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CONDENSATE AND AIR REMOVING APPARATUS.

APPLICATION FILED JAN. 7, 1918.

1,277,151

Patented Aug. 27, 1918.

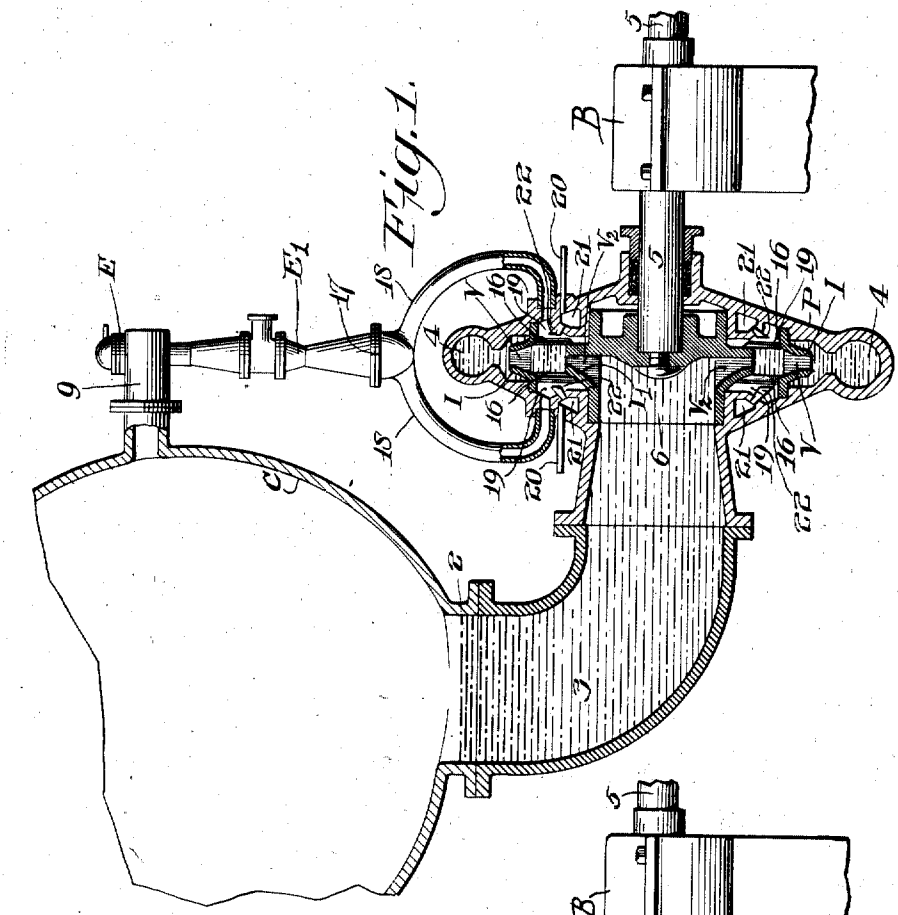


Fig. 1.

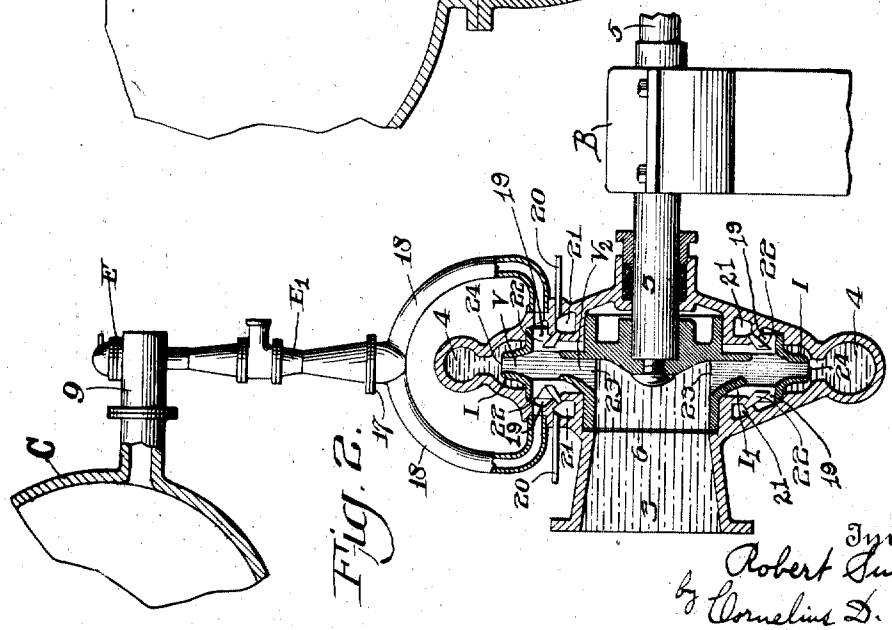


Fig. 2.

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UNITED STATES PATENT OFFICE.

ROBERT SUCZEK, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO C. H. WHEELER MANUFACTURING COMPANY, OF PHILADELPHIA, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

CONDENSATE AND AIR REMOVING APPARATUS.

1,277,151. Specification of Letters Patent. Patented Aug. 27, 1918.

Original application filed December 30, 1916, Serial No. 139,985. Divided and this application filed January 7, 1918. Serial No. 210,654.

To all whom it may concern:

Be it known that I, ROBERT SUCZEK, a subject of the Emperor of Austria-Hungary, residing in the city of Philadelphia, county of Philadelphia, and State of Pennsylvania, have invented certain new and useful Improvements in Condensate and Air Removing Apparatus, of which the following is a specification.

My invention relates to apparatus for removing condensate and air from either a surface condenser or jet condenser, or kindred apparatus, or in general relates to pumping apparatus for simultaneously operating upon liquid and gas.

My invention resides in apparatus of the character referred to comprising centrifugal pumping apparatus embodying impeller structure whereby the liquid is operated upon centrifugally a plurality of times in succession, means being provided for delivering the air or gas into the impeller structure into the liquid after it has been acted upon centrifugally and before it is finally so operated upon, accelerating nozzle structure also being provided if desired for forcing the air or gas into the liquid.

My invention resides in apparatus of the character hereinafter described and claimed.

For an illustration of some of the various forms my invention may take, reference is had to the accompanying drawing, in which:

Figure 1 is a sectional view, some parts in elevation, of apparatus embodying my invention.

Fig. 2 is a sectional view, some parts in elevation, of a modification of the structure shown in Fig. 1.

Referring to Fig. 1, C represents a surface condenser for condensing steam or vapor, especially the exhaust steam from a steam power plant or the like. The condensed steam or condensate is delivered through the opening 2 into the passage 3, which delivers to the suction of the centrifugal pump structure P, the latter comprising the usual volute or discharge casing 4 and the submerged impeller structure comprising the impeller I of larger diameter having vanes V and the second impeller of smaller diameter I_1 having the vanes V_2, the impeller structure being rotated at high speed by the shaft 5 having bearing B and driven by any suitable means, as an electric motor or steam turbine, not shown. The suction 6 of the impeller I_1 communicates with the chamber 3 receiving condensate from the condenser C. The impeller I is supported and secured upon the impeller I_1 by means of the circumferentially spaced ribs 16 resembling the spokes of a wheel.

An air connection 9 communicates with the interior of the condenser C and with the suction chamber of the ejector E, of any suitable type, to which elastic motive fluid, as steam, is delivered, the steam emitted from the ejector nozzle entraining in the well known manner the air or uncondensable vapors delivered from the condenser C through the pipe 9, the mixture being then delivered to the second stage ejector E_1, which delivers at 17 into the divided passages or connections 18, 18 communicating with the annular chambers 19 on opposite sides of the impeller structure. Pipes 20, delivering preferably live steam from any suitable source, communicate with the annular chambers 21 on opposite sides of the impeller structure. On each side of the impeller structure, with suitable circumferential spacing, is provided a series of steam expanding nozzles 22 receiving steam from the annular chambers 21 and delivering the same at high velocity across the chambers 19 and through the spaces between the ribs 16 into the space between the inner and outer impellers I_1 and I.

In operation, the water or condensate delivered through the passage 3 into the suction 6 is operated upon centrifugally by the inner impeller I_1 and delivered by it at its periphery radially outwardly to the outer impeller I from which it is discharged into the volute or discharge casing 3, from which it is then delivered to any suitable point at any suitable pressure, generally atmospheric pressure. The water is thus acted upon in successive stages, each increasing its pressure. The water in its passage through the impeller structure is delivered from the periphery of the impeller I_1 into the free space between that impeller and the inner edges of the vanes V of the impeller I. The impeller I_1 may preferably be so constructed

that it preliminarily accelarates the condensate without materially increasing its pressure. For this purpose it will suffice if the impeller I_1 by centrifugal action produces a pressure sufficient to prevent air or vapors from the condenser passing through the impeller I_1 from its periphery to its suction into the condensate and from there back into the condenser shell through passages 3 and 2.

Simultaneously with the flow of the condensate through the impeller structure as described, the ejector or other air removing apparatus removes air and uncondensable vapors, from the condenser and delivers them through the passages 18, 18 to the annular chambers 19, where steam from the nozzles 22 carries the mixture of steam and air from the pipes 18 into the space between the impellers I_1 and I, where the mixture enters the liquid or condensate and is delivered thereby into the discharge casing 4 at a pressure which is preferably at least atmospheric pressure.

The ribs 16 may be so formed or inclined as to in effect constitute vanes which assist in the movement of the vapor and air into the liquid or condensate.

In Fig. 2 the arrangement is in general that described in connection with Fig. 1; however, in Fig. 2 the ribs 16 of Fig. 1 are omitted, and the vanes V_2 and V of the impellers I_1 and I, respectively, are integral and continuous from the inner edge 23 to the outer edge 24.

The operation is substantially the same as described in connection with Fig. 1, the impeller I_1 preliminarily accelerating the condensate, which is then further accelerated and raised in pressure by the impeller I, the vapor and air mixture being delivered into the condensate or liquid while passing from one impeller to the other.

This application is a division from my application Serial Number 139,985, filed December 30, 1916.

What I claim is:

1. Centrifugal water and air removing apparatus comprising auxiliary and main impellers spaced from each other, an annular chamber in communication with the space between said impellers, means for conducting fluid to said annular chamber, and nozzle structure delivering fluid across said annular chamber into the space between said impellers.

2. Centrifugal water and air removing apparatus comprising auxiliary and main impellers spaced from each other, an annular chamber in communication with the space between said impellers, means for conducting fluid to said annular chamber, nozzle structure delivering fluid across said annular chamber into the space between said impellers, a second annular chamber, and means for conducting fluid under pressure thereto, said nozzle structure receiving fluid from said second annular chamber.

3. The combination with a pump comprising auxiliary and main impellers, the main impeller spaced from and surrounding the auxiliary impeller, an annular chamber in communication with the space between said impellers, means for delivering fluid to said chamber, a second annular chamber separated from said first named chamber and connected to a source of motive fluid, and nozzle structure delivering motive fluid from said last named chamber across said first named chamber into the space between said impellers.

4. The combination with a pump comprising auxiliary and main impellers, the main impeller spaced from and surrounding the auxiliary impeller, an annular chamber in communication with the space between said impellers, means for delivering fluid to said chamber, a second annular chamber separated from said first named chamber and connected to a source of motive fluid, and nozzle structure delivering motive fluid from said last named chamber across said first named chamber into the space between said impellers, said impellers having vanes, the vanes of one of said impellers being independent of the vanes of the other.

5. The combination with a condenser, of centrifugal air and water removing apparatus comprising impellers spaced from each other and operating to remove water from said condenser, a connection for delivering air from said condenser to the space between said impellers, and nozzle structure adjacent the space between said impellers delivering motive fluid for accelerating the fluid delivered through said air connection.

6. The combination with a condenser, of centrifugal air and water removing apparatus comprising impellers spaced from each other and operating to remove water from said condenser, means for removing air from said condenser and delivering it at higher pressure into the space between said impellers, and nozzle structure delivering motive fluid adjacent the space between said impellers for accelerating the air from said condenser.

7. The combination with a condenser, of centrifugal air and water removing apparatus comprising impellers spaced from each other and operating to remove water from said condenser, annular passages on opposite sides of said impellers, a connection delivering air from said condenser to said annular passages, and nozzles delivering motive fluid across said annular passages for accelerating the air from said condenser.

8. The combination with a condenser, of centrifugal air and water removing apparatus comprising impellers spaced from each

other and operating to remove water from said condenser, annular chambers on opposite sides of said impellers, ejector apparatus for removing air from said condenser, and means forming divided passages receiving air from said ejector apparatus and delivering it into said annular chambers.

9. The combination with a condenser, of centrifugal air and water removing apparatus comprising impellers spaced from each other and operating to remove water from said condenser, annular chambers on opposite sides of said impellers, ejector apparatus for removing air from said condenser, means forming divided passages receiving air from said ejector apparatus and delivering it into said annular chambers, and nozzle structure delivering motive fluid adjacent the outlets of said passages.

10. The combination with a condenser, of an air and water removing pump comprising a pump casing, impellers therein spaced from each other and removing water from said condenser, means for conducting air from said condenser to the space between said impellers, and nozzle structure within said pump casing delivering motive fluid for accelerating air from said condenser into the space between said impellers.

11. The combination with a condenser, of centrifugal air and water removing apparatus comprising a submerged auxiliary impeller, a main impeller, said auxiliary impeller delivering condensate under pressure in dense liquid form to said main impeller, means delivering air from said condenser into the space between said impellers, and nozzle structures delivering motive fluid adjacent the space between said impellers for accelerating the air from said condenser.

12. The combination with a condenser, of centrifugal air and water removing apparatus comprising a submerged auxiliary impeller, a main impeller, said auxiliary impeller delivering condensate under pressure in dense liquid form to said main impeller, means for removing air from said condenser and delivering it at higher pressure to the space between said impellers, and nozzle structure delivering motive fluid adjacent the space between said impellers for accelerating the air from said condenser.

13. The combination with a condenser, of centrifugal air and water removing apparatus comprising a submerged auxiliary impeller, a main impeller, said auxiliary impeller delivering condensate under pressure in dense liquid form to said main impeller, chambers on opposite sides of said impellers, and means for conducting air from said condenser in divided streams to said chambers.

14. The combination with a condenser, of centrifugal air and water removing apparatus comprising a submerged auxiliary impeller, a main impeller, said auxiliary impeller delivering condensate under pressure in dense liquid form to said main impeller, chambers on opposite sides of said impellers, means for conducting air from said condenser in divided streams to said chambers, and nozzle structure delivering motive fluid across said chambers to accelerate the air from said condenser.

15. The combination with a condenser, of centrifugal air and water removing apparatus comprising a submerged auxiliary impeller, a main impeller, said auxiliary impeller delivering condensate under pressure in dense liquid form to said main impeller, chambers on opposite sides of said impellers, means for removing air and delivering it at higher pressure in divided streams to said chambers, and nozzle structure delivering motive fluid across said chambers to accelerate the air from said condenser.

16. The combination with a condenser, of centrifugal air and water removing apparatus comprising impellers spaced from each other and operating to remove water from said condenser, an ejector removing air from said condenser and delivering it into the space between said impellers, and nozzle structure delivering motive fluid adjacent the space between said impellers for accelerating the air delivered by said ejector.

In testimony whereof I have hereunto affixed my signature this 4th day of January, 1918.

ROBERT SUCZEK.