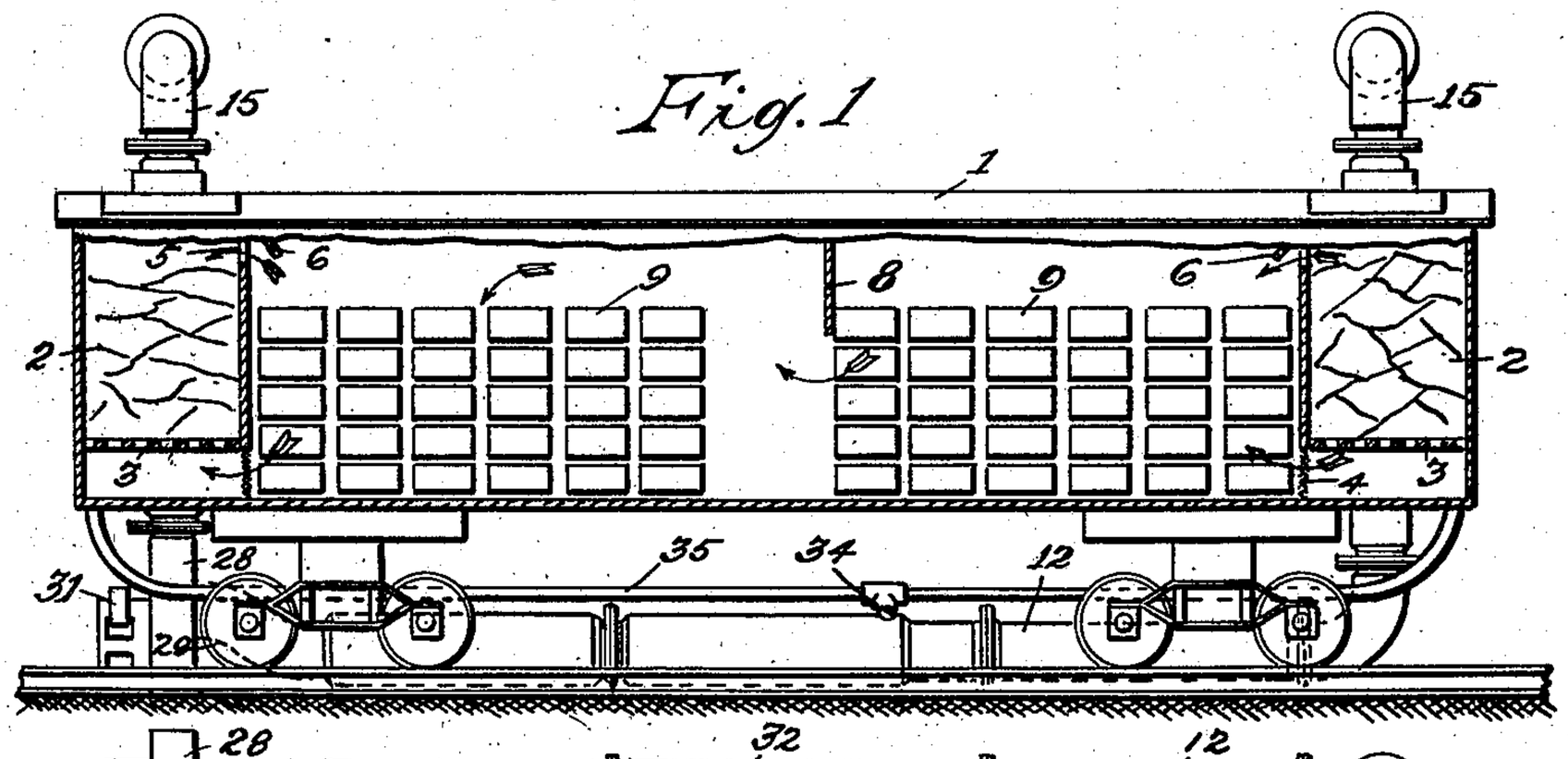
No. 881,733. PATENTED MAR. 10, 1908.

A. R. SPRAGUE.

APPARATUS FOR REFRIGERATION.

APPLICATION FILED SEPT. 27, 1905.

Fig. 1



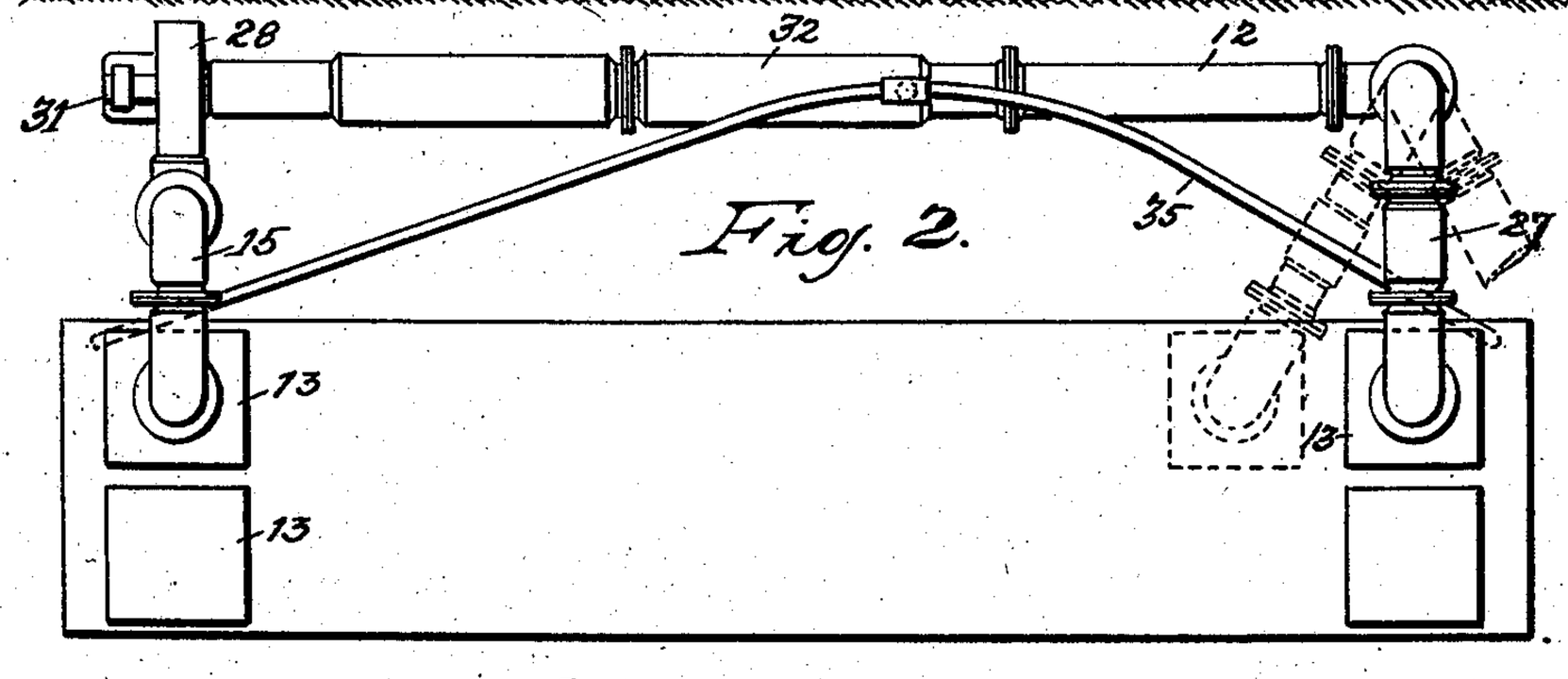


Fig. 2.

Fig. 3.

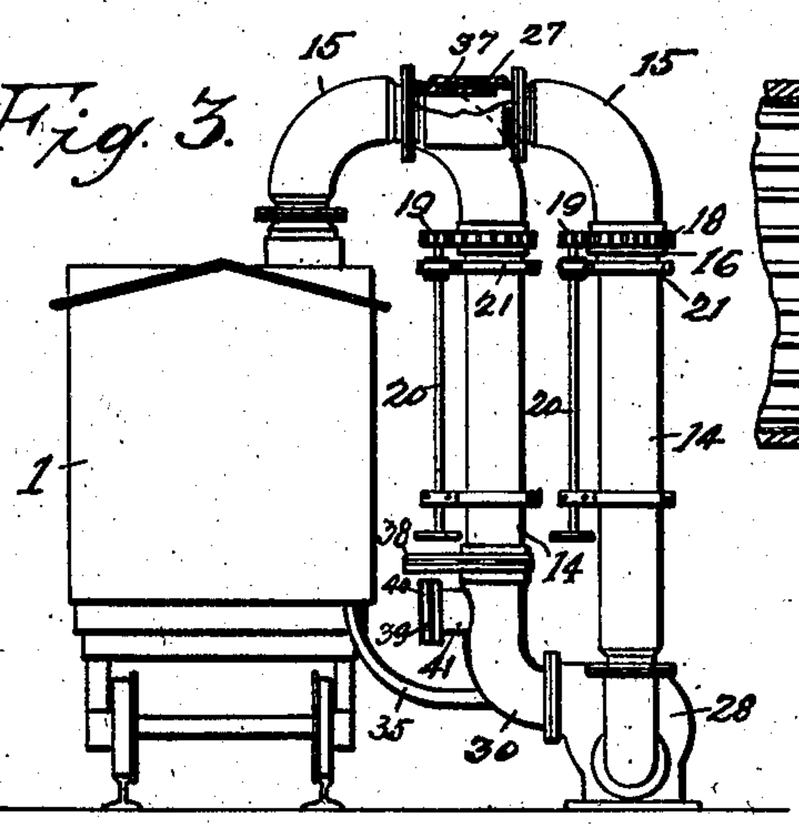
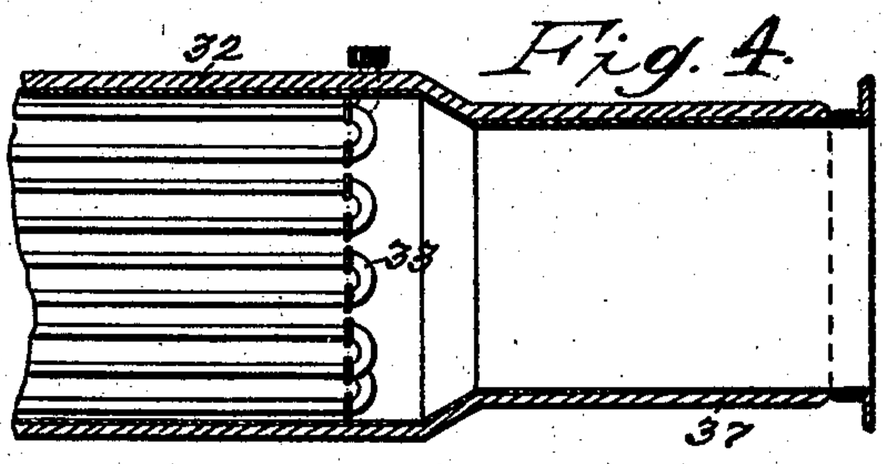


Fig. 4.



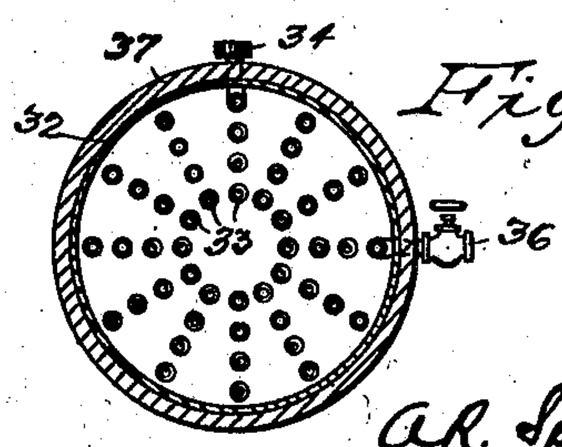


Fig. 5

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APPARATUS FOR REFRIGERATION.

No. 881,733. Specification of Letters Patent. Patented March 10, 1908.

Application filed September 27, 1905. Serial No. 280,354.

To all whom it may concern:

Be it known that I, ALMERIN R. SPRAGUE, citizen of the United States, residing at Sacramento, in the county of Sacramento and State of California, have invented certain new and useful Improvements in Apparatus for Refrigeration, of which the following is a specification.

In shipping perishable products, as fruits, vegetables, etc., long distances, as across the continent, it has been discovered that if such products be thoroughly cooled before starting upon the journey the loss from decay during transit will be reduced to a minimum. Heretofore it has been the practice in shipping fruit from California to the eastern markets to pack the fruit in boxes and put it into cars as quickly as possible and start it upon its journey with as little delay as possible depending upon the circulation of cooled air within the car to effect the thorough cooling of the fruit during its journey. But it has been found impossible to so thoroughly cool the fruit under these conditions as to prevent its decay and especially when the fruit passed through regions of country of extremely high temperatures and the fruit was also subjected to the rise in temperature within the car caused by the decay of some of the more perishable portions of the load.

The object of my invention is to avoid these objections by thoroughly and quickly cooling the fruit or other products before starting it upon its journey and preferably after it has been loaded into the car. A most efficient and economical means for accomplishing this purpose is by passing a current of cold air through the car from one end to the other and also through a cooling medium, preferably ice at one or both ends, and thoroughly circulating and distributing the current to all parts of the car during its passage. It is also very desirable that the warm air within packages, as boxes of oranges, be replaced by cooler air to more thoroughly cool the products being shipped. But so long as the current of air finds an easier passage between the packages it is impossible to force it through them, hence it becomes necessary to provide means for forcing as much of the air as possible from the interior to exterior of the packages where it can be taken up by the current and carried out of the car.

It is a well known fact that when a portion of the air is removed from a chamber to form a partial vacuum the remaining air will immediately expand and fill the entire space occupied by all of the air before any of it was removed. By taking advantage of this fact the air within a car of fruit may be exhausted to a greater or less extent by any suitable means which will cause the air in the packages to expand and a portion of it to pass into the spaces between the packages from whence it may be removed by passing a current through the car. As soon as the current fills the car the air remaining in the packages contracts to its normal condition and the portion of the current that takes the place of the removed air cools the fruit with which it comes in contact and also mingles with the remaining air to a greater or less extent, so that when the current is again stopped and suction established the air within the packages is again expanded and a portion removed as before. By alternating the current and the partial vacuum within the car the contents of the packages can be cooled so quickly and thoroughly that substantially all chemical action, as decay or further ripening, can be stopped, and by keeping such contents at that temperature, which can be easily done by means of ice within the car, fruit can be ripened on the trees before packing and then delivered at a distant market in as good condition as at a nearer market.

It is also desirable at certain times of the year, as at the beginning of the orange season, to ripen the fruit artificially, as by the application of a greater degree of heat than it would receive by leaving it on the trees. This can easily be done by means of my invention by heating the current of air during its passage and then passing it continuously or intermittently through the car in the same manner as cool air for refrigeration. In fact, after the fruit has been sufficiently ripened by the warm air, it is only necessary to shut off the warm air and turn on the cool and fill the ice tanks in order to cool the fruit as first described, when it is ready for transportation to the most distant markets.

I accomplish this and other objects by means of the mechanism and apparatus shown in the accompanying drawings and hereinafter more fully set forth.

Figure 1 is a vertical longitudinal section of a car, together with a side elevation of one

form of apparatus embodying my invention for producing the refrigeration; Fig. 2 is a top plan view of the same; Fig. 3, is an end view; Fig. 4, is a broken longitudinal sectional view of a portion of the cooling apparatus; Fig. 5, is a transverse view of the same.

In the drawings 1 indicates the body of a car which may be of any ordinary construction and provided with the usual ice tanks 2 at the ends. The bottoms 3 of the tanks are arranged at a slight distance above the floor of the car and an opening 4 is formed into the interior of the car which is preferably covered with wire screen in the usual manner. An opening 5 is also formed at the upper portion of said wall at or near the roof of the car. A movable damper or regulator 6 is provided for the opening 5 which may be in the form of a wing or shutter that is adapted to be moved to close the opening to a greater or less extent.

In the construction shown in Fig. 1, a baffle board or obstruction 8 is arranged transversely of the car at the top, preferably near the center, with its lower end extending down to a greater or less distance between the boxes or packages of fruit 9, which are arranged in tiers within the car, generally with a wider space at the center of the car than at any other place. By this arrangement of baffles a current of air is caused to enter the top of the car at one end and have the major portion forced down through the ice in the tank at that end and out through the opening at the bottom where it is distributed and caused to pass among the boxes and through to the opposite end of the car and out through the ice in the tank at that end. The minor portion of the air enters the car through the opening at the top of the ice tank, depending upon the size of the opening as regulated by the dampers at that point and commingles with the air from the bottom opening. In passing from the interior of the car a greater portion of it passes out through the larger opening at the bottom while a lesser portion passes out the graduated opening at the top of the ice tank at that end.

In the construction shown in Fig. 1, the baffle prevents the air from passing in a current from one end of the car to the other in the space between the tops of the tiers of boxes and the top of the car and causes it to be thoroughly broken up and evenly distributed throughout the car.

The current of air may be generated and controlled in any suitable manner, but I have shown a very desirable construction in which an elongated chamber, preferably in the form of a tube 12, is arranged lengthwise at one side of the track upon which the car stands while being cooled. The tube is preferably formed in sections for convenience in handling, with the ends of the sections flanged so as to be secured together, as by bolts. A connector or conduit extends from each end of the tube in position to be detachably connected with the car at its top as through the openings 13 into the ice tanks. I prefer to construct these conduits as standpipes 14, the upper end of each of which overhangs the main portion and is adapted to be moved over the top of the car and away again as by means of a curved portion 15, one end of which extends into the upper end of the pipe and is adapted to be rotatably supported therein, as by means of a band or collar 16. An annular gear wheel 18 is rigidly secured to the portion 15 so as to rest upon the band and rotate the curved portion when the wheel is turned, as by a pinion 19 at the upper end of a crank shaft 20, which is journaled in bearings in two clamps 21 secured to the main portion of the stand pipe.

Means may be provided for adjusting the position of the ends of the curved portions 15 for adapting them for use with cars of different lengths. This is preferably done by providing one of them with a straight telescopic joint 27, by means of which its length can be varied and the end moved to one side or the other of a plane through the stand pipe at right angles to the side of the car. By making the joint rotatable as well as telescopic the extension upon that curved portion can be inserted into and removed from the openings 13 at that end of the car without removing it from said portion.

One of the standpipes is preferably connected with the end of the tube 12 by means of a casing 28, within which is mounted an ordinary fan or blower which is adapted to create a continuous current through the tube and stand pipes and through the car. One end of the tube is curved as at 29 so as to be joined to the inlet at the center of the casing 28 and the lower end of the stand pipe is curved as at 30 and joined to the outlet of the same casing. In this manner that pipe normally stands nearer the car than the other one as shown more particularly in Fig. 3, and permits of the curve at the upper end of said other pipe being provided with the telescopic joint. It also causes the fan shaft 31 to stand lengthwise of the tube whereby the power for rotating the shaft, not shown, can be placed to one side of the tube.

One or more sections of the tube as 32 are preferably enlarged as shown more particularly in Fig. 4, and located therein is an elongated coil 33 of horizontally arranged pipes through which the water or brine, as the case may be, from the melted ice is caused to pass from the drip tubes of the ice tanks and thereby materially assist in cooling the air as it is forced through the tube by the

fan or blower in the casing 28. The inlet 34 to the coil is preferably provided with a T and detachably connected with the drip pipes from the ice boxes by means of a flexible conduit or hose 35, and the outlet 36 is conveniently located at any suitable point in the section, as in one side. To prevent the absorption of heat from the outside the tube and stand pipes are preferably provided with a suitable covering as 37.

In cooling or refrigerating a car with the apparatus as above described, the car, preferably loaded, is drawn to a point adjacent to the apparatus and the curved portions adjusted so as to permit of the insertion of the extension into the openings of the ice boxes thereby forming an endless conduit of which the car body forms a part. The blower is then put in operation by starting the motor which will cause a strong current of air to be rapidly circulated through the car and the tube. As the air enters the car the major portion of it passes through the tank and is cooled and dried by the ice and from there it is circulated through the car and passes out at the other end, the most of it going through the tank where the heat and moisture that it has accumulated from the contents of the car are absorbed by the ice in the tank. The lesser portion of the air current passes into the car through the graduated opening at the top of the first tank and commingles with the current of air within the car body which is being deflected and driven to every part of the car by the baffles, and on leaving the car a smaller portion of the air passes through the graduated opening at the upper end of the tank at that end.

After leaving the car the air passes down through one stand pipe, through the tube, and up through the other stand pipe back into the car again, and on its way through the tube it is broken up and caused to pass in contact with the different pipes of the coil where it is further cooled by the melted ice and salt, the temperature of the water rising from a trifle above 30 where it leaves the car to about 50° where it leaves the coil. The tube and stand pipes are of such a large size that the air can pass through them in a large volume thereby causing the process of cooling to proceed with great rapidity which is very essential in order to get the car cooled and started on its journey with as little delay as possible. While very desirable results can be secured in this manner, it requires considerable time to replace the air in the packages with the cooler air, hence I prefer to provide the apparatus with means for intermittently varying the density of the air within the car which will cause a movement of the air within the packages from their interior to the exterior. This can be easily done by closing the conduit at a point before it reaches the car to stop the current and opening it at another between the stop and the blower to permit the air from the blower to escape.

In Fig. 3 of the drawings I have shown the stand pipe between the blower and the car as provided with two valves 38 and 39, each of which is formed from a sheet of metal that is seated in a rectangular pocket-like frame 40 formed upon or connected with the stand pipe, the pocket of the valve 39 being preferably located in a short extension 41 from the side of the stand pipe. One of the valves, as 38, is arranged to close the pipe between the blower and the car and the other one is adapted to open or close communication between the blower and the atmosphere.

With such a structure it is evident that when the valve 39 is closed and the valve 38 opened the air will be circulated through the car and the apparatus will operate the same as heretofore described, but by closing the valve 38 and opening 39 the air will be shut off from reëntering the car but will be exhausted through the extension 41. This will produce a partial vacuum in the car which will cause the air in the packages to expand and fill the car, including the space between the packages. After exhausting the air in this manner for any desired time the valve 38 is opened and 39 is closed which will cause the air to be again moved in a current. It is better to restore the tension of the air to its normal condition before circulating it which can be done by leaving the valve 39 open for a short time after opening the valve 38. Instead of entirely opening and closing the valves they can be partly opened which will permit of the circulation of a current varying in density from a slight compression when the full current is flowing, to a greater or less degree of attenuation, as when a portion of the current is permitted to escape and the remainder of it is circulated. By manipulating the two valves in this manner during the operation of the blower the fruit will be cooled much quicker and with more uniformity than where the continuous current alone is used.

When it is desired to utilize my apparatus and invention for warming fruit or other articles, as for ripening or coloring oranges in the early part of the season, the current of air can be warmed or heated to any desired degree by connecting the ends of the coil 33, as the case may be, in any ordinary manner, with any suitable steam generator, not shown. By using such an arrangement the fruit can be taken from the orchard where the temperature at that time of the year is comparatively low and the ripening process correspondingly slow, and putting it in a place where it can be subjected to a temperature of 90 degrees or more, which will cause the ripening or coloring to be correspondingly accelerated. After the fruit has been sufficiently ripened the heat is cut off and the connections and arrangements made

for refrigeration which process will be carried on in the same manner as though the fruit had been ripened on the trees. After the car has been thoroughly cooled in this manner, which experience has shown requires to be about 40 to 50 degrees, the ice tanks are replenished with fresh ice, the car closed as tightly as possible and sent forward. Actual experience has shown that when fruit is treated in this manner it has arrived in the eastern markets in first class condition, or much better than similar fruit that was shipped at the same time but only treated in the usual manner.

Although I have shown a construction that has been found to be very efficient and have described it as applied to fruit, it is evident that changes and modifications may be made in the apparatus and the process may be applied to other products than fruit, as for instance, meats, vegetables, etc., and I reserve the right to make all such changes, variations and applications as will come within the scope of my invention.

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

1. In a refrigerating apparatus, a chamber, a conduit connected therewith provided with an opening to the atmosphere, a blower and valve, said valve being between the blower and the chamber, and being adapted to control the passage through the conduit, a second valve adapted to control the opening to the atmosphere, and a coil in the conduit.

2. In a temperature changing apparatus, a chamber adapted to contain a temperature changing medium, a conduit connected therewith at both ends and provided with an opening to the atmosphere, a blower and two valves, said opening being between the blower in the conduit and the chamber and one of the valves being adapted to control said opening and the other valve being adapted to control the passage through the conduit.

3. In a refrigerating apparatus, a chamber adapted to contain a cooling medium, a conduit connected therewith, a coil in the conduit adapted to be connected with said chamber and said cooling medium passed through it, and means for intermittently passing a current of air through the conduit and chamber in such volume as to appreciably vary the density of the air within the chamber and its contents, whereby said contents are quickly cooled.

In testimony whereof I affix my signature, in presence of two witnesses, this 16th day of September, 1905.

ALMERIN R. SPRAGUE.

Witnesses:
B. W. SHEPHERD,
A. S. ANDERSON.