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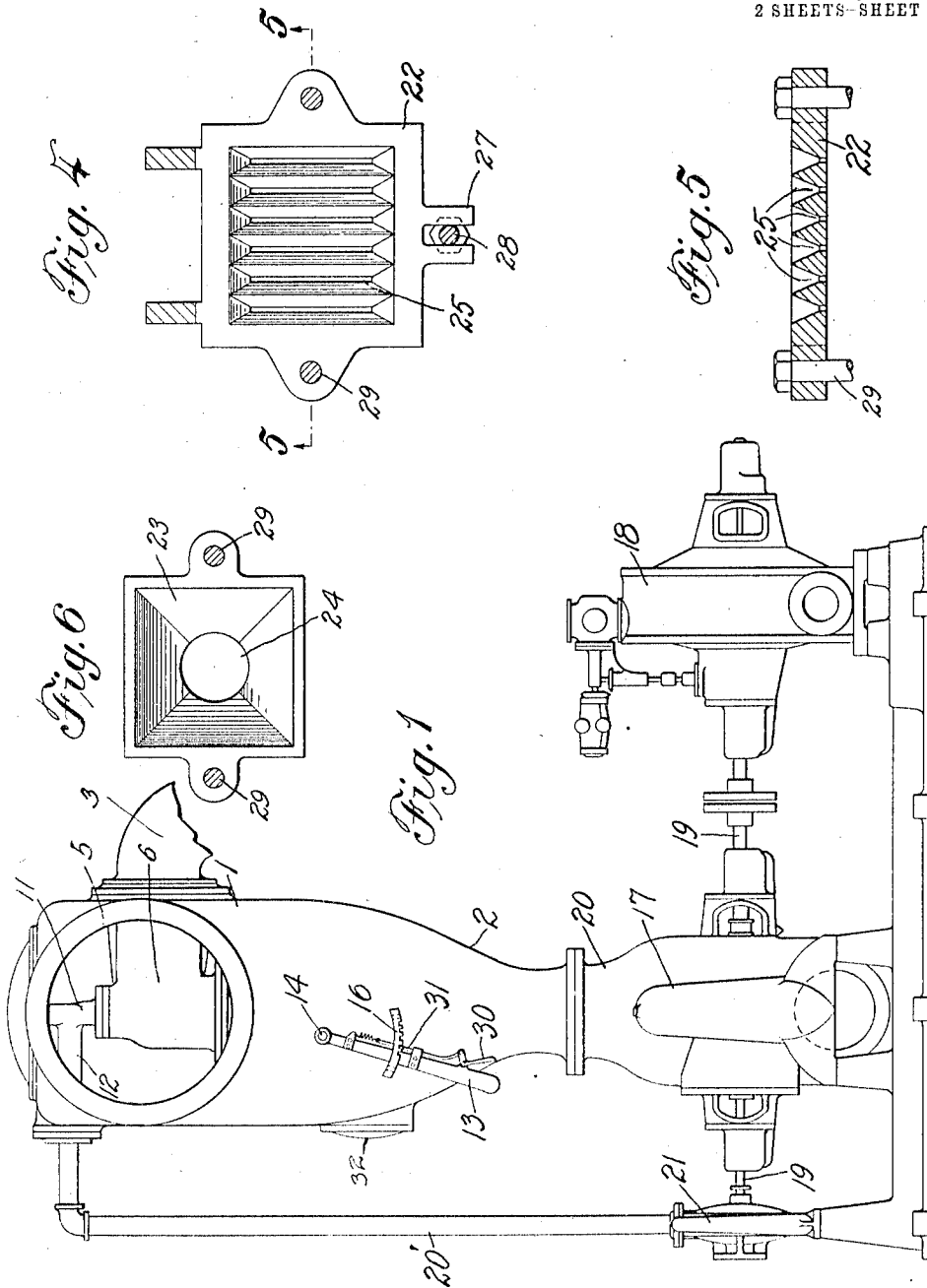
STEAM CONDENSER.

APPLICATION FILED OCT. 3, 1910.

Patented July 7, 1914.

2 SHEETS-SHEET 1.

1,102,380.



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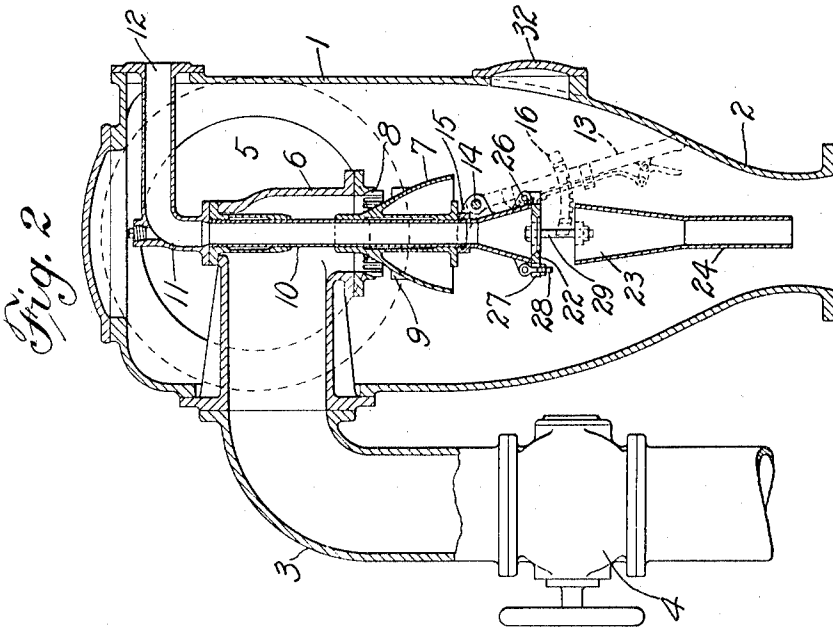
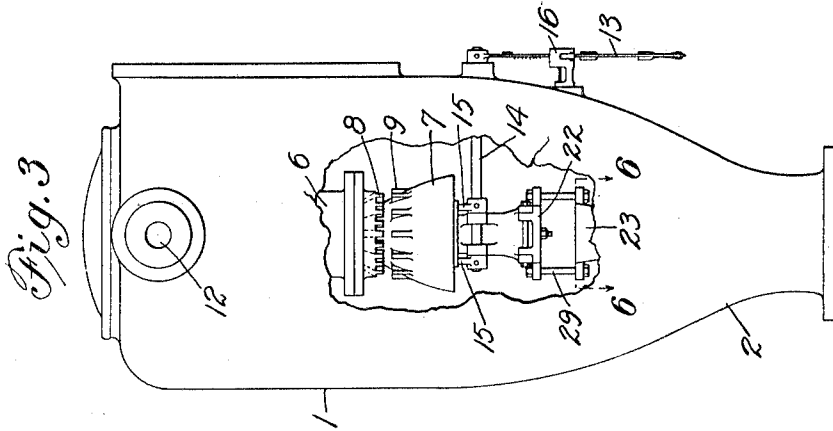
STEAM CONDENSER.

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2 SHEETS—SHEET 2.

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UNITED STATES PATENT OFFICE.

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STEAM-CONDENSER.

1,102,380.

Specification of Letters Patent.

Patented July 7, 1914.

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To all whom it may concern:

Be it known that I, LOUIS R. ALBERGER, a citizen of the United States of America, residing at Greenwich, in the county of Fairfield and State of Connecticut, have invented certain new and useful Improvements in Steam-Condensers, of which the following is a specification, reference being had therein to the accompanying drawing.

10 This invention refers to certain new and useful improvements in apparatus for condensing steam, the object being to simplify and make more perfect the means for operating the condenser, and also to dispense
15 with the necessity of a separate air pump by enabling the air within the condenser, together with the condensing water and the water of condensation, to be all removed from the condenser through the throat and
20 tail pipe thereof. The removal of the water of condensation, the condensing water, and the commingled air, gas and other vapors, is accomplished by means of a centrifugal, turbine, or similar pump. Although I have
25 represented the invention as applied to a jet condenser, yet it will be understood that I do not wish to be confined to any special type of apparatus, but can employ the invention with any kind of condenser system
30 with which it may be found useful and operable.

The invention may therefore be said to consist essentially in the construction, combination and arrangement of the various
35 parts and in numerous details and peculiarities thereof, substantially as will be hereinafter more fully described and then pointed out in claims.

In the annexed drawing:—Figure 1 is a
40 side elevation of my improved condensing apparatus; Fig. 2 is an enlarged vertical section of the condensing chamber and appurtenant parts; Fig. 3 is an outside view of the same condensing chamber as that
45 shown in Fig. 2, with the wall partially broken away to expose certain of the inner parts. Fig. 4 is a bottom plan view of the grid which forms a part of the means whereby the water entangles the air within
50 the condenser chamber. Fig. 5 is a cross-section of the same on the line 5, 5, of Fig. 4. Fig. 6 is a top plan view of the collect-

ing cone which forms another part of the means for trapping the air.

Similar characters of reference designate 55 corresponding parts throughout the different figures of the drawing.

In the example of the invention illustrated in the drawings 1 denotes the main condenser chamber or shell, the same belonging to a jet condenser, and it has its lower end contracted into the usual conical throat 2. This condensing chamber 1 may be supported in any desired manner, and I reserve the liberty of providing such supporting
60 means as may be found most suitable and effective. One way, however, of supporting it which has proved very advantageous in practice is to locate it directly over and allow it to be supported by the water-removal
70 pump, which, in Fig. 1, is seen to be a centrifugal, turbine, or similar pump 17. I do not represent the detailed construction of the pump 17, because this is unnecessary. Any well-known type of centrifugal or tur-
75 bine pump will be suitable for the purpose. The motive power of the pump may be a steam turbine 18, or an electric or other motor, which drives the pump shaft 19. In Fig. 1 I have shown the pump 17 as connected to the throat 2 of the main shell 1
80 by means of an elbow 20.

Referring to Fig. 2, 3 denotes a pipe which supplies injection water to the condenser, lifting this water from a source of supply
85 by means of the vacuum within the condensing chamber. Pipe 3 is provided with a valve 4 placed at any convenient point so that the water supply may be cut off from the condenser whenever the motive power is
90 slowed down, or it becomes desirable for any other reason to cut off or reduce the water supply. The condenser shell 1 is provided with an opening at 5 for the entrance of the steam. This opening may obviously be at
95 any preferred point in the wall of chamber 1. Through the opening 5 comes the steam which is to be condensed, flowing in large volume into the condenser shell 1 where it meets the condensing water in the usual
100 manner.

The injection water upon entering the condenser through the supply pipe 3 passes through the elbow 6 on the inner end of said

pipe 3, and from there is sprayed into the condensing chamber by being caused to pass over the spraying cone 7. In so doing the water passes through an annular opening between the cone 7 and the end of the elbow 6. This end of the elbow is provided with a horizontal series of teeth 8, set preferably quite close together, and, opposite to said series of teeth 8, there is another series of teeth 9 on the cone 7; thus the water emerging from the elbow 6 passes between the two series of teeth 8 and 9 which subdivide the water into a multiplicity of small streams which cast themselves about in every direction in contact with the steam. The steam is condensed, and the air and other vapors are set free. The removal of this air maintains the vacuum that is required in an apparatus of this character.

The spraying cone 7 is vertically adjustable, so that the size of the space between the teeth 9 and the teeth 8 may be increased or diminished, and the size of the outflowing sheet of water correspondingly regulated. The means for supporting the cone 7 so as to render it adjustable may vary widely, but one form which is practical and successful consists in making it movable on the vertical pipe 10, that is supported within the elbow 6, and on which pipe 10 the cone 7 can be adjusted up or down. The means for raising and lowering the cone 7 may be of various kinds, but one which may be mentioned consists of a lever 13, securely fixed on the end of a horizontal shaft 14, that is supported in the wall of the condenser shell 1, the lever 13 being outside of the shell 1, and being provided with a quadrant 16 and a detent 31 which takes into the teeth of the quadrant 16, and is operated by a handle 30, pivoted near the end of the lever 13. Inside of the chamber 1 the inner end of the shaft 14 carries a suitable cam device 15, one or several, which acts loosely underneath the central hub of cone 7, as shown in Fig. 2, and by means of which the cone is raised or lowered accordingly as the outside lever is manipulated for the purpose. A hand hole 32 allows access to the interior of the condenser chamber 1.

Another water pipe 12, usually much smaller than the main injection water pipe 3, is located in the upper part of the chamber 1, and has an elbow 11, which connects with the vertical pipe 10, which as I have said is supported in the elbow 6. Outside the chamber 1 a vertical pipe 20 connects with aforesaid water pipe 12. Water is pumped into the pipe 20 by a small centrifugal pump 21, which, in some examples of my invention, is driven by the same shaft 19 as that which actuates the main water removal pump 17. A second supply of water is thus given to the condenser, which second supply is independent of the first or main supply, and is a sup-

ply of cool water, that is to say, of water that is colder than the mixture of water and air that is removed from the condenser after condensation of the steam. The stream of water which flows through the pipe 20 into the pipe 12 and through the elbow 11 and pipe 10, is usually supplied at a higher velocity than that of the main injection water supply coming through the pipe 3. As this stream of water, flowing at a very high speed, passes downwardly through the pipe 10 it passes into a device which has the function of enabling the water to entangle or trap the air, and which I shall now proceed to describe.

The means for trapping the air consists of two main parts, a grid and a collecting device. The grid is placed on the lower end of the pipe 10, which end is expanded as shown in Fig. 2, into a bell-shape or inverted cone, the lower edge of which may be rectangular. Hinged at 26, or otherwise supported on the lower end of pipe 10, is the grid 22, consisting of a frame having a series of parallel slots 25, which allow the water to pass out through them in the form of flat sheets. In order that the grid 22 may be removed for cleaning when necessary, it is conveniently furnished with a bolt 27, having thereon a nut 28, but other equivalent devices may hold it and by coöperating with the hinge 26 will do as well. Immediately below the grid 22 is the collecting device, consisting of a rectangular or other-shaped upper conical section 23, and a lower circular pipe section 24, which is formed integral with the upper part 23. Rods 29, affixed in some suitable way to the grid 22, are arranged to uphold the collecting device by being so attached thereto that this collecting device may be suspended directly beneath the grid; these rods 29, however, are only one of the many devices possible of employment for this purpose. The arrangement which I have just detailed consisting of a slotted plate forming the grid placed at one point, and the collecting device or receiver placed below it at a distance, makes it possible that the water which flows through the grid may fall for a certain distance through the air before it reaches and enters the collecting device; hence the flat sheets of water passing out of the grid travel through a certain space before being collected by the rectangular conical part 23. This way of dividing the water into a plurality of flat sheets by causing it to be split up by passing through a grid device enables a large surface of water to be presented to the air and uncondensed vapors in the center of the condensing chamber 1. These sheets of water manifestly are flowing at a high velocity, inasmuch as the stream of water supplied by the small centrifugal pump 21 is delivered at a high velocity to the condens-

ing chamber, and the result of having said sheets of water so flowing at high velocity is to entangle the air and uncondensed vapors with the water, and thus carry the air and vapors along into the conical collecting device where they are all thoroughly commingled with the water.

The water and the entangled air and vapors pass downward through the larger rectangular part 23, into the constricted or smaller circular channel 24, of the collecting device, whereby the water air and vapors are led down into the throat 2 of the condensing chamber. At this point the flow of the injection water which has entered the condensing chamber from pipe 3, and been split into a multiplicity of streams by the teeth 8 and 9, and sprayed downwardly and outwardly against the wall of the chamber by means of the cone 7, will be sufficiently rapid to carry along with it the water and the air coming out of the pipe 24. The latter is really a means for giving the second supply of water such a velocity that it may trap the air and gases and carry them along with the condensing water to the discharge.

Another function of the air-trapping device consists in the force imparted to the injection water, by having discharged into the center of its mass the water at high velocity from the pipe 24. This tends to assist the passage of all the water to the water removal pump by increasing the velocity of the flow, and enabling said removal pump to receive and discharge the combined mixture of heated injection water, air, uncondensable vapors, and the supplementary stream of water supplied by the small centrifugal pump 21, and discharged through the grid 22.

The operation of the invention described herein will be easily understood from the foregoing description of the construction and arrangement of the various parts. The main incoming injection water, which is the chief volume of water employed for the purpose of condensing the steam, enters the shell 1 through the elbow 6, and is sprayed throughout the chamber 1 by means of the spraying cone 7 and the teeth 8 and 9; thus a great mass of the condensing water is thrown about in the chamber 1; and into contact with this water the steam entering through the inlet 5, comes, and is condensed into water which mingles with the condensing water. In the process of condensation air and other vapors and gases are set free. Naturally, the air and other gases will be found in the greatest quantity in the center of the volume of condensing water, or at a point or points near the middle of the shell 1. By a removal of the air a vacuum is maintained. Such is the ordinary condition in a jet condenser of the type being described. In some well-known forms the air

and other vapors, which would tend to clog the working of the condenser if not removed, are taken out at the top of the condenser by a separate air-pipe, which runs to a vacuum or air-pump, and when this air is removed the vacuum is maintained. In my condenser, however, a separate air-pump is entirely unnecessary. I have the novel principle of the introduction into the mass or volume of injection water, of a secondary or auxiliary stream of water, which is exposed to the air and other vapors in such a way as to become entangled therewith. The best results are attained when this second supply of water flows at a relatively high velocity. This stream of water, flowing at a high velocity, is pumped into the shell 1 by means of the pump 21, and flows through the pipes 20, 12 and 10, until it reaches the air-trapping device. As I have described, the means whereby the water entangles the air enables the stream of water which flows at a high velocity, to be broken into a plurality of sheets, so that a large surface will be exposed to the air, which sheets are then re-collected into a single stream that passes to the bottom of the condenser. The means whereby the water entangles the air thus removes the air which otherwise if not removed would destroy the vacuum. The secondary stream at the throat end 2 of the condenser, combines at a high velocity with the condensing water and the water of condensation, which is also flowing through the throat, and in this way all the water is removed from the condensing chamber through the throat 2, the removal being accomplished by means of a centrifugal, turbine, or similar pump 17, having an inlet 20, which connects with the throat 2. Hence the air and other vapors in the shell 1 are collected at the point where they are naturally separated from the water, that is to say, in the center of the condensing chamber, and it is unnecessary to remove them by a separate pipe exterior to the chamber. In a construction of the kind I have just been describing, the number of joints liable to leakage of air is reduced to a minimum.

I do not wish to be restricted to the particular specimen of mechanism illustrated and described. A great many different ways may be found of trapping the air within the condensing chamber by the use of a stream of water of high velocity, and I therefore, reserve the liberty of modifying and changing the details of the invention within wide limits. The air-entangling device may be built in a great variety of ways, it being only necessary that some means should be provided whereby the secondary stream of water may expose a large surface to the air in the condenser chamber during its passage through said chamber, and then be re-collected with the commingled air for de-

livery at the throat, where the secondary water combines with the other water that has produced the condensation of the steam.

Very many details of the construction and combination may be altered and changed in many ways, for the purpose of carrying out the general principles of the invention.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:—

1. In a condenser, the combination with a condensing chamber, of means for introducing the condensing water and the exhaust steam, and means for affording a second supply of water at a high velocity, together with means for entangling the air whereby said second supply is enabled to entrain the air and other gases within the condensing chamber, said air-entangling means comprising a device for subdividing the water into sheets or streams, and a second device removed a distance from the latter and operating to collect said sheets or streams, and means for withdrawing the water from the lower end of the condenser.

2. In a condenser, the combination with the condensing chamber, of means for introducing the condensing water and the exhaust steam, a spraying means for the condensing water, means for introducing an independent supply of water into the condensing chamber, together with air-entangling means comprising means for subdividing the water into sheets and a second device removed therefrom for collecting said sheets whereby said secondary supply is caused to entrain the air and other gases within the condensing chamber, and means for discharging the mixture to the atmosphere.

3. In a condenser, the combination with the condensing chamber, of means for introducing the condensing water and the exhaust steam, an adjustable spraying means for the condensing water, means for introducing an independent supply of water into the condensing chamber, together with means for enabling the water to trap the air, said means comprising essentially a device for subdividing the water so as to ex-

pose a large surface to the air and another device for re-collecting the subdivided water and trapped air whereby said secondary supply is caused to entrain the air and other gases within the condensing chamber, and means for discharging the water and vapor mixture to the atmosphere.

4. In a condenser, the combination with the condensing chamber, of means for introducing the condensing water and the exhaust steam, an adjustable spraying device for the condensing water comprising rows of teeth with a space between the rows, means for introducing an independent supply of water into the condensing chamber, together with means whereby the water is enabled to entangle the air, consisting of a device for subdividing the water into sheets or streams and a second device removed a distance from the other for re-collecting said water whereby said secondary supply is caused to entrain the air and other gases within the condensing chamber, and means for withdrawing the water mixture from the lower end of the condensing chamber.

5. In a condenser, the combination with the condensing chamber, of means for introducing the condensing water and the exhaust steam, a spraying device comprising an adjustable cone having teeth and a second row of teeth removed from the first row, means for introducing an independent supply of water into the condensing chamber, together with means for enabling the water to trap the air, comprising a grid having a series of parallel slots to allow the water to pass through in the form of sheets, and a collecting device below the grid for re-collecting the water whereby said secondary supply is caused to entrain the air and other gases within the condensing chamber, and means for withdrawing the water mixture from the lower end of the condensing chamber.

In testimony whereof I affix my signature in presence of two witnesses.

LOUIS R. ALBERGER.

Witnesses:

A. L. KENT,

L. S. PERRINE.