S. DE W. CHAPMAN.

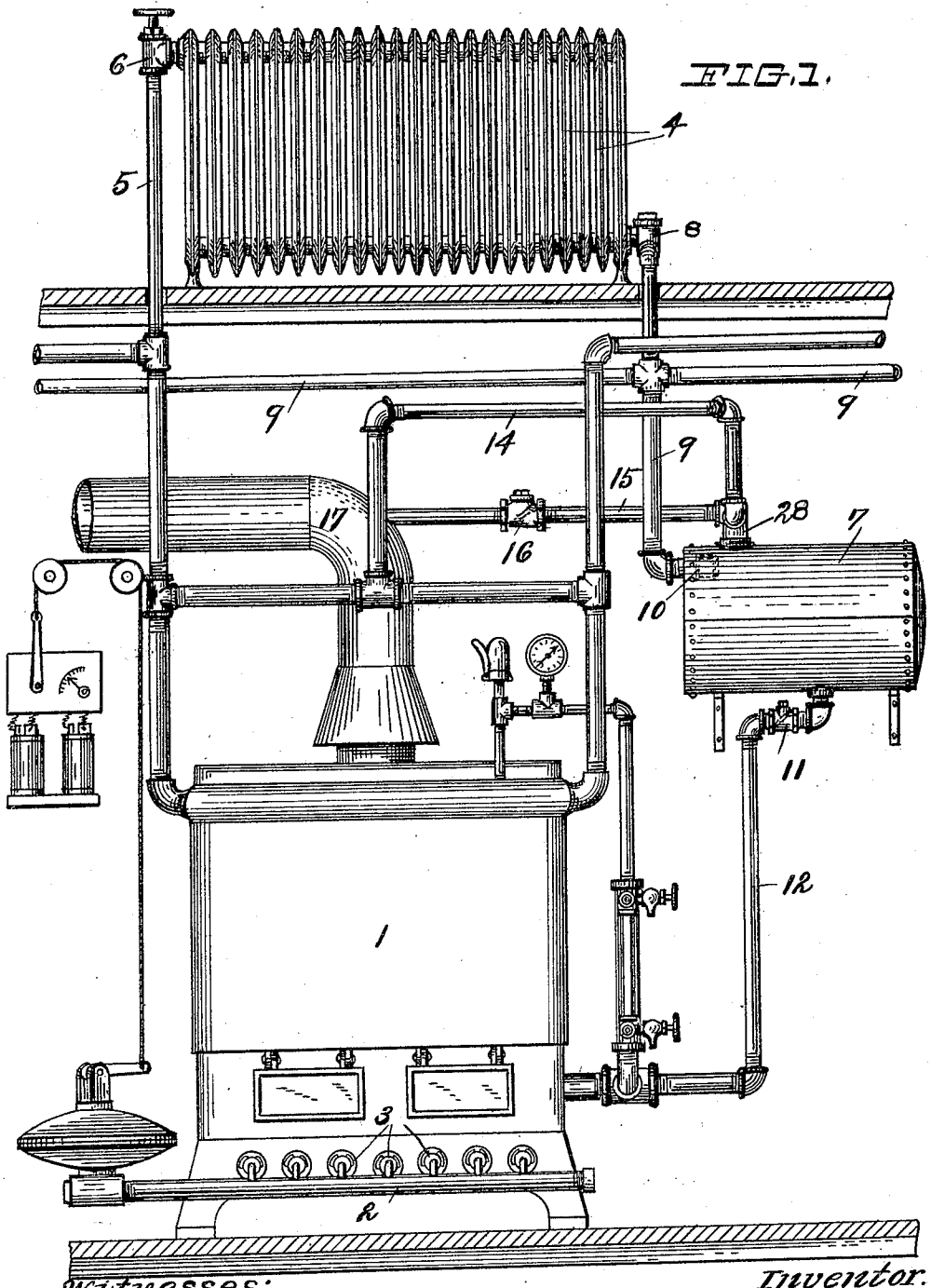
HEATING APPARATUS.

APPLICATION FILED SEPT. 16, 1914.

1,405,281. Patented Jan. 31, 1922.

4 SHEETS—SHEET 1.

FIG. 1.



Witnesses:
J. C. Turner
Earl C. Carlson

Inventor.
Solomon DeWitt Chapman.
By Harry Grease
Attorney.

S. DE W. CHAPMAN.

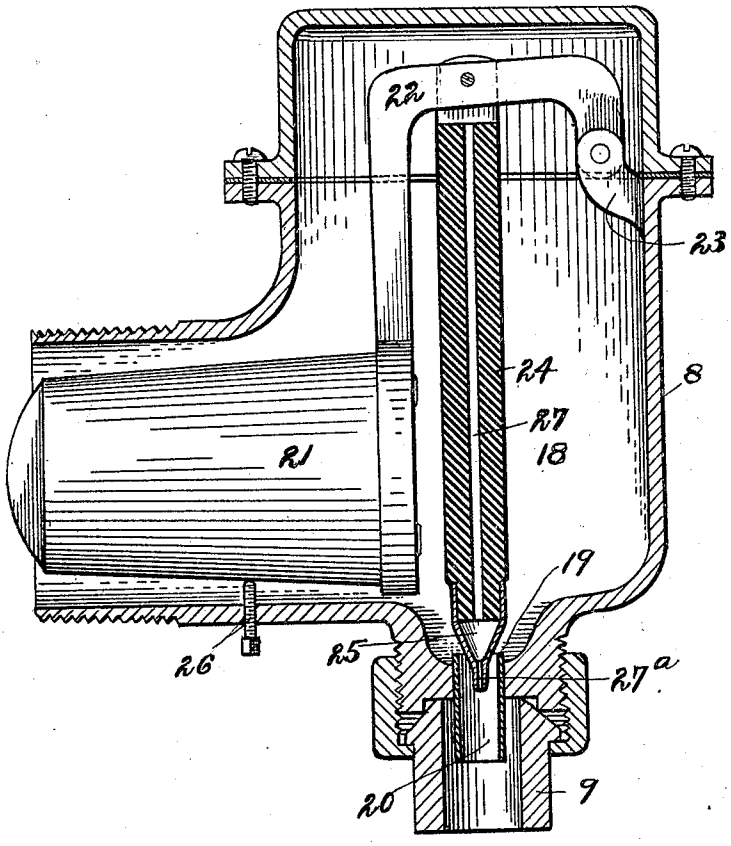
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4 SHEETS—SHEET 2.

FIG. 2.



Witnesses:
J. C. Turner
Earl C. Carlson

Inventor:
Solomon DeWitt Chapman.
By Harry Grease
Attorney.

S. DE W. CHAPMAN.

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4 SHEETS—SHEET 3.

FIG. 3.

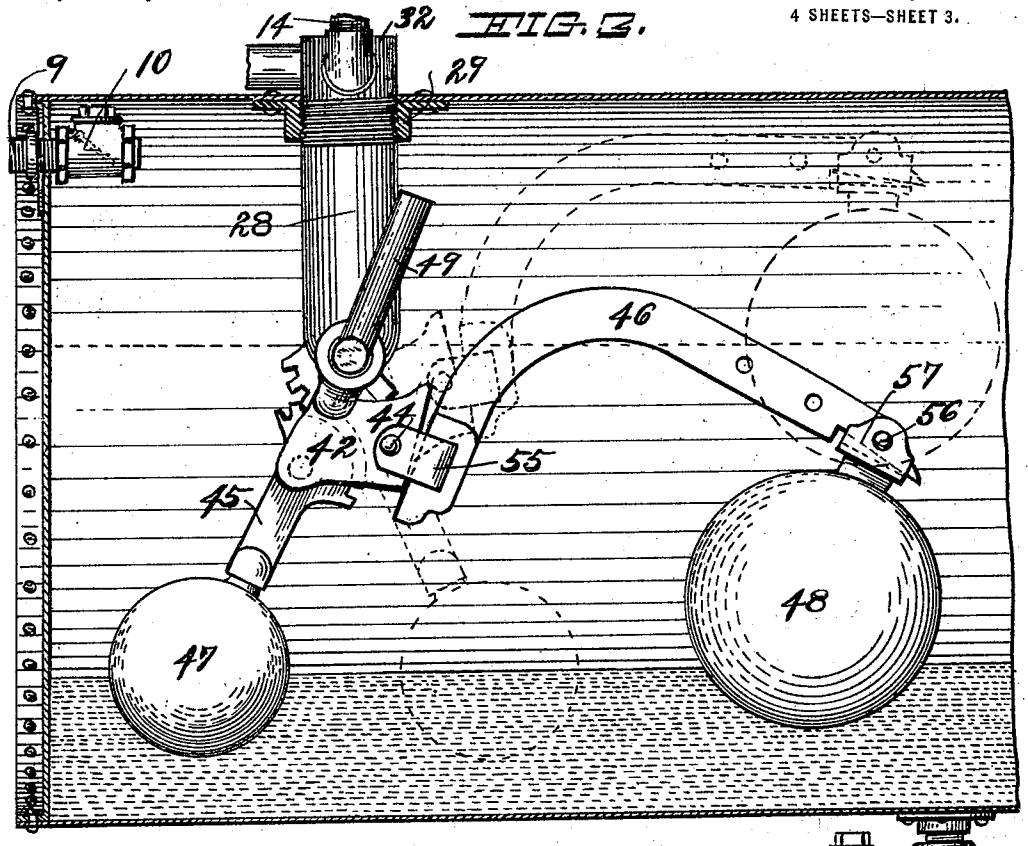
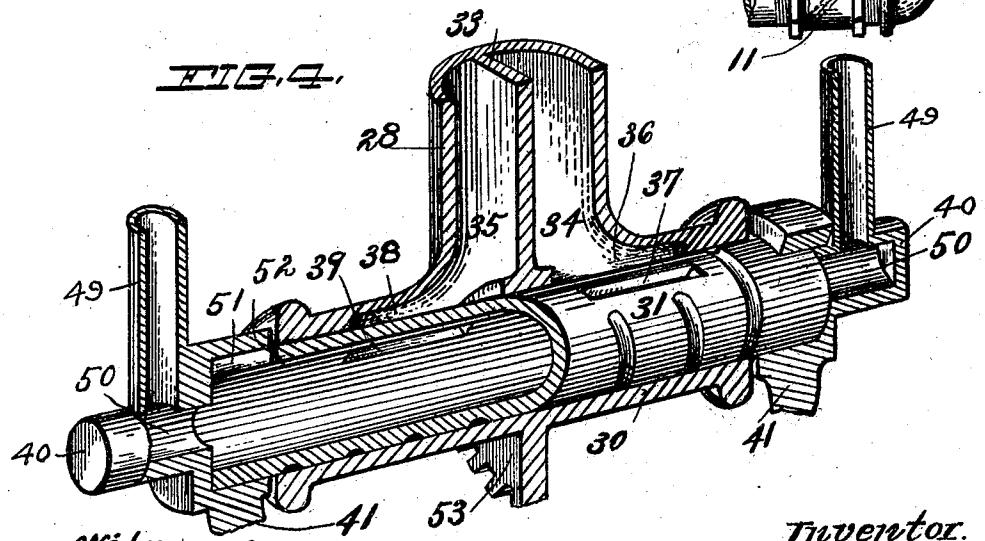


FIG. 4.



Witnesses:
J. C. Turner
Earl C. Carlson

Inventor.
Solomon DeWitt Chapman.
By Hawgrease
Attorney.

S. DE W. CHAPMAN.

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4 SHEETS—SHEET 4.

FIG. 5

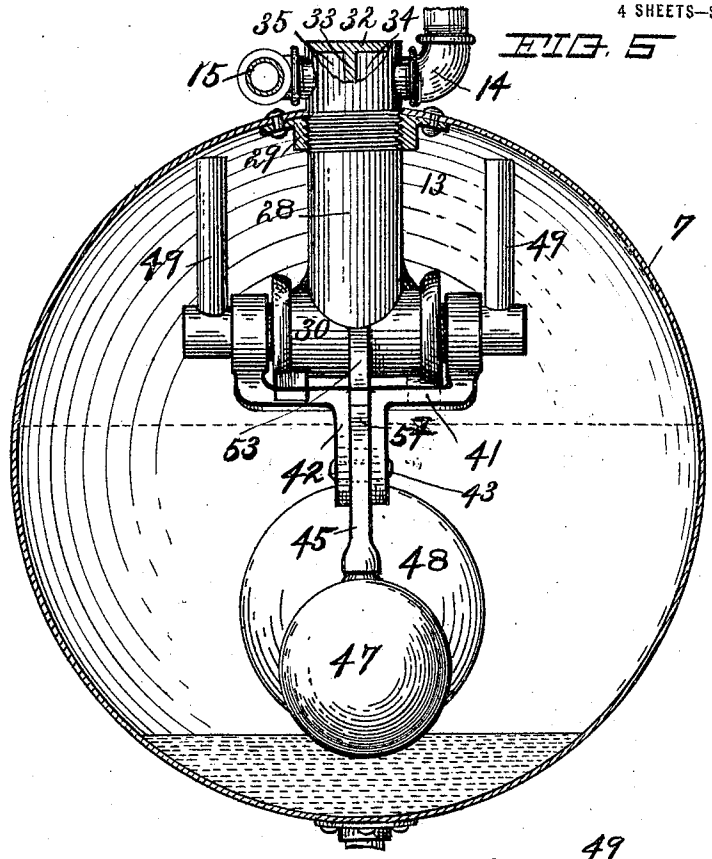


FIG. 7.

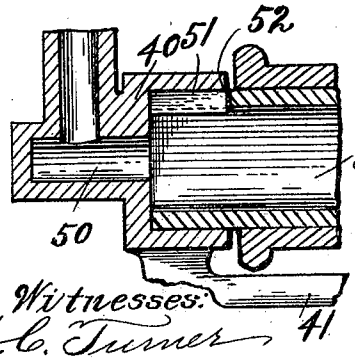
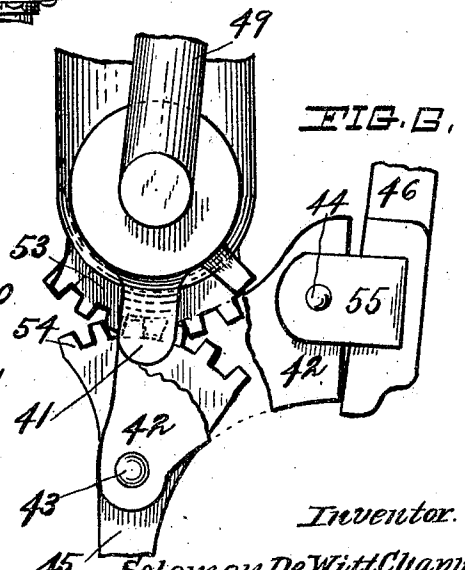


FIG. 8.



Witnesses:

J. C. Turner

Earl C. Carlson.

Inventor.

Solomon DeWitt Chapman.

BY Harry Grosse

Attorney.

UNITED STATES PATENT OFFICE.

SOLOMON DE WITT CHAPMAN, OF CANTON, OHIO.

HEATING APPARATUS.

1,405,281. Specification of Letters Patent. Patented Jan. 31, 1922.

Application filed September 16, 1914. Serial No. 862,011.

To all whom it may concern:

Be it known that I, SOLOMON DE WITT CHAPMAN, a citizen of the United States, residing at Canton, in the county of Stark and State of Ohio, have invented certain new and useful Improvements in Heating Apparatus, of which the following is a specification.

The invention relates to heating apparatus including a water heater and one or more steam or vapor condensing radiators; and the object of the improvement is to combine in such apparatus suitable return valves for the radiators, and a return trap for the heater, having such characteristics that the apparatus may be operated at either greater or less than atmospheric pressure, respectively with live steam or vapor within the system; and so that in either case there will be such a circulation as will constantly eliminate the water and air at any temperature from the radiators and the piping system, and will return the water of condensation to the heater without the use of a piston pump, or other external operating power or means.

In other words, it is the purpose of the present invention to provide a self-contained and automatically controlled heating apparatus which may be operated either at less than air pressure with vapor, or at greater than air pressure with live steam, depending upon the amount of fuel applied to the heater; and in either case the water of condensation at all temperatures will be automatically drained from the radiators and the piping system and returned to the water heater by a steam-actuated condenser-trap, and at the same time all air will be drained and exhausted therefrom.

The objects of the invention are attained by the construction, mechanism and arrangement illustrated in the accompanying drawings, in which—

Figure 1 is an elevation of the complete apparatus, showing, however, but one radiator of the system;

Fig. 2, an elevation section of one of the radiator return valves;

Fig. 3, a side elevation section of the condenser-trap, showing the quick-acting float-valve therein in normal closed or exhausting position;

Fig. 4, a longitudinal section of the float-valve in neutral position;

Fig. 5, a transverse section of the condenser-trap, showing the float-valve therein, as in Fig. 3;

Fig. 6, a fragmentary side view of the trap-valve gearing; and

Fig. 7, a fragmentary section of one end of the actuating valve.

Similar numerals refer to similar parts throughout the drawings.

The apparatus includes the water heater 1, which may be supplied with gas through the pipe 2 and the burners 3; one or more coils or radiators 4, which receive steam or vapor from the heater through the pipe 5 and the inlet valve 6; the condenser trap 7, which receives water and air from each radiator through the radiator return valve 8, the drain pipe 9 and the check valve 10.

The condenser-trap also communicates with the lower or water compartment of the heater 1 through the check valve 11 and the feed pipe 12; and is provided with the quick-acting float-valve 13 which receives steam from the heater through the pipe 14, and may exhaust through the pipe 15 provided with the check valve 16 into the smoke pipe 17 of the heater.

Each radiator return valve 8 may be of the type shown in my Patent No. 1,006,629, and is provided with the valve chamber 18 having the valve seat 19 in its lower end which may be formed by the upper end of the adjustable outlet tube 20 leading downward into the drain pipe 9. The float 21 is located in the return-valve chamber 18, and is secured on the arm or lever 22 having its end pivoted to the wall of the return valve 8, as by the bracket 23.

The pendent stem 24 is pivoted to the arm 22, and is provided with the inverted cone valve 25 on its lower end adapted to operate in and upon the seat 19. The valve stem 24 is made of hard rubber or other suitable material adapted to be expanded or extended endwise by the action of heat, and an adjustable rest or stop 26 may be provided for the float 21.

The parts of the radiator return valve are so proportioned and arranged that when the valve is cold, the float 21 will rest upon the stop 26, and the valve stem 24 will be contracted so as to slightly open the outlet tube 20 leading from the bottom of the valve chamber; and that when the valve is heated, the expansion of the stem 24 will close the valve upon its seat at any given temperature to which the parts may be adjusted.

When the valve is thus heated and closed, it is evident that an accumulation of water

of condensation in the chamber will lift the float with the valve stem and thereby open the valve so as to permit a discharge or drainage of the water from the valve chamber; and the capillary passages 27 and 27ª are provided in the valve stem and the conical valve which permit the passage of dry air or vapor into the drain pipe from the upper end of the valve chamber at all times, but will be sealed by water of condensation to prevent the similar discharge of steam.

And finally, when the valve is cooled after being heated, as by closing the inlet valve to the radiator or by a cooling of the heater, it is evident that water of condensation will intermittently drain through the outlet of the valve chamber by the recurring elevation of the valve stem by the float as the water accumulates in the chamber; which method of drainage continues until the cooling of the water so contracts the length of the valve stem as to open the valve when the float is seated upon its rest, after which the water of condensation will drain freely through the outlet without an elevation of the float.

The return valve may, therefore, be described in terms of its functions, as means for checking the escape of steam from the outlet of the radiator, and for permitting a substantially continuous drainage of water and air therefrom under all temperatures and conditions of use.

The actuating valve 13 for the condenser-trap is of a quick-acting type, and is operated by a compound float mechanism. The valve case is preferably formed as an inverted T, with the upright tubular stem 28 secured in and through the top wall of the trap as by means of the screw bushing 29; and the transverse tubular bearing head 30, in which is located the tubular valve 31 which is adapted to operate by rotating in the bearing head of the case.

The upper end of the tubular stem of the valve case is closed by the wall 32, and the cross wall 33 divides the stem into the two independent lateral passages 34 and 35; the former of which constitutes the steam inlet passage, and the latter of which constitutes the exhaust outlet passage for the valve.

The steam pipe 14 leading from the heater communicates with the upper end of the steam inlet passage 34, and the lower end of said passage communicates with the steam inlet port 36 formed in the tubular wall of the head of the case, which port 36 is arranged to register with the corresponding port 37 provided in the tubular valve when the same is rotated into open position for admitting steam into the condenser through the open ends of the tubular valve.

The exhaust passage 35 in the tubular stem 14 of the case likewise communicates with the exhaust port 38 provided in the tubular wall of the crosshead of the valve case, and is arranged to register with the corresponding port 39 provided in the tubular wall 31 of the valve when the same is rotated into closed position, as shown in Fig. 3, for exhausting steam from the condenser through the open ends of the tubular valve.

And the upper end of the exhaust passage 35 communicates with the exhaust pipe 15 in which is provided the check valve 16 for preventing the suction or return of air into the condenser chamber through the exhaust pipe, which pipe may be arranged to deliver the exhaust into the smoke pipe 17 of the heater, as shown.

The open ends of the tubular valve 31 preferably extend beyond the ends of the tubular head 30 of the case. These ends are also partially closed by the caps 40 formed on or secured to the pendent brackets 41 which carry the pendent plates 42, in which plates are provided bearings for the pivots 43 and 44 of the arms 45 and 46 which carry the main float 47 and the trip float 48, respectively.

The caps 40 are preferably provided with upright tubular extensions 49 which communicate with the interior of the tubular valve through the axial passages 50 formed in the body of each cap, and have their upper open ends located in the upper portion of the trap, so that steam will be discharged into and exhaust received from the trap chamber above the level of the water therein, thus preventing the discharge of any water with the exhaust from the trap, or a condensation of the steam by passing through the water.

The caps 40 are keyed on the ends of the valve as by means of the lugs 51 engaging in the notches 52 provided in the ends of the valve, so that the valve will be rotated for its operation by an oscillation of the pendent bracket 41; for which purpose the gear segment 53 is provided on the lower side of the tubular head 30 of the valve case, and the corresponding gear segment 54 is provided on the upper end above the pivot 43 of the arm 45 which carries the main float 47; and it is evident that an oscillation of this float to and fro upon its pendent pivotal bearing in the ears 42 of the brackets 41, and the intermeshing of the gear segments, will serve to rotate the valve from open to closed position, and vice versa.

The inner end of the arm 46 which carries the trip float 48 is journalled on the pivot 44 by means of the clevis 55, and the contiguous parts of the ears 42 and the arm 46 are spaced at a slight interval so as to give a certain amount of looseness or play in the joint, which is limited by the stops formed by said contiguous parts; and the trip float 48 is similarly connected to the pivot 56 on the end of the arm 46 by means

of the clevis 57, with a like play between the contiguous parts, so that the float can oscillate a short distance to and fro upon the end of the arm.

The check valve 10 is provided at the outlet of the otherwise closed drain pipes 9, leading into the upper part of the condenser-trap, which permits water and air to flow freely by gravity into the trap, but checks a reverse flow of steam or air toward the radiators; and the check valve 11 is provided in the feed pipe 12 leading from the bottom of the trap chamber downward into the heater, which permits a free flow of water from the trap to the heater and stops a return flow of water or steam from the heater to the trap.

When the heating apparatus is operated under steam pressure, and the actuating valve in the condenser-trap is in closed position, that is to say, with its steam ports closed and its exhaust ports open, it is evident that the water of condensation and air will drain freely downward by gravity from the radiators through the return valve 8 and the drain pipes 9 and the check valve 10 into the upper portion of the trap chamber; such drainage being permitted by the fact that the check valve 11 in the feed pipe prevents the pressure from the heater from passing into the trap chamber.

When the water of condensation and air enter the trap chamber, the water flows downward into the bottom thereof and fills the chamber to a gradually increasing depth, while the air may escape through the open exhaust ports of the actuating valve by entering the same through the upper ends of the tubular extensions 49, and thence escaping through the exhaust pipe 15 and the check valve 16 into the smoke pipe 17.

When the actuating valve 13 is in its closed or normal position, the main float and the trip float, and their carrying arms and gearing connections are in the position shown in Fig. 3, with the trip float hanging downward in its lowest position, and the main float oscillated to the end of its movement in the direction opposite from the trip float.

As the surface of the water of condensation rises in the trap chamber, the buoyancy of the trip float causes it to swing inward toward the main float, without raising its carrying arm 46, until further inward movement with reference to the arm is stopped by the abutment of the contiguous parts of the joint; whereupon a further elevation of the trip float caused by the rising water, lifts the outer end of its carrying arm by rotating it upon its pivot 44, but without swinging the brackets and plates depending from the valve until such free relative movement of the trip float and its arm are stopped by the abutment of the contiguous parts of the joint; during which preliminary elevation of the trip float, it is evident that the main float is held by its buoyancy in its normal position on the opposite side of the valve, in which position it keeps the steam ports entirely closed and the exhaust ports fully open.

By this construction and arrangement of the trip float with reference to the valve and the main float, it is evident that the surface of the water of condensation may rise a considerable distance upward into the trap chamber before the exhaust ports are closed and the steam ports opened by an oscillation of the main float; after which a further rising of the trip float by its gearing connection with the main float serves to swing the same inward until it approaches a position directly under the axis of the valve; by which time the trip float has so risen that its center passes outward beyond a position directly beneath its pivotal support, whereupon its buoyancy carries it quickly outward until such movement is suddenly stopped by the abutment of its contiguous joint parts, the jar of which carries the main float quickly beyond its neutral position directly below the axis of the valve; after which the buoyancy of the main float, which is by this time completely submerged in the water of condensation, acting with instead of against the buoyancy of the trip float, causes both floats to swing immediately full way into open position, so that the valve ports are quickly opened to the full extent; during which action the trip float may be thrown upward entirely above the water.

When the actuating valve is thus opened, steam under pressure in the water heater rushes quickly through the steam pipe 14 into the trap chamber above the water therein, and by equalizing the pressure therein with respect to the pressure in the heater, permits the water of condensation to return by gravity downward through the check valve 11 and the feed pipe 12 into the heater; the check valve 10 preventing this pressure from reaching the radiators through the drain pipe 9, and the closing of the exhaust ports in the actuating valve preventing any escape of the steam or pressure through the exhaust pipe 15.

The reverse operation of the actuating valve 13 is accomplished in a similar manner by the sinking of the surface of the water in the condensation trap as the same flows by gravity back into the heater. In this operation, the main float is held by its buoyancy in full open position at the end of its oscillation toward the trip float until the surface of the water descends far enough in the trap chamber to permit the main float to swing downwardly and laterally toward a position directly under the axis of the valve; during which time the trip float and its car-

rying arm is held upward above the water during the time the greater portion of the same is flowing out of the trap chamber, and during the same time the steam valves remain open so as to continue the equalization of pressures in the trap and the heater.

When, however, the main float approaches the position directly under the axis of the valve, the weight of the trip float and its carrying arm serves to swing the main float quickly past its neutral position, which is also the neutral position of the valve between an opening of its steam and exhaust ports; whence the buoyancy of the main float quickly carries it laterally to completely close the steam ports and open the exhaust ports; whereupon a portion of the steam in the trap chamber exhausts through the pipe 15 until the pressure within the trap is equal that of the atmosphere, while the remaining portion thereof condenses in the trap chamber and forms a partial vacuum therein, which is maintained by the presence of the check valve in the exhaust pipe; and this partial vacuum, by extending through the drain pipes, reaches the outlets of the return valves, so that none of the radiators is ever subject to a back pressure, either from the condenser trap or from another radiator.

By these means it is evident that the heating apparatus will automatically operate under steam pressure, and that there will be an opportunity for drainage of air and water of condensation from each radiator to the condenser trap, an opportunity for an escape of air from the condenser trap, and a feeding of the water of condensation back into the heater, without at any time affecting by back pressure or otherwise the proper operation of any one of the radiators or of the return valves associated therewith.

When it is desired to operate the apparatus with a partial vacuum or less than air pressure throughout the system, the same can be done by merely reducing the heat of the water to less than the steam producing temperature at atmospheric pressure, and it is evident that the constant condensation of aqueous vapor which rises into and fills the radiators—the air and water of condensation being drained therefrom, as above described—serves to create a partial vacuum in the radiators and through the supply pipes 5, which partial vacuum extends into the heater above the water.

After the apparatus has been operated under steam pressure, the partial vacuum which has been created in the trap chamber and throughout the drain pipes by the operation of said chamber as a condenser, may and no doubt does extend through the return valve either through the capillary passage 27 in the thermostatic stem thereof, when this passage is not sealed by water of condensation; or at any event, through the outlet tube 20 when the same is intermittently opened by the action of the valve float for the drainage of water from the valve chamber, which gives an opportunity for equalizing the pressure throughout the system.

At any event, the aqueous vapor which rises from the water in the heater at less than steam producing temperature at atmospheric pressure, flows upward through the supply pipes 5 and inlet valves 6 into the several radiators, and the water of condensation therefrom flows downward by gravity through the return valve 8 and the drain pipes 9 into the chamber of the condenser-trap; whence the water flows on downward through the feed pipe 12 into the heater to seek its level therein; which it is free to do by gravity because of the absence of pressure upon the water in the heater.

Under these circumstances, it is obvious that none of the water of condensation will remain in the trap chamber, it being assumed, as shown, that the same is located above the level of the water in the heater, but that the water will merely flow through the trap chamber without stopping therein as it flows by gravity from the radiators back into the heater; from which it is evident that the heating apparatus, having combined therein the elements as herein described, may be operated with temperatures in the heater which will produce steam and the corresponding pressure throughout the heater and the radiators, or at such reduced temperatures as will produce vacuum vapor at less than air pressure throughout the heater and the radiators; and that in either event there will be a substantially continuous and automatic circulation and return by gravity of the water of condensation from the radiators through the drain pipes, the condenser-trap and the feed pipe to the heater, with an accompanying elimination of air from the system through the exhaust ports of the trap actuating valve whenever the pressure in the trap chamber is equal to or greater than atmospheric pressure; a reverse suction of air into the system through the same ports, when there is a partial vacuum in the trap chamber, being prevented by the check valve 16 in the exhaust pipe 15.

It is also evident that whether the apparatus is operated with a pressure or a partial vacuum within the heater and the radiators, such pressure will never be present in the drain pipes, and that none of the radiators will ever receive back pressure from the heater, the trap chamber, or another radiator, to interfere with its proper and efficient operation.

I claim:

1. Heating apparatus including a water

heater, one or more radiators having inlets communicating with the heater and outlets permitting drainage of water and air and checking the flow of steam or vapor therefrom, a condenser trap, checked drainage pipes leading from said outlets to the trap and from the trap to the heater, a checked air exhaust pipe, and means for alternately supplying steam to the trap and discharging air therefrom.

2. Heating apparatus including a water heater, one or more radiators having inlets communicating with the heater and outlets permitting the drainage of water and air and checking the flow of steam or vapor therefrom, a condenser trap having checked drainage communication with the outlets, a steam pipe from the heater to the trap, a checked exhaust pipe from the top of the trap to the atmosphere, a checked drainage pipe leading from the trap to the heater, and valve means alternately opening the steam pipe and closing the exhaust pipe for draining water from the trap to the heater, and closing the steam pipe and opening the exhaust pipe for discharging air from the trap.

3. A heating apparatus including a water heater, one or more radiators having inlets communicating with the heater and outlet means for checking the flow of steam and permitting the drainage of water and air therefrom, and a drainage system including a condenser trap having inlet and outlet check valves, drain pipes leading from the radiator outlets communicating with the condenser only through the trap inlet check valve, an exhaust pipe having a check valve leading from the top of the trap, a feed pipe leading from the outlet of the trap to the heater, a valved steam pipe leading from the heater to the trap, and means actuated by the rising of water in the trap for intermittently closing the exhaust pipe and permitting a flow of steam from the heater into the top of the trap.

SOLOMON DE WITT CHAPMAN.

Witnesses:

EARL C. CARLSON,

LOUISE M. CORBY.