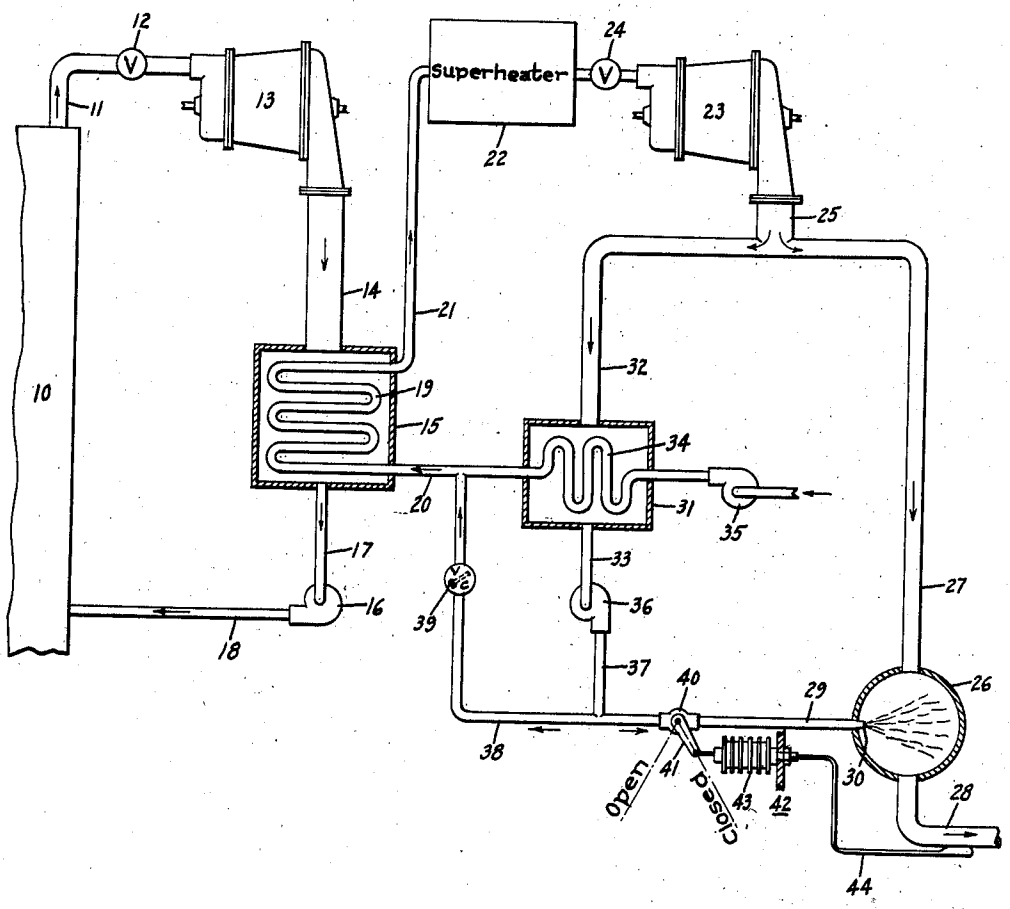
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ELASTIC FLUID POWER PLANT

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ELASTIC FLUID POWER PLANT

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The present invention relates to elastic fluid power plants in which elastic fluid is discharged from a turbine or like consumer and desuperheated in a spray type desuperheater before it is used for heating, processing or other purposes. Heretofore it has been customary to remove the superheat from the superheated steam by means of a spray of make-up water, especially in plants in which 100 per cent make-up water is necessary as is the case in chemical and paper factories in which steam used for process work is contaminated. Difficulties have been experienced with the use of fresh water in a spray type desuperheater due to clogging of the nozzle or nozzles for producing a spray by impurities contained in make-up water.

The object of my invention is to provide an improved elastic fluid power plant in which clogging of the spray nozzles of the desuperheater is substantially eliminated. This is accomplished in accordance with my invention by the provision of an arrangement for condensing part of the superheated steam and using condensate as a cooling medium for the spray type desuperheater. In a preferred embodiment the condensing of superheated elastic fluid is accomplished in a feed water preheater.

For a better understanding of what I believe to be novel and my invention, attention is directed to the following description and the claims appended thereto in connection with the accompanying drawing.

The single figure of the drawing illustrates diagrammatically an elastic fluid power plant embodying my invention.

In the present example I have shown a mercury vapor and steam power plant with the mercury cycle and the steam cycle linked in known manner by a condenser boiler. The mercury part of the plant comprises a boiler 10 for producing mercury vapor. The vapor is discharged through a conduit 11 including a valve 12 into a mercury vapor turbine 13 which has an exhaust end connected by a conduit 14 to a condenser boiler 15. The condensate is returned from the condenser boiler 15 to the boiler 10 by means of a condensate pump 16 having an inlet conduit 17 connected to the condenser boiler 15 and a discharge conduit 18 connected to the boiler 10.

The condenser boiler 15 includes a cooling element shown in the form of a coil 19 having an inlet conduit 20 for receiving cooling water. The water in passing through the coil 19 is evaporated and the steam thus formed is discharged through a conduit 21. The coil 19 forms a part of the steam cycle which in addition includes a superheater 22 having an inlet connected to the conduit 21 for superheating the steam formed in the condenser boiler 15. In actual practice the superheater may be combined with the boiler 10. The superheated steam is conducted from the superheater to an elastic fluid turbine 23 having an inlet conduit with a valve 24 connected to the discharge end of the superheater 22. The elastic fluid turbine 23 exhausts steam in a superheated condition into a conduit 25. Before this superheated steam can be used for certain industrial purposes it has to be desuperheated. This is done in known manner by means of a desuperheater 26 having an inlet conduit 27 connected to the conduit 25 and a discharge conduit 28 for conducting desuperheated steam or like elastic fluid to a consumer for desuperheated elastic fluid. In addition the desuperheater includes a conduit 29 for receiving water and having an end portion with a nozzle 30 for spraying the water into the desuperheater.

In order to produce a source of clean water or like cooling medium to be forced through the nozzle 30 I provide a condenser 31 having an inlet conduit 32 connected to the exhaust conduit 25 and a discharge conduit 33 for condensate. In addition the condenser 31 includes a cooling coil 34 having an inlet conduit connected to a feed pump 35 for receiving make-up water and a discharge conduit connected to the inlet conduit 20 of the condenser boiler. Thus, the condenser 31 for condensing part of the desuperheated steam discharged from the turbine 23 broadly constitutes a surface type heat exchanger for preheating the feed water conducted to the condenser boiler 15. The condensate formed in the condenser 31 is used partly as a cooling medium in the spray type desuperheater 26. To this end the condensate discharge conduit 33 is connected to a pump 36 which has a discharge conduit 37 connected to the aforementioned conduit 29. In addition the conduit 37 is connected by a conduit 38 including a check valve 39 to the inlet conduit 20 of the condenser boiler 15 so that the condensate in the feed water preheater not needed in the spray type desuperheater 26 is conducted through the conduit 38 to the conduit 20.

The flow of water through the conduit 29 into the desuperheater 26 is controlled in response to temperature changes of the desuperheated steam discharged from the desuperheater 26. To this end a valve 40 is provided in the conduit 29 and

connected by an arm 41 to a temperature responsive device 42 including a bellows 43 connected to the arm 41 and a sealed pipe 44 containing a fluid communicating with the bellows and having a sealed end portion adjacent the conduit 28 and subject to temperature changes of the desuperheated steam flowing through the conduit 28.

During operation an increase in temperature of the fluid in the conduit 28 causes expansion of the fluid sealed into the pipe 44 whereby the bellows 43 expands and moves the valve 40 towards opening position. This increases the flow of cooling water through the conduit 29 and thereby reduces the temperature of the desuperheated fluid in the conduit 28. Upon a drop in temperature of the fluid in the conduit 28 the valve 40 is moved towards closed position to reduce the flow of cooling water through the conduit 29 and thereby to effect an increase in temperature of the de-superheated fluid in the conduit 28.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. Elastic fluid power plant comprising a turbine having an inlet for receiving superheated elastic fluid and an outlet for discharging fluid in superheated condition, a spray type desuperheater connected to the outlet to receive superheated elastic fluid discharged from the turbine, and means for supplying cooling liquid to the desuperheater comprising a condenser connected to the outlet to receive part of the superheated fluid discharged from the turbine and means including a pump for forcing condensate from the condenser into the desuperheater.

2. Elastic fluid power plant comprising a turbine for receiving superheated elastic fluid and an outlet for discharging fluid in superheated condition, a boiler and a superheater for supplying superheated elastic fluid to the turbine, a spray type desuperheater connected to receive superheated fluid discharged from the turbine, and means for supplying cooling liquid to the desuperheater comprising a surface type preheater having an element connected to the boiler and another element for receiving part of the superheated elastic fluid discharged from the turbine and a pump for forcing condensate from the preheater into the desuperheater.

3. Elastic fluid power plant comprising a boiler and a superheater for producing superheated steam, a steam turbine connected to the superheater, a spray type desuperheater connected to receive superheated steam from the exhaust of the turbine, and means for supplying a spray of cooling water to the desuperheater, said means comprising a feed water preheater including a conduit for conducting feed water to the boiler, a conduit for conducting part of the exhaust from the turbine to the feed water preheater and another conduit including a pump for forcing condensate from the feed water preheater into the desuperheater.

4. Elastic fluid power plant comprising a boiler and a superheater for producing superheated steam, a steam turbine connected to the superheater, a spray type desuperheater connected to receive superheated steam from the turbine and having a discharge conduit, means for supplying a spray of cooling water to the desuperheater, said means comprising a feed water preheater for conducting feed water to the boiler, a conduit for conducting part of the exhaust from the turbine to the feed water preheater, another conduit including a pump for forcing condensate from the feed water preheater into the desuperheater, and means for controlling the flow of cooling water to the desuperheater to maintain constant the temperature of the desuperheated steam, said means comprising a valve in the other conduit and a device connected to the valve and responsive to temperature changes of the steam in said discharge conduit.

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