METHOD AND MEANS FOR PREVENTING LOW TEMPERATURE CORROSION, BY SULPHUR CONTAINING FLUE GASES, OF THE TERMINAL PARTS OF AIR HEATING MEANS

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UNITED STATES PATENTS
3,175,953 3/1965 Nettel et al. 60/105 UX
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ABSTRACT

In order to prevent corrosion of economizers and the like structures carried in the output section of steam generators burning sulphur-containing fuel, the feed water circuit for the steam generator includes the usual heat exchangers followed by a deaerator feeding the economizers and the temperature of the water supplied to the deaerator to the economizers is raised on an adjustable extent above corrosion temperature by steam extracted from different points of the steam turbine. Gates controlled by the pressure in the deaerator control the flow of steam out of these different points to ensure the desired pressure and temperature in the deaerator.

2 Claims, 1 Drawing Figure
METHOD AND MEANS FOR PREVENTING LOW TEMPERATURE CORROSION, BY SULPHUR CONTAINING FLUE GASES, OF THE TERMINAL PARTS OF AIR HEATING MEANS

Our invention has for its object a conventional plant including a steam generator burning sulphur-containing fuel, a steam turbine and heat exchangers adapted to heat the water feeding the steam generator.

Our invention has in particular for its object a method for operating a plant of such a type, showing in particular the advantage or preventing corrosion in the terminal heat exchangers of the steam generator.

According to our invention, the deaerator means fed with water passing out of the water heater or heaters receives steam tapped off different stages of the steam turbine so as to maintain in said deaerator a pressure and a temperature which are substantially constant whatever may be the load on said turbine, whereby the terminal economizer or economizers are fed with water at a temperature which is sufficiently high to prevent corrosion.

Our invention has also for its object a plant for executing such a method. In said plant the deaerator fed with water passing out of the water heater or heaters is connected with several stages of the turbine by extraction channels in each of which is inserted a non-return valve while a number of said channels are provided with a gate controlled by the pressure prevailing in the deaerator means so as to maintain said pressure at a substantially constant value.

There is described hereinafter by way of example and in a non-limiting sense an embodiment of a plant according to our invention, reference being made to the single FIGURE of the accompanying drawing which illustrates diagrammatically the said plant.

As shown our improved plant includes a steam generator 1 fed with fuel at 2 and producing superheated steam which expands in a turbine 3. The steam generator 1 is provided with a superheater 4 and an economizer 5. The flue gases pass in succession through said parts before they are exhausted through the chimney 6.

At the output of the turbine 3 the steam is condensed in a condenser 7 at the output of which the water is sucked in by an extraction pump 8, after which it is heated in the water heaters 9 and 10 fed respectively by the extraction points S1 and S2 in the steam turbine 3.

At the output of the water heater 10, the water passes into a deaerator vat 11 which may be fed with steam passing out of the extraction ports S3 and S4 of the turbine and out of the pipe feeding steam into the turbine.

The water passing out of the deaerator vat is sucked in by the feed pump 12 which delivers it directly under pressure into the economizer 5 of the steam generator. Each of the channels feeding steam into the deaerator vat includes a non-return valve 13. The steam passing out of the extraction port S4 is furthermore controlled by a regulating gate 14. The steam passing out of the pipe feeding the turbine is also provided with a regulating gate 15. The regulating gates 14 and 15 are controlled by an apparatus 16 for measuring the pressure in the deaerator vat 11 and a regulating chain which keeps the steam pressure in said deaerator vat substantially at a constant value. An alternator 17 is connected with the shaft of the turbine 3.

It is a well-known fact that in steam generators burning sulphur-containing fuel external corrosion arises in the terminal exchangers when the temperature of the metal in the exchangers is lower than the temperature of the acid dew point of the flue gases.

It is a well-known fact furthermore that, when the deaerator is fed only by a single extraction port, the pressure of the extracted steam is lower under partial loads than under full load conditions and the same is the case for the saturation temperature corresponding thereto and for the temperature of the water at the output of the deaerator vat since the latter temperature approximates the saturation temperature.

For such conditions the temperature of the metal forming the tubes of the economizer 5 which is substantially at the same temperature as that of the water feeding the steam generator, is lower under partial loads than under full load and it may for low loads fall below the acid dew point temperature of the flue gases.

It is not possible to increase indiscriminately the pressure of the extracted steam fed to the deaerator vat so as constantly to obtain for all loads, feed water for the steam generator at a sufficiently high temperature since this would lead under full load conditions to an excessively high temperature at the input of the economizer 5 and this would in turn result in much too high a temperature for the flue gases at the output of the steam generator and thus result in a considerable reduction in the general efficiency of the cycle.

It is therefore of considerable interest to maintain under partial load conditions the water feeding the economizer at a temperature which is sufficiently high for it to remain above corrosion temperature without reducing the efficiency of the present cycle under full load.

This result is reached in accordance with the invention by feeding the deaerator 11 with steam from different sources so as to maintain substantially constant pressure and temperature conditions under all loads as provided by the two pressure regulating chains described above.

The regulating chains maintain a constancy of the pressure in the deaerator by opening the gates 14 and 15 to an extend depending on the load so that the pressure is maintained in the deaerator at a predetermined value.

The temperature of the water at the output of the deaerator then remains constant under all loads and it is sufficient to suitably select the extraction ports feeding the deaerator for said temperature to be higher than that which might lead to a corrosion of the economizer.

In brief, our improved method eliminates under partial loads the external corrosion of the low temperature section of the economizer 5 by holding the temperature of the water feeding said economizer at a constant value result being obtained by retaining a constant pressure in the deaerator which is fed by steam diverted at points subjected to different loads.

The protection against corrosion is obtained without any reduction in the efficiency of the plant under full load conditions.

Obviously, the invention is not limited to the embodiment described and illustrated and it covers the modifications thereof falling within the scope of the accompanying claims and, in particular, it is applicable to a cycle including one or more reheaters.

What we claim is:
1. In the operation of a steam power plant including a steam generator burning sulphur-containing fuel, a terminal economizer for heating the feed water for said generator, a steam turbine fed by said generator, heat exchangers ahead of said economizer for heating said feed water by steam from said turbine and a deaerator located between said heat exchangers and said economizer, the steps of extracting steam from a plurality of different points of said turbine and feeding said extracted steam into said deaerator in a direct heat exchange relationship to increase and maintain the temperature of the water fed by said deaerator into said economizer to a valve above the acid dew point of said flue gases to minimize corrosion of the economizer structure by said flue gases, automatically adjusting the amount of steam extracted from said different points of said turbine to thereby maintain the pressure and water temperature in said deaerator substantially constant.

2. In a steam power plant including a steam generator burning sulphur-containing fuel, a terminal economizer inside said generator adapted to heat the feed water for said generator, a steam turbine fed by said generator, heat exchangers adapted to heat said feed water ahead of said economizer by steam extracted from said turbine and a deaerator inserted between said heat exchangers and said economizer, the provision of a plurality of channels opening at different points of said turbine and connected with said deaerator to feed it with said extracted steam to raise the temperature, in a direct heat exchange relationship, of the water supplied by said deaerator to said economizer to above the acid dew point of said flue gases to minimize corrosion of said economizer structure by said flue gases, a non-return valve in each channel and a gate in at least one channel the opening of which is controlled by the pressure prevailing in said deaerator thereby to maintain substantial constancy of said pressure and water temperature.
UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,693,353 Dated September 26, 1972

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It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

On the cover sheet: before "[22]" insert--73

Assignees: Societe General De Constructions Electroniques et Mecaniques and Stein Industrie, both of Paris France--;
before "[52]" insert
--30 Foreign Application Priority Data May 14, 1969 France......69 14333--

Signed and sealed this 20th day of February 1973.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR. ROBERT GOTTSCALK
Attesting Officer Commissioner of Patents