J. L. SPARKS & E. R. EDDINS.

STEAM HEATING SYSTEM.

APPLICATION FILED APR. 14, 1908.

1,013,328.

Patented Jan. 2, 1912.

2 SHEETS—SHEET 1.

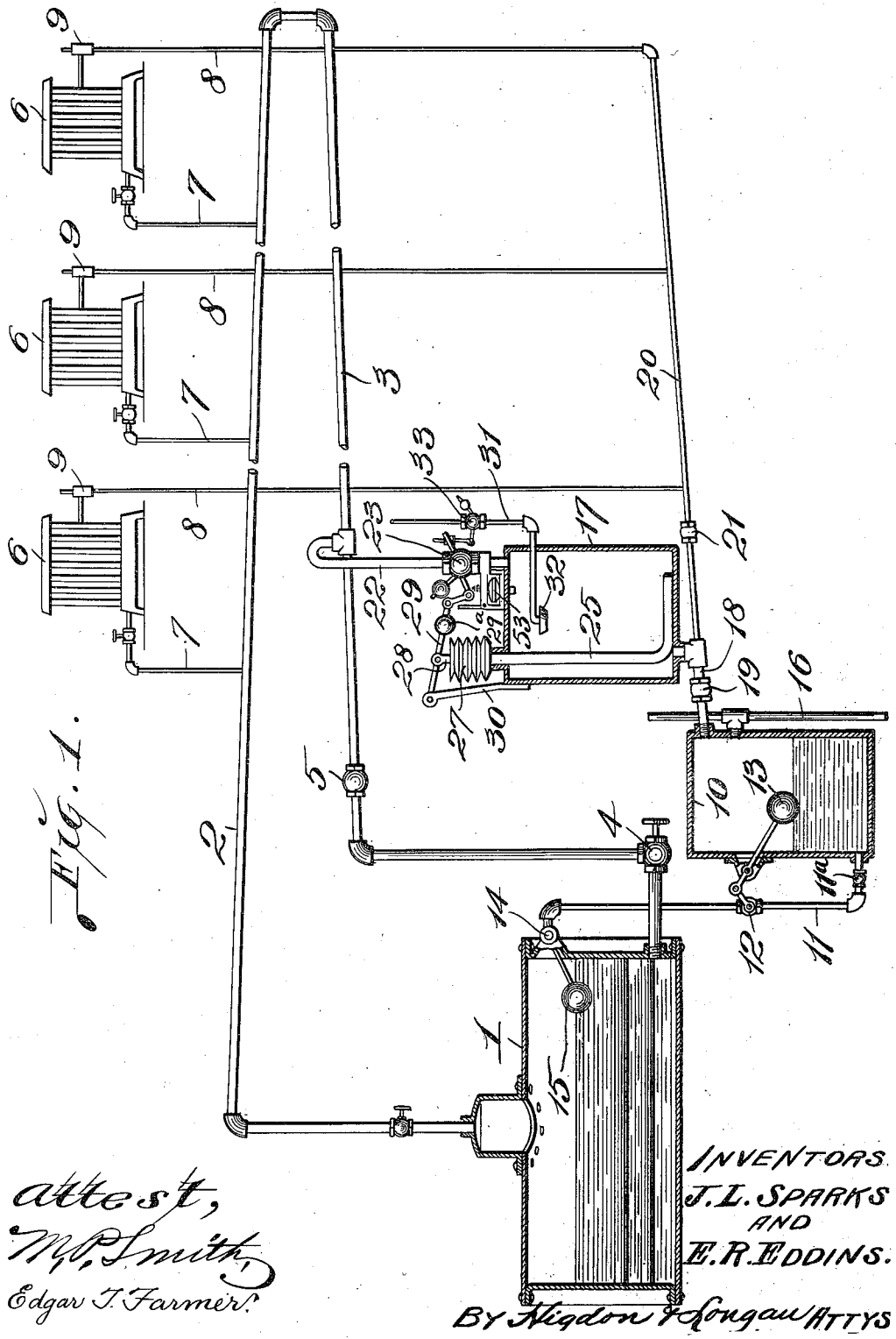

Fig. 1.

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Fig. 2.

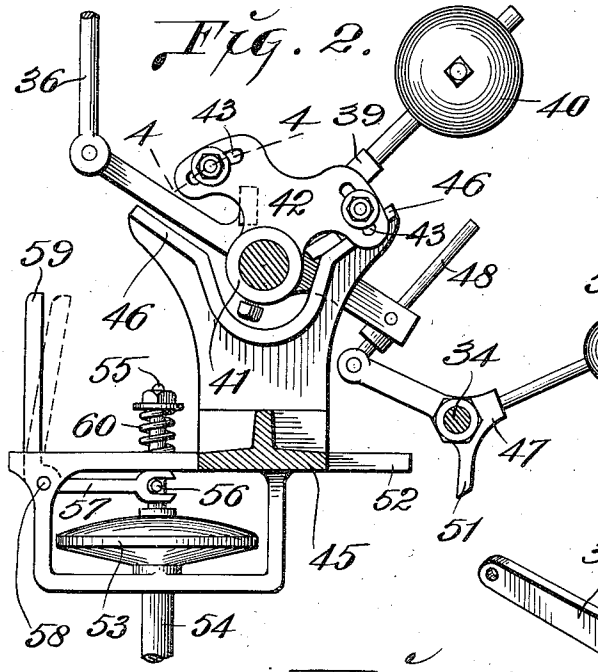


Fig. 4.

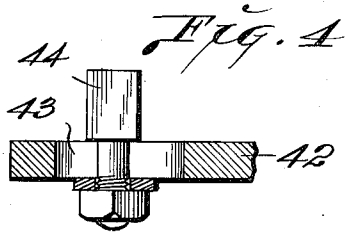


Fig. 5.

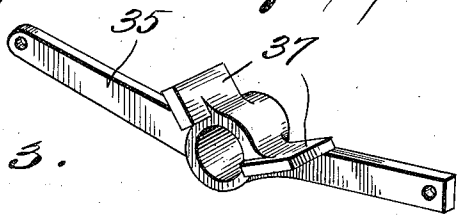
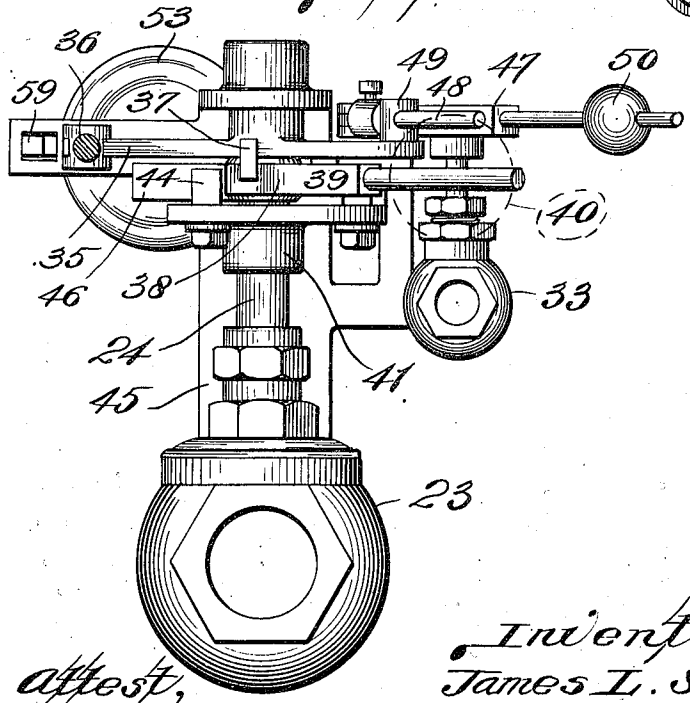


Fig. 3.



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UNITED STATES PATENT OFFICE.

JAMES L. SPARKS AND EDWARD R. EDDINS, OF ST. LOUIS, MISSOURI, ASSIGNORS TO AUTOMATIC VACUUM PUMP COMPANY, OF ST. LOUIS, MISSOURI, A CORPORATION OF MISSOURI.

STEAM-HEATING SYSTEM.

1,013,328. Specification of Letters Patent. Patented Jan. 2, 1912.

Application filed April 14, 1908. Serial No. 427,056.

To all whom it may concern:

Be it known that we, JAMES L. SPARKS and EDWARD R. EDDINS, citizens of the United States, and residents of St. Louis, Missouri, have invented certain new and useful Improvements in Steam-Heating Systems, of which the following is a specification containing a full, clear, and exact description, reference being had to the accompanying drawings, forming a part hereof.

Our invention relates to a steam heating system, wherein a small amount of steam from a suitable source of supply is condensed for the purpose of producing a partial vacuum utilized for withdrawing the air and water of condensation from the circulating pipes and radiators of the heating system, thus inducing a perfect circulation of steam through the system, which action naturally results in the maintenance of proper heat in a building with a minimum amount of fuel.

The principal objects of our invention are: 1st, to induce and control a perfect circulation of steam to and through the radiators of the system; 2nd, to automatically regulate and control the creation of the vacuum necessary to withdraw the air and any water of condensation which may accumulate in the air pipes of the system; 3rd, to utilize the water of condensation from the radiators and circulation pipes by returning said water to the boiler or steam generator; 4th, to automatically control the delivery of the water of condensation to the boiler or steam generator; and 5th, to provide a free outlet for the air in relieving all back pressure in the circulating pipes and radiators.

To the above purposes, our invention consists in certain novel features of construction and arrangement of parts, which will be hereinafter more fully set forth, pointed out in the claims, and illustrated in the accompanying drawings in which:

Figure 1 is a diagrammatic view of a heating system of our improved type, with the boiler, water tank, and vacuum tank shown in section; Fig. 2 is an elevation of a quick acting valve made use of for controlling the supply of steam, air, and water to the vacuum tank; Fig. 3 is a plan view of the valve and actuating mechanism; Fig. 4 is an enlarged detail section taken on the line 4—4 of Fig. 2; and Fig. 5 is a perspective view of a lever made use of in the quick acting valve.

Referring by numerals to the accompanying drawings: 1 designates a steam boiler of any suitable construction, and leading from the top thereof is the usual steam supply pipe 2, which leads through the building in which the system is installed, said pipe being connected to a return pipe 3, which leads back to the boiler 1, and said return pipe being provided with an ordinary globe valve 4 and a check valve 5.

6 designates the radiators of a system, which are connected in the usual manner by branch pipes 7 to the supply pipe 2, and leading from the sides of the radiators, opposite the sides to which the pipes 7 are connected, are air pipes 8, in which are located thermostatic valves 9, of any suitable construction, and which are adapted to close at a predetermined temperature.

10 designates a water tank, preferably located adjacent the boiler 1, and leading from the lower end of said tank 10 to the boiler is a pipe 11, in which is located a valve 12, connected to and adapted to be opened and closed by the movement of a float 13 within said tank 10. The pipe 11 is provided with a valve 14 adjacent the end entering the boiler 1, and which valve 14 is connected to and operated by a float 15 within said boiler. Connected to the upper portion of the tank 10 is a vertically disposed tube 16, open at both ends, which tube communicates with the tank 10, and also acts as an outlet pipe in case of an overflow of water within said tank.

17 designates a vacuum tank, preferably located adjacent the water tank 10, and connected to and leading from the lower end of said vacuum tank to the upper portion of the water tank is a pipe 18, in which is located a check valve 19.

20 designates a pipe to which is connected the lower ends of all of the pipes 8; said pipe 20 leading to the pipe 18 and being provided with a check valve 21.

Leading from the return pipe 3 to the upper portion of the vacuum tank 17 is a pipe 22, in which is located a quick acting valve 23 of suitable construction, the stem 24 of which extends horizontally from the valve housing, in order to receive the valve actuating mechanism, (presently described).

25 designates a volatile fluid container, which is vertically disposed within the tank 17, and the lower end of said container being extended horizontally across the bottom of said tank; and connected to the end of said container that projects above the tank 17 is a collapsible and expansible member 27, the top of which is provided with a stem 28; and pivotally connected to said stem is a lever 29, fulcrumed at its outer end to a bracket 30, and provided with a weight 29a.

Leading into the upper portion of the vacuum tank 17 is a small water supply pipe 31, which is provided, within said tank 17, with a spraying nozzle 32; and arranged in said pipe, adjacent the valve 23, is a valve 33, the stem 34 of which projects horizontally from the housing of said valve 33. The mechanism for imparting quick action to the valve stem 34 is constructed as follows: A lever 35 is loosely journaled on the outer end of the valve stem 24, one end of said lever being connected by a link 36 to the free end of the lever 29. Formed integral with the hub of the lever 35 is a pair of stop plates 37; and loosely journaled on the stem 24, immediately adjacent the hub of the lever 35, is a collar 38, with which is formed integral an arm 39, which operates between the stop plates 37; and adjustably positioned on the outer portion of this arm 39 is a weight 40. Fixed on the valve stem 24, immediately adjacent the collar 38, is a collar 41, provided with a segmental plate 42; and formed in said plate is a pair of slots 43, in which are adjustably held stops 44, against which the arm 39 is adapted to engage. A bracket 45 is fixed to the pipe 22 below the valve 23, and formed on or fixed to said bracket is a pair of stops 46, against which the stops 37 and 44 are adapted to engage. Fixed on the end of the valve stem 34 is a bell crank 47, the end of one of the arms of which is pivotally connected to the lower end of a rod 48, which is adapted to slide through a block 49 pivotally arranged on the end of the lever 35, opposite the end to which the link 36 is connected. The opposite arm of the bell crank 47 is provided with an adjustable weight 50, and formed integral with the under side of the bell crank is a finger 51, which is adapted to engage against a stop 52 carried by the bracket 45.

53 designates a collapsible and expansible member, which is held in a portion of the bracket 45, and connecting said member with the interior of the vacuum tank 17 is a pipe 54. Connected to the top of the collapsible member 53 is a stem 55, and carried thereby is a pin 56, which passes through the bifurcated end of one arm of a bell crank 57, which is pivotally mounted at 58 in a portion of the bracket 45, and the vertical arm 59 of said bell crank being so disposed as that it may be drawn into the downward path of travel of the end of the lever 35 to which the link 36 is connected, as shown by dotted lines in Fig. 2. The upper end of the stem 55 is provided with an expansive coil spring 60, which normally maintains the collapsible member 53 in its expanded and normal condition.

The operation of our improved apparatus is as follows: The valve 23 is normally open, with the collapsible member 27 and levers in the positions seen in Fig. 1, and steam passing from the return pipe 3 through the pipe 22 and open valve 23 enters the vacuum tank 17, forcing the air therein out through the pipe 18 to the tank 10, and as the steam in the vacuum tank passes downward, the heat thereof causes the fluid within the container 25 to gradually expand, and as a result the member 27 is expanded to such a degree as that the lever 29 is elevated, and the the valve stem 24, during which action the gravity of the weights 29a and 40 is overcome, and when said weight 40 passes the center it will by gravity drop into the positions shown in Figs. 2 and 3, thus reversing the position of the lever 35 and shifting the plate 42 from one side to the other, the movement of which plate is regulated by the position of the stops 44, which engage against the stops 46. The movement of the plate 42 takes place with great rapidity, and therefore the valve stem 24 is rocked to close the valve 23, thus shutting off the flow of steam into the vacuum tank 17. At the same time the valve 23 is closed, the water valve 33 is opened, owing to the action of the weighted bell crank 47, which is connected to the free end of the lever 35, and when said water valve is open water passes through the pipe 31 and discharges from the spraying nozzle 32 within the vacuum tank. The spray of water within the vacuum tank quickly condenses the steam therein, thus creating a partial vacuum in said tank, and this partial vacuum is also formed in the pipe 20, pipes 8, and radiators 6, and as a result of this partial vacuum, any air in the radiators 6 is withdrawn therefrom, and passes through the pipes 8 and 20, into the tank 17. This withdrawal of the air from the radiators 6 only takes place when the thermostatic valves 9 are open, due to the lowering of the temperature beyond a normal point, and during this time the partial vacuum naturally increases the flow of steam through the branch pipes 7 and supply pipe 2, thereby inducing the flow of steam through said pipes into the radiators, and when the heat from the steam in said radiators comes in contact with the thermostatic valves 9, the same automatically close. Thus the partial vacuum created in the tank 17 simultaneously withdraws the air from the radiators 6 and pipes 8 and 20, and induces the circulation of steam through the

pipes 2 and 7 and radiators 6. When the vacuum within the tank 17 is destroyed, the water and air which have accumulated therein will discharge through the pipe 18 into the tank 10, and the air will pass from said tank 10 out through the pipe 16. Any water of condensation which may accumulate in the pipes 2 and 3 is carried back to the boiler 1 through said pipe 3, in which is located the check valve 5 and valve 4, which latter is normally open. The pipe 22 is connected to the top of the return pipe 3, in order that steam may be readily conveyed to the vacuum tank 17, this manner of connection preventing any water of condensation within said pipe 3 from passing through said pipe 22 to the vacuum tank, and also permits all air accumulated in the boiler and main supply pipes 2 and 3 to flow out through the tank 17, pipe 18, tank 10, and pipe 16, to the atmosphere, thus relieving all back pressure to the flow of steam through the mains 2 and 3. When the fluid in the container 25 is condensed or returns to its normal condition, the member 27 collapses and a reverse action of the quick acting valve 23 takes place, which opens said valve, and at the same time the water valve 33 is closed, and this automatic action intermittently takes place as long as there is sufficient steam pressure in the system to cause the steam to travel through the main supply pipe 2 and return pipe 3. Under normal conditions the water in the boiler holds the float 15 elevated to such a degree as that the valve 14 is closed, and when the water level in the boiler lowers to such a degree as that said float opens the valve 14 and there is a partial vacuum established in the boiler, water from the tank 10 will be forced through the pipe 11 into the boiler 1, owing to the atmospheric pressure in the tank 10, which pressure enters through the tube 16, it being understood of course that when this action takes place there is sufficient water in the tank 10 to elevate the float 13 and open the valve 12. The float 13 located in the tank 10 will close the valve 12 before the water in said tank has been discharged below the pipe 11 leading from said tank, thereby preventing the tank 10 from being emptied of water, and preventing any flow of air into the boiler. Thus it will be seen that the valve 12 in the pipe 11, operated by the float 13, is to prevent the air from flowing into the boiler, and the valve 14, operated by the float 15, admits water to the boiler and also prevents the boiler from becoming overflowed. The pipe 11 is provided with a check valve 11^a, the function of which is to prevent any water or steam from flowing out of the boiler 1 into the tank 10, or the atmosphere. When there is a maximum amount of vacuum created in the tank 17, the member 53 will be collapsed to such a degree as that the vertical arm 59 of the bell crank 57 is carried over into a position directly beneath the end of the lever 35, which lever is elevated when the valve 23 is closed, and when the member 27 collapses to such a degree as that the lever 35 is brought downward into contact with the upper end of the vertical arm 59 of the bell crank 57, the parts will stand in such positions with the valves 23 and 33 closed until the vacuum within the tank 17 lowers to such a degree as to permit the member 53 to expand and throw the vertical arm of the bell crank out of position beneath the lever 35, thus automatically starting the apparatus. Thus our improved apparatus performs the function of an automatic vacuum pump for withdrawing the air from the radiators and air lines, provides a free and automatic outlet of the air from the boiler and steam mains; and also acts as an automatic pump to cause the condensing water and water of condensation to pass from the water tank to the boiler, thus utilizing water which would otherwise be discharged to the sewer, or other outlet.

A system of our improved construction is simple, inexpensive, easily installed, is automatic in its entire operation, and said automatic operation depends solely upon the heat of the steam passing through the circulating pipes and radiators, and therefore only such a degree of steam pressure need be generated in the boiler as is necessary to cause the steam to travel through the circulating pipes.

We claim:

1. In a heating system employing a heat generator and radiators, the combination with the supply and return pipes connecting the generator and the radiators, of air pipes leading from the radiators, check valves in said pipes, a vacuum tank to which the air pipes are connected, a tubular connection between the return pipe and the vacuum tank, a valve located in said tubular connection, a thermostat located in the path of travel of the heating medium discharging from the said tubular connection and in the path of travel of the air discharging from the air pipe and alternately actuated by said heating medium and air for intermittently actuating the valve, an open water tank, a connection from the vacuum tank to the water tank, a check valve located in said connection, a tubular connection from the water tank to the heating medium generator and a non-return valve in said last mentioned connection.

2. In a heating system employing a heat generator and radiators the combination with the supply and return pipes connecting the generator and the radiators, of air pipes leading from the radiators, check valves in said pipes, a vacuum tank to which the air

pipes are connected, a tubular connection between the return pipe and the vacuum tank, a valve located in said tubular connection, a thermostat located in the path of travel of the heating medium discharging from the said tubular connection and in the path of travel of the air discharging from the air pipe and alternately actuated by said heating medium and air, for intermittently actuating the valve, an open water tank, a connection from the vacuum tank to the water tank, a check valve located in said connection, a tubular connection from the water tank to the heating medium generator, and valves located in the last mentioned tubular connection for controlling the passage of water from the water tank into the heating medium generator.

3. In a heating system employing a heat generator and radiators, the combination with the supply and return pipes connecting the generator and the radiators, of air pipes leading from the radiators, check valves in said pipes, a vacuum tank to which the air pipes are connected, a tubular connection between the return pipe and the vacuum tank, a valve located in said tubular connection, a thermostat located in the path of travel of the heating medium discharging from the said tubular connection and in the path of travel of the air discharging from the air pipe and alternately actuated by the heating medium and air for intermittently actuating the valve, a water tank, a connection from the vacuum tank to the water tank, a check valve located in said connection from the water tank to the heating medium generator, and a pipe forming connection between said water tank and atmosphere.

4. In a heating system employing a heat generator and radiators, the combination with the supply and return pipes connecting the generator and the radiators, of air pipes leading from the radiators, check valves in said pipes, a vacuum tank to which the air pipes are connected, a tubular connection between the return pipe and the vacuum tank, a valve located in said tubular connection, a thermostat located in the path of travel of the heating medium discharging from said tubular connection and in the path of travel of the air discharging from the air pipe and alternately actuated by the heating medium and air for intermittently actuating the valve, a water tank, a connection from the vacuum tank to the water tank, a check valve located in said connection, a tubular connection from the water tank to the heating medium generator, valves located in the last mentioned tubular connection for controlling the passage of water from the water tank into the heating medium generator and an open ended air pipe forming communication between the water tank and atmosphere.

In testimony whereof, we have signed our names to this specification, in presence of two subscribing witnesses.

JAMES L. SPARKS.
EDWARD R. EDDINS.

Witnesses:
M. P. SMITH,
E. L. WALLACE.