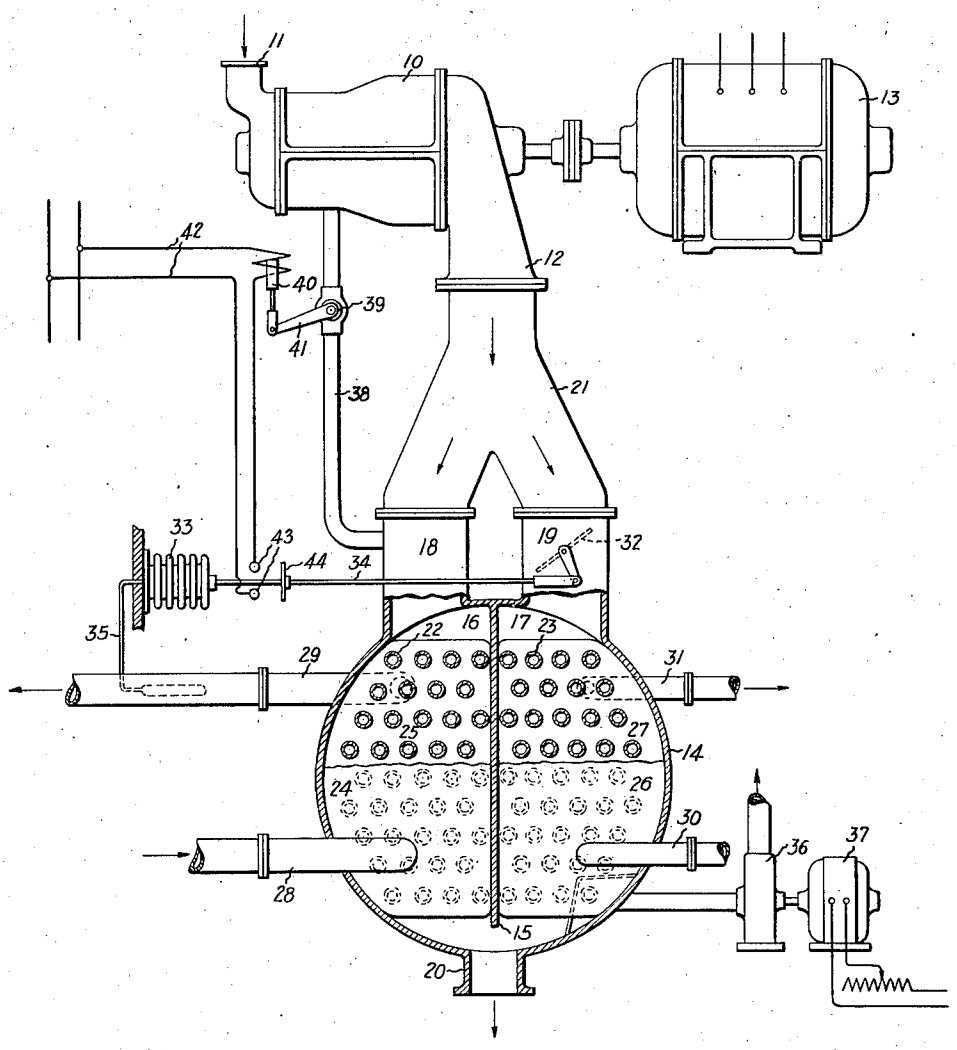
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CONDENSER ARRANGEMENT

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CONDENSER ARRANGEMENT

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The present invention relates to condenser arrangements for elastic fluid engines in which elastic fluid exhausted from such engines is passed through and condensed within a surface type condenser, heat exchanger, or heat transfer apparatus. The cooling or condensing may be effected by any suitable medium, such as water. The cooling medium during operation is heated and in many cases is utilized for industrial purposes. Often it becomes desirable to control and maintain constant the temperature of the heated cooling medium discharged from the condenser. Temperature control of this medium is especially difficult where the elastic fluid engine exhausting into the condenser is subject to great variations in load and also where the demand for heated cooling medium fluctuates considerably.

The object of my invention is to provide an improved construction and arrangement for surface type condensers and like apparatus whereby the temperature of a cooling medium discharged from the condenser may be readily controlled and maintained substantially constant.

This is accomplished according to my invention by dividing the condenser into a plurality of sections or chambers having separate cooling circuits and by the provision of means for controlling the flow of exhaust steam through at least one of the sections. In addition, means may be provided to vary the vacuum in the condenser and other means to supply additional heating fluid to one of the sections or to reheat the cooling fluid discharged from one of the sections.

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 drawing illustrates by way of example a condenser arrangement embodying my invention in connection with an elastic fluid turbine installation.

The arrangement comprises an elastic fluid engine or turbine 10 having an inlet 11 and an outlet 12 for elastic fluid. The turbine is coupled with an electric generator 13. The outlet or exhaust end 12 of the turbine is connected to a surface type condenser or heat exchanger 14. The latter has a partition 15 in the direction of flow to form a plurality, in the present instance two, separate condensing chambers 16 and 17 having inlet conduits 18 and 19 respectively and a common conduit 20 for discharging condensate. The inlet conduits 18, 19 of the condenser are connected to the exhaust end 12 of the turbine by a branched conduit 21. A plurality of cooling pipes or conduits 22 and 23 are disposed in each of the chambers 16 and 17. The pipes 22, 23 form parts of separate cooling circuits, the pipes 22 being connected to a front header 24 and a rear header 25, and the pipes 23 being connected between a front header 26 and a rear header 27. Cooling medium, for instance water, is conducted to the pipes 22 by an inlet conduit 28 connected to the front header 24 and discharged through an outlet conduit 29 connected to the rear header 25. Similarly, an inlet conduit 30 and an outlet conduit 31 are connected to the front header 26 and the rear header 27 respectively. The cooling medium circulated through the second cooling chamber 17 including the inlet conduit 30 and the outlet conduit 31 may be the same or different from that circulated through the first chamber 16. In the present instance I have shown an arrangement in which it is desired to control the temperature of the cooling medium discharged from the chamber 16 through the conduit 29, the heated cooling medium being used for some industrial process to be carried out under constant temperature condition.

The first means for controlling the temperature of the cooling medium discharged from the conduit 29 comprises a valve means, in the present instance indicated as a butterfly valve 32, disposed in the conduit 19 to regulate the relative amounts of elastic fluid flowing through the condensing chambers 16 and 17. Closing of the valve reduces the amount of fluid flowing through the chamber 17 and increases the amount of fluid flowing through the chamber 16 to effect an increase in temperature of the cooling medium discharged through the conduit 29 and vice versa. The control of the valve 32 may be effected automatically by a heat-responsive device, in the present instance shown as including a sealed bellows 33 connected by a rod 34 to the valve 32. The temperature-responsive device also comprises a pipe 35 having one end communicating with the interior of the bellows and another end sealed and disposed within the conduit 29. The bellows 33 and the pipe 35 contain a medium, such as air, which expands as its temperature increases and contracts as its temperature drops. With this arrangement an increase in temperature of the heated cooling medium flowing through the conduit 29 effects expansion of the bellows which in turn causes opening movement of the valve 32, resulting in an increased flow of exhaust fluid through the chamber 17 and consequently a corresponding decreasing flow through

the chamber 16 whereby the temperature of the heated cooling medium flowing through the conduit 29 is reduced. Vice versa, a decrease in temperature of the cooling medium discharged through the conduit 29 effects closing movement of the valve 32. This closing movement may continue until the valve 32 is completely closed, in which case all of the exhaust fluid is passed through the chamber 16. If under such condition a further drop in temperature of the heated cooling medium discharged from the chamber 16 takes place, I effect an increase of the temperature by reducing the vacuum in the condenser, the vacuum being maintained by means including a pump 36 connected to the condenser and driven by a variable speed motor 37. By reducing the speed of the motor 37 the vacuum in the condenser is reduced and thereby the available heat energy of the exhaust fluid increased. It may occur that even with a reduced vacuum in the condenser the available heat energy is not sufficient to heat the cooling medium passed through the chamber 16 to the desired temperature. To this end I provide auxiliary means for conducting elastic fluid to the chamber 16. This means in the present instance comprises a bleeder or extraction conduit 38 connected between the inlet 18 of the chamber 16 and an intermediate stage of the turbine 10. The conduit 38 has a valve 39 for controlling the flow of extraction fluid from the turbine to the condenser. The valve 39 is normally closed and preferably is opened only if the exhaust steam and a reduced vacuum in the condenser are insufficient to properly heat the cooling medium circulated through the chamber 16. The operation of the valve 39 may be effected automatically by means including an electromagnet 40 having a core connected to a valve arm 41 and being energized through a circuit 42 including two contacts 43 arranged in cooperative relation with a contact-closing member 44 secured to the rod 34. Movement of the rod 34 towards the left causes closing of the valve 32, as described above, and in a certain position of the rod 34 the contact member 44 bridges the contacts 33 and thereby closes the circuit 42 for the electromagnet 40. When this happens the valve 39 is opened and extraction fluid is supplied to the chamber 16 from an intermediate stage of the turbine 10 until the heated cooling medium reaches the desired temperature.

Having described the method of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof, I desire to have it understood that the apparatus shown is only illustrative and that the invention may be carried out by other means.

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

1. The combination of an elastic fluid engine, a surface type condenser having at least two chambers, a branched conduit connected between the engine exhaust end and said chambers, a separate cooling circuit for each chamber, each cooling circuit including a plurality of tubes and an inlet and an outlet conduit connected to the tubes, and means for automatically controlling the temperature of the cooling medium discharged from the outlet conduit of one of the circuits comprising a device responsive to the temperature in such outlet conduit and a valve connected to the device and disposed in the branched conduit.

2. The combination of an elastic fluid engine, a surface type condenser having at least two chambers, a branched conduit having one end connected to the engine exhaust end and a separate branch connected to each chamber, a separate cooling circuit for each chamber, each cooling circuit including a plurality of tubes and an inlet and an outlet conduit connected to the tubes, and means for automatically controlling the temperature of a heated cooling medium discharged from the outlet conduit of one of the circuits comprising a device responsive to the temperature in said outlet conduit, a valve connected to the device and disposed in one of the branches, and auxiliary means for supplying heating medium to one of the chambers in response to complete closing of the valve.

3. The combination of an elastic fluid engine, a surface type condenser having at least two chambers, a branched conduit connected between the engine exhaust end and said chambers, a separate cooling circuit for each chamber, each cooling circuit including a plurality of tubes and an inlet and an outlet conduit connected to the tubes, and means for automatically controlling the temperature of the cooling medium discharged from the outlet conduit of one of the circuits comprising a device responsive to the temperature in said outlet conduit, a valve connected to the device and disposed in the branched conduit, and means for reducing the vacuum in the condenser to increase the available heat energy when said valve is completely closed.

ROBERT KOCH.