

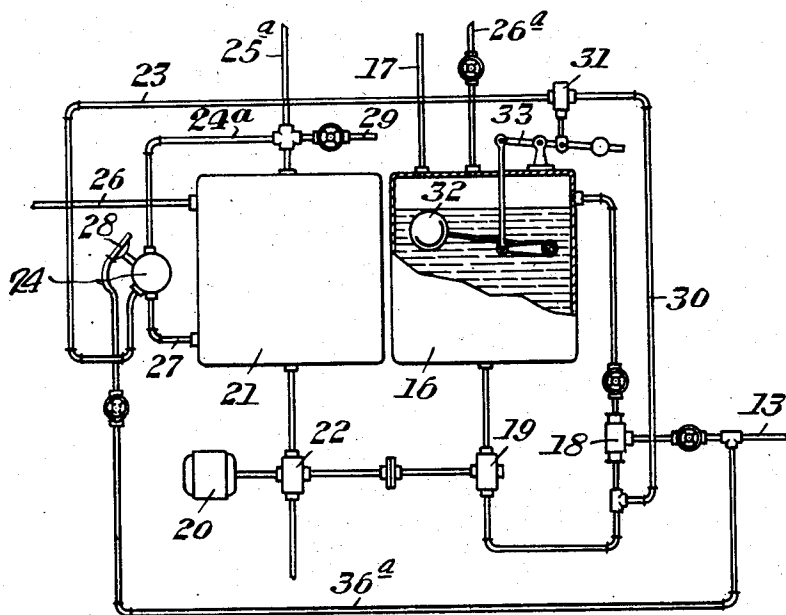
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VACUUM PRODUCING AND DEAERATING APPARATUS

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VACUUM PRODUCING AND DEAERATING
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My invention relates to heating systems and, in general, to heating systems in the larger sizes, such as are employed in office buildings, schools, apartments and the like. The general object of the invention is to simplify and improve upon present systems so that the initial cost thereof will be lessened and the expense and complications of maintenance and upkeep similarly reduced.

The present trend in heating systems of the type mentioned seems to be toward the steel boiler of welded or riveted construction, because of the relatively lower weight as compared with other types of boilers. The operation of systems including steel boilers, however, has not been entirely free from certain difficulties of maintenance.

Perhaps the commonest difficulty experienced in the operation of heating systems including steel boilers is the fact that corrosion within the boiler seems inevitable. It is known that this corrosion is accelerated by the presence of free air drawn into the boiler with the feed water. It is not so well known (although equally true) that the air dissolved in the water also plays a prominent part in increasing the damage wrought by corrosion within the boiler.

It has been the practice heretofore to vent the condensate from a steam heating system to atmosphere to release free air trapped in the system. It is also known to employ a direct contact boiler feed water heater for the purpose of preheating boiler feed water. Such heaters are connected to a steam supply and are filled with steam having direct contact with the water. The water is either sprayed into a chamber or passed over a series of baffles to give intimate contact with the steam. In the process of heating, the air in the water is liberated and vented to the outside of the heater and, therefore, a process of deaeration of the heater occurs incident to the heating. Identical temperatures of steam and water connotes complete air removal.

While methods and means for removing both free and dissolved air from the condensate delivered by the return line of a steam heating system are known, it has been impractical heretofore to take advantage of the known devices. It has been common practice, in the past, to provide means for producing a vacuum in the return line of a steam heating system including a condensate receiver connected directly to the return line and adapted to provide a space for accumulation of condensate, and an ejector-water supply chamber adjacent thereto. The condensate receiver is

provided with an ejector operated by means of water circulated by a pump from the ejector-supply chamber. A second pump usually driven by the same motor as the first pump, has been employed for delivering the excess condensate discharged from the ejector-supply chamber, to the boiler.

It has also been known to connect a direct-contact, boiler-feed water heater in the line from the second pump to the boiler, but this has necessitated a third pump for delivering condensate from the heater to the boiler. Architects and building committees have always been very reluctant to incur the additional expense of the heater and boiler feed pump, for several reasons. In the first place, it is not generally recognized that the air dissolved in the condensate increases the corrosion effect. In the second place, the cost of the heater and third pump is always an argument against their use. Perhaps the greatest objection to the use of the system described above including a heater and boiler feed pump, however, has been the fact that just that much more complication is introduced into the system so that more skilled and attentive supervision of the heating plant is required. In most cases, heating plants of the types I have mentioned are operated by comparatively unskilled men and, for that reason, it has been thought unwise to introduce any complexities whatever into the system. On the other hand, every effort has been made to increase the simplicity of maintenance and operation.

In addition to the aforementioned objection to present types of heating systems, namely, that the free and dissolved air cause excessive corrosion, there is also the fact that present systems return the condensate to the boiler at a comparatively low temperature, ranging from 140° to 160°. This is substantially the same temperature at which the condensate flows from the return line. The introduction of condensate at this temperature, obviously, sets up internal strains in the boiler, which is always operating at a much higher temperature, because of the unequal expansion and contraction of the various portions of the boiler due to the difference in the temperatures of the interior of the boiler and the feed water supplied thereto. Such unequal expansion and contraction of different parts of the boiler develops leaks in the latter, with all their attendant dangers and disadvantages. These effects can be reduced materially by heating the feed water to the boiling point.

The foregoing comments apply chiefly to heat-

ing systems in buildings where the steam is generated on the premises. In numerous metropolitan sections, it is the practice to purchase steam from a central plant for heating buildings throughout the vicinity. In the usual system of this type, the steam, after passing through the radiators and being reduced to condensate, is handled by a vacuum pump as previously described and delivered to a tubular heat exchanger, for preheating the hot water supply of the building before it reaches the hot water heater. The latter is also a simple heat exchanger and is fed with steam from the supply mains whereby the supply of service hot water for the building is raised to the proper temperature. The condensate from the hot water heater is also delivered to the exchanger and all the condensate after its heat is recovered, is then discharged from the exchanger to the sewer through a meter.

This system is also objectionable because of its comparative complexity and it is an object of this invention to provide a simpler and more efficient method and means for taking advantage of the residual heat in the condensate resulting from purchased steam for the purpose of preheating the hot water supply.

In accordance with my invention, I provide a vacuum producing mechanism for steam heating systems which comprises in general an ejector supply chamber and a direct contact water heating chamber. An ejector cooperating with the first-mentioned chamber serves to evacuate the condensate return line of the heating system and deliver condensate eventually to the water heating chamber which serves as a deaerator. A pump is provided for circulating water from the ejector supply chamber through the ejector. A vent condenser is connected to the heating chamber. The condenser is connected to the ejector intake and a branch line is provided for supplying water from the ejector chamber to the heating chamber.

For a complete understanding of the invention, reference should be made to the accompanying drawing illustrating a present preferred embodiment.

Referring in detail to the drawing, the condensate return of a steam heating system is indicated at 13. The condensate from the return is delivered to an ejector supply chamber 16 by an ejector 18 having connections therewith. A pump 19 circulates water from the chamber 16 through the ejector and thereby evacuates the return. The pump 19 is driven by a motor 20. The motor 20 also serves to remove heated feed water from a water heater 21 by means of a pump 22 which may be on the same shaft as the pump 19, or even in the same casing therewith. The pump 22, of course, delivers feed water to the boiler (not shown). The boiler delivers steam to the radiators and the cycle is completed by the return of the condensate from the radiators to the return 13.

A pipe line 23 extends from a vent condenser 24. The condenser is connected to the water heater 21 by a pipe 27 for the venting of the heater. Heating steam for the chamber 21 may be supplied through a pipe 26. Condensate from other sources may be admitted to the chamber 21 by a pipe 25a. The vent condenser 24 has a valved vent 28. A connection 24a is provided whereby water delivered to the vent condenser by pipe 23, flows into the top of heater 21. Make-up water may be supplied to the chamber 21 through a connection 29.

If it is desired to supply cold water to the vent condenser 24, this may be done by a separate connection (not shown).

A branch line 30 permits condensate from the storage chamber 16 to be delivered by the pump 19 through a valve 31 to the pipe 23 leading to the condenser 24. The valve 31 is controlled by a float 32 and a linkage 33 on the chamber 16.

The valve vent 28 of the condenser 24 is connected by a pipe 36a to the return 13 whereby the condenser is evacuated by the ejector 18.

If desired, the float 32 may be utilized to actuate a switch controlling the motor 20 so that the latter operates only when the float reaches a predetermined level in the chamber 16. The storage chamber 16 has an air vent 17 to the atmosphere. Condensate and make up water may be introduced into the storage chamber 16 through the pipe 26a.

The operation of the vacuum producing mechanism will be either continuous or intermittent. When intermittent, it will be controlled automatically in accordance with the vacuum in the return line during the day when the heating plant is operating. During the night when the heating plant is operating on reduced load, the pump operation can be controlled by a float switch in the receiving or other chambers.

In addition to the other advantages of the invention previously mentioned, the condensate is returned to the boiler at a higher temperature than is usual practice. This reduces the difference in temperature between the interior of the boiler and the feed water, and thereby decreases the uneven contraction and expansion of parts of the boiler which tends to produce leaky joints.

Although I have illustrated and described herein but a few preferred embodiments of the invention, together with modifications thereof, it will be apparent that many changes in the present disclosure may be made without departing from the spirit of the invention or the scope of the appended claims.

I claim:

1. A water-heating and vacuum-producing means comprising an ejector-supply chamber and a direct-contact water-heating chamber communicating directly with a steam supply, inlet and outlet water circulating connections at the top and bottom, respectively, of the ejector-supply chamber, a pump and an ejector between said connections, a condensate return line having an exhaust connection to the ejector, a pipe line for conveying water from the ejector-supply chamber to the heating chamber, a vent condenser in said line for removing gases from the water-heating chamber, an air discharge connection from the vent condenser to the aforesaid ejector, and a discharge outlet for the heating chamber.

2. A water-heating and vacuum-producing means comprising an ejector-supply chamber and a direct-contact water-heating chamber communicating directly with a steam supply, inlet and outlet water circulating connections at spaced points on said ejector-supply chamber, a pump and an ejector in series with said connections, a condensate return, an exhaust connection from the ejector to the return, a branch connection from between said pump and ejector extending to the water heater chamber, a vent condenser on said water heater chamber, a vent connection between the heater and the vent condenser, a pipe connecting the vent condenser to the ejector, and a discharge connection from the heater.

3. A water heater and vacuum-producing

means comprising a combination ejector-supply and receiving chamber, a direct-contact water-heating chamber communicating directly with a steam supply, a water circulating inlet and outlet in the combination ejector-supply and receiving chamber, a pump and an ejector connected between said inlet and outlet, a condensate return

connected to the ejector, a branch connection extending from between said pump and ejector to the water heater chamber, a vent condenser in said branch for removing gases from the water-heating chamber, and an air vent pipe connection from the vent condenser to the ejector.

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