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RESERVE CAPACITY ATTEMPERATOR

Filed April 16, 1963

2 Sheets-Sheet 1

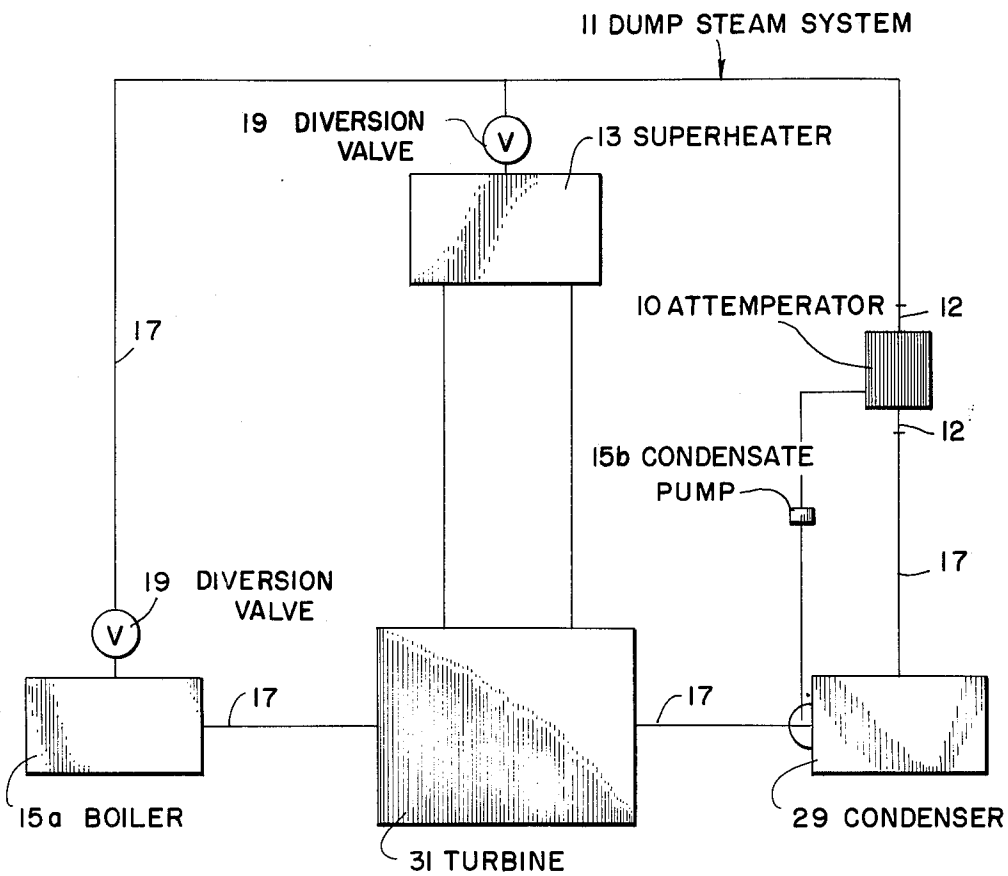


FIG. 1

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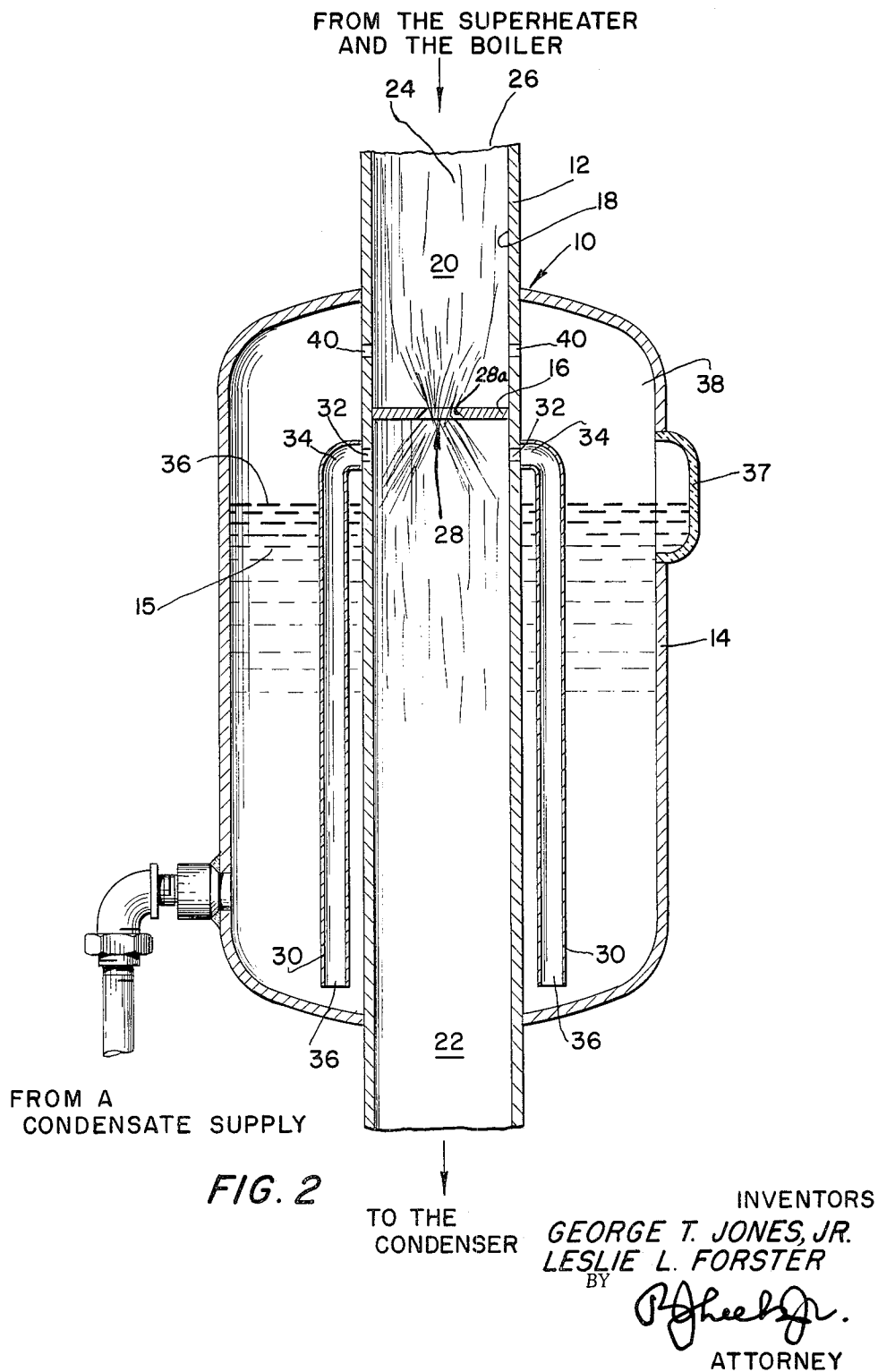
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RESERVE CAPACITY ATTEMPERATOR

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This invention relates to steam condensers and more particularly to an improved attemperator for such steam condensers and for reducing the temperature of the steam which is to be condensed.

Heretofore, it has been known that steam from a boiler or a superheater is fed to a turbine where the steam drives the turbine and thereby does work. In the course of driving the turbine the temperature of the steam is reduced. From the turbine the used steam is exhausted into a condenser where the steam is condensed.

In the case of the occurrence of an emergency condition such as a power failure in the power plant, a safety device, such as a diversion valve, in the boiler and in the superheater acts to discharge the steam in a dump steam line, which dump steam line by-passes the turbine and discharges the steam from the superheater, or the boiler, directly to the condenser. However, the steam in the dump steam line is hot steam capable of causing great damage to the condenser and other equipment in its path. In addition, during the emergency condition the conventional condenser is not provided with sufficient condensate to condense and cool the hot steam. No provision has heretofore been devised in conventional systems to provide an additional supply of condensate, which condensate would automatically be utilized to reduce the temperature of the hot dump steam before it flowed to the condenser and caused damage to the condenser.

It is the general object of the present invention to avoid and overcome the foregoing and other difficulties of and objections to prior art practices by the provision of an attemperator which would automatically provide condensate to lower the temperature of the dump steam exhausted through the attemperator during emergency conditions.

Another object of the present invention is to prevent the damaging of the condenser or other equipment in the path of hot dump steam.

The aforesaid objects of the present invention, and other objects which will become apparent as the description proceeds, are achieved by providing an attemperator for reducing the temperature of steam. The attemperator is provided with a first means for receiving the steam and with a second means operatively associated with the first means to automatically reduce the temperature of the steam when the steam is received by the first means.

For a better understanding of the present invention reference should be had to the accompanying drawings, wherein like numerals of reference indicate similar parts and wherein:

FIGURE 1 is a diagrammatic view of a condenser system incorporating the improved attemperator;

FIGURE 2 is a sectional view of the improved attemperator.

With specific reference to the form of the present invention illustrated in the drawings, and referring particularly to FIGURE 2, an attemperator is indicated generally by the reference numeral 10.

Although the principles of the present invention are broadly applicable to all systems embodying the reduction of the pressure and the temperature of a gaseous substance, the present invention is particularly adapted for use in conjunction with a dump steam system and hence it has been so illustrated and will be so described.

In order to receive and conduct steam flow the attemperator 10 is provided with flow means, such as a pipe 12. The attemperator 10 is adapted to be installed in a dump steam system 11 (FIG. 1) of a superheater 13 and a boiler 15a by connecting pipe 12 to the steam piping 17 of the dump steam system 11. The dump steam system 11 serves as a steam by-pass system for a standard turbine 31. Connecting pipe 12 can be connected to the steam piping 17 by any number of well known methods, such as welding, screwing, etc.

Reservoir means, such as a tank 14 (FIG. 2) or a large diameter pipe is connected around the pipe 12. The connection between the tank 14 and the pipe 12 is a liquid tight connection, which connection is accomplished by any number of well known methods such as welding. The tank 14 is provided with condensate 15 by any number of well known means such as a condensate pump 15b connected to a source of condensate supply such as the condenser 29.

A chamber defining means, such as an orifice plate 16, is disposed in pipe 12 and cooperates with the inner wall 18 of the pipe 12 to divide the pipe 12 into two chambers 20 and 22 (FIG. 2). The orifice plate 16, as will be seen from FIG. 2, includes a sharp-edged, tapering orifice 28a which communicates the two chambers 20 and 22.

The occurrence of an emergency condition, such as a power failure, actuates a safety device, such as a diversion valve 19 (FIG. 1), connected to the superheater 23 and the boiler 15a and causes the safety device 19 to discharge hot steam into the dump steam system 11. The hot steam 24 travels in the steam piping 17 of the dump steam 11 to the attemperator 10 which is connected in the dump steam piping 17. The hot steam enters the upstream side 26 of the connecting pipe 12 and flows through the attemperator 10 as indicated by the arrows in FIGURE 2. As the hot steam 24 flows through the orifice plate 16 a vena contracta is formed at 28 and thereafter the steam expands in chamber 22 and it flows out of the attemperator 10, on to the condenser 29 (FIG. 1).

It will be understood by those skilled in the art that as the steam flows through the pipe 12 the chamber 20 as viewed in FIGURE 2 will be under a higher pressure than the lower chamber 22. In order to provide condensate to condense the hot steam 24 in the lower pressure chamber 22, conduit means, such as pipes 30, are disposed in the tank 14 and port means, such as ports 32, are disposed in pipe 12. The pipes 30 communicate at one end 34 with the ports 32 and are open at the other end 36 just above the bottom 38 of the tank 14 to allow condensate 15 to flow up the pipes 30 through the ports 32 and into the lower chamber 22.

The tank 14 is filled with condensate 15 up to a predetermined level 36. This predetermined level 36 of the condensate 15 in the tank 14 can be checked and accurately controlled by any number of well known methods such as a liquid level controller or a glass gage 37. The tank 14, since it is not fully filled with condensate 15, is left with an empty portion 38. In order to conduct steam from the high pressure or upper chamber 20 into the empty portion 38 of the tank 14, port means, such as ports 40 are disposed in connecting pipe 12 communicating with the high pressure chamber 20. It will be recognized by those skilled in the art that when hot steam 24 is flowing through the pipe 12 a difference in pressure will result between the pressure in the high pressure chamber 20 and the pressure in the lower chamber 22. In addition, steam 24 will flow from the high pressure chamber 20 into the empty portion of the tank 14 and since the pressure in the high pressure chamber 20 is greater than the pressure of the lower chamber 22, the steam 24 will push the condensate 15 into the lower

chamber 22 to mix with the steam 24 and thus to lower the temperature of the steam 24 flowing through the lower chamber 22.

Operation

Even though it is believed the operation of the apparatus will be apparent from the foregoing description, a brief review of such operation will now be made for purposes of summary and simplification. Normally the attemperor 10 is void of steam and is therefore under the same pressure as the condenser 29 (FIG. 1). In the event of the occurrence of an emergency condition such as a power failure, the diversion valves 19 cause hot steam 24 to be dumped from the superheater 23 and the boiler 15a into the dump steam system 11. The hot steam 24 therefore, is caused to flow through the connecting pipe 12 of the attemperor 10. As the hot steam 24 flows through the orifice plate 16 and is expanded into the lower chamber 22 as viewed in FIGURE 2 it lowers the pressure in lower chamber 22 below the pressure in the upper chamber 20. In addition, steam from the upper chamber 20 flows through the ports 40 into the empty portion 38 of the tank 14 and pushes the condensate 15 through the pipes 30 and the ports 32 into the lower or low pressure chamber 22. As will be seen from the foregoing description, the condensate 15 thus supplied to the lower chamber 22 is proportional to the flow of the hot steam 24 from the upper chamber 20 to the tank 14. The turbulence of the flow of the hot steam 24 and the condensate 15 in the lower chamber 22 serves to mix the hot steam 24 and the condensate 15 intimately and thus reduce the temperature of the hot steam 24 before the hot steam flows on to the condenser 29 (FIG. 1).

It will be recognized by those skilled in the art that the objects of the present invention have been achieved by providing an attemperor which will automatically provide condensate to reduce the temperature of hot steam flowing through it.

While in accordance with patent statutes a preferred embodiment of the present invention has been illustrated and described in detail, it is to be particularly understood that the invention is not limited thereto or thereby.

We claim:

1. An attemperor for reducing the temperature of steam flowing through a conduit, said attemperor comprising:

- a reservoir located adjacent said conduit and adapted for containing a supply of condensate fluid;
- a wall within said conduit dividing such into a first chamber upstream of said wall and a second chamber downstream of said wall;
- said wall including a sharp-edged orifice communicating said first and second chambers, said orifice tapering from said second chamber towards said first

chamber to permit gradual expansion of steam flowing from said first chamber to said second chamber; a first fluid passage communicating said first chamber with said reservoir above the level of condensate fluid therein for directing steam from said first chamber to said reservoir upon the flow of steam through said conduit; and

a second fluid passage communicating said second chamber with said reservoir below the level of condensate fluid therein for directing a flow of condensate fluid to said second chamber proportional to the flow of steam through said first fluid passage during the flow of steam through said first fluid passage.

2. An attemperor for reducing the temperature of steam flowing through a conduit, said attemperor comprising:

a reservoir located circumferentially around said conduit and adapted for containing a supply of condensate fluid;

a wall within said conduit dividing such into a first chamber upstream of said wall and a second chamber downstream of said wall;

said wall including a sharp-edged orifice communicating said first and second chambers, said orifice tapering from said second chamber towards said first chamber to permit gradual expansion of steam flowing from said first chamber to said second chamber;

a first fluid passage communicating said first chamber with said reservoir above the level of condensate fluid therein for directing steam from said first chamber to said reservoir upon the flow of steam through said conduit; and

a second fluid passage communicating said second chamber with said reservoir below the level of condensate fluid therein for directing a flow of condensate fluid to said second chamber proportional to the flow of steam through said first fluid passage during the flow of steam through said first fluid passage.

References Cited by the Examiner

UNITED STATES PATENTS

424,764	4/1890	Davol	261—160
1,393,499	10/1921	Christie	165—110
1,738,773	12/1929	Hesse	165—110
2,317,814	4/1943	Schuchmann et al.	165—110
2,425,669	8/1947	Brock	165—111
2,522,743	9/1950	Brousseau et al.	261—78 X
2,966,312	12/1960	Wilson et al.	261—78 X
3,034,771	5/1962	Harris	261—116 X

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