STEAM CONDENSER DEAERATION

Alton Kirkpatrick, Brighton, Mass., assignor to Stone & Webster Engineering Corporation, Boston, Mass., a corporation of Massachusetts

Application November 18, 1955, Serial No. 547,667

2 Claims. (Cl. 257—24)

This invention relates to steam condensers, and particularly to surface condensers of the type used in steam electric power stations in conjunction with steam turbine generating units.

Objects and advantages of the invention will be set forth in part hereinafter and in part will be obvious herefrom, or may be learned by practice with the invention, the same being realized and attained by means of the combinations and improvements pointed out in the appended claims.

It is desirable that the water collected by condensers such as these be deaerated as much as possible before being returned to the feed water and power system. This will reduce corrosion of piping, pumps, and heaters. This has previously been accomplished by means of separate deaerating, direct contact heaters, and these are still employed in conventional systems.

In such condensate deaeration there is usually obtained no better than an oxygen content of 0.03 cc. per liter at loads higher than 1/2 of rating and circulating water inlet temperature of not less than 50° F. With the present invention deaeration to an oxygen content of 0.01 cc. per liter is obtainable, without restrictions on rating or circulating water temperature.

The embodiment of the invention specifically described herein comprises a divided condenser unit with separate but interconnected condenser sections. The sections are disposed in side-by-side spaced apart relationship and have interconnected steam and water passages. A recirculation pump removes the condensate from the condenser shells to a deaeration and collection zone from which the condensate is removed by a withdrawal pump.

A particular advantage of the present invention is that the condensate in the condenser sections is interconnected with the recirculated and deaerated condensate in the collection zone so that in the absence of forced circulation the respective condensates arrive at a common level. However, the recirculation pump operates at a greater capacity than the withdrawal pump so that the flow of condensate is normally directed from the collection zone to the condenser sections thus preventing the dilution of deaerated condensate by freshly deposited condensate.

The accompanying drawings, referred to herein and constituting a part hereof, illustrate a typical and illustrative embodiment of the invention and, together with the description, serve to explain the principles of the invention.

Of the drawings:

Figure 1 is a plan view, partially in section, of the condenser and deaeration system of the invention;

Figure 2 is a view in vertical section taken along the line 2—2 of Figure 1; and

Figure 3 is a fragmentary view in section of a side elevation of the system taken along the line 3—3 of Figure 2.

Referring now in detail to the embodiment of the invention shown in the accompanying drawings, condenser sections 1 and 2 have a common steam inlet 3. On the water side, cooling water is passed between water boxes 4 and 5 and 6 and 7 by means of tube bundles of pipes 8 and 8'.

Steam entering from inlet 3 passes in part over pipes 8 and in part over pipes 8', condenses, and runs into sumps 9 and 10. From there it is removed by recirculating pump 11 and is forced through spray heads 12 into the steam space between tube bundles 8 and 8' where the condensate is deaerated and subsequently collected in collection compartment 14. Compartment 14 has a sump 15 on a level with sumps 9 and 10, and said compartment 14 is interconnected with the condenser sections 1 and 2 by openings 16 where the compartment side walls 17 terminate.

Deaerated condensate is withdrawn from sump 15 by means of pumps 18 and delivered to the feed water system. Pump 11 operates at a greater capacity than the combined capacity of pumps 18 resulting in a continuous flow of deaerated condensate from compartment 14 to sections 1 and 2. Thus the condensate delivered to the feed water system by pumps 18 is normally highly deaerated because the condensate in compartment 14 is not contaminated by any direct flow of condensate from sections 1 and 2.

Because of the common level of condensate in compartment 14 and that in sections 1 and 2, pump 11 can be shut down without interfering with the operation of the condenser system. In such an event the system would then revert to conventional operation with pumps 18 withdrawing condensate which has not been deaerated in the spray zone.

In addition to the advantages above indicated it should be noted that the deaeration feature of this invention is an integral part of the condenser system and entails very little additional construction or power cost.

The invention in its broader aspects is not limited to the specific steps, combinations and improvements described but departures may be made therefrom within the scope of the accompanying claims without departing from the principles of the invention and without sacrificing its chief advantages.

What is claimed is:

1. A steam condensing and deaerating system comprising a divided condenser unit having a pair of separate interconnected condenser sections each having a condensate collecting section; a steam distributor interconnecting said condenser sections; wall means forming a deaerating and collecting chamber between said condensate collecting sections, said wall means having wall openings for the gravity flow of condensate between said chamber and said condensate collecting sections; means overlying said chamber for spraying condensate to be deaerated into the path of flow of steam being distributed to said condenser sections; pump means for circulating said condensate to be deaerated from said condensate collecting sections to said spraying means, and, separate pump means for withdrawing deaerated condensate from said condensate collecting chamber, said circulating pump means having a greater capacity than said withdrawal pump means.

2. A system as in claim 1 in which said condensate collecting chamber and said condensate collecting sections are on substantially the same level.

References Cited in the file of this patent

UNITED STATES PATENTS

<table>
<thead>
<tr>
<th>Patent Number</th>
<th>Date</th>
<th>Inventor(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,586,234</td>
<td>May 25, 1926</td>
<td>Bancel</td>
</tr>
<tr>
<td>1,756,987</td>
<td>May 6, 1930</td>
<td>Morgan</td>
</tr>
<tr>
<td>1,854,288</td>
<td>Apr. 19, 1932</td>
<td>Bancel et al.</td>
</tr>
<tr>
<td>2,095,534</td>
<td>Oct. 12, 1937</td>
<td>Schmidt</td>
</tr>
<tr>
<td>2,180,840</td>
<td>Nov. 21, 1939</td>
<td>Tuley et al.</td>
</tr>
<tr>
<td>2,266,406</td>
<td>Dec. 16, 1941</td>
<td>Bowman</td>
</tr>
<tr>
<td>2,722,920</td>
<td>Nov. 8, 1955</td>
<td>Arrowsmith</td>
</tr>
<tr>
<td>2,782,150</td>
<td>Feb. 19, 1957</td>
<td>Stalcup</td>
</tr>
</tbody>
</table>

FOREIGN PATENTS

<table>
<thead>
<tr>
<th>Patent Number</th>
<th>Date</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>567,338</td>
<td>Dec. 31, 1932</td>
<td>Germany</td>
</tr>
</tbody>
</table>