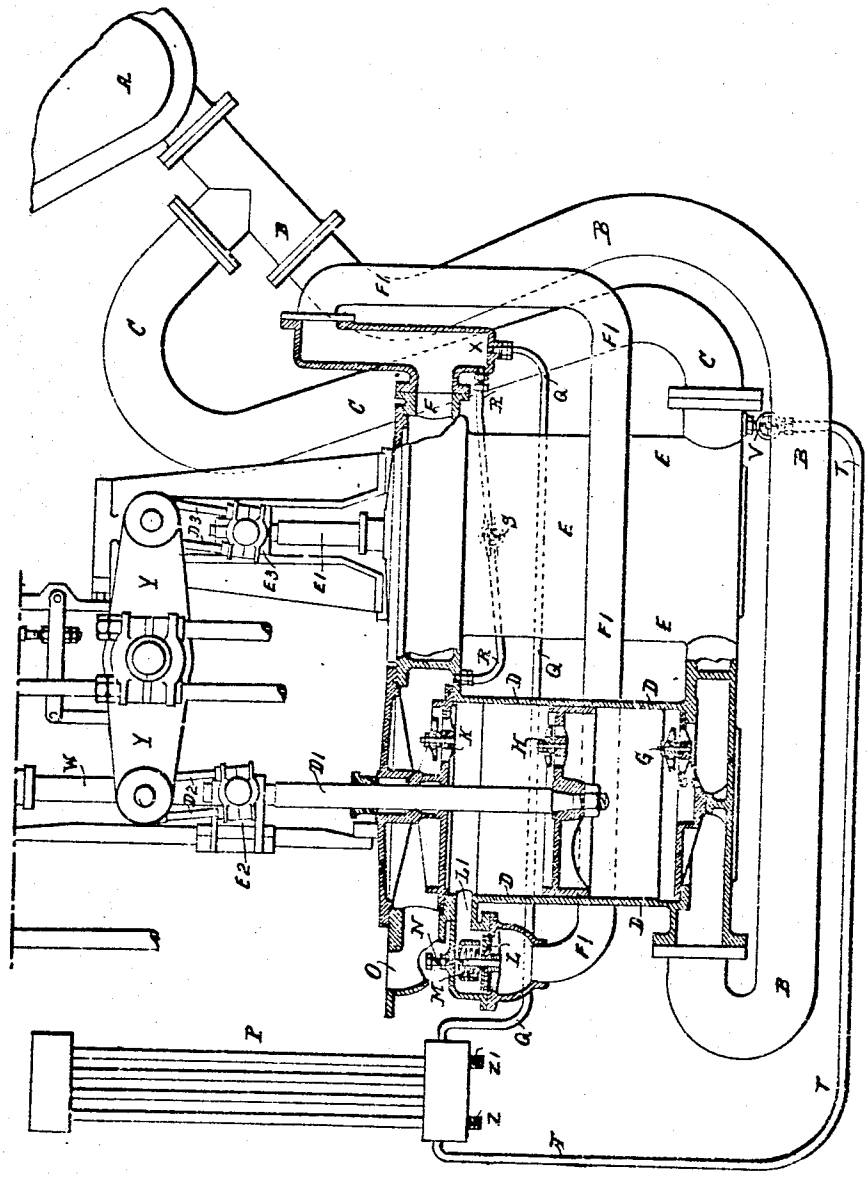
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STEAM CONDENSING PLANT AND AIR PUMP.

APPLICATION FILED FEB. 7, 1910.

957,638.

Patented May 10, 1910.



WITNESSES

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STEAM-CONDENSING PLANT AND AIR-PUMP.

957,638. Specification of Letters Patent. Patented May 10, 1910.

Application filed February 7, 1910. Serial No. 542,499.

To all whom it may concern:

Be it known that I, WILLIAM WEIR, a subject of the King of Great Britain and Ireland, and a resident of Cathcart, in the county of Renfrew, Scotland, have invented certain new and useful Improvements Relating to Steam-Condensing Plants and Air-Pumps, and of which the following is the specification.

This invention has for its object to provide a supply of cooling water for injection into the suction pipes of so-called dry air pumps working in conjunction with high vacua condensers for the purpose of cooling the air and condensing a portion of the vapor, and the invention relates more particularly to the arrangements for the provision of this cooling water supply in connection with air pumps of the special nature referred to in the specification accompanying the application for a British Patent No. 2618 of 1909.

If this cooling water supply is taken from the hot well or feed tank, it will be at the feed temperature, and at atmospheric pressure, and consequently will contain whatever proportion of air is present in the water at that temperature and pressure. The introduction, therefore, of this supply into the vacuum system causes inefficiency to the extent of whatever amount of air is contained in the water, as this air has to be pumped out of the system again. The only space where practically no air is contained in the feed water is in the base of the condenser, but it is not convenient to utilize this water, as to cool it by means of an efficient cooler it would require to be pumped through the cooler, otherwise the velocity of the flow through or over the cooling tubes could only be that due to the static head which the water possessed over the cooler, and it is not convenient on board war vessels in particular to place the cooler below the condensers. Any arrangement of this character would therefore require the use of a large cooler, as the rate of transmission of heat is largely dependent on the velocity of flow, and this velocity is unobtainable without a difference in head.

In carrying out this invention according to one example, this cooling water supply is taken from the receiver space between the wet and dry compound pump referred to in the specification accompanying the application for a patent hereinbefore referred to. In this receiver, the water will always be at a pressure considerably below that of the atmosphere, but greater than that in the condenser, and the quantity of air in the water will be in proportion to the pressure. Preferably, there is arranged on the casting above the head valve of the dry air pump a receiver or chamber so situated in relation to the pipe leading to the wet pump that this receiver will fill up with water before any water is discharged into the wet pump.

From the base of the receiver a pipe carries the water to a cooler of the tubular type having a supply of cold circulation water from the sea or outside source. After passing through the cooler, the water is allowed to flow into the dry air pump suction through a regulating valve. As this cooling injection water becomes augmented by the condensation of vapor in the air pump, the receiver will always remain full, but for starting purposes it may be replenished by a pipe led to it from the hot well of the wet pump.

The velocity of flow of the cooling water through the cooler will depend on the differences of pressure between the dry air pump suction and the dry air pump receiver, and if the difference of these pressures should be too slight to cause the necessary flow, the non-return valve between the two pumps may be spring, dead-weight, or otherwise loaded to cause the necessary difference in pressure.

In order that this invention and the manner of performing the same may be properly understood there is hereunto appended a sheet of explanatory drawings showing a general diagrammatic arrangement of a condensing plant fitted with my improvements.

As shown in the drawings, A is the condenser which is of usual form and to which is connected the combined wet and dry air pumps D and E of the nature described in the specification hereinbefore referred to. These pumps are operated by a steam cylinder, the piston rod W of which is connected directly to the plunger rod D^1 of the wet air pump D, while the plunger rod E^1 of the dry air pump E is connected to the piston rod W through crossheads E^2, E^3, links D^2 D^3, and a beam Y. It is, however, to be understood that the actuation may be by electric motor or other prime mover.

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The wet air pump D is connected to the condenser A by the suction pipe B and the dry air pump E by the suction pipe C. The wet air pump D is provided with foot valves G, bucket valves H and head valves K and with a discharge branch O. The dry air pump E is arranged to discharge through the pipe F' and the non-return valve L into the barrel of the wet air pump D through the port L' at a point below the head valves K.

A receiver or chamber X is provided on the discharge portion F of the dry air pump E; and it is so arranged that the air only will pass into the pipe F', while the water will accumulate in the base of the chamber X. From the base of this chamber or receiver the water will pass by the pipe Q to a tubular cooler P, and after being cooled the water passes through a pipe T and a valve V to the base or suction of the dry air pump E. This cooler P is provided with a supply of cold circulating water led to it through an inlet branch Z, such water after performing the cooling, being led away by a branch Z'. It is obvious that the rate of flow of the water to be cooled through the cooler P will depend on the difference in pressure above the head valves of the dry air pump and the suction pipe or base of that pump, and if such a difference is too slight to cause the necessary circulation, the non return valve L which is spring, dead-weight, or otherwise loaded is adjusted to increase the difference in pressure. As shown, this valve is loaded by a spring M, and the degree of loading may be regulated by the screw N.

For the purpose of conveniently obtaining a supply of water to charge the dry air pump cooling system, a pipe R with valve S may be fitted to lead from the wet air pump discharge, and when the pump is being started this valve S may be opened for a few minutes and then closed, thereafter the dry air pump cooling system is self-contained and continuous as the injection water passes through the cooler P into the dry air pump E through that pump and back into the cooler in a continuous circuit. Any condensation of vapor resulting in an excess of water in the system will pass over through the pipe F' and be returned to the main feed system. It is specially to be noted, however, that only excess water will pass in this manner. The actual injection-water circulating through the dry air pump system will never mix with the feed system, and thereby no cooling of the main feed system can take place.

What I claim is:—

1. In steam condensing plant having air pumps of the combined wet and dry type wherein the dry air pump discharges into the wet air pump below its head valves, a cold water charged tubular injection water cooler connected to the suction and discharge of the dry air pump.

2. In steam condensing plant having air pumps of the combined wet and dry type wherein the dry air pump discharges into the wet air pump below its head valves, a cold water charged tubular injection water cooler connected to the suction and discharge of the dry air pump and a controllably-loaded non-return valve on the discharge of the dry air pump.

3. In steam condensing plant having air pumps of the combined wet and dry type wherein the dry air pump discharges into the wet air pump below its head valves, a cold water charged tubular injection water cooler connected to the suction and discharge of the dry air pump, a controllably loaded non-return valve on the discharge of the dry air pump, and a valve controlled pipe connection between the hot well of the wet pump and the dry air pump discharge.

4. In steam condensing plant having air pumps of the combined wet and dry type wherein the dry air pump discharges into the wet air pump below its head valves, a cold water charged tubular injection water cooler connected to the suction and discharge of the dry air pump and a valve controlled pipe connection between the hot well of the wet pump and the dry air pump discharge.

5. Improved steam condensing plant comprising in combination a condenser, a combined wet and dry air pump of the type where the dry air pump discharges below the head valves of the wet air pump and a water-charged injection-water cooler connected with the suction and discharge of the dry air pump.

6. Improved steam condensing plant comprising in combination a condenser, a combined wet and dry air pump of the type where the dry air pump discharges below the head valves of the wet air pump, a water charged injection-water cooler connected with the suction and discharge of the dry air pump and a controllably loaded non-return valve on the discharge of the dry air pump.

7. Improved steam condensing plant comprising in combination a condenser, a combined wet and dry air pump of the type where the dry air pump discharges below the head valves of the wet air pump, a water charged injection-water cooler connected with the suction and discharge of the dry air pump, a controllably-loaded non-return valve on the discharge of the dry air pump and a valve controlled pipe connection between the hot well of the wet pump and the dry air pump discharge.

8. In steam condensing plant having air pumps of the combined wet and dry type wherein the dry air pump discharges into

the wet air pump below its head valves, a water receiving chamber on the discharge connection between the dry air pump and the wet pump, a cooler through which cold water is circulated, a pipe putting the base of the water receiving chamber in communication with the cooler and a valve controlled pipe connection leading from the cooler to the suction of the dry air pump.

9. In steam condensing plant having air pumps of the combined wet and dry type wherein the dry air pump discharges into the wet air pump below its head valves, a water receiving chamber on the discharge connection between the dry air pump and the wet pump, a controllably-loaded non-return valve on this discharge connection, a cold water charged tubular-injection water cooler, a pipe putting the base of the water receiving chamber in communication with the cooler and a valve controlled pipe connection leading from the cooler to the suction of the dry air pump.

10. In steam condensing plant having air pumps of the combined wet and dry type wherein the dry air pump discharges into the wet air pump below its head valves, a controllably loaded non-return valve and a water receiving chamber on the discharge from the dry air pump, a valve controlled pipe connection between the wet air pump discharge and the injection water receiving chamber, a cooler through which cold water is circulated, and valve controlled pipes putting the cooler in connection with the base of the water receiving chamber and the base of the dry air pump.

11. Improved steam condensing plant comprising in combination a condenser, a combined wet and dry air pump of the type in which the dry air pump discharges below the head valves of the wet air pump, a controllably loaded non-return valve and a water receiving chamber on the discharge from the dry air pump, a valve controlled pipe connection between the wet air pump discharge and the injection water receiving chamber, a cooler through which cold water is circulated and valve controlled pipes putting the cooler in connection with the base of the water receiving chamber and the base of the dry air pump.

12. Improved steam condensing plant comprising in combination a condenser, a combined wet and dry air pump of the type in which the dry air pump discharges below the head valves of the wet air pump, a water receiving chamber on the discharge connection between the dry air pump and the wet pump, a cooler through which cold water is circulated, a pipe putting the base of the water receiving chamber in communication with the cooler and a valve controlled pipe connection leading from the cooler to the suction of the dry air pump.

13. Improved steam condensing plant comprising in combination a condenser, a combined wet and dry air pump of the type in which the dry air pump discharges below the head valves of the wet air pump, a water receiving chamber on the discharge from the dry air pump, a valve controlled pipe connection between the wet air pump discharge and the injection water receiving chamber, a cooler through which cold water is circulated, valve controlled pipes putting the cooler in connection with the base of the water receiving chamber and the base of the dry air pump.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses.

WILLIAM WEIR.

Witnesses:
DAVID FERGUSON,
JAMES EAGLESOM.