

J. A. OCA-BALDA.
ELECTRIC HEATING SYSTEM.
APPLICATION FILED APR. 12, 1920.

1,369,702.

Patented Feb. 22, 1921.

6 SHEETS—SHEET 1.

Fig. 2.

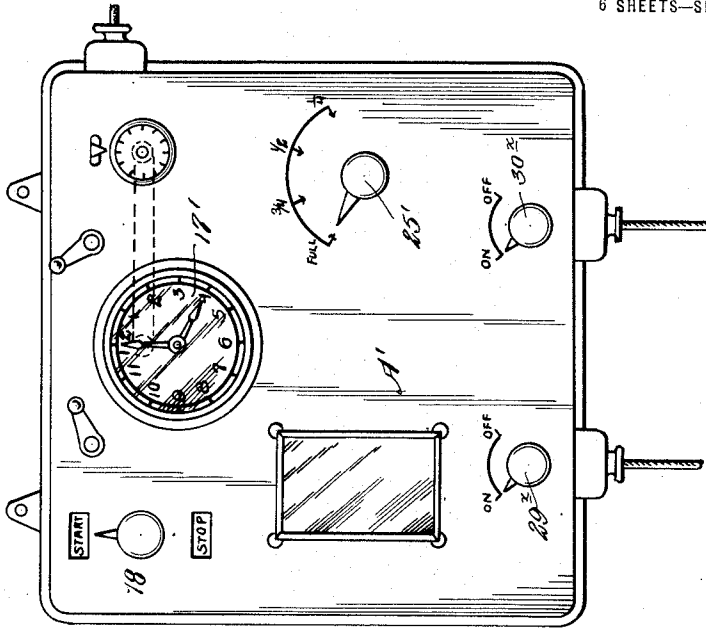
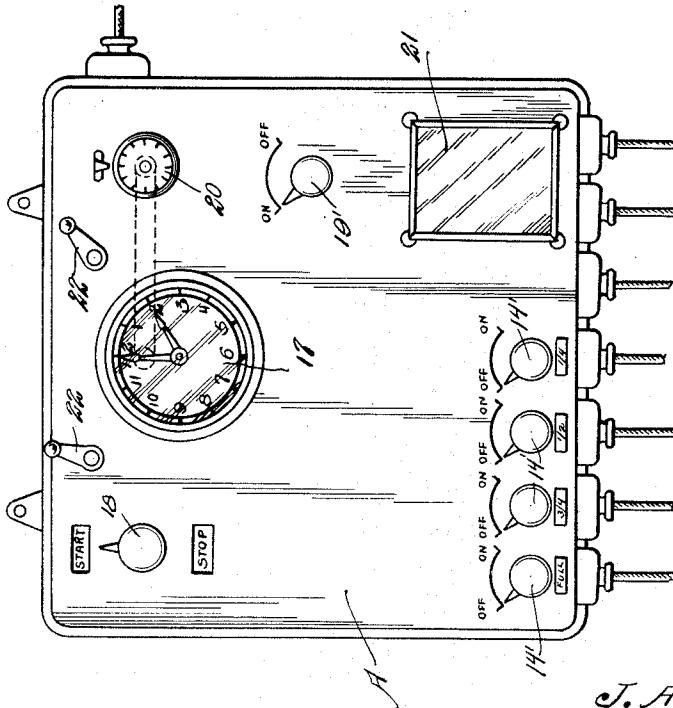


Fig. 1.



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6 SHEETS—SHEET 2.

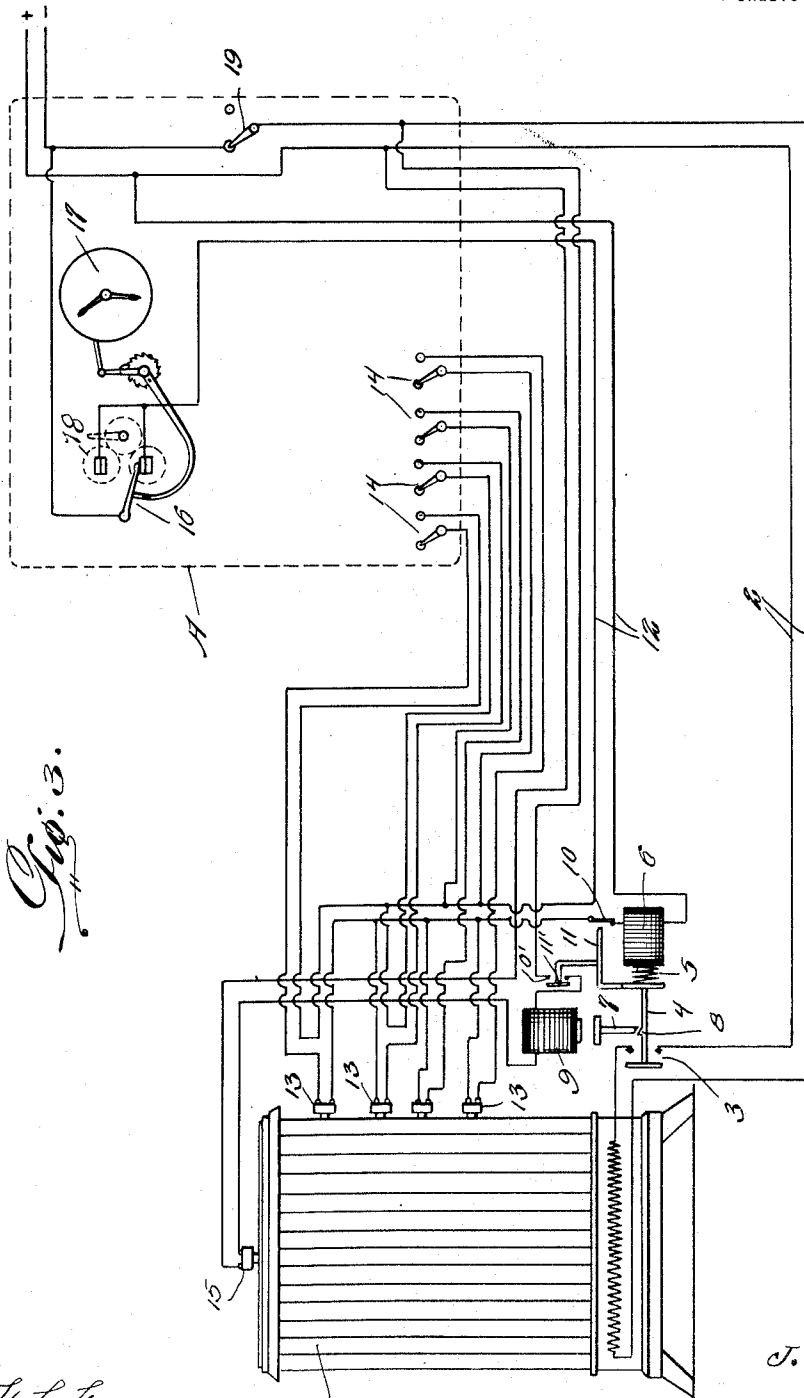


Fig. 3.

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6 SHEETS--SHEET 3.



WITNESSES;

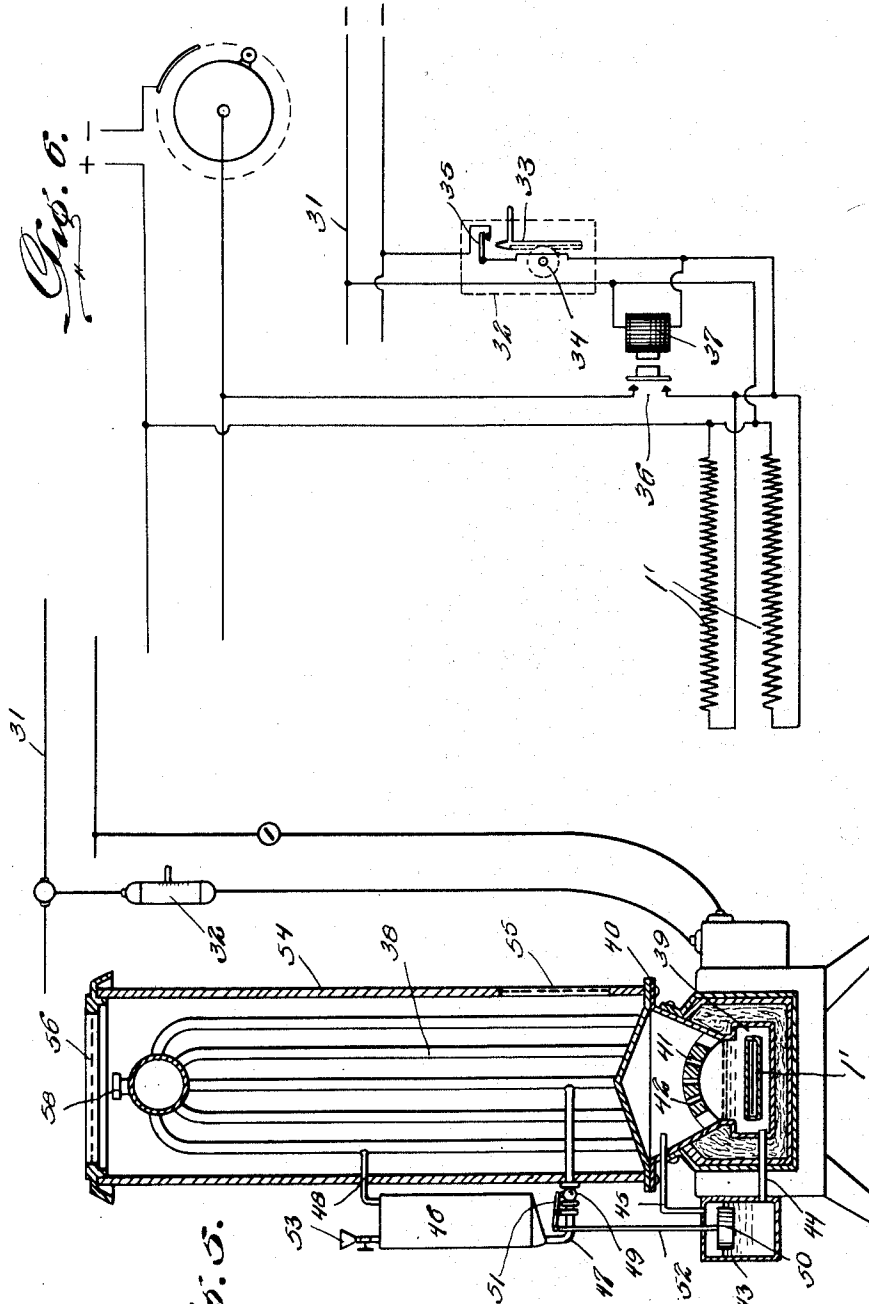
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6 SHEETS—SHEET 4.



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6 SHEETS—SHEET 5.

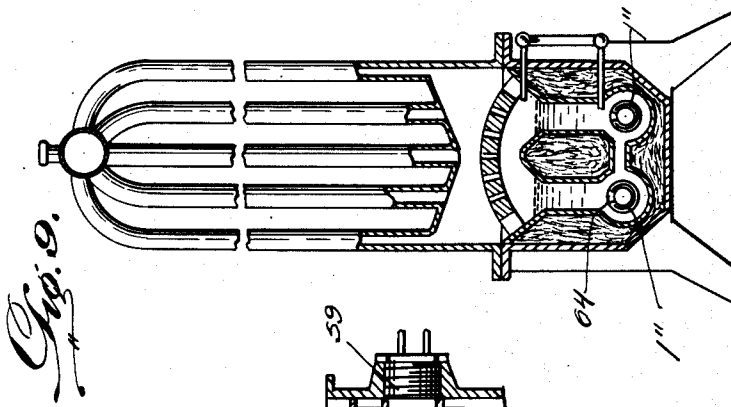


Fig. 8.

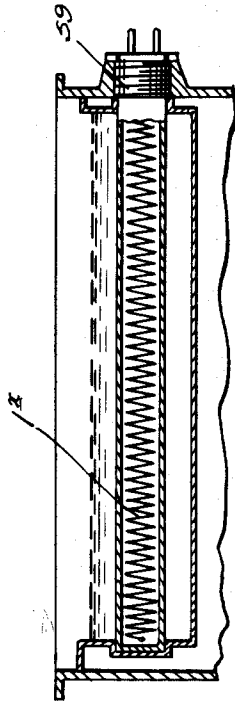


Fig. 10.

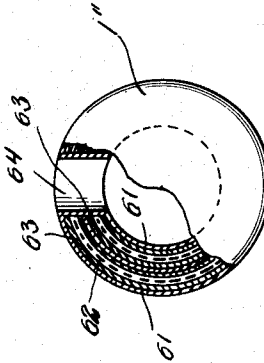
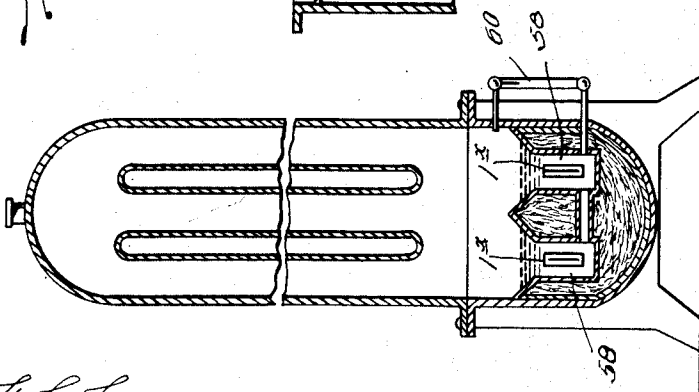


Fig. 7.



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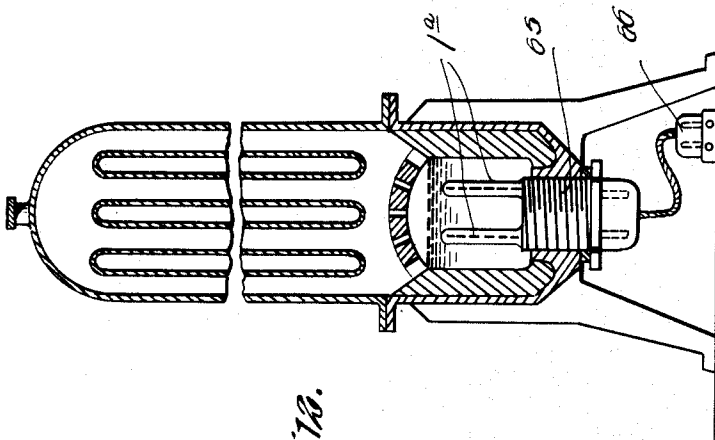
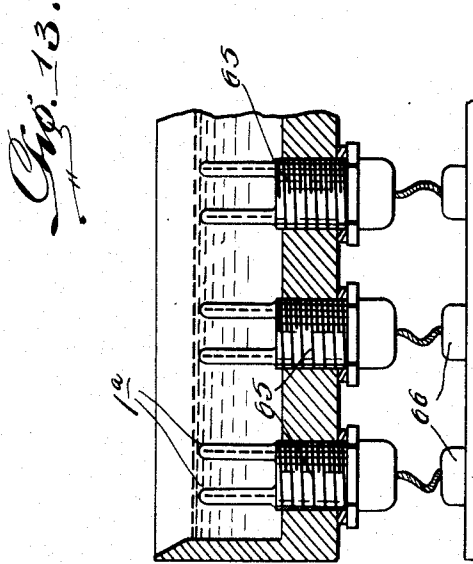
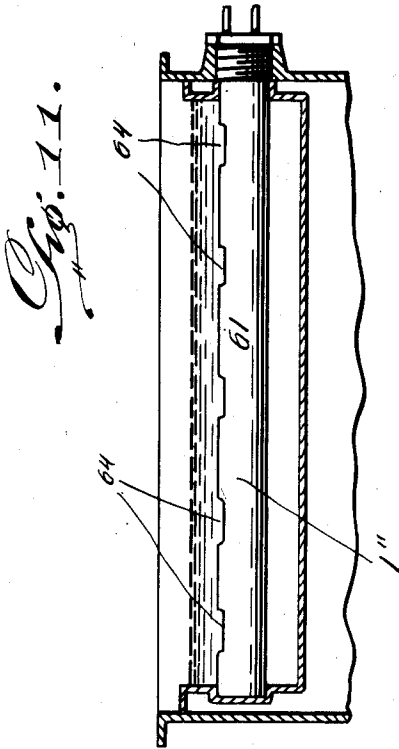
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6 SHEETS—SHEET 6.



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Fig. 10.

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UNITED STATES PATENT OFFICE.

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ELECTRIC HEATING SYSTEM.

1,369,702.

Specification of Letters Patent.

Patented Feb. 22, 1921.

Application filed April 12, 1920. Serial No. 373,201.

To all whom it may concern:

Be it known that I, JOSÉ A. OCA-BALDA, a citizen of Argentina, residing at New York city, in the county of New York and State of New York, have invented new and useful Improvements in Electric Heating Systems, of which the following is a specification.

This invention relates to an electric heating system. The convenience of heating by electricity is perfectly well known, as it reduces the work of operation to a minimum, as it is simply a matter of turning a switch to secure heat in the heating elements. Due to the expense involved in the use of electricity for heating purposes, this system has not met with general approval, as the cost is so much more than that of coal, gas and oil. The latter fuels are used in spite of their many disadvantages.

In former applications filed by me in the Patent Office and referred to hereinafter means were presented for reducing the cost of operation by supplying the current to the heating elements only at intervals, so as to reduce the consumption of current to a minimum, a body of liquid being used to hold the heat while the current is cut off.

The main purpose of this application is to give complementary appliances to my other cases, such as that of Serial No. 313,153, filed July 25, 1919, and No. 341,007, filed Nov. 28, 1919, by making a type of radiator having the conditions of simplicity, easy manufacture, efficiency and security.

Essentially the present invention consists in a radiator comprising a boiler and a body, the body to be heated intermittently by vapor generated in the boiler in combination with means for automatically putting on and off the heating elements, maintaining the temperature of the body within two limits, and in such a manner that, having once reached the upper limit, the heating elements will be cut off, remaining in such condition until the lower limit is reached, then the heating elements will be turned on again, until the upper limit, and so on; this controlling device permitting to profit by the condition that a radiator is able to work and give efficient heat, while the body remains within certain limits of temperature, becoming slowly cold, and that the elapse of time of cooling off the body by the external temperature and the elapse required

to heat the same by vapor are considerably different. Such difference permits an economy which may be expressed, broadly speaking, by the relation which exists between the elapse of time of heating the body by vapor generated in the boiler and the elapse of time required in cooling off the same, due to the external temperature.

In addition, and cooperating with this method of controlling the heating elements, to increase the difference between the elapse of time required for heating the body until the upper limit selected, and the elapse of time of cooling of the same until the lower limit by the external temperature, we use a boiler suitably insulated to keep the temperature as near as possible to the boiling point while the heating elements are off, so as to start the production of vapor as soon as the heating elements are on. After a great number of observations and experiments made by me during very cold winter days, I have found that the efficiency of a radiator working within two limits of temperature is practically the same as if the body would be maintained at a constant temperature. This latter method of control (*i. e.*, maintaining the temperature constant) is uselessly more expensive, no matter what kind of a radiator is used, and under similar conditions two limits suitably selected give a more reasonable manner of operating upon the heating elements.

There are several ways of maintaining the body of the radiator within two limits to profit the heat radiated while the body becomes slowly cold, operated by the external temperature. Similar arrangements to those explained by me in applications Serial No. 313,153 and No. 341,007 are excellent ways of accomplishing such a result. Nevertheless, it is self evident that as soon as the radiator starts working, the temperature of the place where the radiator is located is raised rapidly and therefore the external temperature which operates in cooling off the body is a variable factor. Consequently, the elapse of time of cooling off the body is a variable factor too.

A perfect automatic self-controlled device which includes all the advantages and profits of working radiators within two limits is obtained by the use of thermostats suitably arranged and combined. Such arrangement will give automatically the profit

of changeable differences between the elapses of time of cooling off the body and that required to heat the same. Besides that, by making such limits adjustable at will, according to the circumstances, the efficiency of the device may be increased during practical use.

The above explained method of controlling radiators may be operated, as we will see, in combination with temperature regulators located in the place where the radiator is working, such temperature regulators forming a secondary control of the intermittent mechanism arranged in such a manner that it will be rendered inactive while the temperature of the place to be heated remains within certain limits adjusted. By the use of both arrangements suitably combined there will be no danger of overheating the place where the radiator is located, useless waste of heat will be avoided, and all the energy and heat expended will be exactly controlled and utilized.

A further object of the invention is to provide means for rendering easy the handling of the devices by inexperienced people, providing suitable instructions and making all parts of the most simple construction.

A still further object of the invention is to so arrange all the parts in such a manner that any change, repairing or overhauling may be made in a very easy manner and in a short time.

The invention also consists in certain other features of construction and in the combination and arrangement of the several parts, to be hereinafter fully described, illustrated in the accompanying drawings wherein like characters denote like or corresponding parts through the several views, and in which:

Figure 1 is a face view of the box for inclosing the controlling means for the system.

Fig. 2 is a like view of a box used with a slightly different arrangement of the parts of the invention.

Fig. 3 is a diagrammatic view showing the arrangement of the parts used with the box shown in Fig. 1.

Fig. 4 is a diagrammatic view showing the arrangement of the parts used with the box shown in Fig. 2.

Fig. 5 is a sectional view of a radiator with two different means of supplying the same with current.

Fig. 6 is a diagrammatic view of the circuits of the construction shown in Fig. 5.

Figs. 7 and 8 are sectional detail views of a modified form of a radiator and its heating means.

Figs. 9, 10 and 11 are sectional views of another form of radiator and its heating means.

Figs. 12 and 13 are sectional detail views

of still another form of radiator and its heating elements.

Referring to Figs. 1 and 3, A indicates the box or casing containing the controlling parts of the apparatus and B indicates one of the electrically heated radiators. The supply of current to which is controlled by the parts in said box. The heating elements 1 of this radiator are connected by the conductors 2 with the main line, these conductors having portions passing through the box and a switch 3 is arranged for controlling the supply of current to these conductors and heating elements. This switch is carried by a rod 4 which is normally held in a position with the switch open by a spring 5. This rod carries an armature part which is associated with the magnet 6 so that when the magnet is energized the rod will be moved into a position to close the switch. The parts are held in closed position by the latch 7 engaging the projection 8 on the rod 4 and this latch carries an armature part which is associated with the magnet 9 so that when said magnet is energized the latch will be moved out of engagement with the projection to permit the spring 5 to force the rod 4 into a position with the switch open. In order to break the circuit to each magnet as soon as the armature part is attracted thereto I provide a switch 10 in the circuit leading to the magnet which is normally closed and is opened by a member 11 connected with the rod 4 and engaging the switch to open the same when said rod 4 is attracted by the magnet. This member 11 has an extension 11' for engaging the switch 10' of the magnet 9 and opening the same when the rod 4 is in a position with the switch open.

The magnet 6 is electrically connected with the source of current by the line 12, which has portions arranged in the box and a plurality of thermostatic devices 13 are connected in parallel with the line of said magnet, the line of each thermostat being controlled by a switch 14 which is carried by the box. These thermostat devices are arranged on the radiator. Another thermostatic device 15 is carried by the radiator and this device is connected in series with the line of the magnet 9.

It will thus be seen that when one of the switches 14 is closed and the temperature of the radiator is below that for which the thermostat of this particular switch is set the contacts of said thermostat will engage so as to complete the circuit to the magnet 6 and this magnet will therefore attract the armature part on rod 4 and thus close the switch 3 so as to complete the circuit to the heating elements 1. The rod 4 will be held in this position by the latch 7 and the circuit to the magnet 6 will be broken by the opening of switch 10. Current will con-

tinue to flow to the heating elements until the temperature reaches the point for which the thermostat 15 is set, when this thermostat will close the circuit to the magnet 9, so as to cause said magnet to attract the armature part on latch 7 and thus release the rod 4 to permit its spring to move said rod into position with the switch open and thus break the circuit to the heating elements. The temperature will then begin to fall until the degree is reached for which the thermostat 13 the switch of which is closed is set, when this thermostat will close the circuit again to the magnet 6 and thus cause the parts to again close the circuit to the heating elements. By having a plurality of the thermostatic devices 13, each device being set for a different degree, the limits of temperature between which the current will flow can be adjusted. Nevertheless, by the reason given at the beginning of the present application, complications may be avoided by using only two limits in all circumstances.

I locate a switch 16 in the line 12 of the magnet 6 and I provide means for controlling this switch by the alarm mechanism of the clock 17, this mechanism being similar to that described in my application. Serial No. 316,191, filed August 8, 1919, and I also provide means, indicated at 18, for causing this mechanism to either open or close the switch, this mechanism being similar to that described in the above application.

I locate a switch 19 in the main line 2 for manually controlling the flow of current to said line, this switch being controlled by the handle 19' located on the face of the box A. The switches 14 are controlled by the handles 14' located on the face of the box A and I prefer to place indicia on said box to indicate that said switches 14 will give "full rate," "three-fourths rate," "one-half rate" and "one-fourth rate," respectively. The setting means for the alarm mechanism of the clock is indicated at 20 and instructions for the use of the apparatus may be placed at 21. Handles for winding both the clock and the alarm mechanism from the outside of the box are indicated at 22.

Figs. 2 and 4 show an arrangement whereby the supply of current to magnet 6' is controlled by alternating means which consist of a rotating finger 23 and a stationary contact 24 so arranged in the circuit of the magnet that when the finger 23 engages with said contact 24 the circuit to the magnet will be completed. These parts are located in the time controlled circuit which includes the switch 16' and the clock mechanism 17' for opening or closing said switch. The part 23 is rotated by a small electric motor 25 passing through suitable reducing gears,

and this motor may be set to operate at different speeds by means of the rheostat 26. By adjusting the speed and rotation of the motor the elapses of time in which current is being supplied to the magnet 8' can be controlled so that the closing of the main circuit to the heating elements of the radiator can be made to occur at shorter intervals or at longer intervals as desired. The current is turned off when the temperature of the radiator reaches a certain degree by means of the thermostat 15' controlling the circuit to the magnet 19', these parts being arranged as before described. Setting mechanism 25' is arranged on the box A' for setting the motor to rotate at different speeds and the indicia for this setting mechanism is also arranged at "rates" as before described.

These Figs. 2 and 4 also show means for controlling the circuit of the magnet 6' by means of a thermostat 27 which may be located in the room or apartment. Such arrangement consists of a pair of magnets 28 and 29 for controlling a switch 30 in the same way as the switch of the main line is controlled by the magnets 6 and 9. The thermostatic means 27 are electrically connected with the main line and the parts are so arranged that the switch is held normally closed by the latch. If the temperature in the room should become higher than that for which the thermostatic device 27 is set this device would close the circuit to the magnet 29 to cause its latch to free the switch carrying member and thus open the switch 30 and break the circuit to the magnet 6'. I may place a resistance 28' in the line of the thermostatic means 27. I also provide manually operated means, such as that indicated at 29 and 30 on the box A' for rendering the thermostatic means 27 and the radiator inactive.

The thermostat 27 may be of any approved type working between two limits, as shown only diagrammatically in the drawings. Figs. 5 and 6 show means for connecting the heating elements of the radiator with a second source of current, such as the line 31, so that if a person should come into the room and wish to supply current to the radiator at once, without awaiting the operation of the alternating means by operating the time switch 32 he can secure heat immediately. This time switch may be of any approved type. It consists in the present case of a rack bar 33 operated by clock mechanism 34 and when pulled down permits the switch 35 to close the circuit. The clock mechanism then starts to return the rack bar to its upper position and when this position is reached the rack bar will open the switch. The briefly described time switch is the same as explained by me in application Serial No. 329,031, filed Oct. 7, 1919. Such arrangement of connecting the

radiator to an independent source of current has only use when a system of several radiators are operated with alternating means, and only one device for alternatively giving and cutting off the current is operating upon a main line on which several radiators are connected and located in different apartments and rooms, as explained by me in application Serial No. 341,007, filed Nov. 28, 1919. In order to prevent interference between the two circuits, I locate a switch 36 in the first circuit which is normally closed and is opened by the magnet 37, which is located in the circuit controlled by the rack bar 33, so that as soon as the switch 35 is closed the magnet will be energized and thus the switch 36 will be opened and current can only pass through the heating elements of the radiator from line 31. This arrangement is only explained here as complementary, because it can be useful in special circumstances. The radiator shown in Fig. 5 consists of a body part 38 containing the tubes and the boiler part 39, the two parts being detachably connected together as at 40 in such a manner to provide tight joints. The boiler of the radiator is composed in this case of metal walls with heavy insulation between them, so as to prevent the rapid cooling of the liquid in the boiler when the current to the heating element is cut off. A wall 41 separates the boiler from the body 38, and this wall is provided with perforations 42 to permit the vapors generated in the boiler to pass into the tubes of the body and also permits the water of condensation in the body to return to the boiler. This wall must be insulated too, and arranged in the best way to accomplish the purpose of keeping the temperature of the liquid in the boiler while the current is cut off from the heating elements. As it is clearly shown in the drawings, the heating elements are entirely surrounded by the liquid and made in this case in the form of a narrow elongated strip inclosed in a metal casing.

Using radiators as the ordinary type used for heating houses, the elapse of time of cooling off the body operated by the external temperature will be ordinarily short, and therefore the water in the boiler can be kept at a very reasonable temperature while the heating elements are in off condition by utilizing any kind of material as insulator. It must be clearly understood nevertheless, that when I claim a boiler surrounded by insulation so as to keep the temperature of a liquid as near as possible to the boiling point while the heating elements remain in off condition I give to such claim the latitude of using any kind of insulator, either the most expensive used for keeping liquid air and comprising metallic vacuum chambers with bright silver coated walls,

as ordinary thermos bottles are made, or merely an insulator as asbestos, mineral wool, cork, sawdust, or other cheap material. For the same reasons, no special arrangements have been devised to operate the communications between the boiler and the body, and only suitable openings are shown, yet I desire it to be understood that such kind of arrangements are entirely subordinated to the main idea of the present invention, no matter if necessary or not. As I have stated before, the cooling off of the body will require during ordinary use an elapse of time so short, that any effort made to increase the efficiency of the radiator by making expensive insulations and complicated arrangements may be of very doubtful practical results.

At Fig. 5 we show means for automatically supplying water to the boiler, such means consisting of a tank 43 having the pipe 44 connecting it with the boiler and the equalizing pipe 45 connecting it with the upper part of the same. A second tank 48 is connected with the body of the radiator by the pipe 47 and this tank also is provided with an equalizing pipe 48. A valve 49 is placed in the pipe 47 for controlling the flow of water to the radiator and this valve is operated by a float 50 located in tank 43 and connected with the valve by the lever 51 and the link 52. The tank 46 is provided with a filling inlet 53. It will thus be seen that when the water in the boiler becomes low the float 50 will move downwardly and through the connections with the valve will open this valve so that the water from tank 46 will pass into the radiator.

Such arrangement is not believed to be necessary, because if the radiator is made with tight joints, it will not need to be refilled but occasionally. In order to facilitate the circulation of air through the tubular part of the radiator a casing 54 for inclosing said tubular part is provided. This casing has a low window 55 and an upper window 56 which are preferably covered with wire mesh. A filling cap 58 is arranged in the upper part of the radiator, and provided with packing to make tight joints.

In the form of radiator shown in Figs. 7 and 8, the boiler is provided with two compartments 58, in each of which is located an electric heating element 1*. Each element is removably supported in the boiler by means of the screw threaded connection and each element is in the form of a narrow strip vertically arranged and located in a metal casing. A gage glass 60 is used for indicating the level of the water in the boiler.

In the radiator shown in Figs. 9, 10 and 11, the heating elements are of circular formation, as indicated at 1''. In this case each element consists of an inner and an outer wall 61 of metal, between which is located

the coils 62 and the usually employed mica insulator 63. Holes 64 are formed in the element for permitting the water to have access to the interior thereof, thus increasing the heating surface. In the radiator shown in Figs. 12 and 13, the heating elements 1^a are carried by screw threaded plugs 65, which are located in the bottom of the boiler and have their terminals in electrical connection with a bar 66 to which the main circuit is connected.

By forming the radiator of two parts, detachably connected together, and the heating elements in the manner explained before, everything can be easily disassembled when necessary for cleaning, repairing or changing any part.

Referring to the diagram on Fig. 3, by the use of thermostatic devices as shown, we will suppose that the device 15 is set to close the circuit at 270 degrees, and the devices 13 are set to close the circuit at 230, 190, 150 and 100 degrees, respectively. If one wishes the apparatus to work within the limits of 150 degrees and 270 degrees he would close the switch 14 of the devices 13 which is set for 150 degrees, the other switches being open. Say the temperature is below 150 in the radiator so that the contacts of the device 13 are closed and thus current will be supplied to magnet 6 and this magnet will therefore close the switch 3 and permit the current to flow through the heating elements of the radiator. As soon as the temperature reaches 270 degrees and the device 15 will act to close the circuit to the magnet 9 and thus raise the latch and permit the spring to open the switch 3 to break the circuit to the heating elements. The body of the radiator will then slowly cool until it reaches a temperature of 150 when the device 13 will act again to supply current to magnet to close the switch 3 again and thus permit current to flow to the heating elements. This action will continue as long as the switches 16 and 19 are closed so that current will be intermittently supplied to the heating elements of the radiator while the body is maintained within the two selected limits.

Several devices 15, can be provided and located in series and in different places upon the body of the radiator. With such arrangement the magnet 9 will be energized when all the thermostatic devices are closed. That is to say, when the temperature of the external body of the radiator is uniform.

The above stated temperatures are given only as an example though we have selected 270° which is too high for heating purposes. Nevertheless, the radiator can be operated at any temperature, if provided with tight joints to keep any internal pressure.

The heating elements may be provided with thermostatic means when desired and

considered necessary for preventing damage to the parts if occasionally the water in the boiler should become low. These thermostatic means operated only at a high temperature must be located upon the heating elements with arrangement to act at dangerous temperature upon the circuit of the magnet 9.

While I have explained my invention and give solutions to put it into practice, I do not care to be limited to the exact details and combinations made in the present specifications, but I desire it to be understood that changes and alterations may be made by me, providing they fall within the scope of the appended claims.

What I claim as new is:

1. A radiator comprising a body and a boiler, electric heating elements located in the boiler, the vapor generated in the boiler to be used to heat the body of the radiator, in combination with means for cutting off the current after a predetermined elapse of time and means for adjusting this elapse of time.

2. A radiator comprising a boiler and a body, electric heating elements located in the boiler, the boiler containing arrangements to be totally inclosed by suitable insulation when the current in the heating elements is turned off, so as to keep the temperature of the liquid in the boiler during this time at the boiling point in order to start the production of vapor as soon as the current is on again with means for opening the communication of the boiler with the body of the radiator when the current is on.

3. A radiator comprising a boiler and a body, electric heating elements located in the boiler, the boiler containing arrangements to be totally inclosed by suitable insulation making a regular closed thermo device when the current is turned off from the heating elements so as to keep the temperature of the liquid at the boiling point during the time the current is off in order to start the production of vapor as soon as the current is on again with means for opening communication of the boiler with the body of the radiator when the current is on, and close this passage when the current is off.

4. A radiator comprising a body and a boiler, electric heating elements located in the boiler, the boiler being surrounded by heavy insulation so as to keep the temperature of the water at the boiling point when the current is turned off the heating elements with the purpose of starting the production of vapor as soon as the current is turned on and heating intermittently the body of the radiator, maintaining the temperature of the same within certain limits adjusted by suitable controlling means, the insulations for keeping the temperature in the boiler saving the current necessary to

carry the temperature to the boiling point each time that the current is on as would happen if the liquid in the boiler was not protected by insulation and became slowly cold at the same time that the body of the radiator cooled off.

5. A radiator comprising a body and a boiler, electric heating elements located in the boiler, insulation surrounding the boiler to maintain the temperature in the boiler at the boiling point when the current is cut off from the heating elements, so as to start the production of vapor as soon as the current is on again, the radiator being constructed and provided with air tight joints so as to keep for a time any air pressure, the degree of which has been set by the manufacturer.

6. A radiator comprising a boiler and a body, said boiler having heat insulated walls and means of communication between the boiler and the body to permit the passage of vapor from the boiler to the body.

7. A radiator comprising a body and a boiler, electric heating elements located in the boiler, the body of the radiator being heated intermittently by the vapor generated in the boiler and in such a manner that the temperature in the body may be maintained within certain limits adjusted by the intermittent mechanism, the boiler being surrounded by heavy insulation so as to keep the temperature of the liquid at the boiling point when the current is turned off the heating elements and the body of the radiator becomes slowly cold, the insulation of the boiler having the purpose of permitting production of vapor as soon as the intermittent mechanism turns on the current to the heating elements, thermostatic means for cutting off the current from the heating elements when the water level in the boiler becomes low and the heating elements reach a certain dangerous temperature.

8. A radiator comprising a body and a boiler, electric heating elements located in the boiler, the boiler being surrounded by suitable insulation to maintain the temperature when current in the heating elements is off and so start the production of vapor as soon as the current is on, means for indicating the level of the liquid in the boiler, means for detachably connecting the body with the boiler, means for making the joints tight to prevent the escape of vapor so as to maintain the level of the liquid in the boiler, a cover surrounding all the external body of the radiator, upper and lower windows therein to give natural circulation of air through the parts and wire mesh covering the windows.

9. A radiator comprising a body and a boiler, electric heating elements located in the boiler, a set of thermostats and means for adjusting the flow of current through

the heating elements by a combination of said thermostats.

10. A radiator comprising a body and a boiler, electrical heating elements located in the boiler, a set of thermostats and means for adjusting the flow of current through the heating elements by a combination of the thermostats, setting means for handling each combination comprising a plurality of switches and their corresponding indicia arranged on a board.

11. A radiator comprising a body and a boiler, electric heating elements located in the boiler, a set of thermostats, means for adjusting the flow of current through the heating elements by a combination of the thermostats, setting means for arranging each combination, comprising a switch board with the corresponding indicia, said indicia indicating the different rates of work given by the combination so as to make the handling of the apparatus easy.

12. A radiator comprising a body and a boiler, electric heating elements located in the boiler, a set of thermostats, means for adjusting the flow of current through the heating elements by the combination of the thermostats, setting means for locating each combination comprising a box containing switches with the corresponding indicia, this indicia indicating the different rates of work given by the combination so as to make the understanding and handling easy at a glance and means for starting or stopping the combination at any predetermined desired time.

13. A radiator comprising a boiler and a body, electric heating elements in the boiler, the boiler being surrounded by insulation to keep the temperature while the current of the elements is turned off and maintaining this temperature as long as possible near the boiling point, a set of thermostats and means for adjusting the flow of current through the heating elements by a combination of the thermostats.

14. A radiator comprising a body and a boiler, electric heating elements in the boiler, insulation surrounding the boiler to keep the temperature of the liquid when the current is turned off, as long as possible near the boiling point, a set of thermostats, means for adjusting the flow of current to the heating elements by a combination of the thermostats, setting means for handling each combination comprising a box, switches carried thereby with corresponding indicia and connections.

15. A radiator comprising a body and a boiler, electric heating elements located in the boiler, insulation surrounding the boiler in order to keep the temperature in the boiler, while the current is turned off from the heating elements, a set of thermostats, means for adjusting the flow of current to

the heating elements by a combination of the thermostats, setting means for handling each combination and means for starting and stopping the combination, at any desired predetermined time.

16. A radiator comprising a body and a boiler, electric heating elements located in the boiler, insulation surrounding the boiler to keep the temperature in the boiler while the current is turned off, a set of thermostats, means for adjusting the flow of current to the heating elements by a combination of the thermostats, setting means for handling the combinations and means for starting and stopping the radiator at any desired predetermined time this means including the alarm device of a clock, a box containing the clock and setting means for the clock outside the box.

17. A radiator comprising a body and a boiler, electric heating elements located in the boiler, the boiler being surrounded by suitable insulations to keep the temperature in the boiler while the current is turned off, a set of thermostats, means for adjusting the flow of current to the heating elements by a combination of thermostats, setting means for handling the combination, means for starting and stopping the combinations at any desired predetermined time and thermostatic means for controlling the work of the radiator so as to maintain the temperature of the room within certain limits regulated at will.

18. A radiator comprising a body and a boiler, electric heating elements in the boiler, the boiler being surrounded by insulation to maintain the temperature of the boiler when the current is turned off from the heating elements, in combination with means for giving current to the heating elements at equal elapses of time, thermostatic means for cutting off the current when a certain temperature is reached with the purpose of controlling the radiator by the combination of the current given at elapses of time and thermostatic means which will cut off the current automatically when the body of the radiator is properly heated.

19. A radiator comprising a boiler, and a body, electric heating elements located in the boiler, the boiler being surrounded by insulation to maintain the temperature while the current is cut off from the heating elements, in combination with means for giving current to the heating elements at equal elapses of time, means for adjusting the elapses of time and thermostatic means for cutting off the current to the heating elements when a certain temperature is reached.

20. A radiator comprising a body and a boiler, electric heating elements in the boiler, the boiler being surrounded by suitable insulation to maintain the temperature when

the current is off, in combination with means for alternatively giving and cutting off the current to the heating elements and means for adjusting the elapses of time in which the current will flow and be cut off.

21. A radiator containing liquid, electric heating elements therein, a set of thermostats, means for adjusting the flow of current through the heating elements by a combination of the thermostats, setting means for locating each combination including a box carrying switches with the corresponding indicia, this indicia indicating the different rates of work of the combinations so as to make the understanding and the handling of the radiator easy at a glance.

22. A radiator containing a liquid, electric heating elements therein, means for giving current to the heating elements at equal elapses of time, means for adjusting the elapses and thermostatic means located in the body of the radiator to cut off the current when a certain temperature is reached.

23. A radiator comprising a boiler and a body in communication therewith, said boiler having heat insulated walls, means for heating the boiler to produce steam therein for heating the body and means for actuating the heating means to maintain the temperature of the body between two limits.

24. A radiator comprising a boiler and a body in communication therewith, said boiler having heat insulated walls, means for heating the boiler to produce steam therein for heating the body, means for actuating the heating means to maintain the temperature of the body between two limits and means for adjusting said limits.

25. In combination with a radiator, thermostatic means located in the body of the radiator for controlling the heating thereof by the temperature of the body of the radiator and thermostatic means associated with said thermostat for controlling the system by the temperature of the apartment to be heated.

26. A radiator comprising a body and a boiler, the body to be heated intermittently by the vapor generated in the boiler, the intermittent mechanism comprising means for cutting off the heating elements when a certain temperature is reached, remaining cut off while the body becomes slowly cold until a certain lower temperature, means for turning on the heating elements when this lower temperature is reached and so on, the boiler composed of heat insulated walls to keep the temperature as near as possible to the boiling point while the heating elements are off so as to start the production of vapor as soon as the heating elements are on, this insulation cooperating with the controlling means to increase the difference between the elapse of time required for heating the body of the

radiator until the upper limit selected and the elapse of time of cooling off from this upper limit until the lower limit.

27. A method of utilizing heat radiated
5 from a body, the temperature of which is maintained within two limits by means of the vapor generated in a heat insulated

boiler in which the liquid is kept at a temperature as near as possible to the boiling point during all the elapses of time in which 10 the heat has been turned off from the boiler.

In testimony whereof I affix my signature.

JOSÉ A. OCA-BALDA.