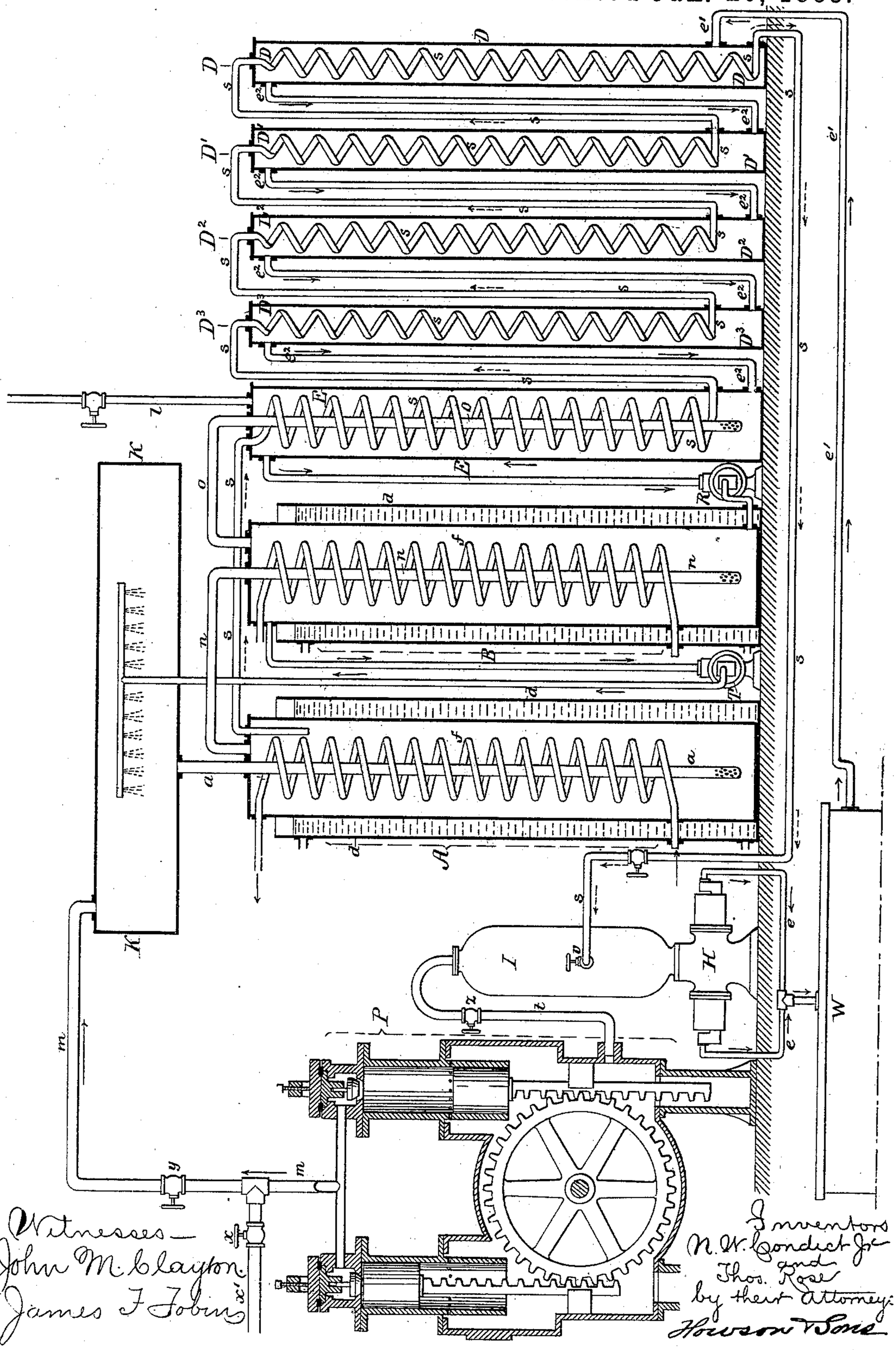
(No Model.)

N. W. CONDICT, Jr. & T. ROSE.

REFRIGERATING APPARATUS.

No. 311,062. Patented Jan. 20, 1885.



UNITED STATES PATENT OFFICE.

NATHAN W. CONDICT, JR., OF JERSEY CITY, NEW JERSEY, AND THOMAS ROSE, OF BROOKLYN, NEW YORK.

REFRIGERATING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 311,062, dated January 20, 1885.

Application filed November 24, 1884. (No model.)

To all whom it may concern:

Be it known that we, NATHAN W. CONDICT, Jr., a citizen of the United States, residing in Jersey City, New Jersey, and THOMAS ROSE, a subject of the Queen of Great Britain and Ireland, residing in Brooklyn, New York, have invented certain Improvements in Refrigerating Apparatus, of which the following is a specification.

Our invention consists of certain improvements, fully described and claimed hereinafter, in the refrigerating apparatus for which application for Letters Patent No. 128,206 was filed by Thomas Rose, April 17, 1884, the said application having been allowed June 20, 1884.

The accompanying drawing illustrates, partly in section, the refrigerating apparatus with our improvements.

The parts composing the apparatus are as follows: first, a gas-pump, P, preferably constructed in the manner hereinafter set forth; second, a receiver, K; third, a pipe, *m*, through which the gas is forced from the pump into the receiver K, the pipe being furnished with suitable stop-valves, *x* and *y;* fourth, the vacuum-chamber I and a pipe, *t*, forming a communication between said chamber and the inlet-chamber of the pump; fifth, a pump, H, below or adjoining the vacuum-chamber I, and having an inlet-chamber communicating therewith; sixth, an absorber, A, with which the receiver K communicates through a pipe, *a;* seventh, a secondary absorber, B, similar to the first, and communicating therewith through a pipe, *n;* eighth, a refrigerating-chamber, W, which contains a system of refrigerating-pipes, and which can be constructed in different ways without departing from our invention; ninth, pipes *e*, through which the pump H forces the refrigerating solution derived from the vacuum-chamber into the pipes of the refrigerating-chamber, the said pipes forming a continuation of the spent-liquor pipe *e';* tenth, a series of vessels, D D′ D^2 D^3, forming, with connecting-pipes e^2, continuations of the spent-liquor pipe *e'*, and forming a communication between the latter and the vessel E; eleventh, a circulating-pump, R, for forcing the spent liquor into the secondary absorber B; twelfth, another circulating-pump, T, for forcing the spent liquor received from the secondary absorber into the receiver K; thirteenth, a pipe, *s*, furnished with a stop or feed valve, *v*, and forming a communication between the first absorber, A, and the vacuum-chamber, and in its course assuming the form of coils in the several vessels D, D′, D^2, D^3, and E.

In order to charge the machine with hydrate of ammonia in the first instance, the valve *y* is closed and the valves *x z v* opened, after which the pump P is set in motion, so as to expel the air from every part of the machine through a branch, *x'*, of the valve *x*. If, after this, the valves *z* and *v* be closed and a temporary communication be made between the pipe *l* and a vessel containing a proper quantity of the solution, and the stop-valve of the pipe be opened, this solution will enter the machine through the vessel E, and when the solution can be seen through a gage-glass on the absorber A the apparatus will be properly charged and the valve of the pipe *l* may be closed.

To set the apparatus in motion the valve *x* must be closed, and the valves *y* and *z* opened, and feed-valve *v* so adjusted that mercury in a gage-glass attached to the vacuum-chamber I shall register at about 27° of vacuum. The saturated solution is conveyed by the pipe *s* to the vacuum-chamber I, and is admitted thereto in suitable quantity through the said valve *v*. In this chamber the solution comes under the influence of the pump P by way of the pipe *t*, the pump extracting a portion of gas from the solution and reducing the temperature of the remaining solution nearly to zero. This remaining solution coming under the influence of the pump H is forced through any desirable system of pipes or passages in the refrigerating-chamber W, and when the solution in traversing these pipes has absorbed the requisite amount of heat it becomes spent liquor, which, on leaving the said refrigerating-chamber by the pipe *e'*, has to be returned to the absorber A, to be resaturated with gas, which is constantly entering the said absorber from the pump P through the pipe *m*, receiver K, and pipe *a*, the latter extending nearly to the bottom of the said absorber. The spent liquor which leaves the pipes of

the refrigerating-chamber by way of the pipe *e'* takes a circuitous course before it reaches the absorber, for the vessels D, D', D², D³, and E are really enlarged continuations of the said pipe *e'*, and are always full of the spent solution, which, on leaving the vessel E, comes under the influence of the pump R, and is forced by the latter into the secondary absorber B, where it flows to the pump T, and by the latter is forced into the receiver K, where it is partially saturated with gas from the pump P prior to entering the absorber A, where it is thoroughly saturated. The strength of the solution fed to the machine determines, in a great measure, the temperature of the refrigerating solution which enters the pump H, and it is most desirable to have the solution saturated at its full strength at all times. In using one absorber only this is difficult of accomplishment without at times creating some pressure in the machine; but by adding a second absorber, B, to take up the excess of gas from the first, this trouble is entirely overcome. The temperature of the feed solution as it enters the vacuum-chamber I also influences the refrigerating solution, and hence it is important that this feed solution should be reduced in temperature on its way from the absorber A to the vacuum-chamber I. This is done by continuing the conveying-pipe *s* in the form of coils—one coil in each of the vessels D, D', D², D³, and E—before the said pipe reaches the vacuum-chamber. These coils being always immersed in the spent liquor as the latter is being circulated through the said vessels in the direction pointed out, it necessarily follows that the feed solution must be reduced in temperature in its course from the absorber to the vacuum-chamber. The feed solution will often leave the absorber A at a temperature of 80° Fahrenheit, whereas the temperature of the spent liquor from the refrigerator rarely exceeds 30°; but by passing the feed solution in one direction through the pipes exposed to the spent solution circulating in a contrary direction the feed solution will enter the vacuum-chamber I at or near a temperature of 30°, while the spent liquor will enter the absorber at or near a temperature of 80°; but the spent liquor, on reaching the absorber, where it is saturated with gas, must be reduced in temperature, and this is brought about in the present instance by the circulation of cold water within a jacket, *d*, surrounding the chamber, and through the coil *f*, in which cold water is also circulated, the secondary absorber B being under similar cooling influences. When the spent liquor has reached the vessel E, it flows thence, as before remarked, into the chamber of the small pump R, and is forced thereby into the secondary absorber B, and thence it passes to the chamber of another small pump, T, and is forced thereby into the receiver K. The reason for this arrangement of circulating-pumps is to enable gas to pass from the absorber A to the absorber B through the pipe *n*, and air, if any, to pass from the secondary absorber B to the vessel E through the pipe *o*. The presence of air in the machine may sometimes occur, owing to leaky joints. Should this be the case, it will pass from the secondary absorber into the vessel E, and can be permitted to escape through the pipe *l*. The presence of air in the machine may be indicated by a pressure-gage applied to the receiver K. The spent liquor is pumped into the receiver K rather than into the absorber A, because it will take up some gas in its passage from K to A down the pipe *a*, and so reduce the quantity of gas to be admitted to the absorber. The receiver K has other uses. For example, it materially reduces the intermittent action of the gas-pump, and so induces the gas to flow in a comparatively uniform current into the absorber A; but its principal use is to prevent the flow of the solution into the pump P when the machine is stopped, which it would do should the pipe *m* be carried directly into the absorber A.

It should here be understood that in carrying out the main feature of our invention it is not essential to adhere to the construction of the several parts or arrangements of parts illustrated in the drawing, which has been introduced more as a diagram to illustrate the mode of operation of the invention and some of its special features than as a definite guide for constructing and arranging the several parts. Other systems of pipes or passages, for instance, may be adopted for causing the spent solution, on its way to the absorber, to reduce the temperature of the feed solution on its way to the vacuum-chamber. It may be stated, however, that it has been found to be economical and efficient in practice to use lap-welded tubes with cast-iron tops and bases for the several vessels, and to use lead pipes for the coils. It may be remarked, as a conclusion to the above description of the apparatus, that its operations are entirely under the control of the feed-valve *v*, and that when the latter has been once properly adjusted the apparatus will continue in action without intermission as long as the movements of the pumps are continued. The pump P is preferably similar to that described in an application for a patent filed by N. W. Condict, March 31, 1884, Serial No. 126,098, certain features of the pump being also shown in the application for a patent filed by Thomas Rose, March 31, 1884, Serial No. 126,188.

We claim as our invention—

1. The combination of the absorber of refrigerating apparatus with a secondary absorber communicating with the first, for receiving from the latter any surplus gas, and thereby preventing the creation of pressure in the apparatus, substantially as set forth.

2. The combination of the pipe *e'*, for carrying the feed solution from the pipes or passages of the refrigerating-chamber, a series of vessels, D D', &c., forming enlarged continu-

ations of the pipe, the pipe *s*, for conveying the solution from the absorber to the vacuum-chamber, and coils forming parts of the pipes and contained in the above-mentioned vessels, substantially as specified.

3. The combination of the first and secondary absorbers and the vessel E and its pipe *l* with the circulating-pumps R and T and receiver K, communicating with the first absorber, substantially as described.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

NATHAN W. CONDICT, JR.
THOMAS ROSE.

Witnesses:
JOHN M. CLAYTON,
HARRY SMITH.