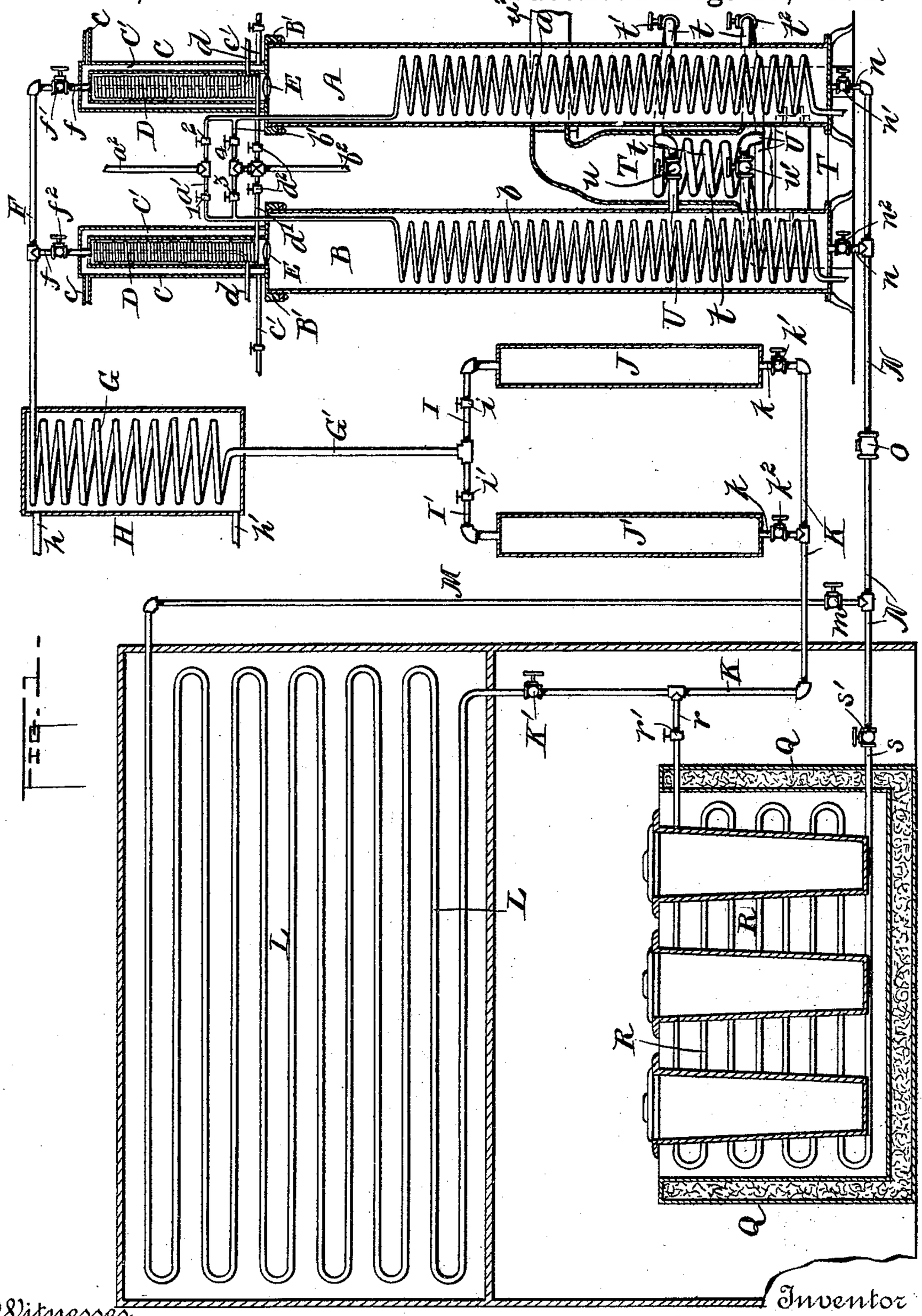
(No Model.) 2 Sheets—Sheet 1.

C. F. MILLER.

REFRIGERATING MACHINE.

No. 481,146. Patented Aug. 16, 1892.



Witnesses

Severance.

W. Harry Muzzy

Inventor

Chas. F. Miller

by

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Attorney

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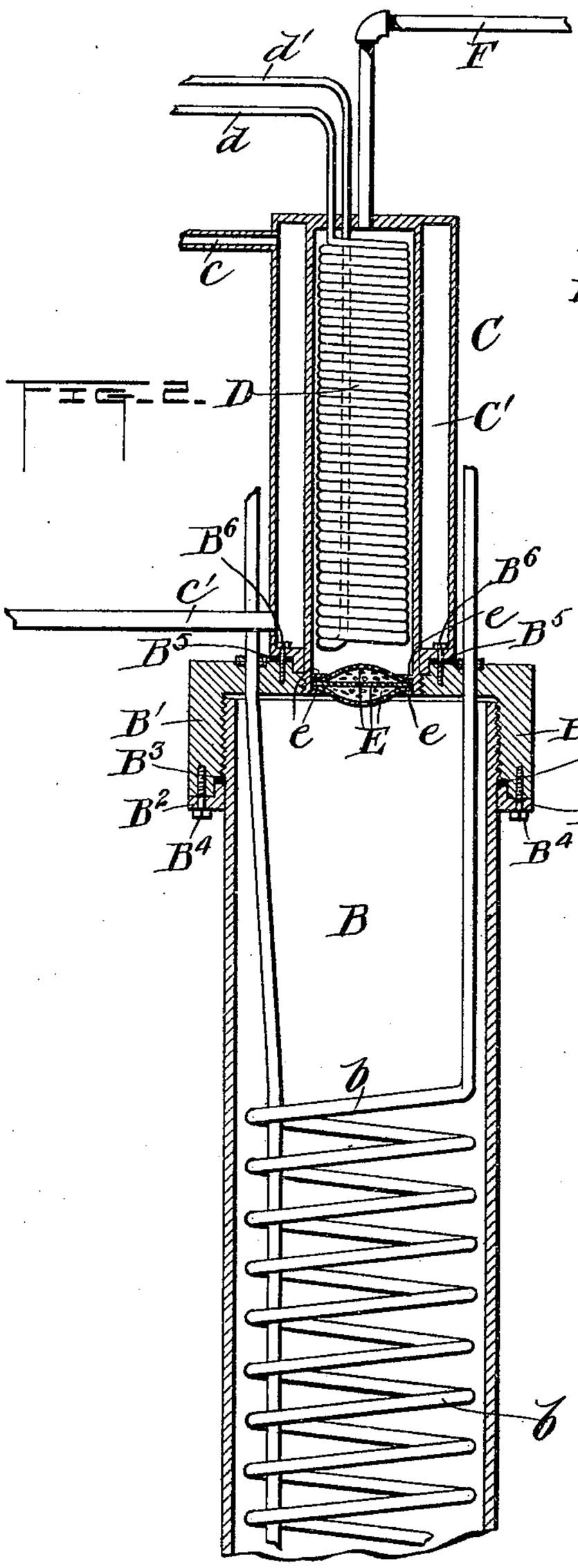

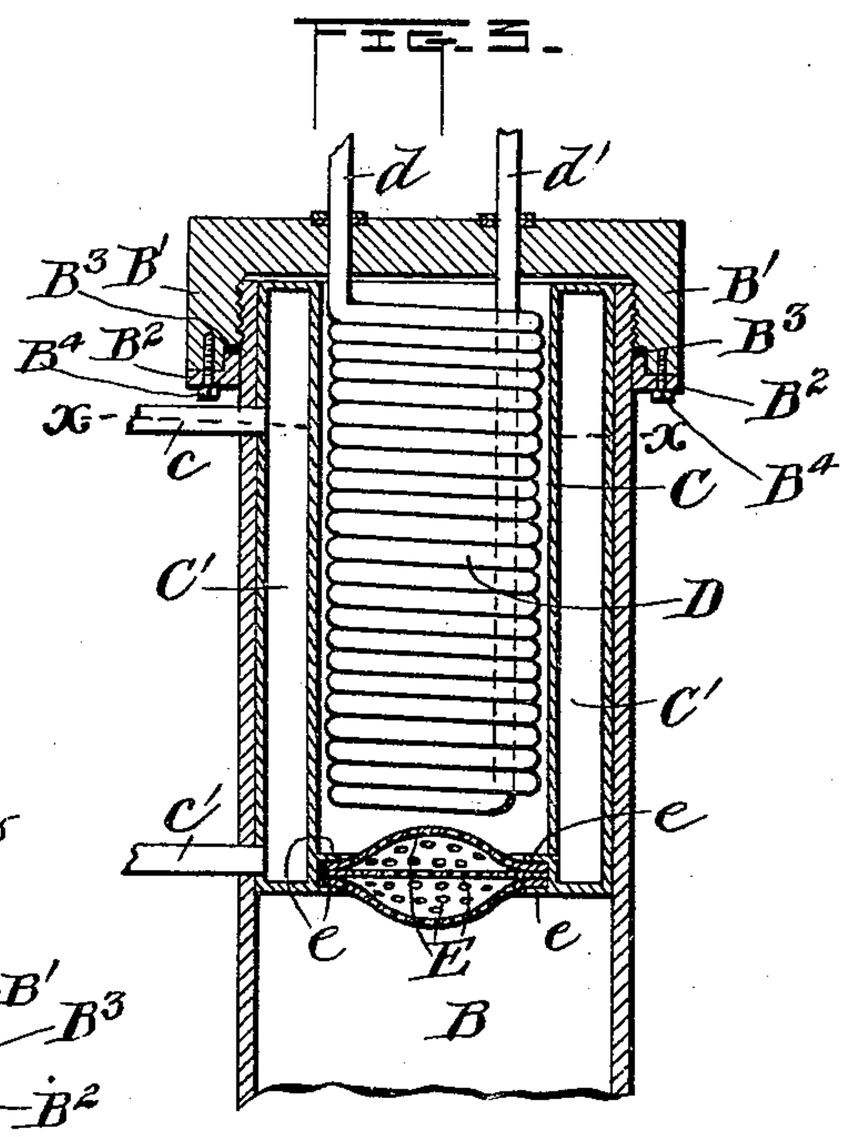

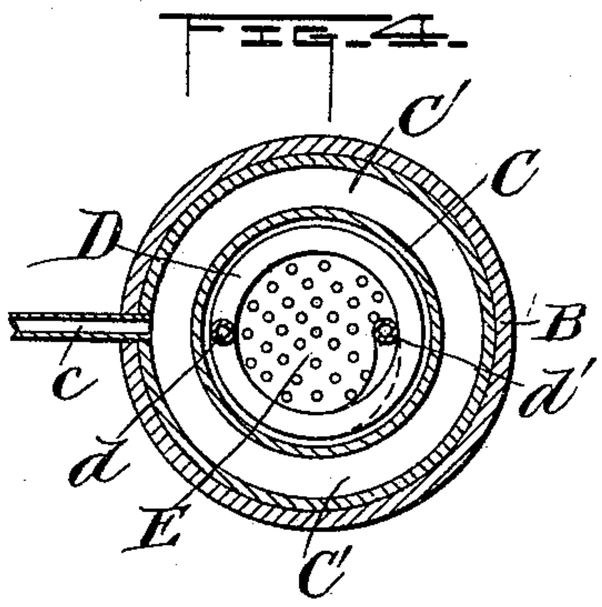

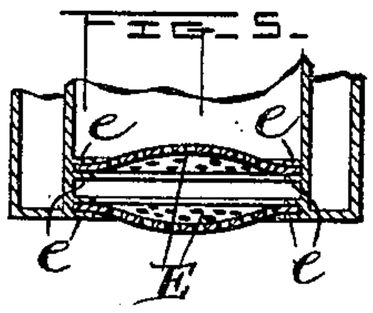

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UNITED STATES PATENT OFFICE.

CHARLES FREDERICH MILLER, OF LANCASTER, PENNSYLVANIA.

REFRIGERATING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 481,146, dated August 16, 1892.

Application filed January 9, 1892. Serial No. 417,520. (No model.)

To all whom it may concern:

Be it known that I, CHARLES FREDERICH 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 Refrigerating-Machines; 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 relates to improvements in refrigerating-machines, and especially to those operating by absorption.

In consists, partly, in the combination of a generator with a jacketed extension of the same having a coil therein, the said jacket and coil being supplied with cold water to condense the steam which ascends with the generated gas, in order to dispense with a separate dehydrator, or the said coil may be arranged in the jacketed upper part of the generator itself.

The said invention also consists in the combination, with the generator, extension, and coil arranged in the latter, of a perforated shell or shells arranged in the passage from the said generator to the said extension for the purpose of keeping down the foam while the gas escapes.

The said invention also consists in the combination of two generators and heating and cooling devices therefor with two storage-tanks for condensed liquid refrigerant, a refrigerating-coil or equivalent, and a condenser which is in communication with both generators and both liquid-storage tanks, the said devices being provided with the necessary pipes and valves and means of gas-supply and arranged to constitute two independent circuits having a condenser and refrigerating pipe or coil in common, each generator being its own absorber for the exhausted gas of its circuit and one generator being cooled and supplied with this exhausted gas while the other is heated and giving off gas. Thus there will be two independent plants and circuits and two independent bodies of ammonia operating alternately to produce refrigeration, but having a condenser in common.

In the accompanying drawings, Figure 1 represents a vertical section of the refrigerating apparatus embodying my invention. Fig. 2 represents an enlarged detail view, in vertical section, of one of the generators, the extension, the coil therein, and the perforated shells between the said generator and the said extension, the arrangement of the pipe-outlets being changed. Fig. 3 represents a vertical section of the upper end of the generator having the coil D therein and without the extension C. Fig. 4 represents a horizontal section of the same on the line $x\ x$ of Fig. 3; and Fig. 5 represents a detail view of the top of the generator, with a pair of flanges for each shell.

A and B designate the two generators of my apparatus, which are counterparts in construction, preferably cylindrical, and contain aqua-ammonia. Each of these generators is provided with a heating and cooling pipe a or b in helical form, the upper ends of these pipes being connected by two cross-pipes a' b', the former of which is supplied with steam through a pipe a^2 and the pipe b' with cold water through a pipe b^2. Valves 1 and 2 on each side of pipe a^2 in pipe a' allow steam to be turned into or cut off from either of the pipes or coils a b at will. Valves 3 and 4, similarly situated in pipe b', likewise control the flow of cold water into the said pipes or coils. These valves are opened and closed by hand, the valve 1 being always open to discharge steam into coil b while the valve 4 is open to discharge cold water into the coil a and the valve 2 being open to discharge steam into the coil b when the valve 3 is open to discharge cold water into the coil a. In either instance the valves not mentioned as open are closed. By the above arrangements one generator is heated for giving off the gas, while the other is cooled for absorbing it.

As shown in Figs. 1 and 2, a cylindrical extension C, preferably of less diameter than the generator, is formed on or attached to the top of the latter in each instance and provided with a hollow water-jacket C', having an inlet c and an outlet c' for cold water. A coil of pipe D is arranged within this extension, having its outlet end d passed through the said jacket. The two coils D are supplied through pipe b^2 aforesaid and branch pipes d', the latter being controlled by valves d^2. The steam which is carried up with the gas from the generator is cooled and condensed

by the action of the water in the jacket C′ and coil D and falls back into the generator.

To prevent foam from passing up with the gas into the said extension, I make use of two or more perforated shells E, preferably flat or concavo-convex, as shown, which are held at their peripheries by flanges *e*, arranged in pairs above and below the said shells around the openings in the tops of the said generators. These shells and flanges may be arranged either as shown in Fig. 3—that is to say, with all the shells between a single pair of flanges—or, as shown in Fig. 5, with each shell between a pair of flanges used for it alone. These shells, being made of thin elastic metal, may easily be sprung into position between the flanges. The perforations in these shells allow the water to drop through them, but are not large enough to permit the foam to ascend through them. As shown in Fig. 4, the coil D in each instance may be put within the upper part of the generator and the jacket C′ around the said upper part instead of employing the extension C; but the extension is preferable.

From the top of the interior of each extension or directly from the top of the generator when no extension is employed a pipe *f* extends upward, provided with a cut-off valve *f′* or *f*², the former for the gas from generator A, the latter for that from generator B. These pipes unite in a pipe F, which forms a coil G within a condenser H, the latter being a casing having cold water circulated through it by means of an inlet *h* and an outlet *h′*. A continuation G′ of the said pipe and coil is provided with two branch pipes I I′, the former provided with a cut-off cock or valve *i* and the latter with a cut-off cock or valve *i′*. The pipe I supplies a liquid-storage tank J and the pipe I′ a liquid-storage tank J′. Outlet-pipes *k* from these tanks are provided with valves *k′* *k*² and unite in a pipe K, which runs to the refrigerating-coil L, preferably arranged in a chest or chamber where cooling is desired. A valve K′ in the said pipe K regulates the supply of the refrigerant as it expands into the said coil. From this refrigerating-coil a pipe M, controlled by a valve *m*, runs to a pipe N, which through branch pipes *n*, controlled by cut-off valves *n′* *n*², supplies the exhausted gas to either one of the generators. The generator thus supplied at any time is always that which is then being cooled and absorbing. A check-valve O in pipe N prevents the gas from escaping back to the refrigerating-coil.

Q designates a brine-box having within it a refrigerating-coil R, which is connected at the inlet end by a pipe *r*, controlled by a cut-off valve *r′*, to the pipe K below the valve K′ and at its outlet end by a pipe *s*, controlled by a valve *s′*, to the pipe N aforesaid. The opening of valve *r′* allows the refrigerant to expand as gas into the said coil R with the usual chilling effect. When the valves *r′* and *s′* are open, the said brine-box is in the refrigerating-circuit.

The operation is as follows: The generator A being heated by the flow of steam through the coil *a*, as described, the gas passes up through the open valve *f′* to the condenser, and thence through pipe I and valve *i* to the storage-tank J, where under its own pressure and the cooling action of the said condenser it assumes a liquid form. There it remains until allowed to flow out by opening valve *k′* for refrigerating purposes. When it is thus drawn off, the gas flows through the refrigerating-coil L, the valve K′ being opened to the extent desired, and thence through pipes M N and valves *m n′* to the generator A, whence the gas was given off. During this flow from the storage-tank J back to the generator A the latter is cooled by the flow of cold water through the pipe or coil *a* and the aqua-ammonia within the said generator absorbs the spent ammonia-gas thus supplied. Thus the generator is its own absorber also. At the same time that the cold water is let into the coil *a* steam is admitted, as before explained, into coil *b*. The gas is given off by generator B through valve *f*² and through the condenser H and valve *i′* to storage-tank J′. There it remains as liquid until the charge is withdrawn from tank J, when the outlet-valve *k′*, before described, is closed and the outlet-valve *k*² is opened. The liquid refrigerant then flows from tank J′ through the refrigerating-coil, following the course of the previous charge from J and expanding into gas within the said coil for refrigerating action, as stated. From said coil it flows through pipes M and N and valves *m* and *n*² into the generator B. Of course at the time the charge from tank J′ is set free for refrigeration the steam is turned again into coil *a* and the cold water into coil *b* of the generators A and B, respectively. There are thus two plants, each with its own charge of ammonia, its own generator, which also acts as absorber, and its own liquid-storage tank, but having in common the condenser, the refrigerating-coil, and some connecting-pipes. The charges need never mingle if the gas given off by generator A be all received as liquid in the storage-tank J before that given off by generator B is admitted to the pipe F and the condenser and if the refrigerant supplied by the tank J′ be all absorbed by the aqua-ammonia in generator B before the charge is set free from tank J, the corresponding action and arrangement of the complementary parts being understood in both cases.

In my patent, No. 462,904, dated November 10, 1891, a very similar arrangement of many parts and devices is described and shown; but, as set forth in the said patent, the operation is by discharge from one generator into the other and without confinement of one generator to the use of one storage-tank. Therefore the charges would not be kept separate

and there would not be two independent alternately-acting systems of refrigerant-supply having little beside the condenser and refrigerating-coil in common. This double system is found to be a great improvement over those hitherto employed.

The extensions C of the generators, with their cold-water coils and cold-water jackets, do away, unless under exceptional circumstances, with the necessity for a separate dehydrator or additional steam-separator in common, such as is shown in the said Patent No. 462,904, the condensation of aqueous vapor being very complete as the said vapor ascends between the cold coil and the cold jacket.

Each extension C is preferably a piece of wrought-iron pipe screw-threaded at its lower end and screwed into the similarly-screw-tapped top or cover B′ of the generator. This top is itself screw-threaded on its internal periphery and screwed on the externally-screw-threaded upper end of the generator. The joint between the said cover and generator is made gas-tight by a packing-ring B^3, which is compressed by a follower or clamping-ring B^2, this last being fastened to the said cover by screws B^4. A similar packing-ring B^5 is used with the joint between the extension and the generator in each instance, and screws B^6 are employed as additional means of fastening the former to the latter.

T designates a hood or shell within which a coil of pipe *t* is subjected to the action of heat from a fire arranged below the said coil or by any other suitable means, the heated air and products of combustion finally escaping through an outlet-flue u^2 of the said hood or shell. Both ends of the pipe *t* connect with the generator A, the one at a higher point than the other. The upper end is provided with a valve *t′* and the lower with a valve t^2. The generator B is similarly connected to the ends of the coils by pipes U and U′, controlled by valves *u u′*. By means of this coil and connections and the heating agency applied to it the contents of one generator may be thoroughly heated to a high degree for giving off gas while the other generator is being cooled for absorbing. Substantially the same combination applied to and combined with one generator only is described, shown, and claimed in my application, Serial No. 413,873, filed December 3, 1891. Therefore it is not claimed here as thus applied to and combined with a single generator.

My system of plants, independent, though connected, has this great advantage, that if either plant becomes in any way disabled, as by leakage developing in the generator or storage-tank, the other plant may be used alone, so that there need never be any cessation of the supply of ice or cold air; but ordinarily the two plants or series of devices having the condenser and refrigerating-coil in common are used in rapid alternation, as above stated.

The coil *t* and the other devices connected therewith or relating thereto for keeping up a circulation of ammonia-gas through the generators need not be used, except on special occasions.

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

1. In combination with a generator of volatile refrigerant, a cooling-coil and a cooling-jacket exterior to said coil, the two cooling devices being arranged to allow the gas to flow out between them, while the steam accompanying it will be condensed and precipitated, substantially as set forth.

2. In a refrigerating-machine, a generator provided with an extension C of less diameter, in combination with a cooling-jacket C′, applied to this extension only, an inlet and outlet for water to circulate through the said jacket, and a coil for cooling-water arranged within the said extension only, this extension communicating at bottom with the interior of the said generator and having in its top an outlet for gas, substantially as set forth.

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

CHARLES FREDERICH MILLER.

Witnesses:

JACOB HALBACH,

J. C. SHAUB.