No. 816,972. PATENTED APR. 3, 1906.

C. A. DUNHAM.

VACUUM HEATING SYSTEM.

APPLICATION FILED MAR. 16, 1905.

2 SHEETS—SHEET 1.

Fig. 1.

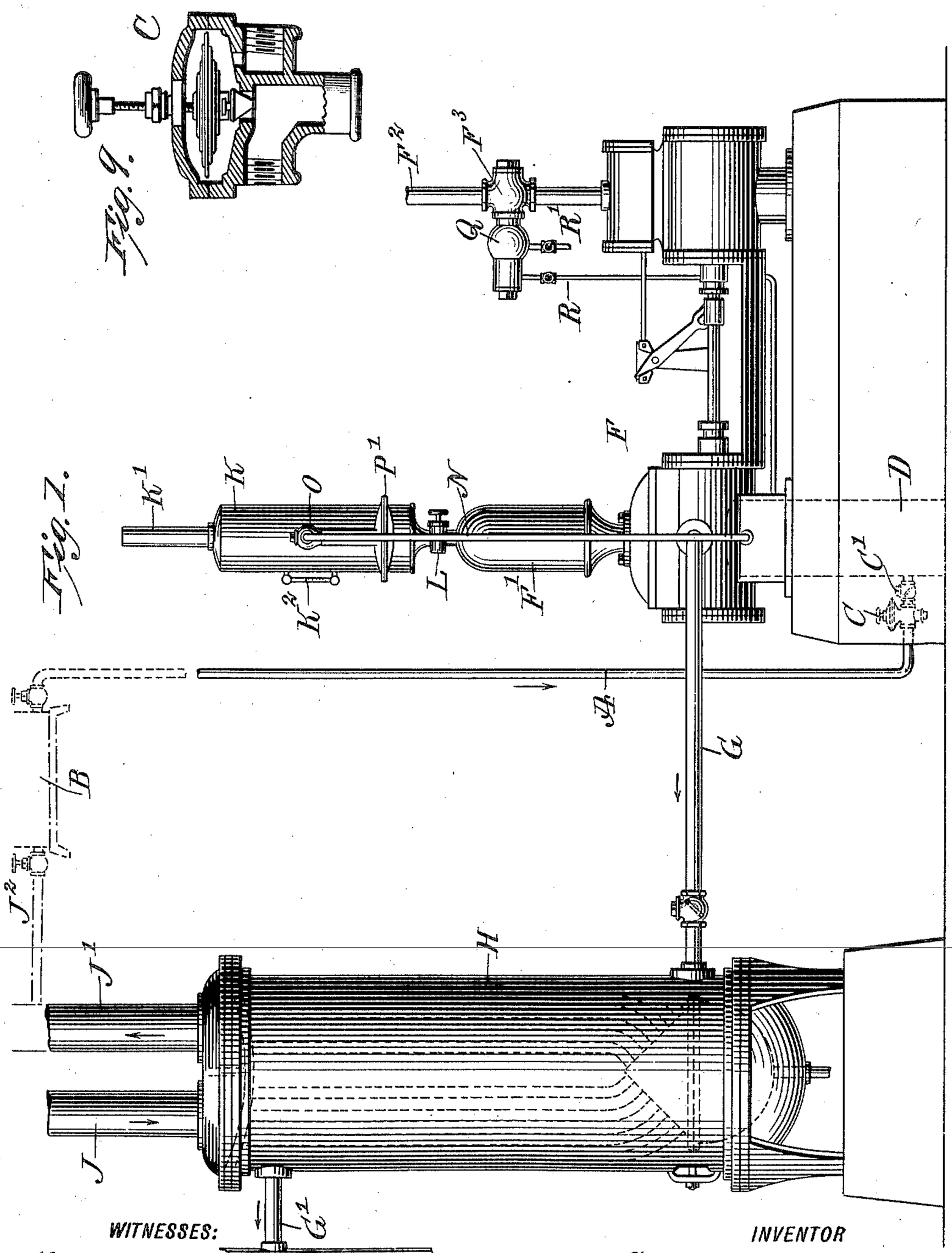

Fig. 2.

WITNESSES:

Edward Thorpe.

Percy Hooker.

INVENTOR

Clayton A. Dunham

BY Munn & Co

ATTORNEYS

No. 816,972. PATENTED APR. 3, 1906.

C. A. DUNHAM.

VACUUM HEATING SYSTEM.

APPLICATION FILED MAR. 16, 1905.

2 SHEETS—SHEET 2.

Fig. 2,

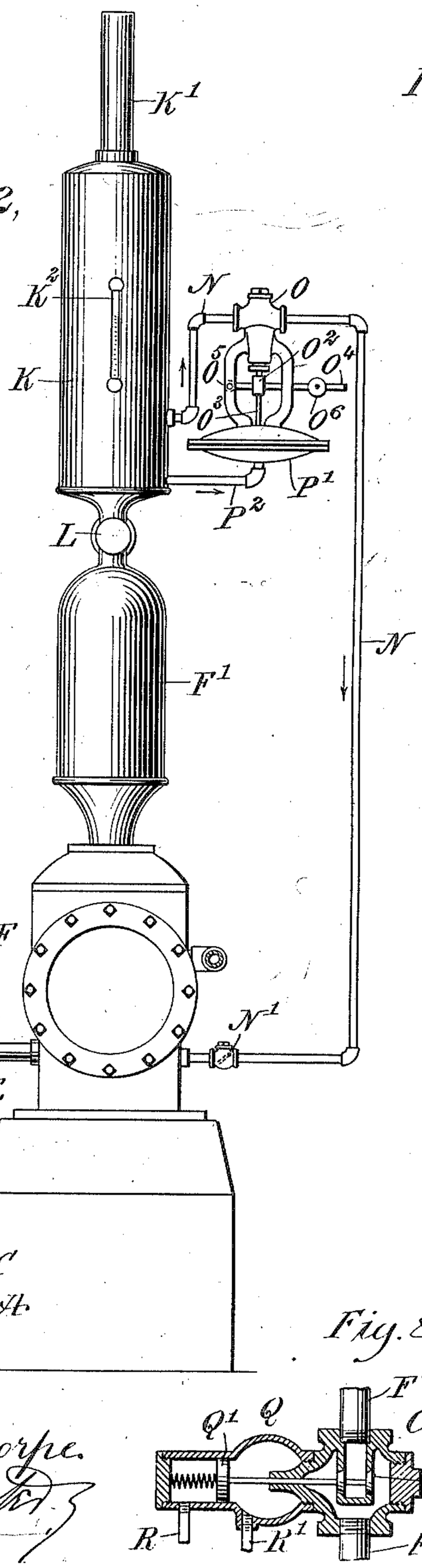

Fig. 3,

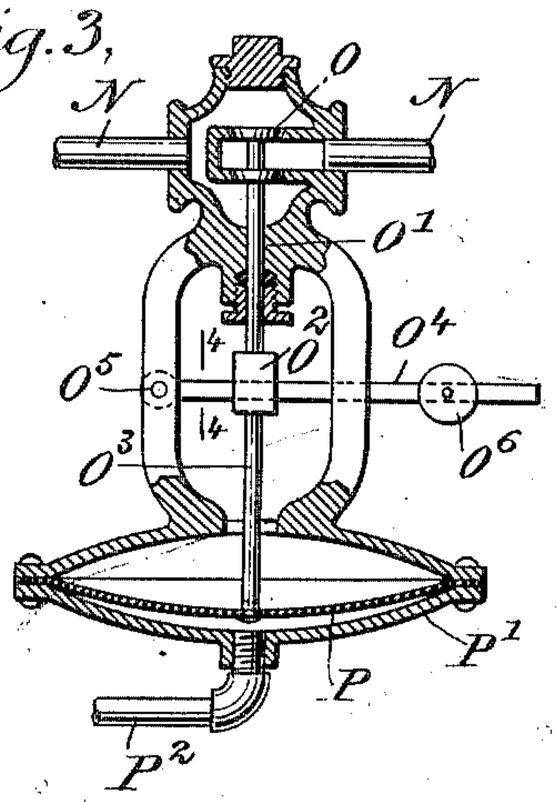

Fig. 4,

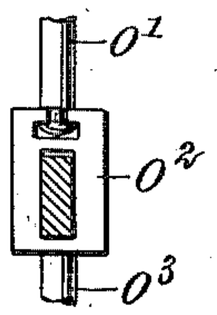

Fig. 5,

Fig. 6,

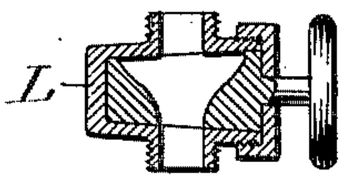

Fig. 7,

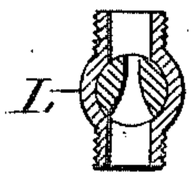

Fig. 8.

WITNESSES:

Edward Thorpe.

Rev. J. Hoover

INVENTOR

Clayton A. Dunham

BY Munn & Co

ATTORNEYS

UNITED STATES PATENT OFFICE.

CLAYTON A. DUNHAM, OF MARSHALLTOWN, IOWA.

VACUUM HEATING SYSTEM.

No. 816,972. Specification of Letters Patent. Patented April 3, 1906.

Application filed March 16, 1905. Serial No. 250,403.

To all whom it may concern:

Be it known that I, CLAYTON AUBRA DUNHAM, a citizen of the United States, and a resident of Marshalltown, in the county of Marshall and State of Iowa, have invented new and useful Improvements in Vacuum Heating Systems, of which the following is a full, clear, and exact description.

The object of the invention is to provide certain new and useful improvements in vacuum heating systems whereby a thorough and uniform heating is insured, a partial vacuum may be maintained throughout the system, only one pump is employed for returning the water of condensation directly to the boiler, the use of air-escape valves on the radiators or like heating mediums is dispensed with, and the air in the water of condensation is separated from the water and is discharged at the pump, which latter is kept primed at all times.

The invention consists of novel features and parts and combinations of the same, as will be more fully described hereinafter and then pointed out in the claims.

A practical embodiment of the invention is represented in the accompanying drawings, forming a part of this specfication, in which similar characters of reference indicate corresponding parts in all the views.

Figure 1 is a side elevation of the improvement. Fig. 2 is an end elevation of the pump and the parts connected therewith. Fig. 3 is an enlarged sectional elevation of the diaphragm controlling-valve. Fig. 4 is an enlarged transverse section of the coupling for the said valve, the section being on the line 4 4 of Fig. 3. Fig. 5 is a plan view of the coupling-block. Fig. 6 is an enlarged sectional side elevation of the regulating-valve between the air-chamber of the pump and the air-separating chamber. Fig. 7 is a transverse section of the same. Fig. 8 is an enlarged sectional side elevation of the pump-governor, and Fig. 9 is a sectional view of the expansion steam-trap.

The return-flow pipes A from the radiators B are each provided with an expansion steam-trap C and a check-valve C′, and the said pipes A discharge the water of condensation and the air contained therein into a water-receiving chamber D, connected by a pipe E with the suction-chamber of a pump F, having its discharge-pipe G extending to a heater H to heat the water of condensation prior to passing it into a boiler I by a pipe G′, leading from the heater H to the boiler I.

The heater H is preferably heated by the steam to be used in the radiators B, and for this purpose the steam—such as exhaust-steam, for instance—is passed by a pipe J into the heater H with a view to separate any oil that may be contained in the steam prior to passing the steam from the heater H by way of the pipe J′ and branch pipes J^2 to the radiators to be heated.

In order to separate the air that passes with the water of condensation into the suction-chamber of the pump F, the following device is provided: The upper end of the air-chamber F′ of the pump F is connected with an air-separating chamber K by means of a manually-controlled graduating-valve L, and the upper end of the air-separating chamber K is provided with an escape-pipe K′ for the air. The air-separating chamber K is also provided with a water-gage K^2, and the said chamber is connected by a pipe N with the suction-chamber of the pump F, as plainly indicated in Fig. 2, and in this pipe N are arranged a check-valve N′ and a valve O, controlled by a diaphragm P, arranged within a diaphragm-casing P′, connected by a pipe P^2 with the lower end of the air-separating chamber K. The valve-stem O′ of the valve O is connected by a coupling-block O^2 with a stem O^3, attached to the diaphragm P, and the said coupling-block O^2 is engaged by a lever O^4, fulcrumed at O^5 on the valve-casing and provided with a suitable weight O^6. When the diaphragm P is in a lowermost position, as illustrated in Fig. 3, then the valve O is closed and the flow of water from the air-separating chamber K by way of the pipe N to the suction-chamber of the pump F is shut off. When the pump is in operation and the water of condensation is drawn from the receiver D into the suction-chamber, then any air contained in the said water passes up through the air-chamber F′ and valve L into the air-separating chamber K, in which it separates from the water and escapes through the pipe K′ to the atmosphere. The water passing up through the air-chamber F′ and valve L into the air-separating chamber K rises therein, and when it has reached a certain height then the column of water in the said chamber K exerts sufficient pressure on the under side of the diaphragm P to move the same upward, and in doing so the connected stems O^3 and O′ lift

the valve O off its seat, and water can now pass from the air-separating chamber K by way of the pipe N into the suction-chamber of the pump F to keep the latter primed. By taking the water from the chamber K a distance below the level thereof it is evident that no air can pass by way of the pipe N into the suction-chamber of the pump, as the air is separated from the water above the level and escapes through the pipe K′ to the atmosphere. If the water in the air-separating chamber K falls below a certain level, then the diaphragm P is moved downward by the action of the weighted lever O^4 and connected parts, so that the valve O closes and the flow of water in the pipe N is shut off until the water has again risen to the desired level in the air-separating chamber K. Normally, however, the valve O is open, so that a continuous flow of water takes place from the air-separating chamber K to the suction-chamber of the pump F by way of the pipe N. The water forced by the pump F by way of the discharge-pipe G into the boiler I is heated by the steam in the heater H, so that the water is passed in a heated condition directly from the pump F into the boiler I without the use of an open heater and a separate pump, as heretofore used in vacuum heating systems. The pump F is provided at the steam-inlet pipe F^2 with a valve F^3, (see Fig. 8,) controlled by a governor Q, connected by a pipe R with the receiver D and by a pipe R′ with the heating-mains. The pipes R and R′ open into the governor Q at opposite sides of a piston Q′, connected with the valve F^3 to throttle the same with a view to maintain a certain predetermined vacuum in the receiver D. By the arrangement described a partial vacuum is maintained throughout the entire system, and all the air and the water of condensation is drawn by the pump F through the traps C into the receiver D, where the air is separated from the water of condensation by the use of the air-separating chamber K, and the pump is kept primed by water flowing from the chamber K to the suction-chamber of the pump. Thus air-valves in the radiators can be entirely dispensed with.

It is understood that the expansion steam-traps C allow the passage of water and air to the receiver D, but prevent the passage of steam.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. A vacuum heating system provided with a pump for maintaining a partial vacuum in the system and for forcing the water of condensation back into the boiler, and an air-separating chamber connected with the air-chamber of the pump and with the suction-chamber of the pump, whereby the air will be separated from the water of condensation prior to the discharge of the water from the pump and the pump kept primed.

2. A vacuum heating system provided with a pump for maintaining a partial vacuum in the system and for forcing the water of condensation back into the boiler, an air-separating chamber connected with the air-chamber of the pump, for separating the air from the water of condensation prior to discharging the water from the pump, a valve in the connection between the said air-separating chamber and the said pump air-chamber, and a valved connection between the separating-chamber and the suction-chamber of the pump.

3. A vacuum heating system provided with a pump for maintaining a partial vacuum in the system and for forcing the water of condensation back into the boiler, an air-separating chamber connected with the air-chamber of the pump, for separating the air from the water of condensation prior to discharging the water from the pump, and an automatic valve controlled by the pressure of the water in the said air-separating chamber and connected with the suction-chamber of the said pump.

4. A vacuum heating system provided with a pump for maintaining a partial vacuum in the system and for forcing the water of condensation back into the boiler, an air-separating chamber connected with the air-chamber of the pump, for separating the air from the water of condensation prior to discharging the water from the pump, a connection between the said air-separating chamber and the suction-chamber of the said pump, a valve in the said connection, and a diaphragm connected with the said valve and controlled by the pressure of the water in the said air-separating chamber.

5. A vacuum heating system provided with a pump, an expansion steam-trap receiving the water of condensation from the radiators, a water-receiving chamber connected with the steam-trap and connected with the suction-chamber of the said pump, an air-separating chamber connected with the pump air-chamber, a connection between the said air-separating chamber and the suction-chamber of the said pump, a valve in the said connection, a diaphragm controlling the said valve and actuated by the pressure of the water in the said air-separating chamber, and a heater through which extends the discharge-pipe leading from the pump to the boiler, the heater being heated by the steam previous to the latter passing to the radiators.

6. A vacuum heating system provided with a pump, an expansion steam-trap receiving the water of condensation from the radiators, a water-receiving chamber connected with the steam-trap and connected with the suction-chamber of the said pump, an air-separating chamber connected with the pump

air-chamber, a manually-controlled graduating-valve between the said pump air-chamber and the air-separating chamber, a connection between the said air-separating chamber and the suction-chamber of the said pump, a valve in the said connection, a diaphragm controlling the said valve and actuated by the pressure of the water in the said air-separating chamber, and a heater through which extends the discharge-pipe leading from the pump to the boiler, the heater being heated by the steam previous to the latter passing to the radiators.

7. A vacuum heating system comprising a radiator connected with a steam-supply, a receiver for the water of condensation, a connection between the radiator and the receiver, a steam-trap in the said connection, a vacuum-pump having its suction-chamber connected with the said receiver, a boiler connected with the discharge-pipe of the said pump, and an air-separating chamber connected with the air-chamber and the suction-chamber of the pump.

8. A vacuum heating system comprising a radiator connected with a steam-supply, a receiver for the water of condensation, a connection between the radiator and the receiver, a steam-trap in the said connection, a vacuum-pump having its suction-chamber connected with the said receiver, a boiler connected with the discharge-pipe of the said pump, an air-separating chamber connected with the air-chamber of the pump, a pipe connecting the said air-separating chamber with the suction-chamber of the said pump, a valve in the said pipe, and a diaphragm controlling the said valve and controlled by the water-pressure in the said air-separating chamber.

9. In a vacuum heating system, a receiver for connection with a radiator, a pump with the suction-chamber of which the receiver is connected, an air-separator, a valved connection between the separator and the air-chamber of the pump, a valved connection between the separator and the suction-chamber of the pump, and means controlled by the height of the water in the separator for controlling the valve in the connection between the separator and the suction-chamber of the pump.

10. In a vacuum heating system, the combination with a pump, and an air-separating chamber, of a connection between the separating-chamber and the pump, a valve in said connection, a casing connected with the air-separating chamber, and a diaphragm in the casing and connected with the said valve.

11. In a vacuum heating system, the combination with an air-separating chamber, and a pump, of a connection between the separating-chamber and the pump, a valve in said connection, a casing connected with the separating-chamber, a diaphragm in the casing, and provided with a stem, a coupling between the stem of the diaphragm and the valve-stem, and a weighted lever connected with said coupling.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

CLAYTON A. DUNHAM.

Witnesses:
E. G. BEESON,
E. A. FRANCIS.