

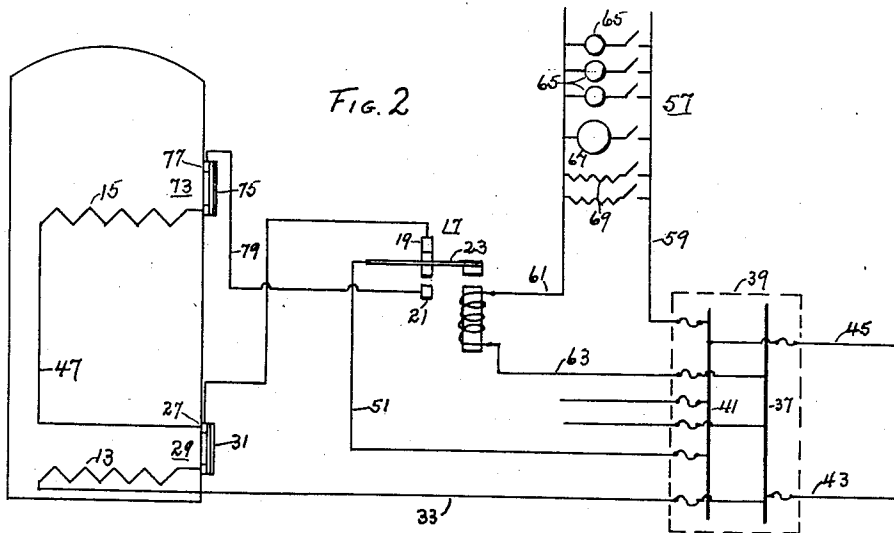
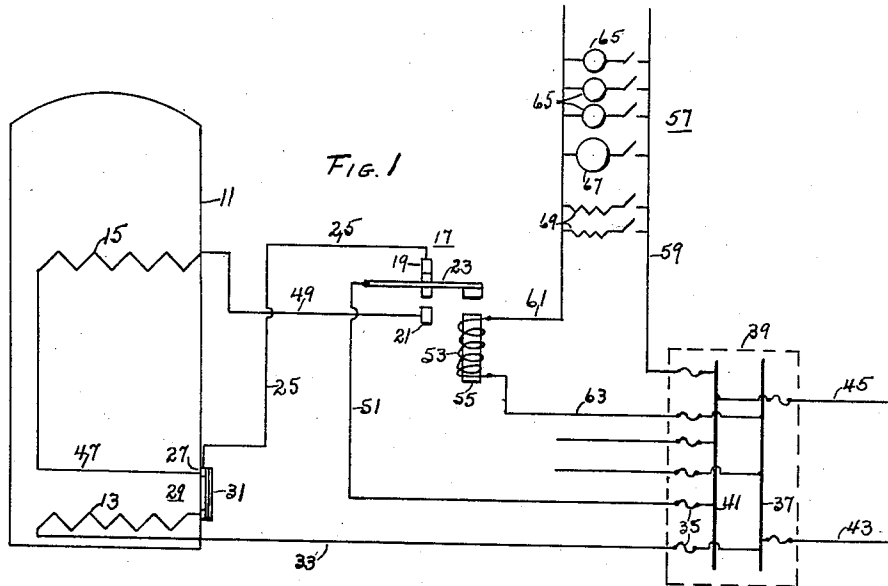
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WATER HEATING SYSTEM

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WATER HEATING SYSTEM

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My invention relates to control systems and particularly to hot water heating systems.

An object of my invention is to provide a hot water heating system which will continue heating of the water even under periods of heavy load on circuits other than the water heater circuit in case of overload conditions on said other circuit.

Another object of my invention is to provide a water heating system having means for reducing the amount of energy translated into heat in the heaters associated with the water tank during periods of heavy loads on other circuits in a house.

Other objects of my invention will either be apparent from a description of one form of system embodying my invention or will be set forth in the course of such description and particularly in the appended claims.

In the single sheet of drawings,

Figure 1 is a generalized view of a hot water tank of the ordinary domestic kind having associated therewith a system embodying my invention, and

Fig. 2 is a modified form of system embodying my invention as applied to a domestic tank.

Referring first to Fig. 1 of the drawing, I have illustrated generally only a domestic hot water tank 11 which may be provided with cold water inlet means and a hot water outlet means in a manner all well known in the art.

I provide a lower tank heater 13 and an upper tank heater 15 which are shown generally only and it is to be understood that I may provide any kind of electric heater either mounted on the outside of the tank or extending through the tank wall into direct engagement with the water. The lower tank heater 13 is preferably mounted at a lowermost point of the tank and it is to be understood that the upper heater 15 may be mounted at any desired point along the upper part of the tank, the amount of water affected directly by said upper heater being, of course, in proportion to its position on the tank.

I provide an electromagnetically controlled switching means 17 including a first fixed contact member 19, a second fixed contact member 21 spaced apart from the first fixed contact member, and a movable contact arm 23 so designed and constructed as to be normally yieldingly biased into engagement with fixed contact member 19.

A conductor 25 connects fixed contact member 19 with a fixed contact member 27 of a thermal switch 29 which includes in addition to the fixed

contact member 27, a bimetal bar 31 having its fixed end so mounted relatively to the tank 11 as to be in direct heat-receiving relation therewith. It is to be noted that the bimetal bar 31 will normally engage fixed contact member 27 as long as the thermal switch 29 is subject to cold water but that bimetal bar 31 will flex out of engagement with contact 27 when all or substantially all of the water in the tank 11 has been heated to a predetermined high temperature, all in a manner well known in the art. One terminal of heater 13 is electrically connected with the fixed mounting of bimetal bar 31 while the other end of heater 13 is connected by a conductor 33, through a suitable fuse 35, with one bus bar 37 of a panel board 39. The panel has mounted thereon a second bus bar 41 and the two bus bars are connected through suitable fuses with supply circuit conductors 43 and 45. It is to be understood that the showing of the panel board is general only since it is such as is now used in electric installations and forms no part of my invention. Contact member 27 is connected by a conductor 47 to one terminal of the upper heater 15, the other terminal of which is connected by a conductor 49 to a fixed contact member 21 of switch 17. Movable contact arm 23 of switch 17 is connected by a conductor 51 with bus bar 41 and therefore with the other supply circuit conductor 45.

I have shown an electromagnet including a coil 53 and a fixed magnetizable core 55 to cause movement of contact arm 23 out of engagement with fixed contact 19 and into engagement with fixed contact 21 under conditions to be hereinafter described. A second electric load circuit is shown generally as by numeral 57 and includes a conductor 59 connected through suitable fuses with bus bar 41 and a conductor 61, one end of which is connected to one terminal of coil 53, the other terminal of which is connected by a conductor 63 with bus bar 37.

I have illustrated a plurality of lamps 65 each controlled by a suitable switch, an electric motor 67 and a plurality of electric resistors 69 as being connected between conductors 59 and 61. I desire to illustrate thereby that I may connect the electromagnet and particularly its coil 53 in circuit with some other part of the usual house load, such as incandescent lamps 65 or the electric range represented by the resistors 69, to control the energization of the tank heaters, in accordance with the load conditions in said second circuit.

As long as less than all of the water in the tank

11 is hot, bimetal bar 31 will be in engagement with fixed contact member 27 and as long as contact arm 23 is in the position shown in Fig. 1 of the drawing, that is, during all such periods of the day when the load in the second circuit is less than a predetermined amount, lower heater 13 will be energized through a circuit substantially as follows: From supply circuit conductor 45 through bus bar 41, conductor 51 to contact arm 23, to contact member 19, through conductor 25 to and through the engaged members 27 and 31, through heater 13 and from there through conductor 33 and bus bar 37 to the other supply circuit conductor 43.

I wish to here point out that the amount of electrical energy translatable into heat in the lower heater 13 and the upper heater 15 may be alike or different and if it is desired, when permitted by my control system, to energize heater 15 to quickly obtain hot water in the upper part of the tank, the upper heater 15 may be designed to translate a larger amount of electric energy into heat than the lower heater although it may be preferable to make the two heaters 13 and 15 of like energy consumption.

As soon as substantially all of the water in the tank has been heated to a predetermined temperature, the thermal switch 29 will cause deenergization of heater 13 even though contact arm 23 may still be in engagement with the fixed contact 19.

Let it be assumed, however, that while bimetal bar 31 is still in engagement with fixed contact member 27, the current in the other circuit exceeds a predetermined limit or value making it desirable to continue energization of the heaters and heating of the water in the tank 11 only under certain operating conditions, this being effected as follows: The overload current in coil 53 causes movement of contact arm 23 into engagement with fixed contact 21 whereby a different heater energizing circuit is effected substantially as, from supply circuit conductor 43 to bus bar 37 and through conductor 33 to heater 13, to and through the thermal switch 29 which is in closed position, through conductor 47 and heater 15 through conductor 49 to contact 21, to engaged contact arm 23 and from there through conductor 51 to bus bar 41 and to the other supply circuit conductor 45.

It is therefore evident that should it be considered necessary to continue heating water in the tank 11 even during the periods of overload on another house circuit, this will be effected since the upper heater is now connected in the circuit and in series circuit relation relatively to the lower heater 13 whereby, of course, reducing the amount of energy translated into heat for heating the water in the tank during the periods of excess or overload in another house circuit. The energization of the upper heater 15 will cause water in the upper part of the tank to be heated, if there is little or no hot water in the tank, thereby ensuring the presence of at least a small quantity of hot water for use.

Referring now to Fig. 2 of the drawing, I have there illustrated a modification of the system shown in Fig. 1 of the drawing and all parts in Fig. 2 similar to those in Fig. 1 are provided with the same numerals. I provide a lower heater 13 and an upper heater 15 together with a lower thermally actuatable switch 29 but in addition I provide an upper thermally actuatable switch 73 similar to the lower thermal switch 29 and includ-

ing a flexing bimetal bar 75 having one end mounted on a suitable contact member and in heat-receiving engagement with the tank 11 and including also a fixed contact member 77. One terminal of heater 13 is connected to the fixed end of bimetal bar 31 and fixed contact member 27 is connected by a conductor 47 with one terminal of heater 15, the other terminal of which is, connected to the fixed support of bimetal bar 75. Contact member 77 of the upper thermal switch 73 is connected by a conductor 79 with fixed contact member 21. All of the other parts shown in Fig. 2 are the same as were shown in Fig. 1 and are therefore provided with the same numerals.

The plural-contact plural-position switch 17 is shown in Fig. 2 of the drawing as in a position where contact arm 23 is in engagement with fixed contact member 19 this being the case when the load in the second electric load circuit is less than a predetermined value, which will cause energization of heater 13 alone to cause heating of the water in case less than substantially all of the water in the tank is hot. The bimetal member 31 of the lower thermal switch 29 is shown as being in engagement with fixed contact member 27 indicating the presence of enough cold water in the tank to affect the lower thermal switch 29.

Let it now be assumed that say the resistors 69 in the second circuit hereinbefore described are energized, causing heavy current to flow through coil 53 with the result that contact arm 23 is moved so as to electrically engage fixed contact member 21. If the tank contains such a relatively small quantity of hot water that bimetal bar 75 of the upper thermal switch 73 is in electrical engagement with fixed contact member 77, an energizing circuit through both heaters 15 and 13 will be effected substantially as follows: From supply circuit conductor 45 through bus bar 41, conductor 51 to contact arm 23, to contact 21 and from there through conductor 79 to contact 77, through the closed switch 73 to and through upper heater 15, through conductor 47 to and through the lower closed thermal switch 29 to and through the lower heater 13 and from there through conductor 33 to bus bar 37 and from there to the other supply circuit conductor 43.

It is evident, therefore, that under these conditions both heaters 13 and 15 will be energized in case the tank contains less than a predetermined fractional amount of hot water which amount must be sufficient to cause flexing of the bimetal bar 75 out of engagement with contact 77 to prevent the hereinbefore described energization of both heaters during the times of relatively heavy loads on some house circuit other than that including the tank heaters.

It is further to be pointed out that the amount of energy in heater 13 now translated into heat is less than was the case when heater 13 alone was energized as during the period of light loads in the second circuit and further, that the total amount of electrical energy translated into heat in both heaters is less than was the case during the periods of normal load in the second house circuit.

Various modifications may be made in the system embodying my invention as herein shown and described and all such modifications clearly coming within the scope of the appended claims are to be considered as being covered thereby.

I claim as my invention:

1. A control system for a hot water tank comprising an electric circuit having an upper and a lower electric heater for the tank connected

therein, switching means for said heaters normally biased into position to effect energization of said lower heater in case less than all of the water in the tank is hot, a second electric load circuit and an electromagnet carrying the current of said second circuit and effective, when the current therein exceeds a certain value, to move said switching means into a second position to effect energization of both said heaters in series electric circuit with each other in case the tank contains a predetermined quantity of cold water at the time when the current in said second circuit exceeds said certain value.

2. A control system for a hot water tank comprising an electric circuit having an upper and a lower electric heater for the tank connected therein, switching means for said heaters, a second electric circuit and electromagnetic means controlled by the current in said second circuit and effective, when the current value in said second circuit is below a predetermined limit, to cause energization of said lower heater only as long as less than all of the water in the tank is hot and to cause energization of both said heaters in series electric circuit with each other as long as the tank contains a predetermined amount of cold water, during such time as the current value in said second circuit is above said predetermined limit.

3. A control system for a hot water tank comprising an electric circuit having an upper and a lower electric heater for said tank connected therein, a thermal heater control switch effective to cause deenergization of said heaters when substantially all of the water in the tank is hot, switching means for said heaters, a second circuit, electromagnetic means controlled by the current in said second circuit and electric connections between said heaters, said thermal switch and said switching means for causing energization of the lower heater only during periods of normal load in said second circuit in case less than all of the water in the tank is hot, for causing energization of both said heaters in series electric circuit with each other during periods when the load in said second circuit is above normal value and less than all of the water in the tank is hot and for causing deenergization of both said heaters when substantially all of the water in the tank is hot.

4. A control system for a hot water tank comprising an electric circuit having an upper and a lower electric heater for said tank connected therein, a thermal heater control switch effective to cause deenergization of said heaters when substantially all of the water in the tank is hot, switching means for said heaters, a second circuit, electromagnetic means controlled by the current in said second circuit and electric connections between said heaters, said thermal switch and said switching means for selectively causing energization of the lower heater alone and of both heaters at the same time in accordance with the value of the current in said second circuit.

5. A control system for a hot water tank comprising an electric circuit having an upper and a lower electric heater for said tank connected therein, a thermal heater control switch effective to cause deenergization of said heaters when sub-

stantially all of the water in the tank is hot, switching means for said heaters, a second circuit, electromagnetic means controlled by the current in said second circuit and electric connections between said heaters, said thermal switch and said switching means to cause the number of heaters energized to increase and the energization of the lower heater to decrease with a predetermined increase in the current in said second circuit.

6. A control system for a hot water tank comprising an electric circuit having an upper and a lower electric heater for said tank connected therein, a thermal heater control switch effective to cause deenergization of said heaters when substantially all of the water in the tank is hot, switching means for said heaters, a second circuit, electromagnetic means controlled by the current in said second circuit and electric connections between said heaters, said thermal switch and said switching means for selectively causing energization of the lower heater alone at a predetermined current value and the energization of both heaters and at less than said predetermined current value in said lower heater in accordance with the value of the current in said second circuit.

7. A control system for a hot water tank comprising an electric circuit having an upper and a lower electric heater for said tank connected therein, an upper and a lower thermal heater control switch, switching means for said heaters, a second circuit, electromagnetic means controlled by the current in said second circuit and electric connections between said heaters, said thermal switches, said switching means and said circuits to selectively cause energization of the lower heater only during periods of normal load in said second circuit in case less than all of the water in the tank is hot and to cause deenergization of the lower heater when substantially all of the water in the tank is hot, to cause energization of both heaters in series electric circuit with each other during periods when the load in said second circuit is above normal value and in case the tank contains less than a predetermined amount of hot water and to cause deenergization of both heaters when the tank contains more than said predetermined amount of hot water.

8. A control system for a hot water tank comprising a first electric circuit having an upper and a lower electric heater for the tank connected therein, a second electric circuit having a variable load connected therein and means consisting of an upper and a lower thermal heater control switch, an electromagnetic switch for the first circuit controlled by the current in the second circuit and electric connections between the upper and the lower thermal switches, the upper and the lower heaters, the electromagnetic switch and the two circuits to ensure that substantially all of the water in the tank shall be hot during those periods of time when the load in the second circuit is below a certain value and to ensure that a predetermined quantity of water in the tank shall be hot during those periods of time when the load in the second circuit is above said certain value.

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