(No Model.)

H. F. HODGES & D. J. HAVENSTRITE.

METHOD OF AND APPARATUS FOR DISTILLING WATER.

No. 520,525. Patented May 29, 1894.

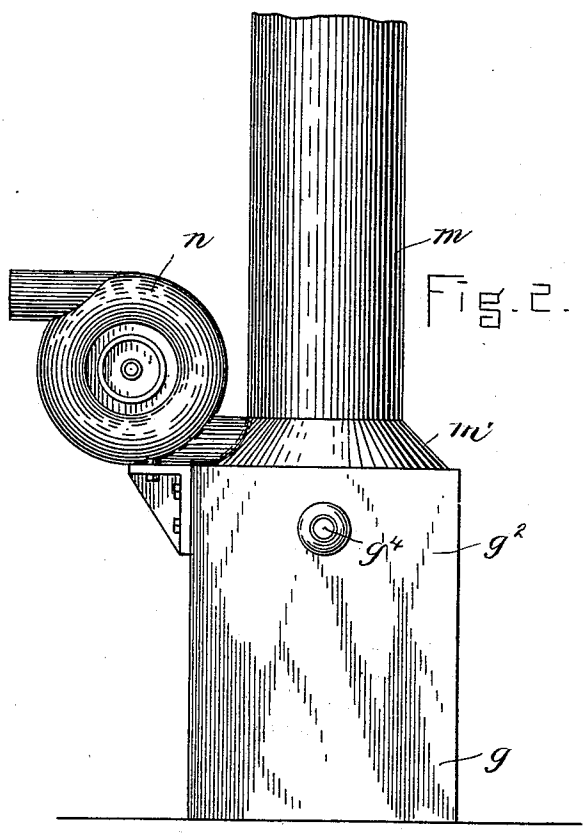

Fig. 2.

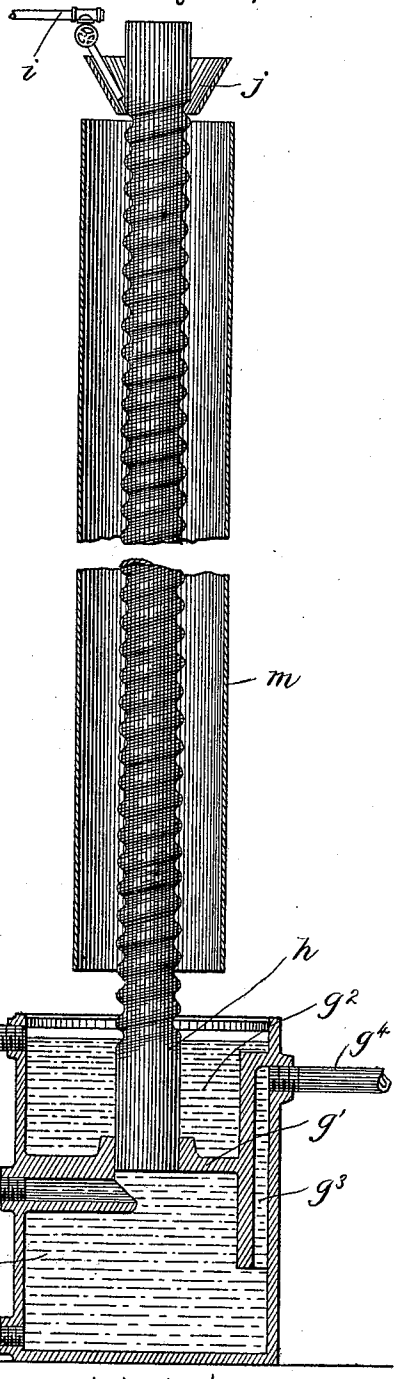

Fig. 1.

WITNESSES.

L. E. Brown

A. D. Harrison

INVENTORS:

H. F. Hodges

D. J. Havenstrite

by Wright Brown Quinby & Attys.

THE NATIONAL LITHOGRAPHING COMPANY,
WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

HORACE F. HODGES AND DAVID J. HAVENSTRITE, OF BOSTON, MASSACHUSETTS, ASSIGNORS TO C. B. SOUTHARD, TRUSTEE, OF SAME PLACE.

METHOD OF AND APPARATUS FOR DISTILLING WATER.

SPECIFICATION forming part of Letters Patent No. 520,525, dated May 29, 1894.

Application filed November 26, 1892. Serial No. 453,195. (No model.)

To all whom it may concern:

Be it known that we, HORACE F. HODGES and DAVID J. HAVENSTRITE, of Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Methods of and Apparatus for Distilling Water, of which the following is a specification.

This invention has for its object, first, to rapidly and economically condense steam or vapor, by the employment of a smaller relative quantity of cold water as the condensing agent than has been heretofore necessary; and, secondly, to produce a distillate from steam or vapor which shall be free from the impurities contained in the steam or vapor.

To these ends, the invention consists, first, in certain improvements in the method of condensing steam or vapor, said improvements comprising the following steps, namely: first, passing steam from a boiler or generator through a body of water, and thereby absorbing its surplus heat, and creating more vapor, and then condensing said steam and vapor in a chamber or passage that is open to the atmosphere, so that the noxious gases which are present in steam are allowed to escape into the atmosphere and are not absorbed by the distillate. Another step of the said method includes the passage of steam or vapor through the distillate for the purpose of agitating the distillate and liberating therefrom any noxious gases and air that said distillate may have absorbed.

The invention also consists in the improved apparatus employed for carrying out the method above indicated, all of which we will now proceed to describe and claim.

Of the accompanying drawings, forming a part of this specification: Figure 1 represents a partial side elevation and partial vertical section of our improved distilling apparatus. Fig. 2 represents an elevation of a portion of the apparatus, showing a fan blower connected therewith, and a hood connecting the draft casing with the base of the apparatus to make the blower effective.

The same letters of reference indicate the same parts in all the figures.

In the drawings: *a* represents a chamber, which receives steam through a pipe *b* connected with a boiler or generator and entering the lower portion of said chamber. The chamber is kept partially filled with water, the height of the water being preferably regulated by means of a valve *c*, regulated by a float-lever *d* connected with the valve, said valve controlling an inlet pipe *e* which supplies water to the chamber *a*. Steam entering the chamber *a* is therefore obliged to pass through a body of water, which absorbs the surplus heat of the steam. A portion of the water in the chamber *a* is converted into vapor or steam of comparatively low pressure adapted to be more rapidly condensed than the steam originally entering said chamber.

f represents a pipe, which extends from the top of the chamber *a* into a chamber *g*, which is kept full of distilled water, as hereinafter described. Steam and vapor from the chamber *a* pass through the pipe *f* and into the chamber *g*, and are discharged into said chamber in such manner that, in escaping from the chamber through the condensing pipe *h* hereinafter described, they will pass through a portion of the water in the chamber *g*. The condensing pipe *h* is vertically arranged, and is made of sheet metal, preferably corrugated, as shown in Fig. 1. Its lower end is inserted in and affixed to a partition *g'*, which constitutes the top of the chamber *g* and separates the latter from a chamber g^2 which receives the water that is supplied to the exterior of the condensing pipe as the means for condensing the steam or vapor passing through said condensing pipe.

The condensing pipe *h* is preferably of considerable height, say about fifteen feet (15), though the height may be more or less.

i represents a pipe for the supply of cold water to the exterior of the condensing pipe *h*, said pipe being arranged to deliver a stream of water upon the exterior of said pipe at the upper end thereof. A trough *j* is preferably provided to receive the water from the pipe *i*, said trough surrounding the condensing pipe, and being separated from the exterior of the latter at its lower edge by a narrow annular space which permits a thin layer of water to flow down the exterior of the pipe

h, said water accumulating in the chamber g^2 which surrounds the base of the pipe h.

There is no connection between the chambers g and g^2, and the chamber g receives only the distillate or water of condensation from the interior of the condensing pipe h. The chamber g is provided with an outlet g^3 g^4, which is preferably higher than the lower end of the condensing pipe h, so that the distillate accumulating in the chamber g rises in the lower portion of the condensing pipe h. By reference to Fig. 1, it will be seen that the steam or vapor which enters the chamber g is delivered immediately under the lower end of the condensing pipe h, so that said steam or vapor, in rising, passes through an accumulation of the distillate, and then passes on and upwardly through the condensing pipe and is condensed by contact with the cooled surface thereof, the distillate passing back to the chamber g and escaping through the outlet g^3 g^4. The distillate formed within the pipe h is liable to re-absorb not only air, but also gases set free by the condensation of the steam. The gases and air thus absorbed are again set free by the violent ebullition caused by the passage of the steam through the accumulated distillate in the lower part of the pipe h, so that said distillate passes to the chamber g comparatively free from noxious gases and air, and is therefore in a highly desirable condition for ice making by artificial means. The water applied externally to the condensing pipe, after flowing down said pipe accumulates in the chamber g^2, and overflows through the pipe k, from whence it may be conducted through a suitable trap to the boiler, this water being in a heated condition by reason of its contact with the heated condensing pipe, so that its use in feeding the boiler is a measure of economy. A part of the water that escapes through the pipe k may be used to supply the chamber a, and to this end the supply pipe e above described may be connected with the pipe k, as shown in Fig. 1. Experience has shown that when the apparatus is properly operated, all the water flowing down the exterior of the pipe h passes down the pipe e and is evaporated in the chamber a.

It will be seen that the steam or vapor is condensed in a pipe or passage which is open to the atmosphere, so that there is at all times a free escape of the deleterious gases present in the steam. It is well-known that ordinary steam is not pure, but contains an admixture of the gases or volatile products of the impurities contained in the water from which the steam is generated. Hence when the steam is condensed, in the distillation of water, under pressure, the distilled water, owing to its great solvent powers, re-absorbs the noxious gases. This difficulty we have entirely overcome, the distillate being much purer than would be the case if the distillation were carried on under pressure.

An important feature or step of our improved method is the passage of the supplied steam through water, before the steam is admitted to the condensing pipe. By this step, we cause a portion of the surplus heat of the steam to be utilized in generating vapor, which is borne with the steam to the condensing pipe, so that the amount of moisture which enters the condensing pipe is increased, while the temperature within said pipe is materially diminished. We are thus enabled to cause a much more rapid condensation by the use of a given quantity of cold water, and to produce a larger relative quantity of distilled water in proportion to the amount of cold water employed than heretofore. We find it entirely practicable to produce a quantity of distilled water far exceeding the quantity of the cold water supplied to the exterior of the condensing pipe. The passage of the steam or vapor through a portion of the distillate before it reaches the condensing surfaces, is also advantageous because the passage of the vapor through said water prevents the water from retaining the gases carried by the steam or vapor, as in all apparatus heretofore employed.

m represents a flue or draft casing surrounding the condensing pipe. Said casing forms an air passage around the condensing pipe, so that a current of air may be passed along the exterior of the condensing pipe to absorb and carry away a portion of the heat from the steam or vapor within said pipe. The circulation of air within said flue m may be either natural or forced. In Fig. 2, we show a fan blower n connected with the lower portion of the casing m, and adapted to force a current of air into the latter. When the blower is used a hood m' connects the lower end of the casing m with the chamber g to cause all the air supplied by the blower to pass upwardly through the casing. In most cases however we do not employ a blower, but leave an open space between the chamber g and the lower end of the casing as shown in Fig. 1, for the free admission of air to the lower end of the casing. Experience has shown us that the vapor generated on the outside of the pipe h creates a powerful upward draft in the casing m which materially hastens evaporation.

We have found that the efficiency of the apparatus depends largely on the maintenance of a suitable relation between the quantity of water supplied to the outside of the pipe h, and the quantity and temperature of steam or vapor supplied to the inside of said pipe, an excess either of water or steam diminishing the rapidity of evaporation.

We claim—

1. The improved method of distilling water, which consists in first passing steam through a body of water, and thereby depriving said steam of a portion of its heat, and utilizing said heat to produce an increase of vapor which is carried forward with the original steam,

and then passing said steam and vapor into a condenser open to the atmosphere, as set forth.

2. The improved method of distilling water, which consists in first passing steam through a body of water, and thereby depriving said steam of a portion of its heat and adding vapor to it, passing said steam and vapor into a condenser open to the atmosphere and accumulating the products of the condensation at and in the lower end of said condenser where it will be subjected to agitation by the passage of the said steam and vapor through it prior to condensation, as set forth.

3. The improved method of distilling water which consists in continuously distilling steam and vapor passing it into a condenser open to the atmosphere, and agitating the distillate by passing said steam and vapor, prior to its condensation, through an accumulation of said distillate, as set forth.

4. In a distilling apparatus, the combination of a substantially vertical condensing pipe or chamber open to the atmosphere, means for cooling said pipe, a distillate receptacle communicating with and receiving the lower portion of said pipe, and a steam or vapor conduit entering said receptacle and having its discharging end located below the outlet of said receptacle and below the condensing pipe, whereby the steam or vapor admitted to the condensing pipe is compelled to pass through water in the receptacle, and purge it from any air and absorbed gases, as set forth.

5. In a distilling apparatus, the combination of a water chamber, a steam inlet entering the lower portion of said chamber, an outlet pipe for steam and vapor from the upper portion of said chamber, a substantially vertical condensing pipe or chamber open to the atmosphere at its upper end arranged to receive steam and vapor from said outlet pipe, and means for cooling said condensing pipe, as set forth.

6. In a distilling apparatus, the combination of a water chamber, a steam inlet entering the lower portion of said chamber, a water inlet entering said chamber and provided with a float valve which is controlled by the water in the chamber, a steam or vapor outlet pipe extending from the upper portion of said chamber, and an open condensing pipe or chamber arranged to receive steam or vapor from the said outlet pipe, as set forth.

7. In a distilling apparatus, the combination of a water chamber, a steam inlet entering the lower portion of said chamber, a water inlet entering said chamber and provided with a float valve which is controlled by the water in the chamber, a steam or vapor outlet pipe extending from the upper portion of said chamber, an open condensing pipe or chamber arranged to receive steam or vapor from the said outlet pipe, a distillate receptacle at the lower portion of said condensing pipe, a water supply pipe arranged to direct condensing water against the exterior of the condensing pipe, a receptacle for the condensing water, and an outlet pipe extending from the last-mentioned receptacle, as set forth.

8. In a distilling apparatus, the combination of a water chamber, a steam inlet entering the lower portion of said chamber, a water inlet entering said chamber and provided with a valve which is controlled by the water in the chamber, a steam or vapor outlet pipe extending from the upper portion of said chamber, a condensing pipe or chamber arranged to receive steam or vapor from the said outlet pipe, a distillate receptacle at the lower portion of said condensing pipe, a water supply pipe arranged to direct condensing water against the exterior of the condensing pipe, a receptacle for the condensing water, an outlet pipe extending from the last-mentioned receptacle, and a connection between said outlet pipe and the first mentioned water chamber, whereby said chamber is supplied with water which has been previously utilized in condensing steam and vapor in the condensing pipe, as set forth.

In testimony whereof we have signed our names to this specification, in the presence of two subscribing witnesses, this 15th day of November, A. D. 1892.

HORACE F. HODGES.
DAVID J. HAVENSTRITE.

Witnesses:
C. F. BROWN,
A. D. HARRISON.