W. W. SEAY.

REFRIGERATING APPARATUS.

APPLICATION FILED JUNE 12, 1906. RENEWED NOV. 13, 1907.

941,733.

Patented Nov. 30, 1909.

2 SHEETS—SHEET 1.

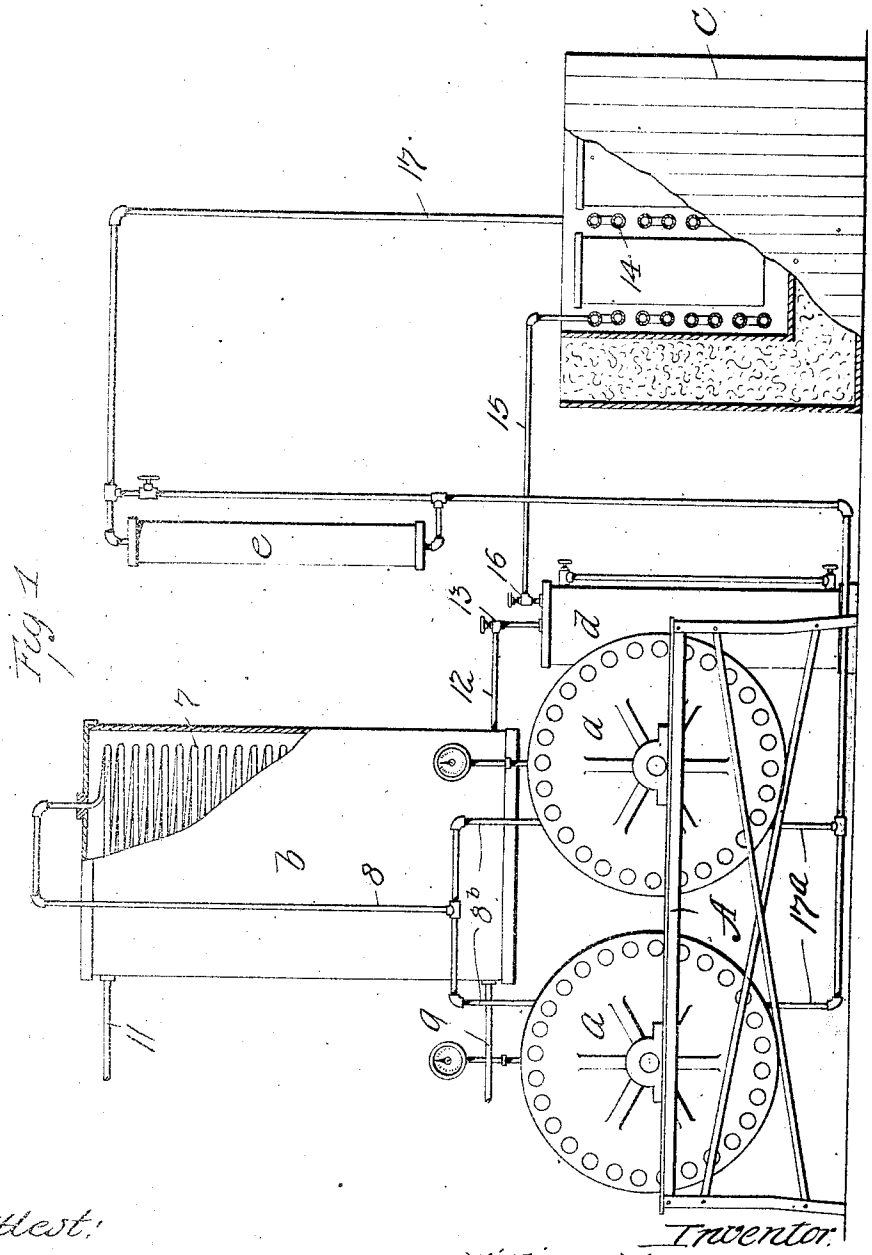


Fig. 1

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2 SHEETS—SHEET 2.

Fig. 2.

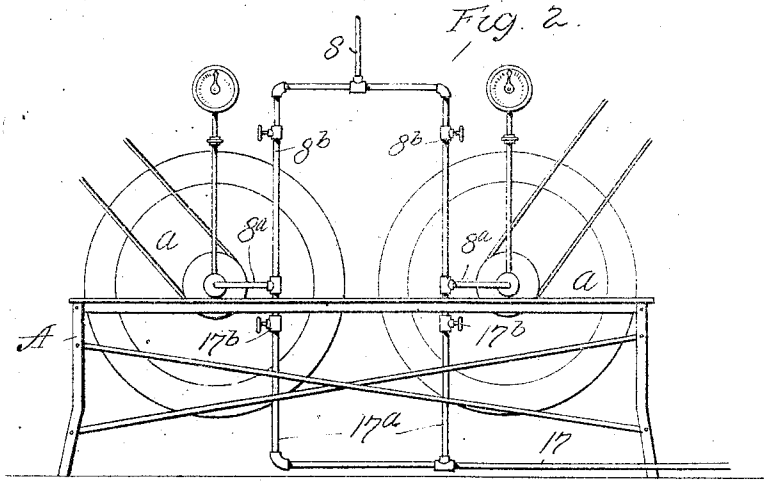



Fig. 3.

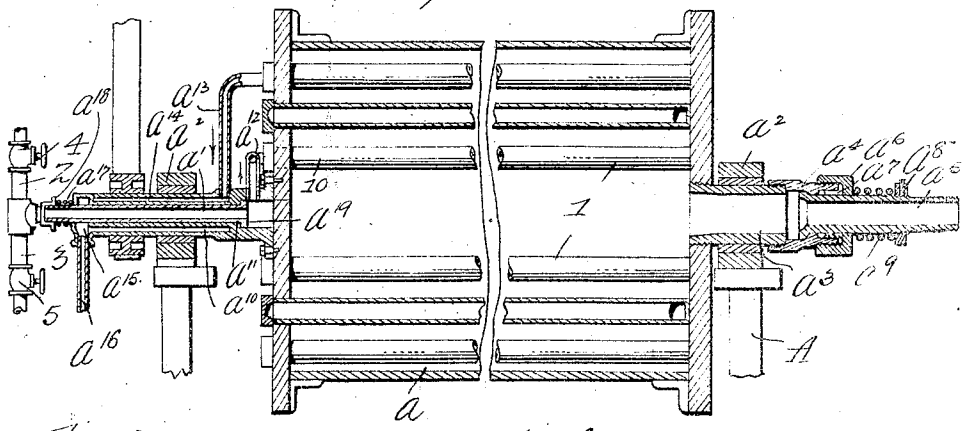



Fig. 5

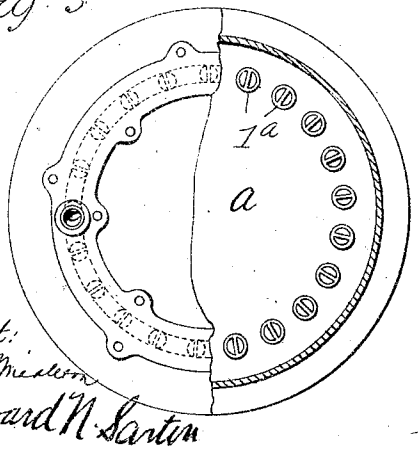
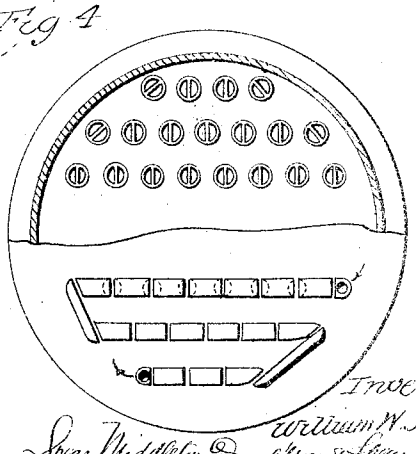



Fig. 4



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# UNITED STATES PATENT OFFICE.

WILLIAM W. SEAY, OF SAN FRANCISCO, CALIFORNIA.

## REFRIGERATING APPARATUS.

941,733. Specification of Letters Patent. Patented Nov. 30, 1909.

Application filed June 12, 1906, Serial No. 321,405. Renewed November 13, 1907. Serial No. 401,988.

*To all whom it may concern:*

Be it known that I, WILLIAM W. SEAY, a citizen of the United States, residing at San Francisco, California, have invented certain new and useful Improvements in Refrigerating Apparatus, of which the following is a specification.

My invention relates to improvements in apparatus for use in the art of refrigeration, such for instance, as in the production of artificial ice or artificial cold for use in storage chambers and in the arts.

The invention is designed more especially for carrying out the process which forms the subject of an application filed by me in the United States Patent Office on the 28th day of March, 1905, Serial Number 252,571, and the object of the invention is to provide an apparatus which will enable the process to be carried out in a continuous manner and without any interruption, which will facilitate the absorption of the ammonia vapor by the absorbent material and which will also cause said material to absorb a maximum amount of the ammonia vapor.

With these and possibly other objects in view, the invention comprises the features of construction and arrangement and combination of parts hereinafter described and particularly set forth in the appended claims.

The invention is illustrated in the accompanying drawings, in which—

Figure 1 is a front elevation with parts in section. Fig. 2 a partial rear elevation. Fig. 3 is a central longitudinal section through one of the generators. Fig. 4 is a view of one of the generators partially in section. Fig. 5 a sectional detail of a modification.

Referring by reference characters to this drawing, *a*, *a*, designate the absorbing and generating tanks, which may conveniently be of cylindrical form, and of which I prefer to use two for the purpose which will hereinafter appear. These tanks have hollow trunnions *a'* which are journaled in suitable bearings $a^2$ on a suitable supporting frame A. Each has an interior coil which is in communication through the hollow trunnion at one end by means of suitable pipe connections with the hot and cold water supply pipes 2 and 3 provided with suitable cocks 4 and 5 by which hot or cold water can be supplied to the coil in alternation as desired. The interior of each tank or generator is in communication through its hollow trunnion by a short pipe section $8^a$ with branch pipes $8^b$ which unite in or are connected to the pipe 8 and which leads to a condenser *b*. The condenser *b* is a tank having an interior coil 7, which is in connection with the pipe 8. The condenser tank has an inlet pipe 9 and an outlet pipe 11 for the condensing water. The condenser coil 7 is connected to a receiver *d* for the liquid anhydrous ammonia by pipe 12 having a suitable cock 13. A refrigerator is indicated at *c* which may be of the ordinary or any desired construction according to its destined employment for making ice or for cooling storage chambers as used in the arts generally.

For convenience I have shown this refrigerator as a freezing tank adapted to be filled with brine and to receive cans and having an interior coil 14 which is connected to the receiver *d* by pipe 15 having an expansion cock 16. Through this pipe 15 the anhydrous liquid ammonia is supplied to the refrigerator. The other end of the coil 14 communicates by a pipe 17 and branch pipes $17^a$ with the pipes $8^a$ leading into the tanks *a*, suitable stop cocks $17^b$ being provided in these pipes $17^a$. If desired, I may pass the expanded ammonia vapor going through the pipe 17 through a drier *e* connected to the pipe 17 by branch pipes as shown, but if perfectly anhydrous ammonia is used, such a drier will not be needed.

It will be understood that my invention contemplates the employment in the tanks *a* of a solid absorbent which easily combines with liquid anhydrous ammonia or ammonia vapor, and by such process it becomes liquefied and forms with the ammonia a solution. After the ammonia vapor has been absorbed and becomes liquefied and the absorbent also liquefied, hot water or steam is introduced into the coils of the absorber and generator and the liquefied ammonia vaporized and driven off through the pipe 8 and introduced into the condensing tank, whence it passes in the form of liquid ammonia into the receiver *d*. It then passes through the coils 14 of the refrigerator where it is expanded and consequently abstracts heat from the freezing tank producing the ordinary refrigerating effect. After all the available ammonia has been driven out from the absorbent by the heat from the hot water and coils of the generator and the

refrigerating effect produced, the supply of hot water is cut off and a supply of cold water turned into the coils of the generator which now becomes the absorber, the cocks $17^b$ now being open and the cocks $8^b$ being closed. The expanded ammonia gas now passes by the pipe 17 back to the tank $a$ which now acts as an absorber where it is reabsorbed.

From the foregoing description it will be seen that were I to use but a single tank a continuous refrigerating effect upon the refrigerator could not be secured, as there would be alternate periods during which a single tank $a$ would be absorbing and vaporizing. It is to avoid this intermittent action that I provide two tanks with their appropriate connections, and as the periods of absorption and vaporization are practically of equal duration, by the use of two tanks I secure a continuous refrigerating effect.

I have found that when the ammonia is being driven by the heat off from the absorbent, the absorbent tends to settle and form in a solid mass in the bottom of the generator. If the expanded ammonia vapor were allowed to enter the tank $a$ with the absorbent at the bottom of the tank in this solid condition, the action of the vapor would be to cause a liquid film to form over the surface of the solid absorbent which would tend to retard the absorbing action. It is to avoid this that I mount the tanks $a$ on trunnions so as to be capable of being turned. By this construction when a tank is to act as the absorber its position is reversed so that the solid absorbent is now at the top and the ammonia vapor acts on the under surface of the solid absorbent. As fast as the vapor is liquefied and the absorbent likewise liquefied it falls away into the bottom of the tank leaving a fresh surface of the solid absorbent exposed to the action of the vapor.

I have found further that after all of the solid absorbent has become liquefied under these conditions it will have absorbed a certain amount of ammonia and will not absorb more if left in a quiescent state. If, however, the liquid be agitated it will continue to absorb the ammonia vapor up to a considerable further degree. For this reason I find it very desirable to arrange the coil, 1, within each tank $a$ in a circular or annular form, as shown at $1^a$ in Fig. 5 and to provide means by which each tank may be continuously rotated during the absorbing action, thereby hastening such action very materially and increasing its efficiency as by the agitation thus effected a larger percentage of the ammonia vapor will be absorbed and the gain in efficiency will far outweigh the cost of rotation. It will be understood, however, that this continuous rotation of the tank is simply representative of any means for agitating the liquid contents of the tank.

While any suitable form of hollow trunnion may be used to lead the refrigerant into and from the tanks $a$ and the heating and cooling medium into and from the coils 1, I prefer to use the construction shown in detail in Fig. 3.

The trunnion through which the refrigerant is introduced is shown on the right of this figure. It comprises a tubular member $a^3$ journaled in the bearing $a^2$ to which is connected a coupling member $a^4$ having an internal flange engaging a corresponding external flange on the pipe section $a^5$, which connects with the branch $8^a$.

The section $a^5$ is surrounded by a collar $a^6$ which has a flange screwed onto the coupling member $a^4$. Between this collar and coupling member is located a suitable packing material $a^7$. A second collar $a^8$ is rigidly but adjustably secured on the pipe $a^5$ and between it and the collar $a^6$ is located a helical spring $a^9$ which tends to keep the flange on the inner end of pipe $a^5$ pressed against the internal flange of coupling member $a^4$.

The particular means by which the heating and cooling medium is supplied is shown on the left of Fig. 3.

The shaft $a^{10}$ which is secured rigidly to the head of the tank or drum has a central longitudinal passage $a^{11}$ at one end which is in communication at its outer end by a suitable T coupling with the pipes 2 and 3. At its inner end this passage communicates by a lateral branch $a^{12}$ with one end of the coil 10. The other end of the coil communicates by a pipe $a^{13}$ with a passage $a^{14}$ in the member $a^{10}$. This passage at its outer end communicates with a junction box or casing $a^{15}$ which has a waste pipe $a^{16}$. A spring $a^{17}$ located between a collar $a^{18}$ on pipe $a^{11}$ and the junction box serves the double function of keeping the flanged end $a^{19}$ of the pipe $a^{11}$ pressed against a corresponding flange or shoulder of the shaft $a^{10}$, and holding the junction box against the end of shaft or trunnion $a^{10}$ to effect a tight joint.

The process of refrigeration disclosed in this specification as carried out by this form of apparatus is made the subject-matter of a divisional application filed by me on January 4, 1909, Serial No. 470,561.

I have found in practice that the absorbent salts or the solutions thereof formed with the ammonia have no appreciable action upon tin. Therefore, preferably, the apparatus should be formed of iron with a tin lining, or, a lining of a porcelain nature would give good results.

Having thus described my invention what I claim is:—

1. In a refrigerator system, the combination with a condenser and refrigerator, of a

combined generator and absorber, a solid absorbent contained therein and adapted to liquefy to form a solution when combined with an anhydrous vapor, a container or conductor for heating and cooling means for attemperating said absorber, an opening into the absorber for the refrigerant, and means for reversing the position of the generator and absorber to expose fresh surface of the absorbent material.

2. In a refrigerating system of the class described, a rotatable tank for the refrigerant, a hollow trunnion at one end for the passage of said refrigerant, a coil within said tank, a hollow trunnion at the opposite end, and means for introducing a heating and a cooling medium through said hollow trunnion into said coil, substantially as described.

3. In a refrigerating system of the class described, a rotatable tank or drum for the refrigerant, means for rotating said tank, a hollow trunnion for said tank, at one end through which the refrigerant passes, a coil within said tank, a trunnion at the opposite end having an inner passage communicating with one end of said coil and an outer passage connected to the other end, means for introducing a heating or cooling medium into one of said passages, and a waste pipe connected to the other passage, substantially as described.

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

WILLIAM W. SEAY.

Witnesses:
HENRY E. COOPER,
EDWARD N. SARTON.