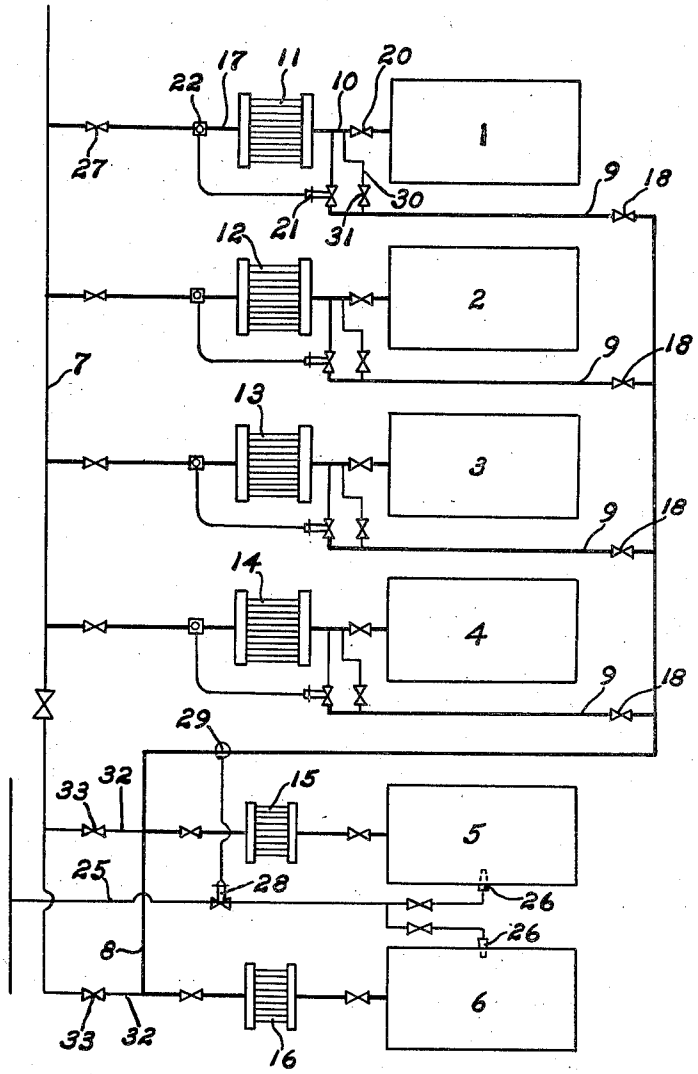
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STEAM GENERATING AND SUPERHEATING INSTALLATION

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STEAM GENERATING AND SUPERHEATING INSTALLATION

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This invention relates to steam generating and superheating installations.

Where a steam generator is equipped with a superheater the ultimate temperature of the steam at the superheater outlet varies with the variations in the load on the boiler due to the changes in the rate of firing necessary to accommodate the quantity of steam generated to the demand. It is well recognized that over the range of load between a predetermined minimum and a predetermined maximum it is very desirable to maintain a constant or approximately constant ultimate superheated steam temperature, and various means have been proposed for controlling or regulating the temperature of steam delivered by a superheater incorporated in a steam generator.

The present invention has for its object a simple and efficient method of and means for regulating or controlling the final steam temperature in a steam generating installation comprising a plurality of boilers with a steam superheater or steam superheaters incorporated in one or more of such boilers. The means employed according to the present invention for regulating or controlling the final superheat temperature is relatively cheap to provide and install and avoids the use of desuperheating apparatus and apparatus for by-passing either steam or gases of combustion. It will be appreciated that desuperheating apparatus is relatively costly and that where large volumes of steam have to be dealt with the size of the desuperheating apparatus becomes an undesirable factor.

The method according to the present invention of maintaining substantially constant the final superheat temperature of steam delivered by a steam generating and superheating installation notwithstanding variations in load on the installation and other factors consists in utilizing a section of the installation to supply regulatable quantities of relatively low temperature steam to the superheating apparatus of another section of the installation, from which latter section steam is delivered to the main superheated steam range, in order that, when necessary the quantity of steam passing through such superheating apparatus may be greater than that generated in the boiler or boilers associated therewith, so that the steam delivered to the main range shall be at the required ultimate temperature.

Further according to the invention the quantity of additional low temperature steam supplied to a superheater may be regulated by a valve controlled by a thermostat influenced by the temperature of the steam at the outlet of such superheater. Also the additional steam may be low temperature superheated steam.

Further according to the invention the rate of firing of the boiler or boilers supplying low temperature steam may be controlled automatically in accordance with the demand for such steam by a regulator or regulators influenced by the pressure of the steam in the range supplying such low temperature steam.

In order that the invention may be fully understood an installation embodying the invention will be described with reference to the accompanying drawing which shows diagrammatically a steam generating and superheating installation comprising six boiler units numbered 1 to 6 inclusive. Each boiler is to be assumed as being equipped with a steam superheater, such superheaters being marked 11 to 16 inclusive. Superheaters 11, 12, 13 and 14 deliver steam to the main superheated steam range 7 of the installation. The superheaters 15 and 16 are such that the steam passing from the boilers 5, 6 through such superheaters is superheated to a temperature materially lower than the temperature at which steam is delivered by the superheaters 11, 12, 13 and 14. Instead of delivering superheated steam into the main superheated steam range 7 of the installation, the superheaters 15 and 16 deliver into a low temperature range 8, which has branches 9 leading to the inlet sides of the respective superheaters 11, 12, 13 and 14. As shown the branches 9 are connected to the saturated steam supply pipes 10 leading from the boiler stop valves 20 to the inlet headers of the superheaters. The branch pipes 9 are themselves equipped with shut-off valves 18. The superheaters 11, 12, 13 and 14 deliver to the range 7 through pipes 17 equipped with shut-off valves 27.

Associated with each of the superheaters 11, 12, 13 and 14 is a valve 21 in the branch 9 leading from the low temperature steam range 8, said valve 21 being controlled by a thermostat 22 in the pipe 17 leading from the superheater to the main superheated steam range 7. Alternatively the thermostat 22 might be in the outlet header of the superheater. The low temperature steam generating and superheating units 5, 15 and 6, 16, operate at a pressure appropriately above the pressure at which the other units of the installation operate and are fired at a rate varying in accordance with the demand for low

temperature steam. The control of the low temperature steam supply from the main 8 to the superheaters 11, 12, 13 and 14 is such that the quantity of such steam supply is regulated in such a manner that on the temperature of the steam delivered by the superheaters and influencing the thermostats 22 exceeding a predetermined degree, steam from the low pressure main 8 will be fed into the inlet pipes 10 in such quantity that the increased quantity of steam passing through the superheaters will prevent the ultimate steam temperature rising above that required. It will be understood that the thermostats 22 operate to control the quantity of low temperature steam supplied to the individual superheaters with which such thermostats are associated.

The regulation of the firing of the boilers 5, 6 may be effected automatically and be under control of the pressure obtaining in the low temperature steam range 8. Thus, assuming the boilers 5, 6 to be oil fired, the firing of these boilers may be controlled by a valve 28 in the oil fuel pipe 25 supplying oil fuel to the burners 26 of the said boilers, which valve in turn is controlled by a regulator 29 influenced by the pressure of steam in the low temperature range 8. On one or more of the thermostats 22 operating to increase the quantity of low temperature steam supplied to one or more of the superheaters 11—14, the pressure drop in the range 8 will cause the valve 28 to be operated through the medium of the regulator 29 and the firing of the boilers 5, 6 to be increased, thereby increasing the generation of the low temperature steam.

Whilst there is shown in the accompanying drawing means for automatically controlling the quantity of low temperature steam supplied to the superheaters 11—14 and of automatically controlling the firing of the boilers 5, 6 in accordance with the demand for low temperature steam it is to be understood that the invention is not restricted to the employment of these automatic controlling or regulating means, as if desired the necessary regulation may be effected by the operator in charge of the installation from observation of appropriate indicators.

The superheaters 11—14 incorporated in the boilers 1—4 may be of the convection type or of the radiant type or there may be incorporated with each boiler superheaters of both types. In the latter case the superheaters of a boiler may operate in series or in parallel as desired.

Whilst there is shown, and has been described, low temperature superheaters 15, 16 as being incorporated in the boilers 5, 6, it is within the ambit of the invention to omit these superheaters and feed the low temperature steam main 8 with saturated steam from the boilers 5, 6. Where, however, the low temperature steam is superheated the superheaters incorporated in the boilers 5, 6 may be either of the convection or radiant type as desired.

It will be understood that the superheater or superheaters 11—14 will be designed so that when a boiler unit is operating at a predetermined load the steam delivered by the superheater or superheaters of such unit will be at the temperature which it is desired to maintain constant as the final steam temperature. Further it will be understood that the working pressure of the low temperature unit or units 5, 6, is higher than that of the high temperature unit or units 1—4 to an extent sufficient to compensate for the pressure drop in the piping or low temperature steam range 8 between the low and high temperature units, and in the superheater or superheaters of the low temperature unit or units if the latter be equipped therewith.

It will be appreciated that when the load of a high temperature unit is varied in such a way as to tend towards an increase in the ultimate steam temperature, by increasing the quantity of steam passing through the superheater of a high temperature unit beyond that generated in the unit, a rise in the ultimate temperature of the steam delivered by the superheater can be prevented.

A steam generating and superheating installation according to this invention may comprise appropriate connections 30 and manually operable valves 31 whereby low temperature steam can be delivered to the superheater of a high temperfature unit when that unit is being started up, thus preventing overheating of the superheater before a sufficient generation of steam obtains in the boiler.

If desired, each low temperature unit may be connected by a pipe 32, controlled by a valve 33, to the main steam range 7 of the installation so that, if necessary or desirable, the low temperature unit or units may be employed to feed the main range, as well as functioning, as above described, to supply steam to the superheater or superheaters of the high temperature unit or units.

The invention is not restricted to such details of construction as have been referred to or described herein as variations may be made without departing from the invention.

What I claim is:—

1. The method of regulating superheat temperature consisting in utilizing a section of the installation to supply regulatable quantities of relatively low temperature steam to the superheating apparatus of another section of the installation, from which latter section steam is delivered to the main superheated steam range and varying rate of firing of the boiler or boilers of the section of the installation which supplies the low temperature steam in accordance with the demand for additional steam from the main steam range of the installation.

2. The method of regulating superheat temperature as claimed in claim 1, wherein the rate of firing of the boiler or boilers supplying low temperature steam is controlled automatically by a regulator or regulators influenced by the pressure of the steam in the range supplying such low temperature steam to the superheaters which deliver to the main superheated steam range.

3. A steam generating and superheating installation comprising, in combination, a plurality of boilers operating at a predetermined pressure and each equipped with a steam superheater arranged to deliver steam to a main superheated steam range, another boiler or other boilers producing low temperature steam at a pressure higher than said predetermined pressure, connections from said last-mentioned boiler or boilers whereby such low temperature steam may be fed to the superheaters of the first-mentioned boilers to increase the quantity of steam passing through such superheaters and thereby maintain the delivery temperature constant, and means for regulating the quantity of low temperature steam supplied to any one of the said superheaters in accordance with variations in the

temperature of the steam delivered by such superheater.

4. A steam generating and superheating installation as claimed in claim 3, wherein there is incorporated in the boiler producing low temperature steam, or in each of such boilers, a steam superheater adapted to deliver steam at a temperature materially below that of the steam delivered by the superheaters feeding the main superheated steam range.

5. A steam generating and superheating installation as claimed in claim 3, wherein the quantity of low temperature steam supplied to a superheater which feeds the main superheated steam range is regulated by a valve controlled by a thermostat at the outlet from such superheater.

6. A steam generating and superheating installation as claimed in claim 3 having means for regulating automatically the firing of the boiler or boilers producing low temperature steam in accordance with the demand for such steam.

7. The method of operating a superheater boiler installation having a boiler or boilers operating at a predetermined pressure and each equipped with a steam superheater, another boiler or boilers producing low temperature steam at a pressure somewhat higher than said predetermined pressure, and connections from said last mentioned boiler or boilers whereby such low temperature steam may be fed to the superheater or superheaters of the first mentioned boiler or boilers which comprises passing low temperature steam from said second mentioned boiler or boilers through the superheater or superheaters of said first mentioned boiler or boilers and varying the rate of flow of said low temperature steam in such manner as to maintain a substantially contant steam temperature at the outlets of the superheater or superheaters of said first mentioned boiler or boilers.

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