H. H. FOGWELL AND J. M. MORRIS.

THERMOSTAT.

APPLICATION FILED NOV. 15, 1917.

1,398,635.

Patented Nov. 29, 1921.

Fig 2

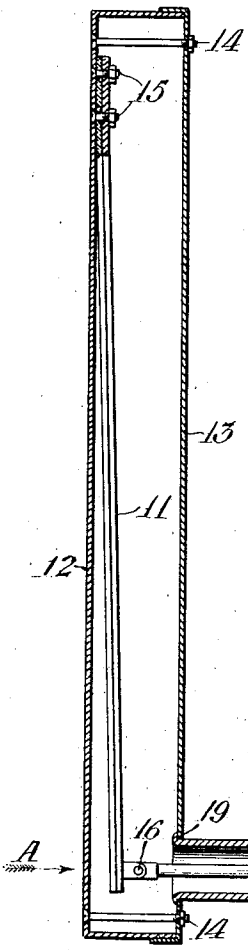


Fig 1

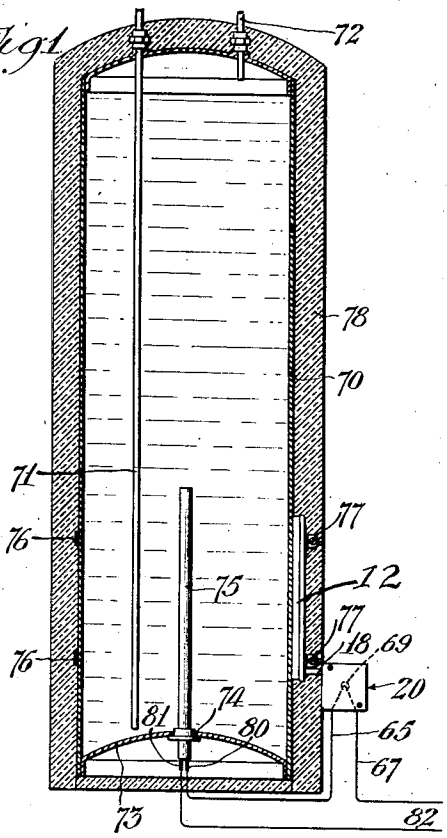
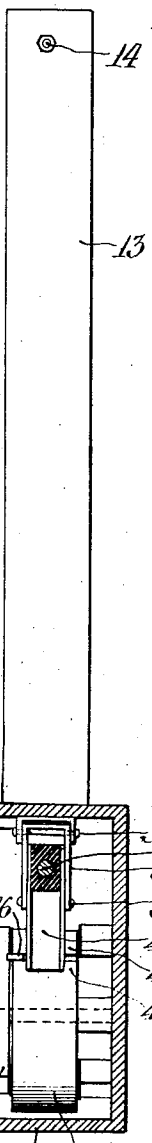


Fig. 3.



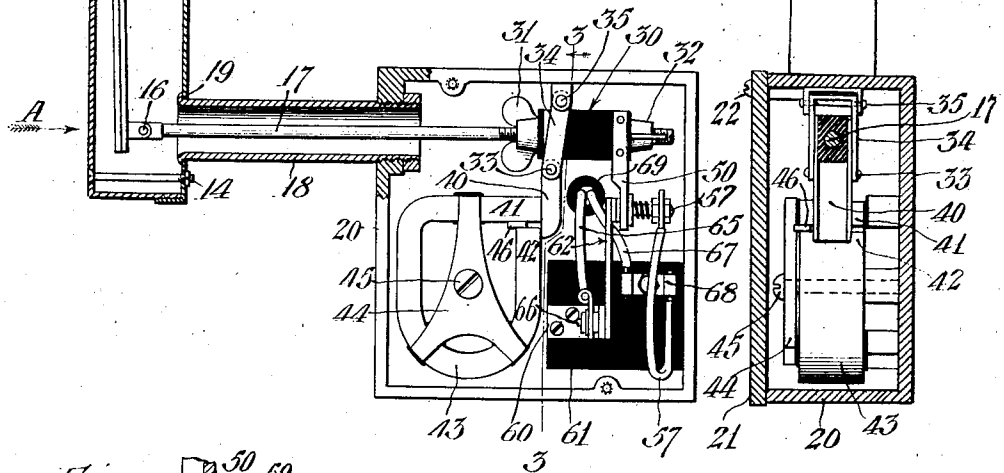
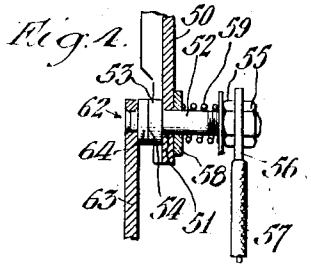


Fig. 4.



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UNITED STATES PATENT OFFICE.

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THERMOSTAT.

1,398,635. Specification of Letters Patent. Patented Nov. 29, 1921.

Application filed November 15, 1917. Serial No. 202,238.

To all whom it may concern:

Be it known that we, HARRISON H. FOGWELL and JOHN M. MORRIS, both citizens of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented a new and useful Thermostat, of which the following is a specification.

Our invention relates to the temperature control of electric currents, and more particularly to a novel form of thermostat by means of which an electric circuit is opened or closed as the temperature of the thermostatic element is varied.

The principal object of the invention is to provide a novel form of thermostat which is particularly adapted for use in applying electric heaters to conventional designs of hot water tanks.

The invention consists in the construction and novel combination and arrangement of parts hereinafter described as illustrated in the accompanying drawings, and pointed out in the claims hereunto appended.

In these drawings,

Figure 1 is a sectional elevation showing our invention applied to a standard hot water tank.

Fig. 2 is a central section on an enlarged scale through the thermostatic device.

Fig. 3 is a section on a bent plane represented by the line 3—3 of Fig. 2.

Fig. 4 is a view on an enlarged scale of the moving contact.

The thermostat consists of a thermostatic element 11 which is inclosed in a case 12 having a cover 13 held in place by screws and nuts 14. The thermostatic element 11 consists of two strips of dissimilar materials which have different co-efficients of expansion. The thermostatic element 11 is secured inside the case 12 near the upper end thereof by means of bolts 15, the lower end of the thermostatic element 11 carrying a small pin 16 to which a thermostatic rod 17 is pivoted. The thermostatic rod 17 passes through a tube 18 which is rigidly secured at 19 in the cover 13, the tube 18 being also threaded or otherwise secured in a switch case 20. This switch case 20 is formed of cast iron and is provided with a cover 21 secured in place by screws 22. The thermostatic rod 17 passes through an insulating block 30 being secured therein by means of thumb nuts 31 and 32. The block 30 is provided with a pin 33 to which are pivoted a pair of links 34, one on either side of the block 30, these links being in turn pivoted on a pin 35 carried in the case 20. Secured on the block 30 and carrying the pin 33 is a keeper 40 formed of sheet iron, this keeper being so placed that it makes contact with the poles 41 and 42 on a permanent magnet 43. The magnet 43 is held inside the case 20 by a cast iron bracket 44 and a screw 45. A magnet shunt 46 is secured between the pole pieces 41 and 42 for reasons which will hereinafter be explained.

Carried on the insulating block 30 is a metal member 50 having a hole 51 therein. Fitting loosely in the hole 51 is a screw having a body 52 and a head 53, the head 53 being flat to provide a contact surface 54. Secured between two nuts 55 at the other end of the screw 52 is a connector 56 to which a flexible lead 57 is soldered. A washer 58 and compression spring 59 tend to hold the screw 52 at right angles to the plate 50 at all times.

Secured on a bracket 60, carried on an insulating slab 61, is a stationary flexible contact 62, this contact consisting of a flat strip 63 with a contact 64 carried at its extreme outer end. A lead 65 is connected by means of a screw 66 on one end of the strip 62, and a lead 67 is connected to a connector 68 carried on the slab 61, the lead 57 being also secured to the connector 68. The leads 65 and 67 pass through an insulating bushing 69 fixed in the side of the case 20.

While the above described thermostat has various uses, it is particularly useful in the installation of electrical heating devices to existing forms of hot water tanks. Such a tank is shown at 70 in Fig. 1 and is ordinarily provided with a cold water inlet pipe 71 and a hot water outlet pipe 72. Such tanks are ordinarily provided with a bottom 73 and this bottom is ordinarily provided with a central outlet 74 through which an electric heating element 75 may be conveniently inserted. The case 12 of the thermostat is then secured to the side of the tank 70 preferably by means of metal straps 76 which pass around the heater and are clamped in place by means of screws 77. A body of heat insulating material or lagging 78 may then be placed around the entire exterior of the heater completely covering the thermostat case 12, the tube 18 being of sufficient length to pass through such a lagging placing the case 20 entirely outside the lag-

ging. The wire 65 is then attached to one terminal 80 of the electric heater 75, the other terminal 81 being connected with a wire 82 with any convenient source of electric current, the wire 67 being connected to the same source.

In the application of electricity to the heating of water for domestic purposes, it is found that the demand for hot water occurs during the early evening hours, at which time the peak load of the central stations is ordinarily at its maximum. For the purpose of so regulating the heating of water in the tank 70 as to make it an attractive commercial proposition to the central stations furnishing the current so that they can make a low flat rate for such heating, it is necessary to so arrange the heater that the heating element 75 will not be in circuit ordinarily during the evening peak load period of the central stations. For this purpose we secure the thermostatic element 11 to the exterior of the tank 70 at a distance approximately one-third of the way up from the bottom. When so secured, the method of operation is as follows:

The tank 70 being filled with cold water through the pipe 71, the thermostatic element is in the position shown in the drawings with the armature 40 in contact with the poles 41 and 42, and with the contact surfaces 54 and 64 in intimate electrical contact. The current then flows from the wire 67 to the wire 65 through the heater 75 thereby raising the temperature of this heater and heating the water in the tank 70. This heating continues by convection at a slow rate so that the current consumption is not large for a considerable time, the heat of the water being transmitted to the thermostatic element 11 through the wall of the tank 70 and through the case 12. The thermostatic element 11 is preferably formed of two strips of metal having widely different co-efficients of expansion. As this strip is heated the upper end being fixed by means of the screws 15, the lower end tends to move in the direction of the arrow "A" of Fig. 2 thereby tending to force the rod 17 in that direction and exerting considerable pressure on the insulating block 30.

The pole pieces 41 and 42 of the permanent magnet 43 exert an attraction on the armature 40 which resists the thrust of the rod 17. The amount of this attraction may be varied by varying the size of the magnet shunt 46. This magnet shunt permits a considerable proportion of the magnetic flux to pass so that the total force of the magnet 43 is not exerted on the armature 40. This allows an adjustment of the magnet pull on the armature 40 and also tends to greatly reduce the loss of magnetism of the permanent magnet 43 with the passage of time.

Whenever the thermostatic element 11 has been sufficiently heated to develop sufficient force to push the armature 40 away from the pole pieces 41 and 42, the insulating block 30 is forced in the direction of the arrow "A" and the contact surfaces 54 and 64 are instantaneously separated thereby opening the circuit to the heating element 75. This quick break is necessary to prevent arcing at the contacts. As the hot water in the tank 70 tends to rise to the top of the tank, this opening of the circuit does not occur until the water is heated in the tank to a point below the position in which the thermostatic element is placed, in other words, the tank is practically full of hot water at the time the heating element 75 is shut off. By covering the tank 70 with the lagging 78 the heat losses therefrom are rendered very small so that the tank can stand for a considerable period without serious loss of heat providing no water is drawn therefrom.

As some demand for water occurs during the preparation of the evening meal, or more often immediately thereafter for the purpose of washing dishes, etc., it is found in practice that the heater operates during the day to bring the water up to the desired temperature, and that during the early evening some of this hot water is drawn off. As the hot water is drawn off through the pipe 72 it is replaced with cold water introduced through the pipe 71. With the heater 75 shut off so that there is no convection circulation inside the tank 70, the cold water tends to stratify, remaining in the bottom of the tank gradually displacing the hot water which is drawn off through the top of the tank. This continues until the level of the cold water is carried considerably above the thermostatic element 11, as it takes some time for the cold water to extract sufficient heat through the walls of the tank 70 and the case 12 to effect the thermostatic element. As a matter of fact, probably one-third of the hot water is drawn off before the thermostat acts to pull the block 30 in a direction opposite to the arrow "A". As soon as this occurs the block moves over slowly to the left under the gradual movement induced by the thermostatic element 11 until the armature 40 commences to come into the magnetic field of the pole pieces 41 and 42 to a sufficient extent for them to exert an appreciable pull thereon. Whenever this occurs the magnet 43 acts to assist the thermostatic element 11, making an instantaneous contact. The contact surfaces 54 and 64 are so adjusted that they touch each other before the armature 40 fully seats on the pole pieces 41 and 42 with the result that the flexible strip 62 is bent slightly thereby putting a definite and constant pressure between the contact surfaces 54 and 64.

The construction of the screw 52 and its

method of attachment in the plate 50 allows considerable flexibility between the plate 50 and the screw 52 so that a square contact is possible at all times. Whenever the contact surfaces 54 and 64 touch, current is thrown into the heater 75 and the heating of the water in the tank 70 is repeated.

By locking the thermostatic element in the position shown and described above, it is necessary to draw off sufficient hot water to raise the cold water level above the point of attachment to the thermostat, and it is thus possible to make considerable demands on the supply of hot water without causing the thermostat to operate and energize the heating element. By so doing the heater does not ordinarily operate during the peak load of the central station. Whenever the thermostat does operate, however, the convection currents set up by the heating element serve to mix the cold water from the bottom of the tank with the hotter water above so that the tank is uniformly heated without any noticeable stratification. This is made possible by the location of the heating element in the bottom of the tank as shown.

What we claim is:—

1. A thermostat for use with a hot water tank comprising a narrow, long and thin case adapted to be clamped in good thermal contact with the outside of said tank; a thermostatic element secured to said case near the upper end thereof and to the side adjacent to the water tank when so clamped; a tube secured in the opposite side of said case; a second case secured to the outer side of said tube; electrical circuit closing mechanism inside said second case; and means by which said element actuates said mechanism through said tube.

2. A thermostat for use with a hot water tank comprising a thermostat case adapted to be clamped in good thermal contact with the outside of said tank at a point intermediate of the height thereof; a thermostatic element in said case; a tube secured in said case; a switch case secured to said tube; a switch in said switch case; and means by which said thermostatic element operates said switch through said tube.

3. A thermostat for use with a hot water tank comprising a thermostat case adapted to be clamped in good thermal contact with the outside of said tank at a point intermediate of the height thereof; a thermostatic element in said case; a switch case secured to said thermostat case; a switch in said switch case; and means by which said thermostatic element operates said switch.

4. A thermostat for use with a hot water tank comprising a thermostat case adapted to be clamped in good thermal contact with the outside of said tank at a point intermediate of the height thereof; a thermostatic element secured to the side of said thermostat case which is clamped next to said hot water tank; a tube secured in said case; a switch case secured to said tube; a switch in said switch case; and means by which said thermostatic element operates said switch through said tube.

5. A thermostat for use with a hot water tank comprising a thermostat case adapted to be clamped in good thermal contact with the outside of said tank at a point intermediate of the height thereof; a thermostatic element in said case; a switch case; a switch in said switch case; and means by which said thermostatic element operates said switch.

In testimony whereof, we have hereunto set our hands at Los Angeles, California, this 9th day of November, 1917.

HARRISON H. FOGWELL.
JOHN M. MORRIS.