

Nov. 1, 1966

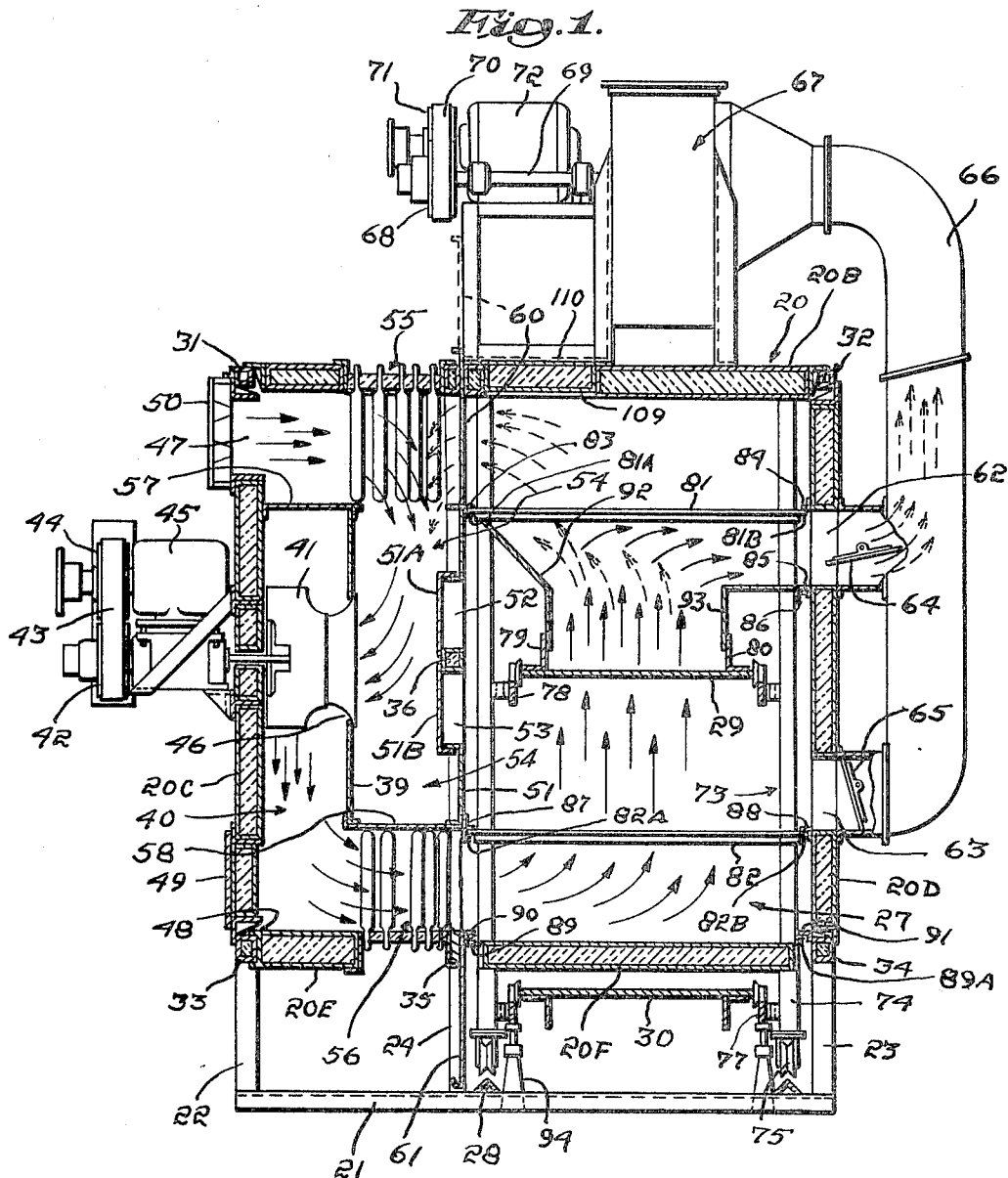
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3,281,958

MATERIAL PROCESSING APPARATUS

Filed March 12, 1963

7 Sheets-Sheet 1



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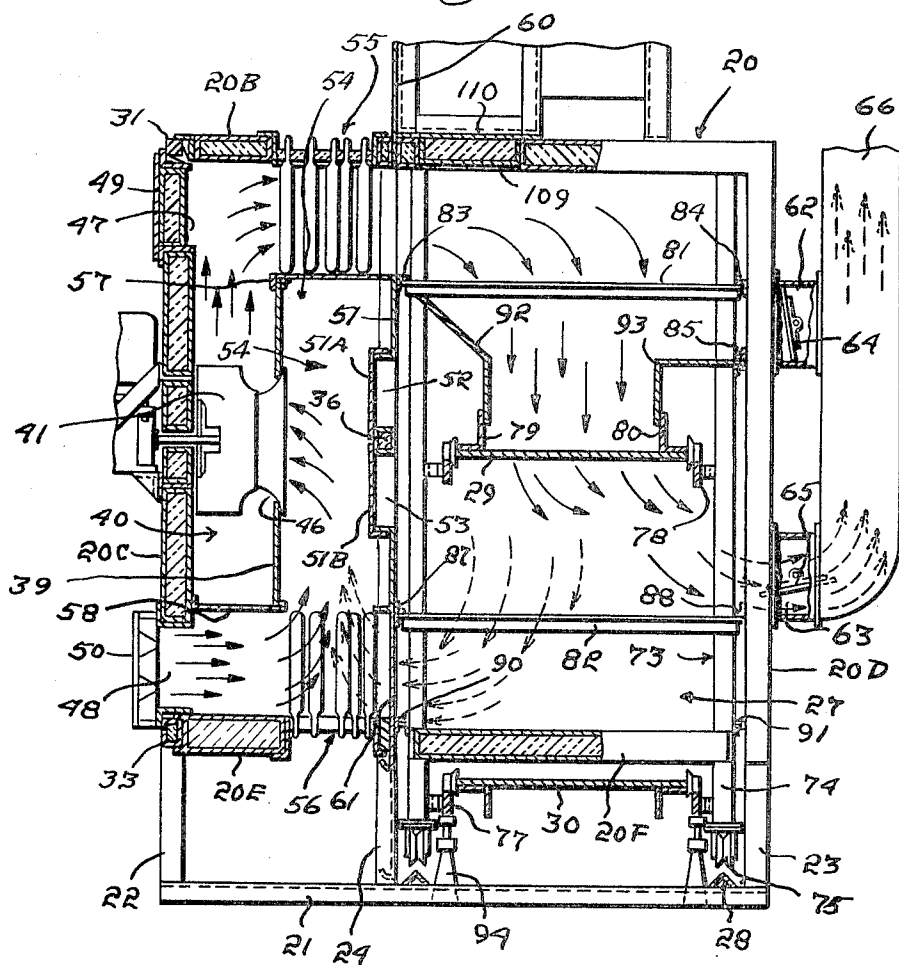
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MATERIAL PROCESSING APPARATUS

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Fig. 2.



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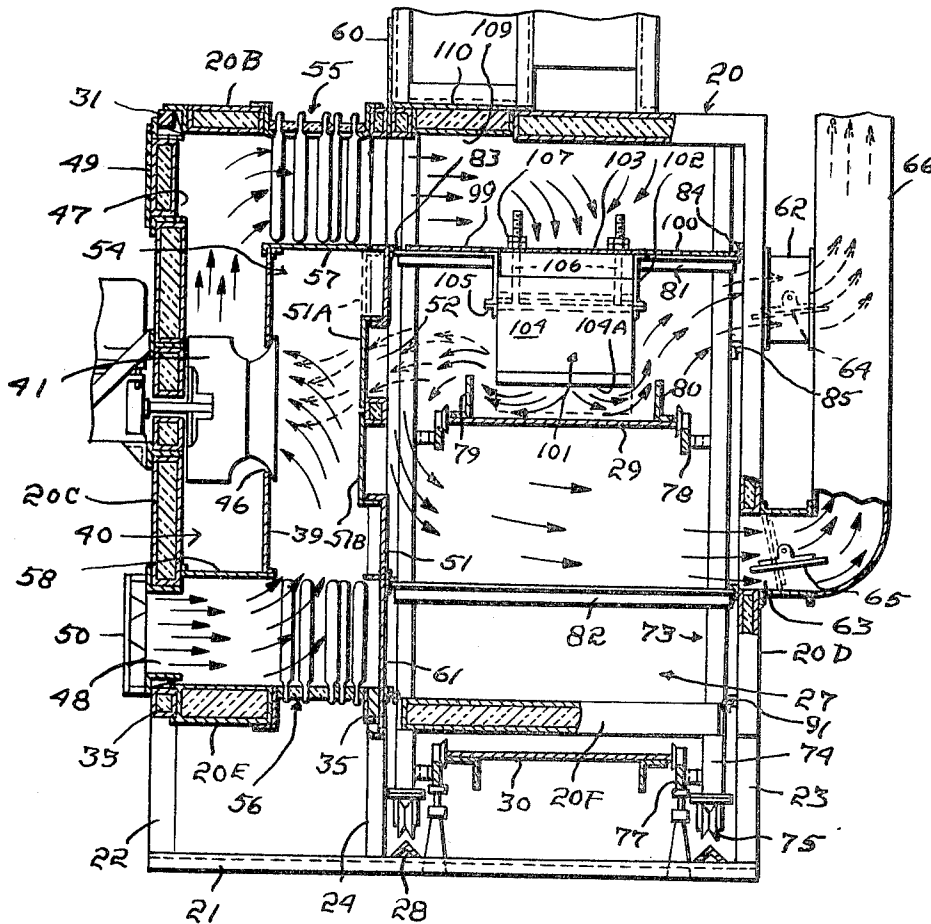
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MATERIAL PROCESSING APPARATUS

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7 Sheets-Sheet 3

Fig. 3.



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Fig. 4.

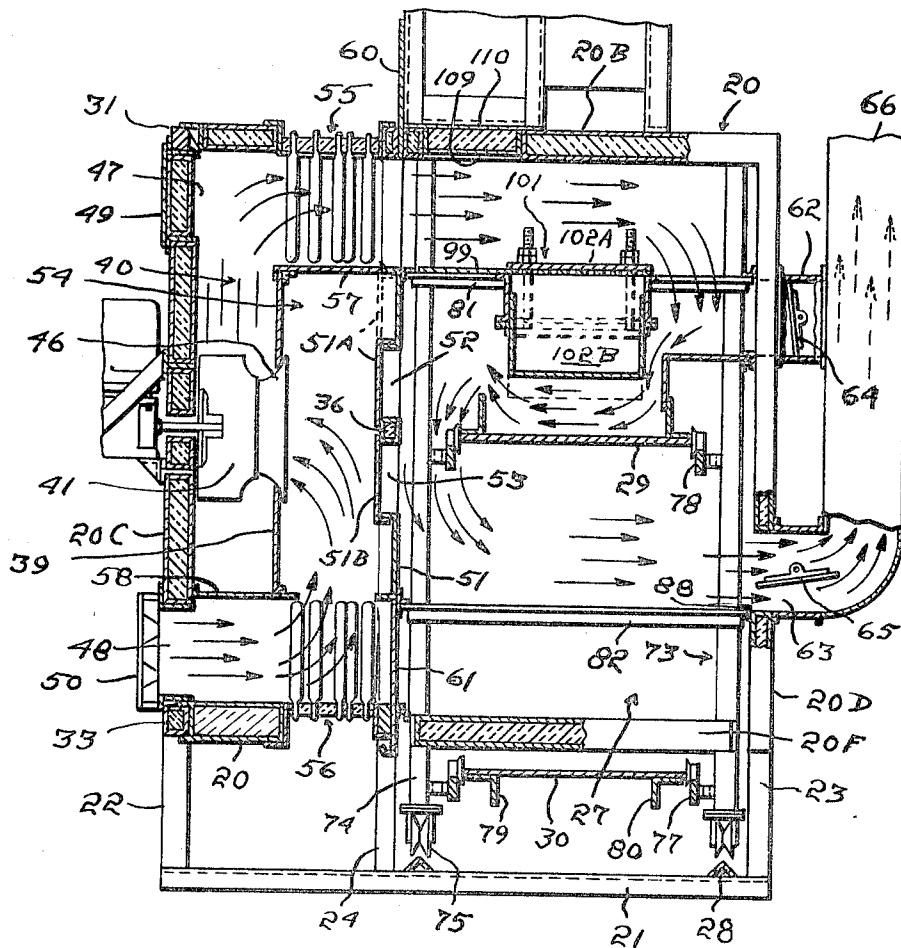
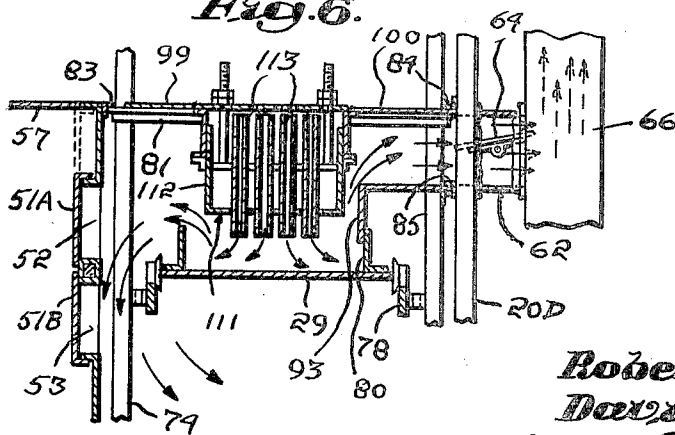


Fig. 6.



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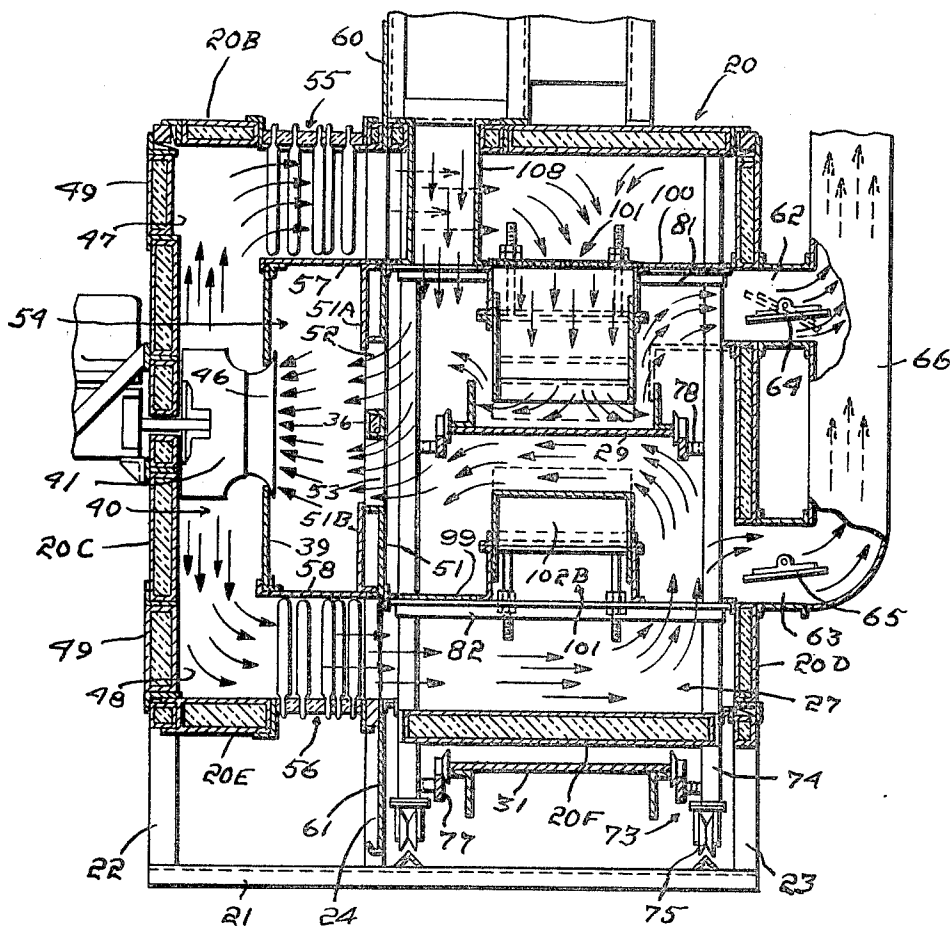
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MATERIAL PROCESSING APPARATUS

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Fig. 5.



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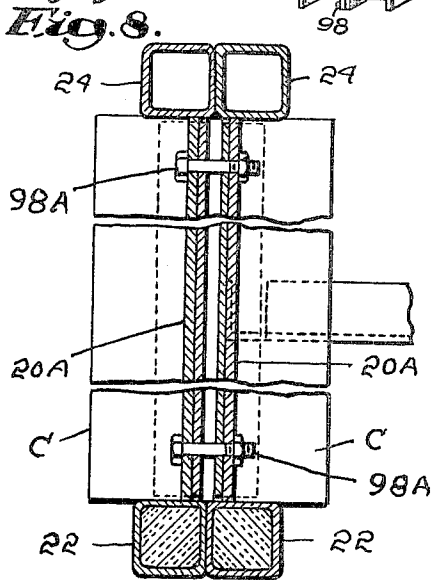
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Fig. 10.

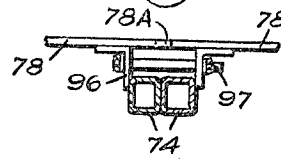
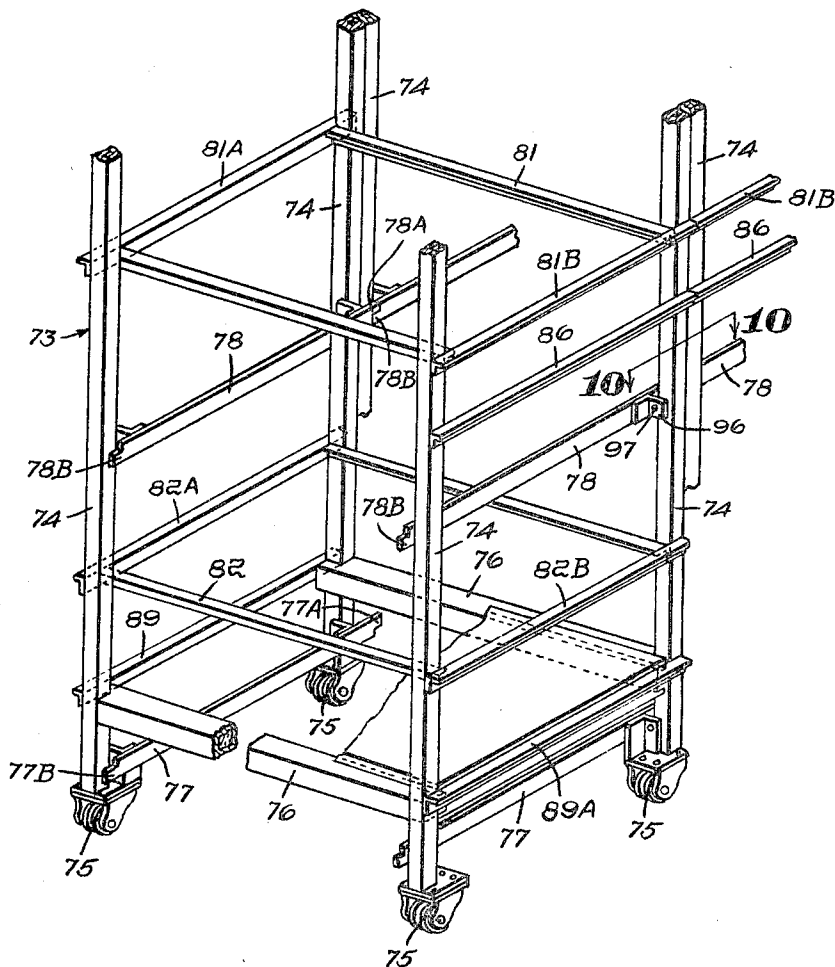


Fig. 9.



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3,281,958

MATERIAL PROCESSING APPARATUS

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Filed Mar. 12, 1963, Ser. No. 264,517
18 Claims. (Cl. 34-222)

The present invention relates to apparatus of both unitary and modular constructions for use in processing various materials in various ways.

In many processes, of which material drying is a most common example, materials are conveyed through a treating chamber for treatment by air, steam, or gas by themselves or in conjunction with other techniques. By way of illustration, materials are conveyed through a dryer where air is delivered, in one or more sections thereof, in a predetermined manner relative to the conveyed material. A dryer is manufactured with special reference to the particular material being processed and to volumetric and time considerations. As a consequence, many dryers are of substantial length and have several sections where the material is subjected to drying air and it is often provided that the air flow is different in different sections.

By way of illustration, one typical drying technique utilizes an upward flow of air through the conveyed material, commonly called "up-draft" drying, and another has a downward flow through the conveyed material, commonly called "down-draft" drying. In another method, the air is passed through a port vertically spaced from but close to the material. This method is called "impact" drying and may be upwards or downwards relative to the conveyor or against both surfaces thereof. Drying is also effected by flowing air across the conveyed material and when such flow is relative to one surface of the conveyor, it is referred to as "cross draft" drying and where the air flow is across both faces of the conveyor, it is termed "dual cross draft" drying. In addition, and somewhat akin to impact drying, is the method where the air flow to the material is passed through a series of openings discharging jets of air against the material.

Commonly, but not necessarily, the drying air is heated and while in some dryers, the air is recirculated, in many, the air is wholly or partially exhausted from the dryer after drying use.

The problem has been to ensure that a dryer, when installed, will meet the requirements of the user for which it was designed whose requirements may be so peculiar, for a variety of reasons, that experience with similar materials may not lead to satisfactory drying in practice.

A general objective of the present invention is to provide a dryer that enables the sections, in which air is delivered to the material, to be quickly and easily converted from one type of drying air flow to another with preferably a wide range of such conversions being possible.

A more particular objective is to provide such a conveyor in the form of a pilot model that can be shipped to a customer's plant and there run, trying out various drying air techniques or combinations thereof to ensure that the most ideal arrangement can be determined accurately.

Another objective of the invention is to provide a dryer, whether pilot or full size, that consists of modules that can be readily shipped and set up for use, with modules added or removed to ensure that efficiency is attained with the most economical dryer size.

Yet another objective of the invention is to provide a dryer or module construction in which there are two major portions, one providing a drying zone and the other being a carriage adapted to be entered into or removed from the drying zone through one or both ends thereof,

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the carriage supporting the conveyor and many of the parts that are to be changed or removed when flow conversions are to be made.

In accordance with the invention these objectives are attained by providing a dryer having at least one section in the form of a chamber provided with an open-ended drying zone through which conveying means extend. The chamber has a fan spaced from the drying zone and there are a plurality of air pathways including controls operable to provide a plurality of alternative directions of air flow relative to the conveyed material. The chamber may be a module and the conveyor may be supported by a removable carriage and the carriage may be modular.

In the accompanying drawings, there is shown an illustrative embodiment of the invention from which these and other of the objectives, novel features, and advantages will be readily apparent.

In the drawings:

FIGURE 1 is a cross section of a drying chamber in accordance with the invention wherein up-draft drying is provided,

FIGURE 2 is a like chamber section illustrating down-draft drying,

FIGURE 3 shows the chamber section of FIGURES 1 and 2 converted to provide downblast, impact drying through transverse slots,

FIGURE 4 illustrates the chamber converted for cross-draft drying,

FIGURE 5 is a like view illustrating chamber conversion to provide impact and cross-draft drying,

FIGURE 6 is a fragmentary section illustrating downblast drying through a transversely spaced series of jet orifices,

FIGURE 7 is a perspective, fragmentary view illustrating two modules joined together with one module having its walls removed,

FIGURE 8 is a fragmentary section taken approximately along the indicated lines 8-8 of FIGURE 7,

FIGURE 9 is a perspective view of a carriage frame, and

FIGURE 10 is a section, on an increased scale taken approximately along the indicated lines 10-10 of FIGURE 9.

In the embodiment of the invention illustrated by the drawings, a module is generally indicated at 20 and, in FIGURE 7, two of these are shown joined together with each constituting a section of a dryer. The number and type of sections and the order in which they are arranged in any dryer is subject to a wide range of variables. Typically, there would be, in most dryers, a plurality of like sections, whether modular or integral, in which drying is effected by the controlled flow of air in a desired manner relative to the conveyed materials. FIGURE 7 is, accordingly, illustrative of a dryer whether or not the sections are unitary or modular and joined together and the description of a module 20 is, therefore, also descriptive, in general, of an embodiment of the invention in which the section of a dryer are integral rather than modular.

Each module 20 is shown, see FIGURES 1 and 7, as a chamber having a frame consisting of base members 21, each having a front upright 22, a rear upright 23 and an intermediate upright 24 with the uprights being joined together at their upper ends by a support 25 and adjacent their lower ends by a support 26. End walls 20A, see FIGURE 7, are secured to the frame wall defined by the front uprights 22, the intermediate uprights 24, and the upper and lower supports 25 and 26, respectively, while the space between the intermediate uprights and the rear uprights 23 is open. This space is generally indicated at 27 and is hereinafter referred to as the drying zone and the base members 21 have tracks 28 extending through it.

The horizontal upper course 29 of a conveyor passes through a central portion of the drying chamber. The lower conveyor course is indicated at 30.

A support 31 interconnects the upper ends of the front members 22 and a like support 32 joints the upper ends of the rear uprights 23 and defines framework in support of the top wall 20B. The support 31 and a support 33, interconnecting the front uprights 22 in the plane of the support 26, and the uprights 22 are the framework to which the front wall 20C is secured. In a like manner, the support 32, the rear uprights 23, and a support 34 interconnecting the rear uprights, provide the supporting framework for the rear wall 20D. A flanged floor 20E rests on the framework defined by the supports 26 and 33 and the coplanar support 35 interconnecting the intermediate uprights 24 which are also interconnected, in the plane of the conveyor course 29, by the support 36. The walls 20B, 20C, 20D, and 20E are thermally insulated.

The uprights 22 and 24 are interconnected by vertically spaced members 37 and 38 supporting a partition 39 terminating short of the top and bottom walls 20B and 20E, respectively, and defining with the front wall 20C a generally indicated upwardly and downwardly opening zone 40 for a fan 41 whose shaft extends through the wall 20C and is provided with a pulley 42 connected by a belt 43 to the pulley 44 on the shaft of the motor 45 mounted on the wall 20C. The partition 39 has a port 46 defining an intake for the fan 41.

The wall 20C has ports 47 and 48 with the port 47 opening into the chamber above the upper edge of the partition 38 and with the port 48 opening into the chamber below its lower edge. Both ports are adapted to receive either an insulated insert 49 or a screen 50.

A partition 51 includes vertically spaced and vertically slidable dampers 51A and 51B for ports 52 and 53, respectively, the port 52 opening into the drying zone 27 above the conveyor course 29 and the port 53 opening into it below that course. The partition 51 is secured to the intermediate uprights 24 with the upper and lower edges approximately level with the corresponding edges of the partition 39. The two partitions define an upwardly and downwardly opening intake zone generally indicated at 54. The top wall 20B supports a heater 55 above the intake zone 54 and a like heater 56 is supported by the bottom wall 20E under the intake chamber 54.

A damper 57, accessible through the inlet 47, is slidable between positions in one of which it closes only the upper end of the fan zone 40 and in the other of which it closes only the upper end of the intake zone 54. A like damper 58, accessible through the inlet 48, is slidable between a position blocking only the lower end of the fan zone 40 and a position blocking only the lower end of the intake zone 54.

The top wall 20B has a slot 59 receiving a vertically slidable damper 60 which is shown in FIGURE 1, in full lines, in its operative position preventing communication between the upper ends of the intake and fan zones and the drying zone and, in dotted lines, in its raised position in which air flow to or from the drying zone is permitted. The bottom wall 20E supports at its inner edge a like, vertically slidable damper 61 which is shown in its inoperative position placing whichever lower zone end is open, in communication with the drying zone 27.

In FIGURE 1, the inlet 47 is open while the damper 60 is in its operative position and the damper 57 is in a position opening the upper end of the intake chamber 54 so that the fan 41 is operative to draw in outside air through the heater 55 and deliver it through the heater 56 into the lower part of the drying zone 27 as the damper 58 is shown as positioned to open the lower end of the fan zone 40 and the damper 61 is in its lowered inoperative position. The dampers 51A and 51B are both closed.

Before considering constructional features of the drying zone 27, attention is directed to the fact that the back wall 20D has vertically spaced outlets 62 and 63 controlled by dampers 64 and 65, respectively. The outlets 62 and 63 open into a conduit 66 in communication with the intake side of a generally indicated exhaust blower 67 mounted on the top wall 20B and having a pulley 68 on its shaft 69 connected by a belt 70 to a pulley 71 on the drive shaft of a motor 72 which is also mounted on the top wall 20B. By these or equivalent means, air is exhausted from the upper part of the drying zone, the lower part thereof, or through both outlets by appropriate control of the dampers 64 and 65.

In FIGURE 1, the damper 65 is shown as in its closed position while the damper 64 is positioned to open the outlet 62. As a consequence, air flowing into the drying zone 27 passes upwardly through the conveyor course 29 and is drawn from the upper part thereof through the outlet 62 to provide updraft drying. If partial recirculation is desired, it is only necessary to raise the damper 60 into its position shown in dotted lines in FIGURE 1 whereupon part of the drying air is withdrawn and recirculated by the fan 41.

Within the drying zone, there is a carriage, generally indicated at 73, and shown in FIGURE 9 as comprising uprights 74, each provided with a track engaging wheel 75. The uprights 74 are interconnected by cross supports 76, see FIGURE 9, supporting the flanged and insulated wall sections 20F which completes the bottom of the chamber, and, along the sides of the carriage, by the tracks 77 for the lower conveyor course 30 and by the tracks 78 for the upper course 29 thereof. While the conveyor may be of any type used in dryers including transfer and vibrating conveyors, it is shown as having marginal stock guards 79 and 80. The conveying means may comprise a series of conveyors placed end-to-end with appropriate transfer means and hold-down conveyors may also be used, if desired.

The carriage also includes upper and lower horizontal supporting frames 81 and 82, respectively, and these are shown as including outwardly disposed, detachable flanges 81A and 81B and 82A and 82B, respectively. The flange 81A is shown in FIGURES 1-6 as engaging the undersurface of the flange 83 carried by the uprights 24, while the flange 81B is shown as engaging the undersurface of a flange 84 attached to the uprights 23 along the upper edge of the outlet 62. Along the lower edge of the outlet 62 there is a flange 85 whose undersurface is shown as engaged by a detachable flange 86 carried by the uprights 74. The flange 82A engages the undersurface of a flange 87 attached to the uprights 24 along the lower edge of the partition 51. The flange 82B engages the undersurface of a flange 88 supported by the uprights 23 along the lower edge of the outlet 63. The interengaged flanges provide horizontal air seals and, as like seals are required for the bottom wall section 20F, it is provided with oppositely disposed, removable flanges 89 and 89A in engagement with the undersurfaces of flanges 90 and 91, respectively. The flange 90 is carried by the uprights 24 and the flange 91 is attached to the uprights 23.

In FIGURES 1 and 2, a stationary stock guard 92 is detachably secured to the flange 81A of the frame 81 while the opposite stock guard 93 is shown as rectangular and supported by the flange 85 which is at the lower edge of the outlet 62.

It will be noted that the wheels 75 are shown as positioned well above the tracks 28 and supported by jacks 94. When the carriage is moved into the drying zone 27 along the tracks 28, the flanges that are to engage to provide air seals are spaced vertically apart and the upper ends of the uprights 74 are spaced below the top wall 20B. Once the carriage is entered into the drying zone 27, it is jacked up until the appropriate air sealing flanges are in engagement and the uprights 74 are so dimensioned

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that, then, depending anchors 95 carried by the support 25 enter and securely anchor the upper ends thereof.

It will also be noted that one set of corresponding ends of the conveyor tracks 77 and 78 are under cut to provide lugs 77A and 78A while their other set of corresponding ends are oppositely cut to provide lugs 77B and 78B. With this arrangement, when one carriage abuts the other, the lugs 77B and 78B of one carriage underlie the lugs 77A and 78A, respectively, of the other carriage so that the raising of the first such carriage also picks up the engaged end of the other carriage.

In this connection, the abutting carriages are locked together. While this result may be otherwise effected, the conveyor tracks 77 and 78 are shown as attached to the uprights 74 by means of angle members 96, see FIGURES 9 and 10, in spaced relationship thereto, thus to enable the angle members of each two abutting uprights 74 to be interconnected as by bolts 97.

It is also essential to securely interconnect abutting module chambers and, in this connection, reference is again made to FIGURE 7. The base members 21 are shown as U-shaped channels whose abutting edges are locked together as by bolts 98 and the walls 20A of abutting modules are held together as by bolts 98A extending through guides C, see FIGURE 8, the guides C for the dampers 57 and 59.

Reference is now made to FIGURE 2 wherein the air flow is down-draft. To achieve this method of drying, the port 47 is closed by an insert 49 and the port 48 is opened and provided with a screen 50. The damper 57 is positioned to close the upper end of the intake zone and the damper 60 is raised into its open position and the damper 61 is raised into its closed position. The damper 58 is set to close the lower end of the fan zone 40 and to open the lower end of the intake zone 54. Outside air is now drawn into the lower part of the chamber and heated air is delivered into the upper portion of the drying zone 27. As the damper 64 is in its closed position and the damper 65 is in its open position, the exhaust blower 67 withdraws air from the lower portion of the drying zone 27 thus providing down-draft drying.

Should some recirculation of the drying air be desired, it is only necessary to lower the damper 61 into its open position to enable the fan 41 to withdraw into its intake some of the air from the lower portion of the drying zone 27.

In FIGURE 3, down-blast, impact drying is illustrated and, given the module of FIGURES 1 and 2, it is necessary to remove the carriage 73 from the drying zone 27 or remove wall 20D and detach the stationary stock guards 92 and 93. The frame 81 now supports a pair of marginal plates 99 and 100 and a generally indicated blast unit 101 which includes a downwardly opening supporting sleeve 102 having a diffusion plate 103 in its inlet and slidably receiving in its lower end a sleeve 104 having end flanges 105 supporting bolts 106 which extend through the supporting sleeve 102 and receive attaching nuts 107 enabling the sleeve 104 to be raised or lowered into a desired position relative to the material being conveyed through the drying chamber. The sleeve 104 has at least one or preferably several transverse slots 104A.

With the damper 64 now opened and with the various other dampers in their position to provide down-draft drying, see FIGURE 2, the drying air is delivered as a blast against the conveyed material and, should partial recirculation of the drying air be wanted, it is only necessary to open the damper 51A of the partition 51.

In FIGURE 4, drying by the cross draft method is illustrated, given the module with the flow arrangement shown in FIGURE 3, it is only necessary to remove the plate 100 and to close the damper 64 and to close the unit 101 as by means of a cover 102A or by replacing the sleeve 102 with a somewhat shorter, closed-end sleeve-like insert 102B, both being shown in FIGURE 4. The

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carriage must be withdrawn from the drying zone 27 for this purpose or the wall 20D removed and also to enable the stationary stock guard 93 to be replaced. Drying air is now delivered at one side of the conveyor to flow over the conveyed material and thence through the outlet 63 if the damper 51A is closed, otherwise partial recirculation takes place.

In FIGURE 5, drying and cross draft drying is illustrated. For this method, and given the module arrangement of FIGURE 3, it is necessary to withdraw the carriage or remove the wall 20D and remove the plate 99 which is replaced by a tubular conduit 108 opening through a port 109 in the top wall 20B which has a removable, insulated insert 110 to permit its use. A plate 99 and a blast unit 101 are supported by the lower frame 82. With both the damper 51A and the damper 51B open and the other dampers in their FIGURE 3 position, a blast of drying air is delivered against the material or the conveyor and below the conveyor, there is a cross draft since the lower blast unit 101 is shown as closed by the sleeve-like insert 102B. By removing the sleeve-like insert 102A and adding the plate 100 to the lower frame 82 dual impact drying is effected. Alternatively the upper unit 101 can be closed and the plate 100 removed so as to provide dual cross draft drying.

In FIGURE 6, a unit 111 is substituted for the blast unit 101 of FIGURE 3 which the unit 111 resembles except that its vertically adjustable sleeve 112 has a series of jet orifices shown as tubes 113.

By substituting inserts 102A for the sleeves 102 of the units 101 and removing both plates 100, a dual cross draft is provided with partial recirculation of the drying air.

It will be appreciated that the various air flow methods that have been described are but representative and that other combinations and modifications thereof are possible but those discussed are illustrative of the purposes of the air flow control means.

While the air flow control means have been referred to as dampers or removable members, any other means for blocking or limiting the flow of air in accordance with any technique may be used but those referred to are the simplest for illustrative purposes. The terms "dampers," "port closing means," "damper controls," "dampers means," "inert plates" are used herein interchangeably as flow control means and those terms are also meant to include port closing means that are fixed but removable.

From the foregoing, it will be apparent that dryers in accordance with the invention are well adapted to provide for a wide range of operating conditions and that the modular constructions are equally well adapted to ensure maximum ease and convenience in their production, transportation and assembly, and make such revisions and conversions as may be necessary to meet the requirements of the purchaser quickly and easily effected, whether as pilot apparatus or otherwise.

We claim:

1. In apparatus for use in the treatment of materials with a gaseous fluid, a support for the material, a treating chamber in which the support is located, first and second vertical conduits laterally of said chamber, gas circulating means in said first conduit having its intake in communication with the second conduit, first and second inlet conduits in communication with the chamber one above and the other below said first and second conduits and said support, means adjustable to place either one of said vertical conduits in communication with either one of said inlet conduits, and means to close the inlet ends of said inlet conduits.

2. The apparatus of claim 1 and means to close the inner end of each inlet conduit relative to the chamber.

3. The apparatus of claim 1 in which the support is foraminous and the chamber is sealed on both sides thereof.

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4. In apparatus for use in the treatment of materials with a gaseous fluid, a support for the material, a treating chamber in which the support is located, first and second vertical conduits laterally of said chamber, gas circulating means in said first conduit having its intake in communication with the second conduit, first and second inlet conduits in communication with the chamber one above and the other below said first and second conduits and said support, means adjustable to place either one of said vertical conduits in communication with either one of said inlet conduits, means to close the inlet ends of said inlet conduits, and damper controlled exhaust means in communication with the interior of said chamber.

5. The apparatus of claim 4 in which the exhaust means include two damper controlled branches, one above and one below the support.

6. In apparatus for use in the treatment of materials with a gaseous fluid, a support for the material, a treating chamber in which the support is located, first and second vertical conduits laterally of said chamber, gas circulating means in said first conduit having its intake in communication with the second conduit, first and second inlet conduits in communication with the chamber one above and the other below said first and second conduits and said support, means adjustable to place either one of said vertical conduits in communication with either one of said inlet conduits, means to close the inlet ends of said inlet conduits, and means supported transversely of the upper end of the chamber below the upper inlet conduit and adjustable to provide any one of a plurality of downward fluid flows relative to the support.

7. In apparatus for use in the treatment of materials with a gaseous fluid, a support for the material, a treating chamber in which the support is located, first and second vertical conduits laterally of said chamber, gas circulating means in said first conduit having its intake in communication with the second conduit, first and second inlet conduits in communication with the chamber one above and the other below said first and second conduits and said support, means adjustable to place either one of said vertical conduits in communication with either one of said inlet conduits, means to close the inlet ends of said inlet conduits, and means to place the chamber and the second vertical conduit in communication.

8. The apparatus of claim 6 in which the means to place the chamber and the second vertical conduit in communication consists of two ports, one above and one below the support and both separately operable.

9. In material treating apparatus, an endless conveyor for the material, a section comprising a chamber, a first partition extending lengthwise of said chamber and defining with one chamber side wall a treating zone through a predetermined horizontal plane portion of which the upper conveyor course extends, said chamber wall having outlets in communication with said treating zone above and below said course, a damper in control of each outlet, the ends of said zone being open to receive said conveyor course, a second partition extending lengthwise of said chamber in spaced relationship to said first partition and the other chamber side wall and defining intake and fan zones, respectively, both partitions terminating short of the top and bottom walls of the chamber to provide upper and lower passages in communication with the top and bottom portions of said treating zone, damper means for each passage adjacent said treating zone, said other wall having inlets, one opening into the upper passage and one opening into the lower passage, means to close each inlet, the fan and intake zones both having ports opening upwardly and downwardly to effect communication with the upper and lower passages, a fan in said fan zone, said second partition having a port with reference to which said fan is so

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located as to draw gas from said intake zone, and damper controls, one for the downwardly opening ports of said fan and intake zones and one for the upwardly opening ports thereof, each control being operable to open either one of the appropriate openings and to close the other thereof.

10. In material treating zone, an endless conveyor for the material, a section comprising a chamber, a first partition extending lengthwise of said chamber and defining with one chamber side wall a treating zone through a predetermined horizontal plane portion of which the upper conveyor course extends, said chamber wall having outlets in communication with said treating zone above and below said course, a damper in control of each outlet, and gas exhausting means in communication with both outlets, said zone being open-ended to receive said conveyor course, a second partition extending lengthwise of said chamber in spaced relationship to said first partition and the other chamber side wall and defining intake and fan zones, respectively, both partitions terminating short of the top and bottom walls of the chamber to provide upper and lower passages in communication with the top and bottom portions of said treating zone, damper means for each passage adjacent said treating zone, said other wall having inlets, one opening into the upper passage and one opening into the lower passage, means to close each inlet, the intake and fan zones both having ports opening upwardly and downwardly to effect communication with the upper and lower passages, a fan in said fan zone, said second partition having a port with reference to which said fan is so located as to draw gas from said intake zone, and damper controls, one for the downwardly opening ports of said fan and intake zones and one for the upwardly opening ports thereof, each control being operable to open either one of the appropriate openings and to close the other thereof.

11. In material treating apparatus, an endless conveyor for the material, a section comprising a chamber, a first partition extending lengthwise of said chamber and defining with one chamber side wall a treating zone through a predetermined horizontal plane portion of which the upper conveyor course extends, said chamber wall having outlets in communication with said treating zone above and below said course, a damper in control of each outlet, and gas exhausting means in communication with both outlets, the ends of said zone being open to accommodate said conveyor course, a second partition extending lengthwise of said chamber in spaced relationship to said first partition and the other chamber side wall and defining intake and fan zones, respectively, both partitions terminating short of the top and bottom walls of the chamber to provide upper and lower passages in communication with the top and bottom portions of said treating zone, damper means for each passage adjacent said treating zone, a heater in each passage adjacent said damper means, said other wall having inlets, one opening into the upper passage and one opening into the lower passage, means to close each inlet, the intake and fan zones both having ports opening upwardly and downwardly to effect communication with the upper and lower passages, a fan in said fan zone, said first partition having damper-controlled ports, one above and one below said upper conveyor course which, when open, place said passages and said treating zone in communication, said second partition having a port with reference to which said fan is so located as to draw gas from said intake zone, and damper controls, one for the downwardly opening ports of said fan and intake zones and one for the upwardly opening ports thereof, each control being operable simultaneously to open either one of the appropriate openings and to close the other thereof.

12. In material treating apparatus, an endless conveyor for the material, a section comprising a chamber, a first partition extending lengthwise of said chamber and defining with one chamber side wall a treating zone through

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a predetermined horizontal plane portion of which the upper conveyor course extends, said chamber wall having vertically spaced outlets in communication with said treating zone above and below said course, a damper in control of each outlet, and gas exhausting means in communication with both outlets, said drying zone being open to receive said conveyor course, a second partition extending lengthwise of said chamber in spaced relationship to said first partition and the other chamber side wall and defining intake and fan zones, respectively, both partitions terminating short of the top and bottom walls of the chamber to provide upper and lower passages in communication with the top and bottom portions of said treating zone, damper means for each passage adjacent said treating zone, said other wall having inlets, one opening into the upper passage and one opening into the lower passage, means to close each inlet, the intake and fan zones both having ports opening upwardly and downwardly to effect communication with the upper and lower passages, a fan in said fan zone, said first partition having damper-controlled ports, one above and one below said upper conveyor course which, when open, place said passages and said treating zone in communication, said second partition having a port with reference to which said fan is so located as to draw gas from said intake zone, damper controls, one for the downwardly opening ports of said fan and intake zones and one for the upwardly opening ports thereof, each control being operable simultaneously to open either one of the appropriate openings and to close the other thereof, and a transverse closure in said treating zone between one of said passages and the proximate outlet and having port means constricting the flow of gas.

13. The apparatus of claim 12 in which the transverse closure includes a unit that is vertically adjustable and which has flow restricting port means.

14. The apparatus of claim 12 in which the transverse closure includes a unit that is vertically adjustable, said

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unit including a plurality of series of laterally spaced jet orifices which are the flow restricting port means.

15. The apparatus of claim 12 in which the restricting port means are located adjacent the chamber wall having the outlets.

16. The apparatus of claim 12 in which the restricting means is adjacent the first partition and includes an inlet conduit opening through a chamber wall.

17. The apparatus of claim 12 and a second transverse closure between the other passage and the outlet proximate thereto, the second transverse closure having flow constricting port means.

18. The apparatus of claim 12 and a second transverse closure between the other passage and the outlet proximate thereto, the second transverse closure including a unit that is vertically adjustable and which has the flow constricting port means.

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