No. 875,107. PATENTED DEC. 31, 1907.

A. B. RECK.

HOT WATER HEATING APPARATUS.

APPLICATION FILED FEB. 13, 1905.

2 SHEETS—SHEET 1.

Fig. 1

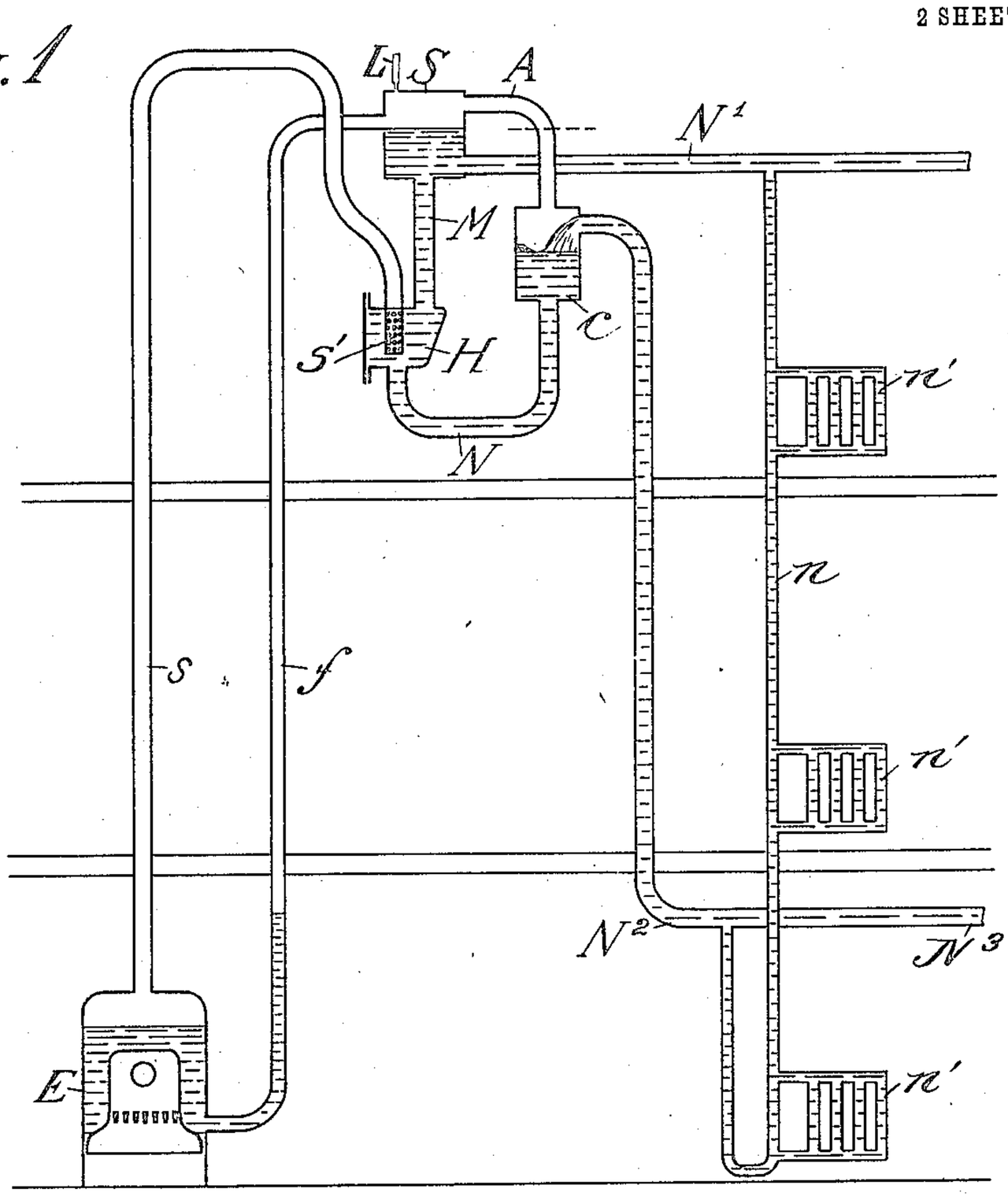
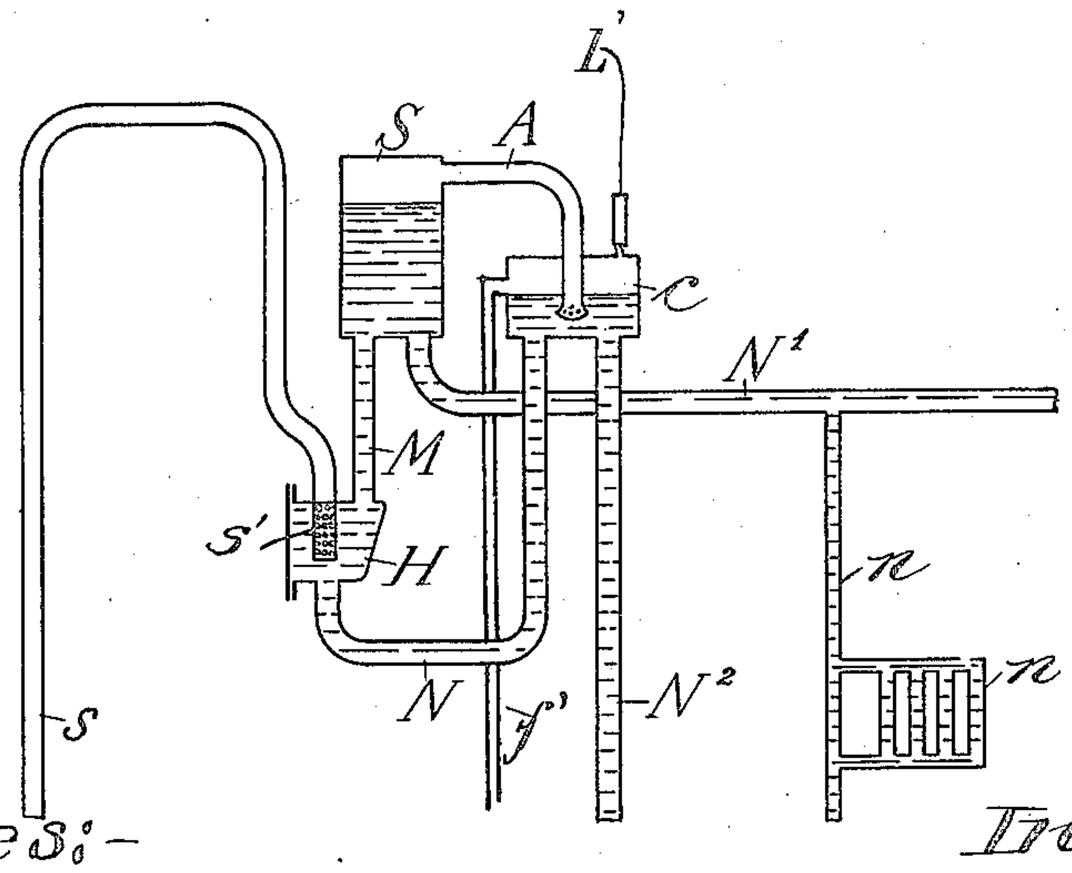


Fig. 2



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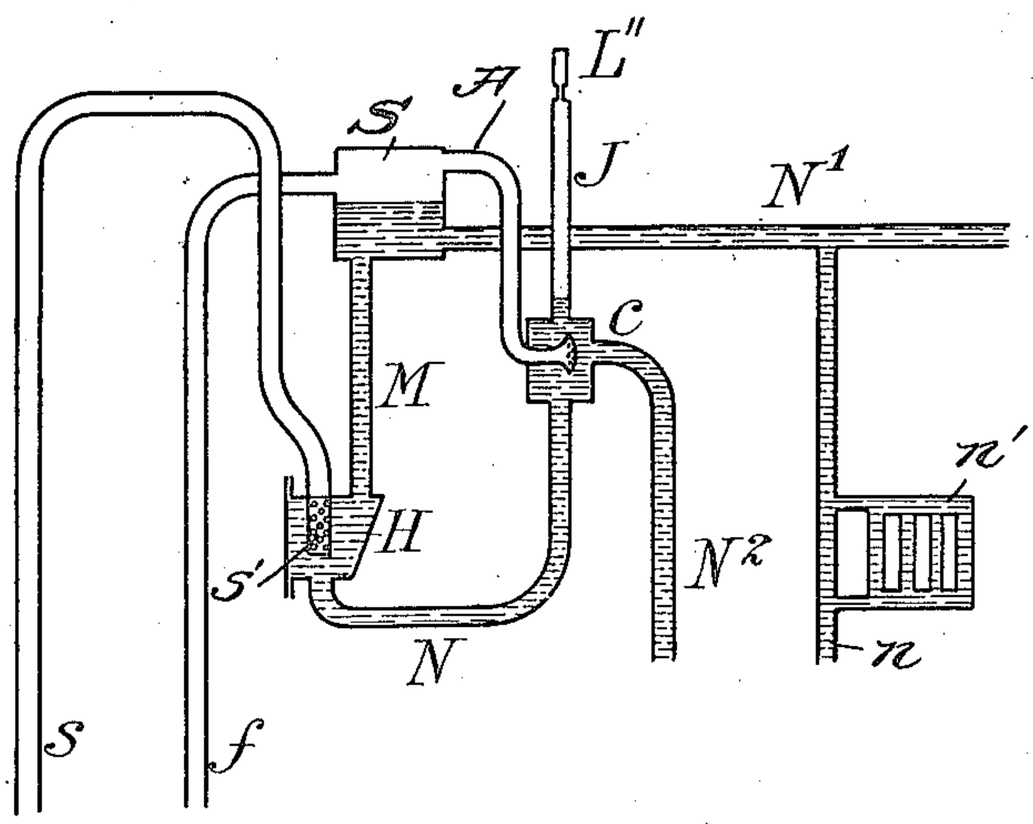
2 SHEETS—SHEET 2.

Fig. 3.



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UNITED STATES PATENT OFFICE.

ANDERS B. RECK, OF COPENHAGEN, DENMARK.

HOT-WATER HEATING APPARATUS.

No. 875,107. Specification of Letters Patent. Patented Dec. 31, 1907.

Application filed February 13, 1905. Serial No. 245,501.

To all whom it may concern:

Be it known that I, ANDERS B. RECK, a subject of the King of Denmark, and a resident of Copenhagen, Denmark, have invented a new and Improved Hot-Water Heating Apparatus, of which the following is a full, clear, and exact description.

My invention relates to hot water heating apparatus of the class, in which the velocity of the circulating water is increased by introducing steam directly into a main rising pipe, causing the water therein to boil; condensation of the steam, developed by such boiling, being effected by the circulating water.

In the improved means constituting my invention a jet (liquid) condenser is employed, condensation being effected by bringing the steam, developed by boiling in the main rising pipe, into direct contact with the water circulating in the hot-water apparatus before the steam from the boiler is introduced into said water.

Figure 1, Fig. 2 and Fig. 3 of the accompanying drawings, are diagrams of three methods of applying wet condensation to hot-water apparatus.

In Fig. 1 is shown a complete hot-water heating circuit consisting of a main flow pipe N^1, a riser *n*, radiators *n'* connected to the riser, a return main and a main rising pipe, comprising sections N^2, N and M and condensing and heating chambers *c* and H communicating with said sections. The section N^2 conducts water from the main return of the hot-water apparatus to the condenser *c*; section N communicates with the heating chamber H; section M delivers to a separator chamber tank S, to which the main flow pipe N^1 is connected, the aforesaid making a continuous circuit.

The steam space of the boiler E and the heating chamber H are connected by a steam pipe *s*, which is provided with a foraminated delivery end *s'*. The top of the separator tank S and the condensing chamber *c* are connected directly by a steam pipe A. An overflow pipe *f*, connected to the water space of the steam boiler, prevents the water line in the hot water apparatus from exceeding a predetermined height. The steam from the steam pipe *s* is condensed in the heating chamber H, thus adding to the quantity of the water in the hot-water apparatus. The separating tank or chamber S is provided with an air passage L preferably in the form of an automatic valve, closing automatically, when the steam has expelled the air from the upper space of the separator. Before starting the apparatus the same is filled with water to about the level of the outlet of the overflow pipe *f*, the water rising in the pipe A to a level equal to that in the chamber S.

When sufficient steam pressure has developed in the steam boiler E, steam will pass through the pipe *s* and enter the heating chamber H. The water in the chamber H, due to the entering steam, will boil as will that in the pipe M. The water column in said pipe is then lightened by the steam and being in communication with the water column formed by section A, chamber *c* and a portion of section N, the latter column descends until a hydrostatic equilibrium is effected, leaving a space within and above the chamber *c*. This space being in communication with chamber S and above the water level in the latter, the steam which separates itself from the water in the tank S thereby gains access to the jet condenser in the chamber *c*. The steam thus passes from chamber S to *c* by reason of the reduced pressure due to the condenser.

The chamber S in the embodiment shown in Fig. 1 performs not only the function of separating the steam from the water, but acts as an expansion chamber for the hot-water-apparatus, the water added to chamber S by condensation of steam in the heater H overflowing by pipe *f*. When steam is cut off from pipe *s* heater H and pipe M, the water column in the latter, not being lightened by steam, will rise in chamber *c* and pipe A. The water necessary to fill the empty space in chamber *c* and pipe A must come from chamber S, and to maintain a continuous circulation in the apparatus, the chamber S must, in the embodiment shown in Fig. 1, be of greater capacity than chamber *c*.

When the water column in pipe M is lightened by the steam, the water in chamber S will flow towards the condensing chamber *c* through the hot-water-flow-pipe N', the riser *n*, the hot-water return main and the pipe N^2. The result will be that water which enters the chamber *c* from the pipe N^2, will meet here the steam from the chamber S, which has access to chamber *c* through pipe A. As a result of the foregoing action space will be provided for steam to be delivered to pipe M, and separated from the water in the

chamber S, thus a continuous circulation in the pipe M and an effective circulation of the water in the whole heating apparatus can be maintained.

In Fig. 2 is shown a modification of the construction shown in Fig. 1, the steam boiler and return main of the hot-water apparatus being omitted. The difference between the two forms of apparatus, as shown is, that in Fig. 1 the air passage L for air from the apparatus and the overflow pipe *f* are connected with the expansion chamber S, in Fig. 2 this outlet, L′, and overflow, *f′*, are shown connected to the condensing chamber *c*, and in the same figure the pipe A is extended to chamber *c* terminating in a rose a short distance from the bottom of chamber *c*.

Tank *c* in Fig. 2 must be of greater capacity than tank S in order to make the water circuit continuous under all circumstances. Before steam enters heater H in pipe M (Fig. 2) and has filled to the level of the overflow pipe in chamber *c*, the water level in chamber S will be the same as in chamber *c*, but as soon as steam rises in pipe M and makes the column in M lighter the water will ascend in chamber S till an equilibrium is established, whereupon the water level in chamber *c* will descend. In this form of apparatus the chamber *c* must be of greater capacity than chamber S, otherwise chamber *c* would be emptied and the continuous water circuit destroyed between pipes N^2 and N, before the water had ascended in chamber S to the level where equilibrium between the different columns is established. The water formed by condensation in the heater H will subsequently refill the tank *c* to the level of the overflow *f′*, where it is shown in Fig. 2. By apparatus built in accordance with the latter figure the condensing chamber *c* acts more nearly as an expansion tank than the tank S, which acts as the separator tank of the apparatus for separating steam and water.

If the steam pressure in the steam pipe *s* is such that with atmospheric pressure in chamber *c* more steam will pass through chamber H, pipe M, tank S and pipe A than can be condensed by the water passing through chamber *c* then an automatic air valve L′ must be provided. If the steam pressure in pipe *s* is kept down below a certain limit, then the steam passing through pipe A will always be entirely condensed and no valve will be needed thus it will be seen that this outlet can be permanently open to the atmosphere or the chamber *c* itself can be open.

In Fig. 3 is shown the preferred form of the invention, wherein the location of the overflow pipe *f* and the proportion between the sizes of the two chambers S and *c* are the same as in Fig. 1, pipe A terminating in chamber C as in Fig. 2, and an air passage L″ located on a vertical pipe J. When no steam enters the chamber H, the water will stand at the same level in tank S, pipe A and pipe J. When steam enters chamber H the rising column of water is lightened in pipe M, then if chamber *c* is not located too low, the pipe A will be wholly empty, and steam will have access from tank S to chamber *c*. The atmospheric pressure, acting through the air passage L″, will depress the water level in pipe J but as the steam pressure over the water in tank S will always be somewhat higher than atmospheric pressure, as long as the water boils in pipe M, the water level will not descend in pipe J as far as in pipe A, and the steam drawn out of pipe A will be condensed in the water in chamber *c*. The air which may be carried with the steam through pipe A will collect over the water in pipe J and will pass out of the passage L″. By very accurate regulation of the steam pressure in pipe *s*, this outlet may be left without any closing device just as in an apparatus built according to Fig. 2, but in most cases it will give best results to provide the outlet with an automatic valve.

I am aware that jet condensers have been employed by others for hot water heating apparatus but only for that class of apparatus, where the boiler of the apparatus is a hot water boiler, and where the main return hot-water pipe after having passed the jet condenser is carried down and connected to the lower part of the hot-water boiler, from which then the water is carried up again to the expansion-tank of the apparatus. It will be seen, that in thus carrying the water through pipes from the jet condenser down to the boiler and from the boiler again up to the expansion-tank, a great deal of friction is caused especially in high buildings and in such buildings where from some reason the expansion-tank can not be placed directly over the boiler. By my invention, where steam from a steam-boiler is employed to heat the water to boiling point the water after having passed the jet condenser need not be carried down to the boiler but only to a heater placed directly under the expansion-tank. Thus the distance the water has to travel in the whole apparatus is much shorter, the friction much less and the circulation of the water much more rapid by the same heat of water.

While I have herein shown and described specific embodiments of my invention, it will be obvious that changes may readily be made therefrom without departing from the spirit of the invention, and I do not wish to be limited to the precise construction shown.

What I desire to secure by Letters Patent is:

1. In a heating system, the combination of a hot-water circuit comprising suitable flow and return pipes, radiating devices, a condensing chamber, a steam heating chamber and a separating chamber with a boiler,

a pipe leading from the steam space of the boiler to the heating chamber, a pipe leading from the upper portion of the separating chamber to the condenser, a pipe communicating with the separating chamber below the entrance to the last named pipe and leading to the water space of the boiler, and suitable pipe connections leading from the condensing chamber to the heating chamber and from the heating chamber to the separating chamber respectively, the parts being so arranged that in operation the flow in the hot-water circuit is toward the separating chamber from the heating chamber.

2. In a heating system, the combination of a hot-water circuit comprising suitable flow and return pipes, radiating devices, a condensing chamber provided with an air vent, a steam heating chamber and a separating chamber with a boiler, a pipe leading from the steam space of the boiler to the heating chamber, a pipe leading from the upper portion of the separating chamber to the condenser, a pipe communicating with the separating chamber below the entrance to the last named pipe and leading to the water space of the boiler, and suitable pipe connections leading from the condensing chamber to the heating chamber and from the heating chamber to the separating chamber respectively, the parts being so arranged that in operation the flow in the hot-water circuit is toward the separating chamber from the heating chamber.

3. In a heating system, the combination of a hot-water circuit comprising suitable flow and return pipes, radiating devices, a condensing chamber, a steam heating chamber and a separating chamber with a boiler, a pipe leading from the steam space of the boiler to the heating chamber, a pipe leading from the upper portion of the separating chamber to the condenser, a pipe communicating with the separating chamber below the entrance to the last named pipe and leading to the water space of the boiler, a pipe rising from the condenser and an air valve on said pipe on a higher level than the entrance on the separating chamber to the said pipe that leads to the water space of the boiler, and suitable pipe connections leading from the condensing chamber to the heating chamber and from the heating chamber to the separating chamber respectively, the parts being so arranged that in operation the flow in the hot-water circuit is toward the separating chamber from the heating chamber.

In testimony whereof I affix my signature in presence of two witnesses.

ANDERS B. RECK.

Witnesses:

C. H. CRAWFORD,

L. WALDMAN.