4 Sheets--Sheet 1.

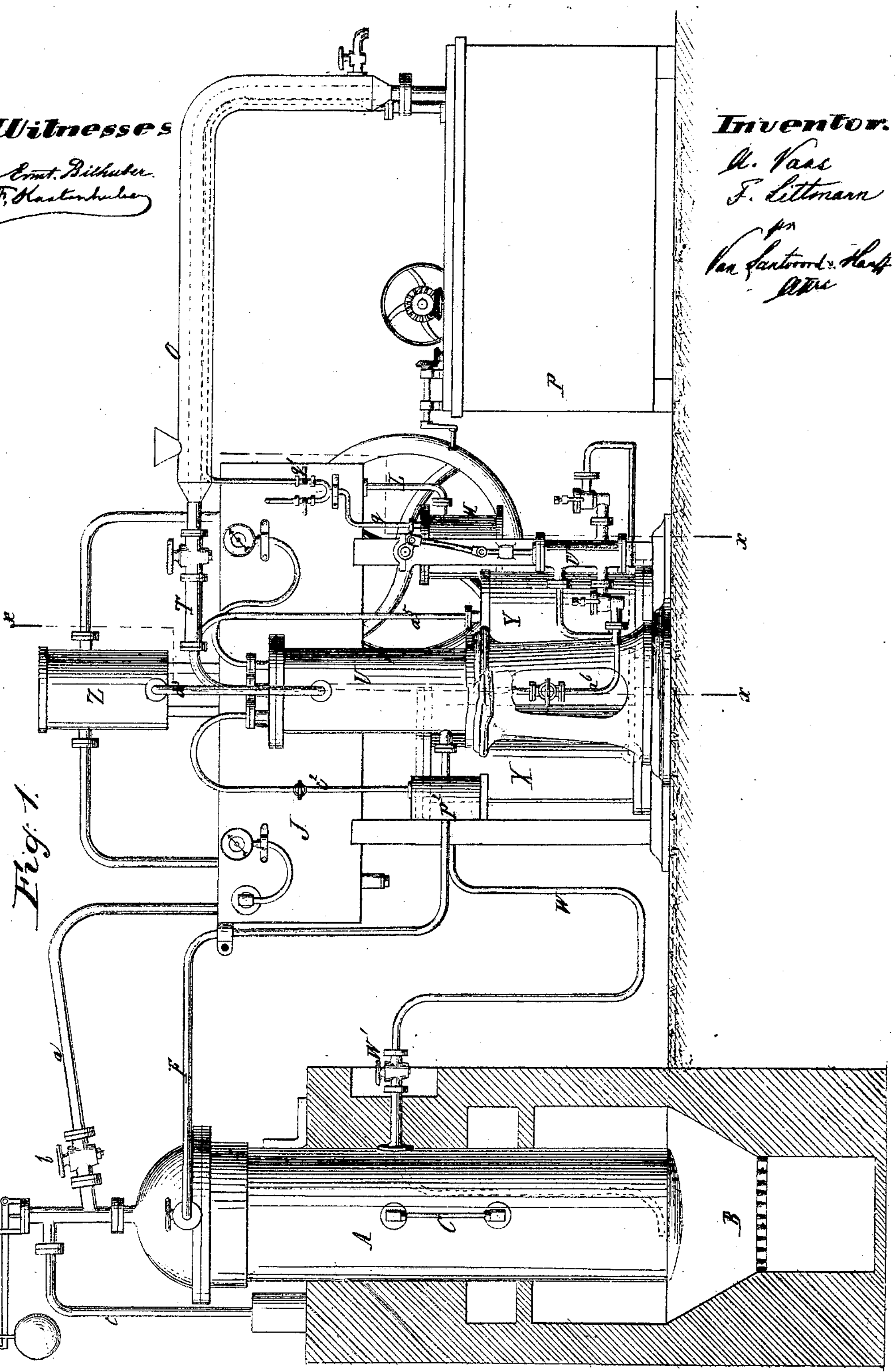
A. VAAS & F. LITTMANN.

Improvement in the Carré Ice-Machine.

No. 114,495. Patented May 2, 1871.

Witnesses

Emil Bilhuber
E. F. Kastenhuber



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AM. PHOTO-LITHOGRAPHIC CO. N.Y. (OSBORNE'S PROCESS.)

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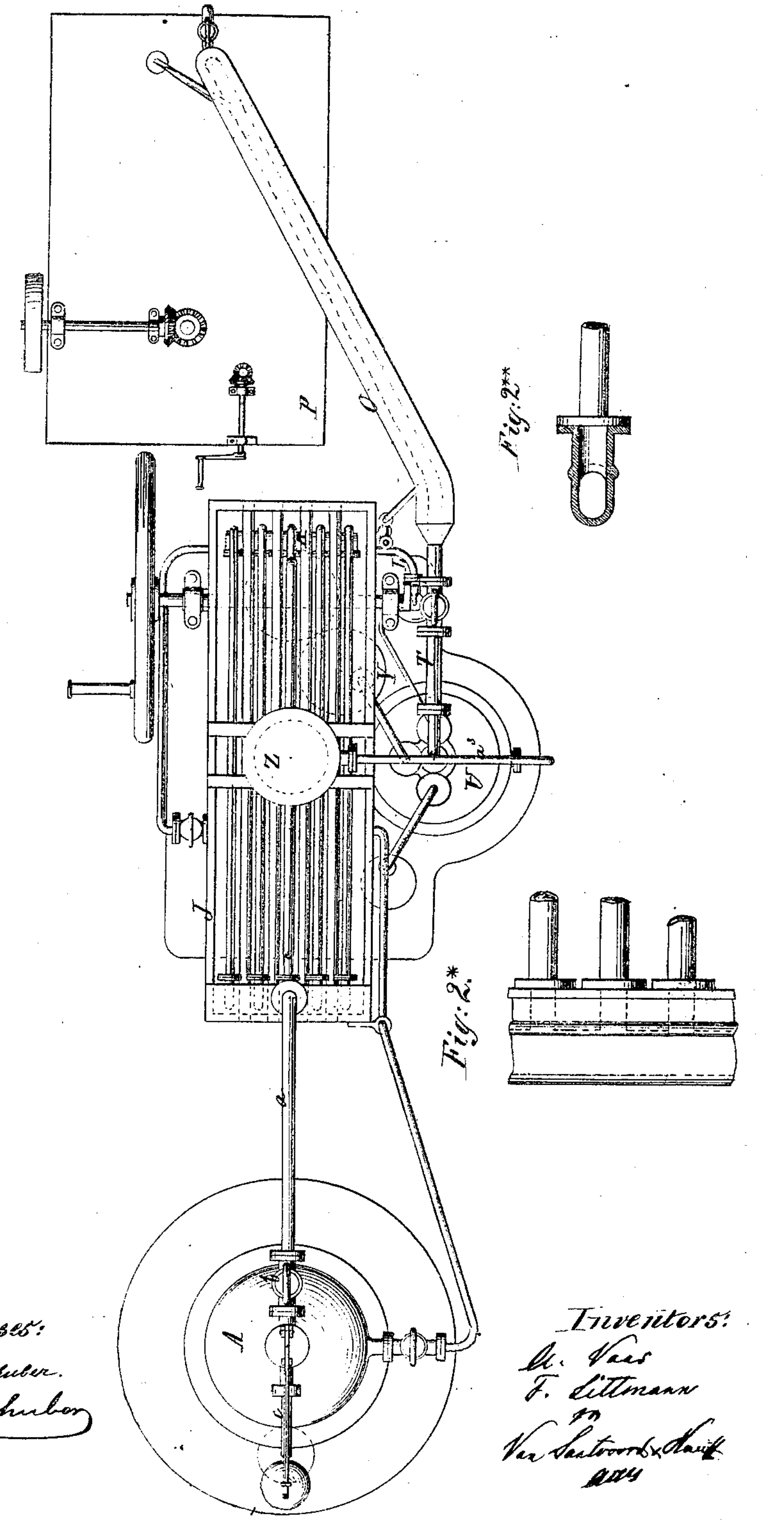

Fig: 2.

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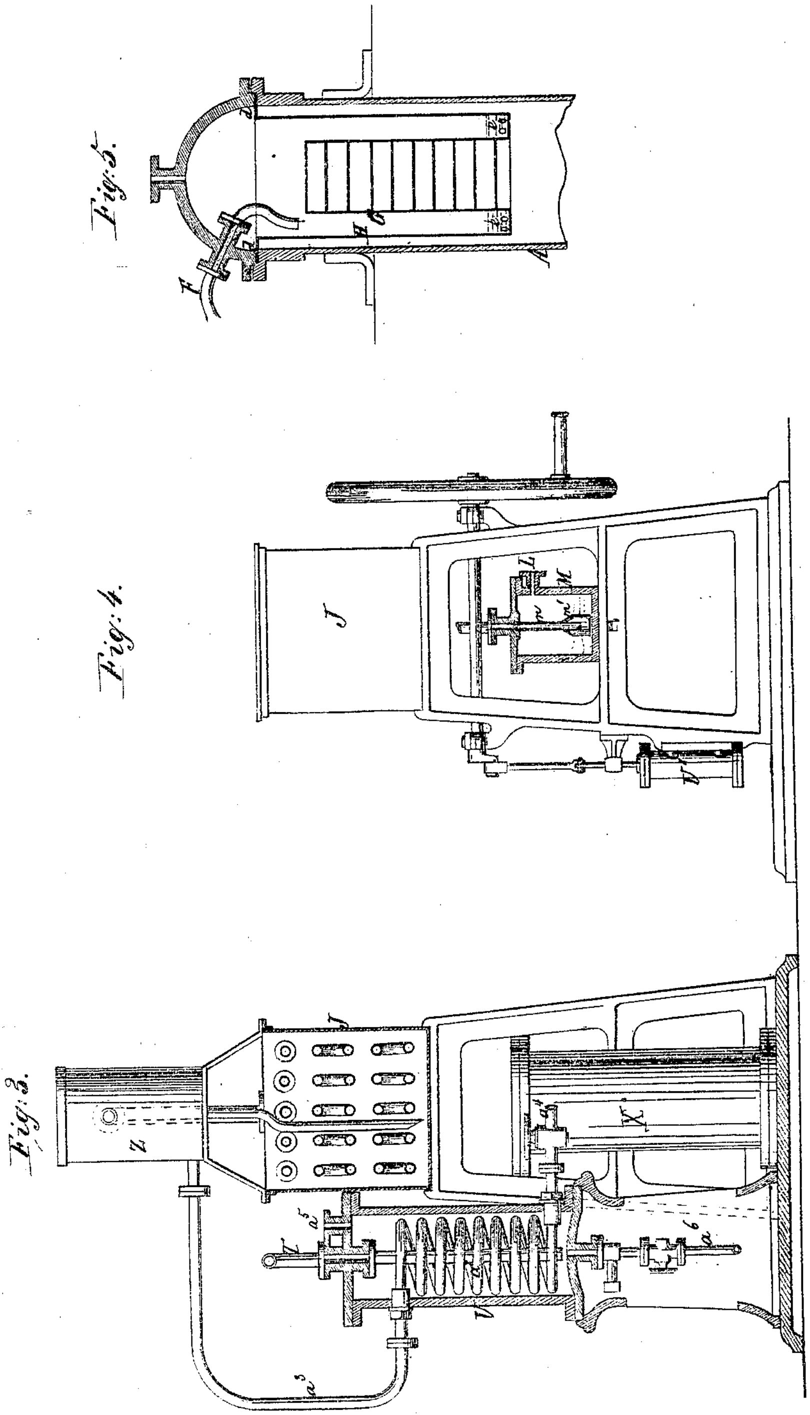

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Fig: 6.

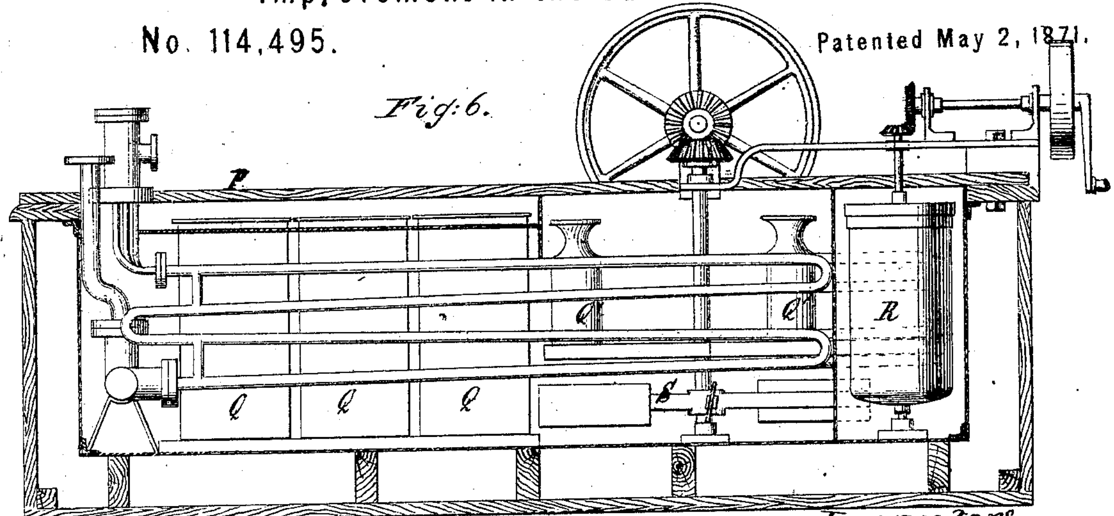

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Fig: 7.

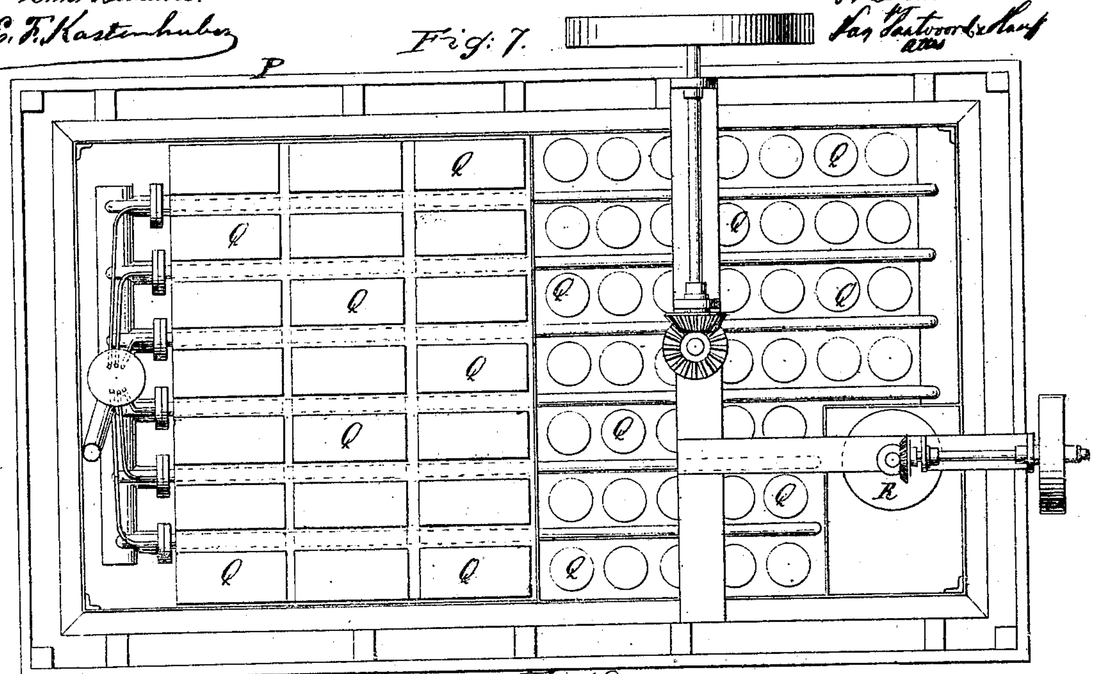
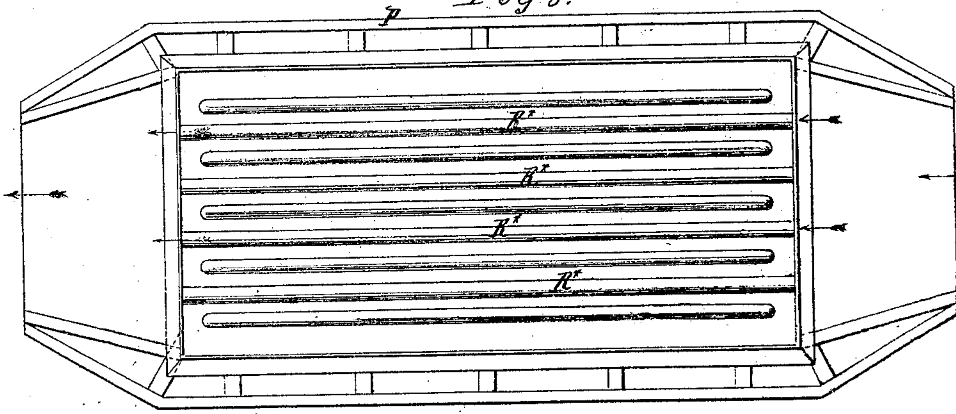


Fig 8.



UNITED STATES PATENT OFFICE.

ALBERT VAASS AND FRANZ LITTMANN, OF HALLE, PRUSSIA.

IMPROVEMENT IN THE CARRE ICE-MACHINE.

Specification forming part of Letters Patent No. **114,495**, dated May 2, 1871.

To all whom it may concern:

Be it known that we, ALBERT VAASS and FRANZ LITTMANN, of Halle, Saxony, Prussia, have invented a new and useful Improvement in Freezing Apparatus; and we do hereby declare the following to be a full, clear, and exact description thereof, which will enable those skilled in the art to make and use the same, reference being had to the accompanying drawings, forming part of this specification, in which drawing—

Figure 1 represents a front view of this invention, partly in section. Fig. 2 is a plan or top view of the same. Fig. 3 is a transverse section of the same, the line *x x*, Fig. 1, indicating the plane of section. Fig. 4 is a similar section taken in the plane indicated by the line *y y*, Fig. 1. Fig. 5 is a central section of the upper part of the boiler. Fig. 6 is a longitudinal vertical section of our refrigerator detached, in a larger scale than the previous figures. Fig. 7 is a plane or top view of the same. Fig. 8 is a modification of the same as used for cooling air.

Similar letters indicate corresponding parts.

This invention relates to certain improvements in the continuous-freezing apparatus of E. Carré, the operation of which depends upon the alternate condensation and expansion of ammoniacal vapors. These improvements relate to the arrangement of a sheet-metal cylinder, in combination with the rectifier in the interior of the boiler in which the ammoniacal vapors are formed, for the purpose of separating from the ammonia the aqueous vapors and returning them in the lower part of the boiler in such a manner that the liquid ammonia admitted into the boiler collects in the space between the rectifier and the cylinder, where it is heated to a high temperature before it trickles down into the boiler in the form of a shower, while the gas, rising from the liquid in the boiler, has to pass through said shower, and then through the rectifier, and thereby the aqueous parts, still mixed with said gas, are effectually disengaged.

The serpentine pipes in the liquefier are connected by an oval tube provided with a continuous flange, whereby the firmness and durability of the apparatus is materially improved. The regulator of efflux is constructed with a trap formed of a pipe, with a protecting-cap to prevent the escape of gaseous ammonia.

The construction of the refrigerator is such that it is capable of receiving vessels of different form, and also an ice-cream freezer. An agitator situated therein serves to equalize the temperature.

In the drawing, the letter A designates the boiler containing the aqueous solution of ammonia. This boiler is exposed to the heat of the furnace B to about one-half of its vertical altitude. The solution should never stand higher than this, and at C is placed an indicator to show its exact level. This indicator is simply a glass tube placed vertically, and communicating with the boiler both at top and bottom. At the summit of the boiler is a tube extending upward, with a branch, *a*, through which the liberated ammoniacal gas is conducted to the large liquefier J. A stop-cock, *b*, serves to shut off this pipe. Above the branch *a* is situated a safety-valve, and a second branch pipe, *c*; and if at any time the safety-valve is lifted, the ammonia, instead of escaping in the air, is forced to pass down through the pipe *c* into a vessel containing water. The boiler is fed through the pipe F with the saturated solution of ammonia brought back from the absorbing apparatus U, which will be presently described. The upper half of the boiler is occupied by a contrivance, G, called the "rectifier," which consists of a series of sieves arranged one above the other. This rectifier G is placed in a cylinder, H, which is suspended from a flange, *d*, at its top, while its bottom is open under the sieves of the rectifier, so that the gas evolved from the liquid ammonia in the boiler can pass up through these sieves.

The cylinder H is perforated with a large number of holes, *e*, near its bottom, and the liquid ammonia is introduced through the pipe F, which leads into the annular space surrounding the rectifier. (See Fig. 5.) As the liquid accumulates in this space it is exposed to the action of the hot gas rising from the boiler, and its temperature is raised to a high degree, so as to save fuel. From the cylinder H the liquid discharges through the perforations *e* in the form of a shower, and as this shower meets the rising gas its temperature is still further increased, while the gas is prevented from carrying up any of the aqueous parts mixed with the shower. The aqueous parts which may be still mixed with the gas rising from the boiler are disengaged as the gas passes through the sieves of the rectifier. Our experience shows that by the combination of the cylinder H with the rectifier the gas is much more effectually freed from aqueous parts than it is if the liquid ammonia is made to trickle down through the same sieves through which the gas rises.

The gas, thus freed from vapor, passes from the boiler through the tube *a* to the liquefier J, which consists of a series of serpentine pipes immersed in a tank of cold water, the water being constantly renewed from an unfailing source in communication with the distributing recipient Z, designed to supply the apparatus.

At the point where the tube *a* meets the liquefier there is an oval tube or box, K, into which it opens, and from which there proceed a series of distinct pipes, said box being provided with a flange, K*, extending through its entire length, (see Fig. 2*,) a section of said oval box with its flange being shown in Fig. 2**. A similar oval box, K′, with a flange, is situated at the opposite end of the liquefier, near its bottom, to connect with the bottom ends of the serpentine pipes. By these means the serpentine pipes are firmly connected, and the flange K* is sufficiently strong to prevent it from breaking off; whereas if the connection is made by detached flanges projecting from the box K, one for each pipe, the flanges are liable to snap, and the operation of the apparatus is interrupted.

On arriving at the lower box K′ the temperature of the gas is reduced to, say, 70° to 80° Fahrenheit; and, under the pressure of ten atmospheres, more or less, which is constantly maintained in the boiler, it is at this temperature reduced to a liquid state.

In this condition it passes through the tube L to the vessel M, which is the regulator of efflux. This is a very important part of the apparatus. It forms the dividing barrier between the space in which there prevails a constant pressure of ten atmospheres, and another where the entire efficiency of the contrivance depends upon the maintenance of a pressure greatly lower, which, in fact, shall never exceed an atmosphere and a half; and while doing this it must at the same time permit the liquid ammonia to flow freely from the first of these spaces to the second, and care must be taken to prevent the liquid from flowing more rapidly than the successful conduct of the operation requires.

The regulator of efflux is seen in Figs. 1 and 4. It connects with the box K′ in the liquefier by the pipe L passing in through the side of vessel M, and the liquid discharges therefrom through a pipe, *m*, which passes down through its center, and is provided at its bottom end with a trap, *m′*, extending nearly down to the bottom of said vessel M. The liquid ammonia, on discharging into the vessel M, soon closes up the space beneath the trap *m′*, so that the gas which disengages from the liquid is prevented from passing up into the pipe *m*, and by the pressure of this gas the liquid is forced up through said pipe and caused to pass through a pipe, *q*, into the refrigerator P, the quantity of liquid allowed to pass off through said pipe being regulated by a faucet, *q′*. (See Fig. 1.)

The pipe *q* on its way to the refrigerator P passes through an enveloping-tube, O, which also surrounds the tube T, through which the vaporized ammonia is returning from the refrigerator. These vapors, being very cold, serve to reduce the temperature of the liquid in the pipe *q* before the same enters the refrigerator.

Our refrigerator is best seen in Figs. 6 and 7. It consists, principally, of a series of serpentine tubes immersed in a tank constructed of non-conducting substances. These serpentine tubes form a number of partitions in the tank, to receive retangular vessels Q, containing water, which is to be frozen into square blocks; also vessels Q′, of various shapes, to contain the articles to be cooled. In one of the compartments of the refrigerator-tank we place an ice-cream freezer, R, to which a revolving motion is imparted by suitable gear from the top. The tank is filled with a solution of chloride of calcium, and an agitator, S, (see Fig. 6,) is placed in the bottom of the tank to keep this solution in motion and to equalize the cooling effect.

If the refrigerator is to be used for cooling air, we construct it in the manner shown in Fig. 8. In this case the refrigerator-tank is constructed with a receiving-spout and with a discharge-spout for the air, and a series of pipes, R*, are made to pass through the tank between the serpentine pipes of the refrigerator, so that the air in passing through these pipes is cooled down to a low temperature.

In the refrigerator-pipes the liquid ammonia, being relieved of its pressure, evaporates, and thereby a large quantity of heat is absorbed, and the surrounding solution is cooled down to a very low temperature.

The gaseous ammonia is conducted from the refrigerator through the pipe T into the absorbing apparatus U, and in passing through the envelope O the temperature of this gaseous ammonia is somewhat raised.

The absorbing apparatus U is ordinarily partially filled with water drawn from the bottom of the boiler, from which the ammonia has been in great part exhausted, and which is therefore ready to take up greedily the gas introduced through the pipe T. This pipe extends nearly to the bottom of the vessel U, and delivers the gas beneath the surface of the water contained in said vessel. (See Fig. 3.) The bottom is covered, as shown in said figure, so that the impurities which may be mixed with the water are carried down to its circumference, and the mouth of the pipe T is not liable to be clogged up. Within the vessel U is a coil, a^2, which connects, by a tube, a^3, with the reservoir Z, while its opposite end connects, by a pipe, a^4, with the cooler Y. The water from the boiler does not, however, pass directly into the absorbing-vessel U. In that case it would be too hot to absorb the gas effectually. It passes first through the coils in the two coolers X Y. The cooler X connects with the boiler by the pipe W, provided with a stop-cock, W′. The pressure of the boiler expels the water without necessitating the use of a pump. The stop-cock may be set to supply very accurately the water in proportion as it is wanted. The space in the cooler X surrounding the coil is filled with the reconstituted ammoniacal solution on its way to the boiler, which is cold, while the water from the boiler passing through said coil is hot, and the temperature of the two liquids is, to some extent, exchanged. From the cooler X the water from the boiler enters the cooler Y, where it is further refrigerated by the water discharging from the spiral of the absorbing-vessel U through the pipe a^4. It passes finally through the pipe a^5 into the absorbing-vessel U. The saturated solution from the absorbent U is returned through the pipe F, being forced into the boiler by the action of a pump, U′, which connects with the bottom of the absorbent by the pipe a^6.

When the operation begins the whole apparatus is necessarily full of air. This is expelled by means of the purger P^2, which consists of a cylindrical vessel partially filled with water, into which descends a pipe, c^2, from the absorbent U, closed ordinarily by a stop-cock. At the commencement of the operation, the boiler having been charged with a strong solution of ammonia, the cocks are all closed until the temperature of the solution has reached 270° to 280° Fahrenheit, when free communication is established between the different parts of the apparatus, and the cock leading to the purger P^2 is also opened. The gas expels the air through the tube c^2 beneath the surface of the water in the purger, from which it escapes in bubbles, while the ammonia is retained in solution by the water, and may be recovered.

What we claim as new, and desire to secure by Letters Patent, is—

1. The cylinder H, surrounding the rectifier G, and forming a space for the reception of ammonia, said cylinder being perforated near its bottom with a large number of holes, to inject the solution in the form of a shower, substantially as shown and described.

2. The trap *m′*, in combination with the discharge-pipe *m* of the regulator of the efflux M, substantially as set forth.

3. The oval box K, provided with a continual flange K*, in combination with the serpentine pipe of the liquefier J, as described.

4. The agitator S in the refrigerator P, as described.

This specification signed by us this 28th day of October, 1870.

ALBERT VAASS.
FRANZ LITTMANN.

Witnesses:
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GUSTAV GLÛSK.