No. 874,113. PATENTED DEC. 17, 1907.

C. C. PECK.

VACUUM HEATING SYSTEM.

APPLICATION FILED SEPT. 24, 1906.

FIG. 1.

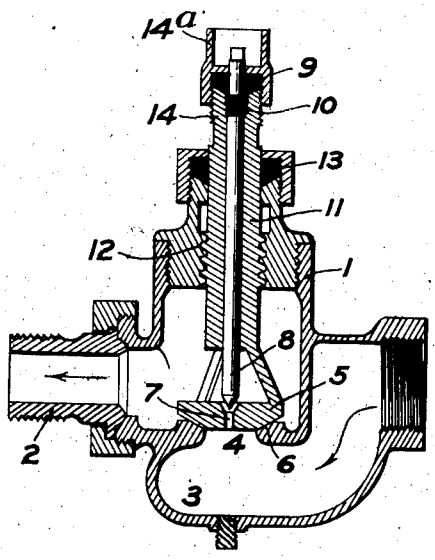

FIG. 2.

WITNESSES:

Clarence W. Carroll

L. Thorn

INVENTOR:

Cassius Carroll Peck

UNITED STATES PATENT OFFICE.

CASSIUS CARROLL PECK, OF ROCHESTER, NEW YORK.

VACUUM HEATING SYSTEM.

No. 874,113. Specification of Letters Patent. Patented Dec. 17, 1907.

Application filed September 24, 1906. Serial No. 335,980.

To all whom it may concern:

Be it known that I, CASSIUS CARROLL PECK, a citizen of the United States, residing at Rochester, in the county of Monroe and State of New York, have invented a certain new and useful Vacuum Heating System, of which the following is a specification.

My invention relates to that class of steam heating apparatus in which a vacuum is employed in connection with the return end of the heating circuit to remove air and water as fast as they accumulate, and thereby to reduce the amount of initial vapor tension required for effecting circulation through the system, and insure an even and complete circulation.

It consists primarily in establishing a definite ratio between valve openings in the returns from the radiators, and certain radiating surfaces that are located between said valves and a vacuum pump, or an equivalent device.

The object particularly in view is to obviate the need of a special form of automatic, float-operated valve now in use, that is comparatively expensive.

In the drawings:—Figure 1 is a central, vertical section of the valve that is one of my improvements; and Fig. 2 shows in elevation a steam heating system equipped with my improvements.

In the drawings, arrows feathered on both sides indicate the flow of steam; those feathered on one side indicate the flow of air; and unfeathered arrows indicate the flow of water. The compound valve 1 is designed for connection with the return end of one of the primary radiators of the heating system by the female thread. Water of condensation, which forms in and flows out of the radiator, settles in the chamber 3, and there deposits solid matter that is carried by the water to this point, such as scales for example. The main opening 4 of the valve is located nearly on a level with the duct that connects it with the radiator, in order to keep the radiator fully drained at all times. The valve head 5, which closes on seat 6, has a relatively small central opening 7, into which fits a pointed stem 8. This stem has a stuffing-box 9, and a screw thread 10 by which the point at the lower end is made to enter hole 7 more or less, when the stem is turned. The main valve has a stem 11, provided with a screw thread 12. It passes through a stuffing-box 13, and is provided with a head 14 for conveniently screwing it up and down. Cap 14^a is attached to stem 11 so that the stem 8 cannot be meddled with after it has been set with reference to the opening 7. Normally the main valve 5 is closed, and the auxiliary valve 8 is open so that the air and water pass through the opening 7. But when it is desired to fill a large radiator quickly with steam, or to blow out sediment, the main valve is opened without disturbing the auxiliary valve.

Boiler 15 supplies steam through valved pipe 16 to the engine 17, and exhaust steam may be used for the heating system through valved pipe 18; or said system may be supplied directly from the boiler through valved pipe 19, in which a pressure reducing valve 20 may be introduced. Pipe 21, in which there is a back-pressure valve 22, is intended to receive the discharge of such exhaust steam as is not needed for the heating circuit. Pipe 23 is the main supply conduit for the heating circuit, and branch pipes 24, in which are shown valves 24^a, supply radiators 25. Branch pipes 26, with my new valves 1 (shown in detail in Fig. 1) deliver air and water from the radiators into main return conduit 27. The return pipe 27, last mentioned (by means of the separator chamber 30), discharges air into the branch pipe 28 and water into the branch 29, the air passing from pipe 28 through the secondary, or auxiliary radiator 31. The return pipe 32 from this radiator 31 goes to the air and water separating chamber 33, from which the air branch 34 leads to the upper part of receiver 35, and water branch 34^a leads to the bottom of said receiver.

36 is a vacuum pump operated by live steam from the boiler 15 through valved pipe 37, and has its suction pipe 38 connected to the vapor space in the upper portion of receiver 35, which space occupies about one-half of the receiver, as indicated by water line 39. The air from this pump is preferably discharged into the atmosphere as shown at 40, though it may be discharged through a radiator. Water pump 41 is operated by live steam through valved pipe 42 from boiler 15. It is connected with the water space of receiver 35, and discharges water therefrom through pipe 43 into the boiler, or elsewhere.

The operation of the apparatus is as follows: In starting, live steam is first turned into the vacuum pump 36 through the valve

in pipe 37, so as to start the pump and remove air as fully as practicable from all the pipes and radiators of the heating circuit. When this has been accomplished and the desired degree of vacuum—usually four inches to eight inches, depending upon extent of the heating system—is indicated on gage 44 (which is connected into return pipe 32) steam is admitted to the main supply pipe 23 of the heating circuit, either through exhaust pipe 18, or through live steam pipe 19, by opening the proper controlling valve. The partial vacuum which exists in radiators 25 and 31, and in connecting pipes, allows steam to fill rapidly the supply pipes, return pipes and such radiators as have their supply valves 24^a open. As steam condenses in radiators 25 the water of condensation flows out by gravity, aided by the vacuum in the return pipes, through valves 1, passing through holes 7 (see Fig. 1). The point of the valve stem 8 is so adjusted that all water of condensation passes out of each radiator, together with such air as comes into the radiators with the steam. The fixed opening also allows a small amount of steam to pass into the branch return pipe 26, and thence to the main return 27, and the secondary radiator 31. The purpose of the latter is to condense, as far as possible, all this steam which passes valves 1, and thus to prevent steam from reaching the vacuum pump 36 in excessive amount, which would make it necessary to run the pump at high speed, in order to maintain the desired degree of vacuum in the return pipes, and would also cause an objectionable amount of hot vapor to be discharged from the pump.

For separating air and water as it flows through the secondary radiator 31, a separator 30 may be employed, and located in the water branch pipe 29. From this separator the water is drained either through the bottom of said auxiliary radiator 31 or around it, as shown by valved pipe 32^a while the air and steam pass through pipe 28, and thence entirely fill and pass through the radiator 31. This separator 30 is not, however, necessary, for an ordinary pipe tee will answer instead. After circulating through the secondary radiator 31, air, water and uncondensed steam, all flow through pipe 32 into chamber 33, which latter is preferably, but not necessarily, adapted to separate the air from the water in order that the air may freely circulate through pipe 34 into the top of receiver 35, and the water through pipe 34^a into the bottom of said receiver. Finally, the air pump 36 discharges from the receiver all air and vapor that enters it, and the water pump 41 automatically removes the water.

The steam valve of the pump is controlled by a float in the receiver which does not permit the water to rise in it above a predetermined level, the arrangement being the usual one of a pump and receiver. It is generally desirable that vacuum pump 36 shall be controlled by a vacuum governor 45, so that the right degree of vacuum shall be steadily and automatically maintained in the return end of the heating circuit, said governor admitting live steam to drive the pump as it is needed to keep up the prescribed amount of vacuum. Vapor tension in supply pipe 23 is indicated by a gage 46. For draining steam supply pipe 23, a valve 1^a, like valves 1, is shown in a drain pipe between pipe 23 and pipe 32, which latter constitutes a continuation of pipe 27 from radiator 31 to separator 33. Port 4 of said valve will in this connection be normally closed, and port 7 opened only to the extent needful for discharging water of condensation which collects in pipe 23 into pipe 32.

Some heating systems with long runs of piping will require higher vacuum than small systems in which the runs are short, and where water of condensation must be lifted, the necessary degree of vacuum required must be provided in the heating circuit. Having determined the amount of vacuum suitable for any system, the next thing is to determine the proper proportion of secondary radiation (represented by indirect radiator 31). This must be determined with reference to the number of valves 1 and the size of the opening 7 in these valves. The size of the openings 7 are determined for each radiator by the square feet of radiating surface which it contains, the valve stem 8 of each valve being set so as to allow the escape of all air and water, with as little steam as possible. Obviously the larger the amount of radiation connected to each valve the larger must be the opening 7 in each valve, and consequently the greater will be the amount of secondary radiation required to condense the escaping steam. Having determined the proper adjustment of the valve stem 8, it need not be changed, unless for the purpose of clearing some obstruction from the opening 7.

As before stated, if steam escapes into the return conduit and is allowed to reach the vacuum pump, it will put an extra load upon the pump, and it is to avoid this that an automatic valve of some kind has heretofore been connected into the drain pipe of each radiator of a heating system, the automatic action in draining water and closing against steam usually depending either on a float, or else on expansion and contraction of some substance under influence of changes of temperature. But my improved system accomplishes the same results by means of a simpler valve that is permanently open, and at the same time utilizes the escaping steam.

Valve 1 shown in the drawings is typical. It may be of any form that has an adjustable opening from the radiator to the return pipe

of such size that it will pass all air and water from the radiator with the least amount of steam consistent with keeping the radiator drained as described. In carrying out my system of vacuum heating, I do not confine myself to the devices which are herein shown and described for the purpose of illustration, for its novel features can be embodied in variously constructed mechanism.

It is obvious that it is important to maintain that degree of rarefaction of the air in the return conduit, for which the valve stem 8 shall be adjusted, for if it is allowed to change materially, the opening 7 will no longer be adapted for the satisfactory operation of the system.

What I claim is:—

1. In a steam heating system the combination of a supply conduit, one or more radiators, and a return conduit; a return pipe from each radiator; a valve in said pipe having a permanently open passage of only sufficient size to keep each radiator drained of air and water, and adapted for such drainage; means for regulating the steam supply to said radiator; and means for maintaining a rarefaction of air in the return conduit at a uniform degree, said return conduit embracing a secondary radiator between said valves and the rarefying means.

2. In a steam heating system the combination of a supply conduit, one or more radiators, and a return conduit; a drainage valve for each radiator, each having a chamber adapted to receive air and water from the radiator, and a permanently open passage for them both from said chamber to the return conduit; means for regulating the flow of air and water to the return conduit; and means for maintaining a rarefaction of air in said return conduit at a uniform degree, said conduit embracing a secondary radiator between the rarefying means and said valves.

3. In a steam heating system the combination of a supply conduit, one or more radiators, and a return conduit; a valve between each radiator and the return conduit, having a chamber adapted to receive air and water from the radiator, and a permanently open passage for them both from said chamber to the return conduit; means for regulating the flow of air and water from the radiator; a separator in the return conduit adapted to separate air and steam from the water in said return conduit; and means for maintaining a rarefaction of air in the return conduit at a uniform degree, said conduit embracing a secondary radiator between said valves and the rarefying means.

4. In a steam heating system the combination of a supply conduit, one or more radiators, and a separate return conduit; means for maintaining a rarefaction of air in the return conduit at a uniform degree, said conduit including a secondary radiator between the air exhausting means and the primary radiators; a drain pipe between said conduit and each primary radiator; a valve in said pipe having an inlet port and an outlet port nearly on the same level, a chamber for water on the inlet side and below said ports and connected with them by a valve the head of which is adapted to close a relatively large opening, and having a small valve in the head; means for raising and lowering said valve head, and an adjustable stem carried by the main valve stem and adapted to open and close the valve opening through the valve head.

5. In a steam heating system, the combination of a supply conduit, one or more radiators, a return conduit, a return pipe from each radiator, a valve in the pipe having a permanently open passage of only sufficient size to keep each radiator drained of air and water, means for regulating the steam supply to said radiators, and means for maintaining a rarefaction of air in the return conduit at a uniform degree, said return conduit embracing a condenser between said valves and the rarefying means.

CASSIUS CARROLL PECK.

Witnesses:
D. GURNEE,
L. THON.