

G. A. CUTTER.
 DRYING MACHINE.
 APPLICATION FILED APR. 19, 1909.

1,052,896.

Patented Feb. 11, 1913.

4 SHEETS—SHEET 1.

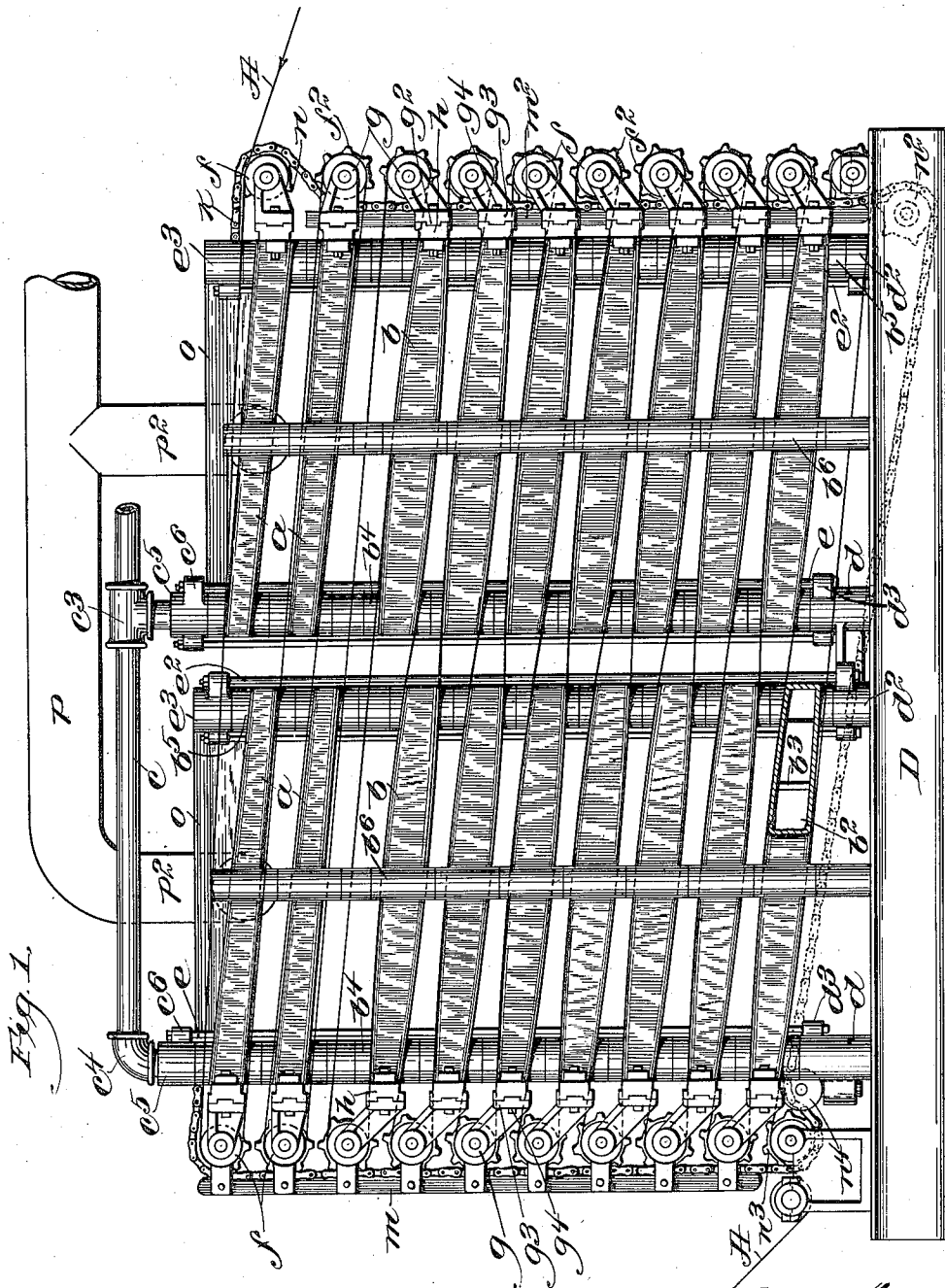


Fig. 1.

Witnesses:
 Jas. J. Maloney.
 M. J. Maloney.

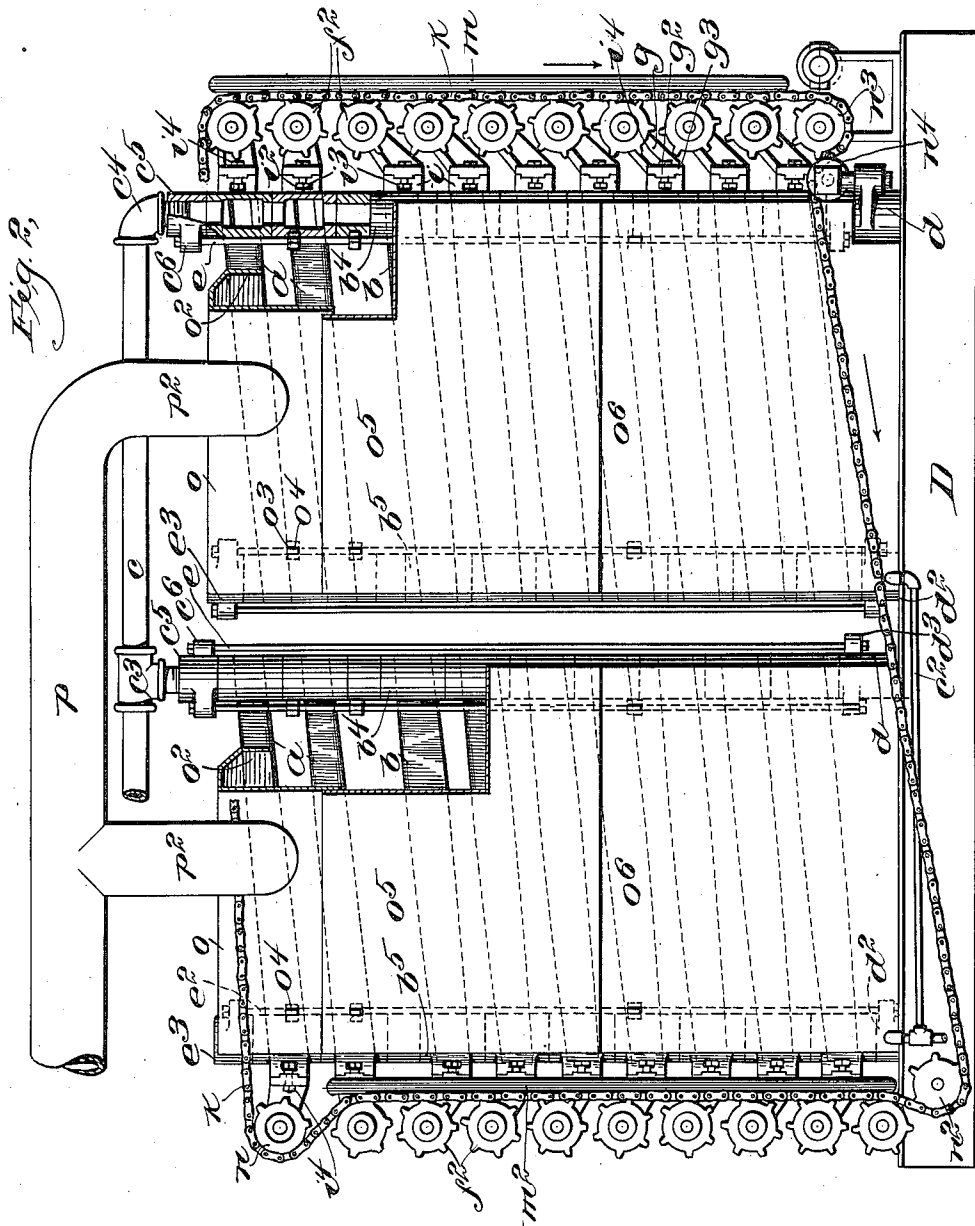
Inventor:
 George H. Cutter.
 by H. J. Swann
 Atty.

G. A. CUTTER.
 DRYING MACHINE.
 APPLICATION FILED APR. 19, 1909.

1,052,896.

Patented Feb. 11, 1913.

4 SHEETS—SHEET 2.



Witnesses:
 Jas. J. Maloney.
 W. J. Lavery.

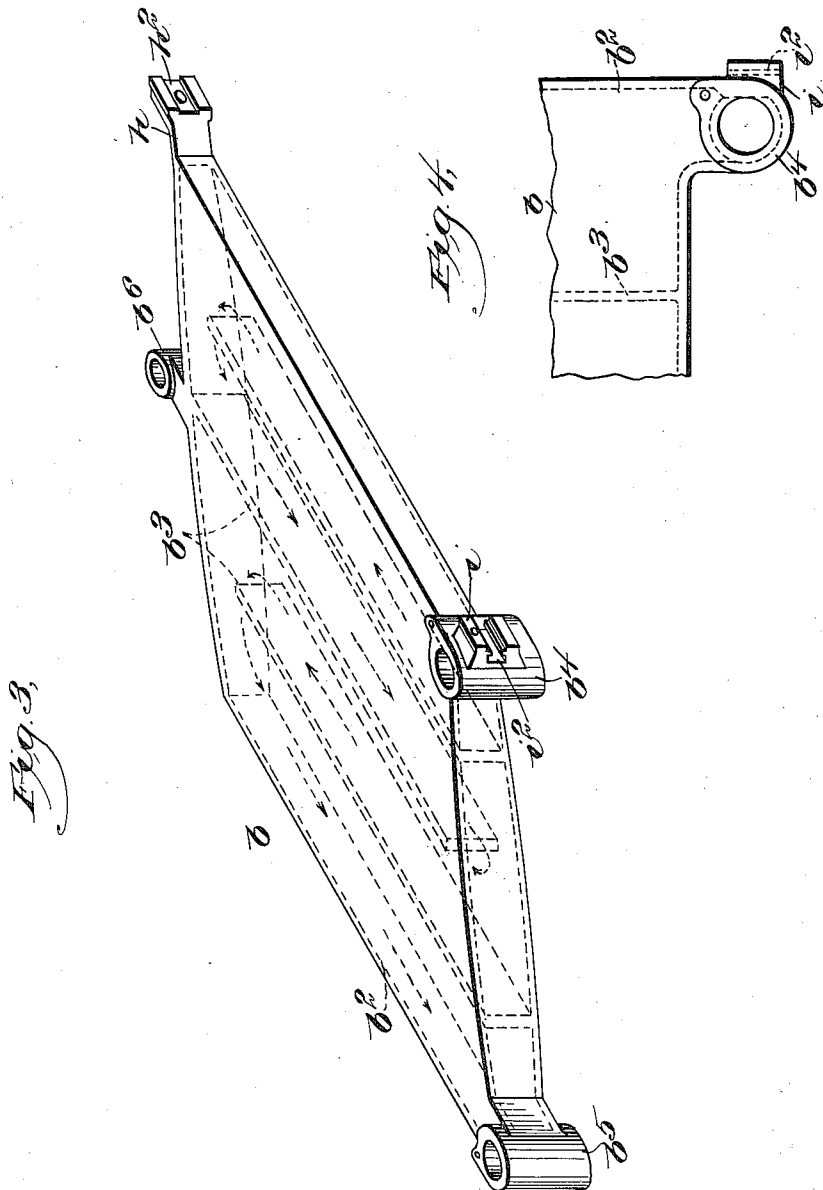
Inventor:
 George H. Cutter.
 by H. J. Livermore.
 Atty.

G. A. CUTTER.
 DRYING MACHINE.
 APPLICATION FILED APR. 19, 1909.

1,052,896.

Patented Feb. 11, 1913.

4 SHEETS—SHEET 3.



witnesses:
 Jas. J. Maloney.
 W. J. [Signature]

Inventor:
 George H. Cutter,
 by H. J. [Signature]
 Attorney.

UNITED STATES PATENT OFFICE

GEORGE A. CUTTER, OF TAUNTON, MASSACHUSETTS, ASSIGNOR TO CELL DRIER MACHINE COMPANY, A CORPORATION OF MAINE.

DRYING-MACHINE.

1,052,896.

Specification of Letters Patent.

Patented Feb. 11, 1913.

Application filed April 19, 1909. Serial No. 490,909.

To all whom it may concern:

Be it known that I, GEORGE A. CUTTER, of Taunton, in the county of Bristol and State of Massachusetts, have invented an Improvement in Drying-Machines, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

This invention relates to a drying apparatus of the type in which the material to be dried is carried back and forth through the apparatus adjacent to, or in contact with, the surfaces of stationary steam heated cells.

The invention, which involves a novel mode of operation for machines of this class, is embodied in an apparatus of novel construction and arrangement, having many advantages not only in facility and economy of manufacture, but also in convenience and accessibility when in use.

In the drying operation, as carried on in this apparatus, the material is caused to travel in approximately horizontal planes; and the carrier rolls are at the ends of the machine. By this construction, the interior of the machine is accessible at all times since it is not necessary to incase the cells—the top cells constituting a closure at the top to confine the rising heat, while the carrier rolls approximately inclose the ends. If it is desirable to utilize air currents to assist in carrying away the moisture, one side of the machine may be inclosed and provided near the top with one or more exhaust outlets; and by the use of any suitable suction device the air is drawn in from the open side over the drying surfaces of all the cells and sucked out through the exhaust outlets.

The invention is further embodied in a unit system of construction, whereby the usual supporting frame work may be dispensed with; the cells being provided with supporting portions whereby any number of them can be piled or stacked, one upon another, the entire structure being completed by uniting the top and bottom cell, or cells, as by tie-bolts. Furthermore, the supporting portions of the cells, or "bosses", as they may be termed, are so constructed as to constitute, when the cells have been assembled, the inlet and outlet passages for the drying elements; and the

horizontal surfaces of the bosses at the same side of each cell are in different planes, so that when the cells are stacked up, the end of the cell where the outlet passage is located will be lower than the end where the inlet passage is located, whereby drainage of the water of condensation is insured.

A further feature of the invention consists in the arrangement of the supporting bosses, there being two of such bosses located at one side of the cell near the corners, these contributing to form the inlet and outlet passages, as above described; and a third boss at the opposite side of the cell near the middle. This constitutes a three-point support, so that the uniformity of the whole structure, tightness of the joints, etc., are not materially affected by sagging or irregularity of the floor upon which the machine is supported when in use.

The invention further relates to a novel driving mechanism, herein shown as employed to operate the driving rolls for the material which is fed through the machine.

A further feature of the invention consists in the means for supporting the driving rolls and the sprockets connected thereto, so that the bearings for the rolls can be made uniform and interchangeable; the rolls and their bearings being supported by the cells themselves, thereby dispensing with a separate frame or support, and insuring the proper position of the rolls relative to the drying surfaces.

By constructing the several parts, as described, it is practicable to build up machines of any size required without making special patterns, and without in any way changing the general arrangement.

Figure 1 is a side elevation of a machine embodying the invention, assembled; Fig. 2 is a similar view of the opposite side of the machine with part of the outer casing broken away; Fig. 3 is a perspective view of one of the cells; Fig. 4 is a detail showing a portion of the cell in plan; and Fig. 5 is a modification, showing in side elevation, a machine having only one stack of cells.

As shown in Fig. 1, it is practicable to build up a machine having cells of different surface configuration in cases where it is desirable to have the material to be dried first pass in proximity, but not in actual contact with, the cell surfaces and afterward to be drawn across in actual contact with the sur-

faces of other cells. In such a construction, the cells a at the top of the machine are arranged with flat surfaces, while the cells b below are arranged with convex surfaces. Apart from the variation of surface configuration for special cases, however, the cells are all made uniform in structure, this being true, even if two stacks are used, the cells of one stack being arranged with the opposite surface upward from that of the cells in the other stack, for the purpose of bringing the bearing supporting projections and the side with the single support in the middle. Each cell is provided, as best shown in Fig. 3, in which one of the cells b is shown, with the main hollow portion b^2 containing baffle plates b^3 , and provided at one side with hollow bosses b^4 and b^5 which constitute the steam inlet and steam outlet portions respectively. These hollow bosses which have lateral openings communicating with the interior of the cell are cast integral with the body of the cell, and are open at the top and bottom, so that adjacent bosses belonging to adjacent cells fit together, thus forming continuous vertical tubes to convey the steam to and from a number of cells, when assembled to form a complete machine. The cells are provided at the opposite sides with bosses b^6 which constitute the supports for the opposite sides of the cells. In the construction shown in Figs. 1 and 2, in which two stacks of cells are arranged end to end, the cells of the different stacks are supported in different horizontal planes, so that the under surface of the cell at one end of the machine lies in substantially the same plane as the upper surface of the adjacent cell at the other end, the material, therefore, traveling from one surface to the other, and coming in contact with both as it passes through the machine. In the above description, the term "sides" is used to indicate the vertical walls of the cells which lie parallel to the edge of the fabric as it travels through the machine, and the term "ends" is used to indicate the vertical walls of the cells transverse thereto. This arrangement of the supporting bosses furnishes a triangular or three-point support for each cell and these three cell supports adjust themselves to irregularities with little tendency to open the steam joints or disturb the operative relation of the parts. After the cells have been assembled to the number required, the projections b^4 and b^5 , which then constitute continuous vertical pipes, are connected respectively with the steam inlet pipe c and the outlet pipe c^2 which carries off the water of condensation. The steam inlet pipe c is connected, as by a T c^3 and an elbow c^4 , with coupling members c^5 , which are adapted to fit over the members b^4 of the top cells to complete the vertical inlet tube. The members

b^4 of the lower cells are supported upon posts d which, in turn, are mounted on an I-beam which constitutes the base of the machine. The outlet members b^5 of the lowermost cells are similarly supported upon tubular members d^2 with which the outlet c^2 is connected. The cells can thus be assembled to any number desired, according to the capacity of the machine, and after they are thus assembled, they are held in place by means of tie-bolts e which extend between the coupling members c^5 and the members d , which members are provided respectively with lugs c^6 and d^3 to receive the said bolts. The cells at the outlet side are similarly connected by means of tie-bolts e^2 which extend between upper tie bolt members e^3 and the lower supporting members d^2 . The lower supporting members, in the double stack construction shown in Figs. 1 and 2, are of different lengths to provide for the support of adjacent cells at different levels. The material is carried through the machine in the drying operation by means of rolls f which are mechanically driven, the material being indicated by the line A, Fig. 1, as entering the machine at the upper right corner, and leaving at the lower left hand corner after traveling back and forth through the agency of the feed rolls, and coming into proximity to, or into engagement with, the surfaces of the drying cells. In accordance with the invention, the rolls f are provided with sprocket wheels f^2 , the bearings for the said rolls being contained in brackets g which, for the most part, are uniform in shape and are supported upon the cells themselves, the said cells being shown as provided, for this purpose, with supporting lugs at the corners. In the double stack construction shown, the cells are provided with supporting lugs at one end only, it being obvious, however, that the number and location of the lugs may be changed without departing from the invention, and without interfering with the uniformity of the cell supporting bosses. As best shown in Fig. 3, one bracket support is formed at one side of the cell, preferably in the surface of the member b^4 , while the other bracket support is formed at the opposite side of the cell and consists of a projection h having a recess h^2 formed in its face to receive a tongue g^2 formed in a lateral supporting member g^3 of the bracket g , the said lateral supporting member and the lug being connected together by means of a bolt g^4 . The supporting member i for the opposite bearing is shown as somewhat differently constructed, and is provided with an undercut recess i^2 to receive the head of a fastening bolt i^3 which extends through the base portion of the bearing member at that end, and is secured by means of a nut i^4 . The reason for constructing this bearing in

this way is that the bearing is adjacent to the tubular portion of the member b^4 , so that it is impossible to pass the bolt wholly through. Each of the rollers is provided at one end with a sprocket wheel f^2 and the said sprocket wheels are arranged to be driven by a single chain k which is adapted to travel along, instead of passing around the periphery thereof, and to be held in engagement with the sprocket teeth by means of a stationary guide piece m . The chain, therefore, is in the form of a single loop extending once around the machine, the location of the chain to drive the rolls in the proper direction being provided for by the use of sprockets n , n^2 and n^3 . Any one of the several sprockets may be used for driving the chain, but it is preferred and assumed that the sprocket wheel n^3 is connected with a drive shaft and arranged to cause the chain to travel in the direction of the arrow, Fig. 2. The slack of the said chain therefore, is at the bottom of the machine, and it is taken up by an idler wheel or guide roll n^4 . The chain k travels along the straight guide bar m by which it is kept in contact with the peripheries of the several roller sprockets f^2 at that side of the machine, thus causing said sprockets to rotate in the same direction and to operate the guide rolls f , for the fabric. At the opposite end of the machine, a guide surface m^2 is located adjacent to the inner peripheries of the driving sprockets instead of the outer peripheries thereof, and as the chain travels in the opposite direction at that side of the machine, it causes the rollers to rotate in the opposite direction to the others, which is necessary for the continuous feed of the fabric through the machine. By using a chain of the so-called roller type, that is, of the type in which each joint is surrounded by a roller member, and utilizing as the guide members m and m^2 a strip of material the width of which is less than the length of the chain rollers, there is very little frictional resistance to the travel of the chain, and the fact that the chain travels through a substantially straight path while doing its work more than compensates for such additional friction as there may be. Moreover, the guide members may be separated from the chain seats between the sprocket teeth by a distance a little greater than the diameter of the rollers, so that normally they will not be engaged by the rollers at all.

In order to facilitate the carrying away of the moisture, the machine may be provided at one side with a housing which incloses that side of the machine, so that the machine, as a whole, is closed at the top by the upper cells, substantially closed at the ends by the feed-rolls, and at one side by the housing, it being practicable, therefore,

by exhausting the air through a passage from the inclosed side, to cause a draft over the drying surfaces of the cells during the drying operation. The housing, which is best shown in Fig. 2, consists of an upper portion o which has an overhanging flange o^2 adapted to fit against the side of the uppermost cell, so as to form with said cell an inclosure for the top of the machine, the said member o being provided with openings o^3 which are adapted to be hung upon hook-shaped projections o^4 connected with the vertical tie-rods by which the cells are connected together. The remainder of the housing is made up of flat plates o^5 and o^6 which are similarly supported by the tie-rods, the purpose of making up the housing in sections being to facilitate the assembling of machines of various sizes. The upper members o are provided with openings to receive branches p^2 of an exhaust pipe p which can be connected with a suction fan or analogous device. By this construction, it will be seen that the air will be sucked through from the outside across the faces of the cells, thus aiding materially in carrying away the moisture in the drying operation. Furthermore, this arrangement is such, that one side of the machine is open and accessible, so that the operation of drawing in the material when the machine is to be started is greatly facilitated.

While, in the construction shown in Figs. 1 and 2, the machine is arranged with cells having flat surfaces at the top so proportioned that the fabric does not lie in actual contact with said surfaces, it is practicable to omit these cells, if it is desirable, as is usually the case, to build up a machine in which the fabric is to be in contact with the cell surfaces throughout, and all the cells accordingly made with convex surfaces. The same elements can be utilized, the upper members c^5 and c^3 being joined directly with the cells having the convex surfaces, and the sprocket joined with the upper cell being used as an idler. In the construction shown, for example, the chain at the right hand end of the machine, Fig. 1, would be carried over the outer side of the third sprocket from the top, and thence over the third sprocket from the top at the other side thus producing the desired result, except for the fact that the fabric would not lie in actual contact with the upper surface of the cell at the right hand side of the machine. It is to be noted, however, that, in the construction shown, only two forms of brackets are employed, the upper brackets for the flat surface cells at opposite ends of the machine being uniform in shape, but reversed in position.

It is to be understood that, while the construction chosen to illustrate the invention constitutes a practical embodiment thereof,

the invention is not limited to such specific construction. While, for example, the double stack arrangement is, for most purposes, probably the best arrangement, it is obviously not essential that there should be neither more nor less than two stacks, and substantially the same results might be otherwise attained.

In Fig. 5 I have shown an apparatus having only one stack of cells, each cell, in this construction, having bracket supports at each end, the supports h^{10} , corresponding to the supports h , being shown in the drawing, the others being at the opposite end of the machine. In this construction, brackets corresponding to those used in conjunction with the flat surfaced cells of Figs. 1 and 2, are used at one end of the machine, since the rolls are supported approximately in line with the bodies of the cells at one end, and between adjacent cells at the other end. If machines having one stack only, or having an odd number of stacks are in sufficient demand, it is obvious that the cells used may be made with bracket supports at both ends, since the additional bracket supports, though not used in the two stack structure, do not in any way interfere with the assembly thereof. In the construction shown in Fig. 5, the driving sprocket is indicated by the reference character n^{30} .

The fact that each of the bearings for the driving rolls is fixed with relation to one of the cells, and may actually form an integral part of the said cell, is of material importance, since the position of the material with relation to the cell surface can not be varied under any conditions; as might be the case if the rolls were supported in an independent frame.

Claims:

1. An inclosed drying cell adapted to be heated by steam and having tubular bosses at one side located substantially at the corners of the cell, said tubular bosses communicating with the interior of the cell, and a third boss located at the opposite side of the cell.
2. A drying apparatus comprising a stack of approximately horizontal drying cells with spaces between them; a housing inclosing said stack of cells at one side; and an outlet duct leading through said housing whereby currents of air can be entrained over the cells and caused to flow through the spaces between the cells.
3. A drying apparatus having a base provided with a tubular support having an outlet, and two other supports; a plurality of cells each having two tubular projections at one side, said projections being adapted to fit together to support the cells and to be supported on the base; couplings at the top of the machine to fit over the projections from the cells, one of said couplings being

provided with an inlet; and tie-rods connecting the couplings with the base.

4. A drying cell consisting of a chamber having tubular projections at opposite corners of one side, the tubular portions thereof being open at the ends and having lateral passages communicating with the interior of the cell, and a supporting projection at the opposite side, substantially as and for the purpose described.

5. A drying cell having supporting projections at opposite ends; combined with bearing brackets adapted to be secured to the supporting projections at one end, whereby a plurality of cells can be assembled in a vertical pile, and the bearing brackets secured thereto.

6. A drying apparatus comprising a plurality of drying cells piled one on another, each cell having at one side two tubular projections, and the projections of the several cells forming continuous passages; a steam inlet coupling and a steam outlet coupling adapted to be applied to the ends of said passages, respectively; and means for connecting the couplings at opposite ends of the pile.

7. A drying apparatus consisting of a plurality of cells having supporting members at opposite ends affording the supports for the cells and separating the drying surfaces thereof; lugs at the outer ends of said cells; bearings secured to said lugs; and rolls mounted in said bearings.

8. A drying apparatus comprising a plurality of cells piled one on another; means for feeding material back and forth over the surfaces of said cells; an inclosing wall extending along said cells at one side thereof; and a suction outlet through said wall whereby a current of air can be drawn over the surface of the material which is being dried.

9. A drying apparatus consisting of a plurality of separate symmetrically constructed drying elements assembled and secured together; feed rolls for conveying and guiding material through the apparatus; and bearings for a roll secured to each of said drying elements.

10. A drying apparatus consisting of a plurality of separate symmetrically constructed drying elements assembled and secured together; feed rolls for conveying and guiding material through the apparatus; bearings for a roll secured to each of said drying elements; and a single drive chain adapted to operate all of said feed rolls.

11. The combination with a plurality of sprockets; of a driving chain of the roller type adapted to travel tangentially with relation to the sprockets; and a guide member also extending tangentially with relation to said sprockets to keep the chain in engagement with the teeth thereof by direct

engagement with the roller members of the said driving chain.

12. The combination with a plurality of sprockets; of a driving chain of the roller type adapted to travel tangentially with relation to the sprockets; and a guide member also extending tangentially with relation to said sprockets, said guide member being out of contact with the chain links, but sufficiently close to the roller members thereof only, to engage the same to prevent the chain from becoming disengaged from the sprocket teeth.

13. A drying cell consisting of a chamber having an upper and lower curved drying surface of large area and three parallel supporting projections arranged at an angle varying slightly from a perpendicular to the general plane of the drying chamber, two of said supports being hollow and forming the inlet and outlet respectively for the heating element, and being arranged at opposite ends of one side of the chamber, and the other supporting projection being arranged approximately at the middle of the other side of the chamber.

14. A drying cell consisting of a chamber having an upper and lower curved drying surface of large area and three parallel supporting projections arranged at an angle varying slightly from a perpendicular to the general plane of the drying chamber, two of said supports being hollow and forming the inlet and outlet respectively for the heating element, and being arranged at opposite ends of one side of the chamber, and the other supporting projection being arranged approximately at the middle of the other side of the chamber; and means for connecting bearing brackets to said cell.

15. In a drying apparatus comprising a plurality of stationary drying elements; bearing members connected with each element; and feed rolls supported upon said bearing members.

16. A drying apparatus consisting of a plurality of symmetrically constructed drying elements assembled one upon another; feed rolls for conveying and guiding material over the surfaces of said drying elements; and means whereby said feed rolls are supported directly upon said drying elements.

17. An inclosed drying cell having upper and lower curved drying surfaces, and three supporting projections triangularly arranged.

18. An inclosed drying cell having upper and lower drying surfaces of large area and three supporting projections triangularly arranged, one of said supporting projections having passages therein so as to form the steam inlet.

19. A drying cell having upper and lower drying surfaces of large area and three sup-

porting projections triangularly arranged, one of said supporting projections having passages therein so as to form the steam inlet, and another having passages therein so as to form the steam outlet; and brackets for rolls attached to said cells.

20. A drying cell having upper and lower drying surfaces of large area and three supporting projections triangularly arranged, one of said supporting projections having passages therein so as to form the steam inlet, and another having passages therein so as to form the steam outlet; and brackets for rolls attached to said cells, one of said brackets being attached to one of the steam pipes, and the other to a projection from the other end of said cell.

21. In a drying apparatus the combination of stacks of superimposed stationary drying cells having upper and lower drying surfaces and supports for bearings and a three point support for the cells, one at one side of the cell and two at different points of the other side; and rolls and actuating mechanism for guiding and carrying the material to be dried back and forth substantially horizontally past the drying surfaces of the cells.

22. In a drying apparatus the combination of stacks of superimposed stationary drying cells having upper and lower drying surfaces and supports for bearings and a three point support for the cells, one at one side of the cell and two at widely separated points of the other side; and rolls and actuating mechanism for guiding and carrying the material to be dried back and forth substantially horizontally past the drying surfaces of the cells out of contact with, but close to, a part of said cells.

23. In a drying apparatus the combination of stacks of superimposed stationary drying cells having upper and lower drying surfaces and supports for bearings and a three point support for the cells, one at one side of the cell and two at widely separated points of the other side; rolls and actuating mechanism for guiding and carrying the material to be dried back and forth substantially horizontally past the drying surfaces of the cells, out of contact with, but close to, a part of said cells in the first part of the transit, and in contact with the drying surfaces of the subsequent cells.

24. A drying apparatus consisting of stacks of approximately horizontal drying cells each cell having upper and lower drying surfaces combined with rolls; bearings for said rolls attached to the cells; and actuating mechanism for drawing the material over said rolls and past the drying surfaces.

25. A drying cell consisting of a chamber having an upper and lower drying surface and three projections for supporting the cell; bracket supports at opposite sides

adapted to support brackets fitted with bearings; and rolls in said bearings.

26. A drying cell having an inlet and outlet tube and bearing supporting projections, one attached to the inlet tube and the other to the other side of said cell; and rolls supported in the bearings borne on said bearing supporting projections.

27. An inclosed horizontal drying cell having upper and lower drying surfaces, and three vertical supports triangularly arranged, one of said supports having passages therein adapted to form a drip outlet.

28. In a drying mechanism, the combination with a series of sprocket wheels; of a sprocket chain of the roller type adapted to travel tangentially to the sprocket wheels; and a guide member extending parallel to said sprocket chain and projecting between the side links of the chain into contact with

the rollers to keep said chain in engagement with the teeth of the sprockets.

29. In a drying apparatus the combination of stacks of superimposed stationary drying cells having upper and lower drying surfaces and a three point support for the cells, one at one side of the cell and two at different points of the other side; and rolls and actuating mechanism for guiding and carrying the material to be dried back and forth substantially horizontally past the drying surfaces of the cells.

In testimony whereof, I have signed my name to this specification in the presence of two subscribing witnesses.

GEORGE A. CUTTER.

Witnesses:

JAS. J. MALONEY,
M. E. COVENEY.