 11. 1922

Fig. 1.

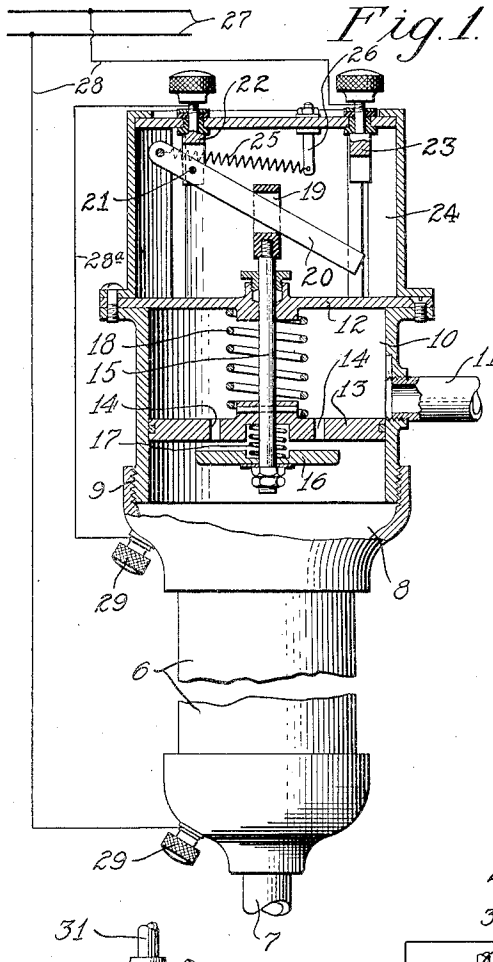
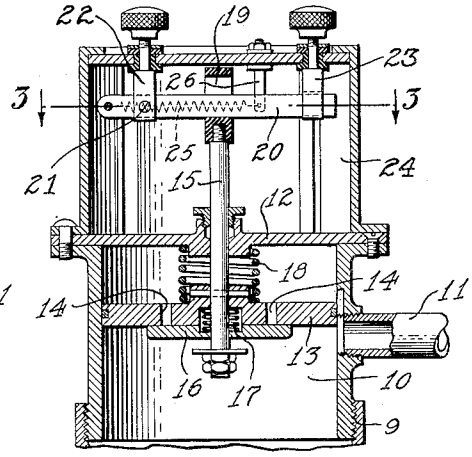


Fig. 2.



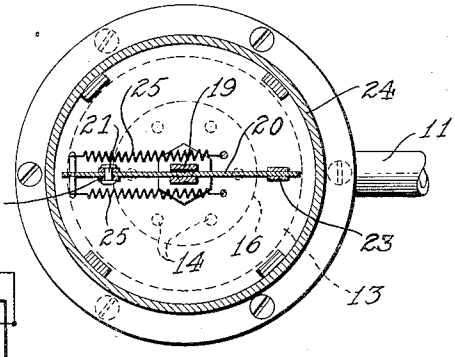


Fig. 3.

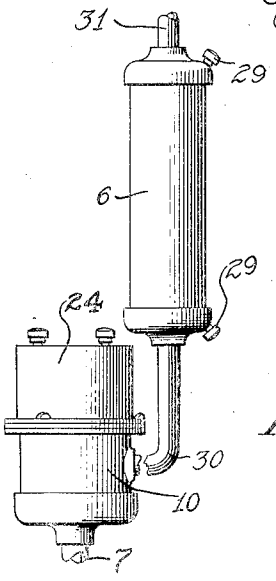


Fig. 4.

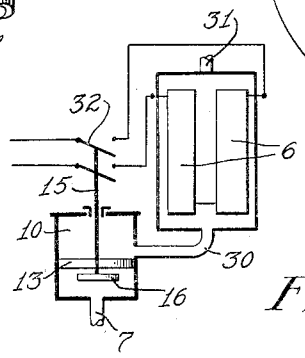


Fig. 5.

Inventor:-

Clark M. Osterheld.

By Emery, Booth, Janney & Varney

his Attorneys.

Patented Mar. 5, 1929. 1,704,627

UNITED STATES PATENT OFFICE.

CLARK M. OSTERHELD, OF STOUGHTON, WISCONSIN.

AUTOMATIC SWITCH-OPERATING MECHANISM.

Application filed May 11, 1922. Serial No. 560,181.

My invention aims to provide an improved electric switch operating mechanism, particularly adapted for automatically closing and opening the circuit of an electric water heater.

In the accompanying drawings, wherein I have shown one embodiment of my invention for purpose of illustration,

Fig. 1 is a longitudinal sectional view of a switch operating mechanism constructed in accordance with the principles of my invention, said mechanism being mounted upon an electric heater, and the switch being shown in circuit opening position;

Fig. 2 is a similar view of the switch operating mechanism showing the positions of the parts when the switch closes the circuit;

Fig. 3 is a horizontal section on the line 3—3 of Fig. 2;

Fig. 4 is an elevation of a modified arrangement of the parts;

Fig. 5 is a diagrammatic view showing the arrangement for a 220 v. circuit.

In the particular embodiment of my invention selected for illustration herein and shown in the accompanying drawings, referring particularly to Figs. 1, 4 and 5, there is shown an electric heating element 6 preferably designed to heat water and preferably of the construction of that heater patented by me February 18, 1919, No. 1,294,695. The details of the construction of this heater need not, therefore, be described. A water supply pipe 7 conducts water preferably into the lower end of the heater, as shown, while the upper end of the heater, in the construction of Fig. 1, is enlarged as indicated at 8 and has internal screw threads 9 or equivalent fastening means whereby a cylinder 10 may be detachably joined to the heater at its upper end, or they may be integral.

The cylinder 10 is open to the heater at one end so that heated water rising from the heater may enter said cylinder. An outlet pipe 11 is joined to the cylinder so that after the hot water flows through the cylinder it may be conducted to the point where it is to be used, as, for example, a bath tub or wash tub. The upper end of the cylinder 10 is closed by plate or head 12.

Within the cylinder there is placed an element movable in response to the flow of the water through the heater and the distribution system, said element preferably being in the form of a piston 13 having several water passageways or ports 14 and connected to a rod 15 so that reciprocation of the piston causes like movement of the rod. A valve 16 is provided for the purpose of closing the ports 14 and this valve by preference is slidable on the lower end of rod 15 which projects below the piston 13. A spring 17 is interposed between the valve 16 and the piston so as normally to maintain the valve spaced from the piston, whereby the fluid pressure on both sides of the piston is equalized except when the valve is closed. A strong coil spring 18 surrounds the rod 15 between the piston and the rod 12 of the cylinder, its purpose being to move the piston down the cylinder to a position below the level of the outlet pipe 11 as shown in Fig. 1.

It will be understood that the pipe 11 in the preferable application of the invention leads to a faucet (not shown), while the water supply pipe 7 is joined to a water main. When a faucet is opened the pressure on the upper side of the piston is lessened, and this difference in pressure causes the valve 16 to rise against the resistance of spring 17 and to close the ports 14, whereupon the piston 13 becomes in effect a solid piston. The pressure of the water quickly moves the piston upwardly in the cylinder and compresses the spring 18 as shown in Fig. 2; and as long as the flow of water continues the piston will remain in the indicated position. As soon as the flow of water ceases, however, the spring 17 will open the valve, thus uncovering the ports 14, and the spring 18 will return the piston to the position of Fig. 1. The ports 14 are sufficiently numerous and of sufficient area to permit water rapidly to pass through the piston to the upper side thereof, whereby the piston does not have the sluggish action of a dashpot, but on the contrary, is restored quickly to its initial position.

The piston rod 15 extends through the cylinder head 12 and at its upper end carries a stirrup 19, which may be of insulating material or if of conducting material will be insulated from the piston rod. The stirrup 19 is more or less rectangular in the preferred form and has a loose or lost-motion connection with a switch 20, preferably a knife switch, pivoted as at 21 upon a stationary terminal member 22. The free end

of the switch 20 makes the circuit when it contacts with another stationary terminal member 23. The terminal members 22 and 23 are mounted upon a switch box 24 preferably secured upon the upper end of the cylinder 10; and in the constructions of Figs. 1 and 2, the heater, the switch operating mechanism and the switch mounting together form a unitary enclosed structure. The lost-motion connection between the piston rod and switch is such that the switch does not close the circuit immediately upon the start of the upward movement of the piston 13; but toward the end of the upward stroke of said piston, the switch is forcibly seated upon the contact element 23.

It will be clear also that the stirrup 19 does not act immediately upon the switch 20 to open the circuit when the piston starts downwardly. When the upper end of stirrup 19 does contact with the switch and starts to pull the switch downwardly with it, it is highly desirable to provide independently acting means whereby the switch is opened with a snap so that destructive arcing at the switch is prevented. In Figs. 1, 2 and 3 a pair of coil springs 25 are shown joined at one end to the switch box 24 by any convenient means, as for example, by a stud or bolt 26 and connected at the other ends to the switch 20. The coil springs 25 are put under considerable tension when the switch closes the circuit, as seen in Fig. 2, but have no tendency to open the switch until the switch is moved toward the open position. As soon as the stirrup moves the free end of the switch downwardly, though before said free end gets out of contact with member 23, the springs 25 act to open the switch rapidly or with a snap so that there is no possibility of destructive arcing which might be occasioned by the relatively slow downward movement of the piston.

In Fig. 1 a 110 v. circuit is shown including the mains 27 from which wires 28 lead to the heater. One of these lead wires is connected to one of the binding posts 29 on the heater element, while the other lead wire is connected to the contact element 23. A wire 28^a or other suitable connection joins the contact element 22 to the other binding post 29 of the heating element. The circuit is open between the two binding posts 29 except when the switch 20 is in the position of Fig. 2.

In Fig. 4 there is shown an alternative arrangement of a heater and switch operating mechanism wherein the water passes first through the cylinder and afterwards enters the heater, the outlet pipe 30 of the cylinder being joined with the bottom of the heater. The hot water is conducted out from the heater through pipe 31. It will be noted that the switch operating mechanism and the switch itself may be located a considerable distance from the heater, for instance, on the other side of the room, or in a wall.

Fig. 5 illustrates diagrammatically an arrangement of the parts for a 220 v. circuit. The apparatus differs from the ones described above only in that two heating elements 6 are employed preferably in series with each other; and a double pole switch 32 closes the circuit. Several of the heating elements may be used in conjunction with my invention where three phase current is available.

Among the advantages of the invention as typified by the illustrative embodiments shown in the drawing are that the piston is sensitive in its action and responds practically instantaneously to any substantial flow of water through the distribution system. In many devices of this character, the construction is such that it is necessary to open the faucet to the fullest extent before the switch which controls the heating circuit is closed. My invention provides means whereby a small stream of hot water may be drawn off from a faucet as readily as a heavy stream of water. The switch breaks the circuit quickly to prevent destructive arcing.

While I have shown a preferred construction for the purpose of illustrating the invention, it will be understood that many changes involving alteration, omission, reversal, and substitution of parts may be made without departing from my invention.

Having described practicable apparatus made in accordance with my invention without limiting myself thereto, what I claim as my invention and wish to secure by Letters Patent is:—

1. In an automatic switch operating mechanism, the combination of a switch controlling the circuit of a heating element, a cylinder through which a fluid is free to flow, a piston reciprocable in said cylinder, a passageway for the fluid in said piston, a valve for closing said passageway when the fluid flows through, means whereby the valve normally remains open, means to move the piston in a direction opposite to that in which it is moved by the fluid flow, and connections between the switch and the piston whereby the switch opens the circuit in the normal position of the piston but closes the circuit when the flow of the fluid starts.

2. In an automatic switch operating mechanism, the combinations of a cylinder, a piston in the cylinder, a fluid port in the piston, a valve for said port which is normally open, a switch for the electric heating circuit, and a lost-motion connection between the switch and the piston, whereby the switch is opened and closed by the piston only after the movement of the piston is well under way.

3. In an automatic switch-operating mechanism, the combination of a switch controlling the circuit of an electric water heater, a cylinder, water pipes leading to and from said cylinder, a valved piston reciprocable in the cylinder, yieldable means for moving the piston toward the inlet side of the cylinder, means for maintaining the valve of the piston normally open, a connection between the piston and switch whereby movement of the piston toward the outlet of the cylinder closes the circuit, and independently acting means causing a quick break of the circuit when the piston moves under the influence of said yieldable means toward the cylinder inlet.

4. In an automatic switch-operating mechanism, the combination of a switch controlling the circuit of an electric water heater, a cylinder, water pipes leading to and from said cylinder, a valved piston reciprocable in the cylinder, yieldable means for moving the piston toward the inlet side of the cylinder, a lost-motion connection between the piston and the switch whereby movement of the piston toward the outlet of the cylinder closes the circuit, and springs connected to the switch and acting independently of the yieldable piston moving means for causing a quick break of the circuit when the piston moves under the influence of said yieldable means toward the cylinder inlet.

5. In an automatic switch operating mechanism, in combination, a switch controlling the circuit of a heater, and means responsive to the flow of water through said heater for closing said circuit comprising a piston, means connecting the piston and the switch, a water passageway through said piston whereby the fluid pressure of both sides of said piston is normally the same, a valve for closing said passageway, a spring for holding said valve normally open whereby reduction in fluid pressure on the side of the piston opposite to that upon which the valve is mounted causes said valve to close said passageway in opposition to said valve spring so that the piston then acts as a solid piston and moves to close said switch and hold the same closed until the flow of the water ceases.

6. An automatic switch operating mechanism comprising, in combination, a switch for controlling the circuit of a heater; a piston 13 reciprocable in a cylinder 10; a lost-motion mechanism 15, 19 directly connecting the piston to the switch; a port 14 in the piston; a valve 16 to close the port when the fluid pressure on one side of the piston exceeds the fluid pressure on the other side of the piston; and a spring 17 normally unseating the valve.

7. In an automatic switch operating mechanism, in combination, a switch controlling the circuit of a heater, a piston 13 reciprocable in a cylinder 10, a port 14 in the piston, a valve 16 to close the port when the fluid pressure on the valve side of the piston becomes greater than the fluid pressure on the other side of the piston, a spring 17 normally unseating the valve, lost-motion connecting means 15, 19 between the piston and switch, and means 25 connected to the switch for causing a quick break of the circuit when the piston moves toward circuit opening position.

8. In an automatic switch-operating mechanism, in combination, a switch controlling the circuit of an electric water heater, and means for opening and closing the switch in response to flow of water, comprising a cylinder, a water inlet and an outlet for said cylinder, a piston reciprocable in the cylinder between said inlet and outlet, a water passageway in the piston, a valve for the passageway, a spring for normally holding the valve unseated, another spring in the cylinder for moving the piston and switch, whereby any flow of water through the system will cause the piston valve to close and the piston to move toward the outlet to complete the circuit, while conditions of no water flow will permit the valve to open whereby the piston will be restored to its position of rest by the spring in the cylinder.

9. In an automatic switch operating mechanism for the circuits of electric water heaters, in combination, a cylinder forming a part of a water distribution system, a piston reciprocable in substantially the cylinder, means whereby upon any flow of water through the system the piston acting as a solid wall to obstruct said flow will be moved by water pressure to a position where free continuous flow of the water is permitted, means whereby the water is permitted to pass through the piston when said flow ceases, means for restoring the piston rapidly to its initial position, and connections between the piston and a circuit-controlling element whereby the heater current is active only during the flow of water through the system.

10. An automatic switch operating mechanism for electric fluid heating apparatus, comprising in combination a switch controlling the circuit of a heating element, a cylinder in which the fluid may circulate, a switch operating piston reciprocable in said cylinder and responsive to the movement of fluid therein, and means other than the fluid to move said piston in one direction, said piston having a passage therethrough, and a normally open valve controlling said passage.

11. An automatic switch operating mechanism for electrical fluid heating apparatus comprising, in combination, a switch for controlling the circuit of an electric heater; means movable responsive to the flow of

fluid; and a lost-motion connection between said movable means and said switch so constructed and arranged that movement of said means responsive to stoppage of flow of the fluid causes a delayed break of the switch, the delay in the break preventing opening of the circuit responsive to minor fluctuations in fluid pressure.

12. An automatic switch operating mechanism for electric fluid heating apparatus, comprising in combination, a switch for controlling the circuit of a heating element; means displaceable by flow of the fluid; a lost-motion mechanism connecting the switch with said displaceable means; and a spring connected to the switch; the parts being so constructed and arranged that the action of said displaceable means in opening the switch is delayed due to the lost-motion mechanism aforesaid, the spring then causing a very quick break at the switch contacts to prevent destructive arcing.

In testimony whereof, I have signed my name to this specification.

CLARK M. OSTERHELD.