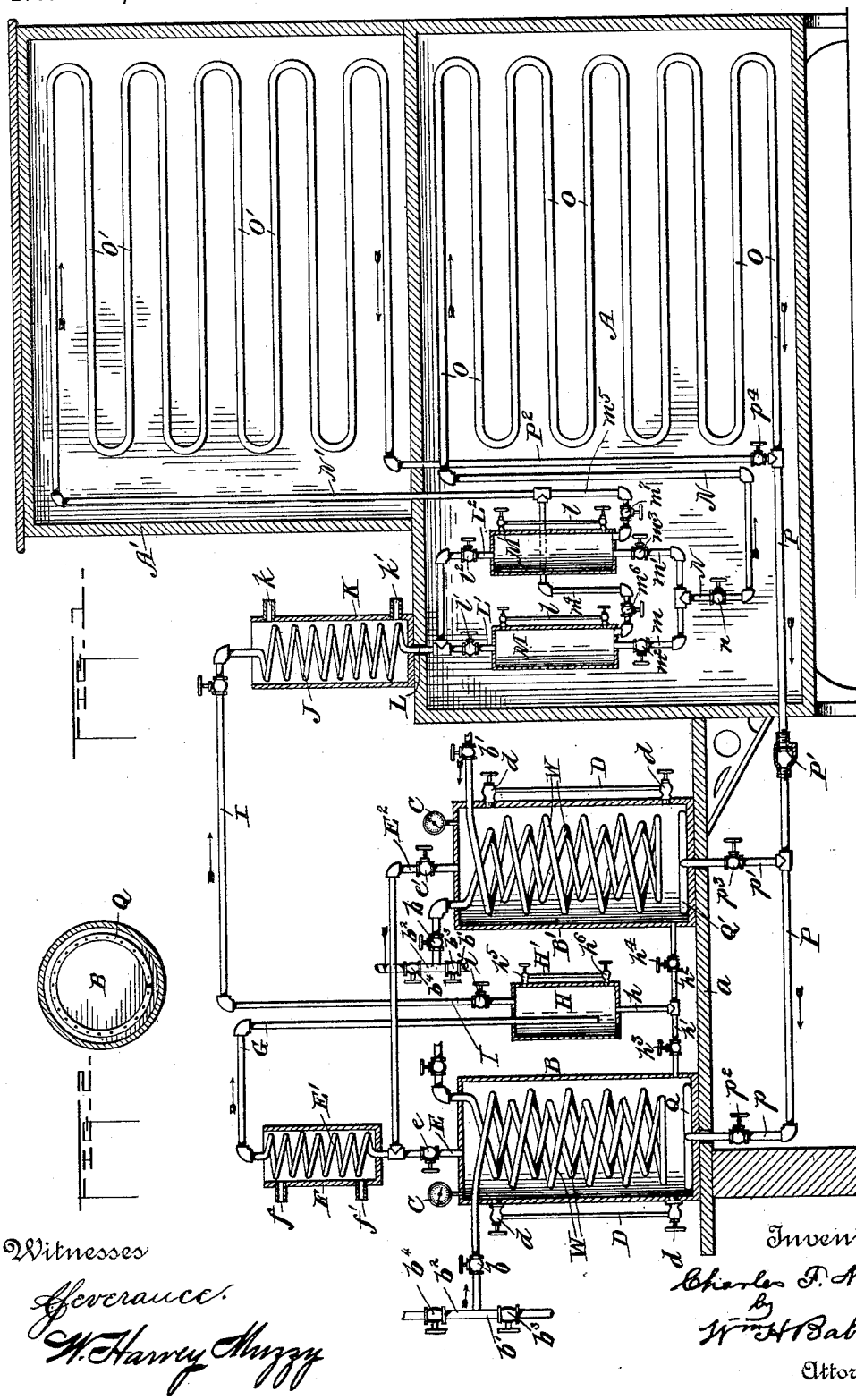
(No Model.)

C. F. MILLER.

REFRIGERATING APPARATUS.

No. 462,904. Patented Nov. 10, 1891.



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REFRIGERATING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 462,904, dated November 10, 1891.

Application filed July 3, 1891. Serial No. 398,412. (No model.)

To all whom it may concern:

Be it known that I, CHARLES F. MILLER, a citizen of the United States, residing at Lancaster, in the county of Lancaster and State of Pennsylvania, have invented certain new and useful Improvements in Refrigerators; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention is an improvement on Letters Patent No. 453,651, granted to me jointly with Alexander W. Carlile June 9, 1891; and it consists in certain devices for increasing the efficiency of refrigerating mechanism, as hereinafter more particularly set forth and claimed.

In the accompanying drawings, Figure 1 represents a vertical longitudinal section through the devices embodying my invention. Fig. 2 represents a horizontal section through one of the generators, taken just above the circular perforated pipe which discharges therein the ammonia-vapor from the refrigerating-coil.

A designates a refrigerating room or chest, which may be of any convenient size.

B B′ designate two generators, which may be supported on a platform *a*, attached to said room or chest, or independently, if preferred. These generators contain liquid or other absorbent of ammonia-gas or other volatile refrigerant. Each of them is alternately heated and cooled at will by a double spiral coil W, arranged within it, the ends of the said coil extending out through the upper end of the said generator and being provided with branch tubes b' b^2, making connection, respectively, with a source of steam-supply and a source of cold-water supply, each steam-tube b' being governed by a valve b^3 and each cold-water tube b^2 being governed by a valve b^4. The extension of the coil beyond the generator is in each instance provided also with a valve *b*, governing the inflow from either branch tube; but this valve is not strictly necessary. Each generator is provided with a pressure-gage C, of any ordinary construction, and also at one side with a vertical glass tube D, having tubular connections *d* with the interior of the said generator, the height of liquid in the latter being shown by the said tube.

From the generator B a straight tube E, provided with a valve *e* for cutting off communication at will, extends to a coil E′, within a cooling-receptacle or cooler F. The construction of this cooler is similar to that of the condensers described in the patent aforesaid, and also to that of the condenser hereinafter described; but it is smaller than the latter and not designed to lower the temperature as greatly. It consists of a case or shell inclosing the said coil and having a cold-water inlet *f* and cold-water outlet *f′* at its top and bottom, respectively, although the flow of water through it may be reversed, if preferred. A tube E^2, similar in use and function to E, extends from generator B′ to said tube E, joining the latter between the valve *e* and the cooler F. This tube E^2 is provided with a valve *e′*, similar to *e*, for opening and closing it at will. By this combination of pipes and valves either one of the generators may be put in communication with the coil E′, the other being cut out, or both generators may be allowed to supply the said coil simultaneously; but in practice one generator will generally be used for giving off the ammonia-gas to the said coil in the cooler while the other generator is absorbing gas preparatory to such service in its turn. From the said coil a bent tube G extends down to and within a drying or separating tank or receptacle H, which has a water-outlet tube *h* extending down from its lower end and communicating by branch tubes h' h^2 with the said generators, near the lower ends of the latter. These branch tubes have valves h^3 h^4 in them controlling at will the flow of water from said separating-tank H to the said generators, so that it may be permitted to enter either one of them only, or both, or neither. This tank or receptacle H is also provided on one side with a glass tube H′, communicating through suitable connections h^5 h^6 with the interior of said receptacle, so as to indicate the height of water therein. From the top of the said separating tank or receptacle H a pipe I for ammonia-gas or other volatile refrigerant passes to the upper end of a coil J in a condenser K, the said pipe being provided

with a valve i for controlling it. The said condenser consists of a casing having a water-inlet k and water-outlet k' at or near its ends, in order that a current of cold water may be supplied to the space surrounding the said coil. From the lower end of the latter a pipe L extends down within the refrigerating room or chest A, where it divides into two branch pipes L' L^2, controlled by hand-operated valves l' l^2 and communicating with two liquid-storage tanks or receptacles M M', supported in any convenient manner within the said chest or room. These tanks are provided with transparent externally-arranged liquid-gage tubes l, similar to those already described. From the lower ends of these storage-receptacles tubes m m', controlled by valves m^2 m^3, extend downward, joining in a tube N, controlled at will by a valve n and leading to the refrigerating-coil O, also within the said chest or cooling-room. From the outlet end of the said coil a pipe P extends out of said chest or room under the said generators B B' and has branch pipes p p', provided with hand-operated valves p^2 p^3, and extending up into the said generators, respectively. Each of these tubes communicates with a circular perforated discharge-tube Q or Q', arranged on or immediately above the floor of the generator B or B', the series of perforations being in the upper side of the discharge-tube, and the construction of the said discharge-tubes being substantially similar in all respects. The pipe P is provided with an automatic check-valve P' to prevent the return of the gas to the refrigerating-coil.

The operation is as follows: Hot water or steam being caused to flow through the coil W of generator B and cold water through the similar coil of generator B', and the former being in communication with the cooler F, while the latter generator is cut off therefrom, the gas from generator B passes first into said cooling-chamber, where it is cooled sufficiently to bring the steam mixed therewith to the point of condensation, so that it passes as liquid down the pipe G and into the separating-receptacle H, whence it flows through outlet-tube h and one or both of its branch tubes h^2 h^3 to one or both of the generators, being preferably directed to the generator B' in the case supposed. The pure anhydrous ammonia simultaneously ascends from the discharge end of said tube G through the said separating tank or receptacle H to the pipe I and through the said pipe to the coil J in the condenser K, where it is liquefied, and passes into one or both of the liquid-storage tanks M M'. Thence it passes to the refrigerating-coil O and by pipes P p' and discharge-tube Q' into generator B', the valve p^2, governing admission to generator B, being closed, and the valve p^3, similarly governing admission into generator B', being open. The check-valve P' prevents any return of the gas which remains in generator B' being absorbed by the water or other absorbent which the said generator contains. This continues until generator B is exhausted and generator B' sufficiently charged. The coil W of former is then supplied with cold water and that of the latter with steam. The generator B' is put into and the generator B out of communication with the cooler F, and the other valves of the mechanism are operated, so far as change in them is necessary, to allow the flow of the refrigerant to begin with generator B' and end in generator B, the action of liberating and absorbing the gas being simply reversed.

By using two liquid-tanks M M', connected by branch pipes and valves with an inlet-pipe and an outlet-pipe which they have in common, I am enabled to supply the liquefied refrigerant to one of them while drawing it from the other, so as to guard absolutely against the supply being at any time unexpectedly exhausted. Of course one tank M or M' may be cut out of the circuit altogether by shutting the valves in its branch inlet-tube and branch outlet-tube, or both of the tanks may be used together.

By supplying the gas to each of the generators through a considerable number of fine holes in a circular pipe on the floor of it the process of absorption is hastened, for the gas in fine jets comes simultaneously into a great many different parts of the mass of absorbent all around the periphery of its base.

It is often desirable to use the same generators, cooler, separating-tank, condenser, and liquid-storing tanks for more than one room or cooling-receptacle. To illustrate this I have shown an additional room or chest A', located, for convenience in illustration, above the room or chest A aforesaid, although this location is not essential. In this room or chest A' is a coil O', similar to coil O, and receiving the refrigerant from tanks M aforesaid, or either one of them, through one or both branch pipes m^4 m^5, corresponding to pipes m m', and pipe N', corresponding to pipe N. Pipes m^4 m^5 are provided with valves m^6 m^7, corresponding to valves m^2 m^3. From the coil O' a pipe P^2, controlled by valve p^4, extends to pipe P, making connection therewith. Thus room A', with its refrigerating system of pipes, valves, and coil, is only a duplication of room or chest A and its corresponding devices. Other rooms may be likewise brought into the refrigerating system and all cooled together or any one of them cooled alone, according to convenience and the refrigerating power of the generators, storage-tanks, and other means employed.

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

1. In refrigerating apparatus, the combination of a pair of generators, with a cooler for the liberated gas, pipes and valves making communication at will between either one of the said generators and the said cooler, a separating-receptacle receiving the gas and

condensed steam from said cooler, and the necessary pipes and coils of a refrigerating-circuit, substantially as and for the purpose set forth.

2. In combination with a pair of generators, a cooler having tubular communication with each of them, valves for cutting off either generator from said cooler at will, a separating-receptacle, a tube conveying the gas and the water of condensation from the said cooler into the said separating-receptacle, outlets for water leading from the lower part of the said separating-receptacle to the said generators, and an outlet-pipe for gas from the said separating-receptacle communicating with the pipes of a refrigerating-circuit, substantially as set forth.

3. In combination with the pipes and gas supplying and liquefying devices of a refrigerating-circuit, a pair of storage tanks or receptacles for the liquid, provided with common inlet and outlet pipes, and branch pipes and valves leading from and to the same, whereby one of the said tanks may be supplied with the refrigerating-liquid while the other is drawn from, or one may be used without the other, or both may be used together, substantially as set forth.

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

CHARLES FREDERICK MILLER.

Witnesses:

GEO. A. LANE,

A. P. WITNER.