R. E. VALENTINE.

DRYING MECHANISM.

APPLICATION FILED APR. 4, 1905.

923,092.

Patented May 25, 1909.

3 SHEETS—SHEET 1.

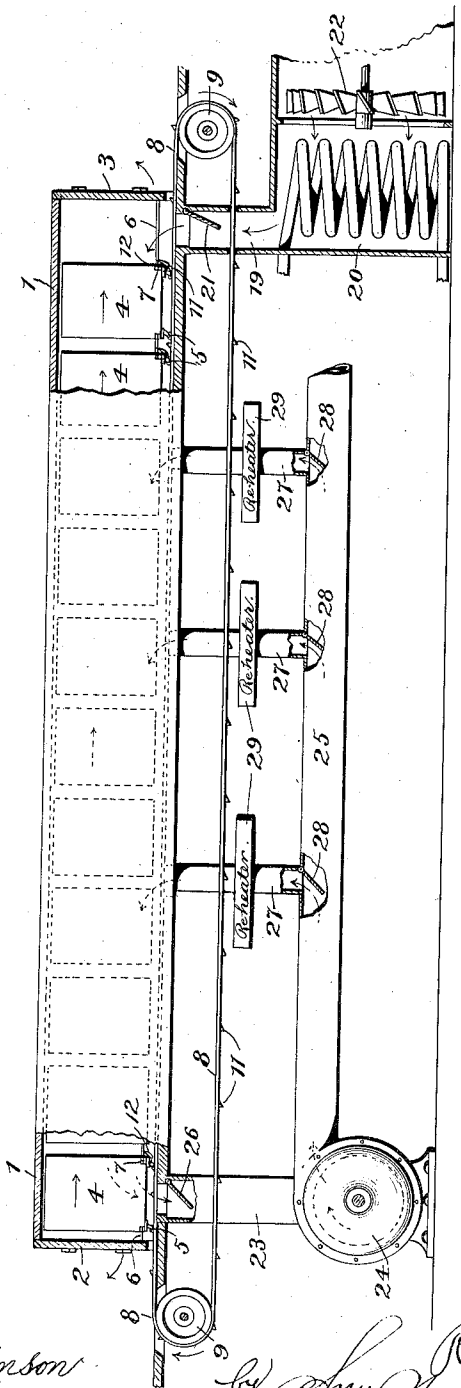


Fig. 1.

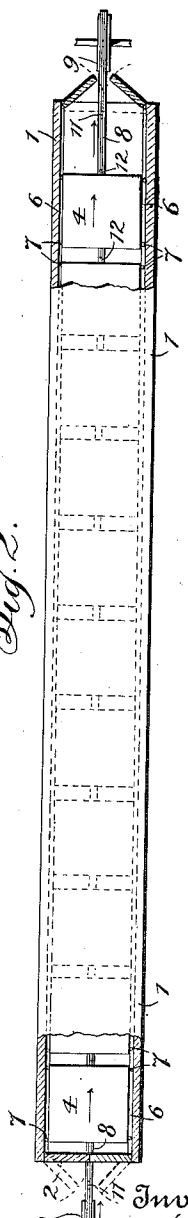


Fig. 2.

Witnesses

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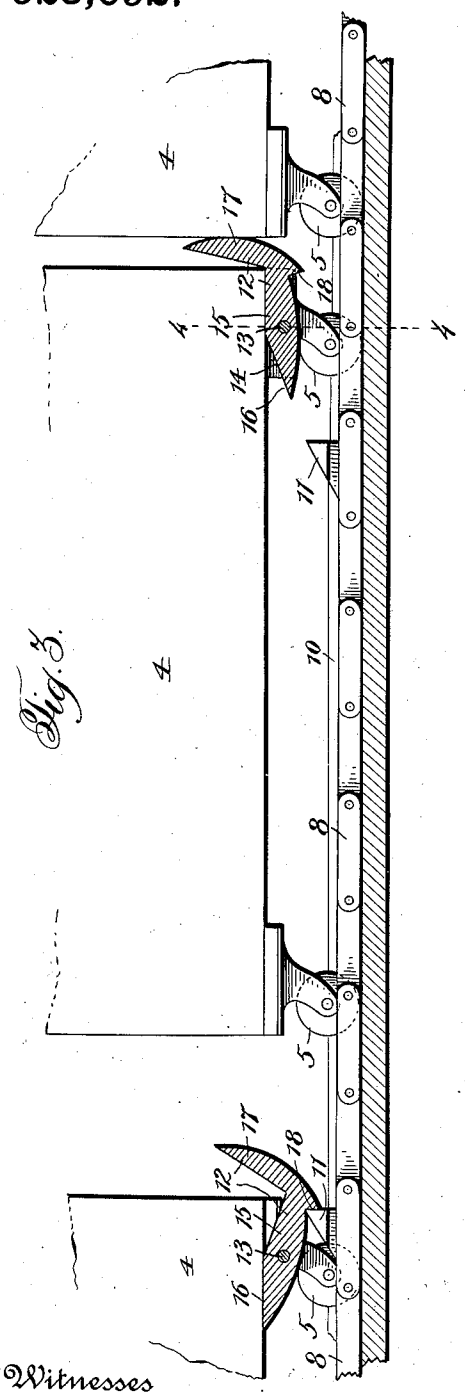


Fig. 3.

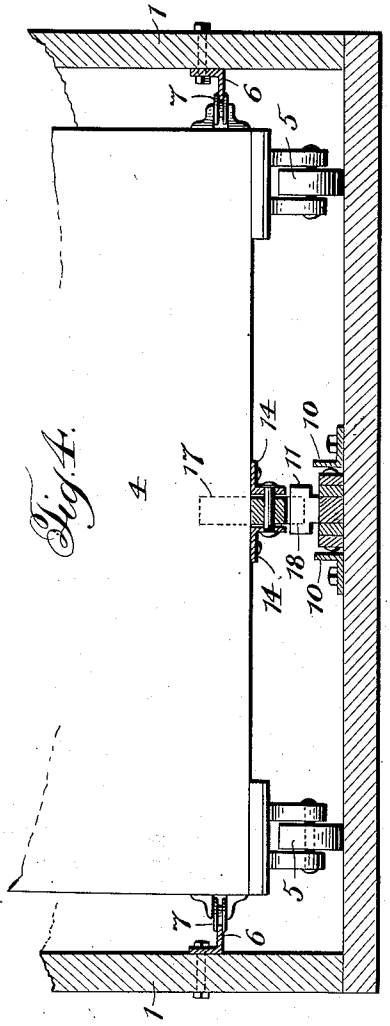


Fig. 4.

Witnesses

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3 SHEETS—SHEET 3.

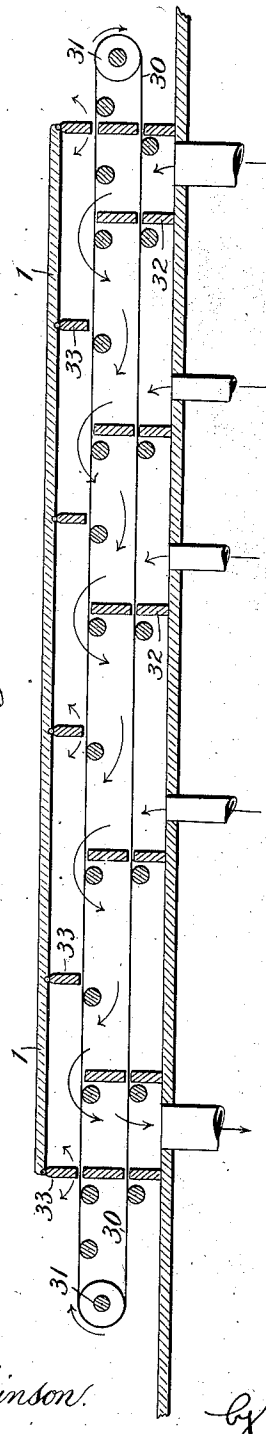


Fig. 5.

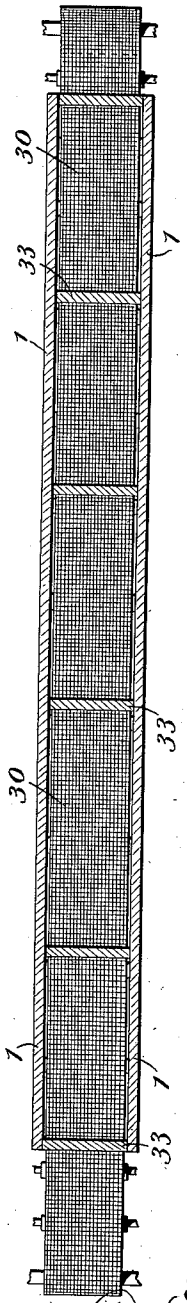


Fig. 6.

Witnesses

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UNITED STATES PATENT OFFICE.

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DRYING MECHANISM.

No. 923,092. Specification of Letters Patent. Patented May 25, 1909.

Application filed April 4, 1905. Serial No. 253,820.

To all whom it may concern:

Be it known that I, RALPH E. VALENTINE, a citizen of the United States, residing at Worcester, in the county of Worcester and State of Massachusetts, have invented certain new and useful Improvements in Drying-Machines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to improvements in drying machines, and more particularly relates to drying machines of that type wherein is employed a series of traveling racks for the carriage through the machine of the material to be dried.

The present invention aims to provide a machine of the character mentioned the construction of which is exceedingly simple, and by the employment of which the most economical use of the drying medium is assured.

Furthermore, the invention also aims to provide a drying machine in which is embodied simple and efficient means for readmitting at different points in the machine the air exhausted therefrom for further action upon the material being dried, and without preventing the rapid and thorough drying of the material.

The invention further has in contemplation a drying machine embodying additional means for effecting a constant moving of the racks, the construction of which means is also such as to render the same simple and automatic in action, and whereby the load upon the rack-conveying means will be minimized, thus enabling the machine to be operated with small power, and assuring against stoppage by reason of the conveying mechanism becoming impaired or damaged.

The invention further aims to provide a drying machine which can be readily controlled and having a wide range of adaptation for different materials and conditions.

With these general objects in view, and others which will appear as the nature of the improvements is better understood, the invention consists substantially in the novel construction, combination and arrangement of parts, as will be hereinafter fully described, illustrated in the accompanying drawings, and pointed out in the appended claims.

While the forms of the invention herein shown and described are what are believed to be preferable embodiments thereof, it is obvious that the invention is susceptible of further changes in the form, proportion and minor details of construction, and the right is accordingly reserved to modify or vary the invention as falls within the spirit and scope thereof.

In the drawings—Figure 1 is a vertical longitudinal sectional view of a drying machine constructed in accordance with the present invention. Fig. 2 is a sectional plan view thereof. Fig. 3 is a detail elevation, on an enlarged scale, of a portion of the conveying mechanism, and illustrating the positions of the racks during their transit through the machine, the racks, at the points of application of the engaging hooks, being shown in section. Fig. 4 is a transverse sectional view on the line 4—4, Fig. 3. Fig. 5 is a longitudinal sectional view of another form of the invention. Fig. 6 is a sectional plan view of the form shown in Fig. 5.

Referring in detail to the drawings, the numeral 1 designates the casing of the herein-described machine, the same consisting of an elongated body provided at one end with an inlet door or doors 2, and at its other end with an outlet door or doors 3, whereby the racks containing the material to be dried are introduced and removed from said casing.

The racks, designated by the numeral 4, may be of the usual form, the same being mounted upon casters 5, and in the construction of the racks it is preferable that the casters at the forward ends thereof shall be fixed, while the casters at the rear ends may be pivoted. By pivoting the casters at the rear ends of the racks the latter may be more easily guided than if the casters are fixed. This is especially desirable when the racks have been removed from the casing 1.

In order that the racks 4 may properly travel from one end of the casing 1 to the other end thereof, the sides of said casing are provided with guide-rails 6, which rails are preferably in the form of angle irons, and the horizontal flanges thereof are engaged by guide-rollers 7 journaled upon the sides of the racks 4. Hence it will be seen that by reason of the rollers 7 coöperating with the guide-rails 6, the racks will traverse the casing 1 in a direct line, and without liability of coming in contact with the sides of the casing. If found more desirable, tracks may be provided upon the bottom of the casing for the

wheels of the casters 5, or any other desired guiding means may be substituted for the rails 6 and rollers 7.

In order to move the racks 4 through the casing 1, an endless conveyer 8 is employed, said conveyer being in the nature of a sprocket chain and passing around a pair of driving rolls or wheels 9, one of said wheels being connected to a suitable motive power, and through the medium of which a constant movement of the conveyer 8, at a slow speed, is effected. It will be observed that the wheels 9 are journaled at points beyond the ends of the casing 1, in order that the conveyer 8 will traverse the entire length of said casing, and it will also be observed that the upper side of the conveyer 8 only is designed to pass through the casing 1, said side of the conveyer moving in close proximity to the floor of said casing. A pair of oppositely-arranged guides 10 is employed for maintaining the conveyer 8 at substantially the middle of the casing, thereby insuring a proper movement of the conveyer, and preventing any sidewise motion thereof. At suitable points along the conveyer 8 a series of spaced dogs 11 is arranged, and it will be observed that the spaces between these dogs are slightly less than the lengths of the racks 4, the purpose of which will presently appear.

In order to connect each of the racks with the conveyer 8, and thereby effect propulsion of the racks through the casing, each of the racks has pivoted to the forward end of the underside, and at substantially the middle portion thereof, an engaging hook 12. Each of said hooks is mounted upon a pivotal bolt 13 arranged in a pair of depending hangers 14 suitably connected to the underside of the rack, and consequently it will be seen that each of the hooks 12 is capable of a limited movement in a vertical plane. The hooks 12 each comprise a shank 15 the rear end of which is beveled, as at 16, and adapted to contact with the underside of the rack for limiting the downward movement of the hook, and arranged at the forward end of the shank 15 is an inclined head 17, the outer surface of which is convex, and said head terminates at its lower end, and at the point of juncture with the shank 15, in an abutment 18 against which the dogs 11 are adapted to contact when the hooks 12 are in their lowermost position. It will be observed at this point that the position of the hooks 12 upon the racks 4 is in the same vertical plane as the conveyer 8, and consequently when the hooks 12 descend, as will presently appear, the same are positioned to be engaged by the dogs 11, which engagement moves the racks 4 toward the discharge end of the casing 1. It will thus be seen that there is no connection between the racks, but that each has an independent connection with the conveyer 8, and hence each rack is entirely independent of the others for its propulsion through the casing.

To supply the casing 1 with a suitable drying medium, an inlet duct 19 communicates therewith at a point adjacent the delivery end of the casing, said duct being in communication with a chamber 20, wherein is located any suitable form of heat generator. The latter, however, is preferably a series of steam coils, but obviously any other generator may be employed, and consequently as air passes through the chamber 20 the temperature thereof will be raised to any desired degree, and delivered at such degree to the casing 1, wherein the heated air will traverse toward the inlet end, and thus in a direction opposite to the direction of movement of the racks 4. A cut-off or damper valve 21 is pivoted in the duct 19, whereby communication between the latter and the casing 1 may be either established or entirely cut off, or the degree of such communication varied in accordance with the amount of heated air which it is desired to introduce to the casing. A fan 22 may also be employed in connection with the chamber 20, which fan may be propelled from any suitable source, and through the medium of which the supply of air may be increased to the chamber 20.

At a point adjacent to the inlet end of the casing 1 an exhaust duct 23 is located, said duct being in communication with the casing 24 of an exhaust fan, and which casing also discharges into a delivery trunk 25. The duct 23 is likewise provided with a cut-off or damper valve 26, by means of which communication between said duct and the interior of the casing 1 is regulated, and it will thus be seen that by means of the valves 21 and 26 communication between the chamber 20 and the fan casing 24 is effectually controlled.

The delivery trunk 25 extends parallel with the casing 1, and at separated points throughout its length said trunk is tapped by a series of return ducts or flues 27, the latter being in communication with the interior of the casing 1, so that, if desired, the air blown into the trunk 25 by the exhaust fan may be returned to the casing 1 at different points. At the juncture of each duct or flue 27 with the trunk 25, a regulating valve or damper 28 is located, the purpose of which valves is to control communication between said trunk and said ducts, and each of said ducts is also provided with a reheater 29 located at a point between the ends thereof, and whereby the temperature of the air delivered from the trunk 25 may be raised before passing into the casing 1. By the arrangement of the heater, fan and ducts, the most economical use of the heat is assured. The air may be readmitted at any point beyond the inlet end of the casing 1 without preventing the rapid and thorough drying of the material carried by the racks 4, the degree of dryness of the

air within the casing increasing toward the discharge end of the casing, at which latter point it is entirely free of moisture, due to the fact that it is initially introduced to the casing 1 at that point directly from the heater. Thus the dryness of the air at any point is in direct proportion to the dryness of the material, and to overcome the slight retardation of the drying process, which may possibly arise incident to the readmission of the air, requires only a proportional increase in the length of the machine. In this connection it may be stated that to secure the best and most rapid drying a high velocity of the air is desirable, and at such velocity, as the air does not become saturated, it is economical in the use of heat energy to readmit the air until it does become saturated or nearly so. This provides for the operation of the machine on the most economical basis.

In Figs. 5 and 6 is illustrated another form of the invention, and in this form the same construction for the purpose of heating the air, exhausting the same, and readmitting the air to the casing, is preserved. This form, however, differs from the other form in that in lieu of the racks 4, for the carriage of the material to be dried, an endless conveyer 30, or a series thereof, is substituted. This conveyer is preferably formed of perforated material, such as wire mesh, in order to permit a free circulation of the drying medium therethrough, and the conveyer 30 passes around a pair of rollers 31 which are journaled at the exterior of the casing, and driven by suitable power for effecting a propulsion of the conveyer. By referring to Fig. 5, however, it will be noted that the casing 1 is provided at intervals with a series of stationary deflectors 32 rising from the floor of the casing, and which deflectors are alternately arranged with a series of swinging or hinged deflectors 33 suspended from the roof of the casing and terminating at a point just above the upper side of the conveyer 30. This alternate arrangement of the deflectors 32 and 33 permits the heated air introduced at the delivery end of the casing 1 to be directed upwardly toward the roof of the casing by which latter it is deflected downwardly, and coming in contact with the next adjacent swinging deflector 33, the air is caused to pass through the conveyer 30 toward the bottom of the casing 1, whence it passes upwardly again by reason of the next adjacent stationary deflector 32, and this circuitous passage of the air from the discharge end to the inlet end of the casing 1 continues during the traverse of the conveyer 30. By reason of the deflectors 33 being hinged, it is also apparent that the same will yield to the material upon the upper side of the conveyer 30, in the passage of the material through the casing 1, so that the material is not displaced in any degree whatever but merely swings the deflectors 33 in the arc of a circle until the material has passed said deflectors and thus freed from contact therewith.

In the use of the invention, and with special reference to the operation of the form shown in Figs. 1 to 4, the material to be dried is placed upon one of the racks 4, and the latter is introduced to the casing 1 at the inlet end 2 thereof. At this time the engaging hook 12 of the rack has gravitated to its lowest position, and as the abutment 18 is in a plane to be engaged by one of the dogs 11 of the conveyer 8, such engagement takes place as soon as the dog contacts with said abutment. The rack 4 immediately commences its transit through the casing 1, and by reason of the slow speed of the conveyer 8 the rack will also travel slowly. During this period of travel the contents of the rack are subjected to the drying agent within the casing 1 which is introduced through the duct 19 from the heating chamber 20. The racks 4 are successively introduced, in accordance with the amount of material to be dried, and this may be done either before the first rack has reached the delivery end of the casing, or not until such end has been reached by the first rack. When the latter arrives at the delivery end of the casing the head 17 contacts with the door or doors 3, and as the rack continues to move forwardly by reason of the continued movement of the conveyer 8, it will be seen that the door or doors offer a resistance to the further forward movement of the rack, and consequently the head 17 moves upwardly, thereby swinging the engaging hook 12 upon its pivot, and raising the abutment 18 from engagement with the dog 11. The latter continues to move forwardly, but having been freed from engagement with the rack, the latter ceases to move, and consequently remains at the delivery end of the casing 1 until it is desired to remove the same therefrom. The remaining racks successively move toward the delivery end of the casing, and as the second one comes in contact with the first rack, the engaging hook 12 of the second rack is freed in a manner similar to the disengagement of the hook 12 of the first rack from its dog 11, and consequently each of the racks is successively stopped in its movement through the casing. When it is desired to remove the first rack from the casing, the door or doors 3 are opened, whereupon the hook 12 of the first rack gravitates, and is engaged by one of the dogs 11 to propel it forwardly. As the first rack leaves the second rack it is obvious that the hook 12 of the second rack will also gravitate, and becoming engaged with one of the dogs 11, the second rack moves forwardly to the position previously occupied by the first rack, but by reason of the

fact that the distance between the dogs 11 is slightly less than the length of the racks, the second rack will move independently of the remaining racks, so that there is only the weight of one rack upon the conveyer 8 in the successive forward movements of the racks, and the load is thereby minimized to the greatest possible degree. As is obvious, the racks are successively moved forward as the preceding ones leave the same, and consequently a rack is always located at the delivery end of the casing 1 for removal therefrom. This action is wholly automatic, and is merely dependent upon the removal of the rack at the delivery end of the casing, and as each rack leaves the latter, a further rack is introduced to the casing for drying the contents thereof.

The heated air introduced from the chamber 20 passes into the casing 1, and traverses the latter until it reaches the inlet end, at which point it is exhausted through the duct 23 by the fan in the casing 24, and is thence discharged into the delivery trunk 25. If the air so delivered is to be exhausted into the atmosphere, the cut-offs or damper valves 28 are closed over the ducts 27, and the air will therefore pass through the trunk 25 to the atmosphere. If, however, it is desired to readmit the air from the trunk 25 to the casing 1, the valves 28 are adjusted in accordance with the point at which it is desired to readmit the air, whereupon the latter will pass through the open duct or ducts 27 and again enter the casing 1 for action upon the material upon the racks 4. The quantity of the air readmitted, and the position at which it is done, must be determined by the amount of evaporation at a certain heat, and the length of time required to evaporate the required amount of moisture, which, obviously, varies greatly. By reason of the reheaters 29, the air passing through the respective ducts 27, may be raised in temperature to the required degree, and thus the dryness of the air readmitted at any point in the casing is in direct proportion to the dryness of the material. While the reheaters are preferably employed, these are not absolutely essential, nor is the fan 22 an essential element, as the fan within the casing 24 alone will prevent the loss of the heated air through any leaks in the machine or by the opening of the doors, the suction created by this fan being inward.

Having thus described the invention, what is claimed as new, and desired to be secured by Letters Patent, is—

1. A drying machine, comprising a casing, means for introducing a drying medium thereto, means for exhausting the drying medium from said casing, a conveyer passing through said casing, a rack or racks for carrying the material, gravity hooks carried by said rack or racks for engaging the conveyer, and means whereby said hooks are automatically released from the conveyer when they meet an obstruction to thereby bring the racks to rest.

2. A drying machine, comprising a casing, means for introducing a drying medium thereto, means for exhausting the drying medium from said casing, a conveyer passing through said casing, racks for carrying the material to be dried, dogs carried by the conveyer, and hooks associated with the racks for engaging said dogs for propelling the racks through said casing.

3. A drying machine, comprising a casing, means for introducing a drying medium thereto, means for exhausting the drying medium from said casing, a conveyer passing through said casing, racks for carrying the material to be dried, dogs carried by the conveyer, and gravitating hooks associated with the racks for engaging said dogs for propelling the racks through said casing.

4. A drying machine, comprising a casing, means for introducing a drying medium thereto, means for exhausting the drying medium from said casing, a conveyer passing through said casing, racks for carrying the material to be dried, dogs carried by the conveyer, and gravitating hooks associated with the racks for engaging said dogs for propelling the racks through said casing, said hooks being provided with actuating heads adapted to effect automatic disengagement of the hooks from said dogs.

5. A drying machine, comprising a casing, means for introducing a drying medium thereto, means for exhausting the drying medium from said casing, a conveyer passing through the casing, racks for carrying the material to be dried, dogs carried by said conveyer and spaced apart a distance slightly less than the length of the racks, and hooks associated with said racks for engagement with said dogs to propel the racks through the casing, said hooks being provided with means whereby the same are automatically released from engagement with said dogs as the racks are successively advanced through the casing.

6. A drying machine, comprising a casing, means for introducing a drying medium thereto, means for exhausting the drying medium from said casing, a conveyer passing through the casing, racks for carrying the material to be dried, dogs carried by said conveyer and spaced apart a distance slightly less than the length of the racks, and hooks associated with said racks for engagement with said dogs to propel the racks through the casing, said hooks being provided with engaging heads adapted to contact with the racks for automatically releasing the hooks from engagement with the dogs as the racks are successively advanced through the casing.

7. A drying machine, comprising a casing provided at its ends with an inlet and discharge, means arranged adjacent to said discharge end for introducing a drying medium thereto, means arranged adjacent to the inlet for exhausting the drying medium from the casing, and means associated with said exhausting means for readmitting the drying medium to said casing between the inlet and exhaust.

8. A drying machine, comprising a casing, means for introducing a drying medium thereto, means for exhausting the drying medium from said casing, a conveyer passing through the casing, racks for carrying the material to be dried, means associated with said racks and coöperating with the conveyer for propelling the racks through the casing, said means being adapted to be automatically actuated when they meet an obstruction for releasing the racks from engagement with the conveyer, and means associated with the exhausting means for readmitting the drying medium exhausted from the casing.

9. A drying machine, comprising a casing, means for introducing a drying medium thereto, means for exhausting the drying medium from said casing, a conveyer passing through said casing, racks for carrying the material to be dried, dogs carried by said conveyer, gravity hooks associated with said racks for engaging said dogs, whereby the racks are propelled through the casing, and means for automatically releasing said hooks from said dogs when they meet an obstruction.

10. A drying machine, comprising a casing, means for introducing a drying medium thereto, means for exhausting the drying medium from said casing, a conveyer passing through said casing, racks for carrying the material to be dried, dogs carried by the conveyer, hooks associated with said racks for engaging said dogs, whereby the racks are propelled through the casing, means for automatically releasing said hooks from said dogs when they meet an obstruction a delivery trunk associated with said exhausting means, and return ducts or flues communicating with said trunk and said casing for readmitting the drying medium exhausted therefrom.

11. A drying machine, comprising a casing, a duct connected at one end thereof for introducing a drying medium thereto, a duct connected to the other end of said casing and through which the drying medium is exhausted, means for conveying the material to be dried through said casing, a fan connected to said exhaust duct, a delivery trunk separated from said casing and connected to said fan, and return ducts or flues communicating with said delivery trunk and said casing for readmitting the drying medium exhausted therefrom.

12. A drying machine, comprising a casing, a duct connected at one end thereof for introducing a drying medium thereto, a duct connected at the other end of said casing and through which the drying medium is exhausted, a conveyer passing through said casing, racks associated with said conveyer for carrying the material to be dried, a fan connected to said exhaust duct, a delivery trunk separated from said casing and connected to said fan, and return ducts or flues communicating with said delivery trunk and said casing for readmitting the drying medium exhausted therefrom.

13. A drying machine, comprising a casing, a duct connected to one end thereof and through which a drying medium is introduced to said casing, a duct connected to the other end of said casing and through which the drying medium is exhausted, a conveyer passing through said casing, racks for carrying the material to be dried, means associated with said racks and coöperating with said conveyer for propelling the racks through the casing, a fan connected to said exhaust duct, a delivery trunk separated from said casing and communicating with said fan, and return ducts or flues communicating with said delivery trunk and the casing for readmitting the drying medium exhausted therefrom.

14. A drying machine, comprising a casing, means for introducing a drying medium thereto, a conveyer passing through said casing, a rack or racks for carrying the material, gravity hooks carried by said rack or racks for engaging the conveyer, and means whereby said hooks are automatically released from the conveyer when they meet an obstruction to thereby bring the racks to rest.

In testimony whereof I affix my signature, in the presence of two witnesses.

RALPH E. VALENTINE.

Witnesses:
JOHN A. ULAROBY,
E. BERT JOHNSON.