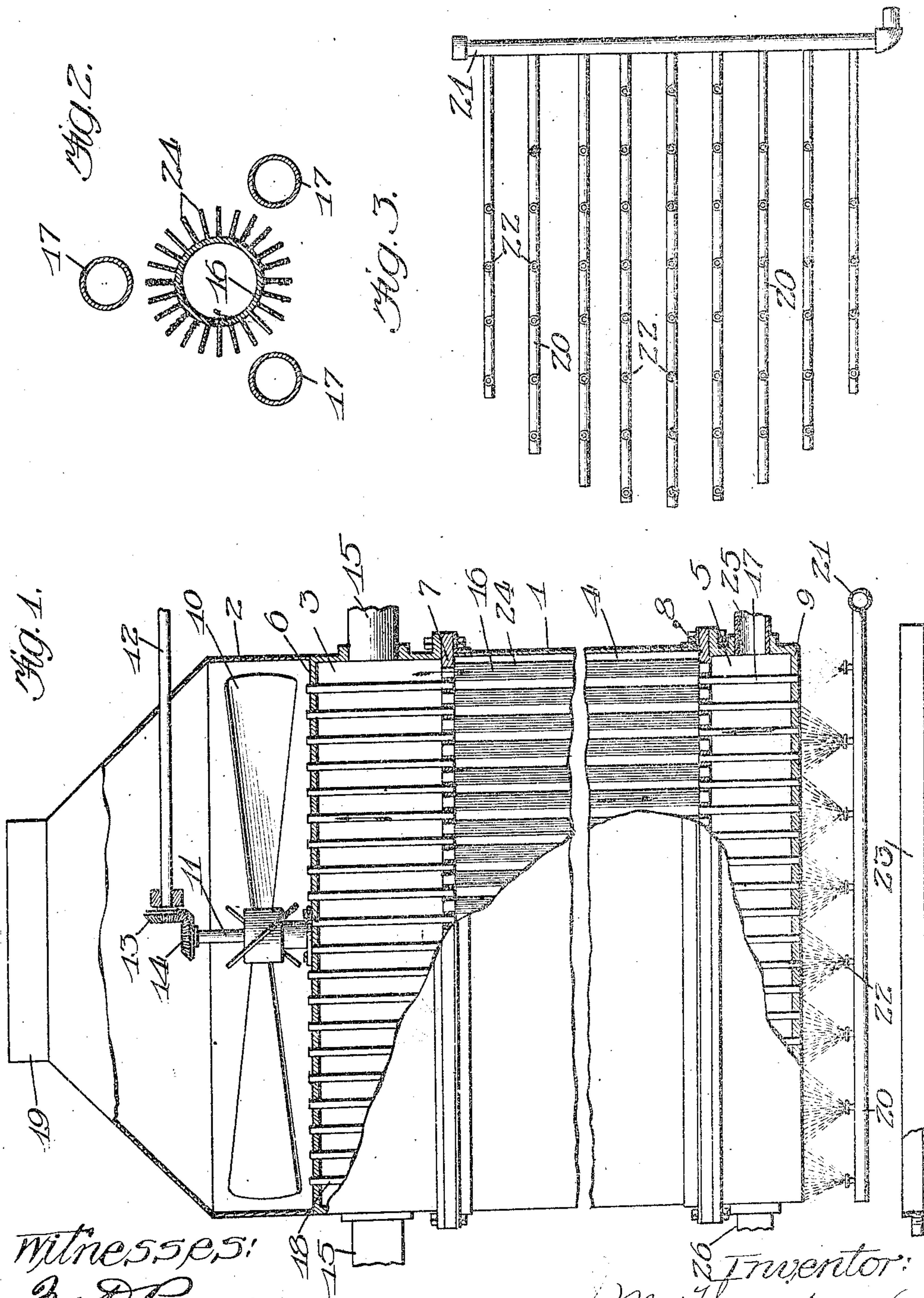


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CONDENSER.  
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999,417.

Patented Aug. 1, 1911.



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# UNITED STATES PATENT OFFICE.

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## CONDENSER.

999,417.

Specification of Letters Patent.

Patented Aug. 1, 1911.

Application filed October 16, 1907. Serial No. 397,751.

*To all whom it may concern:*

Be it known that I, JESSE M. THOMPSON, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Condensers, of which the following is a full, clear, and exact specification.

This invention relates to that class of condensers in which the steam or other fluid to be condensed is allowed to enter passages or tubes, against the outer walls or surfaces of which is maintained a heat absorbing vapor, and it has more especial reference to that species of this class of condensers which depend wholly upon the heat absorbing action of aqueous vapor, as contradistinguished from vapor or air carrying free water or moisture.

One of the great difficulties in condensers of this class has been to produce aqueous vapor in sufficient quantity to carry on the condensing action without resulting in projecting superfluous water into the tubes or passages of the condenser and thereby drowning the condensing or heat absorbing action of the aqueous vapor.

The present invention is designed to obviate this difficulty, and has for its primary object to provide an improved and efficient form of condenser of the described class in which the necessary aqueous vapor will be generated without the presence of any detrimental amount of free moisture in the tubes or passages of the apparatus.

Another object of the invention is to provide the tubes or steam passages with an improved exterior formation that will greatly enhance their heat conducting properties.

With a view to the attainment of these ends and the accomplishment of certain other objects which will appear hereinafter, the invention consists in the features of novelty which will now be described with reference to the accompanying drawing, and then more particularly pointed out in the claims.

In the said drawings—Figure 1 is a vertical sectional view of a condenser embodying this invention. Fig. 2 is an enlarged detail horizontal section showing the arrangement and cross-sections of the forms of tubes employed. Fig. 3 is a plan view of the spraying pipe.

It is an upright shell which is divided into four compartments 2, 3, 4 and 5, by means

of three horizontal diaphragms 6, 7, 8, and a bottom 9. The compartment or chamber 2 is for the accommodation of any suitable fan or exhauster 10 mounted upon a vertical shaft 11 therein, driven from the exterior in any suitable way, as by means of shaft 12 and bevel gears 13, 14; the compartment or chamber 3 receiving the steam or other fluid to be condensed through one or more inlet pipes 15, and the compartment or chamber 5 receiving the water of condensation from vertical tubes 16, whose ends are expanded in the heads or diaphragms 7, 8, and thereby place the chambers 3 and 5 in communication. The chamber or compartment 4 is for the reception and expansion of the aqueous vapor employed for absorbing the heat radiated by the surfaces or walls of the tube 16, and it receives its aqueous vapor from the bottom or lower end of the condenser through a multiplicity of thin tubes 17, whose ends are expanded in the bottom plate 9 and head or diaphragm 8, thereby placing the compartment or chamber 4 in communication with the external atmosphere through the bottom 9 of the condenser, and from which point the aqueous vapor is drawn by the fan or exhauster 10 through a multiplicity of vertical tubes 18 having their ends expanded in the heads or diaphragms 6, 7, thereby placing the exhauster chamber 2 in communication with the chamber 4.

The operation of the fan or exhauster produces a strong upward current of air through the tube 17, the compartment or chamber 4, and the tubes 18, and expels the same through the top of the condenser, having a suitable discharge flue 19, if desired, and in order that this current of air may be converted into aqueous vapor before entering the condenser, I locate at the bottom of the condenser below the inlets to the tubes 17, some suitable means for producing a fine spray or atomized quantity of water sufficient to saturate the air passing through the tube 17, or any other suitable means for causing the air to become laden with moisture without carrying any appreciable amount of free water into the tubes may be employed. A convenient and efficient construction consists of a multiplicity of horizontal pipes 20, closed at one end and connected at the other end to a header or manifold 21, which supplies all of the pipes 20 with the required amount of water from any



suitable source of supply. Each of the pipes 20 is provided at suitable intervals with nozzles or spraying roses 22, projecting upwardly under the tubes 17 and adapted to  
 5 produce a fine spray or shower of water completely underlying the bottom of the condenser and through which the upward currents of air entering the tubes 17 are compelled to pass and therefore become saturated or laden with moisture, producing  
 10 what is known as aqueous vapor. By this method, however, it will be seen that the air entering the tube 17 is free to take up or absorb all the moisture it can carry without  
 15 any appreciable amount of the water being carried along with it into the condenser, and any small amount that should enter the lower ends of the tubes 17 will be free to gravitate or run back as soon as the accumulation thereof becomes considerable or  
 20 too heavy to be supported by the air currents, whereas, if the tubes were horizontal, the water would accumulate therein and be drawn eventually through the condenser.  
 25 This surplus water and the water falling from the spraying nozzles may be caught in any suitable drip pan 23.

Each of the tubes 16 is provided throughout its length with longitudinally radiating  
 30 fins 24, a multiplicity of which is employed on each tube, and the heat radiating power of the tube is thereby greatly increased. These fins being arranged lengthwise of the tubes permit of the free passage of the  
 35 aqueous vapor between them, and this arrangement also avoids accumulation of any surplus water between the fins. It also avoids the formation of eddy currents or dead air spaces contiguous to the walls of the tubes  
 40 and provides for the swift passage of the air in immediate contact with said walls and their fins. The water of condensation forming within the tube 16 and the various chambers of the condenser will eventually  
 45 find its way into the bottom chamber 5 through said tubes, and may be drawn off through any suitable discharge pipe 25, the bottom chamber 5, if desired, being also provided with pipe connection 26 whereby the  
 50 air accumulating therein may be drawn off or pumped out.

In the example of the invention shown in the drawings, the steam is preferably admitted to the interiors of the tubes 16 while  
 55 the aqueous vapor is applied to the exterior, but it will nevertheless be seen that since the tubes in themselves constitute vertical passages, and in conjunction with the shell of the condenser they constitute additional  
 60 vertical passages, it is immaterial, so far as the broad terms of the claims are concerned, whether the word passage be applied to the interior of the tube, or to the passage formed by the exteriors of a plurality of the tubes.  
 65 It might be stated, however, that one im-

portant advantage to be derived from utilizing the passages about the tubes for receiving the aqueous vapor instead of the steam is that it gives the aqueous vapor a chance to expand or become rarefied after  
 70 passing through the small tubes at the bottom of the condenser, and thereby considerably increasing its cooling or condensing effect on the steam within the tubes.

In order that the invention may be understood by those skilled in the art, the details of an exemplification thereof have been thus specifically described, but

What I claim as new and desire to secure by Letters Patent is:

1. In a condenser the combination of a plurality of vertical passages, some of which are open at their upper ends and communicating with the atmosphere at their lower ends, means for admitting steam or fluid  
 85 to be condensed to others of said passages and lengthwise of the tubes, means for exhausting the air from the upper open ends of the said passages, and means for producing a spray of water at the lower ends of  
 90 said passages which communicate with the atmosphere.

2. In a condenser the combination of a shell, a multiplicity of vertical tubes arranged in said shell, means for admitting to  
 95 the upper ends of the tubes a fluid to be condensed, and means for producing an aqueous vapor contiguous to the lower ends of said tubes and exhausting the same vertically lengthwise of said tubes. 100

3. In a condenser the combination of a shell divided into upper and lower and intermediate compartments, vertical passages connecting the upper compartment with the lower compartment, vertical passages connecting the intermediate compartment through the lower compartment with the atmosphere, vertical passages providing  
 105 a multiplicity of outlets from the upper side of the intermediate compartment, an exhauster communicating with said outlets for exhausting the air from the intermediate compartment, means for admitting steam to the upper compartment, and means for saturating the air entering the second said passages with moisture. 115

4. In a condenser the combination of a shell divided into an intermediate and upper and lower compartments, a fan compartment arranged above said upper compartment, a multiplicity of tubes connecting the intermediate compartment with the fan compartment, a multiplicity of tubes connecting the upper compartment with the lower compartment extending through the  
 120 intermediate compartment, a multiplicity of tubes connecting the intermediate compartment with the atmosphere through the bottom of the shell, means for admitting steam to the upper compartment, and means for 130



saturating the air at the bottom of the shell with moisture.

5 In a condenser the combination of a shell divided into an intermediate, and upper  
 10 and lower compartments, a multiplicity of vertical tubes communicating with the intermediate compartment and extending  
 15 through the upper compartment, an exhauster for drawing the air from the upper ends of said tubes, a multiplicity of vertical  
 20 tubes connecting the upper compartment with the lower compartment, a multiplicity of vertical tubes connecting the intermediate  
 25 compartment with the atmosphere through the lower compartment, a multiplicity of upwardly extending water spraying  
 30 devices arranged below the lower ends of the last said tubes, and means for admitting steam to the upper compartment.

6. In a condenser the combination of a shell divided into an intermediate and upper  
 20 and lower compartments, vertical tubes open at their upper ends and extending  
 25 through the upper compartment into the intermediate compartments an exhauster arranged above the upper ends of said tubes  
 30 for exhausting the air therefrom, a multiplicity of vertical tubes having a multiplicity of vertical fins connecting the upper  
 35 compartment with the lower compartment and extending through the intermediate com-

partment, a multiplicity of tubes connecting the intermediate compartment with the atmosphere through the lower compartment, a multiplicity of water spraying nozzles projecting upwardly below the lower ends of the last said tubes, and means for admitting steam to the upper compartment.

7. A condenser having in combination a multiplicity of vertical passages open at their upper ends and communicating at their lower ends with the atmosphere, said passages comprising a plurality of series of sections, said sections being arranged endwise of each other, means situated above the upper ends of the passages for exhausting the air therefrom and creating entering currents of air at their lower ends, means for saturating the air entering the lower ends of the passages with moisture to produce aqueous vapor, and means for confining around said passages the steam or fluid to be condensed.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, on this 14th day of October, A. D. 1907.

JESSE M. THOMPSON.

Witnesses:

CHARLES H. SEEM,  
 FRANCIS A. HOPKINS.