



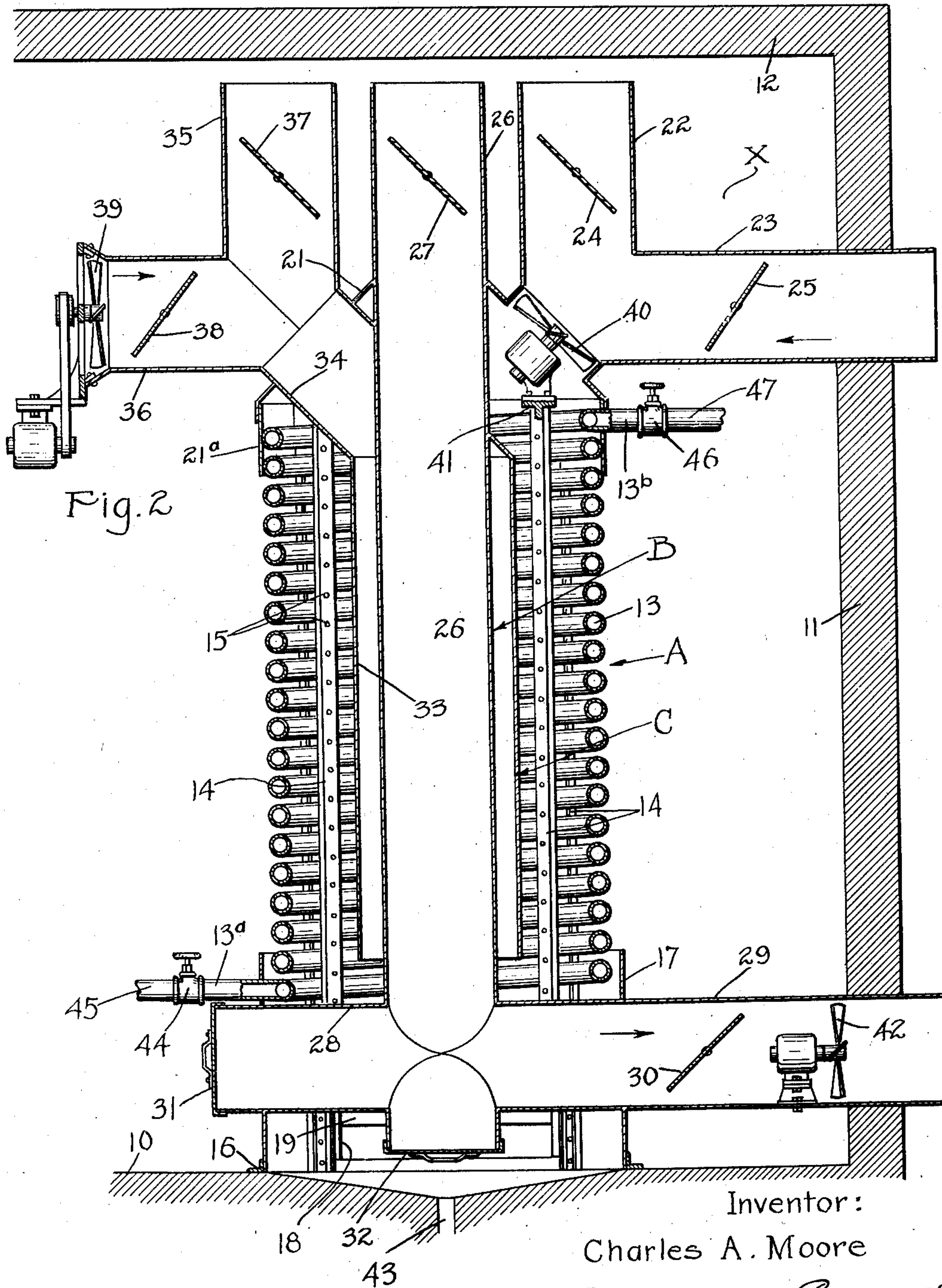
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REFRIGERATING AND VENTILATING APPARATUS

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## UNITED STATES PATENT OFFICE

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## REFRIGERATING AND VENTILATING APPARATUS

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My invention relates to improvements in means for refrigerating, dehumidifying and ventilating rooms or chambers, particularly, though not necessarily, for the storage of perishable products.

The many and various needs for apparatus of the present kind give rise to the requirement for compact unitary, factory built appliances not only capable of being readily handled in shipment and easily installed, but adapted to function efficiently and economically.

An object of my invention is to provide a unitary refrigerating, dehumidifying and ventilating apparatus for pre-cooling, storage and like chambers, the same being simple, durable, relatively inexpensive in construction and capable of being readily handled in shipment and easily installed, the arrangement of parts making for efficiency in operation and economy in the use of the refrigerating medium employed.

With the foregoing and other objects in view, which will appear in the following description, the invention resides in the novel combination and arrangement of parts and in the details of construction hereinafter described and claimed.

In the drawings, Fig. 1 is a side elevation-al view of an embodiment of my invention and Fig. 2 is a vertical, central sectional view thereof.

Referring to the drawings, it will be seen that I have illustrated the floor 10, walls 11 and ceiling 12 of a chamber X in which the apparatus is placed. Said apparatus comprises three upright concentric conduits A, B and C. The outer conduit A supplies the framework of the apparatus, the same including a helically coiled refrigerant pipe 13, the turns thereof being held between a number of paired channel-like standards 14 clamped together by bolts 15, said standards having their footing on a base ring 16 of angle iron. The lowermost turn of the pipe 13 lies considerably above the base ring 16, the space between said turn of pipe and ring being occupied by a sheet metal skirt 17 secured to the outer standards 14 and also to said base ring 16. Openings 18 cut in the

skirt 17 are wholly or partially closed, as desired, by means of doors 19 frictionally slidable at their ends in upright guides 20 secured to said skirt 17. Surmounting the upper end of the pipe coil is a sheet metal cap 21 having a depending flange 21<sup>a</sup> thereon, which is held between the outer sides of the upper turns of the pipe 13 and the inner sides of the outer standards 14. Joining each other near the cap 21 and communicating through said cap with the interior of the conduit A are an upstanding branch pipe 22 and a horizontally extended branch pipe 23, the former being of a height to fall short of the ceiling of a chamber in which the apparatus is installed and the latter sufficiently long to reach through the wall of the chamber into the outer air. Said branch pipes 22 and 23 are respectively fitted with dampers 24 and 25.

The conduit B comprises a sheet metal pipe 26, the upper portion thereof passing centrally through the cap 21. The upper end of the pipe 26 falls short of the ceiling 12, said pipe 26 being fitted with a damper 27 near said end thereof. Joining the pipe 26 near the lower end thereof are a pair of opposed horizontal branch pipes 28 and 29, each extending through the skirt 17, the latter being fitted with a damper 30 and long enough to be projected through a wall 11 of the chamber X. The branch pipe 28 is closed at its outer end by means of a removable cap 31 and the lower end of the pipe 26 is similarly closed by means of a removable cap 32.

The conduit C comprises a pipe 33 encircling the inner pipe 26, the lower end of said pipe 33 terminating at an elevation adjacent to the upper sides of the branch pipes 28, 29. Leading downward to the upper end of the pipe 33 is an inclined branch pipe 34 through which the central pipe 26 extends. The upper end of said inclined branch pipe 34 connects with an upright branch 35 and with a horizontally extended branch 36, said branches being respectively fitted with dampers 37 and 38. The upright branch 35 terminates near the ceiling 12 of the chamber.

The horizontal branch 36 is supplied with a fan 39 for blowing air from the chamber



into and downwardly through the pipe 33. A fan 40 mounted on a beam 41 traversing the upper portion of the conduit A is provided to draw air into said conduit A from the branch pipes 22 and 23 and to force said air downwardly through that conduit. A fan 42 disposed within the branch pipe 29 draws air downwardly through the central pipe 26 and forces it to the outside through said branch pipe 29.

The appliance is installed over a drain 43 in the floor 10 of the chamber, the outwardly turned lower extremity 13<sup>a</sup> of the refrigerant pipe 13 being connected through a valve 44 with a refrigerant feed line 45 and the similarly turned upper extremity 13<sup>b</sup> of the pipe 13 connected through a valve 46 with a return line 47 for the refrigerant. With said valves 44, 46 open to permit of the circulation of the refrigerant through the pipe 13, the walls of the conduit A formed by the pipe 13 are ultimately rendered solid by the accumulation of frost on the turns of said pipe.

The appliance operates in different ways to meet various needs. Without the use of any of the fans 39, 40 and 42, the air may be circulated in the chamber solely by gravity and refrigerated in the process. Under such condition, the dampers 25 and 30 are closed. Upon opening the damper 24 and one or both of the doors 19, the warmest air at the ceiling settles through the conduit A and being refrigerated therein flows out of the appliance into the lower portion of the chamber X, the air entering said conduit at the top thereof being replaced by air rising along the relatively warm walls 11.

Noting that air in the intermediate and central conduits C, B is cooled on account of the proximity thereto of the refrigerant pipe 13 it will be understood that the above noted use of the conduit A may be supplemented in the employment of the conduit C by opening one of the dampers 37, 38 also in the employment of the conduit B by opening the damper 27 and removing one or both of the caps 31, 32. The openings 18 in the skirt 17, supplying a way of egress for air from the outer conduit A, also provided for egress from the appliance of air feeding into the lower portion of said outer conduit from the lower end of the inner conduit B. To stimulate the downward flow of air in the conduit A, the fan 40 may be operated.

Under any of the above noted uses of the appliance, air may be admitted to the room and exhausted therefrom by opening the dampers 25 and 30. Ventilation, under refrigeration, acquired by the opening of said dampers 25, 30 is augmented when both of the caps 31 and 32 are set in place and damper 24 closed. To further augment refrigerated ventilation, either or both of the fans 40 and 42 may be started. And to still further augment such condition and to forcibly diffuse

the refrigerated air in the chamber X, the fan 39 is started.

The disclosed arrangement of conduits provides for an active internal circulation of air within the chamber and for the economical use of a refrigerant. In this connection, it will be understood that air in the inner or exhaust conduit B is affected in least degree by the refrigerant in the coiled pipe 13 of the outer conduit. By thus providing for the exhaustion of air from the chamber through the inner conduit, the cooling effect of the refrigerant is employed almost entirely in refrigerating air in conduits A and C and causing the circulation thereof in both of said conduits.

When it is desired quickly to increase the temperature in chamber X, the coldest air at the bottom of the chamber may be expelled, under pressure, through pipe 29 upon the removal of either or both of caps 31, 32.

By reversing the rotation of fan 39 to create an up draft in conduit C, said fan causes a part of the refrigerated air, near the bottom of conduit A, to be drawn upward into conduit C and forced out into the chamber from the pipe 36. Thus operating, fan 39 builds up pressure within the chamber and thereby promotes the expulsion of air from said chamber through conduit B. Further, with said fan thus operating, air from the upper portion of the room may be drawn through branch pipe 22 into conduit A, whence it will be refrigerated and thereafter boosted through conduit C and further refrigerated therein and then delivered back into the chamber at an elevation from which it may descend about the contents of the chamber. And fresh air admitted to conduit A, through branch pipe 23, may take the same course. Also, a mixture of air admitted to conduit A through the two branch pipes 22 and 23 may take that course.

Changes in the specific form of my invention, as herein disclosed, may be made within the scope of what is claimed without departing from the spirit of my invention.

Having described my invention, what I claim as new and desire to protect by Letters Patent is:

1. The combination with a structure forming a chamber, upright concentric conduits therein, one conduit communicating at its upper end with the upper portion of the chamber and at its lower end with the outer atmosphere, a second conduit communicating at its upper end with the upper portion of the chamber and at its lower end with the lower portion of the chamber, refrigerating means comprising a pipe coiled about and spaced from the second conduit, and adapted to be connected to a source of cooling fluid, the space formed between the pipe coil and the second conduit being adapted to communi-



cate with the outer atmosphere at the top and with the chamber at the bottom.

2. The combination with a structure forming a chamber, of three upright concentric conduits therein, the outer conduit communicating at its upper end with the outer air and at its lower end with the lower portion of the chamber, the inner conduit communicating at its upper end with the upper portion of the chamber and at its lower end with the outer air, the intermediate conduit communicating at its upper end with the upper portion of the chamber and at its lower ends with the lower portion of the chamber, said outer conduit embodying refrigerating means for cooling the air therein and in said other conduits, the air in the inner conduits in least degree.

3. The combination with a structure forming a chamber, upright concentric conduits therein, one conduit communicating at its upper end with the upper portion of the chamber and at its lower end with the outer atmosphere, a second conduit communicating at its upper end with the upper portion of the chamber, and at its lower end with the lower portion of the chamber, temperature affecting means comprising a pipe coiled about and spaced from the second conduit, and adapted to be connected to a source of temperature affecting fluid, the space formed between the pipe coil and second conduit being adapted to communicate with the outer atmosphere at the top and with the chamber at the bottom.

4. The combination with a chamber and means for affecting the temperature therein, of three upright draft conduits, two thereof being arranged within the other, one an ingress conduit communicating at its upper end with the outer air and at its lower end with the lower portion of the chamber, another an egress duct communicating at its upper end with the upper portion of the chamber and at its lower end with the outer air, and the third conduit communicating at its upper end with the upper portion of the chamber and at its lower end with the lower portion of the chamber, and a fan associated with said third conduit for stimulating the flow of air there-through.

5. The combination with a chamber and means for affecting the temperature therein, of three upright draft conduits, two thereof being arranged within the other, one an ingress conduit communicating at its upper end with the outer air and at its lower end with the lower portion of the chamber, another an egress conduit communicating at its upper end with the upper portion of the chamber and at its lower end with the outer air, and the third a conduit communicating at its upper end with the upper portion of the chamber and at its lower end with the lower portion of the chamber, and a fan associated with

one of said conduits for stimulating the natural flow of air therethrough.

6. The combination with a chamber and means for affecting the temperature therein, of three upright draft conduits, two thereof being arranged within the other, one being in valved communication at its upper end with the outer air, also in valved communication with the upper portion of the chamber and, further, in communication at its lower end with the lower portion of the chamber, another conduit being in communication at its upper end with the upper portion of the chamber and at its lower end with the outer air, and the third conduit being in communication at its upper end with the upper portion of the chamber and at its lower end with the lower portion of the chamber.

7. The combination with a chamber and means affecting the temperature therein, of three upright draft conduits, two thereof being arranged within the other, one being in valved communication at its upper end with the outer air, also in valved communication with the upper portion of the chamber and, further, in communication at its lower end with the lower portion of the chamber, another conduit being in communication at its upper end with the upper portion of the chamber and at its lower end with the outer air, and the third conduit being in communication at its upper end with the upper portion of the chamber and at its lower end with the lower portion of the chamber, and a fan associated with said first conduit for drawing air into the same from the outside and also from the upper portion of said chamber.

8. The combination with a chamber and means affecting the temperature therein, of three upright draft conduits, two thereof being arranged within the other, one conduit communicating at its upper end with the outer air and at its lower end with the lower portion of the chamber, another conduit communicating at its upper end with the upper portion of the chamber and at its lower end with the lower portion of the chamber, and a third conduit communicating at its lower end with the lower portion of the chamber, the upper end of said third conduit being in valved communication with the upper portion of the chamber at different elevations therein.

9. The combination with a chamber and means affecting the temperature therein, of three upright draft conduits, two thereof being arranged within the other, one conduit communicating at its upper end with the outer air and at its lower end with the lower portion of the chamber, another conduit communicating at its upper end with the upper portion of the chamber and at its lower end with the outer air, and the third conduit opening at its upper end into the upper portion of the chamber and at its lower end into the lower portion of said chamber, and a blower



associated with one or said conduits for stimulating the flow of air therethrough.

10. The combination with a structure forming a chamber, of two upright draft conduits, temperature affecting means comprising a pipe coiled about and spaced from said two conduits and adapted to be connected with a source of temperature affecting fluid, the unoccupied space within the pipe coil forming a third conduit, one conduit communicating at its upper end with the outer air and at its lower end with the lower portion of the chamber, another conduit communicating at its upper end with the upper portion of the chamber and at its lower end with the outer air, and another conduit opening at its upper end into the upper portion of the chamber and at its lower end with the lower portion of the chamber.

11. The combination with a structure forming a chamber, of an upright refrigerated conduit communicating at its upper end with the upper portion of the chamber, a second conduit, within said first conduit, communicating at its lower end with the interior of the first conduit at the lower part thereof and at its upper end with the upper portion of said chamber, and means for impelling air through the second conduit from said lower part of the first conduit and into the upper portion of the chamber.

12. The combination with a structure forming a chamber, of an upright refrigerated conduit communicating at its upper end with the upper portion of the chamber, a second conduit, within said first conduit, communicating at its lower end with the interior of the first conduit at the lower part thereof and at its upper end with the upper portion of said chamber at a level beneath the level of communication between said first conduit and chamber, and means for impelling air through the second conduit from said lower part of the first conduit and into the upper portion of the chamber.

13. The combination with a structure forming a chamber, of an upright refrigerated conduit communicating at its upper end with the upper portion of the chamber, a second conduit, within said first conduit, communicating at its lower end with the interior of the first conduit at the lower part thereof, said second conduit including a horizontal branch in communication with the upper portion of the chamber, and means for impelling air through the second conduit from said lower part of the first conduit and into the upper portion of the chamber.

14. The combination with a structure forming a chamber, of an upright refrigerated conduit communicating at its upper end with the upper portion of the chamber, a second conduit, within said first conduit, communicating at its lower end with the interior of the first conduit at the lower part

thereof, said second conduit including a horizontal branch at the upper part thereof in communication with the upper portion of the chamber, at a level beneath the level of communication between said first conduit and chamber, and means for impelling air through the second conduit from said lower part of the first conduit and into the upper portion of the chamber.

15. The combination with a structure forming a chamber, of an upright refrigerated conduit in valved communication at its upper end with the upper portion of the chamber and with the outer atmosphere, a second conduit, within said first conduit, communicating at its lower end with the interior of the first conduit at the lower part thereof and at its upper end with the upper portion of said chamber, means of egress for air from the chamber, and means for impelling air through the second conduit from said lower part of the first conduit and into the upper portion of the chamber.

16. The combination with a structure forming a chamber, of an upright refrigerated conduit in valved communication at its upper end with the outer atmosphere, a second conduit, within said first conduit, communicating at its lower end with the interior of the first conduit at the lower part thereof and at its upper end with the upper portion of said chamber, means of egress for air from the chamber, and means for impelling air through the second conduit from said lower part of the first conduit and into the upper portion of the chamber.

In testimony whereof, I have signed my name to this specification.

CHARLES A. MOORE.

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