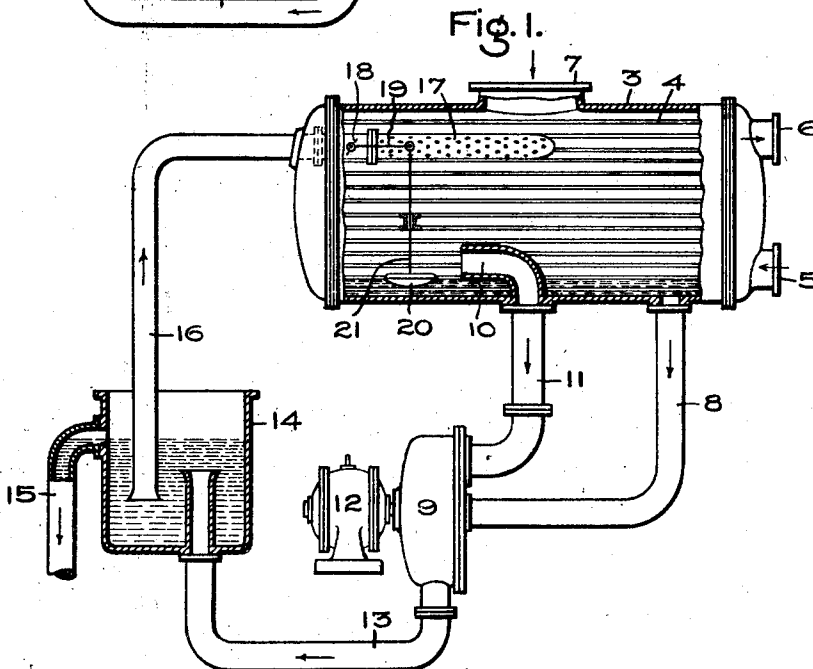
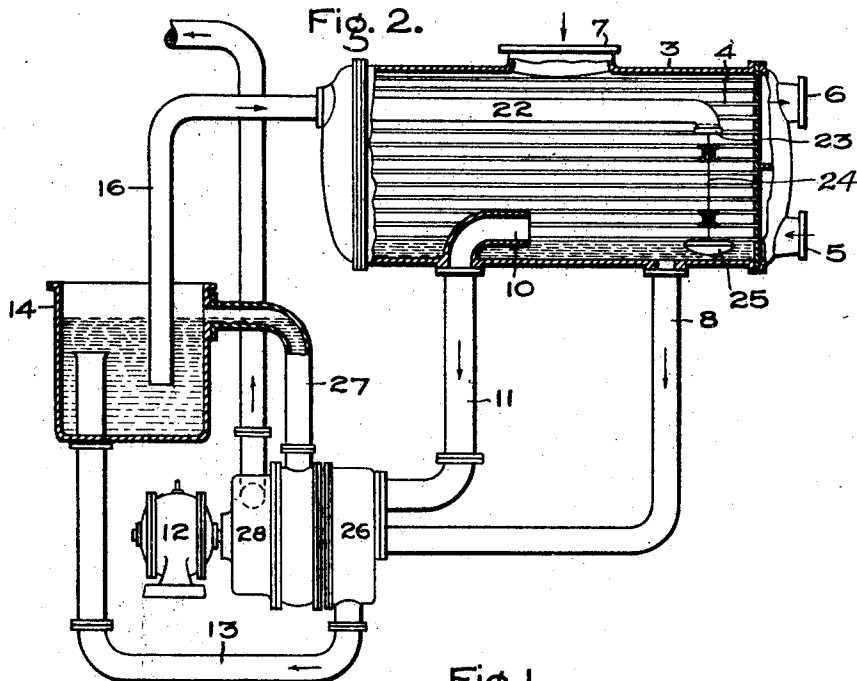


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SURFACE CONDENSER.  
APPLICATION FILED JULY 16, 1909.

1,063,694.

Patented June 3, 1913.



Witnesses:

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# UNITED STATES PATENT OFFICE.

HULDREICH KELLER, OF ZURICH, SWITZERLAND, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

## SURFACE CONDENSER.

1,063,694.

Specification of Letters Patent.

Patented June 3, 1913.

Application filed July 15, 1909. Serial No. 507,683.

*To all whom it may concern:*

Be it known that I, HULDREICH KELLER, a citizen of Switzerland, residing at Zurich, Switzerland, have invented certain new and useful Improvements in Surface Condensers, of which the following is a specification.

The present invention relates to surface condensers and has for its object to improve their action, and more specifically to improve the action of the means employed to extract air from the condenser and also to increase the capacity of the condenser to condense exhaust steam.

For a consideration of what I believe to be novel and my invention, attention is directed to the accompanying description and to the claims appended thereto.

In the accompanying drawing, which is illustrative of my invention, Figure 1 is a longitudinal sectional view of a surface condenser and a centrifugal throwing pump for removing air and water of condensation from said condenser, and Fig. 2 is a similar view showing an additional pump for returning the condensation water to the boiler.

Referring to Fig. 1, 3 indicates the casing or shell of a surface condenser containing tubes 4 through which the cooling or circulating water flows. This water is admitted from a pump or other source of supply by the conduit 5 and is discharged by the conduit 6. Exhaust steam from a turbine or other engine enters by the flanged conduit 7 at the top of the condenser and is condensed as it flows downward over the tubes 4. The condensation water is conveyed from the under side of the condenser by the pipe 8 to the rotor or impeller of the centrifugal throwing pump 9. Located in the bottom portion of the condenser is an L-shaped or other conduit 10 that is so arranged that it will receive air and any uncondensed gases from within the casing without receiving the condensation water. The entrance to said conduit is located at a suitable distance above the lower wall of the casing so that a certain amount of condensation water can be contained and well cooled in the lower portion of the condenser to supply the pipe 8. Under ordinary operating conditions water will tend to accumulate in the lower part of the casing, the water resulting from the continual condensation of the exhaust steam and that drawn from the tank 14 draining to

the bottom of the casing in sufficient quantity to maintain a body of water there from which the throwing pump draws its supply of throwing water. The air and any uncondensed gases entering the conduit 10 are conveyed to the centrifugal throwing pump 9 by the pipe 11. As the impeller of the pump is rotated by the electric or other motor 12 it draws water of condensation from the lower portion of the condenser, raises the pressure of the water, air and gas from condenser to atmospheric pressure and the mixture is discharged through the pipe 13 into the open tank or receptacle 14. In this tank the air and any uncondensed gas escape from the water. The excess water leaves the tank by the overflow pipe 15. Extending into the tank and having its lower end submerged at all times is a pipe 16, the other end of which extends into the condenser. Owing to the suction effect exerted by the condenser a certain portion of the water of condensation from the tank will be automatically conveyed back into the condenser to increase its effective cooling action. At low absolute pressures, the absorption of heat from the uncondensed gases in the condenser by the tubes is slow. This absorption can be materially increased, however, by causing the gases to give up their heat to water and causing or permitting the water to flow over the condenser tubes. I utilize this fact in carrying out my invention and cause the water of condensation to flow from the tank back to the condenser, and as it flows through the latter to absorb heat from the contained gases and deliver or impart it to the tubes and the circulating water flowing therethrough. To enhance this action a spraying device 17 is provided which with advantage may take the form of a perforated pipe that extends well into the body of the condenser. The passage of water through this pipe is controlled or throttled by a butterfly valve 18 that is mounted on a spindle, the latter being provided with an arm 19. The outer end of the arm is connected to a float 20 by means of a rod 21. As the float rises and falls due to a change in level of the water of condensation in the condenser it varies the opening of said valve and hence the amount of condensation water that can return or re-enter the condenser. By reason of this con-

struction or arrangement a very active circulation of the condensation water is secured and a quantity of said water is maintained in contact with some of the tubes through which the cooling water enters. Since the condensation water is taken from the coolest part of the condenser it will be well cooled, this arrangement insuring a sufficient supply of pure water for the pump without the use of special cooling devices which is very desirable and especially so on ship-board where the supply of fresh water is necessarily limited, and where in many if not all cases no space is available for cooling devices. It will be apparent from the description given that the water passing over the tubes and giving up heat thereto is due first to the condensation of the steam received from the engine, and second to the water of condensation reconveyed to the condenser by the pipe 16 which water has had its temperature reduced by the action of the tubes and has been freed from air. And further that said water will be fresh and free from impurities. Owing to the arrangement of the parts a certain amount of water will always be available for the throwing pump irrespective of the amount of exhaust steam supplied to the condenser. It will also be seen that since an abundant supply of condensation water is provided for the throwing pump that the latter will be constantly operating to withdraw or pump air from the condenser casing thereby improving the condensing operation.

In Fig. 2 is shown a modification wherein the condenser is constructed and arranged as before. The water of condensation is discharged through a pipe 22 whose end is turned downward and contains a seat for the throttle valve 23. The valve is mounted on a stem 24 that is suitably guided, and on the lower end of the stem is a float whose position is determined by the level of the condensation water in the condenser casing. Water and air are removed from the condenser by the centrifugal throwing pump 26. Condensation water is returned to the condenser by the pipe 16 as before. The condensation water and air are discharged from the throwing pump 26 by the pipe 13 into the tank 14. Instead of allowing the excess water to flow freely from the tank it is conveyed by pipe 27 to the suction side of the centrifugal pump 28 by means of which its pressure is raised to the desired value, for example, to be returned to the boiler supplying steam to the turbine or engine that exhausts into the condenser. The impellers of the pumps 26 and 28 may advantageously be mounted on the same shaft and driven by a single motor 12 which may be an electric, fluid-actuated or other motor.

The centrifugal throwing pump may be

constructed in a variety of ways, but I prefer to use the construction and arrangements which form the subjects-matter of my United States Letters Patent Nos. 922,595; 987,994 and 987,995.

It is to be observed that I not only utilize the condensation water to reënter the condenser and condense the steam which is a very desirable arrangement in itself, but I can also utilize the same water for pumping air out of the condenser, the two operations taking place simultaneously. This enables me to dispense with an extra pump for extracting air which reduces the initial cost and that of maintenance and also simplifies the system as a whole. Such broader features of the invention disclosed as are not claimed herein are claimed in my pending application Serial No. 508,657.

In accordance with the provisions of the patent statutes, I have described the principle of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof; but I desire to have it understood that the apparatus shown is only illustrative, and that the invention can be carried out by other means.

Having now fully described my invention, what I claim as new and desire to secure by Letters Patent of the United States, is:

1. In a condenser system, the combination of a surface condenser having a casing in which a high degree of partial vacuum is to be maintained, a centrifugal throwing pump for simultaneously removing air and water of condensation from the condenser, a conduit conveying air to the pump from the casing, a conduit conveying water of condensation to the pump from the casing to assist in the removal of the air, means for conveying water of condensation from the discharge side of the pump back into the steam space of the casing where it mingles with the steam, absorbs heat therefrom and gives it up to the cooling surfaces of the condenser, and means for conveying away the excess water of condensation.

2. In a condenser system, the combination of a surface condenser having water-cooled surfaces and a casing in which a high degree of partial vacuum is to be maintained, a centrifugal throwing pump, a conduit conveying water of condensation from the lower portion of the casing to the inlet side of the pump, a conduit conveying air and uncondensed gases from the casing to the pump to be acted upon by the throwing water, an open receptacle that receives the discharge from the pump and in which the air separates from the throwing water, and a conduit that conveys water of condensation from the receptacle back to the casing under the suction effect due to the vacuum

therein to assist in the condensing operation and to afford a water supply for the throwing pump.

3. In a condenser system, the combination of a surface condenser having cooling surfaces and a casing in which a high degree of partial vacuum is to be maintained, means for cooling said surface, a centrifugal throwing pump that withdraws air and water of condensation from the condenser and increases its pressure, a receptacle that receives said air and water, a conduit one end of which is submerged in the water in the receptacle and the other end enters the casing to return water of condensation thereto under the suction effect of the low pressure in the casing, and a spraying device in the steam space of the casing which is connected with the discharge end of the conduit.

4. In a condenser system, the combination of a surface condenser having cooling surfaces and a casing in which a high degree of partial vacuum is to be maintained, means for cooling said surfaces, a centrifugal throwing pump that withdraws air and water of condensation from the condenser and increases its pressure, a receptacle that receives said air and water, a conduit, one end of which is submerged in the water in the receptacle and the other end enters the casing to return water of condensation thereto under the suction effect due to the partial vacuum in the casing, a spraying device arranged in the steam space of the casing which is connected to the discharge end of the conduit, a valve located in the conduit between the receptacle and said device, and means for operating the valve.

5. In a condenser system, the combination of a surface condenser having cooling surfaces and a casing in which a high degree of partial vacuum is to be maintained, means for cooling said surfaces, a centrifugal pump that withdraws water of condensation from the condenser and increases its pressure, a receptacle that receives said water, a conduit, one end of which is submerged in the water in the receptacle and the other end enters the casing to return water of con-

densation thereto, a spraying device connected with the discharge end of the conduit, a valve in the conduit situated within the casing for controlling the reentrance of water of condensation thereto, and a float which actuates the valve and whose position is determined by the level of said water in the casing.

6. In a condenser system, the combination of a surface condenser having a casing and tubes through which cooling water is circulated, a throwing pump for removing air and water of condensation from the condenser, means for returning water discharged from the pump to the steam space of the casing, a device for maintaining a body of water of condensation in the lower portion of the casing in contact with some of the tubes through which the cooling water enters, a conduit for conveying water of condensation from said portion of the casing to the pump to act as throwing water therein, a conduit for conveying air from the region of the condenser above said body of water to be acted upon by throwing water, and means for removing surplus water of condensation from the system.

7. A surface condenser containing tubes through which cooling water is circulated, in combination with a centrifugal throwing pump which simultaneously removes water of condensation and uncondensed gases, a conduit between the condenser and pump for conveying said water alone to the pump, a second conduit between the condenser and the pump for conveying said gases alone to the pump to be acted upon by the throwing water, means for returning a portion of the water of condensation to the condenser to increase its effective action, and a regulator for controlling the amount of water that re-enters the condenser and maintaining a supply therein for the throwing pump.

In witness whereof, I have hereunto set my hand this 16th day of June, 1909.

HULDREICH KELLER.

Witnesses:

HEINRICH BOLTSHAUSER,  
CARL GUBLER.