

(No Model.)

2 Sheets—Sheet 1.

S. W. JOHNSON.
MARINE REFRIGERATOR.

No. 276,824.

Patented May 1, 1883.

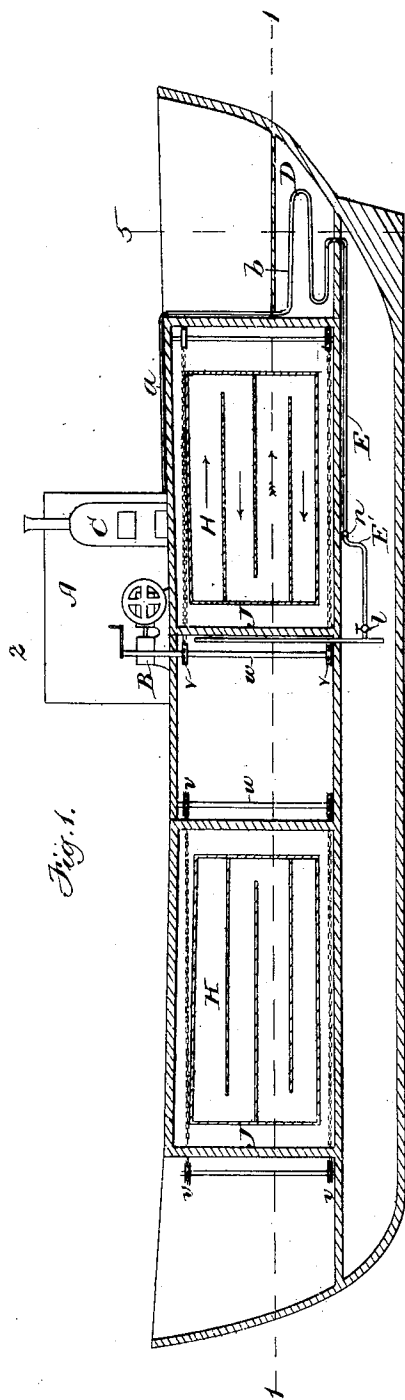


Fig. 1.

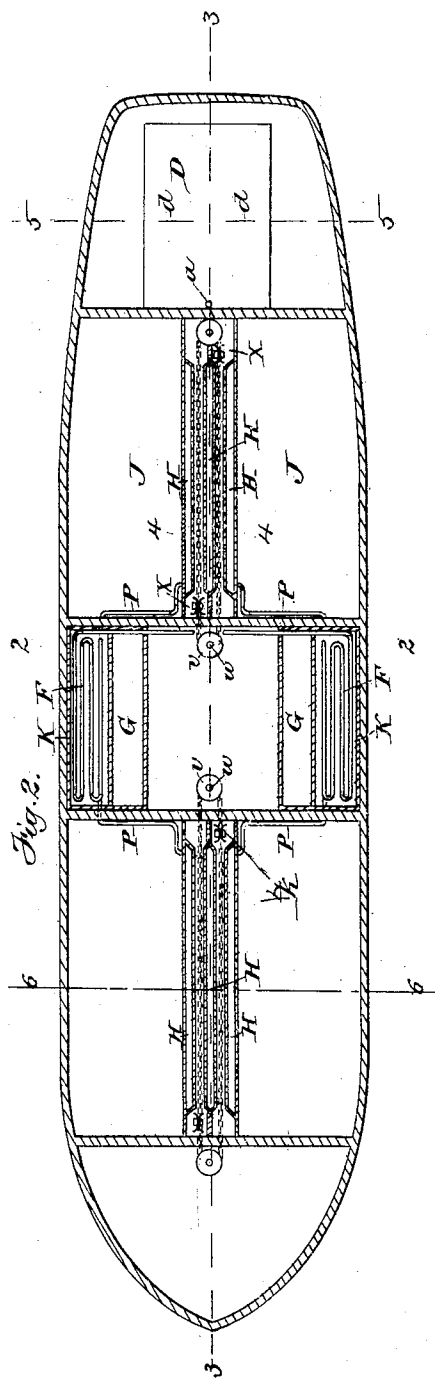


Fig. 2.

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A. L. White

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by Wright & Brown
attys.

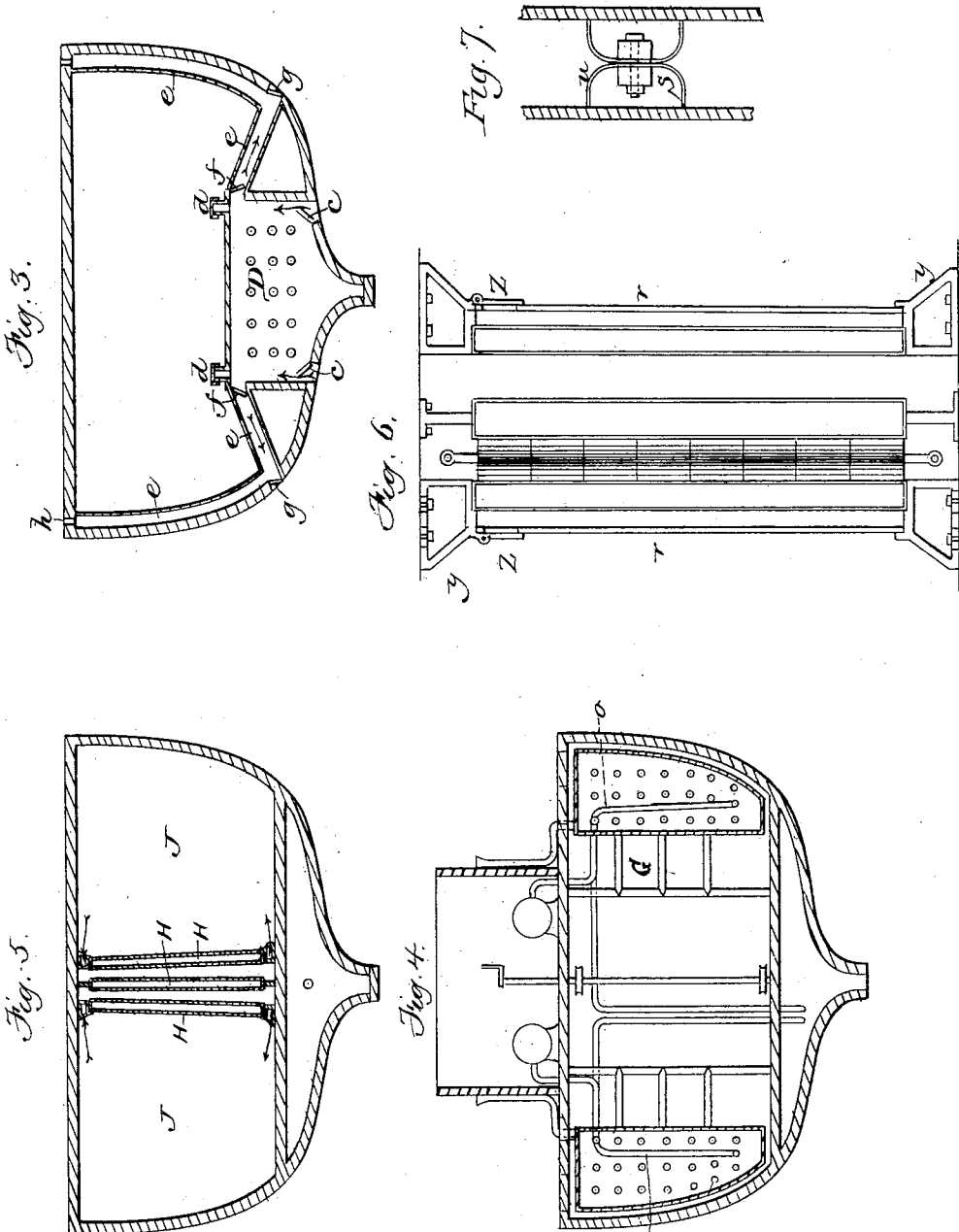
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2 Sheets—Sheet 2.

S. W. JOHNSON.
MARINE REFRIGERATOR.

No. 276,824.

Patented May 1, 1883.



Witnesses.
W. Rogers
A. L. White

Inventor
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UNITED STATES PATENT OFFICE.

SAMUEL W. JOHNSON, OF MEDFORD, MASSACHUSETTS.

MARINE REFRIGERATOR.

SPECIFICATION forming part of Letters Patent No. 276,824, dated May 1, 1883.

Application filed December 6, 1882. (No model.)

To all whom it may concern:

Be it known that I, SAMUEL W. JOHNSON, of Medford, in the county of Middlesex and State of Massachusetts, have invented certain Improvements in Marine Refrigerators, of which the following is a specification.

This invention relates to that class of mechanical refrigerators in which cold is produced by compressing ammoniacal or other liquefiable gas by means of a gas compressor or pump into a coil of pipe immersed in water, where it is liquefied by the combined effect of pressure and the removal of the heat caused by compression. The liquefied gas is then expanded into another coil placed in a tank containing water saturated with salt, chloride of magnesium, or other substance capable of arresting the freezing process. The expansion of gas into this coil produces intense cold, the gas absorbing from the non-congealable liquid surrounding the coil an amount of heat equal to that which it lost in the condensing-coil. The gas then returns through a suitable pipe to the pump, to commence the same operation again. The uncongealable liquid is forced by a suitable pump, through pipes, into the preserving-chamber, where it absorbs any heat that may have penetrated the walls, and returns to the tank from which it started, to be again cooled by the gas in the coil and commence its circuit anew. I am aware that this process has become public property.

The invention has for its object, first, to remove automatically the water in the condensing-tank as fast as it becomes warm and introduce fresh water from the ocean to take its place; second, to produce suitable means whereby the openings which admit the water to the condensing-tank can be closed and the water pumped out to allow of necessary repairs to the coil; third, to provide suitable check-valves in the pipes containing the liquefied gas, for the purpose of preventing the motion of the vessel from interfering with the proper circulation of the liquid; fourth, to provide a convenient and suitable place where meat, fish, &c., can be quickly frozen, and where a lower temperature can be maintained than that of the preserving-chamber; fifth, to provide a refrigerating-tank from which the coil can be easily

removed for necessary repairs, and at the same time one that is most economical in regard to the space that it occupies; sixth, to provide tanks or heat-absorbers in the preserving-chamber, through which the uncongealable liquid is circulated, the cooling-surfaces of which are flat and parallel, and so arranged with regard to each other as to adapt them to be acted on by a suitable scraper for removing the frost; seventh, to provide a suitable scraper for removing the frost from the cooling-surfaces of the heat-absorber, which may be operated either by hand or steam power; eighth, to provide means for regulating the amount of moisture in the air of the preserving-chamber, all of which I will now proceed to describe and claim.

Of the accompanying drawings, forming a part of this specification, Figure 1 represents a vertical section of a vessel fitted with my improved refrigerating apparatus, on line 3 3. Fig. 2 represents a horizontal section of vessel on line 1 1. Fig. 3 represents a cross-section of vessel on line 5 5. Fig. 4 represents a cross-section of vessel on line 2 2. Fig. 5 represents a cross-section of vessel on line 6 6. Fig. 6 represents a cross-section of heat-absorber on line 4 4, also showing the scraper in position for use between two of the tanks, and the braces for holding the adjustable tanks in position. Fig. 7 represents a cross-section of scraper.

The same letters of reference indicate the same parts in each of the figures.

In carrying out my invention I construct a house, A, on the deck of a vessel, containing the gas-compressor B, of well-known construction, and the boiler C, for furnishing steam to the gas-compressor. This house also contains any water-pumps or other machinery necessary to be used in connection with my refrigerating apparatus.

a is the pipe leading from the gas-compressor B along the deck to the condensing-coil b.

D represents the condensing-tank, situated preferably under the cabin, the top of the tank being below the level of the water outside. The tank D is filled with sea-water and contains the coil b.

c c, Fig. 3, are valves which admit the wa-

ter of the ocean to the tank D. If desired, the valves *c c* may be omitted and simple passages be left for the admission of the water.

d d are pipes inserted in the top of the tank D, directly over the valves, through which rods can be passed for fastening down the valves, or plugging the holes if no valves are used, so that the water can be pumped out when it is necessary to repair the coil *b*.

e e is an automatic pump for removing the warm water from the top of the tank D and discharging it into the ocean. Said pump consists of a water-tight box extending from the top of the tank D to the deck of the vessel, and provided with the inlet-valves *f f*, for admitting the water from the tank into the pump, the discharge-valves *g g*, which allow the water in the pump to escape into the ocean, and the vent-pipes *h*, for admitting air to the top of the pump. The design of this arrangement is to furnish a constant supply of cool water from the ocean to the coil *b* in the tank D, the operation being as follows: Any motion of the vessel that lowers the stern causes the warm water in the top of the tank to rise into the pump through the valve *f*. At the same time an equal quantity of cool water from the ocean is admitted to the bottom of the tank through the valves *c c*. In the opposite motion of the vessel which raises the stern the water in the pump is prevented from returning to the tank by the valve *f*, and is discharged overboard through the valve *g*. This operation will take place continually as long as the vessel is in motion. When it is at rest it will be necessary to resort to a common pump to create the necessary circulation.

E represents a pipe leading from the condensing-coil *b* to the refrigerating-coil K.

l is the valve where the liquid ammonia, as it comes from the condensing-coil *b*, is expanded into gas at a very low temperature, which, as it passes through the refrigerating-coil K, exerts its freezing effect on the non-congealable liquid which surrounds said coil, and returns by the pipe *m* to the gas-compressor B, to commence again the same operation.

n represents a check-valve in the pipe *E*. Between this valve and valve *l* the pipe *E* has a downward bend, *E'*. It is of prime importance that the liquid ammonia be kept constantly up to the expansion-valve *l*; and the object of this check-valve *n* and bend *E'* is to prevent the liquid ammonia from running back into the condensing-coil when the stern of the vessel is lowered by the action of the waves.

F represents the refrigerating-tank containing the refrigerating-coil K, the space surrounding said coil being filled with an uncongealable liquid consisting of water saturated with chloride of magnesium. This tank is made of wood, except the front, which is of sheet metal, and secured in its place by screws, so that it is readily removed. Against the front of the tank is bolted a case of shelves,

G, made of wood or metal, the front being closed by suitable doors of wood or other non-conductor. The object of this arrangement is to provide a convenient place for rapidly freezing fish, meat, &c., before it is placed in the preserving-chamber, and also for storing anything that requires a lower temperature than that of the preserving-chamber. The advantage of having the case of shelves *G* removable is that in case of a leak in the refrigerating-coil K the shelves and the front of the tank can be removed after drawing off the liquid, and the pipes will then be easily accessible for repairs.

o represents the pipe through which the uncongealable liquid is introduced into the refrigerating-tank. This pipe is kept partly full.

J J represent the preserving-chambers, and *H* the heat-absorber, which consists of three or more tanks of galvanized iron or copper arranged parallel to each other through the center of the preserving-chamber, and filled with liquid from the refrigerating-tank, with which it is connected by the pipes *p p*. These tanks are of such a size that when in position there is a space of about six inches on the top, bottom, and ends between them and the preserving-chamber. This space in the center tank is filled with wood, thus dividing the preserving-chamber into two parts, but is left open at the top and bottom in the outside tanks, so as to allow the air to circulate over the top of the tank, down between the two tanks, and out under the bottom of the outside tank into the preserving-chamber again, as shown in Fig. 5. These tanks are divided by suitable partition, as shown in Figs. 1 and 6, the object being to distribute the circulation of the liquid more evenly over the surface of the tanks. The direction of the circulation is shown by the arrows in Fig. 1.

The advantage of circulating the non-congealable liquid in tanks of the construction shown instead of in pipes, as is the common practice, is the provision of flat cooling-surfaces formed by the sides of the tanks, from which the frost can be readily removed by means of reciprocating scrapers. The circulation of the liquid in the tanks is secured by a pump placed in one of the pipes connecting the heat-absorber with the refrigerating-tank.

k k represent the scrapers. The greatest obstacle to the production of low temperatures heretofore encountered has been the frost and ice which accumulate on the cooling-surfaces, forming a non-conductor, which prevents any further reduction in the temperature. The object of my improved scrapers is to remove this frost without entering the preserving-chamber. Each scraper is composed of a bar, *S*, which consists of two wooden bars bolted together and suspended on the two wheels *t t*, which run on the top of the tanks, and two curved plates, *u*, of sheet-steel, in sections six inches

wide, bolted to the bar S. When the bar S is drawn backward or forward, the edges of the plates *u* scrape off the frost that has formed on the cooling-surfaces. At the top and bottom of the scraper-bar are rings, to which are attached the chain or rope which operates the scraper, and which engages with the sheave *v*, attached to the crank-shaft *w*, which may be driven by hand or steam.

10 X X represent enlarged spaces between the end of the tanks and the wall of the preserving-chamber. The object of these spaces is to provide a place where the scraper can remain when not in use without freezing in, which it would certainly do if it remained stationary any length of time between the tanks. Said spaces have inclined sides, which gradually press back the edges of the plates *u* when the latter are moved from the space X into the spaces between the tanks, the last-named spaces being narrower than the distance between the scraping-edges of one plate and the scraping-edges of the other plate, so that said scraping-edges bear with a yielding pressure against the sides of the tanks, said pressure being due to the inherent elasticity of the plates *u*.

Y Y are braces of cast-iron, which hold the outer tanks in place. They are firmly attached to the tanks and provided with slots, through which the screws pass which fasten them to the floor and ceiling, which makes them adjustable. *r r* represent wooden partitions extending the whole length of the preserving-chamber in front of the tanks. They are attached to the outer tanks, and kept about three inches distant by cleats between.

Z Z are shutters, which close the space between the partition and tank.

The proper preservation of meat, fruit, &c., depends fully as much on the amount of moisture in the air as on the temperature, too much moisture causing it to mold, while too little gives it a shriveled appearance, which greatly injures its market value. The advantage of having the outer tank adjustable lies in the fact that the nearer the tanks are together the more thoroughly the air is dried in passing between them.

The operation of my apparatus is as follows:
50 When the preserving-chamber is first filled with meat, fruit, &c., the non-congealable liquid is reduced to a very low temperature, the tanks are moved near together, and the shutter Z closed. By this means a small quantity of air is rapidly cooled through a large number of degrees, and the moisture rapidly freezes onto the tanks, from which it is removed by the scraper *k*. After the superfluous moisture is removed the pump B is stopped, the temperature of the non-congealable liquid allowed to rise, the tanks moved farther apart, and the shutter Z Z opened. By this means a large quantity of air is cooled a few degrees. No more moisture is removed, and the temperature remains the same.

I am aware that reciprocating scrapers have been used to remove frost from the surfaces of pipes containing a refrigerating-liquid; hence I do not claim, broadly, the combination of such scrapers with receptacles for refrigerating-liquid.

I claim—

1. In a marine refrigerator, a condensing-tank, D, having valves *c c*, for the admission of sea-water, and openings *d d* over said valves, whereby access can be had to the latter, as set forth.

2. In a marine refrigerator, the combination, with the condensing-tank, of a pump or water-circulating device operated by the motion of the vessel, as set forth.

3. In a marine refrigerator, the combination of the condensing-tank D, having valves *c c*, and the automatic or gravity pump composed of the box *e e*, having valves *f g* and air-vent *h*, as set forth.

4. In a marine refrigerator, the combination of the condensing-tank, having the valves *c c*, with the boxes *e e*, the discharge-valve *g*, and the vent *h*, as set forth.

5. In a marine refrigerator, the combination, with the condensing-coil *b* and refrigerating-coil K, of the connecting-pipe E, having the check-valve *n*, substantially as and for the purpose specified.

6. In a marine refrigerator, the combination, with the condensing-coil *b* and refrigerating-coil K, of the connecting-pipe E, having the check-valve *n* and downward bend E', as set forth.

7. In a marine refrigerator, a refrigerating-tank having a movable metal front and top, substantially as described, for the purpose set forth.

8. The combination of the refrigerating-tank F with the case of shelves G, placed against the front wall of said tank, substantially as described.

9. In a marine refrigerator, the combination, with a preserving-chamber, of a series of flat-sided tanks placed in the central portion of the chamber, separated by a vertical air space or spaces, and communicating with a tank for uncongealable liquid, as set forth.

10. In a marine refrigerator, the combination, with a preserving-chamber, of a series of flat-sided tanks placed in the central portion of the chamber, separated by a vertical air space or spaces, and scrapers adapted to be reciprocated in said spaces, as set forth.

11. The improved scraper composed of the curved sheet-metal plates *u u*, clamped together centrally, and adapted to bear at their edges against the surfaces to be scraped with a yielding pressure due to the inherent elasticity of said plates, as set forth.

12. In a preserving-chamber provided with a tank, H, and a scraper, *u*, the enlarged space X at each end of the tank, in which the scraper can rest without freezing in, as set forth.

13. A preserving-chamber having a series of flat-sided tanks adapted to contain an uncongealable liquid, one of said tanks being rigidly attached to the chamber, and the others
5 being adjustable to vary the width of the air-spaces, as set forth.

14. In a preserving-chamber, a series of tanks adapted to contain an uncongealable liquid, and separated by intervening air-spaces provided with shutters Z, whereby the passage
10

of air through said spaces may be prevented or controlled, as set forth.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 4th day of December, A. D. 1882. 15

SAMUEL WATSON JOHNSON.

Witnesses:

H. B. SELLON,

C. F. BROWN.