R. N. EHRHART.

HEAT CONSERVING APPARATUS.

APPLICATION FILED MAY 4, 1917.

1,390,516.

Patented Sept. 13, 1921.

2 SHEETS—SHEET 1.

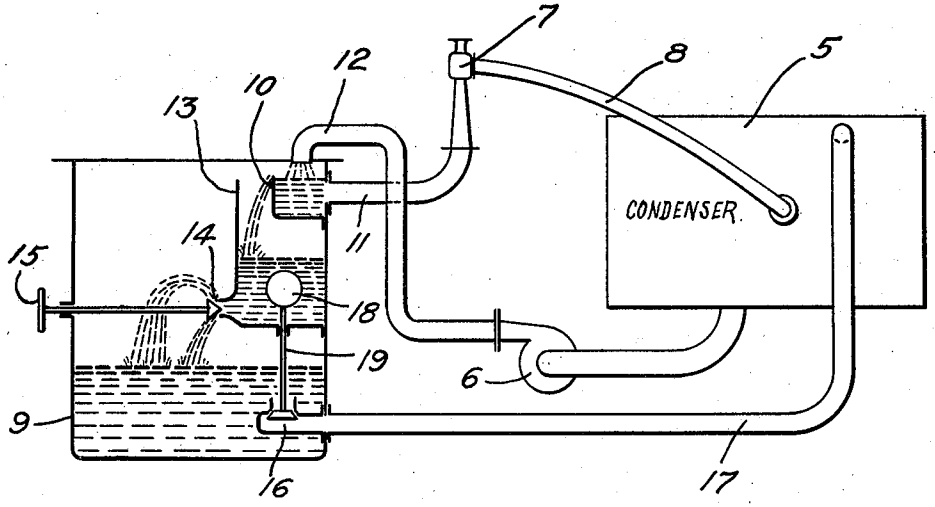


Fig. 1.

INVENTOR.

Raymond N. Ehrhart

BY Green & McCallister

HIS ATTORNEY IN FACT

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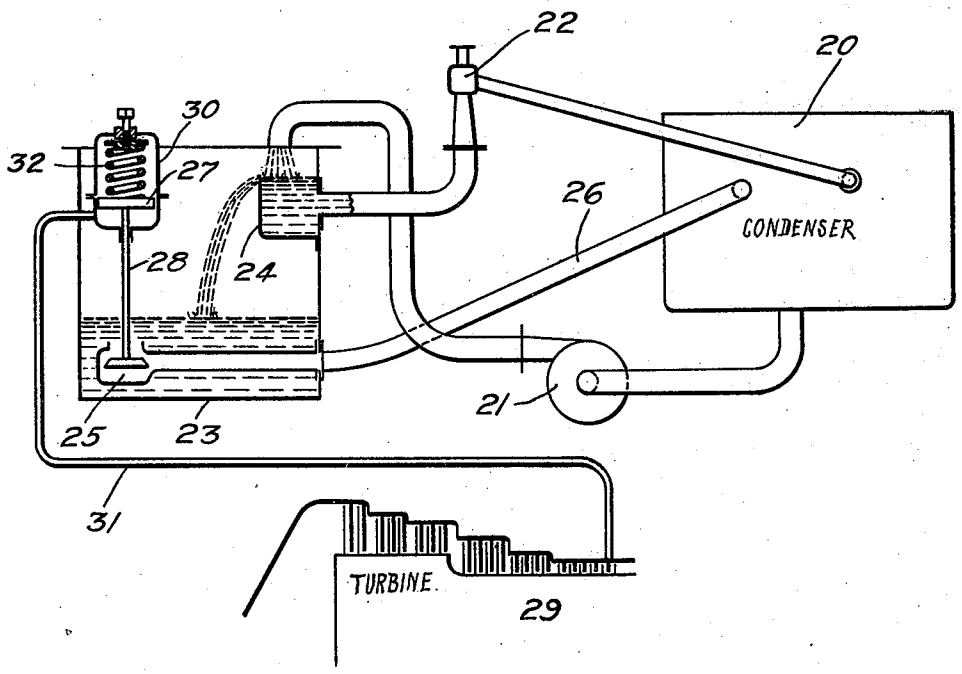


Fig. 2.

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UNITED STATES PATENT OFFICE.

RAYMOND N. EHRHART, OF EDGEWOOD PARK, PENNSYLVANIA, ASSIGNOR TO WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, A CORPORATION OF PENNSYLVANIA.

HEAT-CONSERVING APPARATUS.

1,390,516. Specification of Letters Patent. Patented Sept. 13, 1921.

Application filed May 4, 1917. Serial No. 166,465.

To all whom it may concern:

Be it known that I, RAYMOND N. EHRHART, a citizen of the United States, and a resident of Edgewood Park, in the county of Allegheny and State of Pennsylvania, have made a new and useful Invention in Heat-Conserving Apparatus, of which the following is a specification.

This invention relates to heat conserving apparatus and has for an object to produce an apparatus for conserving the heat in fluids withdrawn from a condenser.

A further object is to produce a heat conserving apparatus in which a steam actuated pump, hereinafter called an ejector, is employed for withdrawing air and other non-condensable gases and vapors from a condenser; in which the condensate from the condenser is employed for cooling and condensing the fluids discharged by the ejector, and in which means are provided for automatically maintaining a supply of liquid for condensing the fluids discharged by the ejector when the supply of condensate from the main condenser is insufficient for this purpose.

A further object is to produce an automatic device for delivering water from a storage tank or hot well to the condenser in order that this water may be cooled and employed in condensing the fluids discharged by an ejector, when the supply of steam to the condenser is insufficient to furnish enough condensate for this purpose.

These and other objects are attained by means of the apparatus herein described and illustrated in the drawings accompanying and forming a part hereof.

In the drawings: Figure 1 is a diagrammatic view, partly in section, of apparatus embodying my invention.

Fig. 2 is a partial diagrammatic sectional view and a partial elevation of another embodiment of my invention.

In the apparatus illustrated as an embodiment of my invention, I have shown an ejector for withdrawing the air and other non-condensable gases and vapors from a condenser and I have also disclosed means by which the condensate withdrawn from the condenser is employed in condensing and cooling the fluids discharged by the ejector. In this manner the heat contained in the fluids discharged from the ejector is given up to the condensate from the condenser, which now becomes feed water and thereby conserves the heat to the best advantage. Although my invention may equally be employed in any power installation, it is especially adapted for ships, since the maneuvering of a ship sometimes requires the frequent stopping and starting of the propelling engines. Under such conditions little or no exhaust steam is delivered to the condenser and consequently there is little or no condensate with which to condense or cool the fluids discharged from the ejector. The ejector cannot be shut down as it is necessary to maintain the vacuum in the condenser over the short periods during which the engines are not in operation, consequently some means must be provided for delivering an auxiliary supply of water to be used in condensing the fluids discharged by the ejector. The apparatus is preferably automatic in order that the engine room crew may give their full attention to the control of the engines and other equipment.

In my invention I have provided a simple and efficient device for automatically delivering water to the condenser from the hot well when the supply of condensate from the condenser becomes too low to condense the fluids discharged by the ejector. The auxiliary water is cooled by contact with the cooling elements in the condenser and is then employed in the same manner as condensate. When the propelling engines are again started up the auxilary water is automatically shut off so that there is no waste of power or heat.

The apparatus embodying my invention and illustrated in Fig. 1 comprises a condenser 5, a condensate pump 6 for withdrawing condensate from the condenser, and a steam actuated ejector 7 for withdrawing air from the condenser through a conduit 8. A hot well 9 is adapted to receive and stores the condensate withdrawn from the condenser until it is again employed in the boilers as feed water.

Inside of the hot well 9, I have illustrated a chamber 10 into which the ejector 7 discharges through a discharge conduit 11. The condensate withdrawn from the condenser 5 by the condensate pump 6 is also

discharged into the chamber 10 by a conduit 12. As illustrated, the ejector is adapted to discharge into this chamber below the level of the water and in such a manner that the fluids are efficiently cooled and condensed and the air liberated to the atmosphere. I have shown the chamber 10 so arranged that it overflows directly into a float tank 13, which is provded with an adjustable outlet 14 to the hot well 9. The outlet 14 may be adjusted for any rate of discharge by means of a hand wheel 15.

Near the bottom of the hot well 9 is shown a discharge valve 16 which is adapted to deliver water from the hot well to the upper part of the condenser 5 by means of a conduit 17. The water so delivered is sprayed over the tubes of the condenser and is then employed in cooling and condensing the fluids discharged by the ejector, when the supply of condensate is insufficient for this purpose.

In order that the delivery of fluid from the conduit 17 be automatic, I have shown the valve 16 operatively connected to a float 18 in the float chamber 13. In this embodiment of my invention a connecting rod 19 between the float 18 and the valve 16 passes through the bottom of the float chamber 13 with a slidable but substantially water tight joint.

In operation if the supply of condensate from the conduit 12 fails, little or no water will overflow from the chamber 10 into the float chamber 13. This will cause the level of the water in the float chamber 13 to fall, due to the fact that the outlet 14 is open, allowing the float 18 to fall and to thereby open the valve 16 and to deliver water from the hot well to the condenser to be cooled and then be employed in condensing the fluids discharged by the ejector 7. The outlet 14 from the float chamber may be adjusted to properly regulate the flow of water out of the float chamber 13, in accordance with the general operating conditions of the installation. It is evident that the apparatus described is entirely automatic after the outlet 14 has been properly adjusted.

In Fig. 2, I have shown a similar installation comprising a condenser 20, a condensate pump 21, an ejector 22 and a hot well 23 arranged as before. Within the shell of the hot well 23, I have shown an auxiliary chamber 24 for receiving the discharge from the condensate pump 21 and the ejector 22 in the same manner as described in connection with Fig. 1. However, in this embodiment of my invention the water in the auxiliary chamber 24 is adapted to overflow directly into the hot well 23. A valve 25 is employed to deliver water from the hot well to the condenser 20 by means of a conduit 26 in order that it may be employed in condensing the fluids discharged by the ejector 22 when the supply of condensate is insufficient for this purpose.

In order to control the valve 25 I have provided, in this embodiment of my invention, a piston 27 which is connected to the valve 25 by a stem 28 and is responsive to variations in fluid pressure, within the working passages of a turbine 29. The piston 27 operates in a cylinder 30, to which working fluid from the turbine is delivered through a conduit 31. An adjustable spring 32 is adapted to move the piston 27 in opposition to the pressure of the working fluid and to force the piston toward the lower extremity of its travel and to therefore tend to hold the valve 25 open, so as to deliver water from the hot well to the condenser to be employed in condensing the fluids discharged from the ejector 22.

In operation the pressure of the motive fluid in the working passages of the turbine 29 is transmitted to the underside of the piston 27 by the conduit 31 and is sufficient to overcome the force of the spring 32 and to therefore hold the valve 25 shut. In case the supply of motive fluid to the turbine 29 is shut off or is greatly diminished the supply of condensate will fail or be insufficient to condense the fluids discharged from the condenser. Under such conditions auxiliary cooling water must be supplied in order to prevent the fluids discharged from the ejector from escaping into the atmosphere. This is automatically accomplished by the piston 27 as the shutting off of the motive fluid to the turbine 29 will cause the pressure in the working passages of the turbine to drop and will therefore allow the spring 32 to force down the piston 27 and to thereby open the valve 25 and deliver an auxiliary supply of water to the condenser from the hot well 23. This water is sprayed over the condenser tubes, is thereby cooled and is then employed in the same manner as condensate in condensing the fluids discharged by the ejector 22.

In both embodiments of my invention the operation of the apparatus is entirely automatic and depends upon the rate at which condensate is delivered from the condenser. This action is direct in the apparatus illustrated in Fig. 1 and indirect in the apparatus illustrated in Fig. 2, although the automatic means varies with the supply of condensate just the same as in Fig. 1, for the supply of condensate depends on the supply of motive fluid to the turbine 29. In both embodiments of my invention the operation is entirely automatic and heat is conserved to the best advantage.

While I have described and illustrated but two embodiments of my invention, it will be apparent to those skilled in the art that various changes, modifications, additions and omissions may be made in the apparatus de-

scribed and illustrated without departing from the spirit and scope of the invention, as set forth by the appended claims.

What I claim is:

1. In a heat conserving apparatus, a prime mover, a condenser, an ejector for removing air and other non-condensable gases and vapors from the condenser, means whereby the condensate from the condenser is employed in cooling and condensing the fluids discharged by the ejector and for allowing the air to separate therefrom, a hot well for storing the condensate and liquids discharged by the ejector, and means directly communicating with the interior of the prime mover and responsive to the amount of motive fluid passing through the prime mover for automatically delivering liquid from the hot well to the condenser to be cooled and employed as condensate when the supply of condensate is insufficient to cool and condense the fluids discharged by the ejector.

2. In a heat conserving apparatus, a prime mover, a condenser, means for withdrawing air and other non-condensable gases and vapors from the condenser, a hot well, a chamber communicating therewith for receiving fluids discharged by the withdrawing means, means for delivering condensate from the condenser to said chamber, and means directly communicating with the interior of the prime mover and responsive to variations in the amount of motive fluid passing through the prime mover for delivering an auxiliary supply of liquid to be employed in place of condensate in cooling and condensing the fluids discharged by the withdrawing means.

3. In combination in a heat conserving apparatus, a prime mover, a condenser, a hot well for receiving condensate and other fluids withdrawn from the condenser and means responsive to variations in the pressure of motive fluid passing through the prime mover for controlling the delivery of liquid from the hot well to the condenser when the supply of condensate decreases below a predetermined amount.

4. In a heat conserving apparatus, a condenser, a hot well, a condensing chamber contained therein for receiving condensate and other fluids withdrawn from the condenser, means for delivering liquid from the hot well to the condenser, and a pressure actuated means responsive to variations in the pressure of the motive fluid passing through the prime mover for controlling said liquid delivering means.

5. In a heat conserving apparatus, a prime mover, a condenser, a hot well, a chamber contained therein for receiving condensate and other fluids withdrawn from the condenser, means for delivering liquid from the hot well to the condenser, and means directly communicating with the interior of the prime mover and responsive to variations in the amount of motive fluid passing through the prime mover for controlling said means.

6. In a heat conserving apparatus, a condenser, an ejector for removing air and other non-condensable gases and vapors from the condenser, a hot well, a condensing chamber communicating with the hot well for receiving fluids discharged by the ejector, and for receiving condensate withdrawn from the condenser employed in cooling and condensing said fluids, means for supplying an auxiliary supply of liquid from the hot well for cooling and condensing the fluids discharged by the ejector when the supply of condensate is insufficient for this purpose, and a pressure actuated means responsive to variations in the pressure of the motive fluid passing through the prime mover for controlling said auxiliary supply means.

7. In a heat conserving apparatus, a prime mover, a condenser, an ejector for removing air and other non-condensable gases and vapors from the condenser, a hot well for receiving fluids discharged by the ejector and condensate withdrawn from the condenser, said condensate being employed in cooling and condensing said fluids, means for supplying an auxiliary supply of liquid from the hot well for cooling and condensing the fluids discharged by the ejector when the supply of condensate is insufficient for this purpose, and means directly communicating with the interior of the prime mover and responsive to variations in the supply of motive fluid to said prime mover for controlling the auxiliary fluid supplying means.

8. In a heat conserving apparatus, a prime mover, a condenser serving the prime mover, an ejector for withdrawing non-condensable gases and vapors from the condenser, means receiving condensate from the condenser for condensing the fluids discharged from the ejector, and means responsive to fluid pressure in a working passage of the prime mover for delivering liquid from the condensate receiving means to the condenser to be employed in condensing the condensable vapors discharged by the ejector.

9. In a heat conserving apparatus, a prime mover, a condenser serving the prime mover, an ejector for withdrawing non-condensable gases and vapors from the condenser, means for condensing condensable vapors discharged by the ejector and receiving condensing fluid from the condenser, and regulable means responsive to fluid pressure in the prime mover for delivering fluid to the condenser to be employed in condensing the condensable vapors discharged by the ejector.

10. In a power developing system, a prime mover, a condenser receiving motive fluid

exhausted therefrom, an ejector for withdrawing non-condensable gases and vapors from the condenser, a hot well into which the ejector discharges, means for delivering condensate from the condenser to the hot well in such a manner as to condense condensable vapors discharged by the ejector, a valve for controlling the flow of condensate from the hot well to the condenser, means responsive to the pressure of motive fluid in the prime mover for controlling said valve, and means for opposing the pressure of the motive fluid on said pressure responsive means.

11. In a power developing system, a prime mover, a condenser receiving motive fluid exhausted therefrom, an ejector for withdrawing non-condensable gases and vapors from the condenser, a hot well into which the ejector discharges, means for delivering condensate from the condenser to the hot well in such a manner as to condense condensable vapors discharged by the ejector, a valve for controlling the flow of condensate from the hot well to the condenser, means responsive to the pressure of motive fluid in the prime mover for controlling said valve, means for opposing the pressure of the motive fluid on said pressure responsive means, and means for varying the force of the opposing means.

In testimony whereof, I have hereunto subscribed my name this 3rd day of May, 1917.

RAYMOND N. EHRHART.

Witnesses:
C. W. McGHEE,
C. LOEWENTHAL.