June 19, 1923.

1,459,433

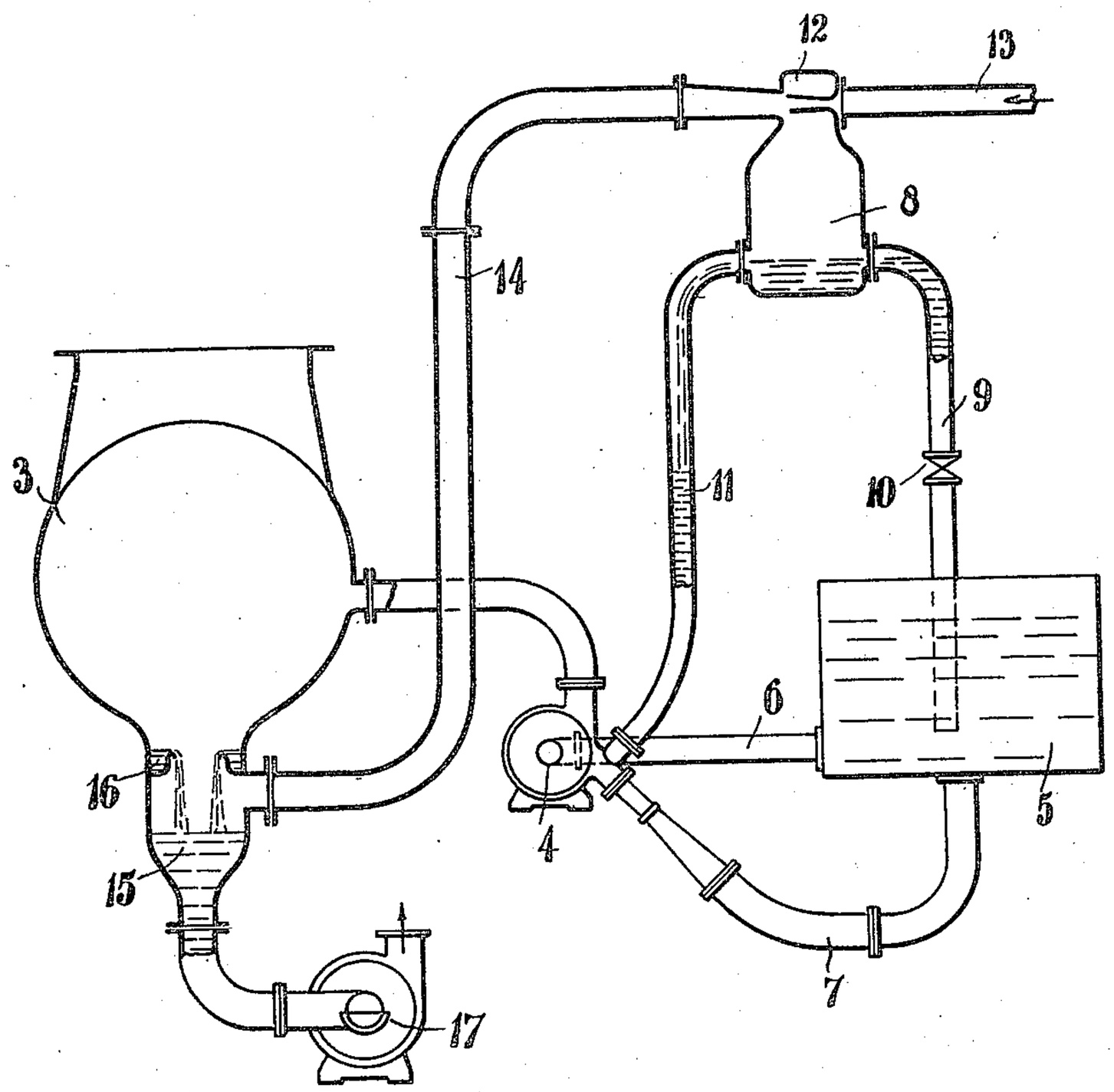
K. BAUMANN

AIR PUMP FOR CONDENSERS

Filed Feb. 2, 1917

2 Sheets-Sheet 1

Fig.1.



WITNESSES

W. J. Holman

INVENTOR

Karl Baumann

by Brun & McCallister

his Attys.

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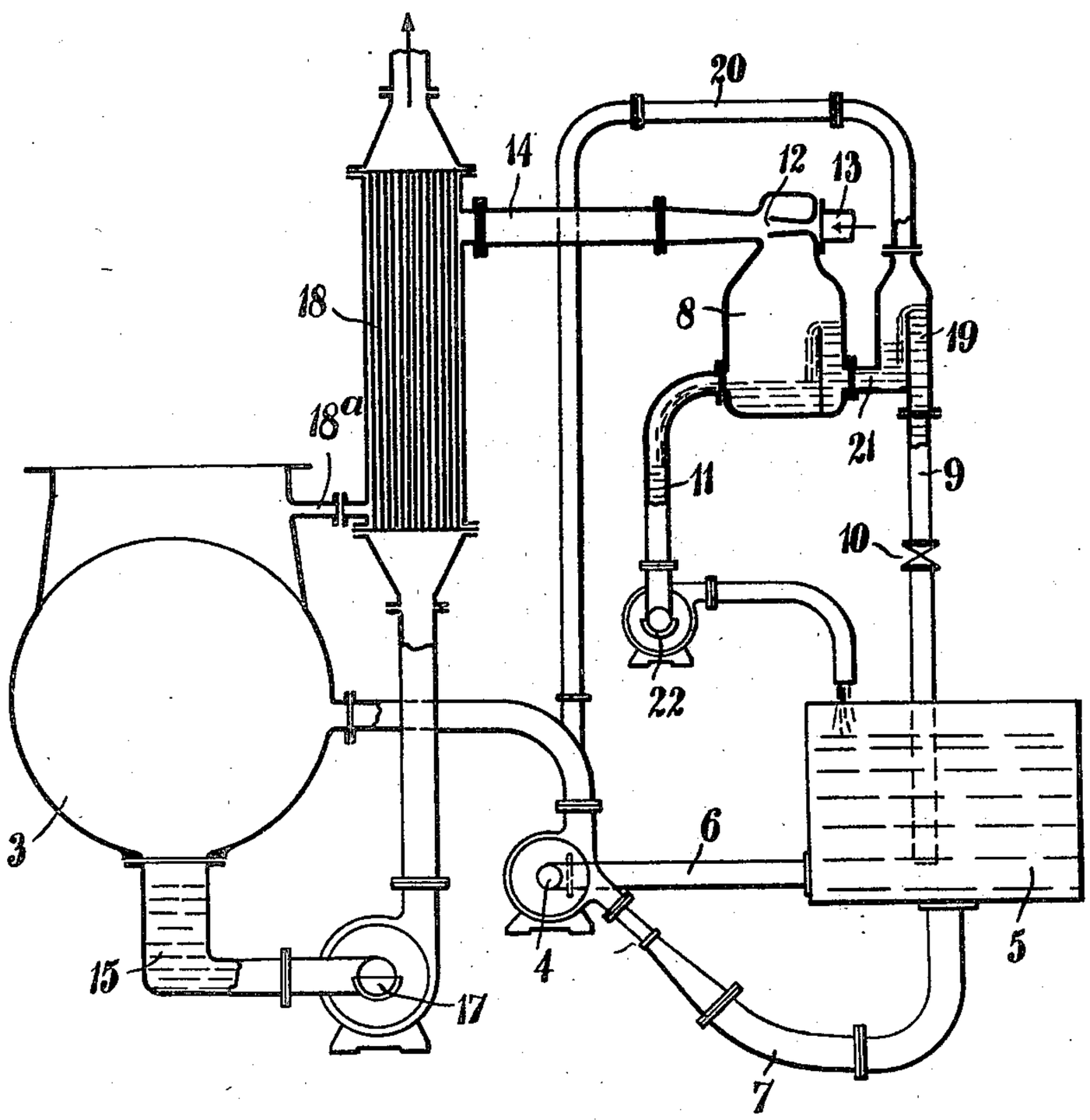
Fig. 2.



WITNESSES

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his Attys.

Patented June 19, 1923. 1,459,433

UNITED STATES PATENT OFFICE.

KARL BAUMANN, OF URMSTON, ENGLAND, ASSIGNOR, BY MESNE ASSIGNMENTS, TO WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY, A CORPORATION OF PENNSYLVANIA.

AIR PUMP FOR CONDENSERS.

Application filed February 2, 1917. Serial No. 146,135.

To all whom it may concern:

Be it known that I, KARL BAUMANN, a citizen of the Confederation of Switzerland, and a resident of Urmston, in the county of Lancaster, England, have invented a new and useful Improvement in Air Pumps for Condensers, of which the following is a specification.

This invention relates to jet air pumps using water as the operating medium, and especially to pumps of this kind employed in connection with steam condensing plants.

In order to obtain the highest possible vacuum with pumps of the above character, it is necessary that the water used as the operating medium, commonly termed the sealing water, and contained in a seal tank, should be maintained at as low a temperature as possible. To do this it has been customary to supply a large amount of cold make up water to the seal tank, or to cool the water in the tank by causing cold water to circulate through tubes placed in the tank.

According to the present invention the sealing water is cooled by evaporating a part thereof by means of a vacuum higher than the vacuum obtaining in the air pump itself. The vacuum for evaporating the seal water is produced by a steam ejector the steam from which, including the steam evaporated from the seal water and non-condensable gases, is discharged into a suitable part of the main condenser or other point in the plant, for example a suitable stage in the main turbine.

Two constructional forms of the invention are represented diagrammatically by way of example in the two figures of the accompanying drawings, similar reference numerals being used to indicate like parts in both figures.

In Figure 1 the condenser is shown at 3 and the jet pump for extracting the air and non-condensable gases therefrom at 4, the pump 4 being of the kind using water as the operating medium, of which the well known Leblanc rotary pump is an example. The sealing water for operating the pump is contained in a seal tank 5, from which it is led into the pump 4 through the pipe 6, the discharge from the pump being connected with the tank 5 by the pipe 7 in the usual way. Water from the seal tank 5 is drawn through a pipe 9 into an evaporating vessel 8, a valve 10 being preferably provided in the pipe 9 for regulating the supply of water to the evaporating vessel 8. The water from the evaporating vessel 8 is led through a pipe 11 to a suitable point under vacuum of the air pump 4. If the pump 4 is of the well known rotary Leblanc type the water passing from the evaporating vessel 8 through the pipe 11 may be led into a point between the collecting cone and the diffuser of the pump. Alternatively, however, the water may be abstracted from the evaporating vessel 8 by a pump and returned into the seal tank 5, as shown for example in Figure 2. A steam ejector 12 fed with steam through the pipe 13 either from the boilers direct or from a stage of the main turbine or engine, or the exhaust of auxiliary engines of the plant or other convenient source, produces the desired degree of vacuum in the evaporating vessel 8. A pipe 14 leads the steam discharged from the ejector 12 into the discharge outlet 15 for the condensate coming from the condenser 3. A weir or weirs 16 is or are provided in the discharge outlet 15 to ensure efficient condensation of the steam coming through the pipe 14 from the ejector 12. The condensate is extracted from the discharge outlet 15 by the usual extraction pump indicated at 17.

In operation the ejector 12 is designed to maintain a vacuum in the evaporating vessel 8 higher than that obtaining in the air pump 4, so that the sealing water passing through the evaporating vessel 8 will be evaporated and consequently cooled. The ejector 12 is so arranged that not only the steam issuing therefrom but also the steam evaporated from the sealing water passing through the evaporating vessel 8, will be discharged through the pipe 14 into the condensate discharge outlet 15. The whole of the heat contained in the steam used for operating the ejector 12, as well as the heat in the steam evaporated from the sealing water, will thus be recovered in the condensate which is utilized as feed water for the boilers in the usual way. Any air or non-condensable vapours reaching the evaporating vessel 8 will also be carried by the steam

from the ejector 12 through the pipe 14 into the condensate discharge outlet 15 from whence they will pass into the steam space of the condenser 3 and be extracted by the air pump 4.

In the arrangement represented in Figure 2 the steam discharged from the ejector 12 in the evaporating vessel 8 is led through the pipe 14 into a feed water heater 18 operating at a suitable vacuum. The feed water heater 18 is here shown as being of the surface type but a feed water heater of the jet type may be employed if desired. To obviate the necessity of providing a separate air pump for the heater 18 the vapours and non-condensable gases are led away therefrom through a pipe 18ª into the condenser 3, from which they are extracted by the air pump 4. If desired, however, the pipe 18ª may connect with the air suction of the pump 4.

In the arrangement shown in Figure 2 an additional air separating vessel 19 is provided into which the water from the seal tank 5 passing through the pipe 9 is first led. The air separating vessel 19 is connected by a pipe 20, as shown, to a suitable point in the air pump 4, but it may be connected to the main condenser 3 or other point under vacuum in the condensing plant, as may be found most convenient. Air will be drawn through the pipe 20 from the water passing through the separating vessel 19, the ejector 12 being thus relieved of the additional work of discharging air from the water passing through the evaporating vessel 8. As, in operation, the degree of vacuum obtaining in the air separating vessel 19 will be less than that obtaining in the evaporating vessel 8 the two vessels are connected with one another by a U leg 21 in order to provide a water seal between the two chambers. If such a seal were not provided the ejector 12 would draw air from the air pump 4 without evaporating the water passing through the evaporating vessel 8.

It may be preferable to dispense with the additional air separating vessel 19 because of the greater simplicity of the apparatus thus constructed, and particularly when the operating conditions are such that the ejector 12, which at all times maintains a lower absolute pressure within the evaporating vessel 8 than that maintained in the vessel 19 by the air pump 4, can be operated efficiently both to remove the air from and to cause a sufficient evaporation of the water passing through the evaporating vessel 8.

In the arrangement shown in Figure 2 the water is extracted from the evaporating vessel 8 through the pipe 11 by a pump 22 which discharges into the seal tank 5, though it may if desired be allowed to flow into a suitable point under vacuum of the air pump 4 as described with reference to Figure 1.

The operation of this form of the arrangement will be understood from what has been said with reference to Figure 1, it being apparent that the heat contained in the steam for operating the ejector 12, as well as the heat in the steam evaporated from the sealing water in the evaporating vessel 8 will be recovered in the heater 18 and returned in the feed water supplied therefrom to the boilers.

With the improved arrangements described above all the steam operating the ejector for producing the vacuum in the evaporating vessel, as well as the vapour drawn over from the condenser into the air pump and the heat equivalent to the mechanical work required to operate the air pump, is recovered in the form of heat in the condensate.

The amount of make up water required for the seal tank will be very small so that pipe connections of small dimensions only are required for the make up water as well as for the overflow.

I claim as my invention:

1. A steam condensing plant comprising a steam condenser and a jet air pump of the kind indicated, and means for cooling the sealing water for the pump by evaporating a part thereof in a vacuum higher than the vacuum obtaining in the air pump itself, said evaporating vacuum being produced by a steam ejector, and means discharging the steam therefrom into a suitable part of the plant operating under vacuum, substantially as described.

2. A condensing plant comprising a steam condenser, a jet air pump communicating therewith, means, including an ejector, for cooling the sealing water for the pump by evaporating a part thereof in a vacuum higher than the vacuum obtaining in the pump itself, and means for discharging steam from the ejector, and the steam evaporated from the sealing water, into the condenser.

3. A steam condensing plant comprising the combination of a steam condenser, a jet air pump communicating with the condenser, a water heater, means, including a steam ejector, for cooling the sealing water for the pump by evaporating a part thereof in a vacuum higher than the vacuum obtaining in the air pump itself, said evaporating vacuum being produced by the steam ejector, and means for discharging the steam from the ejector, and the steam evaporated from the sealing water, through the water heater into the condenser.

4. A steam condensing plant of the arrangement claimed in claim 1 which also comprises an air separating chamber with a water seal connection to the chamber in which the evaporating vacuum is produced, and means for leading the sealing water for

the pump thru said separating chamber before it enters the evaporating chamber.

5. A steam condenser plant of the arrangement as claimed in claim 1 which also comprises means for discharging the sealing water, after being cooled by evaporation, into the jet air pump of the plant.

6. In combination in a condensing plant, a condenser, a jet air pump for withdrawing air from the condenser, a tank receiving water from said pump, an evaporator to which water from said tank is delivered, a steam actuated ejector for maintaining a high vacuum in said evaporator, means for delivering steam from said ejector and vapor entrained therewith to said condenser, and means for delivering water from said evaporator to a working passage of said pump.

In testimony whereof I have hereunto subscribed my name this second day of January, 1917.

KARL BAUMANN.

Witnesses:
W. MORRIS,
F. NIXON.