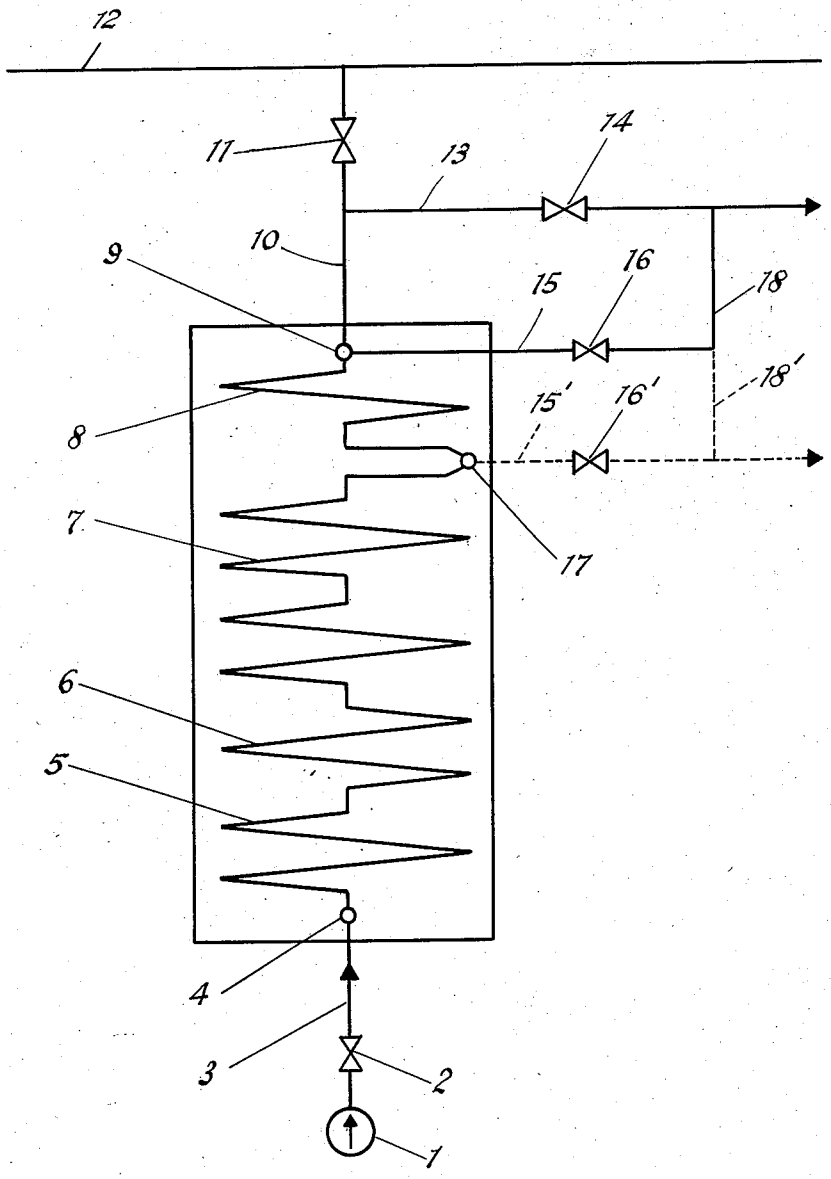
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ONCE-THROUGH BOILER

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ONCE-THROUGH BOILER

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1 Claim. (Cl. 122—379)

This invention relates in general to a once-through vapor generating and superheating unit.

Such a unit is usually provided with a branch pipe of relatively large diameter which is connected, in the flow path of the heated fluid, beyond the heat exchange surfaces and which is used during starting of the unit to discharge large quantities of saturated steam without inadmissible increases in pressure. The so-called starting pipe has also been used, during shutting down of the unit, in feeding cold water through the unit to cool the heat exchange sections after the fire has been removed. The rate of feed of the water has been controlled by means of a valve in the starting pipe but the large diameters of the pipe and the valve have made it difficult to obtain adequate control and to prevent water entering the hot parts of the starting pipe and the super-heated steam line connected to the unit. The large temperature differences between the inside and the outside surfaces of the thick walled tubes and headers, caused by the entry of cold water, give rise to undesirable stresses of the walls thereof which eventually cause cracking of the material and consequent failure of the parts. The temperature differences across the tube walls can be as great as 180° C.

It has been proposed to avoid excessive stresses in the material of the tubes by cutting off the flow of water before it leaves the tubes of the unit. In carrying out this proposal there is the danger that some of the tubes lying adjacent the hot brickwork will not be cooled adequately and so become damaged. In addition it is impossible to relieve build-ups of pressure caused by steam generated by heat in the hot brickwork without water coming out of the tubes of the unit since the valve in the starting pipe does not provide a sufficiently sensitive control on account of its large diameter.

An object of the present invention is the overcoming of these difficulties. Thus, a second branch pipe, in addition to the starting pipe, is provided and is arranged and adapted to be used in feeding water through the unit during shutting down thereof. An advantage of the invention is that the second, or shutting-down pipe may have a smaller diameter and thinner walls than the starting pipe thus avoiding the presence of large temperature differences and undesirable stresses in the walls thereof. Thus, water may be fed through the unit and through the shutting-down pipe without risk of damage to this pipe.

A further advantage of the invention is that a valve mounted in the shutting-down pipe provides a more sensitive control, on account of its smaller diameter, than the valve in the starting pipe and, therefore, it is possible to control the rate of feed of the water correctly and to relieve the build-ups of pressure caused by steam generated by heat in the brickwork during interruptions in the shutting down operation without water entering the superheated steam line.

The shutting-down pipe may be connected to the superheated steam outlet header or to an intermediate header in the unit. The latter arrangement has the advantage

that those heat exchange sections which operate at high temperatures and have thick walled tubes and headers may be protected from damage, caused by entry of cold water, since they may be arranged, in the steam flow path, beyond the header to which the shutting-down pipe is connected and in a region of the gas flow path in which cooling during shutting down is unnecessary.

The invention will now be described, by way of example with reference to the accompanying diagrammatic drawing showing a once-through steam generating and superheating unit.

In the drawing a feed pump **1** is arranged to deliver feed water through a regulating valve **2** and pipe **3** to an inlet header **4**. Beyond the header **4** a preheater **5**, a vaporizer **6**, a primary superheater **7**, a secondary superheater **8** and an outlet header **9** are arranged and connected in succession. Connected to the header **9** is a collecting pipe **10** which leads to a superheated steam line **12**, a shut-off slide valve **11** being mounted in the pipe **10**. A starting conduit **13** is connected to the pipe **10** at a point between the shut-off valve **11** and the outlet header **9**. A shutting-down conduit **15**, of smaller diameter than conduit **13** and provided with a valve **16** is connected to the outlet header **9** as shown by full lines on the drawing. In an alternative construction the shutting-down conduit **15'** with valve **16'** is connected to an intermediate header **17** as shown by dotted lines on the drawing. As shown on the drawing the header **17** is arranged between the primary superheater **7** and the secondary superheater **8** but it may be arranged in the unit so that those heat exchange sections liable to damage if cooled by water during a shutting down operation lie between the headers **9** and **17**. The shutting-down conduit **15** may discharge separately or, as shown, be connected, by piping **18**, to the starting pipe **13** at a point beyond the valve **14**.

During the starting of the unit, water is fed by the feed pump **1** through the valve **2**, the pipe **3**, the header **4**, the heat exchange sections **5**, **6**, **7** and **8**, the header **9**, the starting conduit **13** and the valve **14**, the shut-off valve **11** being closed. As steam is generated it is allowed to escape through the conduit **13** until the required steam temperature and degree of superheat are reached when the valve **11** is opened and the valve **14** is closed. The diameter of the conduit **13** is selected so that the saturated steam, generated during starting, may be readily discharged and dangerous build-ups of pressure in the unit avoided.

During shutting down of the unit the valve **16** is opened and the valves **11** and **14** are closed. Water is fed into the unit by the pump **1** until it flows out of the conduit **15**. Buildups of pressure caused by steam generated by heat remaining in the walls of the unit are relieved under control of the valve **16** which, because of its smaller diameter, provides a more sensitive control than the valve **14**. The alternative construction consisting of line **15'** and valve **16'** may be operated in a similar manner.

It will be seen that, in this way, I provide a once-through vapor generating and superheating unit having a starting pipe provided with a starting valve, wherein a shutting-down conduit of considerably smaller diameter than the starting pipe is provided and is arranged and adapted for use in shutting down operations.

I also provide such a unit, wherein the blowing-off pipe is connected to the unit beyond the heat exchange section or at some intermediate point.

I further provide such a unit, wherein the shutting-down conduit is provided with a blowing-off valve and is connected to the starting conduit at a point beyond the starting valve.

I still further provide such a unit, wherein a connecting

pipe connects the starting conduit and the blowing-off pipe at points beyond the starting valve and the blowing-off valve respectively.

While in accordance with the provisions of the statutes, there is illustrated and described herein a specific embodiment of the invention, those skilled in the art will understand that changes may be made in the form of the invention covered by the claim, and that certain features of the invention may sometimes be used to advantage without a corresponding use of the other features.

I claim:

In combination a once-through vapor generating and superheating unit having a preheater, vaporizer, primary superheater, secondary superheater, and an outlet header connected for the serial flow therethrough of a vaporizable fluid, said secondary superheater located in a low gas temperature convection heating portion of said vapor generator, a vapor outlet conduit receiving vapor from said outlet header and including a stop valve for normally conducting vapor to a point of use, a large flow capacity starting conduit connected to said outlet conduit upstream of said stop valve for discharging large quantities of vapor to a point other than said point of use during the starting-up of said unit, a starting valve in said

starting conduit, superheater bypass conduit means of substantially smaller capacity than said starting-up conduit and connected at a position between said primary and secondary superheaters and arranged to bypass said secondary superheater and starting conduit, and said bypass conduit means including a valve for controllably discharging smaller quantities of vapor than said starting valve.

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