

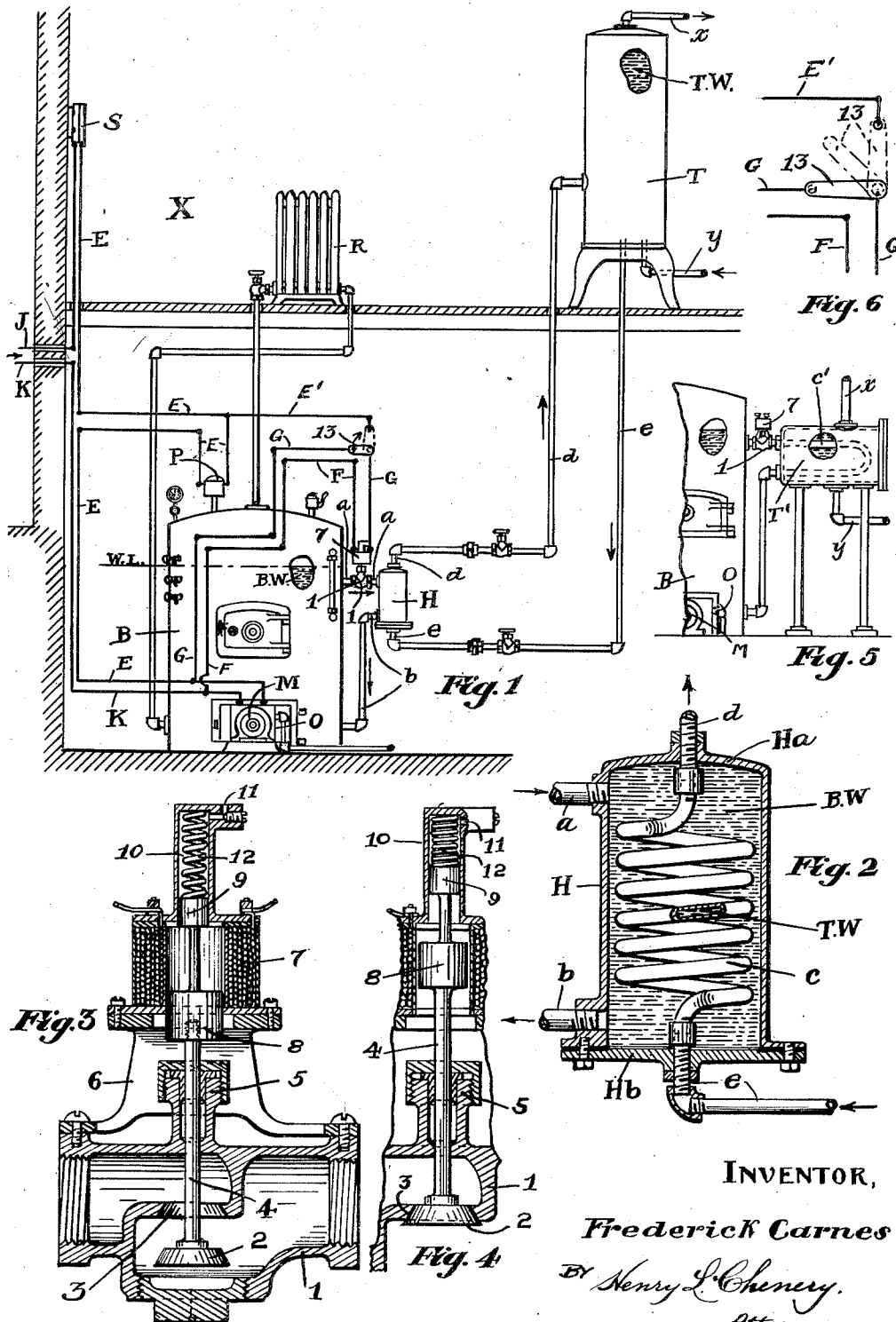
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WATER HEATING SYSTEM

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## WATER-HEATING SYSTEM

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The invention hereinafter to be described relates, in general terms, to water-heating systems in which the heat from the boiler water is utilized to raise the temperature of the water used for household and other purposes, the process being called by those skilled in the art, indirect heating.

While there are in vogue at the present time various arrangements and types of construction for accomplishing this indirect heating of the domestic supply of water, I have in the present instance chosen as the vehicle by which, illustratively, I could comprehensively disclose my improvements in the method of operating these devices, the well known and extensively used "Stack" heater.

It comprises a small cylindrical vessel through which, in the conventional heating systems, a continuous circulation of hot boiler water is maintained.

Within the vessel, immersed in the hot boiler water, is a pipe coil the ends of which are extended to a supply tank from which is drawn the domestic supply of hot water as needed.

This indirect heater element together with other agencies essential in operating an indirect heating apparatus will be more fully dealt with later on; it is to be understood, however, that fundamentally they form only the foundation upon which my invention is built.

The specific and primary object sought in my invention is to so control the two heating functions, namely, heating the rooms in the building and the domestic water in the supply tank, that the maximum load or heating duty of the boiler may be divided. In other words, while the burner is working at substantially full capacity for heating the rooms, the duty of raising the temperature of the tank water is temporarily suspended.

For instance, in cold weather particularly in the night time it is usual for the house-holder to set his thermostat control at a point lower than that maintained during the day time—say fifty to sixty degrees Fahr.—the oil-burner operating on low duty adjustment.

In the morning the first demand on the boiler is to raise the room temperature to say seventy degrees, but with the conventional indirect-heating systems this operation is performed simultaneously with that of raising the temperature of the tank water. It is thus quite obvious that with a heating boiler, particularly if somewhat undersized, the duty of heating the tank water is a more or less serious drag on its ability to satisfactorily heat the rooms, provided, as

is the case with the usual construction, both operations are to be performed at the same time.

It is also obvious that a method, applying to the foregoing conditions but changed in this respect, that automatically the heating of the rooms is first taken care of and immediately thereafter the duty of raising the temperature of the tank water is attended to, one duty at a time, is of great advantage because, eventually, heating of the rooms and the tank water can be effected by the use of a smaller size heating plant, and the heating of the rooms, in particular, accomplished in a shorter period of time.

Furthermore, the tank water, in the morning is comfortably warm anyway since during the night time the burner has been operating on low duty and kept the boiler water at a consistently high temperature, or sufficiently hot to have maintained the tank water in proper condition for personal use.

It is, therefore, axiomatic with my improved water-heating system that when the burner, assuming that oil or gas is used as the fuel burned, is open or operating at substantially full capacity, the heating of the tank water is temporarily suspended; and, conversely, when the burner shifts from high to low duty the tank water will start circulating and will gradually be raised in temperature by reason of the fact that the coil is submerged in boiler water which has become intensely hot during the period of open-burner operation of the apparatus. Burners using fluid as the fuel are made in two types, the intermittent and the high-low firing. The first is either full-on or full-off, whereas the second type is never wholly shut off, but works at two capacities, full or reduced. This type requires certain equipment for operating it.

I am not concerned, however, in my present invention, with the type of burner employed.

The character of the invention may best be understood by reference to the description found in the following specification when taken in connection with the accompanying drawing disclosing an embodiment which, at the present time, I consider preferable to other possible forms in which the invention might be carried out.

In the drawing in which like reference characters are employed to identify like parts in all views thereof—

Fig. 1 diagrammatically illustrates a steam heating boiler equipped with my invention;

Fig. 2 is a sectional elevation of an indirect heater;

Fig. 3 shows, in sectional elevation, a valve,

and solenoid for operating the same, the valve being shown open for free circulation of the boiler water;

Fig. 4 is a fragmentary view of the parts shown in Fig. 3, the valve being closed, and

Fig. 5 shows the indirect heater and tank combined.

Before beginning a detailed description of my invention I will state that while the apparatus will function and is applicable for use in heating plants using coal as fuel, provided, however, that proper stoking mechanism is supplied, I prefer to use it in connection with fuel-oil or gas-burner-equipped boilers, due to the fact that with the latter a closer and more rapid control of the heat is possible.

In order to disclose the functional characteristics of my improved water-heating system as applied to steam boilers, I will first give an outline of the operating features of the conventional type of indirect-heating apparatus, afterwards setting forth the particular duty devolving on the said improvement embodied in my invention.

In Fig. 1 of my drawing, B represents an ordinary house-heating steam boiler, O the oil or gas burner, and M the motor employed to operate the latter.

Disposed alongside the boiler, but in some cases spaced therefrom, is an ordinary type indirect-heating unit H, a sectional view of which is shown in Fig. 2.

The indirect heater comprises the cylindrical member H having one integral head Ha and a removable head Hb. From out of one side of the member H, near its upper end, is a pipe connection a extended to make connection with the boiler at a point below the normal water-level-line W. L. therein.

Likewise passing out of the cylinder member near its lower end is another pipe connection b extending to and into the boiler adjacent the lower end of the water-leg thereof.

It will thus be seen that, except as will hereinafter be pointed out, a continuous circulation of boiler water through the cylindrical member H may be had.

T is a tank designed to hold a supply of water which may be heated and used for household purposes. A pipe line d, constituting an extension of the upper end of the pipe coil c disposed within the cylindrical member H passes through the head Ha of the cylinder and extends to a midway portion of the tank T. Another pipe line e joining the lower end of the coil c passes through the lower head Hb and extended, enters the lower end of the tank T.

In some heating systems of indirect heating, the pipe coil c is placed inside the boiler B. Also in some cases the tank T is located in the basement of the building, with a heating coil therein (see Fig. 5). In all such alternative forms of construction and disposition of the members the principle underlying the system remains the same.

The cylinder H (see Fig. 2) holds hot boiler water B. W. which has passed out of and is free to return into the boiler through pipes a and b, respectively. The coil c contains hot water T. W. which can freely circulate through pipes d and e, flowing from the coil through pipe d to the tank T and returning to the coil through pipe e. Hot water withdrawn from the tank through pipe x for household use is replaced by cold water entering the tank through pipe y.

In one of the rooms of the building is a thermo-

stat device, constituting to all intents and purposes a switch S. It may be of the high voltage type, as shown, or operating in association with a transformer which cuts down the voltage.

Power line wires J and K enter the building and run, respectively, to the thermostat S and motor M, and a return wire E interconnects these two members. P, a pressure regulator of any approved type, is placed on line wire E in series with the thermostat and motor.

As the thermostat and pressure regulator are well known devices their constructional features need not be gone into in detail.

Installed on the pipe line a is my automatic circulation control mechanism, one type of which is shown in Fig. 3. Other means or methods of actuating this control valve are possible and for this reason I wish it understood that the present disclosure is illustrative only.

As illustrated, the control mechanism structure comprises a valve body 1, to the ends of which the pipes a, a have screw-threaded engagement, a valve 2, a valve seat 3, a valve spindle 4, and a stuffing-box 5.

Secured on the valve body is a bracket 6 and surmounting the latter is a solenoid 7. The solenoid armature 8 is attached to the end of the spindle 4 and a plunger 9, on an extended portion of the spindle, operates in a dash-pot 10. A vent 11 is provided at the upper end of the dash-pot.

To release the valve from its seat and return the parts to their original positions I employ the spring 12, this member acting after the solenoid has become de-energized.

The circuit wires F and G are joined to wires K and E, respectively, placing the circulation control element in parallel with the motor circuit.

The mechanism operates as follows:

From the start assume that the temperature of the room X has dropped to a point corresponding to the low setting of the thermo-switch S, at which point the burner would operate only spasmodically without raising the temperature of the rooms appreciably. Upon setting the thermo-switch to the high setting (say to bring the temperature to seventy degrees) the motor starts, and immediately is operating at full capacity.

Now in closing the motor circuit E-K the current in circuit F-G, which is in parallel with circuit E-K, causes the solenoid 7 to be energized and the valve 2 to close, as shown in Fig. 4.

At this time the circulation of boiler water through the indirect heater is temporarily suspended and this results in conserving heat which can for a time be utilized exclusively for raising steam for heating the rooms in the house.

The demands on the heating apparatus are usually greatest in the morning, following a night during which the temperature has dropped in the rooms to say fifty-five or sixty degrees. The boiler is in most cases forced, to hasten the raising of steam for heating the rooms and the pressure will frequently rise to the maximum allowable before the temperature in the thermostat equipped room acts to operate the thermostatic switch S which might otherwise operate to break the circuit to the motor, stopping the burner.

In this event the pressure regulator P functions, and its actuating parts break the motor circuit and shut off the burner until the pressure drops in the boiler sufficiently to permit the cir-

cuit to be again closed and the burner started.

This procedure continues until the room temperature finally arrives at the degree corresponding to the high setting of the thermostat switch S; thereafter this latter member takes care of the burner operation.

The stopping of the burner, however, does not seriously retard the heating of the rooms, as upon the pressure in the boiler falling slightly below the point where the regulator breaks the motor circuit, the latter will close, and the burner again become active.

It is to be noted that in cases where the valve 2 is operated electrically, the times it is open will, or may be, slightly different depending on whether it is connected to the burner electric circuit ahead of or behind the pressure control; or what amounts to the same thing, whether it is connected in series with the thermostat or in parallel with the burner motor.

In the latter case valve 2 opens whenever the burner stops. In the former case there may be times when the pressure control mechanism shuts off the burner while the thermostat circuit is closed, in which case the power will still be on the valve, keeping it closed.

Whichever method is used does not affect the general character of the invention, the only thing affected being the time that heat transfer to the hot water circuit takes place. The principal feature, that when the house heating load is on, the hot water load is off, is not affected.

To attain this object the wire E is continued to E'. Then a two-pole manually actuated switch 13 is placed in line G so that, as shown in full lines in Figs. 1 and 6, the circuits are arranged with the valve-control parts in parallel with the burner circuit. Now by swinging the switch arm to make connection between lines G and E (through E') a circuit is established which places the valve 2 in series with the thermostat S.

In Fig. 6, the central dotted line depiction of the switch 13 shows all circuits to the valve-actuating mechanism broken. It can be left in this position, for instance, in the summer time or periods when the rooms require no, or very little, heat, and the burner works only intermittently to keep the boiler water hot enough to indirectly heat the domestic supply.

I am not particularly concerned as to the specific method or means employed to actuate the valve 2 so long as its operation is timed with the operation of the burner in a manner hereinbefore set forth.

In fact I am aware that a motor-actuated valve mechanism is on the market which without doubt would serve acceptably and satisfactory for the purpose which the solenoid 7 is herein disclosed as being used.

Furthermore, this valve 2 and its operating mechanism may be placed on pipe line d, or on pipe lines b or e, the same result being attained in either case, that is, to open or close the circulation of water in either lines carrying boiler water or domestic tank water, in timed relation to burner operation.

The particular advantages accruing in the aforesaid water-heating system when equipped with my improvement are all in line with economy. First, a smaller size boiler can be used.

For instance, in estimating the size of the heating plant in a new installation the maximum capacity of the boiler need not necessarily include the tank water-heating service since this duty is performed separately, or while the burner

is temporarily out of action. This saves in capital investment.

Then, too, the improvement applies and finds exceptional merit when added to a heating equipment already installed and which, incidentally, may be of a capacity equal to handling both heating loads without difficulty. By dividing the heating duty, however, the boiler can be operated at less expense because of the fact that a lower burner adjustment is called for in raising the room temperature, which saves fuel, or if this is not the main consideration the burner may be operated at full capacity in order to more quickly heat the interior of the house.

What I claim is:

1. A heating apparatus comprising in combination a boiler, a burner therefor, a motor to actuate said burner, a room-heating system connected to said boiler, a thermostat-switch adapted to respond to temperature changes in the rooms within which is said heating system, an electric circuit from said thermostat-switch to said motor, an indirect water-heating member through which water from said boiler may circulate, a valve between said boiler and said indirect water-heating member, actuating means for opening and closing said valve, and an electric circuit placed in parallel with said burner motor adapted in association with said valve actuating means to open said valve immediately said thermostat-switch acts to stop said motor.

2. A heating system adapted for the dual purpose of house and domestic water heating, comprising in combination with a boiler having a motor-driven burner therefor, a thermostatic element placed in a room of the house and responsive to the rise and fall of the temperature therein, a pressure-control element on said boiler, a receptacle for containing a supply of water for domestic use, means for heating the water in said receptacle through the agency of the hot water in said boiler, a water-circulation-control valve in the domestic water-heating portion of said heating system, a valve-actuating mechanism associated with said valve, a house-heating circuit having connection with said boiler, an electric power circuit in which are placed said thermostatic element, said motor-driven burner, and said pressure-control element, a second electric power circuit in which is said valve-actuating mechanism, and a manually actuated, two-pole switch adapted, when thrown in one direction, to close the said valve-actuating mechanism circuit and place it in parallel with said burner motor circuit, and when thrown in the opposite direction to place said valve-actuating mechanism in series with said thermostat when the thermostat is calling for more heat in the room of the house, during which period said valve remains closed regardless of whether the burner motor is operating at full or less than full capacity.

3. In a heating apparatus, a boiler, an electrically equipped pressure regulating device on said boiler, a house heating circuit connected to the boiler, a burner for supplying heat to the boiler, means for operating the burner, thermostatic means located in the house for controlling the operation of the burner, a hot water circuit operatively connecting the boiler below its water line to a hot water storage tank and heating the water in said storage tank through a heat transfer type indirect heater, a valve in the hot water circuit, means for operating said valve, so that, when the burner is running with its full fire the hot water circuit will be shut off, and will remain

shut off until the burner motor circuit is interrupted the said interruption occurring at said pressure regulating device when the boiler pressure has risen to a predetermined amount, or at the said thermostatic means when the temperature in the house has reached a predetermined degree, at which times said hot water circuit will be opened.

4. In a heating apparatus, a boiler, a house heating circuit connected to the boiler, a burner of the intermittent firing type for supplying heat to the boiler, means for operating the burner, a hot water circuit operatively connecting the boiler below its water line to a hot water storage tank and heating the water in the storage tank through a heat-transfer type indirect heater, a valve in the hot water circuit, means for operating said valve, whereby, when the burner is firing, the hot water circuit will be shut off, and conversely, when the burner is not firing the hot water circuit will be opened.

5. In a heating apparatus the combination of a boiler, a house heating circuit connected to the boiler, a burner for supplying heat to the boiler, means for operating said burner, a hot-water circuit connected to the boiler, said hot-water circuit containing a heat transfer type indirect heater in which one side of its heating surface is in contact with the boiler water and in which the other side of its heating surface is in contact with water circulating from and to a hot water storage tank, a valve in the hot water circuit for preventing, when closed, circulation of water in the part of said hot water circuit in which said valve is located, and allowing, when open, said circulation, means for automatically closing said valve and keeping it closed when said burner is operating with its high fire, and means for automatically opening said valve and keeping it open while the burner is not operating with its high fire.

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