3 Sheets—Sheet 1.

A. C. RAND.

Refrigerator.

No. 202,867. Patented April 23, 1878.

Fig. 1.

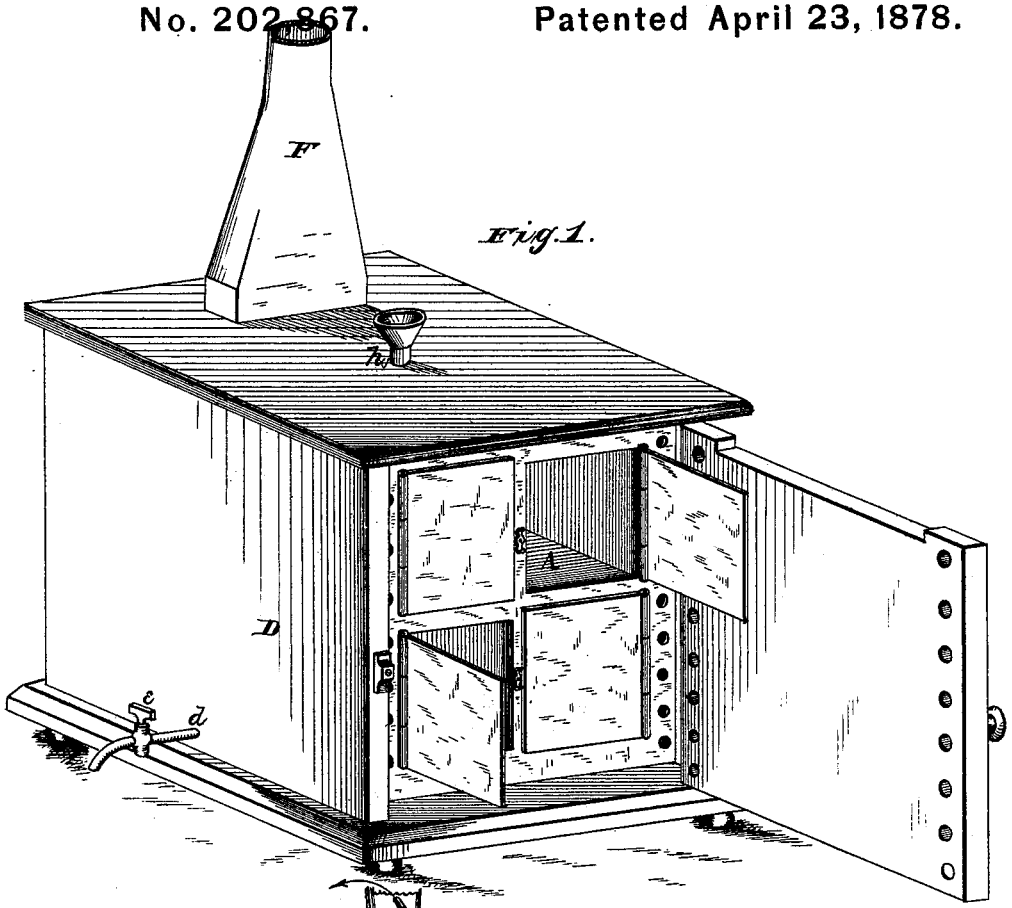
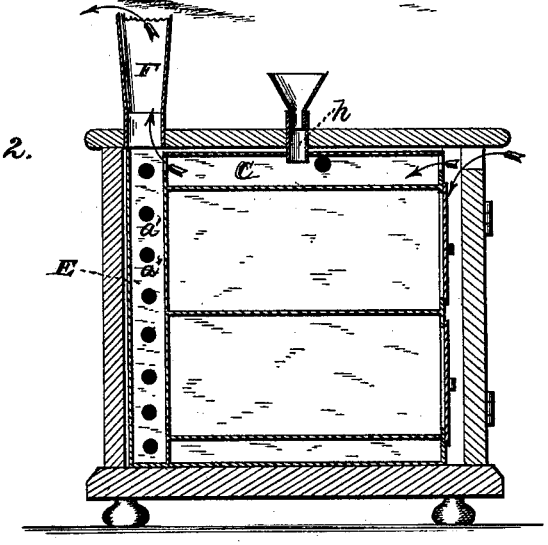


Fig. 2.



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3 Sheets—Sheet 2.

A. C. RAND.
Refrigerator.

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Fig. 3.

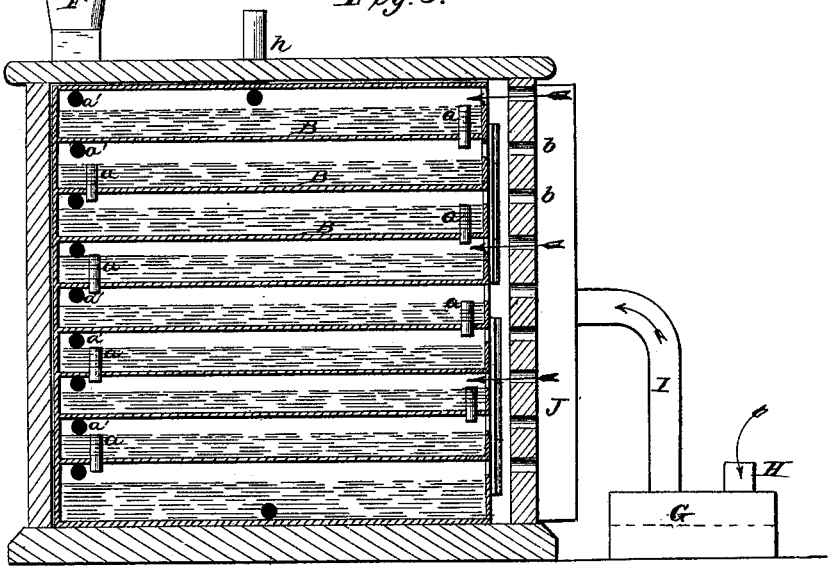
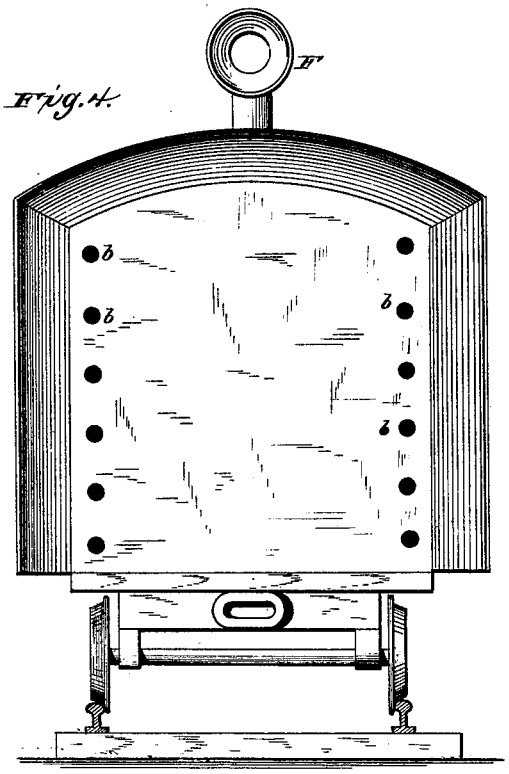


Fig. 4.



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3 Sheets—Sheet 3.

A. C. RAND.
Refrigerator.

No. 202,867. Patented April 23, 1878.

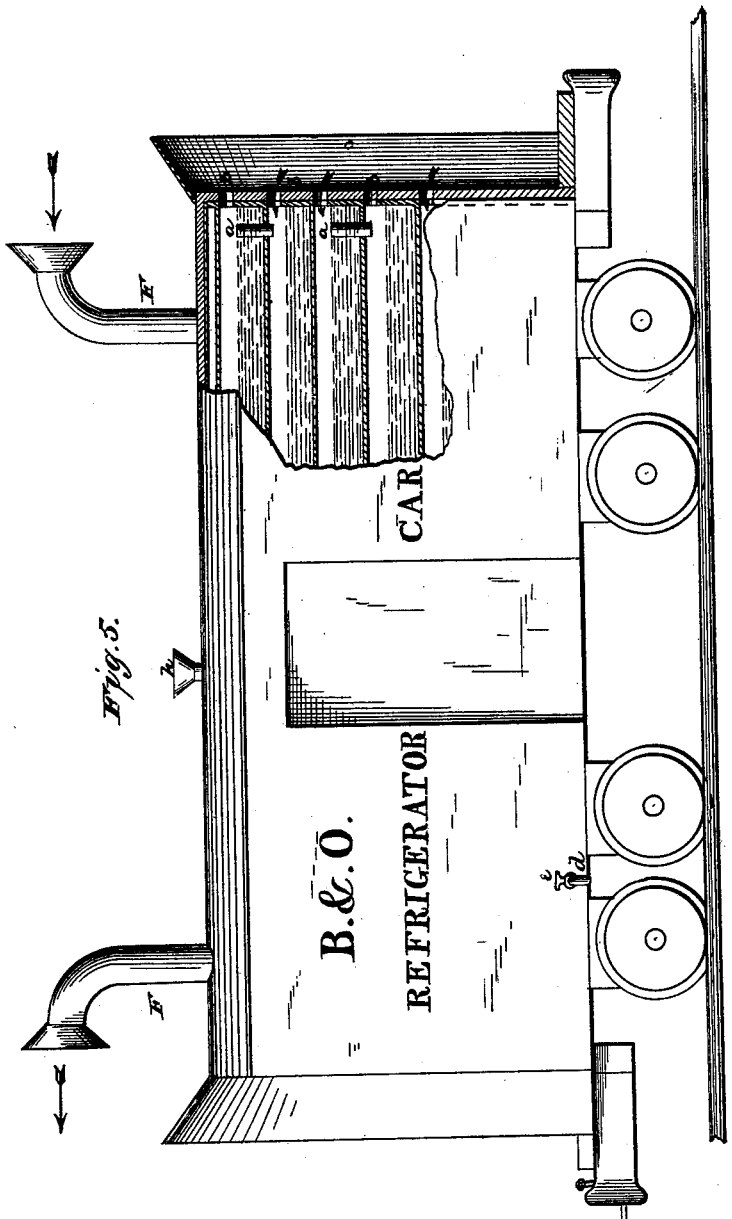

Fig. 5.

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UNITED STATES PATENT OFFICE.

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IMPROVEMENT IN REFRIGERATORS.

Specification forming part of Letters Patent No. **202,867**, dated April 23, 1878; application filed March 30, 1878.

To all whom it may concern:

Be it known that I, ALONZO C. RAND, of Minneapolis, in the county of Hennepin, and in the State of Minnesota, have invented certain new and useful Improvements in Cooling Apparatus; and do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, making a part of this specification.

This invention relates to producing a low temperature by the evaporation of water. Rapid evaporation produces intense cold. The utilization of this principle for the purposes of cooling water, preserving meats, vegetables, fruits, eggs, &c., for refrigerating cars used in the transportation of meats, &c., for cooling large rooms in warm climates—in fact for any purpose where where a low temperature is required—is the nature of this invention.

For a cheap water-cooler, a porous stone cylinder surrounded by a wooden case or other non-conducting substance, the case made large enough to provide an air-passage between the cylinder and case, apertures, either in the top or bottom, are provided for the admission of air. A connection is made between the space and a flue to the chimney, and thus a current of air is established. The loss of heat by this plan is measured by the rapidity of the evaporation; so it is important that the current should be as rapid as possible to insure a low temperature.

On the chimney I provide an automatic jack that turns with the wind, so that a partial vacuum in the chimney may be created when the wind blows, thus accelerating the evaporation.

There are so many ways of keeping the surfaces wet that are exposed to the draft of air, and so many plans for increasing the superfice by corrugating, &c., that I do not wish to confine my invention by claiming any specific plan.

In the drawing I have shown a refrigerator composed of a metal case, A, divided into four compartments, so that the flavor—say of fish—may not injure the butter, &c. The exterior of the case is provided with troughs B B for water, the sides of the troughs forming the sides of the refrigerator, and are sanded, so as to provide capillaries for absorbing the water from the troughs. This plan furnishes a very large surface for evaporation, as the top C is also a water-pan.

I prefer this plan to any other for the reason that the body of water surrounding the case will retain the cold, so that when the doors are opened into any of the compartments the increase of temperature will be lost immediately after the door is closed by the absorption of it by the water around the case.

The inside of the wooden case is better when varnished or otherwise made impervious to water.

Tho top pan C, as well as the troughs B B of the case, are connected by means of small tubes *a a*, so arranged that the water will rise to a certain height in the top trough before it passes down into the next one, and so on to the bottom.

In the front of the case A are air-inlets *b b* to each separate trough or pan, situated in planes immediately above the upper ends of the tubes *a*, so that the water will not pass out or reach to said air-inlets. These inlets correspond with similar openings in the outer wooden case D.

There are also corresponding air-outlets *a'* leading into a flue, E, in the back part of the refrigerator, and above said flue is the chimney F.

The bottom trough of the case is provided with an outlet-pipe, *d*, with stop-cock *e*. Water is admitted from the top through a pipe, *h*, as shown.

Another plan for keeping the surface of the cooler wet is to place a tank of water on top of the cooler, and with capillaries feed the water out of the tank against the top and sides of the cooler, which may be covered with cloth or any other capillary substance.

A jacket around the above, similar to the one first described, is used, care having been first taken to have the capacity of the pipe and flue greater than the air space or spaces. With a device of this kind the temperature can be reduced to 48° Fahrenheit, which is low enough for all the purposes for which this invention is designed.

For a water-cooler, a plain cylinder, of gal-

vanized iron, zinc, or other metal, provided with capillaries for keeping the sides moist and surrounded with a wooden cylinder, as before described, makes a good cheap cooler for water.

An automatic blower or air-pump can be attached to any of these coolers, and they, of course, would dispense with the flues and chimneys, if the air, after passing through the spaces described, is made to pass out of doors.

The amount of water the air will hold in suspension is measured by its temperature, so that in a warm kitchen the air will take up water faster than in a cooler room, so that, for the ordinary refrigerators for house use, the kitchen is the best place for them.

In climates where the air is very moist, I use, in combination with the cooler, a lime tray or trays, G, to absorb the water or moisture in the air. This will produce a lower temperature than when air that is moist is used. The lime-tray G would be provided with an air-inlet, H, and an exit-pipe, I, conveying the dry air to a chamber, J, from which it will pass, through the apertures *b*, into the cooling apparatus, as shown in Fig. 3.

In large rooms for storage of meat, butter, eggs, fruits, &c., the exterior may be porous, or provided with troughs, or covered with capillaries of cloth, as already described, and the partitions may be made in the room double, and kept moist, so that a current of air may pass through them, as well as around the outside of the room. In such a room a large stack must be used, and a fire may be kept in it to establish the draft; or a blower can be used if a very low temperature is required.

For railway-cars, I provide the cars with iron flanges extending outward, so that when the car is in motion the air is made to pass around the car-case, as in the former plan.

By having the flange described in each end of the car, it will be readily seen that when the car is in motion air-pressure will exist at one end and a partial vacuum at the other. When the cars are not in motion, the stacks will furnish draft sufficient to keep the temperature quite low for a number of hours.

To provide against the contingency of an accident whereby the car would be kept a long time standing, I use joints of pipe to attach to the permanent jacks, lengthening them out, and thus increasing the draft. This plan will make a cheap refrigerator-car, and will save the transportation and cost of ice.

For living-rooms in the tropics, a damper, regulating the admission of air into the space or the escape of air from the stack, must be provided to control the temperature.

The success of this plan of refrigerating depends upon rapidly carrying away the air after it has taken up its quota of the water. In the process of evaporation the vapor of water will carry off about six times as much heat as it contained when in condition of water.

If a water-cooler of stoneware is used, the entire interior may not all be vitrified, but spaces occasionally left open or pierced, so that the interior water can be allowed to percolate through, and thus dispense with the tank on top or grooves on the sides, as described.

Another plan might be a spiral passage-way from top to bottom of cooler, and water made to drop in at the top and gradually carried around such spiral passage to the bottom into a receptacle.

When power is used, the air could be delivered in jets and made to impinge with force upon the wet sides of the cooler or refrigerator-room, thus evaporating the water very rapidly.

Besides the use of lime-trays, the air could be made to pass over a bath of sulphuric or other acid absorbent, and the water thus absorbed would leave the air chemically dry before it passed into the space and evaporated the water. This plan would produce a much lower temperature than the others.

Another plan could be successfully used to reduce the temperature in a cooler or vessel or the air in an apartment, for purposes already explained. Say, for a water-cooler, a float be placed upon the surface of the water, a canopy extending beyond the float and close to the water, leaving an air-space between the water and canopy.

By connecting a pipe to the water-tank, so as to carry the air through the slip-joint down upon the water under the canopy, out into a flue and chimney, a very cheap and durable cooler can be made. Of course, power could be attached to this as well as any already described, and for an apartment to be cooled a tank in the center of the room, arranged substantially as the one just described, will work very well. Of course, as the water is evaporated and used the float would drop, and always preserve an equal distance between the canopy and the water.

If for a cooler, the exterior of the cooler may be covered with felt or other non-conductor; but if for a room, the surface of the tank of iron absorbs the heat from the room, and the non-conductor must be dispensed with.

Another plan is to provide the room with tubes lined with capillaries, and into the top of the tubes the water is supplied in drops, and then supply air either by the stack plan, already mentioned, or by power, as described; or the shelving in the room may be made double, and kept moist between, and air supplied in the spaces to evaporate the water therein.

In a railway-car for refrigerating, the interior roof or ceiling may form the bottom of the water-tank, and by having double spaces to the sides of the cars the spaces filled with a non-conductor, the air cooled under the roof of the car would, by a change of gravity, drop to the floor, and may be found cool enough without keeping the sides of the car moistened with water and evaporating the same.

In order to fully illustrate my invention, the accompanying drawings show, in—

Figure 1, a perspective view of a refrigerator embodying my invention. Fig. 2 is a

central vertical section of the same. Fig. 3 is a vertical section through one side of the refrigerator. Fig. 4 is an end view, and Figs. 5 a side elevation, partly in section, of a railroad-car also embodying my invention.

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

1. A cooling apparatus consisting of an exterior case, within which is placed one or more refrigerating-receptacles, with a surrounding space between the two containing water, with air-ducts and a flue, whereby evaporation is increased and a lower temperature attained, substantially as set forth.

2. The combination, in a cooling apparatus, of an exterior case, through which air is admitted, and an interior receptacle, the space between being partitioned to form water-tanks, the exterior case being provided with openings to allow the passage of a current of air over and in contact with the surface of the water and the moistened walls of the case and receptacle, substantially as herein set forth.

In testimony that I claim the foregoing I have hereunto set my hand this 29th day of March, 1878.

ALONZO C. RAND.

Witnesses:
FRANK GALT,
J. M. MASON.