2 Sheets—Sheet 1.

J. M. AYER.

REFRIGERATOR CARS.

No. 184,029. Patented Nov. 7, 1876.

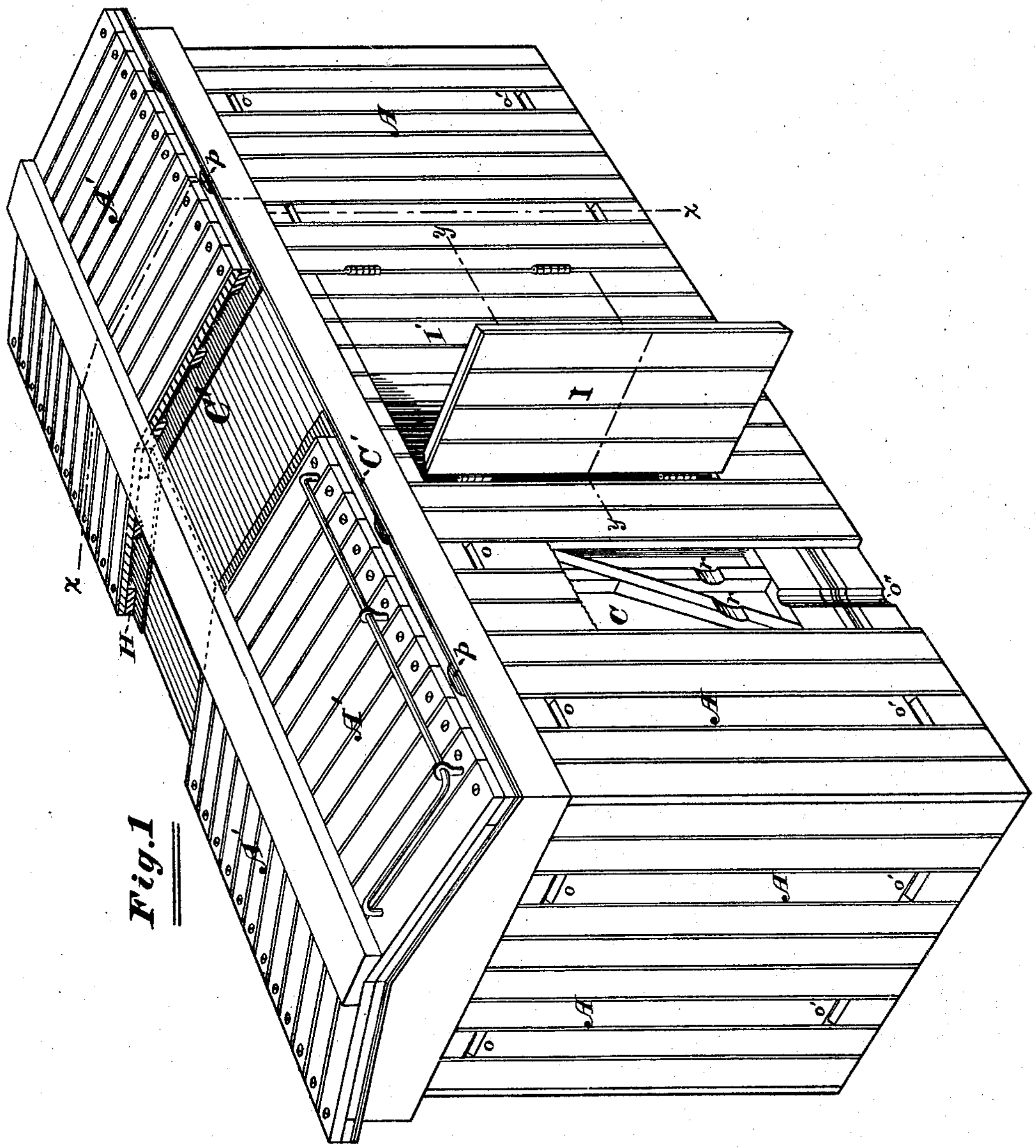

Fig. 1

Attest
Wm. F. Baker
Daniel P. Hathaway

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John M. Ayer

THE GRAPHIC CO. N.Y.

J. M. AYER.

2 Sheets—Sheet 2.

REFRIGERATOR CARS.

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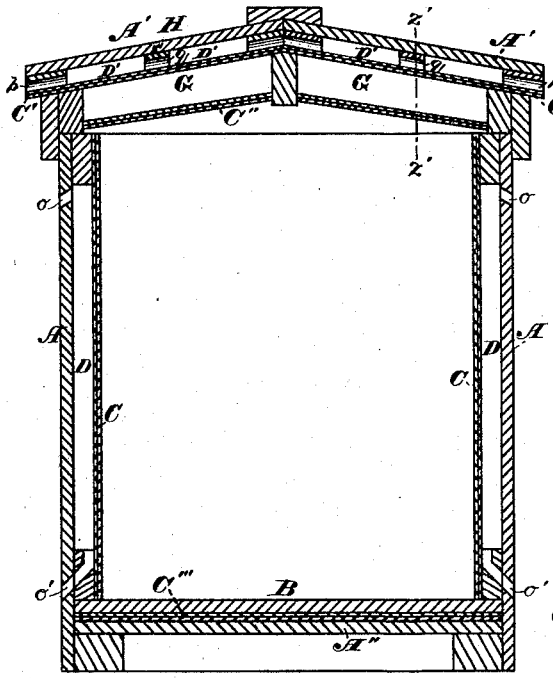

Fig. 2

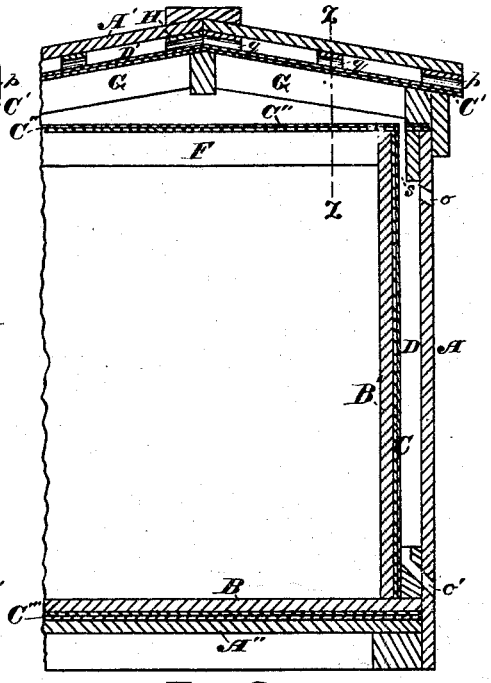

Fig. 4

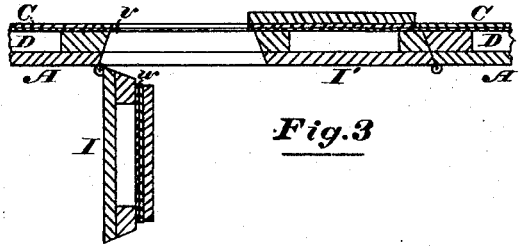

Fig. 3

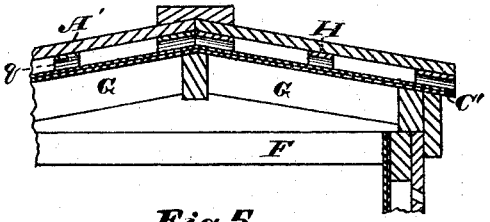

Fig. 5

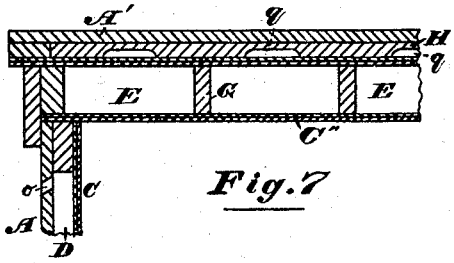

Fig. 7

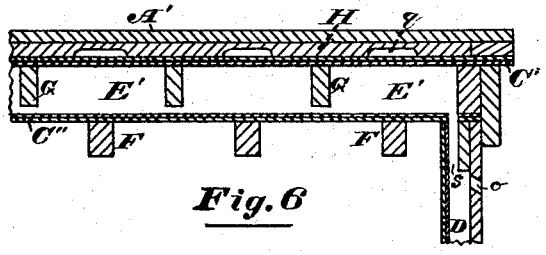

Fig. 6

Attest

W. F. Baker

Daniel Watkaway

Inventor:

J. M. Ayer

UNITED STATES PATENT OFFICE.

JOHN M. AYER, OF CHICAGO, ILLINOIS.

IMPROVEMENT IN REFRIGERATOR-CARS.

Specification forming part of Letters Patent No. **184,029**, dated November 7, 1876; application filed October 9, 1876.

To all whom it may concern:

Be it known that I, JOHN M. AYER, of the city of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Refrigerator-Cars; and I do hereby declare that the following is a full, clear, and exact description thereof, which will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

The object of my invention is to produce a refrigerator-car which shall fulfill every purpose for which such cars are designed—that is to say, which shall have its roof, walls, and floor so thoroughly air-tight, and such nearly perfect non-conductors of heat, as to undergo no appreciable change of temperature within, whatever may be the condition of the external air; and which shall at the same time be much lighter than any other refrigerator-car at present manufactured—lighter even than that described in my former patent in this direction—without any sacrifice whatever of strength or durability; and it consists, first, in constructing the said car with double walls, the outer one of which is of wood, and the inner one my improved lining, composed of a layer of paper or pasteboard, or straw-board, or any like paper product, and a layer of india-rubber, (or any one of the materials termed "rubber packing,") and with an air-space intervening between these two walls and communicating with the external air through openings near the top and near the bottom of the said outer wall of wood, and also through the sill beneath the said air-chamber, whereby a constant circulation of air is maintained therein. It consists, also, in constructing the walls in exactly the same manner as above described, with the addition of an inside layer of boards, placed upon the lining of india-rubber and pasteboard to protect it from injury. It consists, also, in constructing the roof of the said car of the same materials as the walls, the lining of pasteboard and rubber being secured to the upper sides of the carlines, and separated from the outer layer of boards by means of longitudinal strips of timber, the said strips having transverse openings cut in their under sides, at suitable distances from each other, to render the air-chamber continuous, and to permit any water which may find its way through the board covering to escape, and having the openings to this air-chamber at the edges of the roof. It consists, also, in constructing the roof of the car with two air-chambers, if preferred, one below the other; the upper one being constructed as just described, and the lower one being formed by having an additional layer of the lining of india-rubber and pasteboard secured to the under side of the carlines, in which transverse openings may be cut if desired. It consists, also, in forming the second air-chamber, if preferred, by securing the lower layer of pasteboard and india-rubber to the upper (or under) sides of horizontal joists, extending crosswise from one side of the car to the other below the carlines, instead of securing it to the under sides of the latter. It consists, also, in having this lower air-chamber (when constructed in the manner last described) communicate with the air-chambers in the sides and ends, if desired, by means of apertures leading from one to the other; and it consists, lastly, in constructing the floor of the said car with an upper and a lower layer of boards, and an intermediate layer of the india-rubber and pasteboard lining, and with or without an air-chamber, all as hereinafter more fully set forth.

In the accompanying drawings, Figure 1 is a perspective view of my refrigerator-car, with a portion of the external siding removed, also with a portion of the board covering of the roof, and a smaller portion of the india-rubber sheating beneath the boards removed, showing the pasteboard (or paper) underneath. Fig. 2 is a cross-section through *x x*, Fig. 1. Fig. 3 is a horizontal section of the side through *y y*, Fig. 1. Fig. 4 is a partial cross-section, showing a second air-chamber in the roof formed by laying the second or inner lining of pasteboard and india-rubber upon horizontal cross-beams, and showing also an inner course of boards in the side, laid immediately upon the lining of pasteboard and rubber. Fig. 5 is a cross-section, showing horizontal cross-beams, but no second or inner lining, and hence showing only one air-chamber in

the roof. Fig. 6 is a partial longitudinal section through *z z*, Fig. 4. Fig. 7 is a partial longitudinal section, showing the second air-chamber formed by securing a layer of pasteboard and india-rubber to the under sides of the carlines.

A A represent the outer casing of the sides and ends of the car, fastened, as in ordinary freight-cars, to the upper and lower sills. To the inside of the sills and studding is fastened the non-conducting and impervious lining C, composed of india-rubber or "rubber packing" and paper, paper-board, straw-board, or pasteboard, (joined together previously or not, and each of any desired thickness,) the pasteboard being in general placed on the inner side—that is to say, toward the interior of the car. This lining, and the best modes of preparing it, are clearly described in my application for Letters Patent for the same now pending before the United States Patent Office. [No. 184,028.]

Either before or after the lining is placed in position, the exposed surface of the pasteboard or other paper product should be covered with a thick coating of asbestus or other mineral paint; and this is advisable (though not so necessary) even when the said pasteboard does not form the innermost surface of the car.

As a result of the manner above described of placing the outer board casing and the non-conductive lining, an air-space, D, necessarily intervenes between the two. The studding is nearly always narrower than the sills, so that this air-space is continuous; but if not it may be made so by cutting passages in the studding, as at *r r*, or in any other suitable way.

o o are openings or ports, made at suitable distances apart through the outer casing A, near the top of the same, and leading into the air-chamber D; and *o′ o′* are corresponding openings near the bottom of said outer casing A, likewise leading into the air-space D. *o″* is one of the air-passages in the sill beneath the air-chamber.

By means of these different openings a constant circulation of air within the chambers is created and maintained, being usually most active, of course, when the car is in motion.

The air-space performs a valuable office in the car, since air, like all gaseous fluids, is one of the best non-conductors of heat. If, however, the air-space were entirely closed, the air therein being in contact with the wooden casing, which often grows very hot when the sun's rays strike it, might at times become heated by conduction to a temperature higher than that of the external air, thus having its valuable properties in some degree diminished. This effect is obviated by the openings above mentioned, which create a constant current through the air-space, as stated, the air ordinarily entering by way of the upper ports, and then, upon becoming chilled, descending and finding an outlet through the lower ones. The lower openings *o′* and *o″* also serve as outlets for any water, dust, &c., which may find its way into the air-space.

I do not limit myself to the openings placed exactly as above described, for they may be otherwise placed to produce the same effect. Moreover, while I deem these openings a valuable addition in most cases, still I sometimes think it advisable to dispense with them, and have the air-chambers wholly sealed; and this particularly at the ends of the cars, where dust and cinders are most liable to enter.

If desired a layer of boards, B′, Fig. 4, may be placed upon the lining of rubber and pasteboard inside the car, the chief object of this layer being to protect the non-conductive lining from injury. It need not necessarily extend to the top of the car; but may, if preferred, be in the form of a high wainscot.

The roof is constructed as follows: The lining of india-rubber and pasteboard C′ is first placed upon the upper side of the carlines G G, with the pasteboard downward, (preferably coated with asbestus or other mineral paint on its under side, as before mentioned,) and suitably secured in position. Strips of timber H H are next laid longitudinally upon this lining, with transverse openings *q q* in their under side, at intervals of every few feet; and upon these strips is placed the outer casing of boards A′, thus creating the intervening air-chamber D′. *p p* are openings leading into this air-chamber at the side edges of the roof.

It will be seen that by this mode of construction currents of air are caused to circulate through the air-chamber in the roof, as well as through those in the sides and ends of the car; and that any water which may find its way into the said chamber will immediately run off at the sides.

I do not, however, limit myself to laying the strips H longitudinally, since there is no reason why they should not be laid laterally, if preferred, immediately above the carlines, the lining, of course, intervening as before. If these strips are laid laterally the boards of the outer casing A′ should be laid longitudinally.

Owing to the fact that the heat of the sun acts more violently upon the roof than upon any other portion of the car, I often find it advisable to place a layer of the pasteboard and india-rubber on the under side of the carlines G as well as on the upper, thus forming additional air-chambers E E between the two layers, as shown in Fig. 7. These chambers may be connected by suitable openings in the carlines, is desired. Instead of being fastened to the under sides of the carlines, this second or lower layer of india-rubber and pasteboard may be secured to the upper or lower sides of horizontal cross-beams F F, as shown in Figs. 4 and 6, and when this plan is adopted the lower air-chamber of the roof may be made to communicate with the air-chambers in the sides and ends of the car, if desired, by means

of openings *s*, thus creating a circulation of air through that chamber also. Even when not used for the purpose of sustaining the inner lining of india-rubber and pasteboard the cross-beams F F may still be advantageously employed, as shown in Fig. 5, since they not only serve to strengthen the car, but afford also a convenient means for hanging up beef, and the like, for transportation.

Just as the roof is the most affected by the sun's heat the floor is the least affected. I do not usually deem it necessary, therefore, to form an air-space in the last-named part of the car, but simply construct it of a lower course of boards, A″, an upper course, B, and an interposed layer of the india-rubber and pasteboard lining C‴, as shown in Figs. 2 and 4. I do not limit myself to this particular manner of constructing the floor, however, as an air-chamber may be formed there as well as in the other parts of the car, if desired, and in the same manner.

Fig. 4 illustrates the manner in which I construct the doors of my refrigerator-car, so as to make them as nearly air-tight and as durable as possible. The doors I and I′ are of the kind known as double doors, and have inclined edges which fit exactly into a casing inclined so as to coincide. The two edges of the doors, which fit together, are also oppositely inclined. The lining C of pasteboard and india-rubber is made to extend a little beyond the casing to form a cushion, *v*, and a corresponding seat, *w*, is formed on the insides of the doors by having the lining fall short there. A similar cushion and seat are formed on those edges of the doors that fit together. When no inside course of boards is used the cushions may be strengthened by strips of wood placed behind and against them and fastened to the inside wall of the car. A course of boards should always be placed on the inner sides of the doors over the lining.

Although only refrigerator-cars have been thus far referred to in this specification, nearly all that has been said applies with equal force to stationary refrigerators; but a particular description of the manner of constructing the latter is not deemed essential, as the variations and modifications (where any may be required) will naturally suggest themselves.

It will be seen from the foregoing description that my refrigerator-cars must, as a necessary consequence of their mode of construction and the materials employed therein, possess many advantages, among which may be cited the following:

First, the lining employed in them being composed of two of the best non-conductors known, and the perfect system of air-chambers serving to enhance the non-conducting properties of their walls, &c.; and, moreover, being almost perfectly air-tight, (the rubber and pasteboard lining serving to seal them almost hermetically,) my cars are almost absolutely impervious to heat, in consequence whereof perishable materials may be transported long distances in a state of perfect preservation, thereby obviating the loss to shippers and others from decay and injury. For the same reason the consumption of ice is materially less than in ordinary refrigerator-cars, and much of the expense and delay of frequently replenishing them with this substance along the route is, therefore, saved.

Secondly, they are perfectly dry, it being quite impossible for any dampness to pass through the india-rubber of the lining; and the doors being so constructed that when closed they press upon elastic cushions in the frame, no ordinary concussion or jarring of the car has any tendency to loosen them upon their hinges, or produce other damaging effects; hence, they always remain firm, and no warm air from without can ever enter through them to create a damp cold temperature, such as is always injurious to the contents of the car.

Thirdly, they are, so far as I know, the lightest, and by far the most elastic, of all refrigerator-cars made, the materials employed in their construction being the least heavy that could possibly be chosen consistently with strength, and there being none of the usual sodden filling within the walls, but the non-conducting agent used being, on the contrary, light and elastic, scarcely increasing the weight of the car at all, there is no additional strain in consequence of it, and very little extra dead weight to be hauled.

Fourthly, in my cars there is none of the "stenching" or disagreeable and injurious odor inseparable from the non-conducting agents ordinarily employed after they have been in use for a time, in consequence of their becoming damp and moldy, and giving off offensive gases, which always find ingress to the car, sooner or later, through the walls. In the walls of my car, it will have been seen, there is nothing whatever to give off an unpleasant smell, while the air therein is kept perfectly pure by the system of ventilation.

Fifthly, any ordinary box-car may, if desired, be transformed into one of my refrigerator-cars with very little labor and expense, thus effecting a great saving.

Sixthly, even when newly built throughout, they are the cheapest refrigerator-cars manufactured, so far as I can find.

I do not here claim the impervious and non-conducting lining of india-rubber or rubber packing, and pasteboard or other paper product, since that is the subject of my application for Letters Patent hereinbefore referred to; but

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

1. The combination of the outer casing A, internal lining of paper and india-rubber C, intermediate air-chamber D, and openings *o o*, *o′ o′*, and *o″*, substantially as described.

2. The combination of the outer casing A, lining of india-rubber and paper C, intermediate air-chamber D, openings *o o*, *o′ o′*, and

g'', and internal layer of boards B′, substantially as described.

3. The combination of the roof-boards A′, strips H H having transverse openings *q q*, india-rubber and paper lining C′, air-chamber D′, openings *p p*, and carlines G G, substantially as described.

4. The combination of the roof-boards A′, strips H H having transverse openings *q q*, india-rubber and paper lining C′, air-chamber D′, openings *p p*, carlines G G, india-rubber and paper lining C″, and air-chambers E E, substantially as described.

5. The combination of the roof-boards A′, strips H H having transverse openings *q q*, india-rubber and paper lining C′, air-chamber D′, openings *p p*, carlines G G, india-rubber and paper lining C″, cross-beams F F, and air-chamber E′, substantially as described.

6. The combination of the roof-boards A′, strips H H having transverse openings *q q*, india-rubber and paper lining C′, air-chamber D′, openings *p p*, carlines G G, india-rubber and paper lining C″, cross-beams F F, air-chamber E′, and openings *s s*, substantially as described.

7. The combination of the under layer of boards A″, upper layer B, and intermediate layer of india-rubber and paper C‴, substantially as described.

In testimony that I claim the foregoing as my own, I affix my signature in presence of two witnesses.

JOHN M. AYER.

Witnesses:

LEONARD G. KLINCK,

W. L. HIRST.