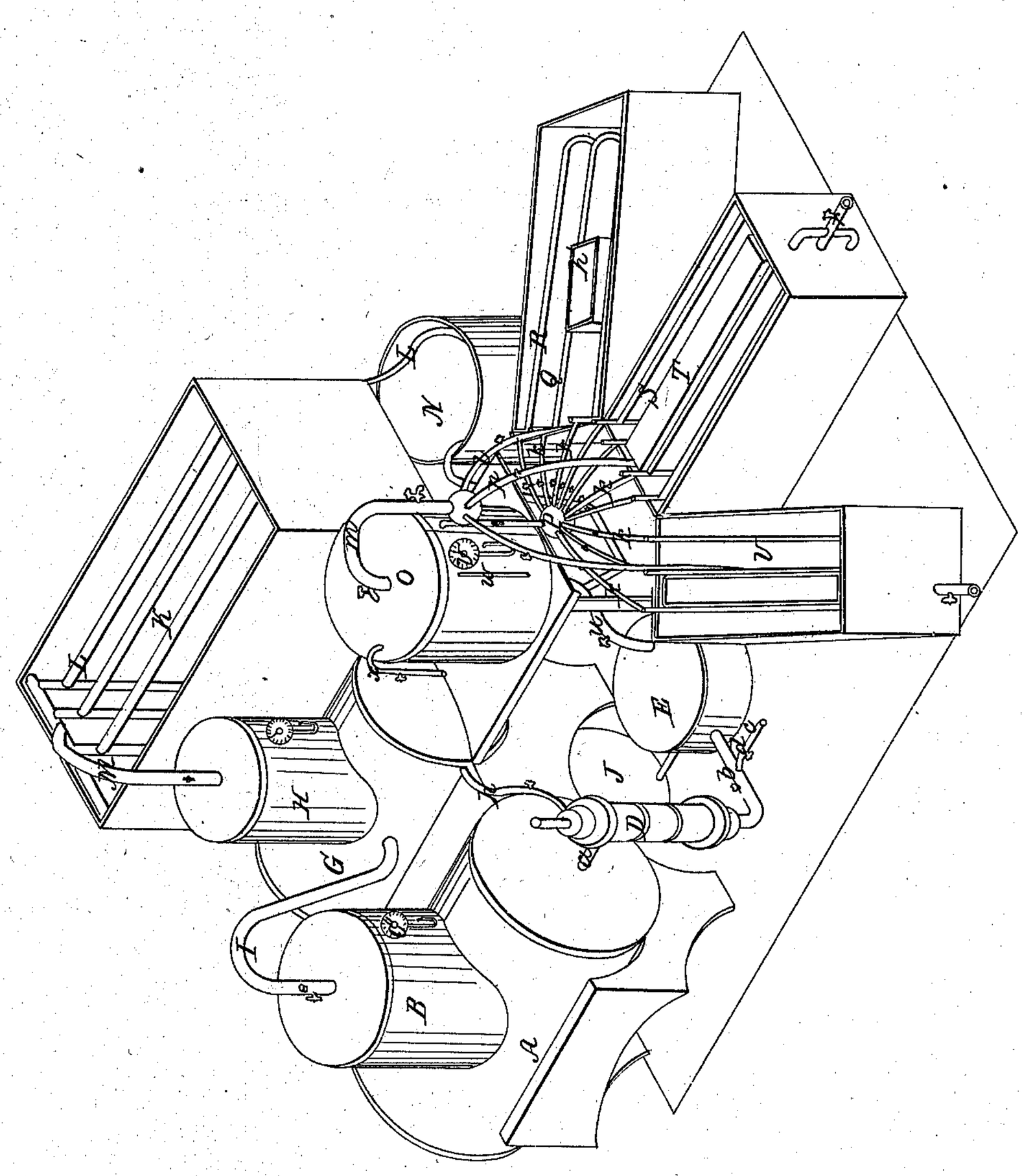
2 Sheets—Sheet 1.

C. E. HAYNES.

COOLING AND PRODUCING ICE.

No. 104,588. Patented June 21, 1870.



Witnesses;
Geo. A. Loring.
Edward Griffith.

Inventor;
C. E. Haynes.
by his attorney
Frederick Curtis

2 Sheets—Sheet 2

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Fig. 2.

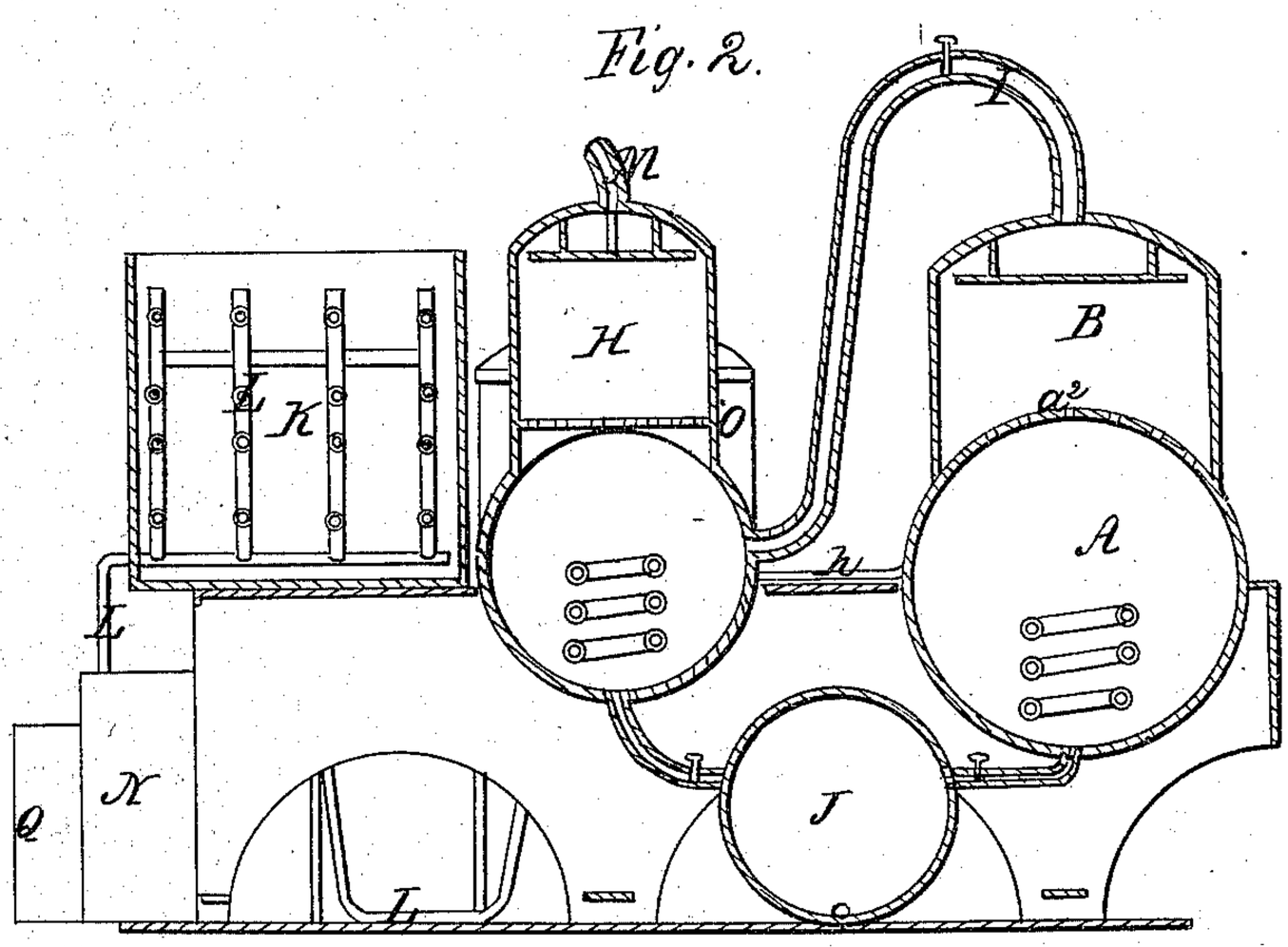
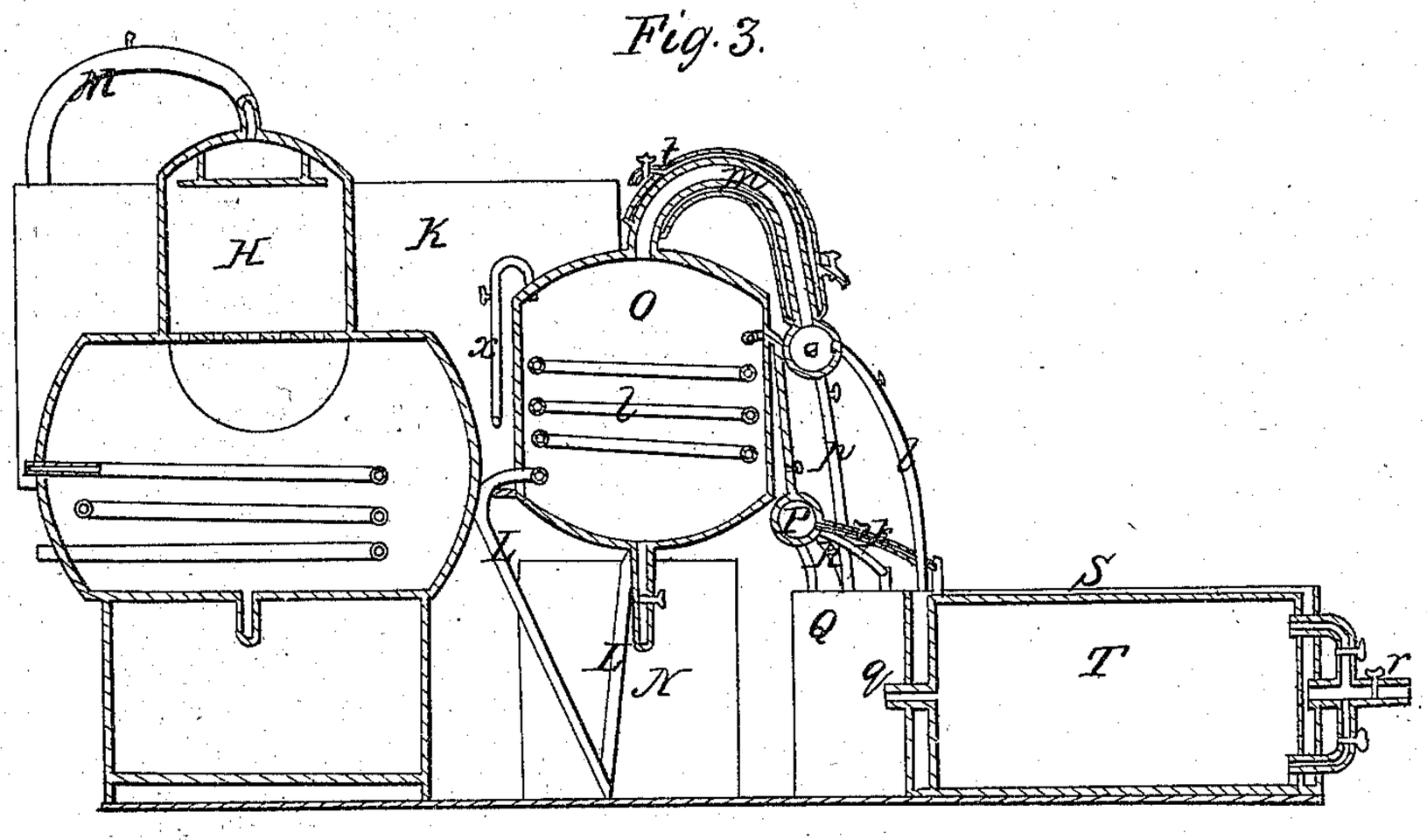


Fig. 3.



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United States Patent Office.

CORNELIUS E. HAYNES, OF BOSTON, MASSACHUSETTS.

Letters Patent No. 104,588, *dated June* 21, 1870.

IMPROVEMENT IN COOLING AND PRODUCING ICE.

The Schedule referred to in these Letters Patent and making part of the same.

To all to whom these presents shall come:

Be it known that I, CORNELIUS E. HAYNES, of Boston, in the county of Suffolk and Commonwealth of Massachusetts, have made an invention of a new and useful Apparatus for Creating Refrigerated Air for the purpose of producing ice, cooling liquids, preserving meats, &c.; and do hereby declare the following to be a full, clear, and exact description thereof, due reference being had to the accompanying drawing making part of this specification, and in which—

Figure 1 is a perspective view of an apparatus embodying my invention.

Figures 2 and 3 are vertical sections of the said apparatus.

The invention comprising the subject-matter of this patent relates to means for producing low temperature by the evaporation, condensation, and ensuing liquefaction of a volatile liquid.

This invention consists, primarily, in the employment of an ammoniacal solution or other highly-volatile fluid, which is injected into a generator and therein evaporated, the vapor resulting from such evaporation being conducted, by its own pressure, to and through a multitubular tank or condenser, or a serpentine coil placed within such tank, the latter being supplied with water at a proper temperature for effecting a rapid condensation and liquefaction of the vapor, by which means the temperature of the resulting liquid is reduced to so low a point as to cause a corresponding reduction of the temperature of the various receivers or chambers to which the continuation of the condensing-coil is extended, the ultimate termination of such coil or its ramifications being a cistern for collecting the liquid, after it has completed the circuit of the apparatus, and hold it in readiness for supplying the pump, to be again injected into the generator, a continuous circulation being thus carried on throughout the entire device.

Details of the invention will be found to exist in the employment of an auxiliary cistern or receiver, to be utilized in case of failure of the primary generator, as well as in the peculiar arrangement of a series of cooling-boxes or chambers, in combination with a delivery-bulb and a collecting-reservoir, as hereinafter explained.

In the drawing above mentioned as accompanying this specification, and which illustrates my invention—

A denotes a multitubular vessel or generator, of any suitable construction, for vaporizing or evaporating a volatile liquid, heat being applied directly to such generator from a furnace disposed below it, or from steam from a suitable source, admitted to a serpentine or coiled pipe disposed within the generator, or from any suitable source.

The generator A is furnished with a surmounting dome, B, and between the two a suitable screw, a^2, is placed, for preventing passage of any particles of dirt to the apparatus, as well as to prevent any amount of liquid being mixed with the vapor by effervescence within the generator.

The dome B is provided with a passage-gauge, C, it being my purpose to maintain a degree of pressure in such dome of about 250° Fahrenheit.

A suitable force-pump, D, is situated in close proximity to the generator A, and is connected with it by a pipe, *a*, the said pump being connected by a feed-pipe, *b*, with a cistern, E, disposed adjacent to it, this tank being supplied with liquid from a reservoir, F, which receives the condensed liquid of the apparatus, as hereinafter explained.

A primary or main reservoir is to be placed near the generator A, and is to be capable of containing a sufficient quantity of liquid to supply the apparatus for a great length of time.

As this liquid diminishes very slowly under the operation of the apparatus, the last-mentioned reservoir need not necessarily be of great size.

A portion of this pipe for conducting liquid from the main reservoir is shown at *c*, and such pipe is to be provided with a cock, *d*, in advance of its junction with the pump-supply pipe *b*.

A second generator, G, is disposed alongside of the generator A, and is its counterpart in construction, though preferably of less capacity, the dome H of the latter generator communicating with that of the former by a conduit, I, provided with a cock, *e*, for regulating communication between the two, the said generator G also communicating directly with the supply-pipe *a* by a pipe, *h*.

In convenient proximity to the two generators, A and G, I place a reserve-tank, J, for receiving the refrigerating liquid, in case of failure or accident to the said generators.

K, in the accompanying drawing, represents a condensing-tank, suitably applied alongside of the generator G, and in practice is to contain a body of water, preferably in a stream.

A coil or nest, L, of pipes is placed within the tank K, and to which the dome of the generator G is connected by a pipe, M, such coils, after traversing the interior of the tank in several alternations, passing out of the lower portions of the same, and into and circulating about the interior of a second condensing-tank, N, of smaller capacity than the first, this latter tank, though not a necessary adjunct of my apparatus, yet serving materially to aid in its successful operation.

After coursing about the interior of the tank N, the coil or pipe L passes out of the upper part of such

tank, and into the lower part of a receiving-reservoir, O, disposed in convenient proximity to the generator G and the tank K, and about on a level with the latter, which would necessarily cause it to stand at some elevation above the cistern E, before mentioned.

The pipe L traverses the interior of the reservoir O, and extends through such reservoir, and is provided with a general delivery-bulb or vessel, P, from whence its liquid contents pass, by conduits, to various freezing or cooling-chambers.

In the accompanying drawing I have represented a tank for forming ice at Q, such tank being provided with a coil or nest, R, of pipes, which are fed by one or more pipes, *k k*, &c., leading from the bulb P before mentioned, the outlets of such pipes communicating with a pipe, *l*, which, in turn, communicates with a conduit, *m*, leading into the top of the reservoir O.

A series of pans, *n n*, &c., is placed within the tank Q, and, when the ice is to be produced, is to be filled with water, the pans being tapering or wedged shaped, in order that their contents of ice may be readily expelled therefrom.

S, in the accompanying drawing, represents a second tank, similar in size to the tank Q before mentioned, and, like it, provided with a coil or nest of pipes communicating with the conduit *m*, and, consequently, with the reservoir O, by a pipe, *p*.

This latter-mentioned tank S may contain a closed box, T, through which a current of air is caused to flow by suitable inlet and outlet-orifices *q r*.

This current of air, as it circulates through the box, gives up its heat, and is reduced to a low temperature by cold induced by the fluid passing through the coil within the tank S, and from the box T this cold air may be conducted to any locality, and employed for preserving provisions, or for any purpose where a low temperature is required.

U, in the accompanying drawing, denotes a third tank, similar in construction to and connected with the conduit *m*, in manner as the tank S, except that in place of the closed box T a vessel may be employed for containing liquid, in order that such liquid may be kept in a cold state for drinking or other purposes.

This feature of the invention will be valuable in connection with distilleries, to refrigerate the distilled products of such establishments.

The conduit *m* is to be provided with a water-jacket, *t*, as shown in the drawing, for the purpose of condensing any portion of the vapor which should find its way to this point, with other advantages which result to the successful working of the apparatus.

The reservoir O is provided at bottom with a discharge-pipe, *u*, leading into the cistern E, for conveying into such cistern the liquid resulting from the condensation of the vapor under the action of the apparatus.

The reservoir O is also to be provided with a pressure-gauge, *v*, and a water-gauge, *w*, as shown in the accompanying drawing, and is further to be provided with a small pipe, *x*, leading from its upper part, for the purpose of freeing its interior of atmospheric air which may have collected therein.

The pipes connecting the tanks Q, S, and U with the reservoir O are to be provided with suitable cocks, and the air-pipe *x* is to be similarly provided. The pipes *a*, *h*, and *u* are also to be provided with cocks.

The above description embraces the mechanical construction of an apparatus embodying my invention.

Its operation is as follows:

We will suppose the pump-supply pipe *c* to be in open communication with the pump, and the cock of the pipe *a* open, and that of the pipe *h* closed, the cock of the pipe M, which regulates communication between the two generators, being also closed.

The pump, being started, forces the proper volatile liquid from the main reservoir into the generator, until the latter is about two-thirds full, the pump being subsequently driven at such a rate of speed as will be necessary to compensate for the evaporation and escape of the liquid within the generator.

Heat is next to be applied to the two generators in a suitable manner, which has the effect of evaporating or vaporizing the liquid in the first generator, and of throwing over the resulting vapor into the second generator G, when the cock of the pipe M is to be opened.

The action of the second generator has the effect not only of completing a perfect evaporation of liquid vaporized in the first generator, but of producing a lighter vapor than can be accomplished by the employment of one generator.

From the second generator G the vapor passes, by pressure, to and through the coil L of the condenser K, the latent heat of the vapor being given out in such condenser to the water contained therein, which, as before observed, is to be renewed sufficiently fast to keep it cool, the vapor, in parting with its latent heat, being, of course, liquefied.

The liquid resulting from the condensation of the vapor, as last explained, together with any portion of the vapor which may not have become liquefied by passing through the coil within the condenser, passes, by means of such coil or the pipe forming its prolongation, into the auxiliary condenser N and the receiver O, in manner as before explained, and is discharged into the general receiving-bulb or vessel P.

From the said vessel P the cold liquid is to be allowed to enter any or all of the tanks Q, S, or U, in manner and for the purpose as before explained, and, after having performed its office with respect to them, flows through the conduit *m* and into the receiver O, from whence it is discharged into the cistern E, in readiness to be drawn from thence by the pump and returned to the generator A, the liquid thus making the entire circuit of the apparatus.

It will be seen that, by the action of the pump, the liquid which has passed through the apparatus, as explained, will reappear again in the generator, and its withdrawal from and return to it become afterward self-regulated and continuous, without further addition, for a considerable length of time.

When such addition becomes necessary, it is to be supplied from the main or primary reservoir before mentioned.

I would remark that, in starting the apparatus, the cock *d* of the pipe *c*, which connects the pump with the main or primary liquid-holding reservoir, is to be allowed to remain open until the liquid has been drawn therefrom in sufficient quantity to make the entire circuit of the apparatus, as before explained, when this cock is to be closed, and only opened to supply a sufficient quantity of liquid to compensate for the waste under the action of the apparatus, which, as before observed, is very small.

The efficiency of the above-described apparatus, or those of a similar nature, depends upon the latent heat of the volatile liquid employed, and of the quantity of vapor formed per hour, since the more rapidly the vapor is formed the greater is the degree of cold produced.

The degree of cold that may be produced by the above apparatus, of course, depends partially upon the efficiency of the absorber or condenser *k*.

The arrangement of pipes and the employment of a stream of water, as shown in my arrangement of such parts, perform the office of condensing the vapor very effectively and rapidly.

The number and arrangement of the tanks Q, S, and U may be varied to any extent that occasion or necessity dictates.

In practical use of the above-mentioned invention, I have found, owing to the volatile nature of the liquid

employed and the great vaporizing and condensing capacities of the apparatus, that I am enabled to congeal water contained in the pans in the short space of one hour. In this respect my invention possesses great advantages over others in use.

Claims.

Having thus described the nature, construction, and operation of my invention,

What I claim as my invention, and desire to secure by Letters Patent of the United States, is as follows:

1. In an apparatus for artificially producing ice or cold air, the employment, in combination with the generator or generators thereof, of one or more tanks or reservoirs, substantially as is shown at J, in the accompanying drawing, as a safeguard or reserve in case of failure or accident to the said generator.

2. In an apparatus for artificially producing ice or cold air, the employment of one or more generators as auxiliaries to the primary generator, for the purpose of obtaining a more perfect evaporation of the fluid to be vaporized, and also for preventing effervescence from the primary generator from passing into the condensing-tank of the apparatus.

3. In combination with the generators A or G, the employment of the pump D, in connection with the tanks or receivers E and F, or their equivalents, and the remainder of the apparatus, whereby not only a continuous circulation and evaporation of the fluid are obtained and maintained, but the necessary pressure throughout the apparatus is secured.

CORNELIUS E. HAYNES.

Witnesses:

FRED. CURTIS,

EDWARD GRIFFITH.