

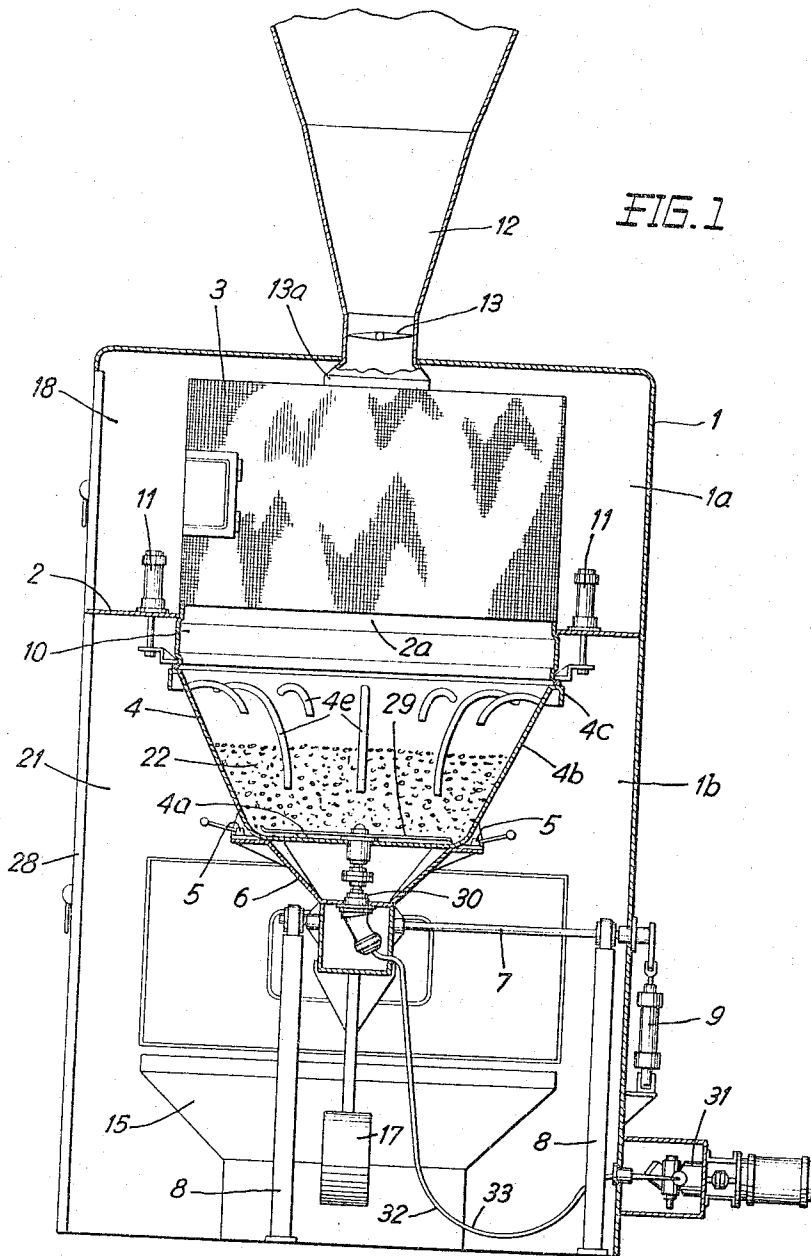
April 25, 1967

W. GLATT ET AL  
QUICK DRIER FOR DRYING MOLTEN AND PASTY MASSES  
AND FOR THE PRODUCTION OF POWDERS AND  
GRANULATES IN A HOT OR  
WARM AIR STREAM

3,315,371

Filed May 13, 1964

4 Sheets-Sheet 1



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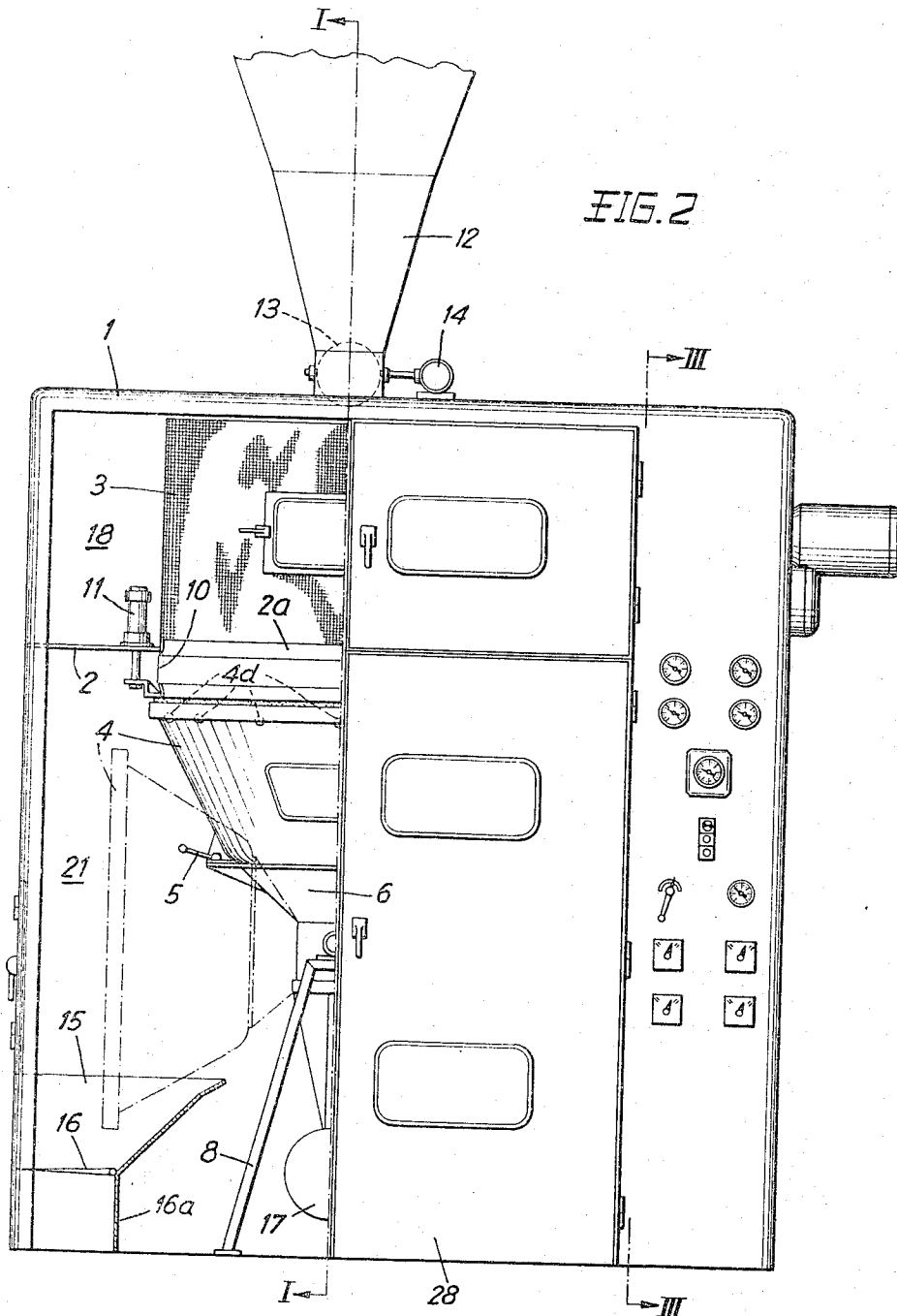
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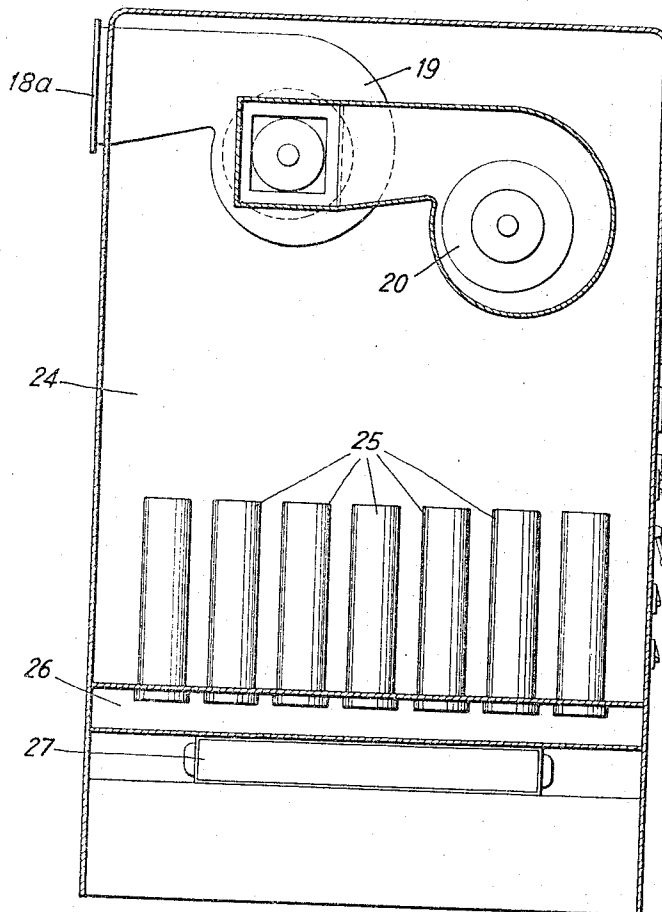


FIG. 3

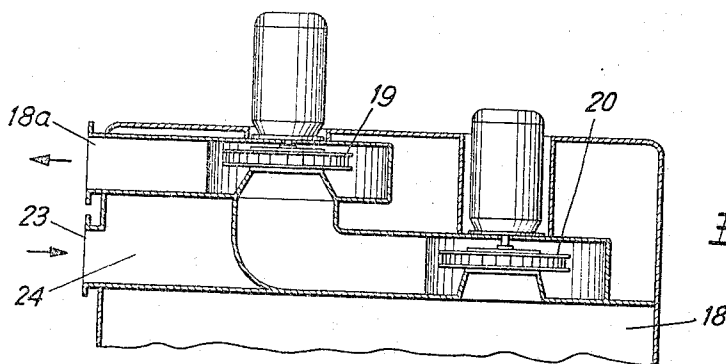


FIG. 4

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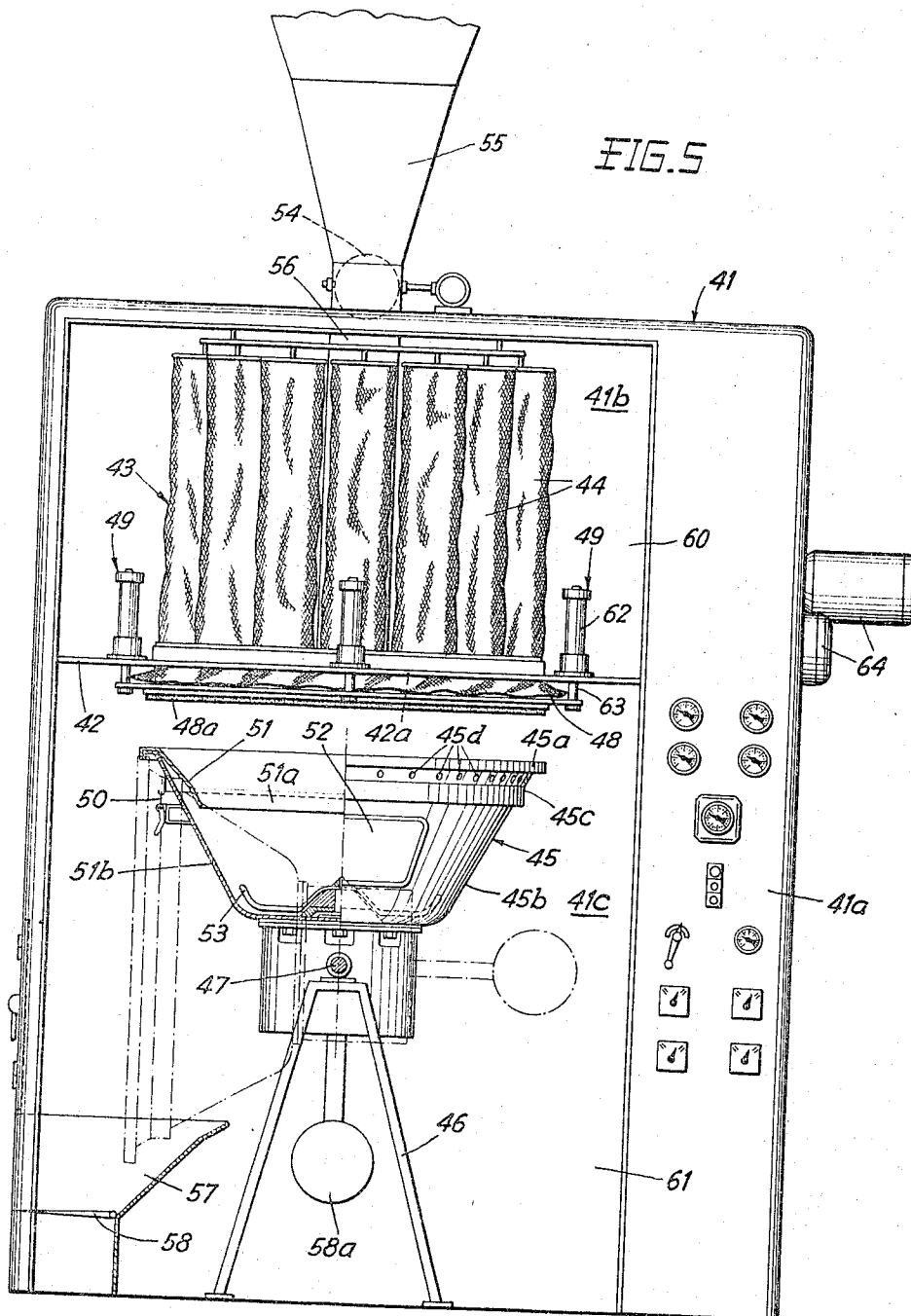
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3,315,371

## QUICK DRIER FOR DRYING MOLTEN AND PASTY MASSES AND FOR THE PRODUCTION OF POWDERS AND GRANULATES IN A HOT OR WARM AIR STREAM

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16 Claims. (Cl. 34—82)

The present invention broadly pertains to quick drier apparatus for drying flowable or molten and pasty masses and for the production of powders and granulates in a hot or warm air stream.

A number of different processes are already known to the art for obtaining powder or granulate materials by drying damp, wet, molten or flowable substances. Thus, there are available granulate quick driers of the most varying physical structure in which a receiver or container provided with a perforated or apertured bottom serves for the receipt of the material to be dried. The air current utilized for drying is sucked or blown through a container by means of a blower after it has been cleaned in a pre-filter and heated by means of a heating apparatus.

Although quick driers of this type for granulates have proven themselves to be satisfactory, it was soon discovered that they are only applicable for given raw or starting materials. Thus, for example, materials cannot be dried by them which in wet condition are so molten or flowable that they can penetrate through the openings in the floor.

It is further known to the art to perform drying operations with reduced air pressure whereby a quick and protective drying is rendered possible.

The present invention has for one of its objects to provide an improved quick drier apparatus for materials which is capable of performing the drying operation in a quick and positive manner without subjecting the goods to considerable whirling and where the danger of clogging of the apparatus is effectively prevented or at least considerably minimized.

A further extremely important object of the present invention resides in the provision of an improved drier apparatus of the mentioned type which possesses a high capacity, ensures for uniformity of the finished product and generally possesses universal applicability.

In order to implement these and other objects, the present invention provides a quick drier for drying molten and pasty masses and for the production of powders and granulates in a hot or warm air current with a pressure lying beneath one atmosphere. The inventive quick drier generally comprises a container or receiver for the material to be dried, an air suction device in order to suck the air through the aforesaid material, as well as filter means for separating such air from the material to be dried and a heating apparatus for heating the air destined to stream through the material. Characteristic of the invention is that the quick drier contains a hot air compartment for the air heated by the heating apparatus, that in this hot air compartment there is arranged a container or vessel serving as receiver for the material to be dried, the wall of which is provided with a device for generating a downwardly directed hot or warm air current out of the hot air compartment into the aforesaid vessel, and further, a filter compartment separated from the hot air compartment is arranged above the aforesaid vessel and in which there is located a filter connectable in airtight relation to the rim of this vessel.

Other features, objects and advantages of the inven-

tion will become apparent by reference to the following detailed description and drawings wherein two illustrative embodiments of inventive quick drier are shown and, in which:

FIGURE 1 is a vertical sectional view through a first embodiment of inventive quick drier taken along lines I—I of FIGURE 2;

FIGURE 2 illustrates a front view of the inventive quick drier whereby the doors for one-half of the cabinet or housing are open in order to expose the interior;

FIGURE 3 is a cross-sectional view taken along lines III—III of FIGURE 2;

FIGURE 4 illustrates the arrangement of the suction or exhaust blowers; and

FIGURE 5 illustrates a front view of a second embodiment of inventive quick drier, the doors of the housing being removed to expose the interior and with a number of members being shown in section.

Describing now the drawings, it will be recognized that the inside of the housing or cabinet 1 of the embodiment of inventive quick drier apparatus depicted in FIGURES 1 to 4 is divided by means of a floor 2 into two compartments 1a and 1b. This floor 2 exhibits a circular opening 2a at which is seated a filter basket 3 which can be formed of metal or any suitable textile material. A container or receiver 4 for housing the material to be dried is located beneath the opening 2a. This container 4 possesses a flat circular floor 4a and a conical downwardly tapering or constricting wall 4b. It is secured to a support or carrier 6 by means of screw-type closure mechanism 5, the support 6 being seated upon a shaft 7 mounted at a pair of bearing supports 8 and rotatable by means of a pressure cylinder 9. The intermediate compartment between the upper rim 4c of the container 4 and the opening 2a or the lower edge or rim of the filter basket 3 is sealed through the agency of an elastic sleeve or packing ring 10, the upper edge of which is secured to the floor 2 and the lower edge or rim of which can be pulled upwardly or pressed downwardly by hydraulic cylinders 11.

An infeed or delivery funnel 12 closeable by a flap or valve 13 serves for filling the container 4. An extension tube 13a of this delivery funnel 12 can extend up to the upper as well as also into the lower portion of the filter basket 3. The valve or flap 13 is operated by means of a mechanism 14, only schematically illustrated in the drawings (FIGURE 2).

A funnel or hopper 15 serves to receive the dried material when the container 4 is emptied upon completion of the drying operation by rotating the shaft 7, as best seen by inspecting FIGURE 2 where such container 4 is depicted in phantom lines in its discharge position. A closure flap or valve 16 closes the funnel 15 so that during the subsequent described drying operation air is not able to enter through the discharge conduit 16a. Reference numeral 17 denotes the counterweight for the container 4.

The air is sucked out of the filter compartment 18 above the floor 2 by means of two series arranged flywheel blowers 19 and 20 and is blown through an opening 28 into the surrounding atmosphere, as best seen by reference to FIGURES 3 and 4. As a result, there appears in this filter compartment 18, as well as externally as also internally of the filter basket 3, and naturally also internally of the container 4, a vacuum or negative pressure with respect to the atmospheric pressure which appears in the lower compartment 21 of the cabinet or housing 1, that is, the hot air compartment in which is located container 4.

As best ascertained by reference to FIGURES 1 and 2 the container 4 is provided with openings 4d in the region

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of the upper rim 4c. An air feed pipe or conduit 4e leads from each of the openings 4d into the container 4 such that the free pipe openings are downwardly directed. A number of these pipes 4e are so long that they extend into the zone of the material to be dried, generally designated by reference numeral 22, others are shorter so that their free openings are located above such material 22 to be dried.

In consequence of the pressure difference between the interior of the container 4 and the exterior of such container there appears a pronounced flow through the pipes 4e, so that, on the one hand, intensive air jets impinge upon the surface of the material 22 to be dried and, on the other hand, such material is mixed with the air jets freely employed therein. This air comes from the outside through the inlet opening 23 into the compartment 24 from where it arrives in the compartment 26 via the air supply filters 25. From this location it streams through an air heater 27 into the lower portion or compartment 21 of the cabinet or housing 1 closed by the doors 28. The warm or hot air then flows out of this compartment 21 on account of the large pressure drop with appropriate velocity through the pipes or tubes 4e and onto the material 22 to be dried. Such receives such an exceptionally good contact with the warm and dry drying air, so that a quick and nonetheless protective drying takes place. By virtue of the fact that a negative pressure or vacuum exists in the container 4 the drying time is rendered still shorter.

Since the entering hot drying air flows downwardly and double-passes through the material 22 to be dried it is mixed very thoroughly with the material 22 without however the entire material being whirled or spun upwardly into the filter basket 3, as such is the case with driers in which the container is provided with an apertured or perforated bottom. There is also, therefore, much less danger that the filter basket 3 will become clogged.

Depending upon the material to be dried it can be advantageous to provide in the container 4, as indicated in the drawing, a stirring or agitating apparatus for comminuating lumps which tend to form. In this instance, there is mounted at the floor 4a of the container 4 a rotatable knife 29 driven via a pressure oil turbine 30. The pressurized oil itself is delivered via a conduit or supply line 32 from a pressure oil pump 31 and arrives back at the aforesaid pump 31 by means of a second conduit or line 33. In this manner, it is possible to accommodate the speed of the comminuting or agitating mechanism 29 to the material to be pulverized or granulated, and also during the drying operation to continually change such speed.

With the second embodiment depicted in FIGURE 5 the cabinet or housing 41 is internally divided into two compartments 41b and 41c by a floor member 42. The floor member 42 exhibits a circular opening 42a at which is seated a filter 43 arranged in the filter compartment, generally designated by reference numeral 60. This filter 43, in the present embodiment, consists of a plurality of cylindrical filter sacks or bags 44 open at the bottom and closed at the top. In the lower portion 41b of the housing 41, that is in the hot air compartment 61 there is located the container or vessel 45 tiltably mounted upon a frame structure 46. The tilting or rocking action can be effected by means of a suitable non-illustrated lever arranged externally of the housing 41 and at the shaft 47. A counterweight 58a serves the purpose of displacing the center of gravity of the empty vessel or container 45 at least in the region of the shaft 47.

In FIGURE 5 there is shown in phantom lines the position which the vessel or container 45 assumes during emptying. A sealing gasket or element 48 is arranged between the floor 42 and the vessel 45, the lower end or rim 48a of which can be pressed into sealing contact with the rim 45a of the vessel or container 45 by means of a

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pneumatic mechanism 49 for example. The vessel or container 45 is provided with a removable peripheral collar or rim 45b which can be detached after releasing the tensioning mechanism 50. This peripheral rim or collar 45b is provided with holes or apertures 45d distributed throughout its entire periphery. Furthermore, it is provided at its inner side with a sheet metal guide means 51 which, starting from the upper rim 45a, extends at least approximately in the direction towards the center of the vessel floor, and at its lower end 51a is directed parallel to the wall 51b of the vessel or container 45. The wall 51b of the container 45 incorporates a window 52 for viewing the condition of the material to be treated.

A rotating knife or a kneading or stirring mechanism 53 is arranged at the floor of the container 45 and which can be driven with adjustable speed by means of a suitable hydraulic pump which is not here visible in the drawing, however for example in the manner of the previously described embodiment. The air can be sucked out of the compartment 41b above the floor 42, that is, from the filter compartment 60 and delivered to the surrounding atmosphere, by means of a two-stage blower, the motors of which are designated by reference numeral 64. Internally of the housing or cabinet 41 there is located in the lower compartment behind the switchboard casing 41a serving as the distribution or switchboard panel an opening for the influx of air, a heating element for heating the incoming air and a filter or filter means for cleaning such air. For convenience in illustration such have not been shown in FIGURE 5, but it will be apparent that the arrangement can be similar to that of the previously described embodiment.

A pipe 56 which at its upper end can be closed by a flap or valve 54 enters into the hot air compartment 61 and serves to fill the vessel or container 45. Above this pipe 56 there is located a delivery or supply funnel 55. A further funnel or hopper 57, sealable by a flap or valve 58, serves for the receipt of the dried material.

Also, when working with this drier the material to be treated is initially filled through the funnel 55 and the pipe 56 into the vessel or container 45, whereby the lower rim 48a of the sealing gasket 48 already bears against the upper vessel edge or rim 45a and is rigidly held thereagainst by pistons 63 displaceable in associated cylinders 62. Thereafter, the flap or valve 54 is closed and the blower motors 64 are switched-on. Such now suck the air out of the filter compartment 60 so that there exists at this location a vacuum or negative pressure and air flows through the filter 43.

As a result, there also exists in the container 45 a negative pressure so that the air located within the hot air compartment 61, existing at atmospheric pressure, streams through the openings or holes 45d into the container 45, is there deflected downwardly by the guide plate 51 and intensively mixes with the material to be processed, whereby such according to the degree of dryness and fineness is whirled up more or less to a certain degree into the filter bags 44 from which it then again falls downwardly. Since with this atmosphere one is concerned with air which is warmed or heated by a heating element arranged behind the switchboard casing 41a and is cleaned by the filter located therat, and, since in addition thereto, the pressure within the container 45 is less than atmospheric pressure, there is guaranteed for a quick and nonetheless material-protective drying operation.

The drying operation can be terminated, for example, by a timer or by means of a control switch which is triggered by a hygrometer measuring the moisture of the sucked-off air, or, also by a hand-operated switch since the person working with the apparatus can observe the condition of the material to be treated via the window 52 of the container 45 and through a further non-illustrated window arranged in the housing or cabinet doors, which as will be recalled have been removed in the present em-

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bodiment for purposes of exposing the housing interior. Upon completion of the drying operation the blower unit is then shut-off, whereby the material falls out of the filter 43 back into the container 45. Thereafter, by displacing the pistons 63 in the associated cylinders 62 by means of a suitable pressurized medium the sealing gasket 48 is raised from the container 45 and the latter is tilted so that its contents can empty into the hopper 57, the flap or valve 58 of which, depending upon its construction, automatically opens under the weight of the discharged material or must be opened.

In order to obtain a positive and complete emptying of the material which has been completed in its treatment, it is possible to provide a recess at the guide plate 51 at the location of emptying, or it is possible to also divide the entire marginal or peripheral rim or collar 45b in such a manner that there is provided at the discharge location a one or two portion door-like, outwardly pivotable section.

It is to be distinctly understood that the hereindescribed quick driers are not, of course, limited in application solely for the drying of a molten or flowable or pasty mass and for the production of powders or granulates for pharmaceutical purposes as well as for the production of coloring powders and other powders, rather, among their other uses, can be employed for the mixing of powders. Furthermore, it is possible to provide a fluid pipe and to thereby moisten a dry mixture so that it can be kneaded by means of the stirrer apparatus 53. The thus obtained pasty mass can subsequently be again dried to a powder or granulate.

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 quick drier apparatus for drying flowable and pasty masses and for the production of powders and granulates in a hot air current with a pressure beneath one atmosphere, comprising a housing, means for dividing said housing into at least a filter compartment and a hot air compartment, said filter compartment being disposed above and separated from said hot air compartment, container means for receiving material to be dried arranged in said hot air compartment, air suction means for reducing the air pressure above said hot air compartment to below atmospheric pressure in order to draw air through said material to be dried, filter means for separating the air from said material to be dried, heater means for heating the air destined to flow through said material to be dried, said hot air compartment receiving the air heated by said heater means, means cooperating with said container means for generating from said hot air compartment a hot air stream which is directed downwardly into said container means through the material to be dried and then under the action of said air suction means back upwardly through said material towards the top of said container means, to thereby provide a double-pass of the hot air stream through said material in said container means, a filter located in said filter compartment, and means for connecting said filter in airtight relation to said container means.

2. A quick drier apparatus as defined in claim 1 wherein said filter is connected in airtight relation to the upper rim of said container means.

3. A quick drier apparatus as defined in claim 1 wherein said container means possesses a downwardly tapering cross-section.

4. A quick drier apparatus as defined in claim 1 wherein said means for generating a downwardly directed hot air stream comprises delivery pipe means mounted to the wall of said container means.

5. A quick drier apparatus as defined in claim 1 wherein said means for generating a downwardly directed hot

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air stream comprises a plurality of openings provided in the wall of said container means and guide means located internally of said container means for downwardly directing the hot air stream entering through said openings.

6. A quick drier apparatus for drying flowable and pasty masses and for the production of powders and granulates in a hot air current with a pressure beneath one atmosphere, comprising a housing, means for dividing said housing into at least a filter compartment and a hot air compartment, said filter compartment being disposed above and separated from said hot air compartment, container means for receiving material to be dried arranged in said hot air compartment, air suction means for drawing air through said material to be dried, filter means for separating the air from said material to be dried, heater means for heating the air destined to flow through said material to be dried, said hot air compartment receiving the air heated by said heater means, means cooperating with said container means for generating from said hot air compartment a hot air stream which is directed downwardly into said container means, a filter located in said filter compartment, means for connecting said filter in airtight relation to said container means, knife means serving as a comminuting mechanism rotatably mounted within said container means, and means for rotating said knife means.

7. A quick drier apparatus as defined in claim 6 including means for tiltably supporting said container means.

8. A quick drier apparatus as defined in claim 7 further including means cooperating with said container means to effect tilting thereof.

9. A quick drier apparatus comprising a housing, means for dividing said housing into at least a filter compartment and a hot air compartment, said filter compartment being disposed above and separated from said hot air compartment, container means for receiving material to be dried arranged in said hot air compartment, air suction means for reducing the air pressure above said hot air compartment to below atmospheric pressure in order to draw air through said material to be dried, heater means for heating the air destined to flow through said material to be dried, said hot air compartment receiving the air heated by said heater means, means cooperating with said container means for generating from said hot air compartment a hot air stream which is directed downwardly into said container means through the material to be dried and then under the action of said air suction means back upwardly through said material towards the top of said container means, to thereby provide a double-pass of the hot air stream through said material in said container means, a filter located in said filter compartment, and means for connecting said filter in airtight relation to said container means.

10. A quick drier apparatus for drying flowable and pasty masses and for the production of powders and granulates in a hot air current with a pressure beneath one atmosphere, comprising a housing, means for dividing said housing into at least a filter compartment and a hot air compartment, said filter compartment being disposed above and separated from said hot air compartment, container means open at its upper end to provide an upper container rim for receiving material to be dried and arranged in said hot air compartment, air suction means for reducing the air pressure above said hot air compartment to below atmospheric pressure in order to draw air through said material to be dried, heater means for heating the air destined to flow through said material to be dried, said hot air compartment receiving the air heated by said heater means, means cooperating with the walls of said container means for generating from said hot air compartment a hot air stream which is directed downwardly into said container means through the material to be dried and then under the action of said air suction means back upwardly through said material

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towards the top of said container means, to thereby provide a double-pass of the hot air stream through said material in said container means, a filter located in said filter compartment, and means for connecting said filter in airtight relation to said upper container rim of said container means.

11. A quick drier apparatus comprising a housing, means for dividing said housing into at least a filter compartment and a hot air compartment, said filter compartment being disposed above and separated from said hot air compartment, container means open at its upper end to provide an upper container rim for receiving material to be dried and arranged in said hot air compartment, air suction means for drawing air through said material to be dried, heater means for heating the air destined to flow through said material to be dried, said hot air compartment receiving the air heated by said heater means, means cooperating with the walls of said container means for generating from said hot air compartment a hot air stream which is directed downwardly into said container means, a filter located in said filter compartment, means for connecting said filter in airtight relation to said upper container rim of said container means, said means for connecting said filter in airtight relation to said container means comprising displaceable sealing means.

12. A quick drier apparatus as defined in claim 11 including means for displacing said sealing means towards and away from said upper container rim of said container means.

13. A quick drier apparatus as defined in claim 12 wherein said displacing means incorporates a piston and cylinder arrangement.

14. A quick drier apparatus for drying flowable and pasty masses and for the production of powders and granulates in a hot air current with a pressure beneath one atmosphere, comprising a housing, means for dividing said housing into at least a filter compartment and a hot air compartment, said filter compartment being disposed above and separated from said hot air compartment, container means for receiving material to be dried arranged in said hot air compartment, air suction means for drawing air through said material to be dried, filter means for separating the air from said material to be dried, heater means for heating the air destined to flow through said material to be dried, said hot air compartment receiving the air heated by said heater means, means cooperating with said container means for generating from said hot air compartment a hot air stream which is directed downwardly into said container means, a filter located in said filter compartment, means for connecting said filter in airtight relation to said container means, said means for generating a downwardly directed hot air stream comprising a plurality of delivery pipe means mounted to the wall of said container means, each said delivery pipe

means having a discharge opening, with the individual delivery pipe means having their associated discharge opening extending to different depths into said container means.

15. A quick drier apparatus comprising a housing, means for dividing said housing into at least a filter compartment and a hot air compartment, said filter compartment being disposed above and separated from said hot air compartment, container means open at its upper end to provide an upper container rim for receiving material to be dried and arranged in said hot air compartment, air suction means for drawing air through said material to be dried, heater means for heating the air destined to flow through said material to be dried, said hot air compartment receiving the air heated by said heater means, means cooperating with the walls of said container means for generating from said hot air compartment a hot air stream which is directed downwardly into said container means, a filter located in said filter compartment, said filter comprising a filter basket, and means for connecting said filter in airtight relation to said upper container rim of said container means.

16. A quick drier apparatus comprising a housing, means for dividing said housing into at least a filter compartment and a hot air compartment, said filter compartment being disposed above and separated from said hot air compartment, container means open at its upper end to provide an upper container rim for receiving material to be dried and arranged in said hot air compartment, air suction means for drawing air through said material to be dried, heater means for heating the air destined to flow through said material to be dried, said hot air compartment receiving the air heated by said heater means, means cooperating with the walls of said container means for generating from said hot air compartment a hot air stream which is directed downwardly into said container means, a filter located in said filter compartment, said filter comprising a plurality of individual filter sacks, and means for connecting said filter in airtight relation to said upper container rim of said container means.

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