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DESUPERHEATER SYSTEM

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Fig. 1.

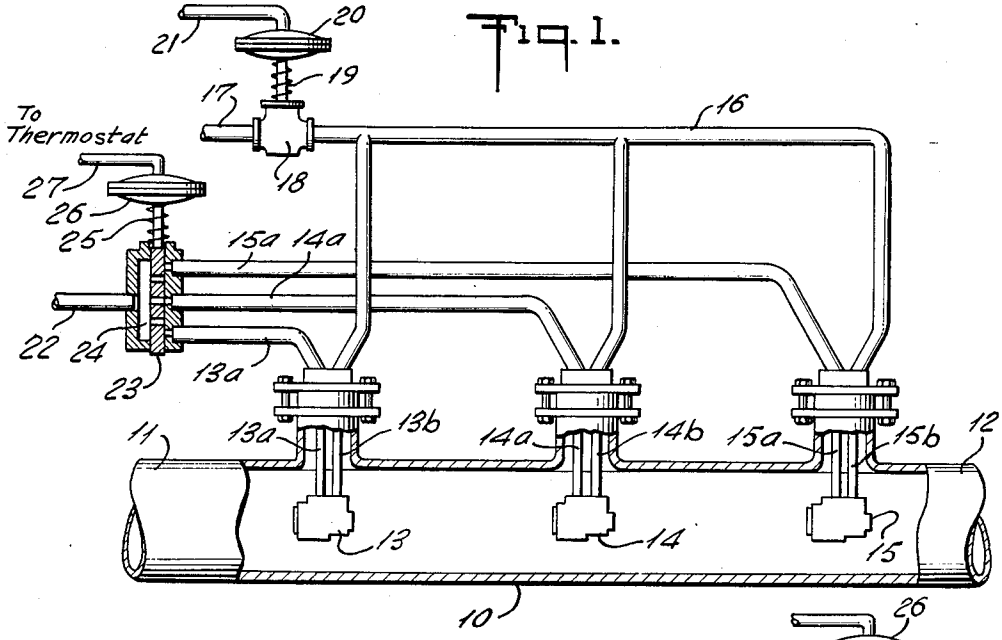


Fig. 2.

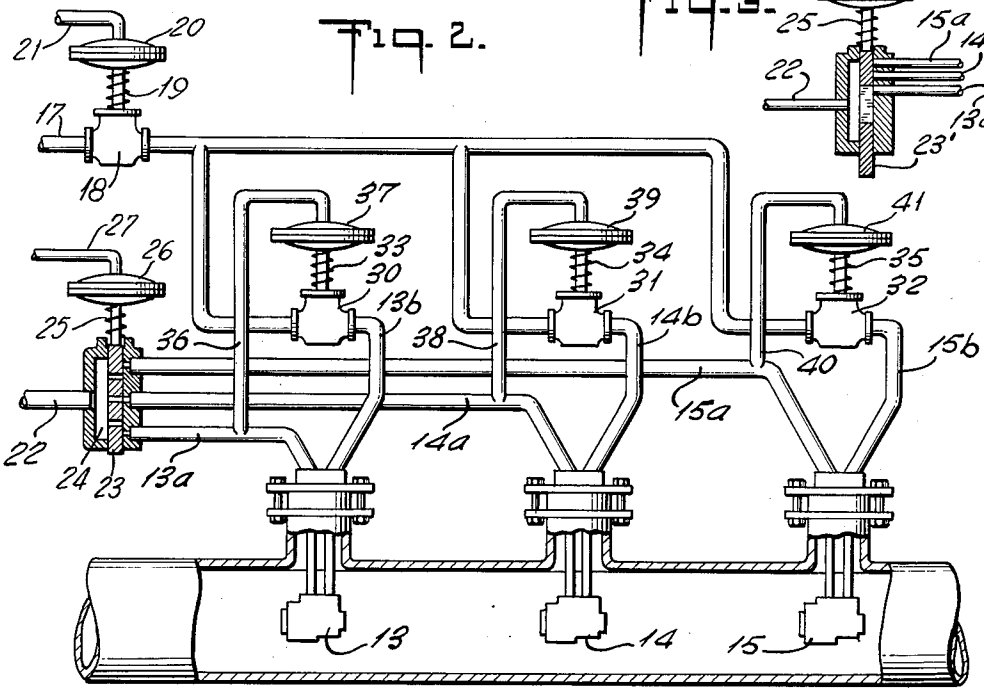


Fig. 3.

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DESUPERHEATER SYSTEM

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The invention, generally, relates to desuperheater systems and, more particularly, to an improvement of the system for desuperheating described in my Patent No. 2,293,314 which issued August 18, 1942.

It is customary to give the steam that is generated in power stations a high degree of superheat at a relatively high pressure. However, there are requirements in power stations for steam at a lower pressure and having a lower temperature; for example, for such purposes as the operation of auxiliaries, heating systems, processing and the like.

It is found to be more economical to desuperheat a small portion of the highly superheated steam rather than install a completely separate steam generating system. Moreover, a common source of steam has the advantage that it provides an uninterrupted supply of desuperheated steam and avoids the starting up and shutting down of a separate steam generating system to supply various ancillary intermittent requirements.

In some installations it has been found that water sprayed through the desuperheater will not be atomized sufficiently to be evaporated in the steam line and produce the desired cooling of the superheated steam. This action occurs in larger systems during, for example, a light load condition when the amount of cooling water required is small and it is difficult or impossible to cause the water to self-atomize.

If the water is not properly atomized, it is not taken up by the superheated steam to cause desuperheating. Therefore, it is the practice to supply also a source of "atomizing steam" to a desuperheater to ensure substantially complete atomizing of the water.

The desuperheater in accordance with my Patent No. 2,354,842 which issued August 1, 1944 is constructed as a single unitary device to provide the desired atomizing of water and steam over an entire range of load requirements. While installations including that desuperheater have been entirely satisfactory, it has been found that some situations require an even greater degree of control and require a more exact amount of desuperheating.

Accordingly, it is a principal object of the present invention to provide a new and improved desuperheater system.

It is also an object of the invention to provide a desuperheater system which admits of a finer degree of control over the amount of desuperheating.

In one form of the invention, the desuperheater system is provided with connections to receive a supply of superheated steam and deliver desuperheated steam. A plurality of desuperheater units is located in the steam path, and each unit has different atomizing capabilities. Suitable connection means are provided to each desuperheater unit to receive a supply of water and a supply of steam, and a valve means responsive to steam flow or demand or any other desired characteristics selects one of the desuperheater units to which the water is delivered for atomizing.

For a more complete understanding of these and other objects and advantages of the present invention, reference may be had to the description which follows and to the accompanying drawings, in which:

FIG. 1 is a view in elevation partly in section showing

the arrangement of a plurality of individual desuperheater units connected in accordance with the principles of the invention;

FIG. 2 is a view similar to that shown in FIG. 1 but showing a modification thereof; and

FIG. 3 is a fragmentary view of a flow distribution valve usable in either of the combinations of FIGS. 1 and 2.

Referring now to the form of the invention shown in FIG. 1, a conduit **10** receives a supply of superheated steam from the end **11** and, in accordance with the invention, delivers a supply of desuperheated steam at the end **12**. Positioned within the conduit **10** in the path of steam flow are three desuperheater units **13**, **14** and **15**.

Each of the desuperheater units **13**, **14** and **15** is capable of atomizing water and steam relatively accurately at different flow rates. For example, the individual desuperheater unit **13** is capable of atomizing a greater quantity of both water and steam than the desuperheater unit **15**, and the intermediate unit **14** is capable of atomizing a quantity of water and steam which is intermediate of the capabilities of the units **13** and **15**.

Of course, the structural arrangement of the desuperheater units **13**, **14** and **15** may be any of those heretofore known. By way of example, each individual desuperheater unit may be in the general form shown in my prior Patent No. 2,293,314, issued August 18, 1942, each such unit being made capable of atomizing a different quantity of water and steam by the use of a different size nozzle.

A supply of water is delivered to each individual desuperheater unit separately through connections **13***a*, **14***a* and **15***a*, and a supply of steam is delivered to each unit through connections **13***b*, **14***b* and **15***b*.

Each of the steam connections **13***b*, **14***b* and **15***b* is connected directly to a manifold **16** which is supplied with steam connected at the conduit **17**, the flow of which is controlled by a valve **18**. A spring **19**, or any other suitable means, maintains the valve **18** normally closed, and a diaphragm (not shown) located within the chamber **20** is operable responsive to a fluid control pressure applied through the conduit **21** to open the valve **18** an amount which is proportional to the magnitude of the control pressure.

In most instances, the small quantity of atomizing steam delivered through a desuperheater unit has little effect toward causing desuperheating of the superheated steam, the primary purpose of the steam through the desuperheater unit being to cause more complete atomization of the water. It is the atomized water delivered by a desuperheater unit that accomplishes the desired desuperheating.

Therefore, steam may be suplied continually through all three desuperheater units **13**, **14** and **15** in various relatively small quantities as determined by the valve **18** without exhibiting adverse effects.

The supply of water, on the contrary, is delivered selectively to a predetermined one of the desuperheater units **13**, **14** or **15**. The water suply is connected to a conduit **22**, and a valve member **23** movable in a chamber **24** connects the water supply conduit **22** with either one of the water conduits **13***a*, **14***a* or **15***a*.

As seen in FIG. 1, with the valve member **23** in its uppermost position the chamber **24** is connected with the conduit **15***a*, and with the valve member **23** in the position shown in the drawing, which is its intermediate position, the chamber **24** is connected with the conduit **14***a*. The lowermost position of the valve member **23** connects the chamber **24** with the conduit **13***a*.

A spring **25**, or any other suitable means, maintains

the valve member 23 in its uppermost position against a diaphragm (not shown) located in the chamber 26. A connection 27 provides control pressure to the upper portion of the chamber 26 to move the valve member 23 downwardly depending upon the magnitude of the control pressure.

The control pressure supplied through conduits 21 and 27 may be obtained from any suitable source, depending upon the control desired. By way of example only, this control pressure may be responsive to a thermostat located toward the steam load end of the system.

To illustrate the operation of the desuperheater system described above, assume that the steam load requirements are very light. With the valve member 23 positioned to connect the chamber 24 with the conduit 15*a*, the water supply through connection 22 will be delivered to the desuperheater unit 15 and will be atomized by the unit itself aided by the steam from the manifold 16 through connection 15*b*.

As load conditions change, however, the valve member 23 moves downwardly and eventually connects the chamber 24 with the conduit 14*a*, thereby disconnecting the chamber 24 from the conduit 15*a* and transferring the atomizing action of the unit 15 to the unit 14. In like manner, the atomizing action under different load conditions may be changed from the unit 14 to the unit 13, etc., for any desired number of atomizing units.

The system shown in FIG. 2 is a slight modification of that shown in FIG. 1 and adds thereto control valves 30, 31 and 32 connected to control the steam in the lines 13*b*, 14*b* and 15*b*, respectively. Each of the valves 30, 31 and 32 is normally closed, as by the action of springs 33, 34 and 35, for example. Therefore, no steam is delivered normally to all three of the desuperheater units 13, 14 and 15 of FIG. 2.

When the water supply from conduit 22 is connected to the connection 13*a* for delivery to the desuperheating unit 13, this same water pressure is connected also through conduit 36 to a control chamber 37 for opening the valve 30 permitting steam delivery through the conduit 13*b*.

In like manner, when the water supply is being delivered through conduit 14*a*, the conduit 38 delivers pressure to the control chamber 39 for opening the valve 31. A conduit 40 connects water pressure in the line 15*a* to a control chamber 41 for opening the valve 32. Otherwise, the system shown in FIG. 2 is exactly the same as that shown in FIG. 1, and corresponding reference numerals have been used in both figures to indicate corresponding parts.

In FIG. 3 I have illustrated a modified flow distribution valve construction similar to that described at 23, 24, 25, 26 by having a modified valve member 23′ capable of directing water in the desuperheater lines 13*a*, 14*a*, 15*a* in various combinations. For example, for the down position shown in FIG. 3 water is directed only into the line 13*a* for operation of the desuperheater 13. Whereas, at an intermediate elevation of the member 23′ water is simultaneously supplied to both lines 13*a* and 14*a*, thus operating both desuperheaters 13 and 14 at the same time. Finally, for a third and upermost position of the valve member 23′, all three or the upper two of the lines 13*a*, 14*a*, 15*a* will be supplied with water to operate a still further combination of desuperheater units. The valve member 23′ is moved upwardly by the spring 25 when the pressure in the control line to the chamber 26 is reduced, and is moved downwardly against this spring by an increase in pressure.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. Therefore, it is to be understood that the invention is not limited in its applications to the details of construction and arrangement of parts specifically described or illustrated, and that within the scope of the appended claims it may be practiced otherwise than as specifically described or illustrated.

What is claimed is:

1. A desuperheater system comprising

a steam path conduit,

input means to connect said conduit to a supply of superheated steam,

output means to deliver desuperheated steam from said conduit,

a plurality of desuperheater units located in the path of superheated steam intermediate said input and output means,

each of said desuperheater units having means for spraying atomized water into said steam path,

different ones of said desuperheater units having means to provide water atomization at different rates,

a first main line connected to deliver water to each desuperheater unit of said plurality,

a second main line connected to deliver steam to each desuperheater unit to more effectively atomize said sprayed water,

a first single valve connected by separate branch steam lines between said second main line and each of said desuperheater units to control the supply of steam to said desuperheater units,

first control means connected to said first valve and responsive to a predetermined fluid pressure for opening said first valve, said first control means including spring means for normally closing said first valve and a control conduit for receiving fluid under pressure, whereby when a predetermined fluid pressure is applied in said control conduit said first valve will be opened to allow steam to pass through said branch steam lines and through each of said desuperheater units simultaneously,

a second single valve connected by separate branch water lines between said first main line and each of said desuperheater units, said second valve including means for selecting different ones of said branch water lines to which water is delivered for desuperheating,

and second control means connected to said second valve and responsive to a predetermined control pressure for actuating said second valve, whereby the degree of the desuperheating of the steam may be controlled.

2. A desuperheater system comprising

a steam path conduit,

input means to connect said conduit to a supply of superheated steam,

output means to deliver desuperheated steam from said conduit,

a plurality of desuperheater units located in the path of superheated steam intermediate said input and output means,

each of said desuperheater units having means for spraying atomized water into said steam path,

different ones of said desuperheater units having means to provide water atomization at different rates,

a first main line connected to deliver water to each desuperheater unit of said plurality,

a second main line connected to deliver steam to each desuperheater unit to more effectively atomize said sprayed water,

a first single valve connected by separate branch steam lines between said second main line and each of said desuperheater units to control the supply of steam to said desuperheater units,

a second single valve connected by separate branch water lines between said first main line and each of said desuperheater units, said second valve including means for selecting different ones of said branch water lines to which water is delivered for desuperheating,

first control means connected to said second valve and responsive to a predetermined control pressure for actuating said second valve,

a further valve connected in each branch steam line,
second control means connected to said further valve in each branch steam line and responsive to water pressure in one of said branch water lines for opening said further valve,
and a control line connected between said second control means and one of said branch water lines, whereby the degree of desuperheating may be controlled.

3. A desuperheater system comprising
a steam path conduit,
input means to connect said conduit to a supply of superheated steam,
output means to deliver desuperheated steam from said conduit,
a plurality of desuperheater units located in the path of superheated steam intermediate said input and output means,
each of said desuperheater units having means for spraying atomized water into said steam path, different ones of said desuperheater units having means to provide water atomization at different rates,
a first main line connected to deliver water to each desuperheater unit of said plurality,
a second main line connected to deliver steam to each desuperheater unit to more effectively atomize said sprayed water,
a first single valve connected by separate branch steam lines between said second main line and each of said desuperheater units to control the supply of steam to said desuperheater units,
a second single valve connected by separate branch water lines between said first main line and each of said desuperheater units,
said second valve including means for selecting at least one of said branch water lines to which water is delivered for desuperheating,
first control means connected to said second valve and responsive to a predetermined control pressure for actuating said second valve,
a further valve connected to each branch steam line,
second control means connected to said further valve in each branch steam line and responsive to water pressure in one of said branch water lines for opening said further valve,
and a control line connected between said second control means and one of said branch water lines, whereby the degree of desuperheating may be controlled.

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