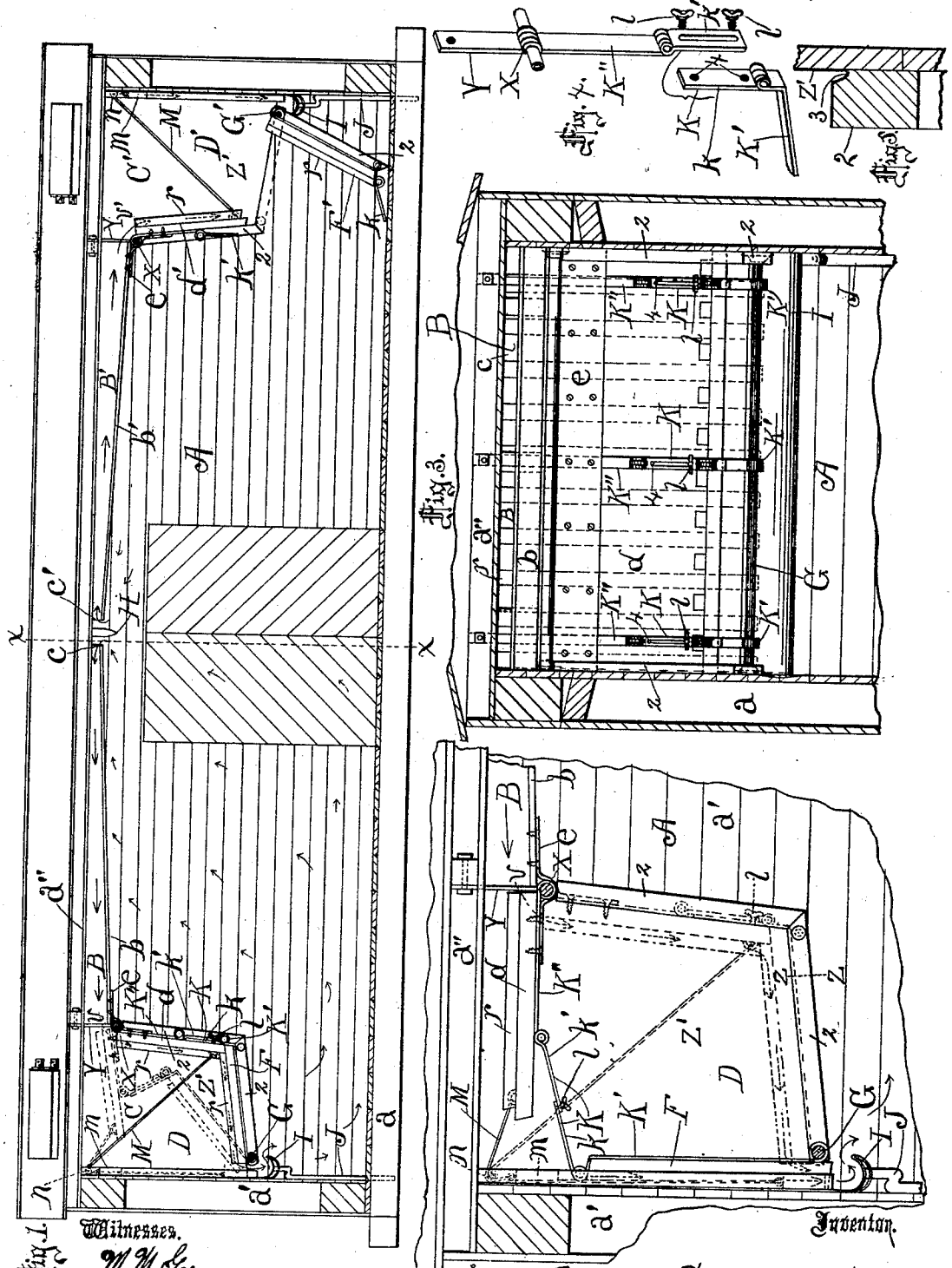
(No Model.)

2 Sheets—Sheet 1.

C. S. HARDY.

DEVICE FOR REFRIGERATION AND STORAGE.

No. 509,805. Patented Nov. 28, 1893.



Witnesses.
M M Gee.
Alfred A Townsend.

Inventor.
Charles Saunders Hardy
by Hazard & Townsend
his attys.

THE NATIONAL LITHOGRAPHING COMPANY,
WASHINGTON, D. C.

(No Model.) 2 Sheets—Sheet 2.

C. S. HARDY.

DEVICE FOR REFRIGERATION AND STORAGE.

No. 509,805. Patented Nov. 28, 1893.

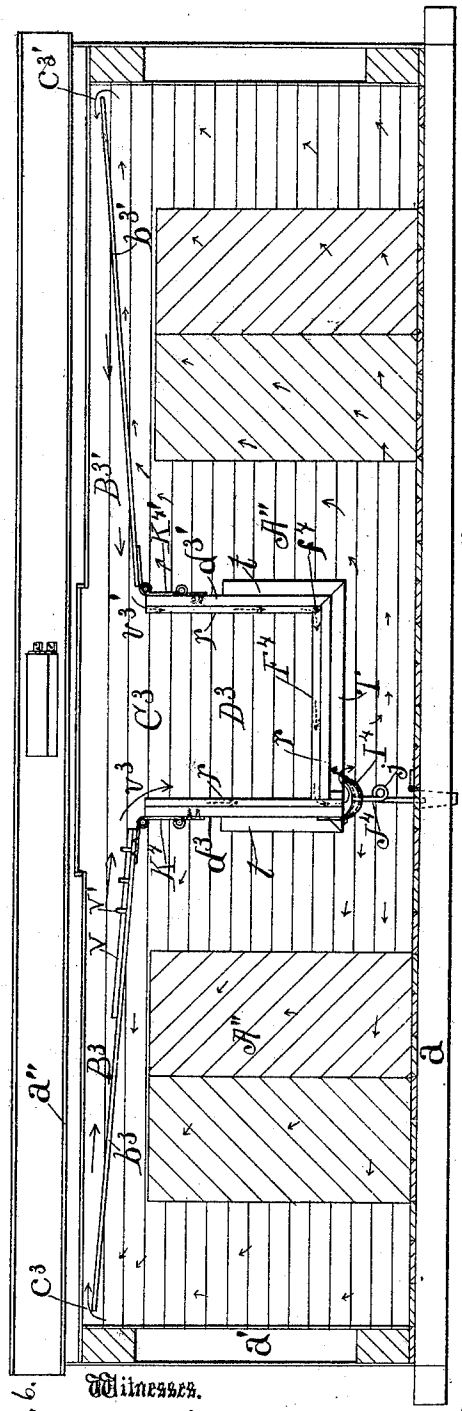


Fig. 6.

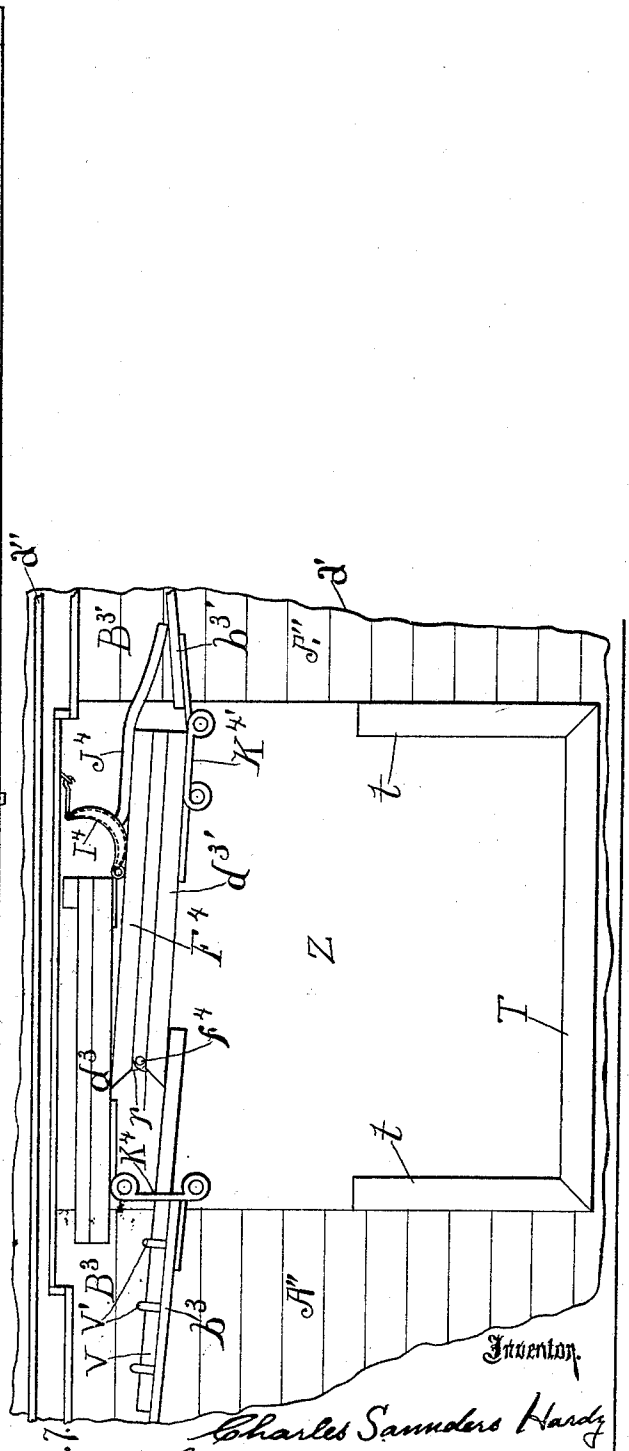


Fig. 7.

Witnesses.
W. M. Gu.
Alfred D. Townsend.

Inventor.
Charles Saunders Hardy
by Hazard Townsend
his attys.

THE NATIONAL LITHOGRAPHING COMPANY,
WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

CHARLES S. HARDY, OF SAN DIEGO, CALIFORNIA.

DEVICE FOR REFRIGERATION AND STORAGE.

SPECIFICATION forming part of Letters Patent No. 509,805, dated November 28, 1893.

Application filed January 4, 1893. Serial No. 457,244. (No model.)

To all whom it may concern:

Be it known that I, CHARLES SAUNDERS HARDY, a citizen of the United States, residing at San Diego, in the county of San Diego and State of California, have invented new and useful Improvements in Devices for Refrigeration and Storage, of which the following is a specification.

My invention applies to refrigerating devices for use in railway cars, steamboats, warehouses, ships, and hotels and for domestic purposes, &c. It is also specially designed for use in situations where it is desired at times to use the space for storage without refrigeration and at other times for storage with refrigeration.

One object of my invention is to so construct and arrange the ice box or ice boxes, the refrigerating chamber and the air flues that the circulation of air will be uniform throughout the chamber, removing the foul gases from every part of the chamber and carrying them into contact with the melting ice so that they will be all absorbed and carried from the car by the water flowing from such melting ice.

My invention with relation to this object comprises the combination of a refrigerating chamber; an ice box or boxes or other cooling and purifying receptacle or receptacles arranged therein; air or draft flues oppositely arranged horizontally at the top of each chamber extending along such chamber and each flue having at one end its intake mouth extending across the chamber, and having at the other end its discharge mouth opening, below the level of the intake mouth of such flue, into the top of its ice receptacle or other cooling receptacle, and oppositely inclined ceilings or draft plates arranged beneath the flues respectively, each extending substantially from its ice receptacle in an upward slope to the intake mouth of the draft flue beneath which such ceiling is arranged. This arrangement can be applied in refrigerating chambers having its ice boxes arranged at the opposite ends thereof or in a refrigerating chamber having but one ice box arranged in the middle thereof, and the accompanying drawings show these two different forms of arrangement.

My invention also embraces the construction and arrangement of parts whereby the ice boxes (or ice box, if but one is used) may be more conveniently and more fully folded out of the way to leave the chamber free for storage when refrigeration is not required; but one or two movements being required to accomplish the folding and the several members of the box constituting means for securing the box in its folded position. The several parts of the folding box are thus always in use, and, being fixed to the car are not liable to become misplaced, lost or stolen. The accompanying drawings show several modes of applying my invention with this regard.

One difficulty to be overcome with refrigerating chambers in which the ice receptacles are arranged at opposite ends of the chamber results from the unequal melting of the ice in the opposite receptacles. This unequal melting often occurs when one end of the refrigerating chamber is exposed to the sun's rays and the other end is not so exposed; this occurs in railway cars moving from the south to the north or vice versa. In such instances the ice in the southern end of the chamber melts much more rapidly than that in the northern end, and the circulation of air through the ice box having the most ice becomes more rapid than that through the other box.

My invention is adapted to equalize and also to increase the circulation of air in refrigerating chambers or store rooms which are subjected at opposite ends to unequal outside temperatures and which have an ice box at each end in one of which the ice melts more rapidly than in the other.

Another object of my invention is to provide for the convenient cleaning of the ice boxes.

Another object is to provide for chambering the folded ice box at the top of the storage chamber when refrigeration is not desired.

My invention is capable of being embodied in several forms and some of these forms are illustrated in the accompanying drawings showing two separate types of devices illustrating my invention. In these drawings no attempt has been made to show the structure of the car in detail as my invention is de-

signed for application to various structures and is not affected by the mechanical construction of the chamber to which it is applied.

Figure 1 is a side elevation of one form of my invention applied to a railway car, having an ice receptacle or box at each end of the chamber. One side of the car is removed to expose the parts. In this view the ice box at one end of the car is shown in solid lines, while dotted lines show the ice box partially folded. At the other end of the car the ice box is shown in position to dump the contents of the ice box. Fig. 2 is an enlarged view showing the ice box in its folded position. Dotted lines show it in its position to receive the ice. Fig. 3 is a cross section on line *x*—*x* Fig. 1 looking toward the left. Fig. 4 is a detail of the hinge illustrating the extensible supplemental hinge member shown in Figs. 1, 2 and 3. Fig. 5 is a detail in section on line *z*—*z* Fig. 2 showing the form of cleat and the gutter for carrying off the drip from the side walls of the ice box. Fig. 6 is a view showing my invention applied to a car at the middle thereof with the storage space at each end. Fig. 7 is an enlarged view showing this form of box in its folded position.

Arrows indicate the direction of the air currents.

A in Fig. 1 and A″ in Fig. 6 in the several views indicate the storage or refrigerating chamber.

a a′ and *a″* in each view indicate the structure of the car—the floor, walls and ceiling respectively—the same being of the ordinary form of insulated floor, wall and ceiling.

B and B′, in Fig. 1 and B^3 and $B^{3\prime}$ in Fig. 6 indicate the draft flues and *b* and *b′*, in Fig. 1 and b^3 $b^{3\prime}$ in Fig. 6 indicate the inclined ceilings or draft plates arranged beneath such flues.

c c′, &c., indicate the intake mouths of the draft flues.

C, C′ and C^3 indicate the tops or intake mouths of the ice receptacles D, D′ and D^3 into which the draft flues discharge.

d d′ in Fig. 1 indicate the movable swinging pendent walls of the ice boxes D and D′. Such walls are connected respectively at their upper ends with the lower ends of the inclined ceilings or draft plates which form the floors of the flues B and B′, and the joints between such walls and such draft plates are sealed, respectively, by a strip of leather or other suitable material *e e* secured to the plate and pendent wall to cover the crack therebetween to prevent passage of draft therethrough. The walls *d d′* of this form of box are fitted respectively to the free ends of the ice box floors F F′ which are hinged respectively upon shafts G G′ secured to the structure of the chamber. The pendent wall *d* of the ice box and the floor F and the supporting shaft G are arranged with relation to each other to cause an incline of the floor F so as to discharge the drip into the drip trough I, at the end of the car.

The purpose of the circulation of air from the storage room or chamber through the ice box is to purify the air as well as to cool it. This results when the air comes into contact with the ice which condenses the warm vapors contained therein which have arisen from the contents of the car, and the impurities drain off along with the water in the drip from the melting ice.

The principle of the operation of the inclined draft plates *b*, &c., is that the cold air descending from the ice forces the heated air from the chamber upward toward the highest portion of such chamber forcing it along the under faces of the inclined draft plates until it reaches the open mouths *c*, &c., of the draft flues. When two ice receptacles are used as in Fig. 1, in case the quantity of ice in one of the ice receptacles is greater than that in the other, a greater draft is thereby caused through that flue which leads to the larger body of ice. This retards the circulation of air through the other flue for the reason that the increased draft through the flue leading to the greater body of ice tends to draw the air from the mouth of the other flue. In order to cause the foul air from the contents of the car to be directed in equal quantities to the separate bodies of ice, there to be condensed to pass into the water of the melting ice and to be carried off thereby and thus to wholly purify all the air within the car, I provide means for dividing the impure air into equal bodies and directing equal currents of such air to come into contact with the ice in the two ice boxes. In Figs. 1 to 3 these means consist of the partition H arranged to project downward from the ceiling of the car to three or four inches, more or less, below the upper end of the ceilings or draft plates *b*, &c., so that when the foul air is forced to the top of the car by the descending cold air, it passes upward along the inclined draft plates or ceilings to the juxtaposed intake mouths *c*, *c′* of the draft flues. The upper strata of the air in one half of the car is separated by the partition from that in the other half of the car and must find its vent through the draft flue provided for its half of the car. This partition thus arranged is valuable in all refrigeration where two air cooling chambers of any character, those cooled by ammonia, brine, &c., as well as those cooled by ice are used in connection with a single refrigerating chamber, and I do not limit my claim to its use in connection with ice boxes solely.

In Fig. 6 in which the ice box is located in the middle of the car, the draft plates b^3, and $b^{3\prime}$, slope from such ice box upward toward the ends of the car, respectively, and the ice box itself serves as a partition to divide the air of the car into two parts and the impure air passes upward along the under faces of the draft plates and thence through the flues into the ice box on each side thereof so that

the circulation of air in the car will remove all the taint and carry it to the ice where it is condensed on the ice into water and thence passes off through the drip pipe.

The floors of the ice boxes are provided with ice supporting cleats, *r*, in the ordinary way and in Fig. 1 the wall of the car which forms one side of the ice box is also cleated and the pendent wall is also cleated, thus providing for free circulation of air in contact with the ice.

I indicates the drip trough arranged beneath the lower end of the floor of the ice box and J indicates the drip pipe.

The ice box shown in Fig. 1 is formed on three sides by the walls of the car, and the other walls of the box (the pendent wall *d*) and the floor F of the box are hinged together by a double extensible hinge which allows the box to be easily folded out of the way and provides suitable locking means for securing the wall *d* and the box floor in their folded position. This hinge consists of a supplemental member K hinged by suitable means such as the strap K′ at one end to the free end of the box floor F and hinged by suitable means such as the strap K″ at the other end to the pendent wall *d*. This strap K″ is adapted for extension by suitable means such as forming it in sections *k k′* one of which is provided with two screw threaded holes 4 adapted to receive a set screw *l*, and the other section being adapted to receive the set screw and to be thereby clamped to the strap *k*. The slot allows the supplemental member to be extended when one of the screws is removed and the other loosened. A cord or chain M is attached to the lower end of the pendent wall *d* and is provided with a weight *m*, the cord being led over a pulley *n* at the top of the car so that the tendency of the weight is to draw the pendent wall upward into the position shown in Fig. 2. Such wall *d* (*d*) is hinged to the ceiling of the car by the hinge X, the upper member Y of which is secured to the roof of the car. This arrangement of parts produces a continuous brace or support for the floor of the ice box when the ice box is in position to receive the ice. The lower strap K′ extends beneath the floor of the ice box to the pivot shaft G upon which the floor is pivoted. This construction gives great strength of support to the ice box.

When the car has reached its destination and discharged its cargo it is desirable that the ice be also discharged and this is easily accomplished with the form shown in Fig. 1 by disconnecting the supplemental hinge members *k k′*, thus allowing the pivoted floor to drop down into the position indicated at the right in Fig. 1 and thus dumping the ice from the box. When the floor is dropped down into this position it gives full access to the ice receptacle for the purpose of cleaning. In practice to fold this box the pendent wall is swung inward, thus driving the parts into the position shown in dotted lines in Fig. 1, and upon a further movement thereof the floor can be brought into the position shown in solid lines in Fig. 2. Before making this movement the set screw *l* is removed or loosened and the extension members *k*, *k′* are drawn out into the position shown in Fig. 2, and the screw *l* is again tightened; this forms a brace to support the floor and pendent wall in the position shown in Fig. 2.

In the form shown in Fig. 6 the ice box is formed of two pendent walls d^3 $d^{3\prime}$ hinged to the ceiling, and the floor F^4 is hinged to one of such walls. Cleats T, *t* are arranged to sustain the weight of the floor and the lateral pressure of the walls of the ice box. The drip trough I^4 in this form is hooked to the bottom of the floor F^4 when the box is in its position to receive the ice. The floor F^4 is pivoted at f^4 to one of the pendent walls and is adapted to fold thereagainst.

In practice the pendent walls and the floor are folded together and brought into position within the chamber above the space between the lower ends of the draft plates b^3 $b^{3\prime}$, thus being wholly out of the way when it is desired to use the room for storage without refrigeration. The supplemental hinge member K^4 which is pivoted to the pendent wall intermediate the edges thereof allows this folding to take place.

It must be understood that the supplemental hinge member can be hinged, indiscriminately, intermediate the edges of either of the hinged or pivoted receptacle forming members, (the swinging wall or the floor) without departing from the spirit of my invention.

V indicates a brace arranged in suitable sockets V′ so as to be shot down under the folded box to hold it in place as shown in Fig. 7. In this form of ice box the drip pipe J^4 is made of a flexible tube which may be twisted as indicated in Fig. 6 to form a trap.

The ice box walls in all the forms are lined with zinc or other suitable material Z, impervious to water to prevent the water from passing into the storage chamber from the melting ice.

The zinc lining Z′ at the side walls of the car is fitted over the ice box floor-sustaining cleat 2 which is beveled at one side from the top downward toward the wall of the car to form the gutter 3 to carry off the condensation which runs down from the side walls of the ice box.

It will be noticed that in closing the ice box both the floor and wall close inward while in opening they open outward against the cleats 2 which are provided with drains to carry off condensations. By this construction the weight of the ice in the box tends to hold it firmly against the cleats thus making a sealed ice receptacle. The zinc Z′ is formed down into the gutter so that the zinc forms a continuous lining for the side wall and gutter.

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

1. The combination of a refrigerating chamber having in its top a draft flue arranged at its inlet end to take the air from the said chamber, and an ice box arranged at the opposite or discharge end of said draft flue and made in sections hinged and adapted to fold, one of its members being arranged to fold upward into approximately the plane of the flue substantially as set forth.

2. The combination of a refrigerating chamber and an ice box having hinged members one of which is arranged to fold upward and a counterbalance weight connected with said member substantially as set forth.

3. A refrigerating device comprising the combination set forth of two hinged or pivoted ice receptacle forming members and the supplemental hinge member hinged by one end to the edge of one of such ice receptacle forming members and hinged by the other end to the other member substantially as set forth.

4. In a refrigerating and storage device the combination set forth of the swinging pendent wall; the pivoted ice receptacle floor; and the supplemental hinged member hinged at one end to the pendent wall between the top and the bottom thereof, and hinged at its other end to the ice receptacle floor substantially as set forth.

5. The combination of the swinging pendent wall; the pivoted ice receptacle floor; the supplemental hinge member hinged to the swinging wall between the top and bottom thereof, the supplemental hinge member hinged to the ice receptacle floor, and suitable means to secure the two supplemental hinge members to each other.

6. A refrigerating chamber provided at its top with longitudinal flues opening at their mouths or inlet ends adjacent each other at the middle of the car and ceiling and joists forming such flues, and with ice receptacles supported at their tops by said flues and arranged at the opposite ends of the car in communication with the discharge ends of the flues and formed with hinged members arranged and adapted to fold when not in use within the plane of the flues all substantially as set forth.

7. A refrigerating device having draft flues and inclined draft plates arranged beneath such flues respectively sloping from the discharge mouths of such flues upward to the intake mouths of such flues, respectively, and having a folding receptacle arranged to fold into the space at the discharge ends of such flues above the lower ends of the draft plates and beneath the ceiling of the chamber.

8. The combination of the refrigerating chamber and an ice receptacle arranged at one end thereof and having a side member pivoted or hinged at its upper edge and arranged to fold upward toward the top of the chamber, a bottom member hinged at one edge to and arranged to fold upward against the end of the chamber, and a connection between said bottom and side members, said connection being adjustable whereby it may be employed to connect the members in both the folded and open positions thereof substantially as set forth.

9. The combination of the refrigerating chamber, the side cleats and the hinged wall and floor of the ice box or receptacle, said wall and floor being arranged to open or turn outward against the side cleats and to be sealed thereby when so adjusted all substantially as set forth.

10. A refrigerating chamber having a longitudinal draft flue and having at one end of said flue a section jointed to and forming practically a hinged extension of the lower wall of said flue all substantially as shown and described.

11. The combination of the refrigerating chamber, the side cleats, and the hinged wall and floor of the ice box or receptacle, said wall and floor being arranged to open or turn outward against said side cleats and to be supported thereby when so adjusted all substantially as and for the purposes set forth.

CHAS. S. HARDY.

Witnesses:
JAMES R. TOWNSEND,
ALFRED I. TOWNSEND.