A. T. ZIEGLER.

THERMOSTAT.

APPLICATION FILED SEPT. 24, 1907.

906,357. Patented Dec. 8, 1908.

3 SHEETS—SHEET 1.

Fig. 1.

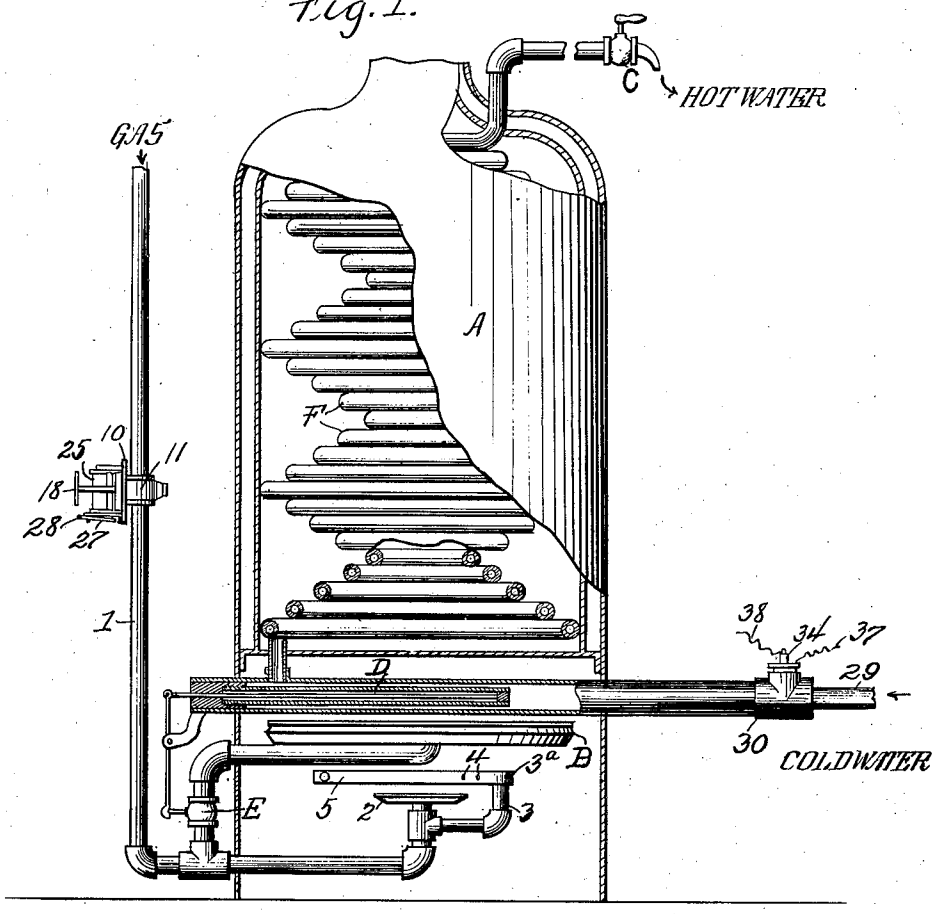
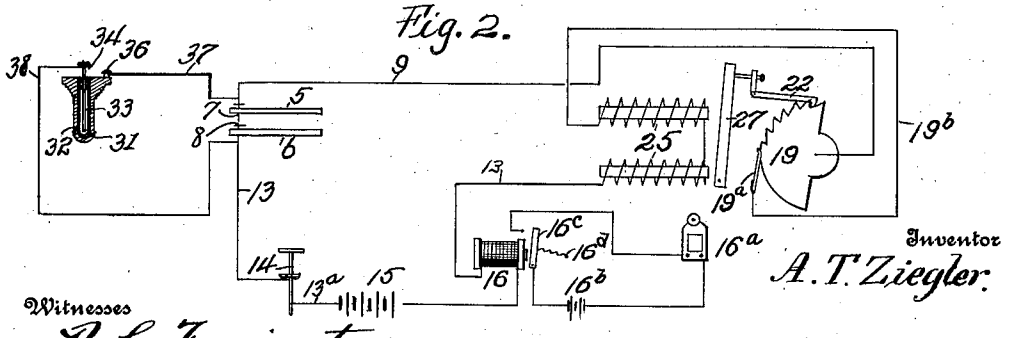


Fig. 2.



Witnesses

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3 SHEETS—SHEET 2.

Fig. 5.

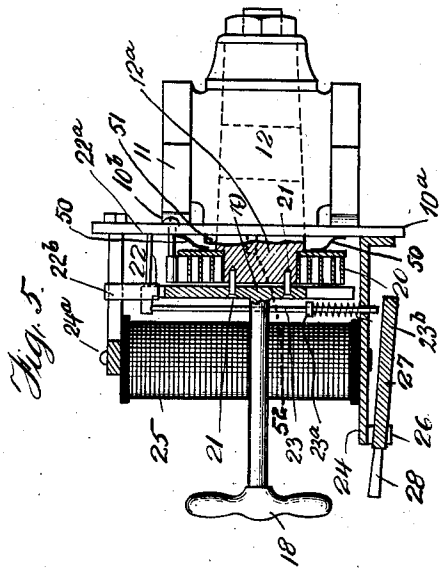


Fig. 6.

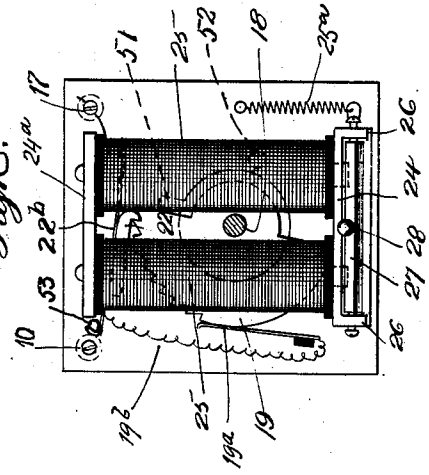


Fig. 3.

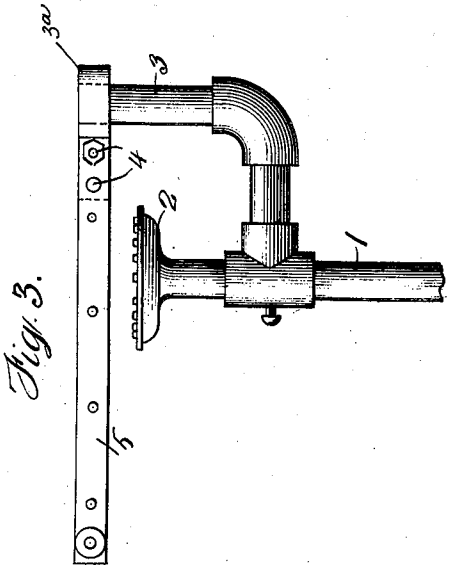
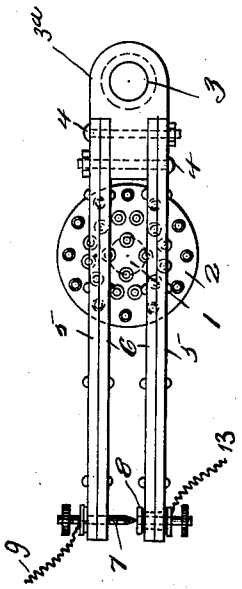


Fig. 4.



Witnesses

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3 SHEETS—SHEET 3.

Fig. 7.

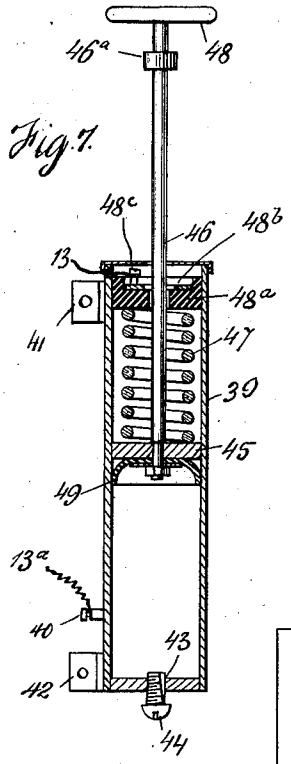


Fig. 8.

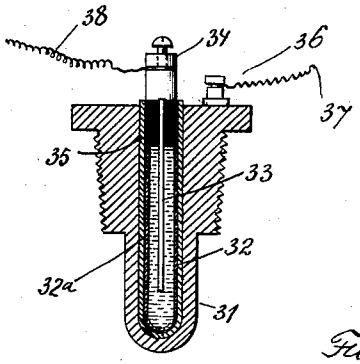


Fig. 9.

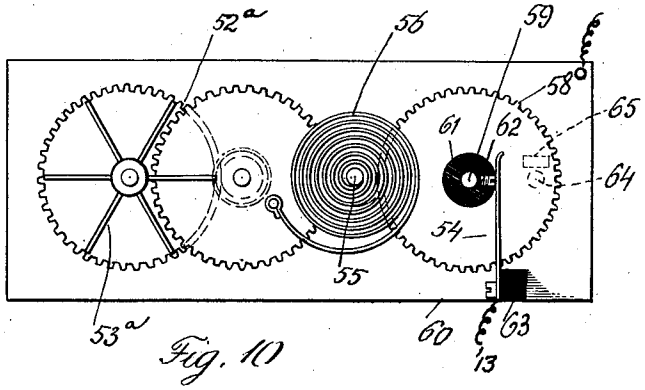
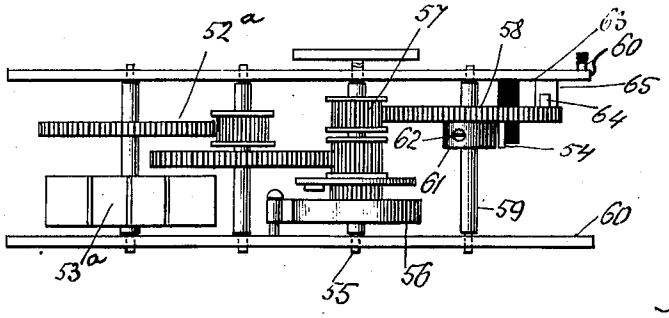


Fig. 10



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UNITED STATES PATENT OFFICE.

ALFRED T. ZIEGLER, OF ALLEGHENY, PENNSYLVANIA.

THERMOSTAT.

No. 906,357. Specification of Letters Patent. Patented Dec. 8, 1908.

Application filed September 24, 1907. Serial No. 394,367.

To all whom it may concern:

Be it known that I, ALFRED T. ZIEGLER, a citizen of the United States of America, residing at Allegheny, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Thermostats, of which the following is a specification, reference being had therein to the accompanying drawing.

This invention relates to thermostats, and the invention has for one of its objects to provide simple and efficient means for automatically controlling the gas supply for that type of water heaters generally known and designated in the trade as instantaneous heaters.

My invention aims to combine novel devices for automatically controlling a gas valve, the principal device being a thermostat, the operation of which is adapted to close an electric circuit and release another device controlling the gas valve.

Another characteristic of the invention is the operation of a safety plug, operating as a thermostat, this safety plug being employed to operate the gas valve, when the flow of hot water is retarded, while the gas of the main burner or burners remains burning, thus causing the water to back up in the cold water supply pipe.

A further object of the invention is to provide a slow-acting switch to hold the gas-valve controlling circuit open for an appreciable time, to permit the thermostatic bars assuming their normal position after they are reheated by the re-lighting of the pilot burner after the gas-valve has been automatically closed.

With these objects in view the invention consists of the mechanism and novel combination of devices hereinafter more fully described and set forth in the appended claims, in connection with the accompanying drawings which form a part of this specification.

In the drawings: Figure 1 is a view partly in side elevation, partly broken away, and partly in section, of an instantaneous water heater with my thermostat applied thereto. Fig. 2 is a diagrammatic view showing the electrical connections, and showing the thermostatic plug of the cold water pipe in section. Fig. 3 is a side elevation of a pilot light burner showing the thermostat bars attached thereto. Fig. 4 is a top plan view thereof. Fig. 5 is a side elevation partly in section of an electrically operated gas controlling valve forming part of the invention, and, Fig. 6 is a front elevation of the same with the shank of the valve handle in section. Fig. 7 is a vertical section on an enlarged scale of one form of slow-moving switch adapted for use with the improvement, the switch being illustrated in its abnormal position, Fig. 8 is a vertical section on an enlarged scale of the thermostatic safety-plug, Fig. 9 is a horizontal sectional view of another form of slow-acting switch, and Fig. 10 is a top plan view of the switch shown in Fig. 9.

In the drawings the reference numeral 1 designates a gas pipe surmounted by a burner 2, providing the pilot flame for an instantaneous water heater A of a well known type. Projecting from the pipe 1 is an angle arm 3 carrying a head 3^a to which are secured by bolts 4 two composite bars, each consisting of an iron plate 5 and a brass plate 6. Each of the composite bars is provided with a contact point designated by the numerals 7 and 8 respectively. The contact 7 is connected by a wire conductor 9 with a binding post 10, carried on a platform 10^a, suitably secured to the valve casing 11 of the valve 12, said valve controlling the gas supply to the pipe 1 and also to the main burner B of the water heater. The other contact 8 of the thermostat is connected by a conductor 13 to a switch 14, hereinafter described, thence to a battery 15, and relay 16 operating in conjunction with a battery 16^b and electric bell 16^a, and to a binding post 17 on the platform 10^a.

The plug or valve 12 of the casing 11 is reduced, as at 12^a and provided with a toothed sector 19, said toothed sector being secured to the reduced end 12^a of the plug or valve 12 by screws 21 or similar fastening means. The toothed sector 19 carries a handle 18, whereby the plug or valve 12 can be manually rotated or manipulated. Flat springs 50 bear upon the sector 19, thus preventing the plug or valve 12 from binding in the casing 11. Surrounding the reduced end 12^a of the valve or plug 12 is a coil band spring 20 having its one end secured to the reduced end 12^a of the plug or valve 12, and its other end secured to a post 10^b carried by the platform 10^a. This spring 20 is employed for automatically rotating the valve or plug 12 in one direction, when the tension of the spring which has been previously wound is released. The plug 12 carries a stop 51 ar-

ranged to engage against pin 52 on the platform 10^a after the plug or valve 12 has made one quarter of a revolution.

Carried by the platform 10^a are brackets 24 and 24^a and between these brackets are arranged two electro-magnets 25. Pivotally secured between lugs 26 depending from the bracket 24 is an armature 27 provided with a handle 28, whereby the armature can be manually manipulated.

Suitably supported in front of the sector 19 behind one of the electro-magnets is a movable rod 23 having one end projecting through an opening in the bracket 24 to be struck by the armature 27. The opposite end of the rod engages the pawl 22 pivotally mounted upon the platform 10^a by a post 22^a. This pawl is normally held in engagement with the teeth of the sector 19 by a spring 22^b attached to post 53 on platform 10^a. To normally hold the rod 23 in engagement with the pawl 22, I provide said rod with a collar 23^a, and interpose a coil spring 23^b between said collar and the bracket 24, said spring encircling said rod. It will of course be understood that this spring is weaker than the spring 22^b, and is principally used to hold the rod 23 in such a position that the protruding end thereof can be struck a sudden and hammer-like blow by the armature. Besides being used for this purpose it relieves the armature 27 of the weight of the rod 23, consequently reducing the work of the armature 27.

The operation of the mechanism as thus far described is as follows: When the flame of the pilot burner 2 is accidentally blown out or extinguished, the temperature of the composite thermostat bars is reduced, causing them to contract, thus bringing the contact points 7 and 8 together, to close an electric circuit through the wire conductors 9 and 13, and the heavy battery 15 to energize the electro-magnets 25. When these magnets are energized the armature 27 is attracted and strikes the protruding end of the rod 23, releasing the pawl 22 from its engagement with the sector 19 and permitting the previously wound spring 20 to partially rotate the valve or plug 12 and shut off the flow of gas to the pilot and main burner. To counterbalance the weight of armature 27, when the valve is mounted in a vertical position, I employ a spring 25^a, (see Fig. 6) the tension of said spring being such as to leave the armature a sufficient distance from the electro-magnets to insure a stroke and blow upon rod 23 when the armature is attracted.

When the plug or valve 12 is operated as above described, the electric circuit is through the relay 16, which attracts the armature 16^c thereof and completes the circuit through the battery 16^b and the bell 16^a, sounding an audible signal. To prevent this bell 16^a from continuously ringing, I immediately break the electric circuit after the valve or plug 12 has been moved. This is accomplished by mounting an insulated contact arm 19^a upon the platform 10^a, said arm engaging the smooth edge of the sector 19. The arm 19^a is connected to one of the electro-magnets by a wire 19^b, and when the spring held sector 19 is released, the circuit is immediately broken, upon the sector 19 traveling out of the path of the arm 19^a, breaking the contact between said arm and said sector. This only permits the audible signal 16^a to sound for a few seconds, the spring 16^d of the armature 16^c of the relay 16 immediately withdrawing said armature when the circuit is broken. If for any reason the plug or valve 12 should fail to operate after contacts 7 and 8 are closed, the audible signal 16^a will be sounded until the sector 19 is rotated manually or the slow-acting switch operated and the pilot burner relighted. Now, to permit of the thermostatic bars assuming their normal position after they are re-heated by the re-lighting of the pilot burner, requires the employment of a slow-acting switch to open the gas-valve circuit. Otherwise, when the sector 19 is returned to its normal position, a circuit can be immediately set up, that would continuously sound the audible signal 16^a and energize the electro-magnets 25. I prevent this by a switch, and have illustrated two forms which will be presently described.

In the distribution of hot water from a water heater, it sometimes occurs that the circulation is retarded while the main burner or burners remain lighted, thus causing the backing up of the water and generation of steam with the liability of causing an explosion or burning up of the pipes. To guard against this, I provide the cold water pipe 29 with a T-coupling 30 within which is a safety plug 31 of novel construction. The safety plug 31 is hollow and is threaded to screw into the coupling 30. It is preferably formed of brass or an alloy and contains a copper tube 32, which is interiorly lined with a soluble insulating material 32^a, as rosin. Centrally disposed within the interiorly lined copper tube 32 is a depending copper rod 33 depending from an insulated binding post 34 arranged in the top of the copper tube 32. The tube is filled with mercury and the plug 31 is provided with a binding post 36, connected by a conductor 37 with the battery circuit wire 9 heretofore referred to. The binding post 34 is connected by a conductor 38 with the battery circuit conductor 13. When the hot water backs up in the supply pipe 29, the soluble insulating lining 32^a of the tube 32 is immediately melted by the hot water, allowing the mercury in the tube 32 to come in contact with the walls of said tube, thus completing an electric circuit through said tube, plug 31, conductor 37 to

the magnets 25, conductor 38 to rod 33, this circuit closing the gas valve 12.

Referring now to the slow-acting switch illustrated in the drawings, reference will first be had to the form shown in Fig. 7. The numeral 39 designates a cylinder provided with a binding post 40 and with perforated lugs 41 and 42 to adapt the cylinder to be attached to a suitable support. The lower end of the cylinder 39 is formed with a threaded opening 43 closed by a screw-plug 44, formed with a longitudinally disposed groove, this plug controlling and regulating the piston 45. Above the piston 45 is a spring 47 which bears against an insulation disk 48^a through which the piston rod 46 extends. Upon this disk is secured a metallic contact ring 48^b having a binding post 48^c to which the conductor 13 is connected, the other battery conductor 13^a being connected to the binding post 40 of the cylinder 39.

Near the upper end of the piston rod 46 is a collar 46^a adapted to contact with the metallic ring 48^b and establish a circuit between the wire conductors 13 and 13^a. When the piston rod 46 is elevated, the spring 47 is placed under tension and upon the rod being released, the spring 47 gradually forces the piston 45 downward, the descent of the piston being regulated by the screw-plug 44. It will thus be observed that the slow-acting switch as described acts functionally as a dash-pot to insure a slow closing of the circuit, thus giving the thermostatic bars sufficient time to expand and assume their normal position before closing the circuit.

In lieu of the switch above described, I can employ a clock-work switch as shown in Figs. 9 and 10. This switch comprises a winding arbor 55 having a conventional form of main spring 56. Upon the winding arbor 55 is a pin wheel 57 meshing with a toothed wheel 58, carried by a shaft 59 journaled in the frame 60 of the switch. The toothed wheel 58 is preferably three times as large as the pin wheel 57, whereby it will require three revolutions of the pin wheel 57 to rotate the wheel 58 one complete revolution. The shaft 59 adjacent to the wheel 58 carries an insulated collar 61 having a screw 62 adapted to engage with the arm 54 carried by the projection 63 of one of the frames 60. The wheel 58 also carries a pin 64 adapted to engage with the arm 65 carried by one of the frames 60. In operation, the winding arbor 55 is rotated until the pin 64 engages the arm 65, this movement of the winding arbor placing the spring 56 under tension, and moving the screw 62 out of contact with the arm 54. Immediately upon the winding arbor 55 being released, the wheel 58 makes a complete revolution, the pin 64 engaging the opposite side of the arm 65, and the screw 62 making contact with the arm 54.

To gradually retard the movement of the winding arbor 55 I use a number of gears 52^a for operating a fan wheel 53^a. This clock movement switch is electrically connected to the battery circuit and is adapted to serve the same function as the switch illustrated in Fig. 7 of the drawings, that is, to keep the circuit open until the thermostatic bars have assumed their normal position after the pilot burner is re-lighted.

The type of instantaneous heater to which I have shown the device attached is of a well known form in which the opening of the hot water faucet C causes the inflow of cold water to act on the thermostat D and open the gas controlling valve E so as to admit gas to the burner B where it is ignited by the pilot light flame to heat the water in the water heating coils F in a manner well known in the art.

Having now described my invention, what I claim as new, is:—

1. The combination with a water heater supply pipe, and a gas valve, of a safety plug extending into said pipe, a copper tube within said plug having a lining of soluble material and containing mercury, a rod mounted in the tube and extending into the mercury therein, and electrical connections between said plug and rod and said valve.

2. The combination with a water heater supply pipe provided with a coupling, of a safety plug fitting in said coupling, a copper tube within said plug and having an interior lining of rosin or like soluble material, and containing mercury, a binding post carried by said tube, a copper rod suspended from said binding post, and electrical connections between said binding post and said plug valve.

3. In combination with a water heater having a cold water inlet pipe, a gas burner for the heater, a gas supply pipe for said burner, and a pilot light burner connected with said gas supply pipe, of a thermostat supported above said pilot light burner, a safety plug disposed in the cold water inlet pipe, an electrically operated controlling valve disposed in said gas supply pipe, and electrical connections between said gas controlling valve, and said thermostat, substantially as described.

4. In combination with a hot water heater having a cold water inlet pipe, a gas burner for said heater, a gas supply pipe connected with said burner, and a pilot light burner connected to said gas supply pipe, of a thermostat supported in close proximity to the pilot light burner, a safety plug disposed in the cold water inward pipe, electrical connections between the plug and thermostat, an electrically operated valve disposed in the gas supply pipe, and electrical connections between said valve and said thermostat, substantially as described.

5. In combination with a hot water heater

having a cold water inlet pipe, a burner for said heater, a gas supply pipe for said burner and a pilot light burner connected with said gas supply pipe, of a thermostat supported in close proximity to said pilot light burner, an electrically actuated valve in the gas supply pipe, electrical connections between the thermostat and said valve, and means for cushioning the movement of said valve when the same is electrically actuated.

6. In combination with a water heater having a cold water inlet pipe, a gas burner for said heater, a gas supply pipe for said burner and a pilot light burner connected to said gas supply pipe, of a thermostat supported in close proximity to the pilot light burner, a safety tube disposed in the cold water inlet pipe, electrical connections between said safety tube and said thermostat, an electrically actuated valve disposed in the gas supply pipe, electrical connections between said thermostat and said valve, and means for cushioning the movement of the valve when electrically actuated.

In testimony whereof I affix my signature in the presence of two witnesses.

ALFRED T. ZIEGLER.

Witnesses:

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MAX H. SROLOVITZ.