E. C. HORST.

DRIER.

APPLICATION FILED APR. 23, 1918.

1,325,848. Patented Dec. 23, 1919.

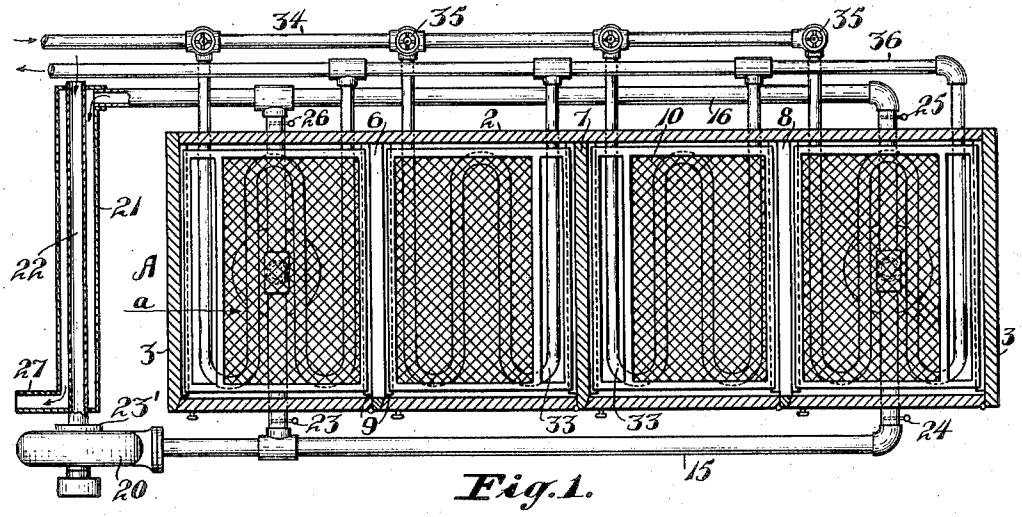


Fig. 1.

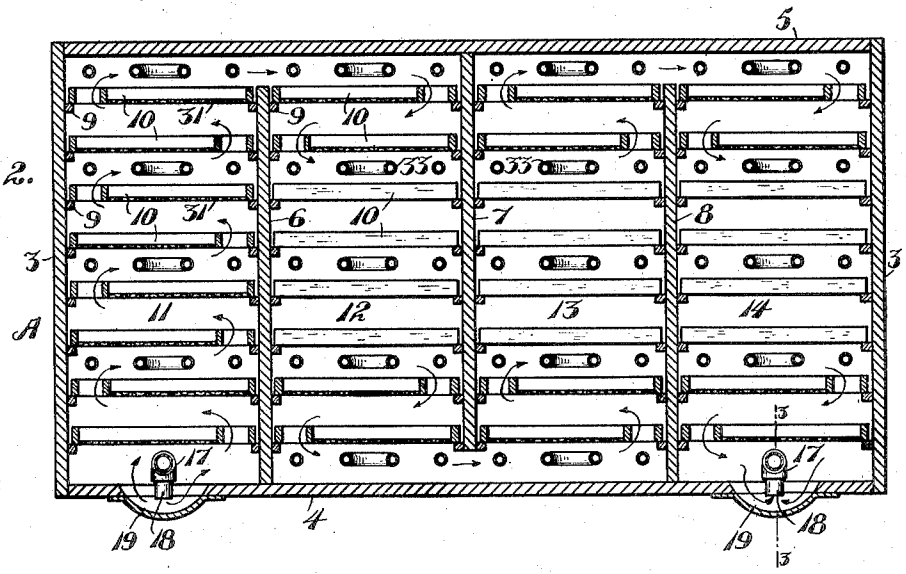


Fig. 2.

Fig. 4.

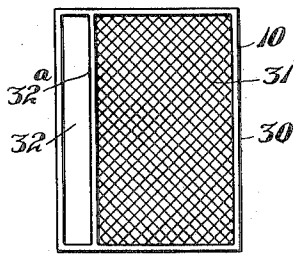
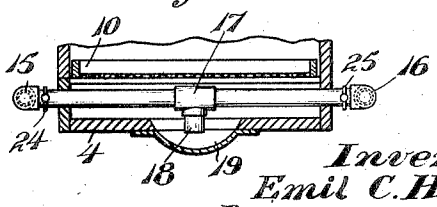


Fig. 3.



Inventor
Emil C. Horst
By Strong & Townsend
Attorneys

UNITED STATES PATENT OFFICE.

EMIL CLEMENS HORST, OF SAN FRANCISCO, CALIFORNIA.

DRIER.

1,325,848. Specification of Letters Patent. Patented Dec. 23, 1919.

Application filed April 23, 1918. Serial No. 230,315.

To all whom it may concern:

Be it known that I, EMIL CLEMENS HORST, a citizen of the United States, residing at the city and county of San Francisco and State of California, have invented new and useful Improvements in Driers, of which the following is a specification.

This invention relates to a drier.

One of the objects of the present invention is to provide a simple, efficient form of drier for food products, such as fruits, vegetables and the like, and particularly to provide means for maintaining a flow of air through the drier and for increasing the temperature of the air during its passage through the drier. Another object of the invention is to form a series of adjacent vertical chambers for the reception of drying trays and to provide connecting passages between the upper and lower ends of the vertical chambers which will permit the air to pass alternately up and down through the successive chambers. Another object of the invention is to provide means for reversing the direction of flow of air through the chambers and to so arrange the trays that the air will not only pass through the same but also over and under each tray during its passage through the chambers. Another object of the invention is to provide means for preheating the incoming air by passing it through a preheater which is heated by the hot moisture-laden air discharging from the drier. Further objects will hereinafter appear.

The invention consists of the parts and the construction, combination, and arrangement of parts as hereinafter more fully described and claimed, having reference to the accompanying drawings, in which—

Figure 1 is a horizontal longitudinal section through the drier.

Fig. 2 is a vertical longitudinal section.

Fig. 3 is a vertical cross section through the lower portion of the drier taken on the line 3—3 of Fig. 2.

Fig. 4 is a plan view of one of the trays.

Referring to the drawings in detail, A indicates in general a housing consisting of a pair of side walls 2, end walls 3, a bottom section 4 and a top or cover 5. Dividing the interior chamber into a plurality of vertical chambers is a plurality of baffle plates or partition walls 6, 7 and 8. These walls extend crosswise of the housing, as shown in Figs. 1 and 2, the walls 6 and 8 extending from the bottom of the housing to a point adjacent the top, while the center wall 7 extends from the top to a point adjacent the bottom section. In other words, a space or passage is left between the top and the partitions 6 and 8, and similarly between the bottom and the partition 7.

Each chamber is provided with shelves 9 for the reception of trays 10, and these trays may be removed to permit the product to be dried to be placed thereon and to be removed when dried. The partition walls 6, 7 and 8 divide the housing into four vertical chambers 11, 12, 13 and 14, the chambers 11 and 14 being each provided with air inlet and outlet pipes, such as shown at 15 and 16. The pipes extend through the side walls, as shown in Fig. 3, and are united by a T-fitting 17. A short pipe section 18 is placed in the lower side of the fitting to direct the incoming air in a downward direction against the bowl 19 which deflects and distributes the air in all directions. There is one bowl 19 in each of the chambers 11 and 14 and there is one inlet and outlet pipe connected, as shown in Fig. 3. The pipe 15 is connected with the discharge side of a blower 20, while the pipe 16 is connected with a preheater 21 which surrounds an inlet pipe 22 connected with the suction side 23 of the blower. Both the inlet and discharging pipes entering the chambers 11 and 14 are provided with dampers, such as shown at 23, 24, 25 and 26. These serve as a means for reversing the flow of air through the vertical chambers. For instance, if it is desired to admit the incoming air to the chamber 11, this is accomplished by opening the dampers 23 and 25 and closing the dampers 24 and 26. The air will therefore enter through the damper 23 and discharge downwardly into the bowl 19 in chamber 11 where it is quickly distributed and here passes upwardly through the trays in chamber 11, then over the partition wall 6 into chamber 12 where it passes downwardly through the trays and again passes under the partition wall 7 and up through chamber 13, then over the partition 8 and down through chamber 14 where it finally escapes through pipe 18 and damper 25 into the discharge pipe 16 which is connected with the preheater 21. The air before finally escaping passes through the preheater where it is partially cooled and is at last permitted to escape to the atmosphere at the opposite

end of the preheater through pipe 27. The incoming air enters through pipe 22 which passes through the preheater.

The incoming air in this manner is preheated before it passes through the blower and enters the drier proper. It is, however, increased in temperature during its passage through the drier and therefore reaches its highest temperature at the point of discharge. A considerable saving is obtained by utilizing the heat of the hot moisture-laden air when it discharges, and, as the incoming air is under most conditions comparatively cool, it can readily be seen that the preheating arrangement provided permits a considerable saving.

By referring to Fig. 4, it will be seen that each tray consists of a rectangular frame 30 which is provided with a screen bottom 31. The trays, when loaded, are preferably left uncovered near one end, as indicated at 32. The trays when inserted or placed upon the shelves in the vertical drying compartments 11, 12, 13 and 14 are alternately reversed, as shown in Fig. 2, so that the air, when passing either upwardly through a chamber or downwardly through the same, will tend to pass in zig-zag fashion, as indicated by the arrows, over and under the trays and also partly through the same, the air having the greatest tendency to travel zig-zag fashion when the material to be dried is comparatively wet, as it adheres more closely to the screen and will have more of a tendency to travel in a straight direction up or down through the trays when the product is partly dried, as the product shrivels and shrinks to such an extent that the meshes of the screen become more or less uncovered, thereby permitting the air to pass directly through the trays. Each tray may be provided with a cross strip 32^a, if desired, to prevent the product to be dried from covering the entire screen, thus insuring a free passage of air at one end of the tray.

Interposed between the trays or alternate layers of same, as shown in Figs. 1 and 2, is a series of steam heating coils 33. These coils are arranged at suitable intervals and have a tendency to increase the temperature of the air during its passage through the several chambers. The incoming air from the blower may, for instance, have a temperature of approximately 100° F., but by passing between the several heating coils shown, it is obvious that the temperature may be increased to any degree desired. In actual practice, I found that most fruits and vegetables will stand a temperature as high as 160° F. without discoloring. It is therefore advantageous to gradually increase the temperature of the air as the moisture-carrying capacity of the same increases in proportion to its temperature. For instance, 10,000 cubic feet of air at 100° F. can absorb as much as 30 pounds of water, while the same air when increased in temperature to 160° F. can carry as much as 130 pounds. It can therefore be readily seen that it is very beneficial to increase the temperature of the air during its passage through the drier, as it is becoming more and more moisture-laden during its passage. This is one of the important features of the invention, as it greatly increases the capacity and efficiency of a drier constructed as here shown.

The gradual increase of air temperature during passage through the drier may be controlled to a nicety in the present instance, as each heating coil 33 is connected at one end with a live steam pipe, such as shown at 34, and provided with a regulating valve 35, while the opposite end of each coil is connected to an exhaust pipe 36. Practically any rise in temperature may thus be obtained, as each succeeding coil may be supplied with more steam, if desired.

To further increase the efficiency of the drier it has been found advantageous to reverse the flow of air through the chambers. This is accomplished by opening or closing the several dampers 23, 24, 25 and 26. If it is desired to pass the air in the general direction of arrow *a* (see Fig. 1), it is only necessary to open the dampers 23 and 25 and to close the opposite dampers. Conversely, if it is desired to reverse the flow and pass it in a general direction opposite to that indicated by arrow *a*, it is only necessary to open the dampers 24 and 26 and close the opposite dampers. The air when passing through the drier after it is once loaded may be reversed as often as desired, permitting every tray to be evenly dried and exposed to air from all sides, as the reversing of the air current will first cause the air to pass downwardly through a tray and then upwardly through the same, and at all times partially over and under each tray, whether the air is flowing in one direction or another, this being due to the staggering of the trays as previously described.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. A drier comprising a housing, a plurality of partition walls extending crosswise of the housing and dividing the housing into a plurality of adjacent vertical chambers, each alternate wall being spaced from the top and each intermediate wall from the bottom of the casing to form connecting passages therebetween, an inlet and an outlet pipe connected with each vertical end chamber formed by the partition walls, a blower connected with the inlet pipes, a discharge pipe connected with the outlet

pipes, a damper in each pipe to permit reversal of the air through the vertical chambers in the housing and means for increasing the temperature of the air during its passage through the vertical chambers in the housing whether passing in one direction or the other.

2. A drier comprising a housing, a plurality of partition walls extending crosswise of the housing and dividing the housing into a plurality of adjacent vertical chambers, each alternate wall being spaced from the top and each intermediate wall from the bottom of the casing to form connecting passages therebetween, an inlet and an outlet pipe connected with each vertical end chamber formed by the partition walls, a blower connected with the inlet pipes, a discharge pipe connected with the outlet pipes, a damper in each pipe to permit reversal of the air through the vertical chambers in the housing, means for increasing the temperature of the air during its passage through the vertical chambers in the housing whether passing in one direction or the other, an inlet pipe connected with the blower, a preheater surrounding said pipe, said preheater being connected with the atmosphere at one end and with the air outlet pipes at the opposite end, and means for increasing the temperature of the air during its passage through the casing whether it is flowing in one direction or the other.

3. A drier comprising a housing, a plurality of partition walls extending crosswise of the housing and dividing the housing into a plurality of adjacent vertical chambers, each alternate wall being spaced from the top and each intermediate wall from the bottom of the casing to form connecting passages therebetween, an inlet and an outlet pipe connected with each vertical end chamber formed by the partition walls, a blower connected with the inlet pipes, a discharge pipe connected with the outlet pipes, a damper in each pipe to permit reversal of the air through the vertical chambers in the housing, means for increasing the temperature of the air during its passage through the vertical chambers in the housing whether passing in one direction or the other, an inlet pipe connected with the blower, a preheater surrounding said pipe, said preheater being connected with the atmosphere at one end and with the air outlet pipes at the opposite end, means for increasing the temperature of the air during its passage through the casing whether it is flowing in one direction or the other, said means comprising a plurality of heating coils positioned in each vertical chamber, means for admitting steam through said coils, and means for regulating the quantity of steam passing through each coil.

4. A drier comprising a housing, a plurality of partition walls in said housing dividing the housing into a plurality of adjacent vertical chambers, said partition walls being alternately spaced from the top and each intermediate wall from the bottom of the housing to form connecting air passages, means for supporting a plurality of superposed separated trays in each vertical chamber, means for passing a current of air from end to end of the housing alternately upwardly and downwardly through the adjacent vertical chambers, and means for reversing the flow of air through said chambers.

5. A drier comprising a housing, a plurality of partition walls in said housing dividing the housing into a plurality of adjacent vertical chambers, said partition walls being alternately spaced from the top and each intermediate wall from the bottom of the housing to form connecting air passages, means for supporting a plurality of superposed separated trays in each vertical chamber, means for passing a current of air from end to end of the housing alternately upwardly and downwardly through the adjacent vertical chambers, means for reversing the flow of air through said chambers, and means for staggering the trays to permit the air to pass over and under the trays in each chamber.

6. A drier comprising a housing, a plurality of partition walls in said housing dividing the housing into a plurality of adjacent vertical chambers, said partition walls being alternately spaced from the top and each intermediate wall from the bottom of the housing to form connecting air passages, means for supporting a plurality of superposed separated trays in each vertical chamber, means for passing a current of air from end to end of the housing alternately upwardly and downwardly through the adjacent vertical chambers, means for reversing the flow of air through said chambers, means for staggering the trays to permit the air to pass over and under the trays in each chamber, and means for increasing the temperature of the air during its passage through the vertical chambers, said means comprising a plurality of steam heating coils interposed between the trays and each vertical chamber and means for regulating the flow of steam through each heating coil.

7. In a drier of the character described, a plurality of separate closed contiguous chambers with partition walls having passages alternately at the top and bottom, trays superposed in each chamber and having openings at alternate ends to permit a continuous flow of air, means by which the flow of air may be induced, and reversed to flow through the chambers in either direction, means by which the heat of the air may be increased as it passes through the chambers,

a pre-heater into which the air is discharged and an inlet supply pipe passing through the pre-heater.

8. In a drier of the character described, an inclosing housing, transverse vertical partition walls dividing the inclosed space into separate chambers, said walls having communicating passages alternately at the top and bottom, and each chamber having separated supports, trays upon said supports with air directing passages at alternate ends to induce a zig-zag current, pipes through which air under pressure may be admitted to either of the end chambers, and valves by which the flow may be reversed, concave bowls, and pipe connection through which the admitted air is discharged into the bowls and dispersed through the chambers.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

EMIL CLEMENS HORST.

Witnesses:
THOS. CASTBERG,
JOHN H. HERRING.