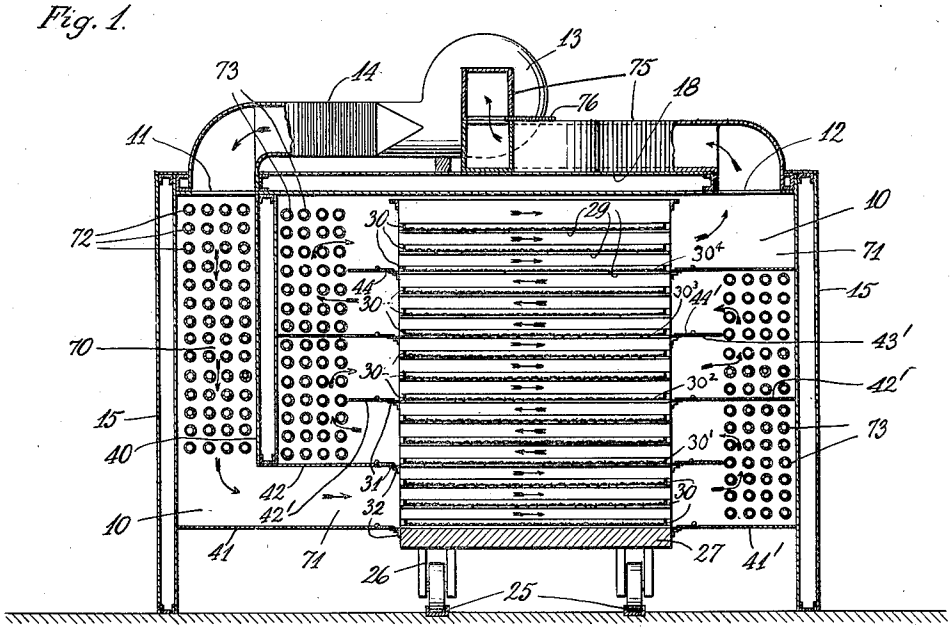
Aug. 12, 1924. 1,504,854

D. S. BAKER

DRIER

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Fig. 1.



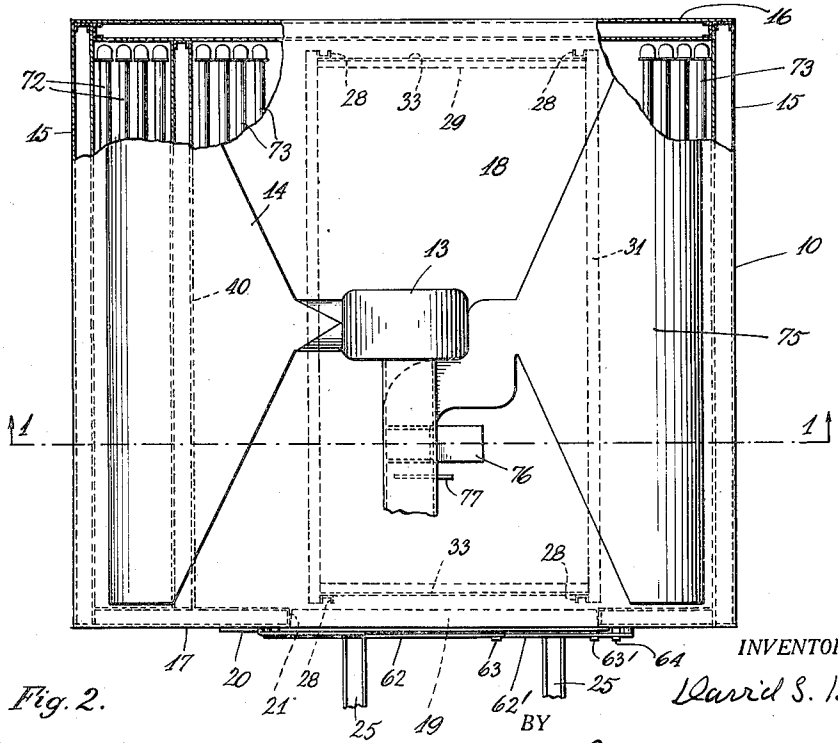


Fig. 2.

INVENTOR.
David S. Baker
BY
Robert W Byerly
his ATTORNEY.

Aug. 12, 1924. 1,504,854

D. S. BAKER

DRIER

Filed March 1, 1922 2 Sheets-Sheet 2

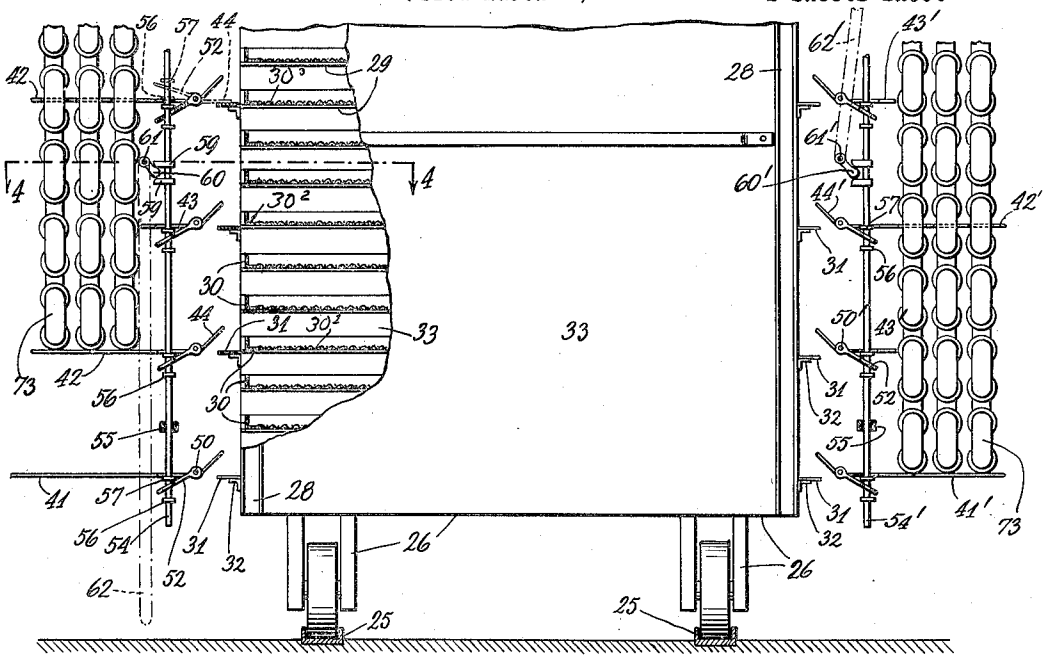


Fig. 3.

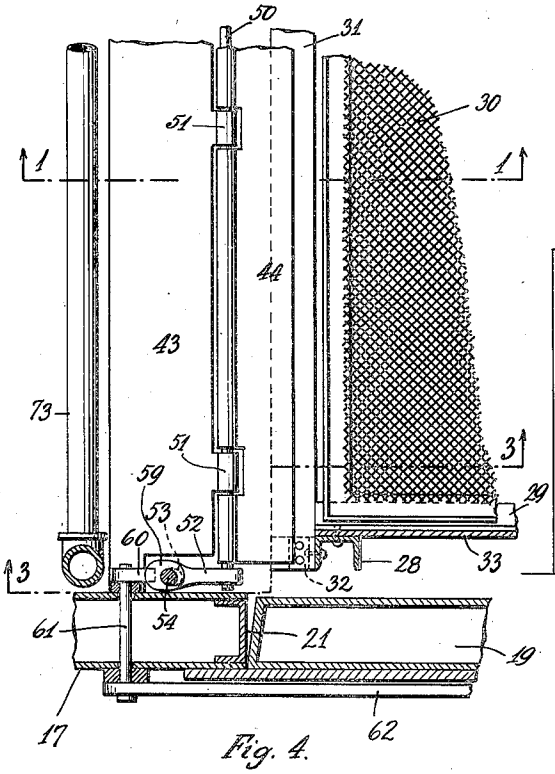


Fig. 4.

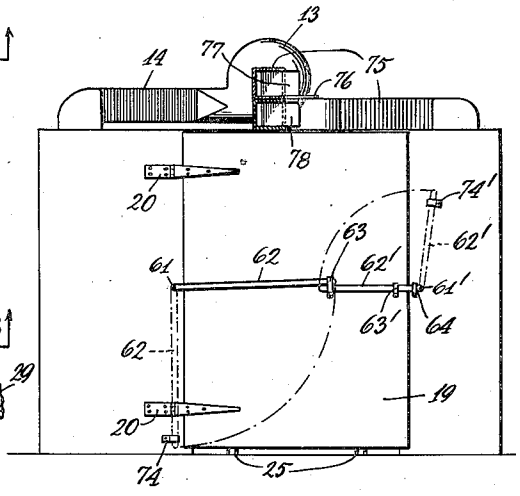


Fig. 5.

INVENTOR.

David S. Baker

BY

Robert W Byerly

his ATTORNEY.

Patented Aug. 12, 1924. 1,504,854

UNITED STATES PATENT OFFICE.

DAVID S. BAKER, OF GREENWICH, CONNECTICUT, ASSIGNOR TO NATIONAL EVAPORATOR CORPORATION, OF PROVIDENCE, RHODE ISLAND, A CORPORATION OF NEVADA.

DRIER.

Application filed March 1, 1922. Serial No. 540,196.

To all whom it may concern:

Be it known that I, DAVID S. BAKER, a citizen of the United States, residing at Greenwich, in the county of Fairfield and State of Connecticut, have invented certain new and useful Improvements in Driers, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

This invention relates to driers for evaporating moisture from various materials, such as paints and paint materials, chemicals and other substances.

An object of the invention is to provide a compact drier occupying small floor space and adapted to dry materials rapidly and thoroughly with a minimum consumption of heat and power.

A further object of the invention is to facilitate introducing the material to be dried into the drier and removing it therefrom.

To attain these objects, I provide a long flow passage of relatively small cross-section and a blower to force air or other drying medium through the passage at high linear velocity. The passage contains a pre-heater for initial heating of the drying medium and re-heaters and material supports arranged alternately. In order to make the drier compact and to avoid loss of heat by radiation, I form the flow passage in a chamber, on top of which is located a blower adapted to force the drying medium into an inlet opening in or near the top of the chamber. The chamber contains flow-directing members which form in it the continuous flow passage with a straight portion leading downwardly from the inlet opening and containing a pre-heater, and a tortuous portion leading upwardly from the lower end of the straight portion to a discharge opening located at or near the top of the chamber. In order to provide for a re-circulation of all or a part of the drying medium, the flow passage may be made part of a closed circuit by connecting the discharge opening to the intake side of the blower.

In order to facilitate moving the material to be dried into and out of the chamber the material supports are mounted upon a carrier or truck movable in a direction parallel to the flow-directing members which form the tortuous portion of the flow passage, and some of these flow-directing members are fixed in the chamber while some of them are mounted on the carrier. Means are provided for making a tight connection between the fixed and movable flow-directing members when the carrier is in the chamber.

Other objects and advantages of the invention are hereinafter pointed out in connection with a detailed description of a drier embodying the invention which is illustrated in the accompanying drawings, in which:—

Fig. 1 is a sectional elevation of the drier taken on the line 1—1 of Fig. 2 and the line 1—1 of Fig. 4;

Fig. 2 is a top view of the drier with parts broken away;

Fig. 3 is a fragmentary sectional elevation on a larger scale, taken on the line 3—3 of Fig. 4 and showing a portion of the end wall of the truck broken away;

Fig. 4 is a fragmentary horizontal section taken on the line 4—4 of Fig. 3, upon a still larger scale; and

Fig. 5 is a front elevation of the drier, on a smaller scale than Figs. 1 and 2.

The drier illustrated comprises a chamber 10 having an inlet opening 11 in its top near one side and an outlet opening 12 in its top near the other side. On the top of the chamber 10 is mounted a blower 13 connected by a short conduit 14 to the entrance opening 11 of the chamber. The side walls 15, the back wall 16, the front wall 17 and the top 18 of the chamber 10 are made double so as to provide a dead air space to prevent conduction of heat from the chamber. The front wall 17 contains a doorway 21 which may be closed by a door 19 supported by hinges 20.

Horizontal tracks 25 extend into the chamber 10 through the doorway 21. Upon these tracks is a truck 26 which may be rolled into and out of the chamber through the doorway. On the platform 27 of the truck 26 is mounted a framework which includes corner posts 28 and a series of inwardly turned angle irons 29 extending across opposite ends of the truck and adapted to support trays 30 in which the material to be dried is supported. The ends of the truck may be closed by sheet metal walls 33 extending between the corner posts 28 while the sides of the truck are open. When the truck is out of the chamber the material trays 30 may be

removed or inserted from the side of the truck, each tray being slid along a pair of the angle irons 29 extending across opposite ends of the truck.

The truck carries spaced horizontal flow-directing members which in the form illustrated comprise the platform 27, together with the flanges 31 extending from the sides of the platform, the material tray 30^1, together with the flanges 31 extending from the sides of this tray, the material tray 30^2, together with the flanges 31 extending from the sides of this tray, and the material trays 30^3, 30^4, together with the flanges extending from the sides of these trays. All the flanges 31 are horizontal and project outwardly from the sides of the truck. They are secured to the corner posts 28 by brackets 32.

The chamber 10 contains flow-directing means fixed therein. These include a vertical partition 40 extending downwardly from the inner edge of the inlet opening 11 and dividing the chamber 10 into a pre-heater chamber and a drying chamber, and horizontal partitions 41, 42, 43, 41′, 42′, 43′ in the drying chamber together with the movable flanges 44, 44′ which are hinged to the edges of these partitions. It should be noted that the horizontal partitions 41, 42, 43, 41′, 42′, 43′ lie in the same planes as the horizontal flow-directing members on the truck 26.

When in operative position the movable flanges 44, 44′ rest upon and overlap the flanges 31 of the truck, as illustrated in Fig. 1, and make a tight connection between the horizontal flow-directing partitions which are fixed in the chamber and the flow-directing members which are mounted on the truck, when the truck is in the chamber. It should be understood that by the expression "tight connection," as used in this specification and the claims which follow, it is not meant that an air-tight connection is formed, but merely that the connection is sufficiently tight to prevent any material portion of a current of drying medium flowing along one side of the flow-directing members to pass through to the other side of the members.

When the truck is in position in the chamber the vertical partition 40 and the horizontal flow-directing members form in the chamber a long continuous flow passage extending from the inlet opening 11 to the outlet opening 12. The flow passage includes a straight portion 70 leading downwardly from the inlet opening 11 and a tortuous portion 71 leading upwardly from the lower end of the straight portion 70 to the outlet opening 12. In the straight portion 70 is placed a pre-heater 72 which may conveniently consist of steam coils. In the bends of the tortuous portion 71 are placed the re-heaters 73 which serve to re-heat the drying medium passing through the flow channel between each of its contacts with the material upon the trays 30. It should be noted that in order to form the tortuous portion 71 of the flow passage the horizontal partitions 42 and 42′ are spaced in staggered relation to each other. The partitions 43 and 43′ are desirable in order to prevent the current of drying medium from changing its direction before it reaches the re-heaters 73.

Owing to the relatively small cross-section of the flow passage the drying medium may be forced through it with high linear velocity by means of a small blower 13. As a result the material on the trays 30 is dried with great rapidity, with a small consumption of energy. Notwithstanding the length of the flow passage 70, 71 the drier is compact, and the blower 13 being located on the top of the chamber 10 does not increase the floor space occupied by the drier.

In cases where the drying medium discharged through the outlet 12 has not reached a predetermined point of saturation, it is desirable to utilize the heat contained in the drying medium at this point by re-circulating all or a part of the drying medium. For this purpose a short conduit 75 is provided connecting the outlet opening with the intake side of the blower 13. When this conduit is used it will be noted that the conduits 14 and 75 form with the passages 70, 71 a closed circuit through which the drying medium is forced by the blower 13. The dampers 76, 77, 78 provide means for regulating the proportion of the drying medium which is re-circulated. It should be noted that while the drying medium may thus be re-circulated through a long circuit of small cross-section, the greater proportion of this circuit is compactly contained in a chamber provided with insulated walls so that only a small portion of the heat of the drying medium is lost during the re-circulation. As a result, the drying medium may be retained at a temperature high enough for satisfactory drying with small consumption of steam, or other heating medium.

The arrangement of the truck in the tortuous portion of the flow passage makes it possible to introduce the material trays into the tortuous passage in such a manner that the drying medium flows over groups of them in series, while at the same time all the material trays may be moved into and out of the drier simultaneously. As the movement of the truck is parallel to the flow-directing members on the truck and in the chamber which form the tortuous passage 71 a tight connection of the flow-directing members may be obtained by means of the flanges 44, 44′ regardless of the exact longi-

tudinal position of the truck upon the tracks.

It may be noted that while it is necessary in order to form the tortuous portion 71 of the flow passage to provide means for making a tight connection between the staggered partitions 42, 42′ and the flow-directing members of the truck, the drier will operate fairly satisfactorily if those of the connecting flanges 44, 44′ which cooperate with the short partitions 43, 43′ are omitted.

In order to prevent injury to the connecting flanges when the truck is moved, means are provided for raising the movable flanges 44, 44′ out of contact with the flanges 31 of the truck. These means will next be described.

Each of the movable flanges 44 is rigidly secured at its inner edge to a hinge rod 50 mounted in bearings 51 provided along the edge of one of the horizontal partitions 41, 42 or 43 (Fig. 4). Upon the front end of each of the hinge rods 50 is fixed an arm 52 containing a slot 53 through which passes a vertical rod 54 which is slidably mounted in bearings 55 secured to the inside of the front wall 17 of the chamber 10. The rod 54 is provided with a series of collars 56 each adapted to come into contact with the lower side of one of the arms 52 when the arm is raised, and a series of collars 57 each adapted to come into contact with the upper side of one of the arms 52 when the rod is pushed down to the position illustrated in Fig. 3. A vertical movement may be imparted to the rod 56 by means of an arm 60 mounted on a shaft 61 extending through the front wall 17, and adapted to engage collars 59 fixed on the rod 54. The shaft 61 may be turned by means of an operating bar 62 mounted on the shaft outside the front wall 17.

The mechanism for operating the movable flanges 44′ is similar to that described in connection with the flanges 44 and comprises a vertical rod 54′ actuated by an arm 60′ mounted upon a shaft 61′ extending through the front wall 17 at the opposite side of the doorway 21 from the shaft 61. The shaft 61′ is turned by means of an operating bar 62′ mounted on the shaft outside the front wall 17. As illustrated in Fig. 5, the operating bar 62′ may serve as a bolt to retain the door 19 closed.

When the truck 26 is to be moved into the chamber 10, the door 19 is open and the operating bars 62, 62′ occupy the positions illustrated in dotted lines in Fig. 5 in which positions they are retained by the catches 74, 74′. A phantom view of the bars in this position is shown in Fig. 3. When the operating bars are in this position the rods 54, 54′ are forced down by the arms 60, 60′ raising the flanges 44, 44′ to the position illustrated in Fig. 3.

After the truck 26 has been moved into the chamber 10 and the door 19 has been closed, the operating bar 62′ is swung down from the position indicated in dotted lines in Fig. 5 to its horizontal position indicated in full lines, where it is retained by engagement with the catches 63, 63′ on the door 19 and the catch 64 on the front wall 17. This causes the arm 60′ to raise the rod 54′ causing each of the flanges 44′ to drop upon the corresponding flange 31.

The operating bar 62 is then raised from the position indicated in dotted lines in Fig. 5 to its horizontal position indicated in full lines. Its end is placed inside the catch 63 and is supported by the end of the operating bar 62′. When the operating bar 62 is thus raised the rod 54 is raised by the arm 60 causing each of the flanges 44 to fall upon the corresponding flange 31.

It should be noted that when the operating bars 62, 62′ are positioned so as to bring the movable flanges into their operative position in contact with the flanges 31 of the truck, the operating bars are located so as to obstruct opening of the door 19 and the removal of the truck 26 from the chamber 10. Consequently there is no danger of moving the truck when the movable flanges are resting on the fixed flanges and thus injuring either set of flanges.

When the drying operation has been completed and the truck is to be removed from the chamber the operating bars 62, 62′ are moved back to the positions indicated in dotted lines in Fig. 5 so that the door 19 may be opened. This movement of the operating bars raises the movable flanges 44, 44′ to the position shown in Fig. 3 so that they are out of contact with the flanges 31 on the truck. The truck may then be rolled out of the chamber on the tracks 25 without danger of injuring the flanges.

It should be noted that the collars 56, 57 on the rods 54, 54′ provide for positive movement of the arms 52 and the flanges in both directions, but that the collars are spaced so as to allow some lost motion. Thus when the rods are raised to their highest positions the collars 56, 57 are out of contact with the arms 52, as indicated in dotted lines in Fig. 3, so that each of the movable flanges is free to seat itself separately upon the corresponding flange of the truck. As a result when the movable flanges are placed in operative position each of them rests upon one of the truck flanges regardless of a bending or inaccurate positioning of any flange, so that a tight connection between all the horizontal flow-directing members is secured.

It should be noted further that when in operative position the movable flanges overlap the truck flanges so that a tight connection is secured even though the truck is slightly displaced laterally. This is a matter of importance as slight inaccuracies in the

laying of the tracks 25 or dirt on the tracks frequently causes lateral displacement of the upper portion of the truck.

It is believed that the use of the drier which has been described and the advantages obtained by the use of the invention will be apparent to those skilled in the art from the foregoing description.

While I have found it most desirable to combine the various features of the invention in a compact drier such as that described, it should be understood that many of the novel features of the embodiment described may sometimes advantageously be used independently of each other and that when so used they nevertheless constitute a part of my invention.

I claim as my invention:

1. In a drier, the combination of means providing a continuous closed flow circuit comprising a straight portion and a tortuous portion located at one side of the straight portion and having its ends connected to the ends of the straight portion, a blower in said circuit adapted to cause a circulation of drying medium therethrough, a heater in the straight portion of the passage, and heaters and material supports arranged alternately in the tortuous portion of the circuit.

2. In a drier, the combination of means providing a continuous flow circuit comprising a straight descending portion, a tortuous ascending portion located at the side of said descending portion and a portion connecting the upper ends of said straight and tortuous portions; a blower in said connecting portion adapted to cause a circulation of drying medium through the flow circuit, a pre-heater in said straight portion, and re-heaters and material supports arranged alternately in said tortuous portion.

3. In a drier, the combination with a chamber having inlet and outlet openings at its top, of flow-directing members in the chamber forming in it a continuous flow passage, comprising a straight portion extending downwardly from said inlet opening, and a tortuous portion extending upward from the lower end of said straight portion to said outlet opening, a blower on the top of the chamber arranged to force a drying medium into the chamber through said inlet opening, a pre-heater in said downwardly extending portion of the flow passage, and re-heaters and material supports alternately arranged in the tortuous portion of said passage.

4. In a drier, the combination with a drying chamber of two sets of horizontal partitions in the chamber arranged at opposite sides of the chamber in staggered relation to each other and providing an open space between their inner edges and a plurality of removable horizontal material supports located in the open space between the two series of partitions, certain of said supports being located in the same planes as said partitions and forming continuations thereof so as to cooperate therewith to form a continuous tortuous flow passage in the chamber.

5. In a drier, the combination with a drying chamber of two sets of horizontal flow-directing partitions in the chamber arranged at opposite sides of the chamber in staggered relation to each other and providing an open space between their inner edges, a material carrier movable into and out of said open space in a direction parallel to said inner edges, horizontal flow-directing members on the carrier having their outer edges parallel to the direction of movement of the carrier, and means for making a tight connection between the flow-directing members in the chamber and those of the carrier so that they cooperate to form in the chamber a continuous tortuous flow passage.

6. In a drier, the combination with a drying chamber of a plurality of flow-directing partitions in the chamber arranged at opposite sides thereof so as to leave an open space between them and having their inner edges parallel, a material carrier movable into and out of the open space of the chamber in a direction parallel to said inner edges, flow-directing members on the carrier having their outer edges parallel to the direction of movement of the carrier, and means for making a tight connection between the inner edges of the flow-directing partitions in the chamber and the outer edges of the flow-directing members on the carrier when the carrier is in the chamber.

7. In a drier, the combination with a drying chamber of a plurality of parallel flow-directing partitions in the chamber arranged along opposite sides thereof so as to leave an open space between their inner edges, a material carrier movable into and out of said open space in a direction parallel to said flow-directing partitions, flow-directing members on the carrier, each of which is located in the same plane as one of the flow-directing partitions in the chamber, and means for making a tight connection between the flow-directing members of the carrier and the partitions in the chamber when the carrier is in the chamber.

8. In a drier, the combination with a drying chamber, of a plurality of horizontal flow-directing partitions in the chamber arranged along opposite sides thereof so as to leave an open space between their inner edges, a material carrier movable into and out of said open space in a horizontal direction, horizontal flow-directing members on the carrier, each lying in the same plane as one of said flow-directing partitions in the chamber, and means for making a tight con-

nection between the flow-directing members of the carrier and those of the chamber when the carrier is in the chamber.

9. In a drier, the combination with a drying chamber of horizontal flow-directing partitions in the chamber, a material carrier movable into and out of the chamber in a horizontal direction, horizontal flow-directing members on the carrier, and means for making a tight connection between the flow-directing members in the chamber and those on the carrier and comprising vertically movable flanges, each adapted to rest upon the edge portion of one of said flow-directing members when the carrier is in the chamber.

10. In a drier, the combination with a drying chamber of a plurality of parallel partitions in said chamber, a carrier movable into and out of the chamber in a direction parallel to said partitions, a plurality of flow-directing members on the carrier parallel to its direction of movement, a plurality of movable flanges, each extending from one of said partitions and adapted to rest upon the edge portion of one of the flow-directing members of the carrier when the carrier is in the chamber, a common operating means for said flanges adapted to raise them out of contact with the flow-directing members of the carrier and to drop them into contact therewith, and a connection between said common operating member and each of said flanges arranged to provide sufficient lost motion to permit each flange to seat itself independently upon one of the flow-directing members of the carrier.

11. In a drier, the combination with a drying chamber of a flow-directing partition therein, a carrier movable into and out of said drying chamber, a flow-directing member on said carrier, movable means adapted when in operative position to make a tight connection between said partition and said members, and an operating member connected to said movable connecting means and so positioned that it obstructs movement of the carrier out of the chamber when said connecting means is in operative position.

12. In a drier, the combination with a drying chamber containing a doorway, of a flow-directing partition in the chamber, a carrier movable into and out of the chamber through the doorway, a flow-directing member on the carrier, movable means adapted when in operative position to make a tight connection between said partition and said member, and an operating bar connected to said movable connecting means and so positioned that it extends across said doorway when said connecting means is in operative position.

13. In a drier, the combination with a drying chamber having a doorway, a door adapted to close said doorway, a carrier movable into and out of said drying chamber through said doorway, a flow-directing partition in the chamber having an edge parallel to the direction of movement of the carrier, a flow-directing member on the carrier having an edge parallel to its direction of movement, movable means adapted, when in operative position, to make a tight connection between said partition and said member, an operating bar connected to said movable connecting means and located outside the chamber and so positioned that it prevents the opening of said door when said movable means is in operative position and permits opening of said door when the connecting means is in inoperative position.

14. In a drier, the combination with a drying chamber of two sets of parallel flow-directing members arranged along opposite sides of the chamber so as to leave an open space between their inner edges, a material carrier movable into and out of said open space in a direction parallel to said flow-directing members, flow-directing members on the carrier parallel to its direction of movement, and each lying in the same plane as one of the flow-directing means in the chamber, all of said flow-directing members being of such size that the inner edges of those in the chamber overlap the outer edges of those on the carrier when the carrier is in the chamber so as to make a tight connection therewith notwithstanding lateral displacement of the carrier.

15. In a drier, the combination with a drying chamber of two sets of horizontal flow-directing members in the chamber arranged at opposite sides of the chamber in staggered relation to each other and providing an open space between their inner edges, a truck movable into and out of said open space in a direction parallel to said inner edges, horizontal flow-directing members on the carrier having outer edges parallel to its direction of movement and each lying in the same plane as one of the flow-directing members in the chamber, all of said flow-directing members being so located that when the truck is in the chamber the inner edge of each flow-directing member in the chamber overlaps the outer edge of one of the flow-directing means on the carrier, making a tight connection therewith, so that the flow-directing members in the chamber and those of the carrier cooperate to form in the chamber a continuous tortuous flow passage.

16. In a drier, the combination with a drying chamber of flow-directing members therein having parallel edges, a truck movable into and out of the chamber in a direction parallel to said edges, a frame on said truck, spaced flow-directing members on the

truck, each of said members including a longitudinal side flange projecting outwardly from the frame and adapted to overlap the edge of one of the flow-directing members in the chamber when the truck is in the chamber.

17. A material carrier for use with a drier, comprising a truck having a frame, and spaced horizontal flow-directing members supported by the frame, each of said members including longitudinal side flanges projecting outwardly from the frame.

18. A material carrier for use in connection with a drier, comprising a truck having a material supporting frame, and a plurality of spaced horizontal side flanges extending outwardly from the frame.

19. A material carrier for use in connection with a drier, comprising a truck having a frame formed to support a plurality of material trays, and horizontal side flanges extending outwardly from said frame in line with certain of said tray supports.

In testimony whereof I have hereunto set my hand.

DAVID S. BAKER.