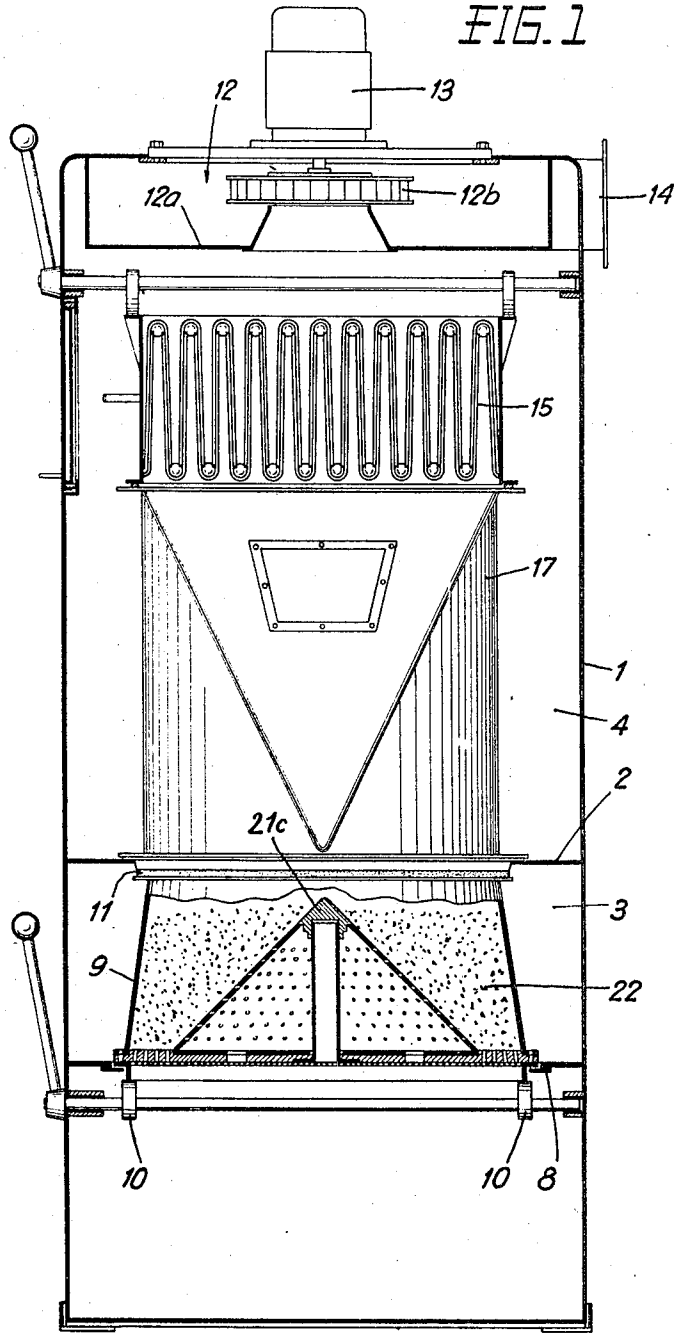
July 30, 1968 HANS-GÜNTHER ZELLER 3,394,468

CONTAINER FOR THE RECEPTION OF A PULVERULENT OR GRANULAR FEED FOR TREATMENT IN A HOT AIR DRYER

Filed June 10, 1966 4 Sheets-Sheet 1

FIG. 1



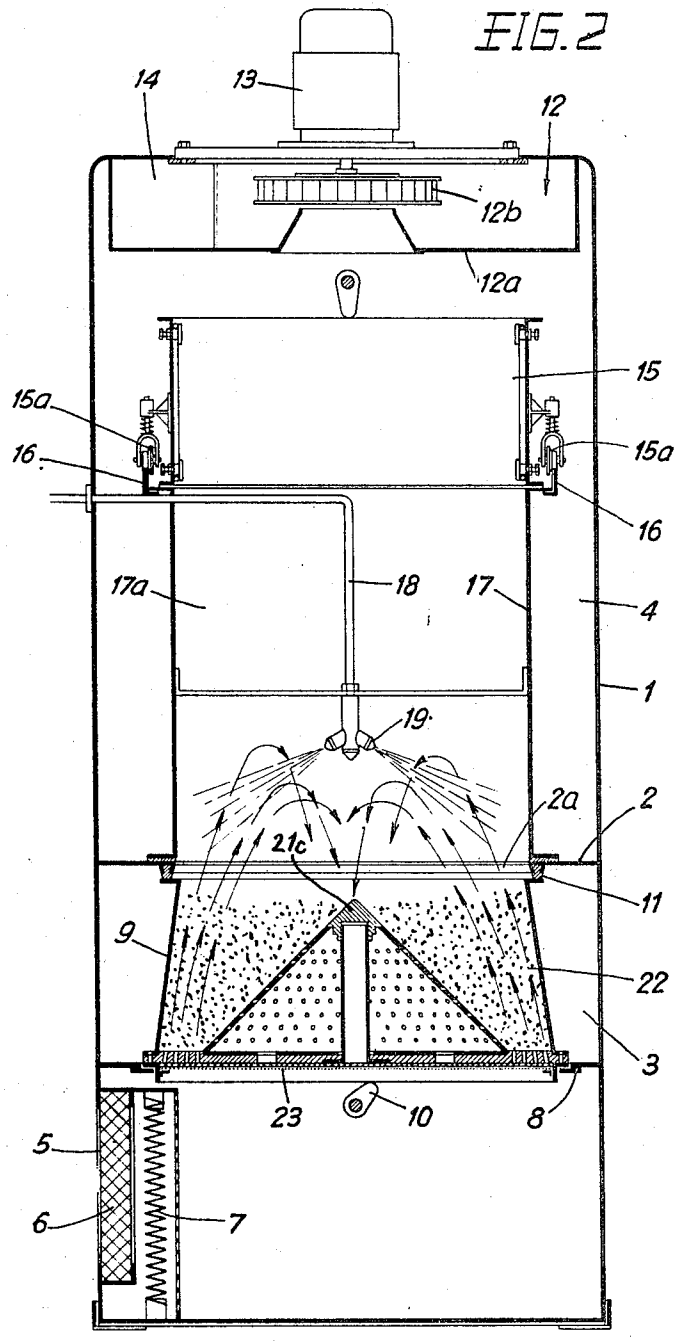
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Filed June 10, 1966 4 Sheets-Sheet 2

FIG. 2



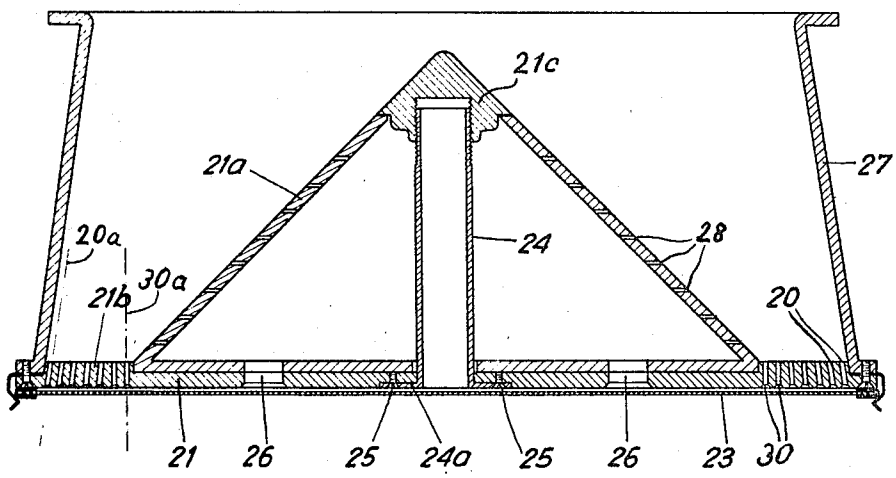
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Filed June 10, 1966 4 Sheets-Sheet 3

FIG. 3



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CONTAINER FOR THE RECEPTION OF A PULVERULENT OR GRANULAR FEED FOR TREATMENT IN A HOT AIR DRYER

Filed June 10, 1966 4 Sheets-Sheet 4

FIG.4

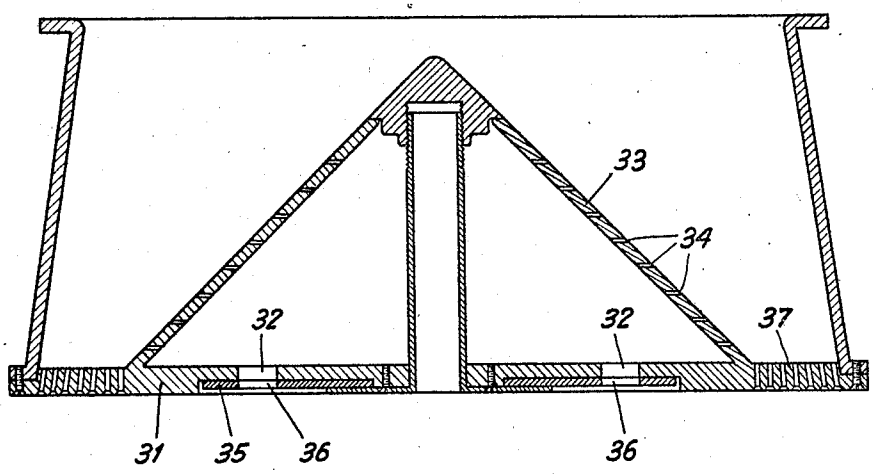
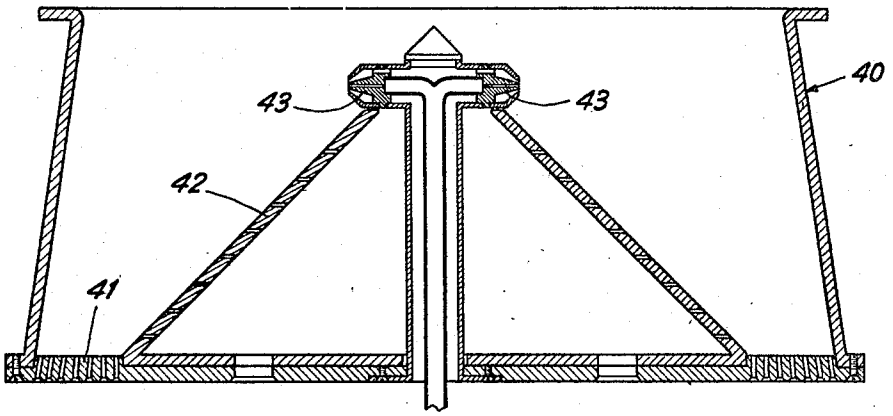


FIG.5



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United States Patent Office 3,394,468 Patented July 30, 1968

3,394,468

CONTAINER FOR THE RECEPTION OF A PULVERULENT OR GRANULAR FEED FOR TREATMENT IN A HOT AIR DRYER

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Filed June 10, 1966, Ser. No. 556,636
Claims priority, application Switzerland, June 14, 1965, 8,246/65
8 Claims. (Cl. 34—57)

ABSTRACT OF THE DISCLOSURE

A hot air dryer having a current of hot air flowing upwardly through a pulverulent or granular feed located in a conatiner arranged within said hot air dryer. The container includes a floor portion provided with openings at its peripheral region for the through flow of the hot air. Means are provided for imparting a greater vertical velocity to the up-flowing air at the peripheral edge of the container than at the central region, thereby lifting the feed contents of the container at the peripheral edge while allowing it to fall in the central region of the container. In the preferred embodiment the velocity imparting means include a substantially conical configuration for the container wall.

The present invention broadly has reference to improvements in hot air dryers and, more specifically, relates to an improved container for the reception of a pulverulent or granular feed for treatment in a hot air dryer.

In a hot air dryer known in the art a pulverulent or granular feed can be treated in a current of hot air which blows through the dryer in upflow. The treatment may be confined to merely drying the feed, but other treatments may be likewise performed, such as mixing or treatments such as granulating or coating with sugar or lacquer wherein the feed is exposed to an ascending current of air and expanded thereby into a fluidised state. According to the nature of the contemplated treatment the velocity, temperature and humidity of the air are adjusted and auxiliary devices such as stirrers, devices for the admission of liquids or liquid sprayers and atomisers and so forth may be provided to bring the treated material into the required state. This method is known as the fluidised solids technique. In such a process the treated feed is usually filled into a suitable container with a gas-permeable or perforated floor through which the air can blow through the material in the container from below upwards.

Now, a primary object of the present invention relates to an improved construction of container for the reception of a pulverulent or granular feed for treatment in a hot air dryer which produces a more uniform fluidized bed and results in shorter treatment times.

Another important object of this invention has reference to an improved container for use in a hot air dryer, specifically for receiving the material to be treated, and which ensures for a very efficient and uniform processing of the material, by virtue of a controlled flow of the hot air current passing through the container, and thereby provides for great versatility in the performance of different treating processes, such as agglomeration, granulation, coating with lacquers or sugar and the like.

The subject matter of the present invention is a container of the specified kind which serves for the reception of the pulverulent or granular feed that is to be treated in a hot air dryer through which a current of air is blown from below upwards, and which is therefore provided

with a floor having openings for the passage therethrough of the air. The proposed container is characterised in that these openings are so located that the current of air flowing through the container in upflow has a higher vertical velocity at the peripheral edge than in the center axis of the container thereby to lift the feed principally at the container periphery and to allow it to fall in the center.

Compared with conventional containers in which the velocity of upflow is roughly the same throughout the entire cross section or possibly even higher in the center axis than at the edge, the proposed type of container has the advantage of generating a far more constant fluidised bed and of exposing every part of the treated feed more evenly to the current of air than is the case in a conventional container. The resultant treatment times are therefore not only shortened, but particular treatments, such as agglomeration, granulation, coating with lacquers or sugar, can be performed much more reliably than in containers previously known in the art.

Embodiment of the invention will be hereinafter described in greater detail by reference to the accompanying drawings in which:

FIG. 1 is a front elevation, partly in section, of a high speed dryer equipped with a container according to the invention,

FIG. 2 is the same dryer in a sectional side elevation,

FIG. 3 is the container, shown on a larger scale, and

FIGURES 4 and 5 are further embodiments of a container designed according to the teachings of the present invention.

The dryer illustrated in FIGURES 1 and 2 comprises an outer casing 1 divided in its interior, by a horizontal partition 2, into a lower chamber 3 and an upper chamber 4. As is conventional in dryers of this particular type the lower chamber 3 contains an air admission opening 5 inside of which there are provided an air filter 6 and a heater 7. Moreover, resting on a ledge 8 is a container generally indicated by reference number 9. During operation this container 9 is pushed upwards by two cams 10 to maintain a tight joint with a seal 11 surrounding the peripheral edge of a central opening 2*a* in the horizontal partition 2. Located at the top of the upper chamber 4 is a fan 12 comprising an impeller 12*b* mounted in a casing 12*a*. This fan 12 is driven by a suitable motor 13 mounted outside the external casing 1 and draws air from the interior of upper chamber 4, delivering the same into an exhaust pipe 14. Moreover, the upper chamber 4 contains an exchangeable exhaust air filter 15, fitted with rollers 15*a* which ride on rails 15 to facilitate the withdrawal of this air filter 15 from the outer casing 1 after a door in the wall of the aforesaid outer casing has been opened. The horizontal partition 2 also carries an intermediate inner casing 17 connecting the circular or central opening 2*a* to the air filter 15, which in the illustrated example is of rectangular section. This intermediate inner casing 17 thus forms a treating chamber 17*a* for the treated feed, and it contains pipes 18 fitted at their ends with sprayer heads 19.

The manner in which this hot air dryer functions, which so far as described is conventional, will be readily understood from the foregoing description. The fan 12 reduces the pressure existing in the upper chamber 4 so that air from the treating chamber 17*a* formed by the intermediate casing 17 will be drawn through the filter 15. Consequently, the pressure in the treating chamber 17*a* as well as in the container 9, which can be taken out of the outer or external casing 1 to be charged and discharged, will also be lowered. This causes air to flow from the lower chamber 3 upwards through the perforated bottom of container 9 and fresh air to be continuously drawn in through the opening at 5, the filter 6 and the

heater 7 to enter the lower chamber 3 in the form of a current of clean and hot air.

The novel and inventive feature of the illustrated hot air dryer is comprised in the container 9 which has an apertured floor 21 for the passage therethrough of the air. Details of this container 9 depicted in FIGURES 1 and 2 are shown on a larger scale in FIGURE 3. The manner in which the arrangement functions, that is to say, the nature of the fluidised bed which can be therein maintained, will be understood from FIGURE 2. First and foremost it will be seen that the apertures or openings 20 in the floor 21 are so disposed that the upflowing air has a higher vertical velocity at the peripheral edge than in the region of the central axis and that the treated feed 22 will thus principally be lifted at the container edge, whereas it is allowed to fall in the center. This is partly achieved by inclining the container wall 27 towards the container interior i.e. by a substantially coned or frusto-conical configuration of the container 9 so that its diameter at the floor 21 is greater than its diameter at the top. In the illustrated embodiment, this angle of slope is such that generatrices of the container wall 27 on diametrically opposite sides enclose an angle of about 10° to 30°, preferably about 20°. At the same time, the container floor 21 is provided with a central coned elevation or projection 21*a* with an angle at the apex of 80° to 100°, preferably 90°, the ratio of the diameter at the base of the coned elevation 21*a* to the diameter of the entire container floor 21 being between about 1:1.2 and 1:1.4. The apertures or openings 20 in the annular horizontal portion 21*b* of the container floor 21 each have a cross section of about 12 to 28 square millimeters, preferably about 20 square millimeters, and their relative spacing is 10 to 20 millimeters, the axis 20*a* of the openings 20 near the edge being inclined at an angle of about 6° to 10° towards the container interior, whereas the axes 30*a* of the openings or apertures 30 on the inside are substantially perpendicular to the floor 21. Contrary thereto, the openings 28 in the coned projection or elevation 21*a* of the container floor 21 each have a smaller cross section in the order of 0.8 to 7 square millimeters, preferably about 3 square millimeters, and they are spaced further apart at relative intervals of about 20 to 40 millimeters, their axes being substantially horizontal, i.e. parallel to the floor 21 containing the openings 20 and 30.

If the above mentioned cross sections of the openings should be too large in relation to the treated feed, which in its initial or final state may be a powder or dust, then a fine screen may be easily fitted above or under the floor 21 in the manner illustrated in FIGURES 2 and 3, where this fine screen is indicated by the reference numeral 23. In the illustrated embodiment it will be seen that the substantially cone-shaped or coned elevation or projection 21*a* is so constructed that a cone of circular section is mounted on the horizontal part of the floor 21 and that a tube 24 which passes through the floor 21 is screwed into the apex 21*c* of the cone, the bottom end of tube 24 carrying a flange 24*a* which is secured by screws 25 or the like to the floor 21. Openings or holes 26 in the floor 21 and in the base of the circular section cone, which as such might be completely open, provide the air access to the openings 28 which are provided in the coned elevation 21*a* in a direction parallel to the floor 21.

The directions of flow impressed upon the air by the particular construction of the openings give rise to the generation of a fluidised bed having the general configuration illustrated in FIGURE 2. The treated feed with which the container 9 is charged before the treatment begins and which fills the container roughly to the apex 21*c* of the coned elevation 21*a* is lifted by the flowing air principally at the peripheral edge of the container 9 and falls again in the middle to impinge on the coned elevation 21*a* and to slide down its sides until it is again entrained and lifted by the current of air.

According to the size of the charge and the nature of the treated material it may become necessary to slightly vary the velocity of flow of the air. This can be fairly conveniently done by constructing the floor partly or wholly of perforated, relatively rotatably adjustable elements in the manner illustrated in FIG. 4, where the central portion of the container floor 31 is provided with holes or openings 32 which correspond to the openings 26 in the preceding embodiment. Through these openings 32 the air can enter the interior of the coned projection or elevation 33 which has an otherwise closed bottom and then flow into the container interior through the horizontally disposed openings 34. The floor in the present arrangement contains a rotatable disc 35 likewise provided with openings 36 which can be turned to register with the openings 32, as is the case in the position illustrated in FIGURE 4 of the drawings. It will be at once understood that by turning this apertured disc 35 the openings 32 can be partly or wholly closed. In analogous manner, rotatably or slidably adjustable members could be provided underneath the substantially vertical openings 37 in the marginal portion of the floor 31 so that these openings could thus be similarly controlled to vary their cross section of flow.

If the treated feed is not intended to be dried, but to be agglomerated, granulated, coated with varnish or sugar or otherwise treated by the addition of liquids, then this liquid such as the sugar syrup for the production of sugar-coated pills, must be sprayed on the particles in the fluidised bed. For such purpose the sprayer heads 19 in FIGURE 2 can be used. These sprayer heads 19 may be so disposed that the spray is directed substantially downwards or alternatively that the spray cone is substantially horizontal. FIGURE 5 is an example of a container generally indicated by reference number 40, likewise comprising a floor 41 with a coned central elevation 42 which at its apex is provided with sprayers 43. These sprayer means or sprayers 43 are two-component sprayers of a type as are already known in the art, i.e. sprayers associated with separate admission pipes for a gas and a liquid, the pressurised gas, which may be compressed air, entraining the liquid and atomising the same in the fluidised bed.

While there is shown and described present preferred embodiments of the invention, it is to be distinctly understood that the invention is not limited thereto, but may be otherwise variously embodied and practiced within the scope of the following claims.

What is claimed is:

1. A container for the reception of a pulverulent or granular feed in a hot air dryer through which a hot air current passes in upflow, said container comprising a container wall and a floor portion, said floor portion being provided with openings for the entry of air into the interior of the container, and means for imparting to the upflowing air a greater vertical velocity at the peripheral edge of the container than at the region of its central axis, to thereby principally lift the feed contents of the container at said peripheral edge while allowing it to fall in the central region of said container, said velocity imparting means includes providing a substantially conical configuration for said container wall, the diameter of said floor portion being greater than the diameter at the top region of said container.

2. A container as defined in claim 1, wherein diametrically opposed generatrices of said container wall enclose an angle in the range of about 12° to 30°.

3. A container as defined in claim 2, wherein said enclosed angle is preferably about 20°.

4. A container for the reception of a pulverulent or granular feed in a hot air dryer through which a hot air current passes in upflow, said container comprising a container wall and a floor portion, said floor portion being provided with openings for the entry of air into the interior of the container, and means for imparting to the

upflowing air a greater vertical velocity at the peripheral edge of the container than at the region of its central axis, to thereby principally lift the feed contents of the container at said peripheral edge while allowing it to fall in the central region of said container, wherein said openings of said floor portion are disposed at the peripheral region of said container.

5. A container for the reception of a pulverulent or granular feed in a hot air dryer through which a hot air current passes in upflow, said container comprising a container wall and a floor portion, said floor portion being provided with openings for the entry of air into the interior of the container, and means for imparting to the upflowing air a greater vertical velocity at the peripheral edge of the container than at the region of its central axis, to thereby principally lift the feed contents of the container at said peripheral edge while allowing it to fall in the central region of said container, wherein said velocity imparting means includes a substantially cone-shaped elevation means arranged substantially centrally at said floor portion within said container, wherein said openings in said floor portion each have a cross-section in the range of about 12 to 20 square millimeters and are spaced from one another in intervals of about 10 to 20 millimeters, said floor portion openings including outer openings and inner openings, the axes of said outer openings being inclined towards the interior of said container at an angle which lies in the range of about 6° to 8°, the axes of said inner openings being substantially perpendicular to said floor portion, said substantially cone-shaped elevation means being provided with apertures having a cross-section in the range of about 0.8 to 7 square millimeters and spaced from one another in intervals of about 20 to 40 millimeters, the axes of said apertures being substantially parallel to said floor portion.

6. A container as defined in claim 5, wherein the cross-section of said openings of said floor portion is preferably about 20 square millimeters, the cross-section of said apertures being preferably about 3 square millimeters.

7. In a hot air dryer having a current of hot air flowing upwardly through a pulverulent or granular feed located in a container arranged within said hot air dryer, said container comprising a floor portion provided with openings for the throughflow of the hot air located at the peripheral region thereof, container wall means projecting upwardly from and encircling said floor portion, said container wall means being of substantially conical configuration and cooperating with said openings such as to impart to the upflowing air a greater vertical velocity at the peripheral region of said container than at the region of its central axis, to thereby principally lift the container feed contents at said peripheral region while allowing it to fall in the central region of said container.

8. In a hot air dryer as defined in claim 7, further including a substantially cone-shaped member carried at said floor portion inwardly of said openings of said floor portion, means for admitting hot air into said cone-shaped member, said cone-shaped member including a series of openings for directing the admitted hot air out of said cone-shaped member into the interior of said container and in a direction substantially parallel to said floor portion.

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