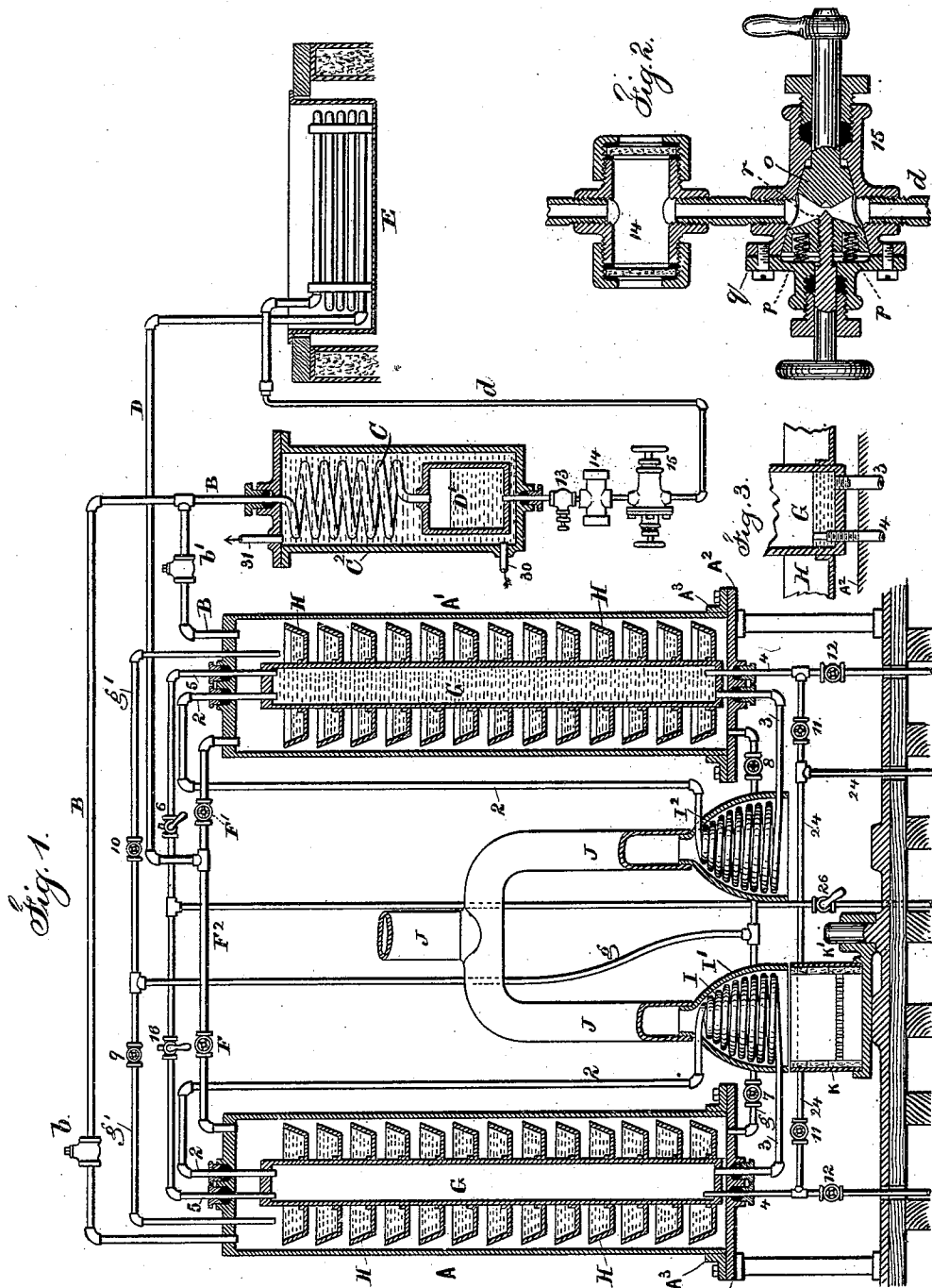


(No Model.)

D. L. HOLDEN.  
REFRIGERATING APPARATUS.

No. 473,157.

Patented Apr. 19, 1892.



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# UNITED STATES PATENT OFFICE.

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## REFRIGERATING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 473,157, dated April 19, 1892.

Application filed March 23, 1891. Serial No. 386,003. (No model.)

*To all whom it may concern:*

Be it known that I, DANIEL L. HOLDEN, a citizen of the United States, residing at the city, county, and State of New York, have invented an Improvement in Refrigerating Apparatus, of which the following is a specification.

This refrigerating apparatus is used with aqua-ammonia; and it is especially adapted to comparatively small refrigerating devices, such as required for butchers, hotels, saloons, &c., and it can be used as a single apparatus, in which the refrigerating operations alternate, or as a double apparatus, in which one portion is in use for generating anhydrous ammonia for refrigerating while ammonia vapors are being absorbed in solution in the other portion.

By this improvement several of the parts used in absorption refrigerating-machines—such as the pump, the absorber, the interchanger, and the cooler—are dispensed with.

In the drawings, Figure 1 is an elevation, partially in section, of the complete apparatus. Fig. 2 is a detached sectional view of the sight-feed and the stop-cock therewith connected in larger size, and Fig. 3 is a detached section at the bottom of one of the temperature-regulators.

I have shown vertical stills A A' connected together by a pipe F<sup>2</sup>, with cocks F and F', and there is a branch pipe D leading to the refrigerating apparatus E, into which refrigerating apparatus the liquid ammonia is passed by the pipe d, and the same expanding cools the apparatus, and the gases pass by the pipe D to either the still A or the still A'. The ammonia-gas from the stills or generators passes by the pipe B to the coil in the condenser C, there being check-valves or cocks b and b', and the liquid ammonia passes from the condenser C to the receiver D', with which the lower end of the ammonia-pipe d is connected, as hereinafter described, and when only one still A is used provision is made, as hereinafter described, for reducing the temperature of the same to absorb the gaseous ammonia, and then such still is warmed to volatilize the ammoniacal gas and cause the same to pass to the condenser C; but where two stills are employed, as shown, the one is

being used for the absorption of the gaseous ammonia passing through the pipe D from the refrigerator, while the other still is warmed for volatilizing the ammonia to cause the same to pass off by the pipe B to the condenser C, and when the gaseous ammonia is driven off from one still the operations are reversed.

Each still is made of a vertical tube closed at the upper end and received at its lower end upon a base or head A<sup>2</sup>, to which it is bolted, there being a ring-flange A<sup>3</sup> around the metal tube. Within the still is a temperature-regulator G, around which pans H are tightly secured. These pans may be of any suitable character, such as shown in my application, Serial No. 386,002, filed March 23, 1891, or the pans may be complete and annular and screwed upon the exterior of the temperature-regulator or connected thereto in any other suitable manner. A suitable heater is provided for the temperature-regulators G. I have shown a coil of pipe and a movable heater K. A coil I of pipe is provided with a case I', and from the upper end of the coil the pipe 2 leads to the upper end of the temperature-regulator G and the pipe 3 to the lower end thereof, and it is advantageous to pass these pipes through stuffing-boxes or glands in the top and bottom heads of the respective stills. There is also a water-pipe 24, with supply-cocks 11 and pipes 4, passing into the regulators. The water is allowed to escape from the temperature-regulator by pipes that may rise within the same or be connected with the upper end thereof, as represented at 5, with cocks 6 and 16 to allow water to run off to a sewer or other place of discharge by the pipe and cock 26. The pipe 4 rises above the inner surface of the temperature-regulator, at the lower end thereof, and when the cock 12 is opened and the cock 11 closed water contained in the temperature-regulator can be drawn off to a sewer or receptacle, but not below the upper end of said pipe 4. Hence the water will remain in the lower end of the regulator, as shown in Fig. 3, and in the pipes 3 and coils, and this pipe 4 can be raised or lowered sufficiently to retain the proper quantity of water, so that when heat is applied to the coil the water therein and in the

lower end of the regulator G is turned into steam and it fills the regulator G, and any water of condensation in the temperature-regulator running back by the pipes 3 into the coil is vaporized and again passed into the regulator G, and the quantity of water left in the regulator G and coil will only be sufficient for the production of the proper quantity of steam for filling the temperature-regulator G at the desired pressure. Hence the apparatus cannot be injured by the careless application of fire to the coil, which is of great advantage, especially where a refrigerating apparatus is made use of by inexperienced persons. A heater is provided for burning gas, petroleum, coal, or other suitable fuel. I have represented a fire-pot or burner at K.

Where two stills are employed I make use of a heater K upon a pivoted support K', and this heater can be swung under either the coil I or the coil I<sup>2</sup>, and the gases and products of combustion pass by the flue-pipes J.

The coils are preferably with large stills; but with smaller stills or generators the temperature-regulator G may pass through or be connected with the bottom head of the still, so that the heater may act directly thereon to vaporize the water that is allowed to remain in the bottom of such temperature-regulator.

There is a pipe g, with branches and cocks 7 and 8, leading to the bottom of the respective stills, and branches g' and cocks 9 and 10 to the top of the stills.

The apparatus is to be used as follows:

When the cock F' is opened, the ammonia-vapors from the refrigerating apparatus pass by the pipe D into the still A', and during this time water is to be run into the temperature-regulator G of that still by its cock 11 and pipe 4, and the warm water passes off by the pipe 5, the cocks 6 and 26 being opened, and in this manner the still A' is kept sufficiently cool for the ammonia-gases to be absorbed by the liquid in the pans H. During the absorption of the ammonia-vapors in the still A' the still A is made use of for driving off anhydrous ammonia from the pans H in that still. During this time the heater K is beneath the coil I, and the water in such coil is converted into steam to fill the temperature-regulator G of this still A at the proper pressure, as aforesaid, and the ammonia-gases pass by the check-valve b and pipe B to the condenser C, where they are condensed, as usual, and the liquid ammonia runs into the receiver D', and thence passes by the ammonia-pipe d into the refrigerating apparatus E. Should any liquid overflow from the pans and run into the bottom of the still A, the pressure therein of the vapors will be sufficient to drive this liquid by the pipe g into the pans in the still A' when the cocks 7 and 10 are opened, and in so doing the pressure in the stills or generators is equalized, and the cool still is also warmed by the escaping vapors. After the ammonia in the still A has been volatilized

the heater K is swung from beneath the coil I and water is admitted by the pipe 4 and cock 11, which not only condenses the steam in the temperature-regulator of the still A, but it fills the coil I with water, and then it cools the still and the contents of the pans H, and the ammonia-vapors are to be admitted to the still A by opening the cock F, and they are shut off from the still A' by closing the cock F', and the ammonia-vapors from the refrigerating apparatus are absorbed by the liquid in the pans H of the still A, such pans being kept cool by the water flowing through the pipe 4 and away by the pipe 5 and cock 16 and pipe and cock 26. The cocks 6 and 16 have, preferably, three-way plugs to admit air to the top of the temperature-regulator when the water is drawn off through the pipe 4 and cock 12 of that regulator. When the water in the temperature-regulator G of the still A' is allowed to run off by the cock 12 to the sewer, the necessary amount of water remains in the bottom of such regulator and in the coil I<sup>2</sup>, according to the height of the upper end of the pipe 4, as before described. The cocks 6 and 12 are now closed and the water in the coil I<sup>2</sup> is evaporated by the heater K being swung beneath the same, and the steam fills the regulator G and the anhydrous ammonia is driven off to the condenser C. During this operation the ammonia-vapors from the refrigerating apparatus E pass by the pipe D and cock F into the still A and are absorbed therein.

By the before-described improvements the refrigerating apparatus can be kept in constant operation by using the stills A and A' alternately as absorbers and vaporizers; but where only one still is made use of it is cooled by the water, as before described, when used for absorbing the ammonia, and then the anhydrous ammonia is driven off to the condenser by the steam in the temperature-regulator when the heater is brought into action.

It is important to be able to observe whether the liquid ammonia is passing properly from the holder D' to the pipe d. With this object in view I provide a cock 13, a sight-feed 14, and a cock 15. This sight-feed is made of a cylinder with glass at each end, and the liquid ammonia passes from the cock 13 across inside the cylinder 14 and passes on to the cock 15, and it is important to regulate the passage of the liquid ammonia through the cock 15, so that a regulated supply of the liquid ammonia may go to the refrigerating apparatus, and the small hole in this cock 15 is liable to become obstructed by foreign substances. I make this cock 15 with a reversible plug o, in which is an opening in the form of two truncated cones united at their apex, and the spindle of the reversible plug passes out through a stuffing-box, and it is provided with a handle. Hence the reversible plug can receive a half-rotation to cause any obstruction that may have lodged in the contraction of

the passage-way in said cock to blow out, thus freeing the cock from such obstruction without having to stop the apparatus.

In ammonia apparatus great difficulty is experienced in keeping all the parts perfectly tight. I find it advantageous to make the spindle of the reversible plug at the small end thereof and to apply springs *p* between the larger end of the plug and the cap *q*, so as to press the plug reliably into its seat within the barrel of the cock, and I pass axially through the cap *q* an adjustable valve *r*, having the point adjacent to the contraction in the reversible plug, and this adjustable valve has a stem passing through a packing in the cap *q*, so that by rotating the stem and valve *r* the contracted passage-way in the reversible plug can be regulated at will to determine with accuracy the flow of the liquid ammonia through the cock 15.

The condenser C and holder D' are preferably both within a case C<sup>2</sup>, to which water or other cooling-liquid is supplied, the inlet being at the bottom by the pipe 30 and the overflow by the pipe 31 at the top. By this means the holder D' is protected from contact with the external atmosphere and the liquid ammonia is preserved in a cold condition and the condensation promoted.

By my present improvements the apparatus is rendered so simple and reliable that a person of ordinary intelligence can manage the same without risk of injury thereto.

It is advantageous to have one water-holding case C<sup>2</sup> for the condenser C and holder D'; but it might be divided, and the supply-pipe 30, being near the holder D', causes the coldest water to act upon the liquid ammonia in the holder to maintain the same at the lowest temperature to prevent the ammonia vaporizing.

I claim as my invention—

1. The combination, in a refrigerating apparatus, of an ammonia-still having within it a tubular temperature-regulator and a range of pans around the same, pipes and cocks for supplying water into the temperature-regulator and withdrawing the water therefrom, a coil of pipe for supplying steam to heat the regulators, said coil being below and connected at its ends to the temperature-regulator, whereby the proper amount of water is retained in the coil when the water is drawn off from the regulator, and a heater for the coil, whereby any excess of steam and pressure is avoided, substantially as specified.

2. The combination, in a refrigerating apparatus, of a still, a temperature-regulator within the still, pans surrounding and in close contact with the temperature-regulator, water-supply pipes and cocks to the temperature-regulator, a coil of pipe adapted to hold

water and connected at its ends to the temperature-regulator, and a heater for heating such coil, substantially as set forth.

3. The combination, with the refrigerator and condenser in a refrigerating apparatus, of two stills, each containing a tubular temperature-regulator and a range of pans around the same, pipes and cocks for connecting the respective stills alternately with the refrigerator and condenser, pipes and cocks for supplying water to the temperature-regulators alternately and withdrawing the water therefrom, two separate coils of pipe for supplying steam to heat the regulators, said coils being below and connected at their ends to the respective temperature-regulators, whereby each coil is filled with water at the same time as the temperature-regulator to which it is connected and the proper quantity allowed to remain in the coil automatically when the water is withdrawn from the temperature-regulator, and a movable heater for vaporizing the water in the respective coils to heat the temperature-regulators alternately, substantially as specified.

4. The combination, in a refrigerating apparatus, of a still having a tubular temperature-regulator within it, pipes and cocks for supplying water into the temperature-regulator and withdrawing the water therefrom, and a steam-generator, and a heating device, and pipes connecting the steam-generator to the temperature-regulator, the water being supplied automatically into the steam-generator from the temperature-regulator, there remaining in the generator only the quantity of water required for steam when the water is withdrawn from the temperature-regulator, substantially as specified.

5. The combination, with the still or generator in a refrigerating apparatus, of a temperature-regulator within the still, a heater for the same, water-supply pipe and cock, and a discharge-pipe rising above the bottom of the temperature-regulator for retaining therein the water necessary to be vaporized by the heater for heating the temperature-regulator, substantially as set forth.

6. The combination, with the refrigerator, a condenser, and the holder for the liquid ammonia below said condenser, of a cock for regulating the passage of the liquid ammonia from the holder and a cylinder below the cock, having glass at both ends, so as to permit of observing the flow of the liquid ammonia through the cylinder to the refrigerating apparatus, substantially as set forth.

Signed by me this 16th day of March, 1891.

DANIEL L. HOLDEN.

Witnesses:

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