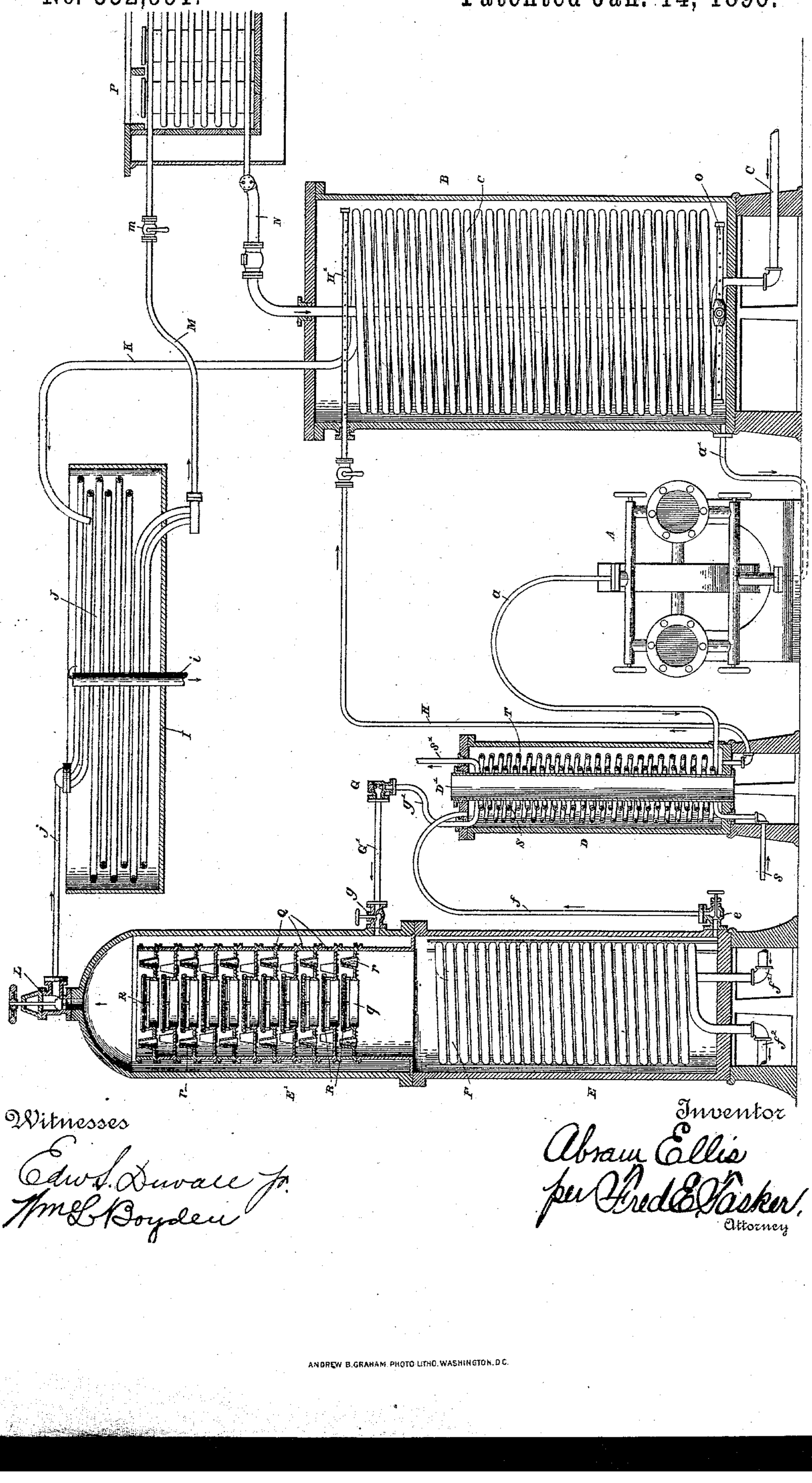
(No Model.)

A. ELLIS.

ABSORPTION ICE MACHINE.

No. 552,991. Patented Jan. 14, 1896.



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UNITED STATES PATENT OFFICE.

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ABSORPTION ICE-MACHINE.

SPECIFICATION forming part of Letters Patent No. 552,991, dated January 14, 1896.

Application filed June 11, 1892. Serial No. 436,376. (No model.)

To all whom it may concern:

Be it known that I, ABRAM ELLIS, a citizen of the United States, residing at Columbus, in the county of Muscogee and State of Georgia, have invented certain new and useful Improvements in Absorption Ice-Machines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to an improvement in a process for manufacturing artificial ice and in the construction of that class of ice-making machinery commonly called "absorption" ice-machines, the object of the invention being to construct a machine having as few parts and as simple an arrangement as possible and to devise a process by means of which ice can be manufactured cheaply and expeditiously; and the invention therefore consists in the herein-described process and also in the construction, arrangement, and combination of the several parts of the apparatus, substantially as will be hereinafter described and then particularly pointed out in the appended clauses of claim.

In the accompanying drawing, illustrating my invention, I have delineated a general view of the apparatus, the generator, the combined heater and exchanger, the absorber, the liquefying-tank, and the refrigerator being shown in section, while the ammonia-pump and connections between the several parts are shown in elevation.

A designates the ammonia-pump, which may be of any suitable and ordinary construction. I lay no claim to the special and detailed form of this pump, as any proper mechanism which will operate for this purpose may be employed. The ammonia-boiler, which is situated at a short distance from the ammonia-pump, may be of any suitable size and shape, and it comprises the analyzer E′, containing the rectifying-pans Q, which are provided with the central openings *q* and the gas-nozzles *r* and also with the flat plates or pans R located above the central openings *q*, and the ammonia-still also comprises the lower part E, containing the pipe-coil F, arranged therein, said coil having the inlet end *f′* and the outlet end *f²* and containing steam, which is supplied thereto in its live condition through the steam-inlet and which is used for the purpose of boiling the ammonia in the lower section of the still, so as to separate the ammoniacal gas which rises upward through the rectifying-pans.

I denotes the condenser, which is filled with water through the pipe K. Within the liquefying-tank is arranged the liquefying-coil J, which is entered by the gas coming through the pipe *j* from the outlet-valve L, located at the top of the upper boiler-section E′. The gas which passes up through the rectifying apparatus is permitted to find an exit through the valve L and pass onward thence in the direction of the arrow into the liquefying-coil, where it is liquefied. The liquefying-tank I is provided with an overflow-pipe *i*, through which the waste water has an exit. The liquefied gas, after being reduced to its liquefied form in the liquefying-coil J, passes therefrom through pipe M into the refrigerator P, within which are suitable ice-cans and a suitable pipe-coil. The pipe M is provided with an expansion-valve *m*.

B designates the absorber, within which is a large pipe-coil C having an inlet end *c*, through which cold water enters the pipe-coil. Said pipe-coil C at the top leads off into the pipe K, already mentioned, which conveys waste water from the absorber-coils and carries it up into the condenser I. A pipe N runs from the refrigerator and passes down into the absorber, being preferably located centrally therein and being provided at its lower end with a horizontal perforated pipe O. The pipe N returns the gas to the absorber and it finds entrance into the same through the perforations in the pipe O. The absorber B connects with the pump A by a suction-pipe *a′*, through which the rich liquor is drawn into the ammonia-pump by suction.

D donates the combined heater and exchanger, which is one of the most important features of my apparatus. It comprises a cylindrical chamber of suitable size. The upper head of the combined heater and exchanger is entered by a pipe or tube *f*, running from the lower end of the generator and serving to convey hot poor liquor of aqua-ammonia away from the ammonia-boiler into

the interior of the heater and exchanger. The pipe *f* is preferably provided at a point where it enters the generator with a valve *e* to control the exit of the poor liquor. In this way the poor liquor is transferred from the ammonia-boiler in a hot state to the heater and exchanger. Said heater and exchanger is provided centrally with a vertical cylindrical tube, serving as an air-flue and displacement-tube. Around this tube D′ and at a suitable distance between it and the wall of the heater and exchanger are coiled pipe-coils S and T, the coil S being the smaller and lying nearest to the air-flue D′. The coil S has at its lower end connection with the pipe *s* and at its upper end connection with pipe *s′*. The pipe-coil T has at its upper end a connection with the pipe *g′*, which connects by means of a coupling G with the inlet-pipe G′ that enters the upper section E′ of the ammonia-boiler and through which the heated rich liquor of aqua-ammonia is fed into the annular space in the upper part of the ammonia-boiler in order that the operations may be performed upon this rich liquor within the ammonia-boiler, which will separate the ammoniacal gas therefrom and permit the latter to pass out from the upper end of said boiler. The pipe-coil T connects at its lower end with the pipe *a* which enters the ammonia-pump A. Cool rich liquor from the ammonia-pump passes through the pipe *a* into the coil T, becoming heated while it is in the exchanger, and then goes on as hot liquor into the boiler. The pipe-coil S contains cold water which comes from the steam-boiler feeder—that is to say, cold water enters through the pipe *s* into the coil S and is therein heated to a certain extent so that when it issues from the coil through pipe *s′* at the top it is carried thence to the steam-boiler. Thus it will be seen that the combined heater and exchanger is filled with hot poor liquor which is in contact with the two coils S and T, said coil S being filled with water which enters it cool and said coil T containing rich liquor which likewise enters it cool, and that in consequence of the contact of the hot poor liquor with these two coils containing water and liquor respectively, as stated, the temperature of the several parts will become equalized to such an extent that the poor liquor within the heater and exchanger will be cooled and will pass out through the bottom of the heater and exchanger into the pipe H and be carried thereby into the absorber B, while the cool water will become heated and will pass out of the heater and exchanger, and the cold rich liquor will likewise become heated so that it will go in a hot condition out of the heater and exchanger and be forced in that condition into the ammonia-boiler. In this way all the heat contained in the poor liquor, which is taken from the bottom of the ammonia-boiler, will be utilized. It will be noted that the poor liquor is passed directly from the ammonia-boiler into the combined heater and exchanger and is carried thence to the absorber. Thus I do away with the cooling-coils, cooling-tank, feed-water heater and other parts which are commonly used in absorption ice-machines as at present constructed, and thus avoid complexity in the construction and arrangement of the parts as well as in the operation of the apparatus.

The air-flue and displacement-tube D′ located centrally in the combined heater and exchanger does a double duty in that it displaces the solid body of hot liquor inside of the small coil, thereby making a smaller body of liquor upon which the water within the coil is obliged to act, and it also furnishes a means of radiation. Commonly a tin pipe will be placed upon the top of the air-flue D′, which will create a draft and thus assist in cooling the hot weak ammonia before it returns to the absorber.

In the ordinary construction of an ice-machine as commonly employed in many instances at the present time a single coil of pipe is used, through which the weak ammonia passes, while the rich liquor or ammonia from the absorber is pumped around the outside of the said coil. The weak ammonia is then continued through the pipe to several coils in a tank and cold water is allowed to flow through said tank to carry off the remaining heat in the weak solution and cool it sufficiently to enable the gas from the freezing-tank to be absorbed.

My improved combined heater and exchanger, which I have already fully described herein, does away with the necessity of using the aforesaid coils and tank for cooling. It carries the rich liquor coming into the ammonia-boiler at a much higher temperature, thereby sooner relieving it of its gas and requiring less steam to keep it hot. It enables the water to be carried to the steam-boiler at about 195° Fahrenheit, thus requiring a great deal less fuel to keep up the steam-pressure, which is preferably about sixty pounds to the square inch. The saving of fuel, as shown by a practical test of the appliance as now running, is fully fifty per cent. It will therefore be fully and clearly observed that the combined heater and exchanger is an important element in the combination of parts which make up my improved ice-machine. An ice-machine constructed as I have described is much cheaper than when made in the ordinary way and the cost of construction is very greatly reduced.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination of the generator, in which ammoniacal liquor is boiled, a steam coil in said generator for heating said liquor, an analyzer arranged directly above the said steam coil so that the ammoniacal gas may rise upward thereinto, a liquefying apparatus having liquefying coils therein which are connected directly to the top of the analyzer and

lead the gas therefrom to be liquefied, a refrigerator, a pipe leading directly thereto from the liquefier, an absorber, a pipe for conveying gas thereto from the refrigerator, a cold water coil within the absorber, an ammonia pump, a pipe for delivering ammoniacal liquor thereto from the absorber, a heater and exchanger, two pipe coils therein, one of which is filled with water which enters it cold at one end and leaves it hot at the other end, while the other is filled with rich liquor which enters it cool through a direct connection with the ammonia pump at the bottom of the heater and exchanger and leaves it hot at the other end, through a pipe by which it passes into the generator from the top of the heater and exchanger, a pipe leading from the bottom of the generator to the top of the heater and exchanger for conveying hot weak liquor to fill the latter around the two pipe coils, a pipe leading from the bottom of the heater and exchanger for conveying the cool poor liquor from the latter to the absorber and the air flue or displacement tube located in a vertical concentric position within the pipe coils in the heater and exchanger so that there may be a smaller body of liquor in the annular space upon which the cooling coil is required to act, said flue also serving the purpose of radiation, substantially as described.

2. In an absorption ice machine, the combination with the generator, condenser, refrigerator, absorber and ammonia pump, of the combined heater and exchanger D, comprising a cylindrical chamber of suitable size, two similarly disposed concentric pipe coils therein, one of which is filled with water which enters it cold at one end and leaves it hot at the other end, while the other is filled with rich liquor which enters it cool through a direct connection with the ammonia pump at the bottom of the heater and leaves it hot at the other end, through a pipe by which it passes into the generator from the top of the heater and a supply pipe leading from the generator to the top of the heater and exchanger for conveying weak liquor to fill the latter around the two pipe coils, all the parts being thus arranged so that the stream of cool liquor may be conveyed through the heater and exchanger in a direction opposite to that of the movement of the stream of hot liquor which surrounds the pipe coils, and the open-ended displacement tube or air flue located in a vertical concentric position within the heater and exchanger so as to leave an annular space between it and the wall of the latter within which annular space the hot liquor acts upon the pipe coils, substantially as and for the purpose specified.

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

ABRAM ELLIS.

Witnesses:
T. L. TATE,
H. I. STRUPPA.