F. SAMUELSON.

STEAM CONDENSER.

APPLICATION FILED FEB. 7, 1910.

1,076,522. Patented Oct. 21, 1913.

Fig. 1.

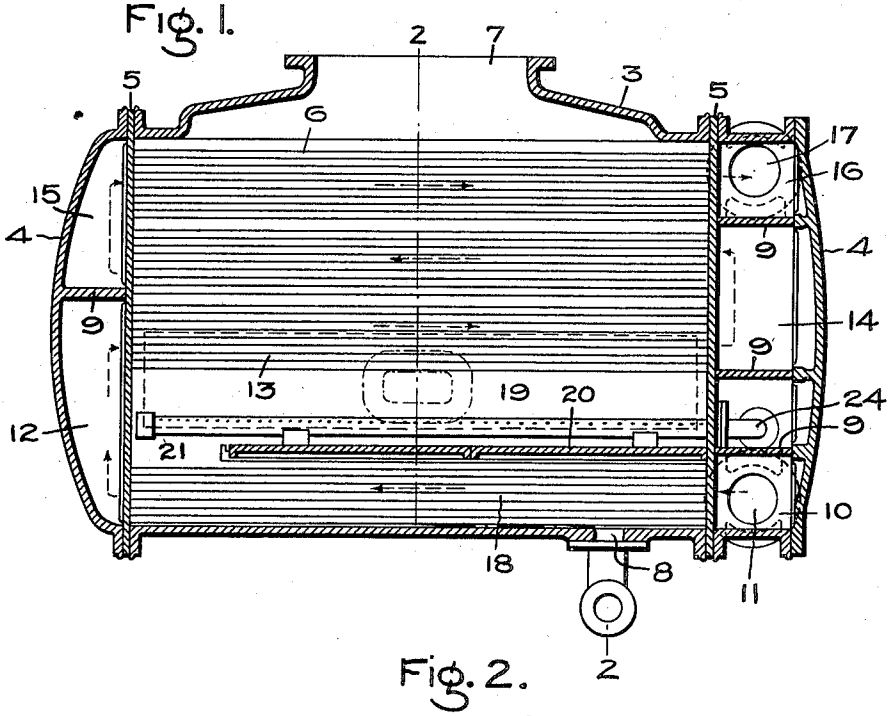
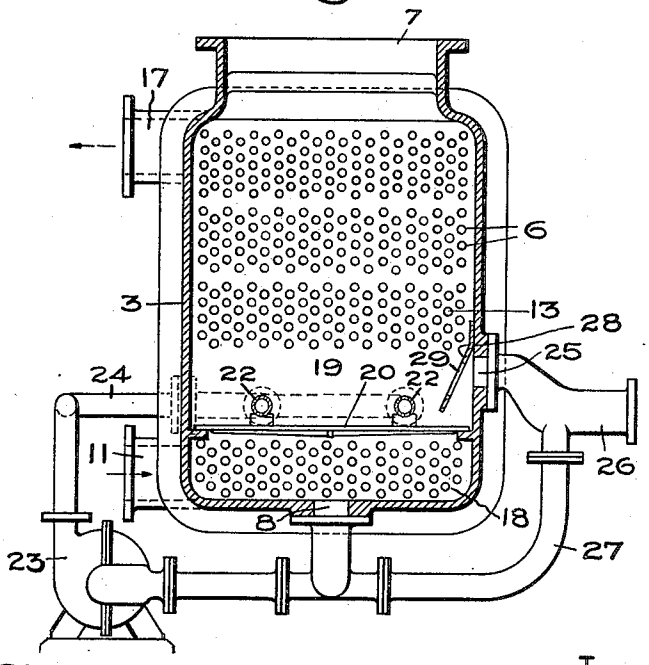


Fig. 2.



Witnesses:

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Att'y.

UNITED STATES PATENT OFFICE.

FREDERICK SAMUELSON, OF RUGBY, ENGLAND, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

STEAM-CONDENSER.

1,076,522. Specification of Letters Patent. Patented Oct. 21, 1913.

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To all whom it may concern:

Be it known that I, FREDERICK SAMUELSON, a subject of the King of Sweden, residing at Rugby, England, have invented certain new and useful Improvements in Steam-Condensers, of which the following is a specification.

The invention relates to steam condensers and its object is to provide apparatus of improved construction and increased efficiency whereby a better vacuum is secured. This improved apparatus has the general form of a combined surface and jet condenser which can utilize water of condensation for the spray or jet and adds to the surface condenser the good features of the jet condenser without introducing any of its disadvantages. The jet condenser cools the steam, water vapor and more especially the uncondensed gases more effectively than the tubes of the surface condenser, while by utilizing water of condensation in the jet condenser the water discharged from the apparatus is in better condition for use in the boilers of the plant than it would ordinarily be if water from some outside source were supplied to the jet condenser. If, as seldom happens, a supply of pure water from an outside source is available, the apparatus can use water from said source in the jet condenser if desired.

In the accompanying drawing which illustrates one of the embodiments of the invention, Figure 1 is a longitudinal section of the condenser; and Fig. 2 is a transverse section on the line 2—2 of Fig. 1, also showing the air pump connections and a pump arranged to take water of condensation from the apparatus and supply it to the jet condenser.

The apparatus is provided with a casing 3 having heads 4. Between the heads and the ends of the casing are secured the plates or sheets 5 in which the ends of the tubes 6 are fastened. Exhaust steam enters by the opening 7 at the top of the casing and water of condensation passes out through the opening 8 at the bottom of said casing. The interior of the heads 4 is divided into chambers by partitions 9 which extend from the outer portion of said heads into engagement with the tube sheets 5. The cooling water enters the chamber 10 from a nozzle 11 supplied from any suitable source and flows through the lower set or bank of tubes to the chamber 12, thence through the set of tubes 13 to the chamber 14 and through another set of tubes to the chamber 15 from which the cooling water passes by way of the uppermost bank of tubes to the chamber 16 and out through the nozzle 17. The number of banks of tubes will be determined by the conditions to be met by the apparatus. The direction of flow is indicated by the dotted arrows.

The jet condenser is arranged between two adjacent banks of tubes. In the form of the invention illustrated, a space or region 19 is provided above the lower bank of tubes 18 for said condenser. At the lower part of this region a plate or partition 20 is supported in any suitable manner just above said bank of tubes. An opening 21 between the end of the plate and the left tube sheet 5 permits a flow from the upper to the lower portions of the condenser. Mounted on the plate 20 are a number of longitudinally arranged spray pipes 22. The pump 23 draws some of the water of condensation from the lower part of the condenser or water from some other suitable source as above described, and by forcing it into the pipes 24 and 22, sprays it into the region 19 to condense and cool the contents of the condenser. The spray and the condensed steam fall on the plate 20 and flow from the left end of it through the opening 21 and toward the right over the cooling tubes to the outlet 8 adjacent the opposite end of the condenser. The condenser also has an opening or outlet 25 connecting with the region 19. A wet air pump of any approved construction is connected to the pipe 26 leading from the outlet 25 to remove vapor and uncondensed gases from the condenser and also to draw the surplus water of condensation through the pipe 27. A shield or deflector 28 arranged adjacent the opening 25 is provided with an opening 29 opposite said opening 25.

Steam entering the inlet 7 flows down over the upper banks of tubes and is con-

densed to a large extent by the cooling water flowing upward through the tubes. The water resulting from the condensation of the steam flows toward the bottom of the condenser, falls on the plate 20 and is further cooled by contact with the bank of tubes 18 on its way from said plate to the outlet 8. The steam remaining uncondensed enters the region 19 where it meets the fine spray from the pipes 22. This spray mingles with and condenses the steam and effectively cools the uncondensed gases. As will be noted, the cooling water flows through the condenser in a direction opposite to the flow of the steam so that the condensed water in the lower part of the apparatus is acted on by the circulating water in its coldest condition. The jet condenser thus cooperates most effectively with the surface condenser to produce a high degree of vacuum and water of condensation is available in the best condition for feeding the boilers, if desired.

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.

What I claim as new and desire to secure by Letters Patent of the United States, is,—

1. In a condensing apparatus, the combination of a casing having a steam space therein and provided with an inlet for exhaust steam and an outlet for water of condensation, banks of tubes arranged in said space through which a cooling medium is circulated, spraying means arranged in the said steam space between adjacent banks of tubes that are spaced apart, one at least of said banks of tubes being arranged between the spraying means and the outlet so that the water from said means and the condensed steam are cooled thereby on their way to the outlet, a partition extending partly across the casing below the spraying means and means including a pump connected to said outlet for supplying water to the spraying means.

2. In a condensing apparatus, the combination of a casing having a steam space therein and an inlet opening at the upper part of said space, banks of tubes arranged in the steam space through which a cooling medium is circulated, a spraying device arranged in the steam space between two adjacent banks of tubes that are spaced apart, a partition extending across the casing below the spraying device and provided with a passage, and means for supplying water to the spraying device.

3. In a condensing apparatus, the combination of a casing having a steam space therein, banks of tubes arranged in said space through which a cooling medium is circulated, spraying means arranged in said space between two adjacent banks of tubes that are spaced apart, a partition extending across the casing between said means and the bank of tubes immediately below it, there being an opening between one end of said partition and the adjacent end wall of the casing, and an outlet for the water of condensation arranged below said partition and adjacent to the opposite end of the casing.

4. A combined surface and jet condenser comprising a casing having a steam space therein, upper and lower banks of tubes arranged in the steam space through which a cooling medium is circulated, there being a space or region between said banks of tubes, a partition that extends across the casing above the lower bank of tubes and is provided with a passage through it, spraying means arranged throughout said region above the partition, and means for withdrawing condensed steam from the condenser and reintroducing it into the condenser through the spraying means.

5. In a condensing apparatus, the combination of a casing having a steam space therein and provided with an inlet for exhaust steam and an outlet for water of condensation, banks of tubes arranged in said space through which a cooling medium is circulated, there being a space or region extending from one end of the casing to the other between two adjacent banks of tubes, a partition extending across the casing above the lower bank of tubes and provided with a passage, spraying devices arranged throughout said region that are mounted on the partition, means for supplying water of condensation from the outlet to said devices, conduit means through which air, vapor, etc. are removed from said region, an outlet for air, vapor, etc. leading from the region to said means, and a shield for the inlet end of the last mentioned outlet.

6. In a condensing apparatus, the combination of a casing having a steam space therein, banks of tubes arranged in said space through which a cooling medium is circulated, a partition extending across the casing above the bottom bank of tubes, there being an opening between one end of the partition and the adjacent end wall of the casing, spraying tubes mounted on the partition, a space or region being provided between the partition and the next bank above it, an outlet for the water of condensation arranged adjacent the opposite end of the casing below said partition, an outlet through which air, vapor, etc., are drawn from said region, a shield adjacent the last mentioned outlet, a conduit leading from

said outlet, a pump, a conduit conveying the discharge from the pump to the spraying tubes, a conduit delivering water of condensation from the condensation water outlet to the pump, and a conduit connecting the first conduit and the condensation water outlet.

In witness whereof, I have hereunto set my hand this twentysixth day of January, 1910.

FREDERICK SAMUELSON.

Witnesses:
AUSTIN W. WILLIS,
J. A. FOSTER.

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