No. 785,613. PATENTED MAR. 21, 1905.

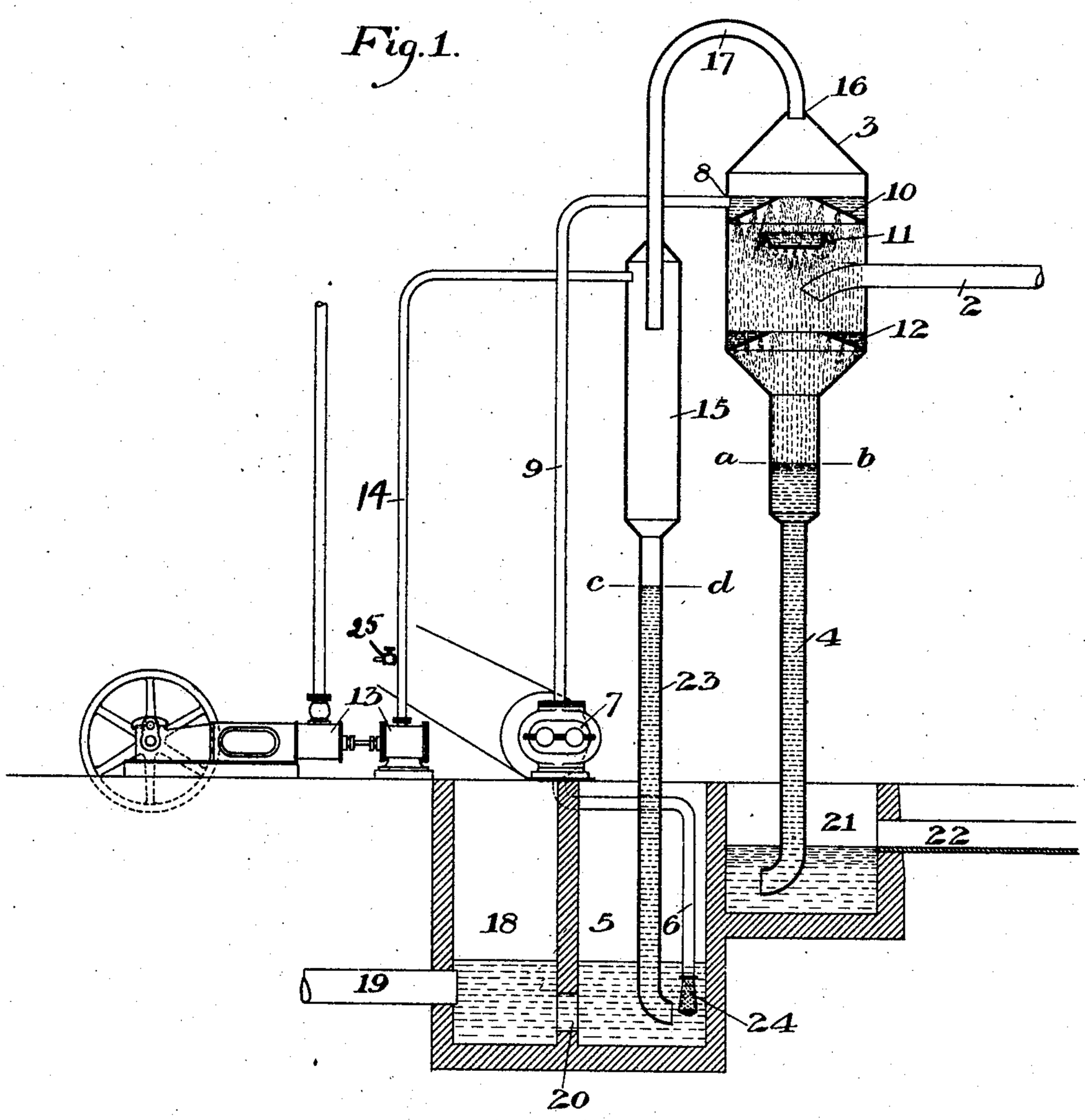
A. H. HELANDER.

STEAM CONDENSER.

APPLICATION FILED AUG. 3, 1904.

2 SHEETS—SHEET 1.

Fig. 1.



WITNESSES

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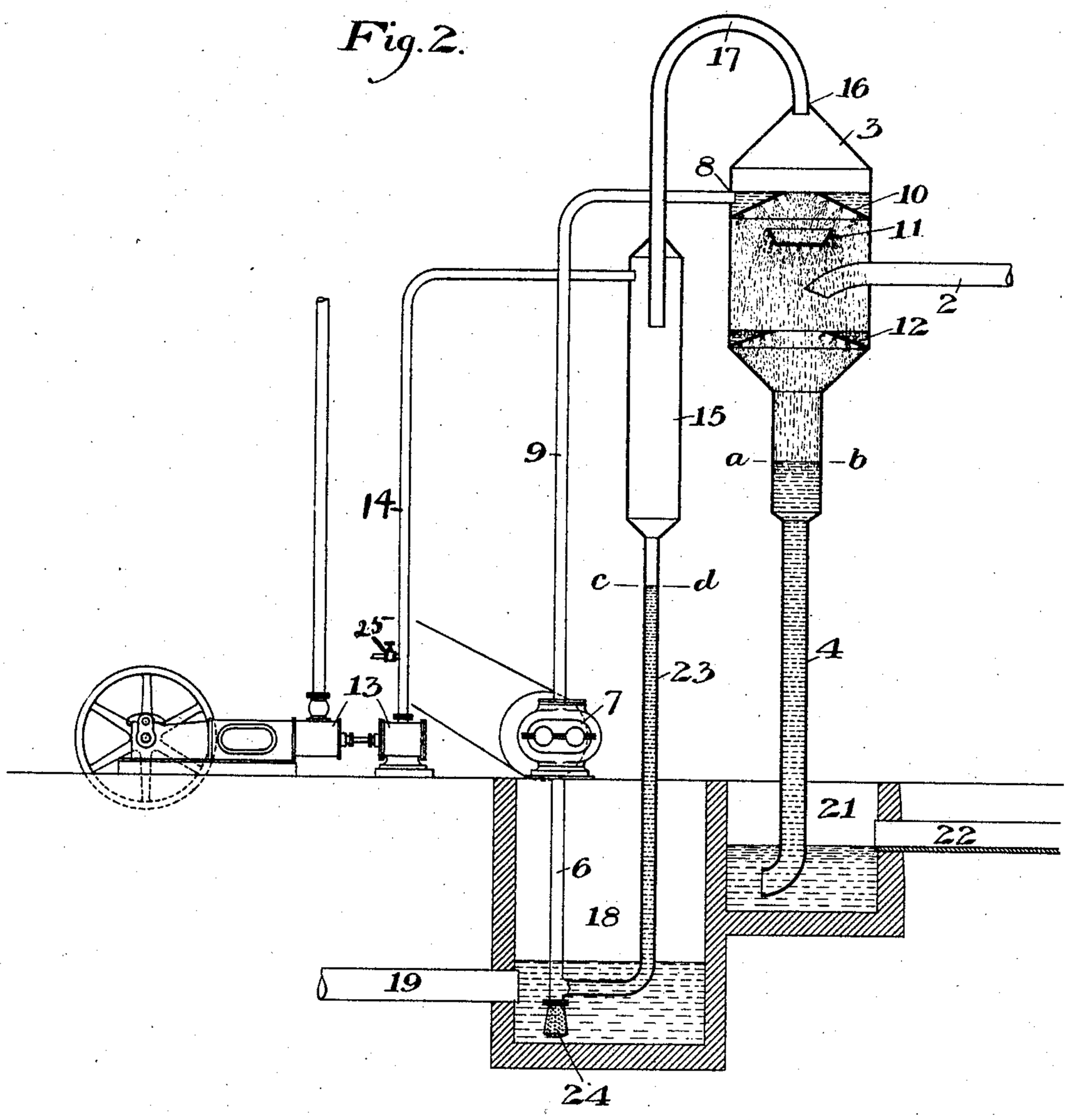
2 SHEETS—SHEET 2.

Fig. 2.



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UNITED STATES PATENT OFFICE.

AXEL H. HELANDER, OF PUEBLO, COLORADO, ASSIGNOR TO MESTA MACHINE COMPANY, OF PITTSBURG, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

STEAM-CONDENSER.

SPECIFICATION forming part of Letters Patent No. 785,613, dated March 21, 1905.

Application filed August 3, 1904. Serial No. 219,290.

To all whom it may concern:

Be it known that I, AXEL H. HELANDER, of Pueblo, Pueblo county, Colorado, have invented a new and useful Steam-Condenser, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is an elevation, partly in vertical section, showing my improved condenser; and Fig. 2 is a similar view showing a modified construction.

The purpose of my invention is to reduce the quantity of water required for condensation of steam and other vapors to a minimum.

There are two types of condensers, the one known as "surface condensers" and the other as "jet-condensers." There are also two types of jet-condensers, the one known as "wet-air-pump" condensers and the other as "dry-air-pump" condensers. My invention is particularly applicable to the latter type, wherein the steam to be condensed is brought into actual contact with the water, and the air and vapor liberated are drawn away by an air-pump.

As usually constructed jet-condensers are not provided with any device for regulating the vacuum in keeping with the quantity and temperature of water employed for condensation and the steam to be condensed. For a given vacuum the quantity of water for condensation will vary with the temperature of the water and the quantity of steam to be condensed. If too much water is used for condensation, power is wasted in pumping it.

The object of my invention is to provide devices whereby the condenser may be so regulated that for the quantity of steam to be condensed and for the temperature of the water for condensation the vacuum produced by the condensation of the steam may be maintained at or nearly at the theoretical vacuum with the minimum quantity of water. I attain these results by means of the apparatus illustrated in the accompanying drawings.

In Fig. 1, 2 is a pipe for leading the exhaust-steam from the engine to the condenser vessel 3, and 4 is the tail-pipe of said vessel. The vessel 3 may be of any desired shape. The water by which the steam from the pipe 2 is condensed is taken from a well 5 by a pipe 6 and pump 7 and is discharged into the condensing vessel 3 at 8 through a pipe 9. 10, 11, and 12 are deflecting plates or pans located within the condensing vessel 3 and intended to distribute the water. 13 is an air-pump connected by a pipe 14 to a vacuum-tight air-separator 15, which in turn is connected to the top of the condensing vessel 3 at 16 by a pipe 17 and is connected to the well 5 by a tail-pipe 23. Fresh cold water comes into the well 18 through a pipe 19 and passes through an opening 20 into the well 5. The hot water is discharged from the vessel 3 through the tail-pipe 4 into the hot-well 21 and flows thence through a pipe 22 to the sewer. After the water has been introduced into the condensing vessel 3 by the pipe 9 it overflows the deflecting-pans 10 and passes into the pan 11, which is perforated on its sides and bottom, so that a portion of the water passes through these perforations to the tail-pipe 4, and the remainder overflows the edges and falls upon the pan 12, whence it overflows into the tail-pipe 4. The water is thus divided into relatively small streams and is brought into intimate contact with the steam entering the condensing vessel 3 from the pipe 2.

The operation is as follows: When water is being discharged into the condensing vessel 3 by the pipe 9 and the steam is discharged into it from the pipe 2, if the volume and temperature of the water bear a proper proportion to the quantity of steam introduced the steam will be condensed, and the combined body of water which has been used for condensation and the condensed steam will pass into the tail-pipe 4, thence into the hot-well 21, and thence through the overflow 22 into the sewer, a vacuum being formed in the meantime in the condensing vessel 3 and the air and vapor liberated therein being removed by the air-pump 13 through the pipes 17 and 14. Accordingly as the vacuum is greater or less so

will the water-levels *a b* and *c d* in the tail-pipes 4 and 23 be higher or lower. The higher the temperature of the water used for condensing the steam the greater the quantity of water required to produce a vacuum of given degree, the quantity of steam remaining the same. The more nearly the quantity of water for condensation is reduced to the theoretical requirement the greater will be the quantity of water-vapor liberated in the condensing vessel. This vapor is removed from the condensing vessel 9 by an air-pump 13, which also removes any air that may enter the condensing vessel with the water. If the quantity of water injected for the purpose of condensing a given amount of steam is too small, it will be heated and vaporized considerably in the vessel 3, and the pressure and volume of the surplus vapors will increase in the top of the vessel, or, in other words, the vacuum will decrease. These vapors will be drawn by the air-pump into the separating vessel 15, where the steam will condense on the cold surfaces of said vessel and only air will pass through the pipe 14 to the air-pump 13. The condensed steam in the vessel 15 is discharged through the pipe 23 to the well 5. It is well known that for the same quantity of cooling-water and the same condition of steam the lower the temperature of the injected cooling-water the less quantity of air and non-condensable vapors will be freed, and the higher the temperature of the injected water the greater quantity of such air and vapors will be freed. With every change in the amount of injected water entering the vessel 3 through the pipe 9 and also with every change in the amount of steam entering the vessel 3 through the pipe 2 a corresponding increase or decrease of the vacuum in the vessel will occur, and consequently the air-pump will displace too little or too much air. If the air-pump is not able to extract all the air from the vessel 3, the absolute pressure in said vessel will increase, which means that the vacuum will decrease. If the capacity of the air-pump is too large, such a surplus vacuum may be formed in the separating vessel 15 that a mixture of vapor, air, and water may be drawn over through the pipe 17 into the vessel 15. If this condition exists, it shows that the vacuum produced is too great for the quantity of condensing-water, although the quantity of water injected would be sufficient with less vacuum. Therefore the assumed condition can be overcome if the vacuum can be reduced. I reduce the vacuum automatically by bringing water of higher temperature into the vessel 3, as I will now describe. As already stated, the condensed water in the separating vessel 15 accumulates through the tail-pipe 23 in the well 5, and in that well (preferably close to the outlet of the tail-pipe 23) is located the suction end 24 of the pipe 6, which leads to the condenser-pump 7. Under ordinary conditions a very small amount of hot water is discharged through the pipe 23, the necessary amount of water required by the pump being drawn from the well 18 through the opening 20. The wells 18 and 5 are on the same level. As soon as water in larger quantities is thrown over to the separating vessel 15 and partial condensation takes place therein most of the hot water discharged through the pipe 23 will be drawn by the pump 7 through the pipe 6 and delivered through the pipe 9 into the vessel 3. This heated water increasing the volume of air and vapor set free will diminish the vacuum in the vessel 3, restoring equilibrium and causing the entire condensation of steam to take place in the vessel 3, from which the water and condensed steam will be discharged through the tail-pipe 4 into the hot-well 21. Under certain conditions it might be impossible to run the air-pump 13 slowly enough to take only the requisite quantity of vapor away from the condensing vessel 3. To meet this condition, a valve 25 is provided in the pipe 14, which may be opened as required to cause a portion of the air for the pump 13 to be taken from the atmosphere and the remainder from the condensing vessel 3. The object of the apparatus being to use the least possible quantity of water for condensation, there will be under ordinary conditions a certain amount of condensable vapor in the condensing vessel 3, which is removed by the pump 13. The most of this condensable vapor will be condensed in the separating vessel 15; but all non-condensable vapors (air) will be removed through the pipe 14 to the atmosphere. Under ordinary conditions the amount of water discharged through the tail-pipe 23 is small and will not substantially increase the temperature of the water in the well 5. As soon as condensation to a large extent takes place in the vessel 15 and a considerable amount of hot water is discharged through the pipe 23 into the well 5 the temperature of the water therein will increase. The pump 7 takes the necessary condensing-water through the strainer 24 near the discharge-opening of the pipe 23 and forces it through pipes 6 and 9 to the condensing vessel 3. This hot water will decrease the vacuum in the condensing vessel 3, as above described.

Fig. 2 shows a like combination of condensing vessel 3, cold-water pump 7, and air-pump 13. The difference from the arrangement shown in Fig. 1 consists in the omission of the well 5 and the direct connection of the tail-pipe 23 to the suction-pipe 6 of the cold-water pump 7, whereby all hot water which accumulates in the separating vessel 15 above the level *c d* will be delivered by the pump 7 into the condenser vessel 3, thereby reducing the vacuum therein.

In the apparatus above described the mech-

anism operates automatically to change the action of the condenser from a parallel-current operation to counter-current operation by introducing hot water into the condensing-chamber with the cold water introduced for the purpose of condensing the steam. The means by which this is accomplished may be varied in many ways without departing from my invention, since

What I claim is—

1. Steam-condensing apparatus comprising a condensing vessel, and means for automatically regulating the condensation by introducing heated water into the condensing-chamber; substantially as described.

2. Steam-condensing apparatus comprising a condensing vessel, an air-exhausting pump, and means for automatically introducing heated water into the condensing vessel for decreasing the vacuum therein; substantially as described.

3. Steam-condensing apparatus comprising a condensing vessel, a water-supply pump discharging water thereinto and having connection with a cold-water supply, a separating-chamber, and a passage leading from the separating-chamber to the inlet of the pump, whereby the temperature of the water supplied to the condensing-chamber is automatically controlled by the accumulation of hot water in the separating-chamber; substantially as described.

4. Steam-condensing apparatus comprising a condensing vessel, means for discharging cold water thereinto, a separating-chamber, and means for discharging the hot water from the separating-chamber into the condensing-chamber, whereby the temperature of the water supplied to the condensing-chamber is automatically controlled by the accumulation of hot water in the separating-chamber; substantially as described.

5. The combination of a condensing vessel 3, a drain-pipe 4, a separating-chamber 15, an exhaust-pump 13, a cold-water-supply pump 7, and means conducting the water of condensation from the chamber 15 to the water-supply pump; substantially as described.

In testimony whereof I have hereunto set my hand.

A. H. HELANDER.

Witnesses:
A. L. BENZ,
HARRY RAVEN.