(No Model.) 2 Sheets—Sheet 1.

H. W. RAPPLEYE.

METHOD OF AND APPARATUS FOR CONDENSING FUMES OR GASES.

No. 601,677. Patented Apr. 5, 1898.

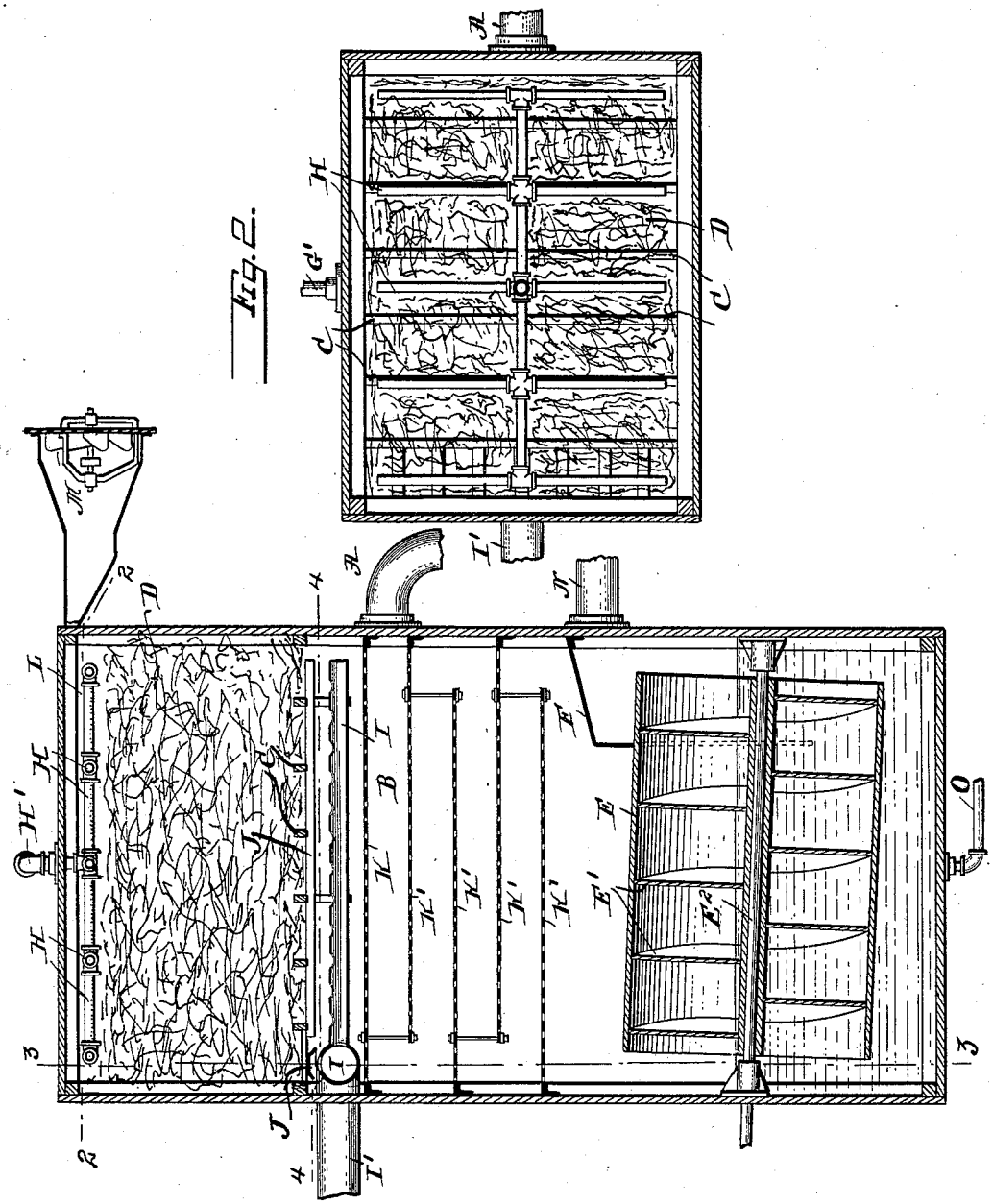


Fig. 2.

Fig. 1.

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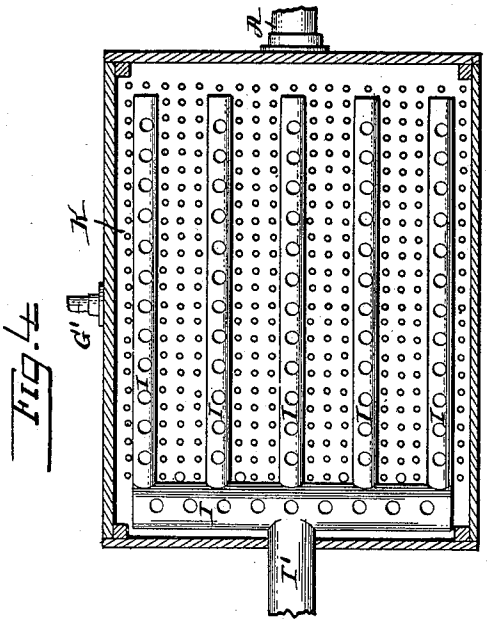


Fig. 7.

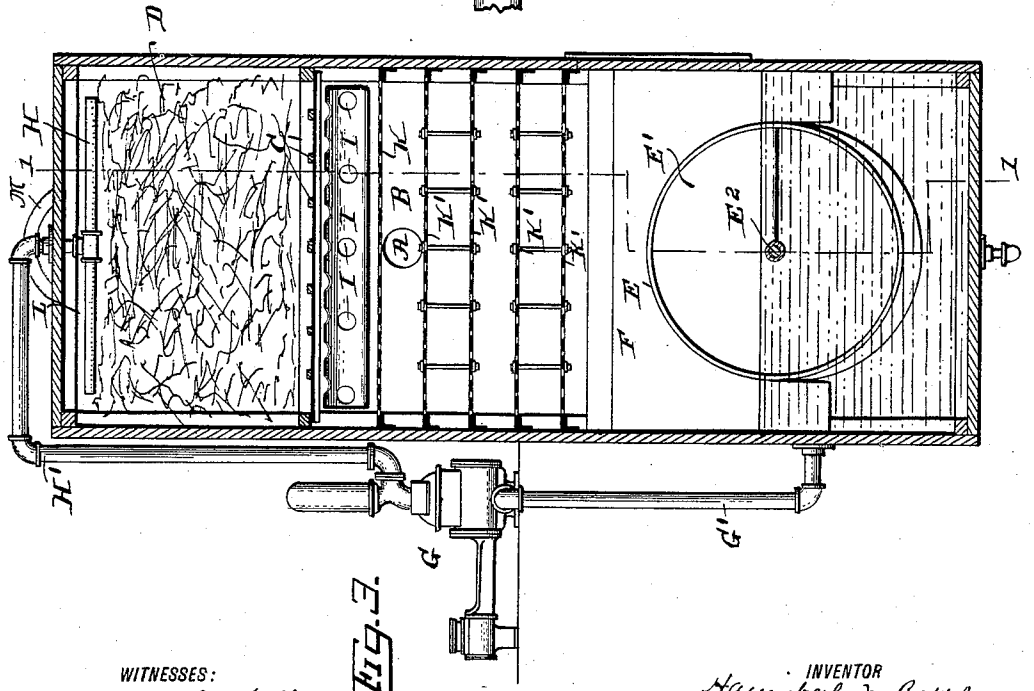


Fig. 7.

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UNITED STATES PATENT OFFICE.

HANNIBAL W. RAPPLEYE, OF PHILADELPHIA, PENNSYLVANIA.

METHOD OF AND APPARATUS FOR CONDENSING FUMES OR GASES.

SPECIFICATION forming part of Letters Patent No. 601,677, dated April 5, 1898.

Application filed August 14, 1897. Serial No. 648,234. (No model.)

To all whom it may concern:

Be it known that I, HANNIBAL W. RAPPLEYE, a citizen of the United States, residing at Philadelphia, county of Philadelphia, and State of Pennsylvania, have invented a new and useful Improvement in Methods of and Apparatus for Condensing Fumes or Gases, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, which form a part of this specification.

My invention has for its object certain improvements in the method of condensing fumes and gases and in apparatus for carrying out said method.

It consists in conveying water to the top of a condenser, holding it in temporary suspension, and at the same time diffusing it over a large area, cooling the water while so suspended by a draft of air, and then causing the water to trickle down into and through a passage containing the fumes or gases to be condensed leading from the smelting-furnace or other source, thus causing a partial condensation of the fumes. The fumes then pass into a condenser consisting, preferably, of a rotary conveyer formed of an Archimedean screw, the revolution of this screw drawing in the gas or fumes from the main chamber into a small division thereof.

The apparatus itself consists of a compartment at the top adapted to sustain brushwood or other material which acts to temporarily hold in suspension and diffuse the water, as before mentioned, water-supply pipes arranged at the top of the condenser, air-inlet pipes arranged beneath the compartment holding the brushwood, a perforated passage beneath the air-inlet pipes through which the gas or fumes pass, and the rotary and partially-submerged conveyer at the bottom, as before described. An exhaust-fan is located at the top for the purpose of drawing the air up through the brushwood.

The invention will be better understood by reference to the accompanying drawings, in which—

Figure 1 is a section on line 1 1 of Fig. 3. Fig. 2 is a section on line 2 2 of Fig. 1. Fig. 3 is a section on line 3 3 of Fig. 1. Fig. 4 is a section on line 4 4 of Fig. 1.

A is a gas-inlet pipe leading to the condensing-chamber B. A short distance above the gas-inlet is arranged a horizontal framework composed of the slats or girders C, extending between the walls of the condensing-chamber and forming an open-work compartment designed to support a mass of loosely-packed brush D, which nearly fills the upper part of the chamber.

F is a partition extending inwardly from one side of the condensing-chamber below the surface of the water in the bottom of the condensing-chamber. Through this division-wall F extends an inclined cylinder E, partially submerged, as shown, and to the interior surface of that cylinder is attached, by air-tight joints, an Archimedean screw E′, which, although I have shown it of uniform pitch, is preferably of varying pitch, the pitch growing less as it approaches the exit end, so that the water-level will be the same throughout the length of the cylinder, which is fastened to and revolves with the spindle E^2, which is revolved by any desired means. This type of rotary screw-cylinder is fully described and claimed in Letters Patent No. 557,880, issued to me April 7, 1896, and forms no part of my present invention.

I prefer to arrange my apparatus so that the water may be taken from the lower part of the condensing-chamber to the top thereof and allowed to descend through the condenser to the bottom, thus completing the circuit and thus saving the by-products held in suspension in the water, and also in case there should be any scarcity of water making it necessary to supply only such quantities of fresh water as will compensate for the water lost by evaporation. To this end I project a pipe G′ from the side of the condensing-chamber a short distance below the level of the water therein and connect the horizontally-disposed perforated water-distributing spray-pipes H (shown in plan in Fig. 2) near the roof of a condensing-chamber with a pipe H′, extending through the roof and down along the side of the condensing-chamber in proximity to the pipe G′, and interpose between pipes H′ and G′ a pump G on an elevated platform alongside of the condensing-chamber. By this arrangement water is pumped from the

bottom of the chamber through pipes G′ and H′ to the distributing-pipes H, and through the perforations thereof the water passes to and through the brushwood D.

Immediately beneath the open-work bottom C of the brush-compartment are arranged the horizontally-disposed air-distributing pipes I, (shown in plan in Fig. 4,) connected to an air-supply pipe I′. These pipes I are provided with perforations in their upper surfaces, and the dripping water is prevented from entering therein by means of the air-pipe shields J, secured to the bottom of the slats or girders C.

Immediately above the gas-inlet pipe A and below the air-distributing pipes I is a perforated horizontal partition K, extending from wall to wall of the condensing-chamber, and below this partition K are the staggered horizontal walls K′. The perforations are small, so that the water constantly dripping through them will form practically a seal to prevent the escape of the gas or fumes, except directly through the staggered passage, and the object of this staggered arrangement of walls is to afford a long passage for the gas or fumes, so as to give ample time for carrying on the process of condensation, which is effected by the water previously cooled by the draft of air through the brush coming in contact with the fumes or gas as it drips through the perforations of the staggered walls.

At the extreme top of the condensing-chamber above the spray-pipes H is an air-chamber L in communication with an exhaust-fan M, arranged exteriorly of the condensing-chamber. By revolving the exhaust-fan a constant circulation of air is induced from the air-distributing pipes I through the brush D.

N is the gas-outlet pipe extending from the side of the condensing-chamber immediately below the partition F.

At the bottom of the condensing-chamber is a water-outlet pipe O, through which the water is drawn off when it is desired to supply entirely fresh water to the apparatus or when access to the bottom of the tank is desired to remove the solid matter deposited thereon.

The operation of the apparatus is probably sufficiently clear from the foregoing description, but it may be summarized as follows: The pump is first set into operation to withdraw the water from the bottom of the condensing-chamber and raise it through pipes G′ and H′ to perforated pipes H. The water is distributed through these pipes and is sprayed through the perforations thereof onto the brush D, through which it percolates. The exhaust-fan at the same time is caused to revolve by any suitable means, inducing a current of air through the brush, reducing the temperature of the water percolating through the same. The water thus cooled and evenly distributed drips from the brush onto and through the perforated partition K and onto and through staggered perforated walls K′. The fumes or gases are then admitted through the pipe A and pass back and forth between the perforated staggered walls. The action of the water upon the gas or fumes precipitates much of the solid matter previously held in suspension. The remaining step of the process is effected in the spiral conveyer E, the solid matter remaining in suspension being precipitated therein and the refuse passing out through pipe N.

I do not intend to limit myself to any specific construction of condensing-chamber nor to the means I have described for suspending and diffusing the water while the current of air is passed over it to cool it; nor do I intend to limit myself to any particular feature of construction hereinbefore described, except by those claims wherein such particular feature is expressly set out as part of the combination claimed.

Having now fully described my invention, what I claim, and desire to protect by Letters Patent, is—

1. The process of condensing fumes, gases and the like, which consists in holding water in temporary suspension and in diffusing it over a large area while so suspended, cooling the water while so suspended by passing a current of air through it, and directing the water so cooled and diffused upon the gases or fumes to be condensed.

2. The process of condensing fumes, gases and the like, which consists in holding water in temporary suspension and diffusing the same over a large area, cooling the water so suspended by a current of air, directing the water so cooled and diffused upon the gases or fumes to be condensed, and retarding the passage of the water through the same.

3. The process of condensing fumes, gases and the like within a condensing-chamber, which consists in holding water in temporary suspension and diffusing the same over a large area, cooling the water so suspended by a current of air, directing the water so cooled and diffused upon the gases or fumes to be condensed, retarding the passage of the water through the same, and then withdrawing such water from the condensing-chamber and again conveying it to the said medium.

4. In an apparatus for condensing fumes, gases and the like, the combination of a condensing-chamber having in its upper part a compartment containing a water suspending and diffusing medium, said compartment having a bottom adapted to permit the passage of the water therethrough, means to admit water into the upper part of said compartment, means for passing a current of air through said compartment to cool the water therein, and means to admit the fumes or gases to be condensed into said condensing-chamber beneath said compartment.

5. In an apparatus for condensing fumes, gases and the like, the combination of a condensing-chamber having in its upper part a compartment containing a water suspending

and diffusing medium, said compartment having a bottom adapted to permit the passage of the water therethrough, means to admit water into the upper part of said compartment, means for passing a current of air through said compartment to cool the water therein, perforated walls in said condensing-chamber beneath said compartment, forming a passage for the fumes or gases to be condensed and adapted to permit the passage of the water through the perforations thereof, and means to admit the fumes or gases to be condensed into said passage.

6. In an apparatus for condensing fumes, gases and the like, the combination of a condensing-chamber having in its upper part a compartment containing a water suspending and diffusing medium, said compartment having a bottom adapted to permit the passage of the water therethrough, a water-inlet pipe, perforated water-distributing pipes arranged in the upper part of the condensing-chamber adapted to distribute water into the upper part of said compartment and communicating with the water-inlet pipe, an air-inlet pipe, perforated air-distributing pipes arranged in said condensing-chamber adapted to distribute air into the lower part of said compartment, an air-exhaust fan in connection with the upper part of said condensing-chamber adapted to withdraw the air from the air-distributing pipes upwardly through said compartment, and means to admit the fumes or gases to be condensed into said chamber beneath said compartment.

7. In an apparatus for condensing fumes, gases and the like, the combination of a condensing-chamber having in its upper part a compartment containing a water suspending and diffusing medium, said compartment having a bottom adapted to permit the passage of the water therethrough, a water-inlet pipe, perforated water-distributing pipes arranged in the upper part of the condensing-chamber adapted to distribute water into the upper part of said compartment and communicating with the water-inlet pipe, an air-inlet pipe, perforated air-distributing pipes arranged in said condensing-chamber adapted to distribute air into the lower part of said compartment, an air-exhaust fan in connection with the upper part of said condensing-chamber adapted to withdraw the air from the air-distributing pipes upwardly through the said compartment, perforated walls in said condensing-chamber beneath said compartment forming a passage for the fumes or gases to be condensed and adapted to permit the passage of the water through the perforations thereof, and a gas or fume inlet pipe communicating with the passage so formed.

8. In an apparatus for condensing fumes, gases and the like, the combination of a condensing-chamber having in its upper part a compartment containing a water suspending and diffusing medium, said compartment having a bottom adapted to permit the passage of the water therethrough, means to admit water into the upper part of said compartment, means for passing a current of air through said compartment to cool the water therein, means to admit the fumes or gases to be condensed into said condensing-chamber beneath said compartment, and a rotary spiral cylinder condenser in the lower part of the condensing-chamber.

9. In an apparatus for condensing fumes, gases and the like, the combination of a condensing-chamber having in its upper part a compartment containing a water suspending and diffusing medium, said compartment having a bottom adapted to permit the passage of the water therethrough, means to admit water into the upper part of said compartment, means for passing a current of air through said compartment to cool the water therein, perforated walls in said condensing-chamber beneath said compartment, forming a passage for the fumes or gases to be condensed and adapted to permit the passage of the water through the perforations thereof, means to admit the fumes or gases to be condensed into said passage, and a rotary spiral cylinder condenser in the lower part of the condensing-chamber.

10. In an apparatus for condensing fumes, gases and the like, the combination of a condensing-chamber having in its upper part a compartment containing a water suspending and diffusing medium, said compartment having a bottom adapted to permit the passage of the water therethrough, a water-inlet pipe, perforated water-distributing pipes arranged in the upper part of the condensing-chamber adapted to distribute water into the upper part of said compartment and communicating with the water-inlet pipe, an air-inlet pipe, perforated air-distributing pipes arranged in said condensing-chamber adapted to distribute air into the lower part of said compartment, an air-exhaust fan in connection with the upper part of said condensing-chamber adapted to withdraw the air from the air-distributing pipes upwardly through said compartment, means to admit the fumes or gases to be condensed into said chamber beneath said compartment, and a rotary spiral cylinder condenser in the lower part of the condensing-chamber.

11. In an apparatus for condensing fumes, gases and the like, the combination of a condensing-chamber having in its upper part a compartment containing a water suspending and diffusing medium, said compartment having a bottom adapted to permit the passage of the water therethrough, a water-inlet pipe, perforated water-distributing pipes arranged in the upper part of the condensing-chamber adapted to distribute water into the upper part of said compartment and communicating with the water-inlet pipe, an air-inlet pipe, perforated air-distributing pipes arranged in said condensing-chamber adapted to distribute air into the lower part of said compart-

ment, an air-exhaust fan in connection with the upper part of said condensing-chamber adapted to withdraw the air from the air-distributing pipes upwardly through the said compartment, perforated walls in said condensing-chamber beneath said compartment forming a passage for the fumes or gases to be condensed and adapted to permit the passage of the water through the perforations thereof, a gas or fume inlet pipe communicating with the passage so formed, and a rotary spiral cylinder condenser in the lower part of the condensing-chamber.

12. In an apparatus for condensing fumes, gases and the like, the combination of a condenser-chamber having in its upper part a compartment containing a water suspending and diffusing medium, said compartment having a bottom adapted to permit the passage of the water therethrough, a water-inlet pipe, perforated water-distributing pipes arranged in the upper part of the condensing-chamber adapted to distribute water into the upper part of said compartment and communicating with the water-inlet pipe, an air-inlet pipe, perforated air-distributing pipes arranged in said condensing-chamber adapted to distribute air into the lower part of said compartment, an air-exhaust fan in connection with the upper part of said condensing-chamber adapted to withdraw the air from the air-distributing pipes upwardly through the said compartment, perforated walls in said condensing-chamber beneath said compartment forming a passage for the fumes or gases to be condensed and adapted to permit the passage of the water through the perforations thereof, a gas or fume inlet pipe communicating with the passage so formed, a rotary spiral cylinder condenser in the lower part of the condensing-chamber, a water-exit pipe leading from the lower part of said condensing-chamber in connection with the water-inlet pipe, and means interposed in said water-pipe connection from the lower to the upper part of the condensing-chamber to force the water therethrough.

13. In an apparatus for condensing fumes, gases and the like, the combination of the condensing-chamber of an open-work flooring in the upper part of the condensing-chamber sustaining a water suspending and diffusing medium, an air-inlet pipe, perforated air-distributing pipes beneath the open-work flooring communicating with the air-inlet pipe, a perforated horizontal partition beneath the air-distributing pipes, perforated staggered horizontal walls beneath the said partition forming a passage for the fumes or gases, a gas or fume inlet pipe communicating with the passage so formed, a rotary spiral cylinder condenser in the lower part of the condensing-chamber, a water-pipe connection between the lower part of the condensing-chamber and the upper part thereof, water-distributing pipes in the upper part of the condensing-chamber communicating with said pipe connection, an air-exhaust fan in connection with the upper part of the condensing-chamber adapted to establish a current of air in the condensing-chamber upwardly from the air-distributing pipes, and means interposed in the water-pipe connection to force the water therethrough from the lower to the upper part of the condensing-chamber, substantially as described.

In testimony of which invention I have hereunto set my hand.

HANNIBAL W. RAPPLEYE.

Witnesses:

FRANK S. BUSSER,

CAROL H. DESHONG.