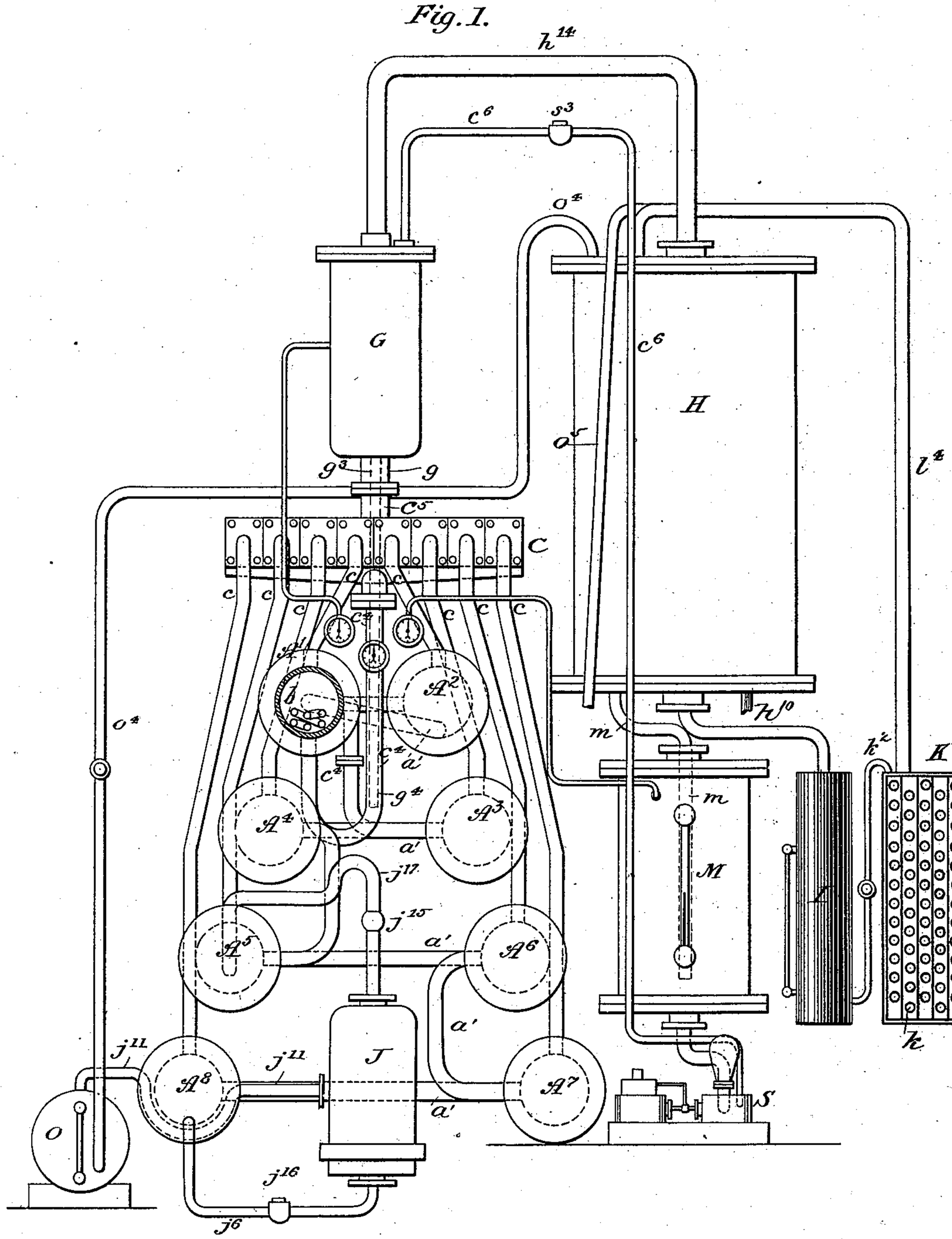
(No Model.) 3 Sheets—Sheet 1.

J. B. CRAFT.

APPARATUS FOR ICE MAKING AND REFRIGERATING.

No. 376,732. Patented Jan. 24, 1888.

Fig. 1.



Witnesses

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(No Model.) 3 Sheets—Sheet 2.

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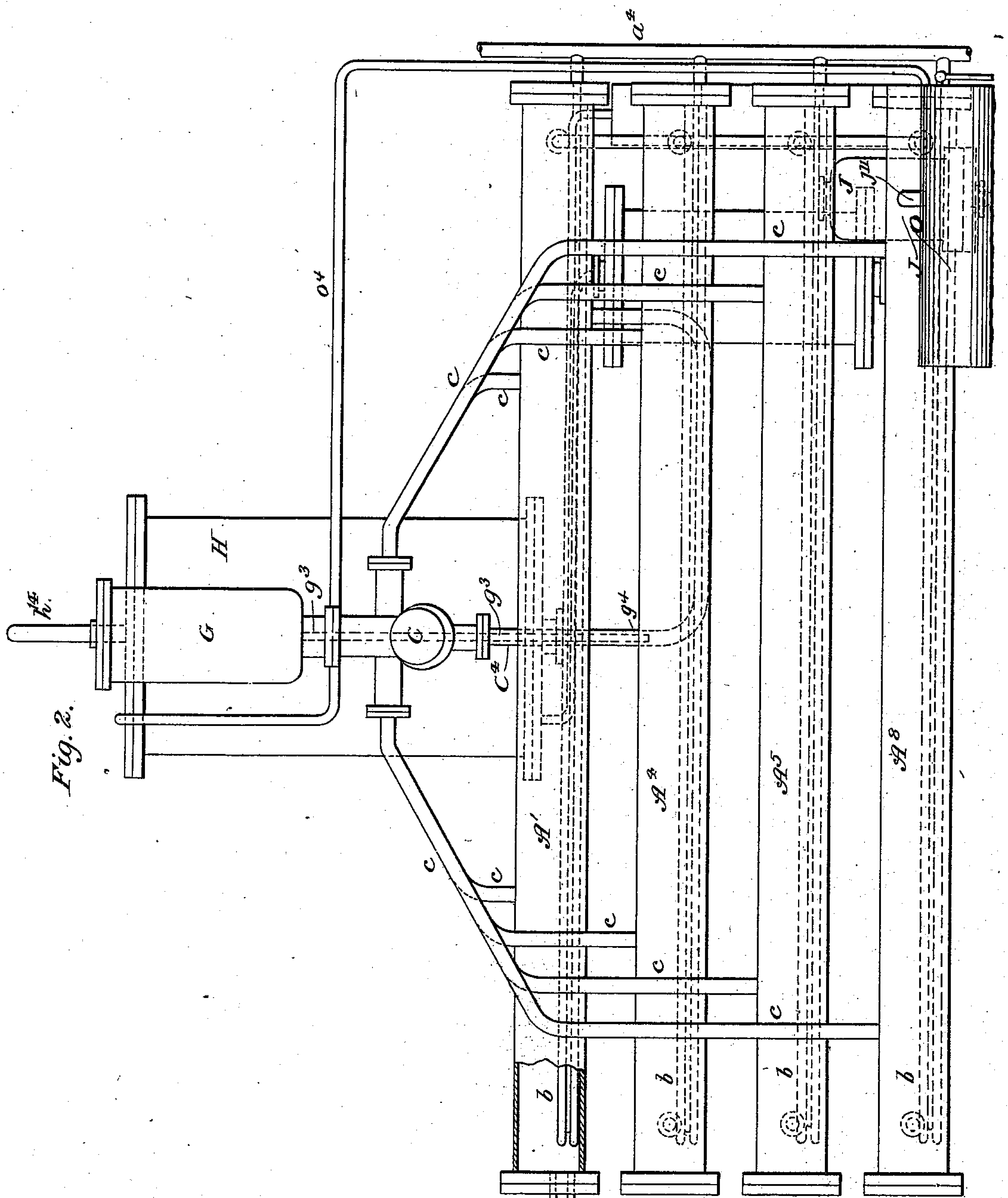

Fig. 2.

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(No Model.) 3 Sheets—Sheet 3.

J. B. CRAFT.

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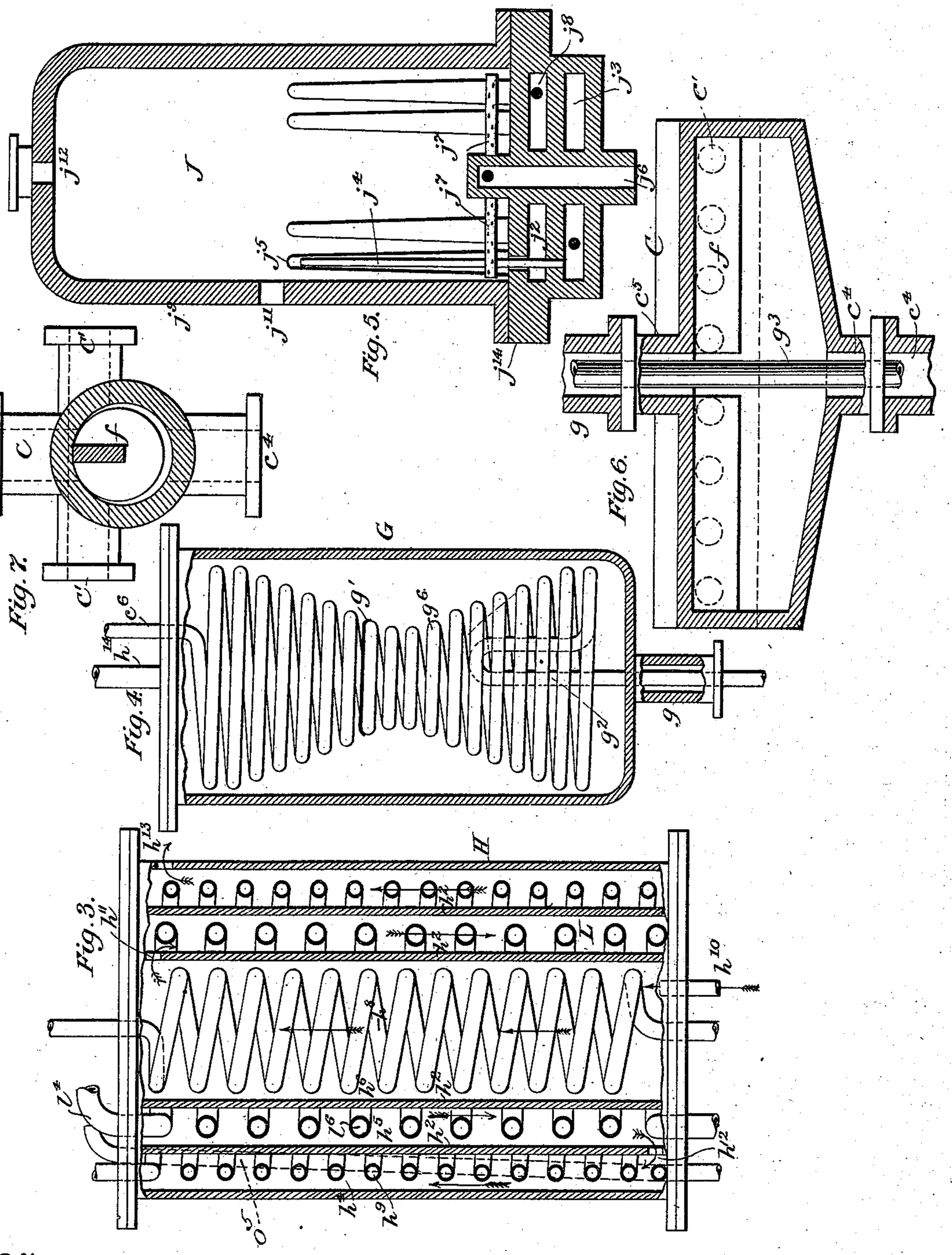

Fig. 5.

Fig. 6.

Fig. 7.

Fig. 4.

Fig. 3.

Witnesses

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UNITED STATES PATENT OFFICE.

JAMES B. CRAFT, OF NEW YORK, N. Y.

APPARATUS FOR ICE MAKING AND REFRIGERATING.

SPECIFICATION forming part of Letters Patent No. 376,732, dated January 24, 1888.

Application filed March 2, 1886. Serial No. 193,763. (No model.)

To all whom it may concern:

Be it known that I, JAMES B. CRAFT, a citizen of the United States, residing in New York city, New York, have invented certain new and useful Improvements in Apparatus for Ice Making and Refrigerating; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon, which form a part of this specification.

The invention has for its object to improve the devices and mechanism at present employed in ice and refrigerating machines that operate upon the absorption principle; and it consists of the improved mechanisms hereinafter described and claimed.

Heretofore great difficulty has arisen in the practical operation of absorption ice-machines from what is known as the "boiling over" of the liquid contents of the distilling-retorts, and especially so in machines in which the hot distilled gas on its passage from the distilling-retorts is used to heat the incoming cold strong water that supplies the distilling-retorts. Various devices have been heretofore used for conducting and receiving the heated gas from the distilling-retorts; but in all of them there has been a progressively-forward movement of the gas from the distilling-retorts over to the condensing apparatus without efficient checks to prevent boiling over, and where the distilled gas has on its upward passage from the distilling-retorts been employed to heat the incoming strong water, stand-pipes have been used to effect that end, in which the distilled gas is brought into actual contact with the water in various ways—such, for instance, as are shown in Letters Patent No. 318,971, issued June 2, 1885, to C. H. Evans, and in Letters Patent No. 316,824, issued April 28, 1885, to T. B. Rankin. The improved methods and apparatus herein described prevent the accident of boiling over and other incidental evils, by performing the operation of heating the incoming strong water by means of the outgoing hot distilled gas, and thereby accomplishing also the rectification of the distilled gas, all without actual physical contact of the cold water and hot gas; and the improved methods and apparatus herein described further prevent boiling over and remedy it if it begins to occur and accomplish simultaneously a continuous rectification of the distilled gas by the interposition of suitable obstructions to the progressively-forward movement of the distilled gas from the distilling-retort over to the condensing apparatus with suitable water-return vents or outlets back to the distilling-retorts, all as hereinafter described and claimed.

In the accompanying drawings, which represent my invention in its preferred form, Figure 1 is a front view of my machine. Fig. 2 is a side view of the same. Fig. 3 is a sectional view of my improved condenser. Fig. 4 is a sectional view of the rectifier. Fig. 5 is a sectional view of the redistiller. Fig. 6 is a sectional side view of the gas-receiver, and Fig. 7 is an end view of the same.

Similar letters refer to similar parts in the different drawings.

A represents the retorts or distilling vessels, eight in number, arranged as shown. These retorts are made of iron, or of any suitable material, and of any shape or size, but more commonly cylindrical. The arrangement of these retorts is preferably such as to make the complete "still" in the angular form of a letter **A**. These retorts may be supported upon an iron frame or upon masonry. The retorts are provided with steam-box coils *b b*, placed inside of the same. (See Figs. 1 and 2.) The strong water or aqua-ammonia, which is pumped up by the pump S through the pipe c^6 and coils g^6, Figs. 1 and 4, pours through the trap-pipe c^4 into the bottom of retort A′. That retort has an inch above its center an outlet-pipe, a', which enters retort A^2 an inch below its center. The latter has a similar overflow-connection with retort A^3, and that with A^4, and so on, in series, to A^8. The outlet in each instance is placed one inch above the center line, and the inlet one inch below the center line, of the retort, the backflow of gas being thus prevented. The retorts thus overflow in series, each one remaining about half-full so long as sufficient strong water is kept supplied to the first one, which can be regulated by the pump S and the valve s^3. Each retort has two or more gas-outlet pipes, *c c*, extending upward from the highest points of the retorts and opening into the upper part of the gas-receiver C. This gas-receiver is

an oblong hollow casting flat on top and slanting at the bottom from ends to center. In this gas-receiver is a diaphragm, *f*, placed, as shown in Figs. 6 and 7, opposite the openings *c' c'* of the gas-inlet pipes *c c*, so that the gas entering by the pipes *c c* is thrown or directed downward toward the bottom of the gas-receiver, and any water carried up with it is thrown down to the bottom of the receiver.

c^4 is the outlet-pipe for this water, being the trap-pipe leading to the bottom of the retort A', and loosely surrounding and inclosing, as shown in Figs. 1, 2, and 6, the strong-water-supply pipe g^6 g^3, which discharges into the trap part of said pipe c^4 at g^4, as shown.

c^5 is the gas-outlet pipe, being at the top of the gas-receiver, and, with the lower neck or sleeve, *g*, of the rectifier, it conducts the gas up into the rectifier G. The rectifier G is placed above the gas-receiver. Inside this rectifier the strong-water-supply pipe c^6 is wound into a close tight coil, g^6, of hour-glass shape, which is provided with a diaphragm, *g'*, that prevents the passage of the gas directly upward through the hollow core of the hour-glass coil and forces it to pass between the pipes of the coil outward below and inward again above the diaphragm. The strong-water-supply pipe c^6 g^6 is preferably bent upward to form a trap, g^2, at the bottom of the rectifier. The cold strong water and the hot wet gas are thus caused, respectively, to heat and cool each other, the gas being thereby rectified. The water condensed from the gas finds its outlet through *g* and c^5 into C, and thence through c^4 into the bottom of retort A'. The rectified gas passes through pipe h^{14} to the condensing-coil h^8.

H is a cylindrical vessel closed at both ends and divided into three concentric apartments that are water-tight. In the inner compartment, h^6, is placed the condensing-coil h^8. In the middle compartment, h^5, is placed the absorbing-coil l^6. In the outer compartment, h^4, is placed the weak-water coil h^9. These compartments are kept filled with running water which enters the inner compartment at h^{10}, passes into the middle compartment at h^{11}, into the outer compartment at h^{12}, and out at h^{13}. The liquid gas condensed in the condenser h^8 runs into the liquid gas-jar I, which has the usual water-gage to show the amount of liquid gas contained in it, and discharges through the pipe k^2 in the usual way into the freezing-tank K, having the usual coils, *k*, where the gas is expanded and the cold produced. The pipe k^2 has the usual valve. The spent gas is returned through the pipe l^4 to the absorber L, which consists of the coil l^6 immersed in water. The gas entering these coils meets in the usual way the weak water from the weak-water jar O, which has come from such jar through the pipe o^4 and weak-water-cooling coil h^9, which latter is immersed in water in the outer compartment of the cylindrical vessel H and through the pipe o^5, which starts from the bottom of the coil h^9 and passes up outside of the vessel H and opens into the pipe l^4, as shown, where that pipe enters the vessel H, and the absorbing-coil l^6 begins. The absorption of the gas by the weak water and the cooling makes strong water which passes by pipe *m* into the bottom of the strong-water receiver M, which has the usual water-gage. The receiver M is kept supplied with sufficient water to keep the end of the pipe *m* submerged in the same. The strong water in the receiver is allowed to flow into pump S, which throws it back into the still through pipe c^6, hour-glass coil g^6, and pipe g^3, discharging into the bottom of the trap at g^4, as heretofore explained.

J is the redistiller. It is shown in detail in Fig. 5. Retort A^8 overflows into it through pipe j^6, which has valve j^{16}. Pipe j^6 discharges into J through four perforated arms, j^7, set at right angles. The dome j^9 has two openings, j^{11} and j^{12}. The base j^{14} has chambers j^2 and j^3, which are provided, as shown, with vertical tubes j^4 and j^5. Steam is admitted into the chamber j^3, thence, passing up vertical tubes j^4, down vertical tubes j^5, into chamber j^2, and out at j^8. The weakened water that overflows into J from A^8 is superheated just at its surface by the peculiar arrangement of steam-pipes shown, and its overflow through j^{11} is of absolutely weak water. The distillation in this redistiller, consisting very largely of steam and but little of ammoniacal gas, is not conducted into the gas-receiver C, but is discharged through pipe j^{17} into one of the distilling-retorts A, underneath the surface of the water in the same, as shown in A^5. This pipe j^{17} has valve j^{15}. The redistiller insures the perfection of the distilling operation and discharges thoroughly-weakened water through pipe j^{11} into the top of the weak-water jar O. This weak-water jar has the usual water-gage. Its discharge-pipe o^4 has its opening under the surface of the weak water in the jar O, and has the usual valve. The pressure throughout the distillers and redistiller drives the weak water up the pipe o^4 as fast as the valve allows.

The operation of my improved device is as follows: The aqua-ammonia is heated in the distilling-retorts. The gas passes up into the gas-receiver and is thrown down toward the bottom of the same by the diaphragm *f* before it can pass up into the rectifier. This prevents any "boiling over" of the still into the condenser and separates from the gas any water that may have been carried up with it, and discharges such water back into the bottom of the distilling-retorts. The hot gas passing into the rectifier is there brought into thermal contact with the descending supply of cold strong water without coming into actual physical contact with the same, the gas giving up its heat to the water and thereby being itself rectified and dried, the water of condensation being discharged downward into the distilling-retorts. The rectified gas is then condensed, stored, and utilized, as usual, and the spent gas reabsorbed by the weak water, and the oper-

ation repeated. The redistiller perfects the distillation and produces uniformly-weak water for purposes of more certain and reliable absorption.

The specific forms of apparatus shown may be varied in many ways without departing from the spirit and substance of my invention.

I do not broadly claim simultaneously heating the incoming liquid contents of a heated still and cooling the outgoing gaseous contents by a juxtaposition, without actual contact, of the two, as such operation is, broadly considered, old in the art of manufacturing ammoniacal salts.

What I claim as new, and desire to secure by Letters Patent, is—

1. In an ice or refrigerating machine, a rectifying-vessel having an hour-glass coil of piping for the cold aqua-ammonia and a central diaphragm in such coil, a gas-inlet and water-outlet vent at the center of the bottom and a gas-outlet vent at the center of the top, whereby the gas to be rectified is cooled and freed from water-vapor and the aqua-ammonia is heated, substantially as and for the purposes set forth.

2. In combination with the distilling devices of an ice or refrigerating machine, a gas receiving or conducting device having a downwardly-conducting portion, with a water outlet or vent at the bottom of such downwardly-conducting portion, and a rectifying device having within it a coil or passage-way for the cold aqua-ammonia, and a water outlet or vent at its lowest point, the gas receiving or conducting device being arranged between the distilling and the rectifying devices and connected therewith, as shown, whereby the distilled gas is freed from water and from water-vapor, substantially as and for the purposes set forth.

3. In combination with the distilling-retort of an ice or refrigerating machine and its gas-discharge pipe or pipes, a gas-receiver, and a return water-pipe connecting the lower part of the gas-receiver with the lower part of the distilling-retort, whereby any water in the gas-receiver is returned to the distilling-retort, while the water-trap formed in said return water-pipe prevents the backflow of gas from the gas-receiver into the distilling-retort, substantially as and for the purposes set forth.

4. In combination with the distilling-retort of an ice or refrigerating machine and its gas-discharge pipe or pipes, a gas-receiver, a return water-pipe connecting the lower part of the gas-receiver with the lower part of the distilling-retort and forming a water-trap thereby, and an aqua-ammonia-supply pipe discharging in such trap, substantially as and for the purposes set forth.

5. In combination with the distilling-retort of an ice or refrigerating machine and its gas-discharge pipe or pipes, a gas-receiver, a return water-pipe connecting the lower part of the gas-receiver with the lower part of the distilling-retort and forming a water-trap thereby, a rectifier having a water outlet or vent at its lowest point and having within it a coil or separate passage-way for the cold aqua-ammonia, and, continuing such coil or passage-way, a supply-pipe discharging in the water-trap of the return water-pipe between the gas-receiver and the distilling-retort, substantially as and for the purposes set forth.

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