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EJECTOR CONTROL APPARATUS.

APPLICATION FILED MAY 8, 1917.

1,239,535.

Patented Sept. 11, 1917.

FIG. 2.

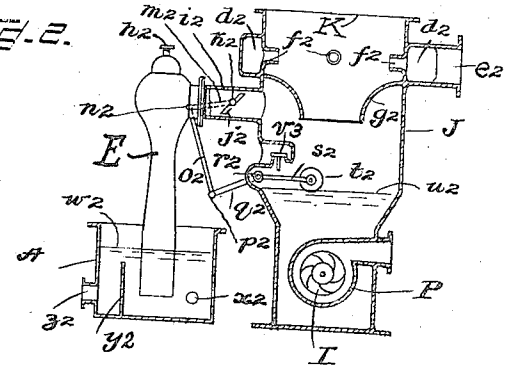
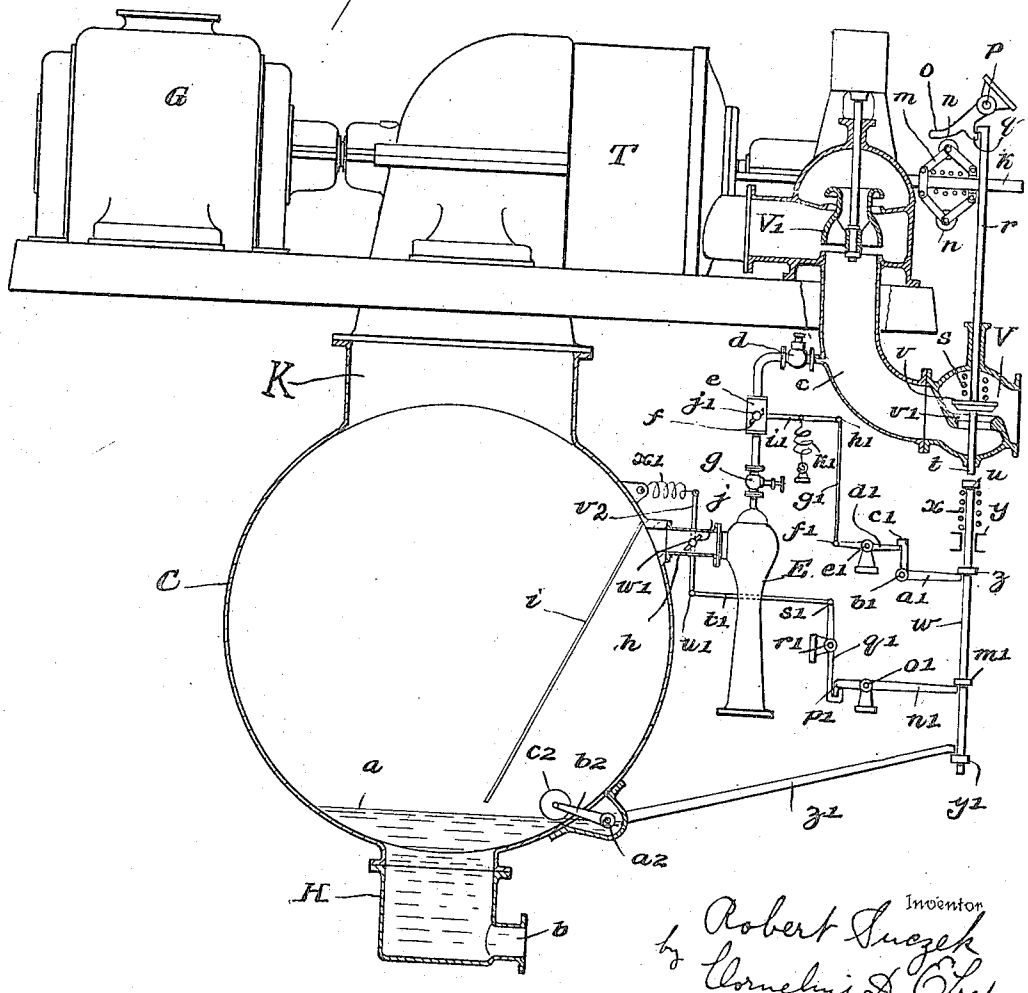


FIG. 1.



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UNITED STATES PATENT OFFICE.

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EJECTOR-CONTROL APPARATUS.

1,239,535. Specification of Letters Patent. Patented Sept. 11, 1917.

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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 Ejector-Control Apparatus, of which the following is a specification.

My invention relates to apparatus for controlling an ejector which removes air or other uncondensable gases or vapors from a condenser.

My invention resides in apparatus for controlling an ejector which removes air or the like from a condenser in response to undesired accumulation or rise in level of condensate, by controlling the air connection between the condenser and ejector; and my invention resides in apparatus for so controlling an ejector used in combination with a steam turbine or other steam engine, the control of the air connection between condenser and ejector and the control of motive fluid being effected by change of level of condensate and in response to predetermined change in speed of the turbine or engine.

For an illustration of examples embodying my invention, reference is to be had to the accompanying drawing, in which:

Figure 1 is a side elevational view, partly in vertical section, of steam turbine and condenser, with means for controlling the cooperation of the condenser with an ejector.

Fig. 2 is a vertical sectional view, partly in elevation, of a jet condenser with means for controlling the coöperation of the condenser with an associated ejector.

Referring to Fig. 1, T is a steam turbine or other steam engine whose load may be a dynamo-electric generator G, or any other desired load. The exhaust steam from the turbine T is delivered through the exhaust steam connection K into the surface condenser whose shell is C, the usual circulating water tubes and other well known appurtenances being omitted. The condensate, whose level is indicated at a, accumulates in the bottom of the shell C and in the hot well or condensate receptacle H, from which it is withdrawn by a pump, not shown, connecting with the discharge passage b. The steam for driving the turbine T is delivered through the valve V comprising the valve member v and the valve seat v^1, to the pipe c between which and the turbine T intervenes the governor controlled valve V^1, of well known construction and mode of operation.

Communicating with the pipe c, between the valves V and V^1, is the automatic pressure controlling valve d, of any well known type, which delivers to the valve e having the movable valve member f. The valve e delivers through the hand operated valve g to the steam nozzle or nozzles of the ejector E, which has a connection h with the interior of the condenser shell C at a point preferably behind the baffle plate i. In the connection h is a movable valve member j.

Upon and rotated by the shaft k, forming an extension of the shaft of the turbine T, is the centrifugal safety governor m having the fly balls n. Disposed in suitable position with respect to the balls n is the latch lever o, shown for the sake of clearness in a plane at right angles to that in which it would be positioned in practice, pivoted at p and having the latch hook q normally retaining in elevated position the valve stem r attached to the valve member v, upon which the helical spring s acts in a downward direction tending to move it against its seat v^1. The valve stem r continues downwardly through the bottom of the valve V and terminates at t above the head u on the rod w. A helical spring x confined between the head u and the abutment y normally holds the rod w elevated in the position shown.

On the rod w is a collar z on the under side of which engages the arm a^1 of a bell crank lever pivoted at b^1 and whose second arm c^1 has an abutment on the under side of which engages the lever d^1 pivoted at e^1 and whose other end is pivoted at f^1 to the link g^1 pivoted at h^1 to the link i^1 secured to the pivotal shaft j^1 on which is secured the valve v. A spring k^1 is under tension and pulls downwardly upon the link i^1.

On the rod w is a second collar m^1 on the under side of which engages one end of a lever n^1 pivoted at o^1 and whose other end has a hook p^1 with which engages a lever q^1 pivoted at r^1 and whose other end is pivoted at s^1 to the link t^1 pivoted at u^1 to the lever v^2 secured upon the shaft w^1 upon which is secured the valve j. A spring x^1 is under tension and exerts a pull upon the lever v^1 tending to rotate it in a counterclockwise direction.

Upon the rod w is a third collar y^1 above which is disposed the end of the lever z^1 secured upon the pivotal shaft a^2 which extends through a vacuum tight joint in the condenser shell C to the interior thereof. On the interior of the condenser shell there is secured upon the shaft a^2 a lever b^2 carrying at its one end a float c^2 floating upon the condensate.

If the turbine or engine T should change its speed, as by racing or otherwise undesirably increasing its speed, the balls n of the governor m, will, due to the increased centrifugal force, move outwardly and so raise the latch o and withdraw the hook q and thereby release the valve r, whereupon the spring s will force the valve v downwardly and close off the steam supply to the turbine T. This downward movement of the valve stem r will cause its lower end t to engage the top u of the rod w and depress the latter in opposition to the spring s, thereby causing the collar z to force the bell crank lever a^1 downwardly and to withdraw its hook c^1 from engagement with the lever d^1, thereby allowing the spring k^1 to pull downwardly on the link i^1 and rotate the valve f in clockwise direction to close off the steam supply to the ejector E, with the result that the ejector discontinues removal of air from the condenser C, whereupon the vacuum within the condenser C diminishes, the pressure therein rising, and this pressure continues to rise so long as the ejector E is not operating, and so increases the back pressure on the turbine T and reduces its speed, because notwithstanding the closure of the valve V the steam in the connections beyond the valve V will continue to drive the turbine T for an appreciable time.

Simultaneously with the aforementioned downward movement of the rod w, the collar m^1 will press downwardly upon the outer end of the lever n^1 and release the lever q^1, whereupon the spring x^1 will contract and rotate the lever v^2 in counterclockwise direction and move the valve j to a position to close off the air connection between the condenser and the ejector E, thus additionally preventing the ejector from removing air from the condenser, with the result above described.

While the turbine is running within the desired limits of speed, and therefore while the rod r is locked in the elevated position illustrated, a rise in the level a of the condensate, above a predetermined desired limit, will cause the float c^2 to rise, with resultant downward movement of the lever z^1, which will thrust downwardly upon the collar y^1 upon the rod w^1, with the result that the valves f and j will be closed, as in the case above described, thus cutting off motive fluid from the ejector E and also closing the air connection between the ejector and the condenser. By this action rise of level of the condensate to such point that it would flow from the air connection into the ejector is prevented. Ordinarily the air connection from the ejector to the condenser will be much lower than indicated in Fig. 1, it being understood that the controls illustrated are diagrammatic in nature.

In Fig. 2 J is the body of a jet condenser having the annular water chamber d^2 to which water is delivered through the connection e^2. Through the inner wall of the chamber d^2 extends a plurality of nozzles f^2 through which water is delivered in streams, the water falling downwardly in contact with the steam entering at K and passing through the diffuser g^2, the steam being condensed into water and the condensed steam and injection water collecting in the bottom of the casing J. Submerged in the collected water is a centrifugal pump P having the impeller I which removes the water and delivers it against atmospheric or any other pressure. E is an ejector to which steam or other suitable motive fluid is delivered through the connection h^2. The ejector E has an air connection i^2 with the interior of the condenser J, and in this connection is a valve j^2 secured upon the pivotal shaft k^2 which extends to the exterior of the connection i^2 through a vacuum tight joint. On the exterior of the connection i^2 there is secured upon the shaft k^2 a link m^2 pivoted at n^2 to a link o^2 pivoted at p^2 to the lever q^2 which is secured upon the shaft r^2 which extends through a vacuum tight joint into the interior of the condenser J. On the interior of the condenser there is secured upon the shaft r^2 a lever s^2 carrying at its end a float t^2 resting upon the water level u^2. Disposed in the path of travel of the lever s^2 is the vacuum breaking valve v^3 of any well known construction.

The ejector E delivers into the air separating chamber A beneath the level w^2 of the water contained therein and delivered thereinto through the opening x^2 at any suitable rate to keep the discharge opening from the ejector E always submerged. To maintain the discharge outlet of the ejector E so submerged there is provided an upwardly extending partition y^2 on the opposite side of which is an outlet z^2 from which the water entering at x^2 is withdrawn.

In case the pump P gets out of order or for any other cause the level u^2 of the water rises, to prevent entry of such water into the ejector E through the connection i^2 the float t^2 rises, and through the lever s^2 and the above described connections actuates the valve j^2 moving it to closed position, to thereby shut off connection between the ejector E and the condenser J; and simultaneously the lever s^2 in rising engages and lifts

the lever v^2, thereby breaking the vacuum by bringing the condenser J into communication with the atmosphere.

The closure of the valve j^2 assists or hastens the breaking of the vacuum at valve v^3, because the ejector upon closure of the valve j^2 no longer continues to extract air from the condenser J.

Water is circulated through the chamber A as above described because the steam from the ejector E is condensed thereby, and to prevent its undue rise in temperature, fresh water is constantly admitted through the aperture x^2 and the warm water drawn off through the outlet z^2.

What I claim is:

1. The combination with a condenser, of an ejector for removing air therefrom, and means responsive to change in amount of condensate for preventing removal of air from said condenser by said ejector.

2. The combination with a condenser, of an ejector, an air connection between said condenser and said ejector, and means responsive to change in level of the condensate for closing said air connection.

3. The combination with a condenser, of an ejector, an air connection between said condenser and said ejector, a valve in said connection, and a float actuated by the condensate for actuating said valve.

4. The combination with a condenser, of an ejector, an air connection between said condenser and said ejector, a valve in said connection, means tending to actuate said valve, means for locking said means to prevent actuation of said valve, and means responsive to change in amount of condensate for actuating said locking means to free said first named means.

5. The combination with a condenser, of an ejector, an air connection between said condenser and said ejector, a valve in said connection, a valve controlling supply of motive fluid to said ejector, means for actuating said valves, means for locking said actuating means to prevent actuation of said valves, and means responsive to changes in amount of condensate for actuating said locking means to free said actuating means.

6. The combination with a condenser, of a steam motor exhausting into said condenser, an ejector, an air connection between said condenser and said ejector, a valve in said connection, and means responsive to change in speed of said motor controlling said valve.

7. The combination with a condenser, of a steam motor exhausting into said condenser, an ejector for removing air from said condenser, a valve controlling supply of motive fluid to said ejector, and means responsive to change in speed of said motor controlling said valve.

8. The combination with a condenser, of a steam motor exhausting into said condenser, an ejector, an air connection between said condenser and said ejector, a valve in said connection, means responsive to change in speed of said motor controlling said valve, and means responsive to change in amount of condensate controlling said valve.

9. The combination with a condenser, of a steam motor exhausting into said condenser, an ejector for removing air from said condenser, a valve controlling supply of motive fluid to said ejector, means responsive to change in speed of said motor controlling said valve, and means responsive to change in amount of condensate controlling said valve.

10. The combination with a condenser, of a steam motor exhausting into said condenser, a valve controlling flow of steam to said motor, an ejector, an air connection between said condenser and said ejector, a valve in said connection, and means responsive to change in speed of said motor controlling said valves.

11. The combination with a condenser, of a steam motor exhausting into said condenser, a valve controlling supply of steam to said motor, an ejector for removing air from said condenser, a valve controlling supply of motive fluid to said ejector, and means responsive to change in speed of said motor controlling said valves.

12. The combination with a condenser, of a steam motor exhausting into said condenser, a valve controlling flow of steam to said motor, an ejector, an air connection between said condenser and said ejector, a valve in said connection, means responsive to change in speed of said motor controlling said valves, and means responsive to charge in amount of condensate controlling said valve in said air connection.

13. The combination with a condenser, of a steam motor exhausting into said condenser, a valve controlling supply of steam to said motor, an ejector for removing air from said condenser, a valve controlling supply of motive fluid to said ejector, means responsive to change in speed of said motor controlling said valves, and means responsive to change in amount of condensate controlling said valve second named.

14. The combination with a condenser, of a steam motor exhausting into said condenser, a steam pipe supplying steam to said motor, a valve in said pipe, an ejector for removing air from said condenser, and a connection to said steam pipe between said valve and said motor for supplying motive fluid to said ejector.

15. The combination with a condenser, of a steam motor exhausting into said condenser, a steam pipe supplying steam to said motor, a valve in said pipe, an ejector for removing air from said condenser, a connec-

tion to said steam pipe between said valve and said motor for supplying motive fluid to said ejector, and a pressure controlling valve in said connection.

16. The combination with a condenser, of a steam motor exhausting into said condenser, a steam pipe supplying steam to said motor, a valve in said pipe, an ejector for removing air from said condenser, a connection to said steam pipe between said valve and said motor for supplying motive fluid to said ejector, and means responsive to changes in speed of said motor controlling said valve.

17. The combination with a condenser, of a steam motor exhausting into said condenser, a steam pipe supplying steam to said motor, a valve in said pipe, an ejector for removing air from said condenser, a connection to said steam pipe between said valve and said motor for supplying motive fluid to said ejector, a valve in said connection, and means responsive to change of speed of said motor controlling said valves.

18. The combination with a condenser, of a steam motor exhausting into the same, means for supplying steam to said motor, an ejector for removing air from said condenser, a connection from said steam supplying means for supplying motive fluid to said ejector, and an automatic pressure controlling valve in said motive fluid connection to said ejector.

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

ROBERT SUCZEK.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents. Washington, D. C."