(No Model.) 2 Sheets—Sheet 1.

P. G. & C. A. RANDALL.

ICE AND REFRIGERATING MACHINE.

No. 301,390. Patented July 1, 1884.

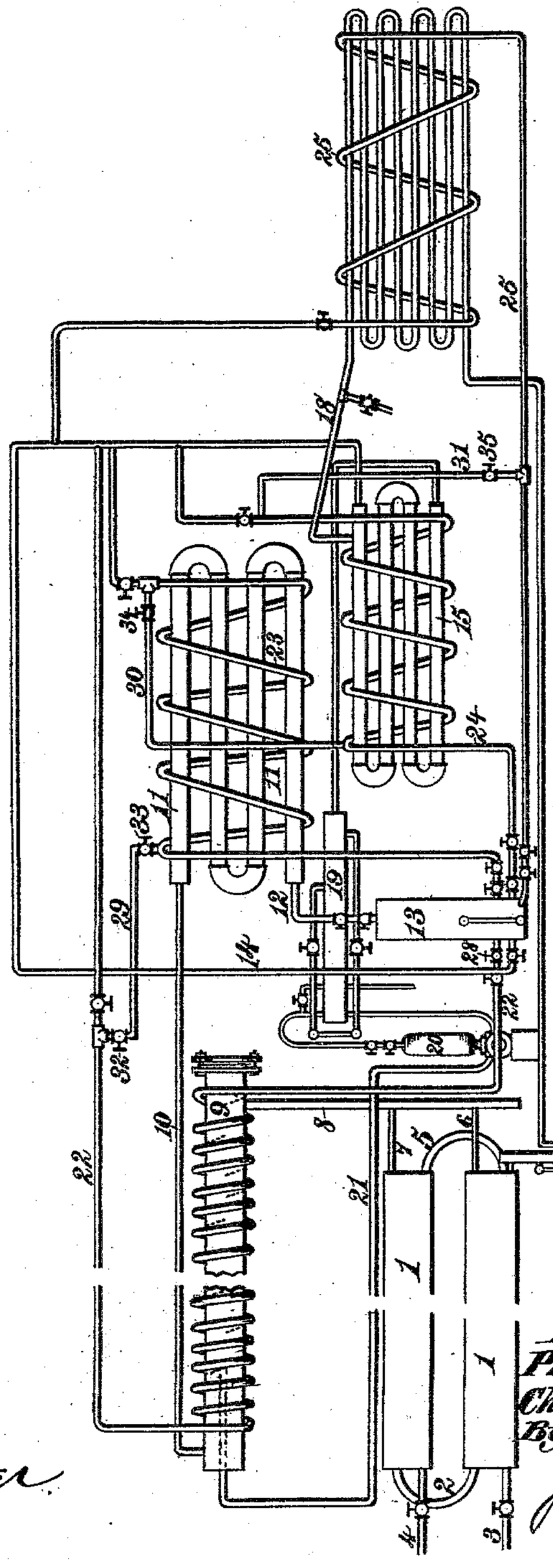

Fig. 1.

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(No Model.) 2 Sheets—Sheet 2.

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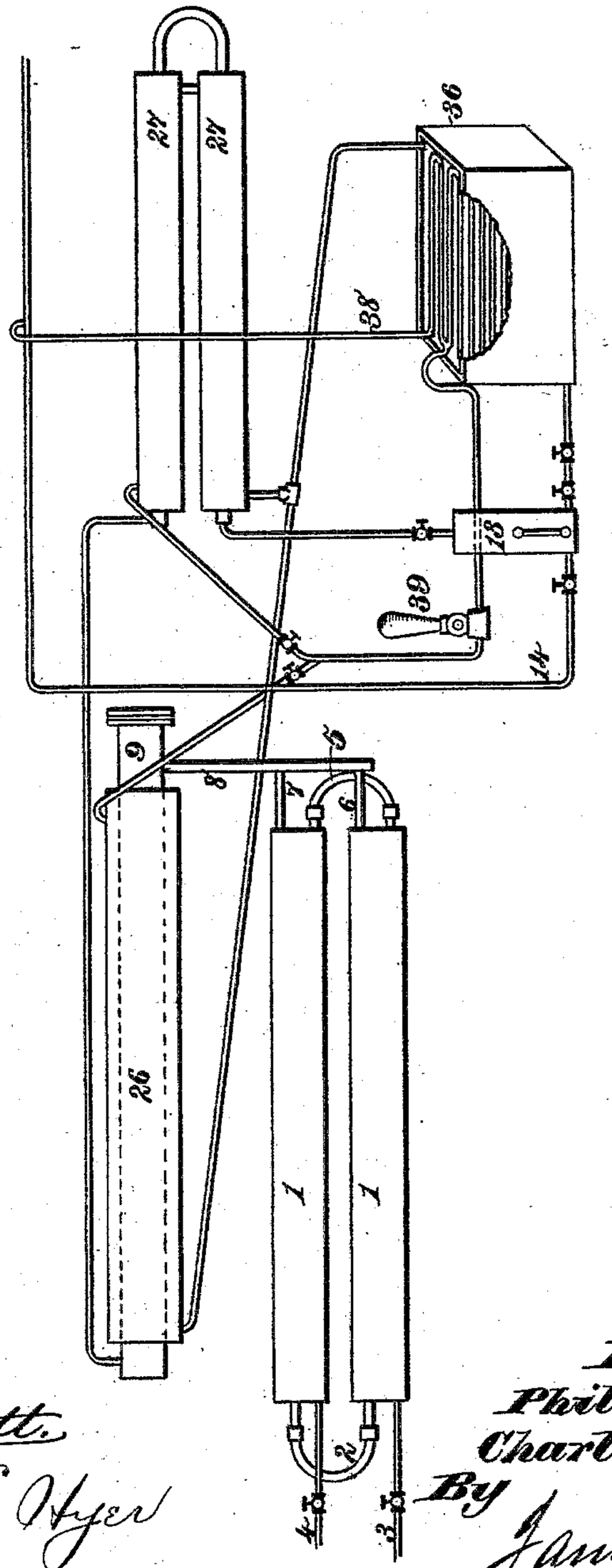
Fig. 2.



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UNITED STATES PATENT OFFICE.

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ICE AND REFRIGERATING MACHINE.

SPECIFICATION forming part of Letters Patent No. 301,390, dated July 1, 1884.

Application filed April 9, 1884. (No model.)

To all whom it may concern:

Be it known that we, PHILIP G. RANDALL, a citizen of the United States, residing at Brooklyn, in the county of Kings and State of New York, and CHARLES A. RANDALL, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented new and useful Improvements in Ice and Refrigerating Machines, of which the following is a specification.

Our invention relates to certain improvements in ice and refrigerating machines, and more especially to the class known as "absorption-machines," wherein the ammoniacal gas, after passing through the condenser and the expansion or cooling pipes, is conducted to an absorber, where it is united with the liquid residue remaining in the vaporizing-still, commonly known as "weak water," and the resulting aqua-ammonia of normal strength is conducted back to the still to be revaporized.

The objects of our invention are, first, to prevent the passage of the steam and hot water from the still to the condenser and expansion-pipes, usually termed "boiling over," and thus to secure the production of a pure dry ammoniacal gas; second, to obtain the proper temperature for the condenser, absorber, and the apparatus generally.

In the attempt to accomplish the first of these objects many different plans have been suggested and resorted to. The means most commonly employed are to provide the stand-pipe between the still and the condenser with interior "drip-plates," upon which the "strong water" on its return to the still for redistillation is sprayed or caused to drip, condensing any steam in the stand-pipe and separating the steam from the ammonia-gas. Water-pipes have also been placed in the still itself, through which was passed water of a temperature slightly lower than that of the steam, which tended to condense it before leaving the still. Another plan has been to surround the condenser and absorber with water-jackets. This plan has not proved successful, not only because of the expense of constructing water-tight removable jackets, but also on account of the large amount of water required, which in many localities is a serious consideration.

To accomplish these objects our invention consists, first, in the process of utilizing the ammoniacal gas in the expansion-pipes to reduce the temperature in the pipe leading from the still to the condenser and the gas and steam therein, either by the direct application of such gas itself or by means of brine or water previously cooled thereby, the result being that any steam which finds its way into such pipe is immediately condensed and prevented from mingling with the dry gas in the condenser.

It consists, further, in a series of independent expansion-pipes leading from the liquefied-gas receiver to the stand-pipe, condenser, absorber, and weak-water coil, and surrounding or otherwise in contact with such parts.

It consists, also, in means for connecting these independent pipes or any of them when desired to form one or more circuits; and, finally, it consists in various details in the construction and arrangement of the apparatus, all of which will be more fully hereinafter explained.

In the accompanying drawings, Figure 1 is a side elevation of our entire apparatus, and Fig. 2 represents a modification.

In these drawings, 1 1 represent the pipes composing the still or retort connected at one end by a small pipe, 2, and adapted to be about half filled with aqua-ammonia. Steam-pipes 3 4 are connected by a pipe, 5. The ammonia-gas leaves the still through pipes 6 7, and passes through the pipe 8 to the transfer or stand pipe 9. Thence it passes by pipe 10 to the condensing-coil 11, where it is cooled and liquefied and allowed to run through the pipe 12 into the receiver 13. The gas in this receiver, being strongly compressed, will expand with great force when released. The receiver is connected either with expansion-pipes running through the building to be cooled or with an ice-making apparatus consisting of a tank of brine, in which cans of pure water may be immersed.

The system of pipes for cooling the atmosphere is represented by the pipe 14, connect-

ed to the receiver 13, and having a suitable valve and stop-cock. The expanding gas passes through this pipe, lowering the temperature of the air surrounding it to the "absorber" 15, which is a series of connected parallel pipes or a common coil. To this absorber is also connected one end of the weak-water pipe 18, the other end entering the weak-water receiver 17, which is in turn connected to the still. The weak water is allowed to flow constantly and in suitable quantity from the still to the receiver 17, thence through the pipe and coil 18 to the absorber, where it mingles with the liquefied gas, forming aqua-ammonia or "strong water" of normal strength. All these pipes are of course provided with proper stop-cocks to cut off or regulate the flow of gas or liquid, so that the proper proportion of both are united in the absorber. The aqua-ammonia in the absorber passes thence to the strong-water receiver 19, from which it is forced by a pump, 20, through a pipe, 21, into the stand-pipe 9, and thence to the still.

The devices thus far described are well known in machines of the class, and form no part of the present invention, which we now proceed to describe.

It being our purpose to utilize a portion of the expansive gas supplied from the condenser both to prevent boiling over and to produce the proper temperature in the apparatus, we surround the stand-pipe, the condenser, the absorber, and the weak-water pipe with coils of pipe which are independently connected to the receiver 12, and to the return or main expansion pipe 14. A pipe, 22, having stop-cock 28, leads from the receiver 13 to and surrounding the stand-pipe, while pipes 23, 24, and 25 lead from the receiver to the condenser, absorber, and weak-water coil, and are all connected independently, as stated, with the pipe 14. All these pipes having proper stop-cocks, it is evident that they may be used separately or simultaneously, as desired. In this case, however, their operation is entirely independent, and, as it may be desirable to cause the gas to pass in a single circuit throughout the apparatus, we have provided the pipe-connections 29 30 31 and stop-cocks 32 33 34 35. By closing the proper stop-cocks, therefore, the gas will pass from the receiver 13, through pipe 22, and around the stand-pipe, through pipes 29 and 23 around the condenser, through pipes 34 and 24 and around the absorber, and thence through pipes 35 and 25 around the coil 18 to the absorber 15. The intense coldness produced by the gas reduces the temperature to such an extent that boiling over in the stand-pipe is prevented, while in addition temperature is maintained at the proper point in the various parts of the apparatus.

A modified form of my apparatus is shown in Fig. 2. In the process there illustrated, instead of conveying the ammoniacal gas directly through pipes which surround the stand-pipe, condenser, &c., we use the same gas for cooling brine or water and force such brine or water into jackets or coils which surround those parts. So far as the essential principle—the utilization of the expanded gas for reducing the temperature—is concerned, the processes are identical. A tank, 36, containing water or brine, incloses a coiled expansion-pipe connected with the receiver 13, and also by means of a pipe, 38, with the absorber. (Not shown.) By means of a pump, 39, the cooled brine is forced through pipes into a jacket, 26, surrounding the stand-pipe, and into jackets 27, surrounding the condenser, whence it will return by gravity to the tank.

Although independent pipes and cocks are shown leading to the respective jackets 26 and 27, it is evident that by a slight change a single stream of cooled brine or water may be caused to pass into the jackets 26 27 in turn. Obviously, also, the tank may be elevated above the apparatus, and the pump used for returning the water which descends by gravity to such tank, and, further, that it is not necessary to employ the water-jackets shown. Coils might be substituted for them, or the brine or water could be sprayed or allowed to drip upon the pipes themselves. We have also found that our process may be used to advantage in the class of machines known as "power" or "compression" machines, especially for cooling some parts where water at ordinary temperature is now employed, and consequently we do not limit ourselves to its use in absorption-machines alone.

While we have shown separate connections to the receiver 13 for the expansion-pipes, it will be understood that the main expansion-pipe can be connected to the receiver, and the separate and independent expansion-pipes may be connected to the main expansion-pipe at points thereon that may be found convenient without departing from the principle.

Having thus described our invention, what we claim is—

1. The process of preventing boiling over, or the passage of steam into the condenser of ice and refrigerating machines, which consists in condensing the steam before reaching the condenser by means of the expansive ammoniacal gas produced in such condenser, substantially as described.

2. The process of preventing the escape of steam into the condenser of an ice and refrigerating machine, which consists in causing the expansive ammoniacal gas to pass from the condenser to and around the transfer-pipe leading from the vaporizing-retort to such condenser, substantially as described.

3. The combination, in an ice and refrigerating machine, of a distilling-retort, a condenser, a transfer or stand pipe, a liquid-gas receiver, and an expansion-pipe connected to the said receiver and surrounding the stand-pipe, substantially as described.

4. The combination, with the distilling-retort, of a condenser, an absorber, a weak-water pipe, a liquefied-gas receiver, and inde-

pendent expansion-pipes connected to the gas receiver and absorber, and surrounding the said condenser, absorber, and coil, substantially as described.

5. The combination, with the condenser, the receiver 13, the stand or transfer pipe, the absorber, and the coil 18 of pipes, leading, respectively, to said stand-pipe, condenser, absorber, and coil and branch or connecting pipes and stop-cocks, all substantially as described.

In testimony whereof we affix our signatures in presence of two witnesses.

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