Jan. 29, 1924. 1,481,790

H. B. BUCKHAM

DRYING APPARATUS

Filed June 12, 1920 5 Sheets-Sheet 1

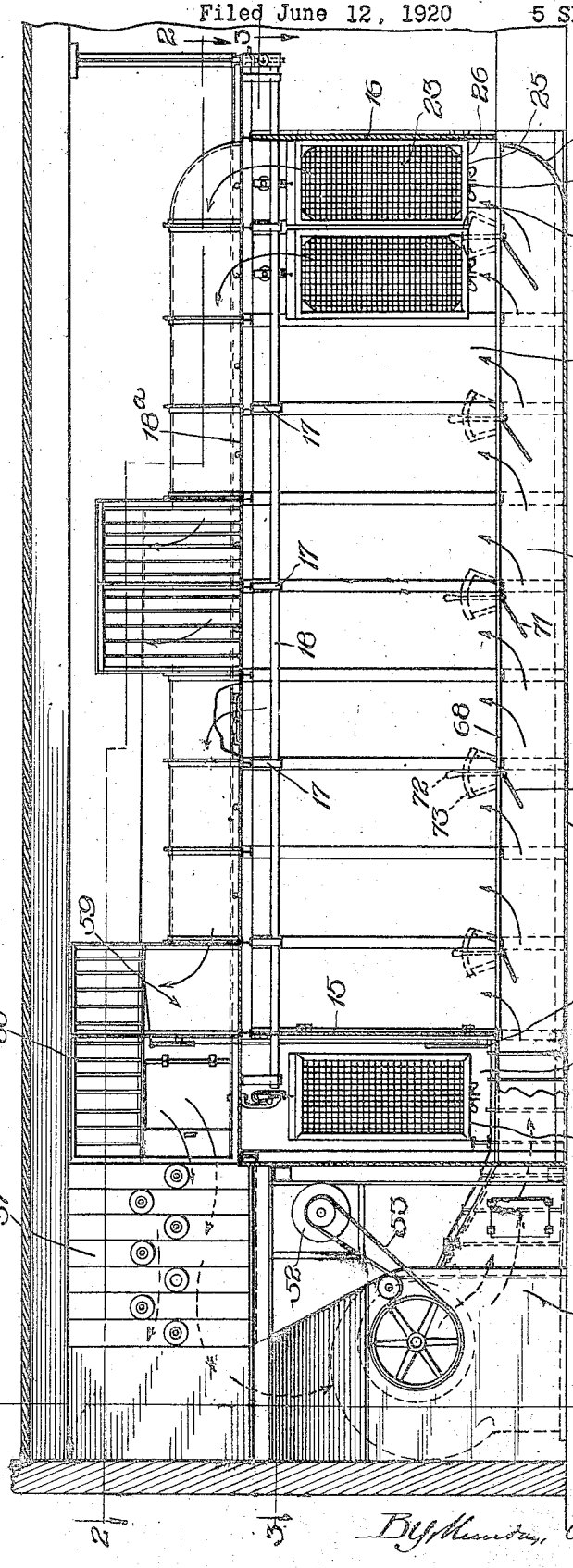


Fig. 1

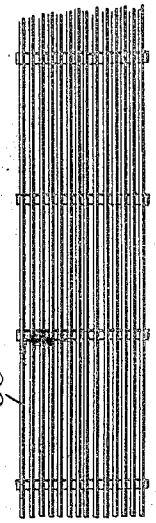


Fig. 11

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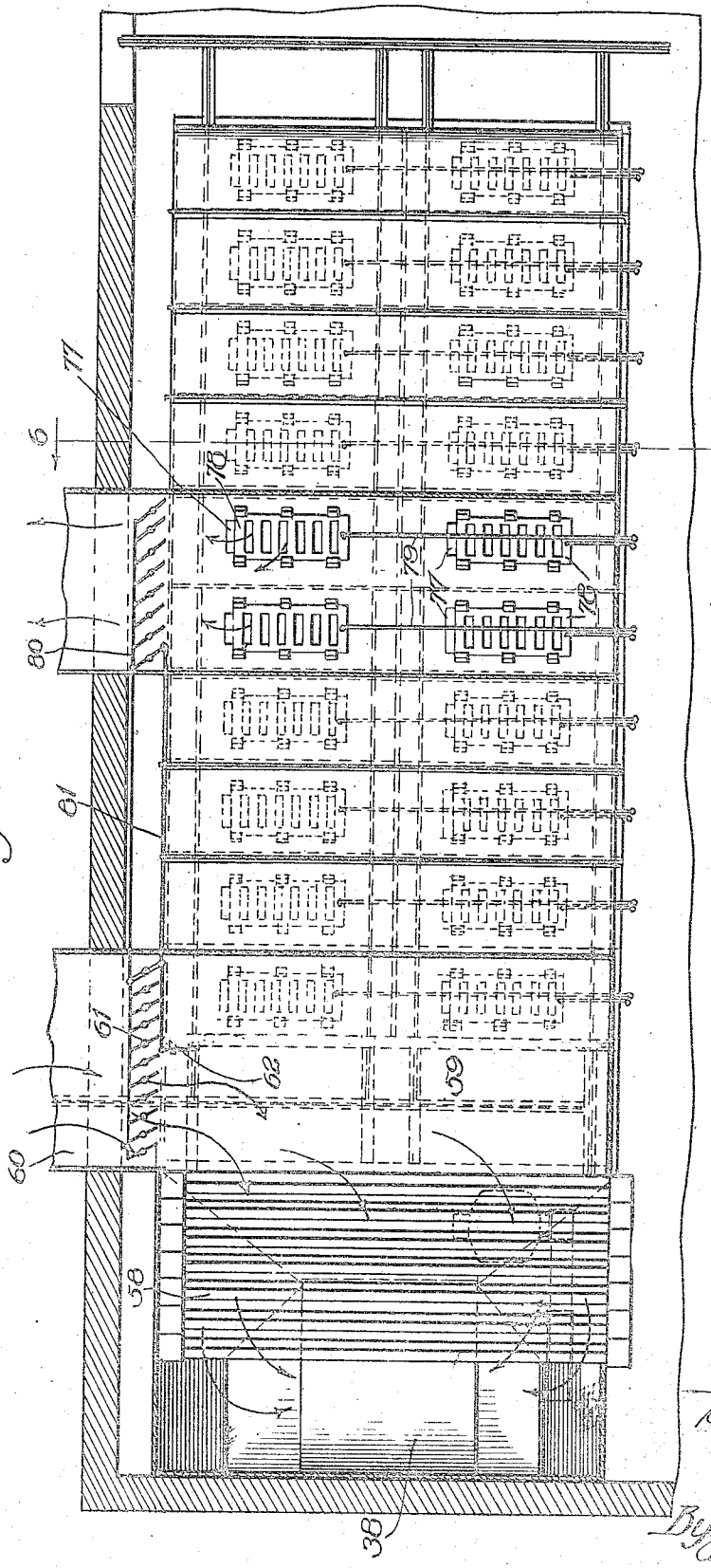


Fig. 2

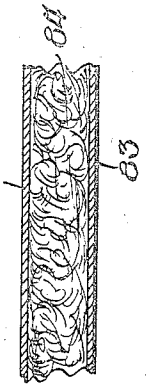


Fig. 7

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Fig. 3

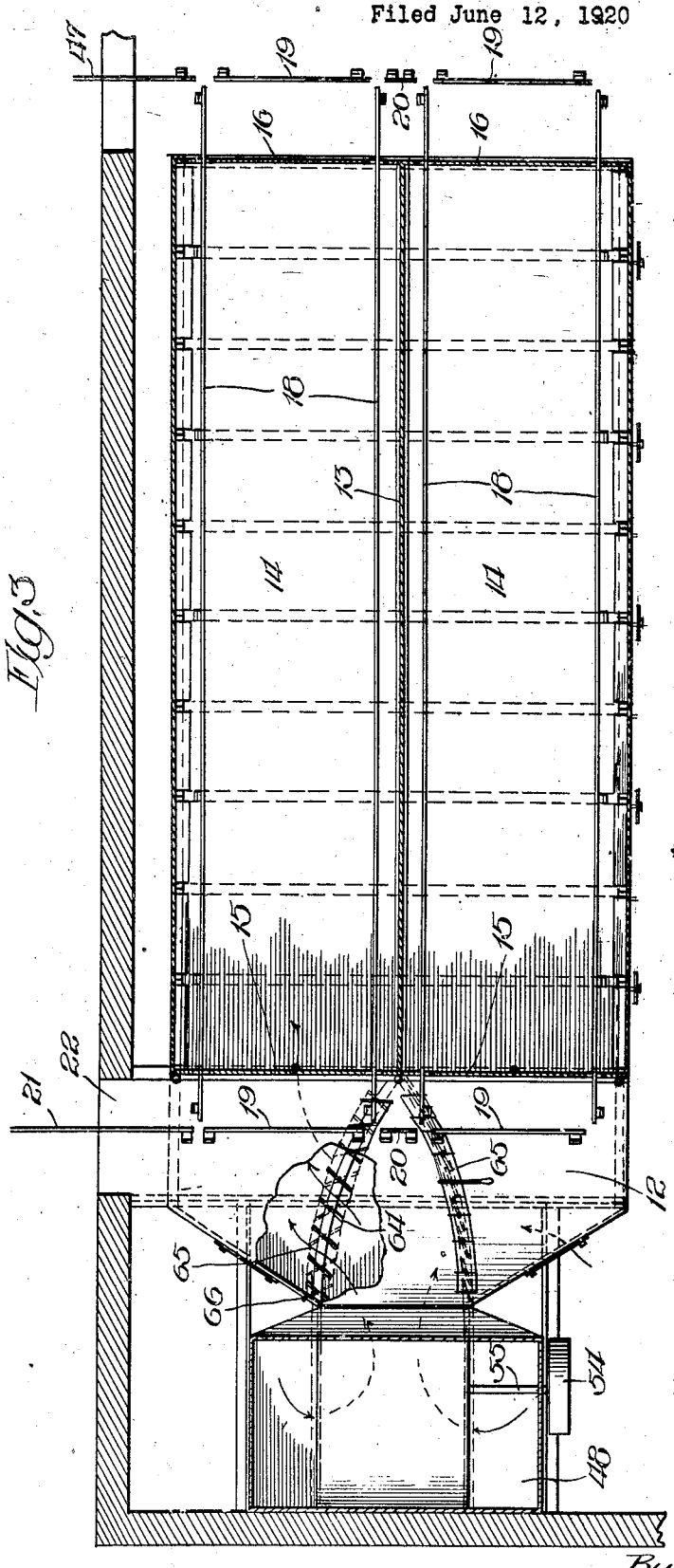
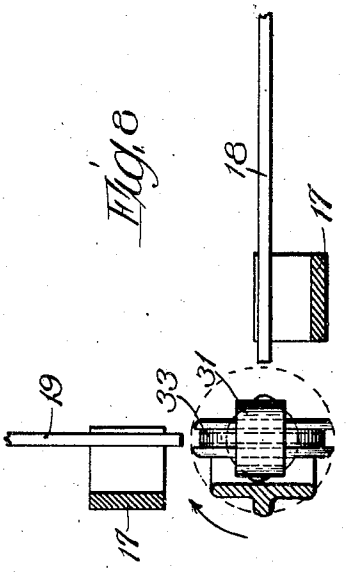


Fig. 6



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FIG. 5

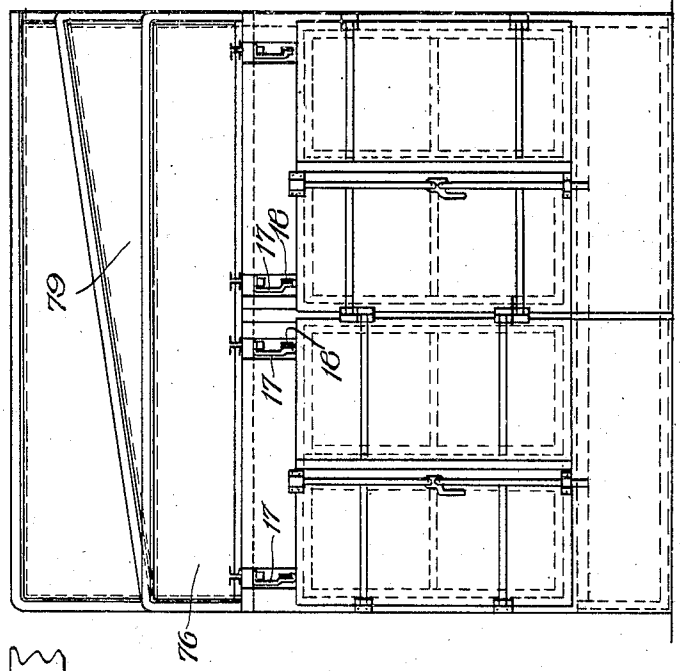
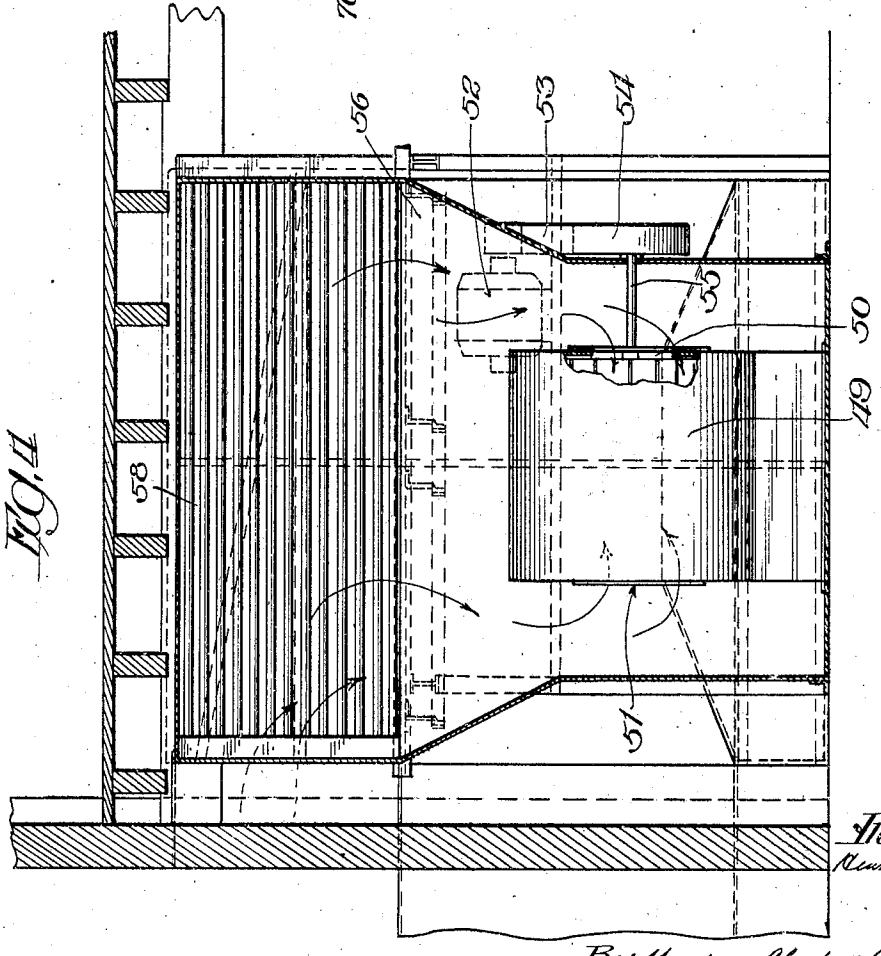


FIG. 4



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DRYING APPARATUS

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Fig. 6

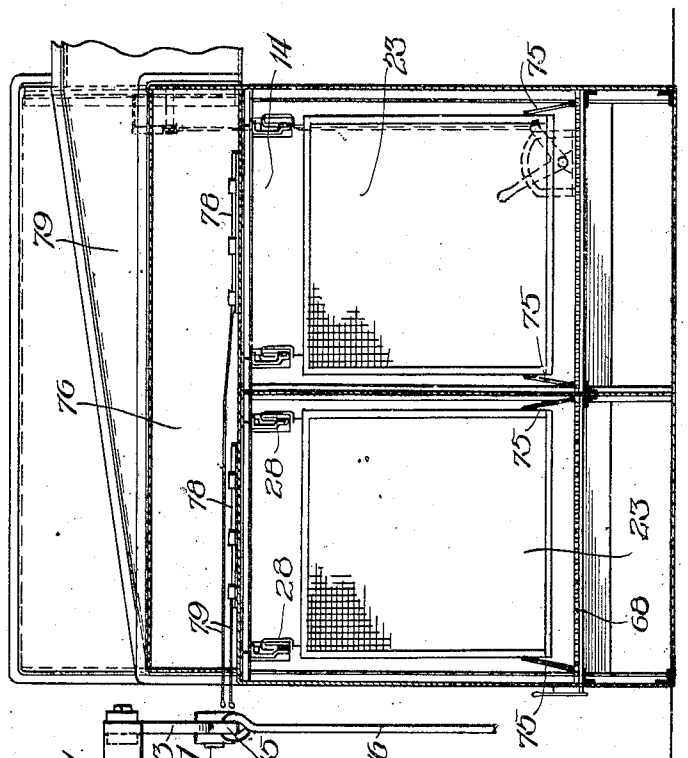


Fig. 10

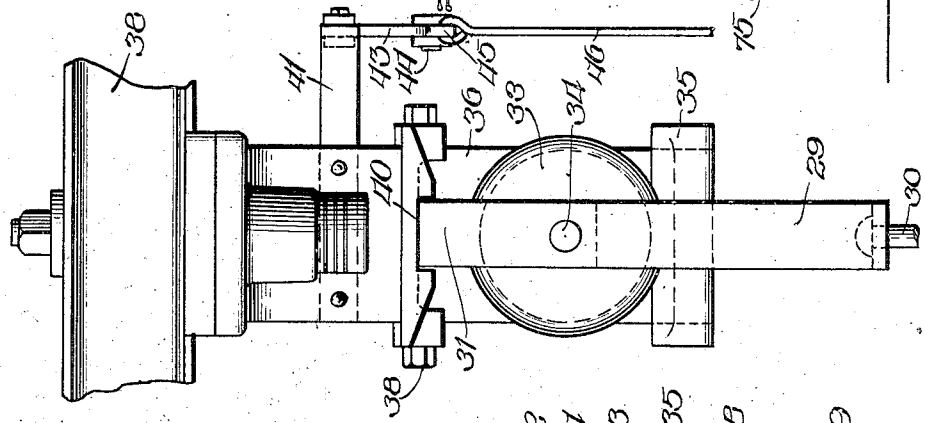
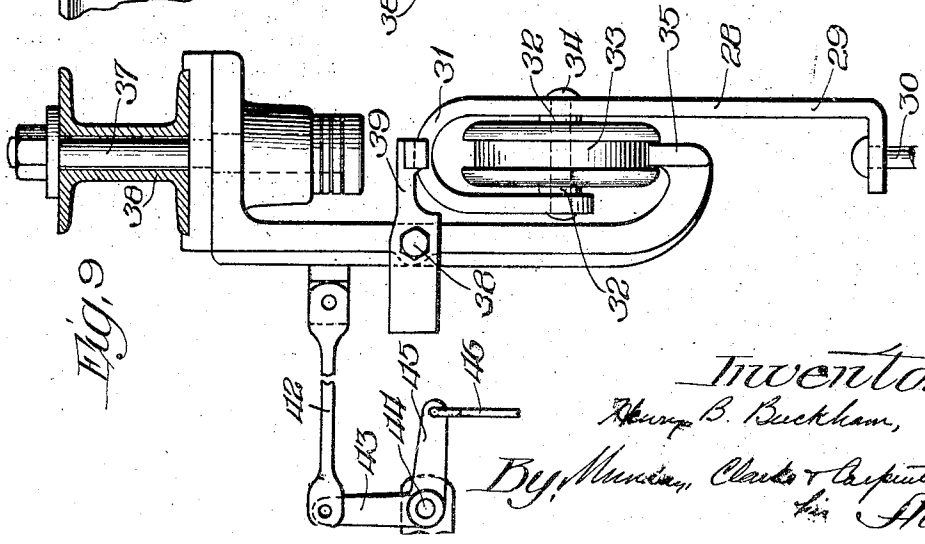


Fig. 9



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UNITED STATES PATENT OFFICE.

HENRY B. BUCKHAM, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE ALLBRIGHT-NELL COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

DRYING APPARATUS.

Application filed June 12, 1920. Serial No. 388,504.

To all whom it may concern:

Be it known that I, HENRY B. BUCKHAM, a citizen of the United States, residing in Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Drying Apparatus, of which the following is a specification.

This invention relates to drying apparatus, which is particularly designed for drying hair in twisted or roped form, although not necessarily limited in its application to this use.

One of the particular objects of the invention is the provision of a drying apparatus which insures efficient handling of the material in the apparatus and also with respect to its delivery and discharge to and from the apparatus, and which provides a most effective circulation of the air through the apparatus by a system permitting complete control of the flow to, from, and through the apparatus and also permitting optional discharge or recirculation of the air that has been utilized in the drying operation.

In addition to the general object recited above, the invention has for further objects such other improvements or advantages in construction and operation as are found to obtain in the structures and devices hereinafter described or claimed.

In the accompanying drawings, forming a part of this specification, and showing, for purposes of exemplification, a preferred form and manner in which the invention may be embodied and practiced, but without limiting the claimed invention specifically to such illustrative instance or instances.

Figure 1 is a longitudinal vertical sectional elevation through a drying apparatus constructed in accordance with the present invention;

Fig. 2 is a horizontal section on the line 2—2 of Fig. 1;

Fig. 3 is a section on the line 3—3 of Fig. 1;

Fig. 4 is a transverse vertical sectional elevation on the line 4—4 of Fig. 1;

Fig. 5 is an end elevation of the drying apparatus looking from the right-hand side of Fig. 1;

Fig. 6 is a transverse vertical sectional elevation on the line 6—6 of Fig. 2;

Fig. 7 is an enlarged cross sectional view of one of the walls of the drying chamber;

Fig. 8 is an enlarged plan view of a portion of the overhead conveyer system hereinafter more fully described;

Fig. 9 is an end elevation of the turntable tracks and trolley forming a part of the aforesaid overhead conveyer system;

Fig. 10 is a front elevation of the bars shown in Fig. 9; and

Fig. 11 is a fragmentary plan view of the flooring of a drying compartment.

The same characters of reference indicate the same parts throughout the several views.

In its present embodiment, the invention is incorporated in a drying apparatus that is especially designed for drying hair in twisted or rope form, and, for convenience, the present description will be confined to this use of the invention. Features of construction are, however, readily susceptible of other valuable applications and consequently, the scope of the invention is by no means confined to the specific use and specific embodiment herein described as an illustrative example.

Referring to the drawings, there is illustrated a drying chamber 11 having a transversely extending delivery passage 12 at one end thereof and divided by a longitudinal partition wall 13 into a plurality of drying compartments 14, there being in the present instance two of such compartments respectively located on the opposite sides of the aforesaid partition 13. The receiving ends of the said compartments 14 respectively communicate with the delivery passageway 12 by means of pairs of swinging doors 15 and the discharge ends of these compartments 14 are similarly provided with pairs of swinging doors 16, the latter opening directly into the room in which the drying chamber is situated. Supported by suitable brackets 17 depending from the ceiling 18[a] of the drying compartment are two pairs of

overhead parallel tracks 18. These pairs of tracks respectively extend longitudinally through the two drying compartments 14 as shown more particularly in Fig. 3. In the delivery passageway 12 similar depending brackets 17 support a number of track rails arranged end to end with respect to each other, as shown in Fig. 3, and extending longitudinally of the delivery passageway but transversely of the aforesaid pairs of tracks 18. These delivery passage track rails include two track rails 19 respectively positioned in front of the receiving end of the aforesaid drying compartments 14, a connecting track rail section 20, for permitting delivery from the rail 19 positioned adjacent to the inlet of the delivery passageway 12 to the other rail 19 which is remote from said inlet. A similarly supported delivery track rail 21 extends through the inlet 22 of the passageway 12 and permits delivery to the track rail 19 adjacent to the said inlet 22.

The material to be dried in the compartments 14 of the drying chamber is deposited in drying cages 23, conveniently made substantially rectangular in form as shown and having reticulated walls to permit free passage of the drying agent through the material contained within said cages. These cages are respectively provided with dumping bottoms 25 constituted of pairs of hinged panels 26 adapted to be held together in closed position by releasable latches 27, which when released permit the panels to swing beneath the cages and allow the material to fall out. Pivotally mounted on the top of each cage are two trolley supports 28 respectively located at the opposite ends of the cage as shown in Fig. 6. Each trolley support 28 is conveniently constructed of a bar 29 suitably secured to the upper end of a vertical pivot pin 30 and provided with an inverted U-shaped portion 31 at its upper end, said portion 31 constituting a yoke having bearings 32 in its opposite sides for the support of a trolley wheel 33. With this construction, the cage 23 may be moved in directions parallel with both its sides and its ends. When the trolley supports 28 are rotated so that the horizontal axes 34 of the trolley wheels are parallel with each other, the cage may be moved in a direction parallel with its sides and along a single track. On the other hand, if the trolley supports 28 are turned so that their axes 34 are in line with each other and the trolley wheels are parallel with each other, the cage may be moved in a direction parallel with its ends and along a double track.

In their movement through the inlet 22 and in the delivery passageway 12, the cages travel suspended from a single track in a direction parallel with their sides, but when moving in the compartments 14 of the drying chamber the cages travel in a direction parallel with their ends and suspended from a double track. While the cages are passing from the delivery passageway 12 to either of the compartments 14 of the drying chamber they are necessarily shifting their direction of movement to one approximately at right angles to their former direction of movement in the passageway 12 and are being transferred from a single track support to a double track support. Such shift in the direction of movement of the cages is moreover effected without bodily turning the cages. In order to effect transfer of the cages from the end to end positioned rails in the delivery passageway 12 to the parallel pairs of rails in the drying compartments 14, there are provided at the opposite ends of the rails 19 rail sections 35 carried by depending brackets 36, which are pivotally hung so that each of the rail sections 35 may be swung from positions in alignment with the rails 19 into positions in alignment with the rails 18 that extend through the drying compartments 14. Referring more particularly to Figs. 9 and 10, each of said brackets 36 is pivotally suspended by a spindle 37 hung from a beam 38 located adjacent to the ceiling of the delivery passageway 12. Pivoted at 38 on the opposite end faces of the bracket 36 is a clip 39 provided with a recess 40 for receiving the upper end of the trolley support 28, when the latter is supported by the rail sections 35, to prevent the trolley wheel 33 from rolling off the rail section 35 during the swinging movement of the bracket 36. Each bracket 36 is provided with a projecting arm 41 pivotally connected by means of a link 42 with one arm 43 of a bell crank lever pivoted at 44 in any suitably supported fixed bracket. The other arm 45 of said bell crank lever is pivotally connected to an operating rod 46, which extends to the lower portion of the passageway 12 so as to be within convenient reach of an operator stationed within such passageway.

From the discharge end of each of the compartments 14, the cages 23 may be conveyed to aligned rail sections 19 and transferred to such discharging rail sections by means of similarly operated track sections 35 whereupon the cages may be pushed out on to the discharge track 47. Connecting the rail sections 19 is a rail section 20 similar to that provided in the passageway 12, to permit movement of a cage from one section 19 to the other.

The operation of transferring each of the cages from the aligned track in the delivery passageway 12 to a pair of tracks in one of the compartments 14, or of transferring a cage from a pair of tracks 18 to the aligned track sections at the outward end of the drying chamber is as follows: Assuming that it

is desired to move a cage from the delivery passageway 12 into a compartment 14 of the drying chamber, the cage is pushed or otherwise propelled along the track 21 with its trolley wheels 33 in alignment with each other, until the trolley wheels at the opposite ends of the cage have been respectively moved on to the swingable rail sections 35 located at the opposite ends of one of the rail sections 19. When positioned on the rail sections 35, the cage is locked against movement by means of the clips 39 engaging the upper ends of the trolley supports 28, in the manner shown in Figs. 9 and 10. The rods 46 are then operated to swing the brackets 36 that support the rail sections 35 into positions in alignment with the pair of track rails 18. Such swinging movement of the brackets 36 causes the trolley supports at the opposite ends of a cage to swing independently of the cage and turn the trolley wheels 33 into parallelism with each other. After this has been accomplished, the trolley wheels of the cage may be readily moved off the rail sections 35 and on to the pair of rails 18, whereupon the doors 15 of a compartment 14 may be opened and the cage pushed into said compartment. In filling a compartment the cages are pushed from the delivery passageway 12 one after the other along into the far end of the compartment and when the material in all of the cages of a compartment has been properly dried, the doors 16 at the far end of a compartment are opened, the cage is moved out of the compartment, transferred to the single track located at the discharge end of the drying chamber, and finally moved to a suitable point for disposing of the dry material within the cage.

The division of the drying chamber into a plurality of compartments all connecting with the delivery passageway 12 and having independent trolley conveyer systems above, all of which connect with the single track trolley conveyer systems at the inlet and discharge ends of the drying chamber, provides a very simple arrangement for controlling the independent delivery and discharge of material with respect to each of such drying compartments. Thus the operation of filling one compartment or emptying the same may be carried on while material is being dried in another compartment.

The material contained within the cages positioned in the drying compartments 14 is dried by means of hot air and the means for insuring the flow and circulation of this air through the material constitutes an important feature of the invention. Located beyond the delivery passageway 12 is a blower chamber 48 within which is mounted a blower or fan 49, in the present instance, of the centrifugal type and having inlets 50, 51 in its opposite sides. The blower 49 may be driven by an electric motor 52 having a belt connection 53 with a pulley 54 mounted on the drive shaft 55 of the blower and positioned outside the side wall of the blower chamber 48, as shown in Figs. 3 and 4. Communicating with the inlet 56 at the upper end of the air chamber 48 is a heating chamber 57 preferably heated by means of a series of steam coils 58 around which the air circulates before passing into the blower chamber 48. Positioned above the ceiling of the drying chamber and located at the receiving end thereof is an intake passageway 59 having a side inlet 60 which may be placed in communication with or shut off from the intake 59 by means of a damper 61, shown more particularly in Figs. 1 and 2. The damper 61 is preferably of the shutter type, that is to say, it consists of a plurality of parallel pivoted blades adapted to be opened and closed in unison by means of suitable connections 62 extending to the lower portion of the delivery passageway 12. When the damper 61 is opened the outside air flows into the intake 59 thence through the heating chamber 57 into the blower chamber 48 and through the inlets 50 and 51, the hot air is drawn into the blower and subsequently discharged through the outlet 63 of the blower into an air chamber 64 from which the air may be directed to either one or both of the compartments 14 of the drying chamber. This distributing chamber extends down to and beneath the floor of the delivery passageway 12, and said distributing chamber 64 is provided with outlets 65 respectively located in its opposite sides and the flow through said outlets may be controlled individually by means of dampers 66 located respectively in the outlets. These dampers 66 are also preferably of the shutter type and are adapted to be opened and closed independently of each other by means of operating connections 67 extending to the passageway 12. One outlet from the distributing chamber 64 leads to one compartment 14 whereas the other outlet of said distributing chamber leads to the other compartment.

The floor of each compartment 14 is constructed of latticework 68, shown in detail in Fig. 11 and between the latticed floor 68 of each compartment 14 and the bottom 69 thereof there is formed a channel 70 for the passage of hot air discharged by the blower and from which the blast of hot air is directed through the floor 68 into the entire compartment 14. In order to insure flow of the air blast to and through that end of the compartment which is remote from the distributing chamber 64, there is provided beneath the floor 68 of each compartment a series of baffles 71 which serve to equalize and distribute the flow throughout the entire compartment, as well as to pre-

vent short-circuiting of the flow in the inlet end of the compartment. These baffles 71 are pivotally mounted just below the level of the floor 68 and are respectively provided with adjusting levers 72 which cooperate with rack segments 73 for holding the baffles 71 in adjusted position. By moving the individual levers 72 of the baffles 71 the inclination of the baffles may be varied independently of each other. These baffles 71 are located at intervals beneath the floor of the compartment 14 and progressively increase in length toward the remote or discharge end of the compartment, that is to say, the shortest baffle is located nearest the outlet of the distributing chamber 64 whereas the longest baffle is located adjacent to the discharging end of the compartment. Preferably the bottom 69 of the compartment curves up to the floor 68 at the discharging end of the compartment, as shown at 74 thereby preventing pocketing of the air beyond the longest baffle 71.

Discharging through the floor 68 of a compartment 14, the hot air rises in the compartment and flowing through the material contained in the cages 23 rapidly dries out the material. In order to direct the flow of the air through the cages and prevent the flow from passing entirely along their sides or ends, the opposite side walls of each compartment are provided with a series of deflecting plates 75 pivoted at their bottom edges and movable into inclined position for engaging the opposite ends of the cages 23 disposed within said compartments, as shown more particularly in Fig. 6. In filling or emptying a compartment the deflecting plates 75 may be readily moved into upright position to prevent interference with the movement of the cages through the compartments and when the cages have been positioned within the compartment the deflecting plates are moved into the inclined positions shown to direct the air through the cages.

The air discharges through the ceiling 18 of each of the compartments 14 into a discharge channel 76 which communicates with each compartment through series of elongated discharge outlets 77 disposed at intervals in the ceiling of each compartment, as shown in Fig. 2. For each such series of discharge outlets 77 there is provided an individual slide damper 78 adapted to be operated to restrict or increase the flow through the series of outlets 77 which it controls. As stated, these dampers and outlets extend along the ceiling of each compartment and the flow from the compartment may thus be adjusted at practically any point thereal ng. The respective dampers 77 of each compartment are provided with individual operating rods 78 all of which extend through the outer side wall, as shown in Fig. 2, in order to permit adjustment of the dampers from the exterior of the drying chamber.

Communicating with the discharge channel 76 is an outlet passageway 79 for the air. The flow through this outlet passageway 79 may be opened or cut off by means of a shutter damper 80 adapted to be operated by connections 81. When the damper 80 is open the discharged moist air flows through the passageway 79 to the atmosphere. If desired, the damper 80 may be closed after the material in a drying chamber 14 has been partially dried. By also closing the damper 61 in the inlet 60 the discharged air flowing through the channel 76 may be recirculated back to the coils 58 in the heating chamber and thence blown back through the material in the drying compartment. This permits the utilization of the heat in the discharged air, with the result that highly superheated air for completing the drying operation may be produced without increasing the supply of steam to the coils 58. During the preliminary drying stages, however, the discharged air is laden with moisture and it is desirable to permit the air to pass out the discharge passageway 79 by opening the damper 80.

The walls of the drying chamber are preferably constructed of spaced metallic plates 82, 83 with an interposed layer of asbestos or other heat insulating material. This wall construction reduces the radiation of heat through the walls to the atmosphere and thus enhances the efficiency of the drying apparatus.

The invention as hereinabove set forth is embodied in a particular form of construction but may be variously embodied within the scope of the claims hereinafter made.

I claim:

1. In a drying apparatus, in combination: a drying chamber divided into a plurality of compartments, each adapted to be opened from end to end for the free passage therethrough of containers supporting the material to be dried; a blower; a heating chamber for supplying heated air to the inlet of said blower; a distributing chamber receiving the hot air discharged by said blower and adapted to feed such air to any of said compartments; and means for individually controlling the feed of air from said distributing chamber to any one of said compartments; and means for selectively causing an open and closed circulation of air through said compartments, substantially as specified.

2. In a drying apparatus, in combination: a drying chamber divided into a plurality of compartments; a blower; a heating chamber for supplying heated air to the inlet of said blower; a distributing chamber receiving the hot air discharged by said blower and

adapted to feed such air to any of said compartments; means for individually controlling the feed of air from said distributing chamber to any one of said compartments; and means for optionally permitting the air discharged from a compartment to recirculate back to said heating chamber, or to discharge into the atmosphere; substantially as specified.

3. In a drying apparatus, in combination: a drying chamber divided into a plurality of compartments; a blower; a heating chamber for supplying heated air to the inlet of said blower; a distributing chamber receiving the hot air discharged by said blower and adapted to feed such air to any of said compartments; means for individually controlling the feed of air from said distributing chamber to any of said compartments; a plurality of containers suspended for longitudinal movement through said compartments, said containers being of reticulated structure to permit the relatively unobstructed circulation of heated air therethrough; and means for controlling the individual flow of air through each of said compartments; substantially as specified.

4. In a drying apparatus, in combination: a drying chamber divided into a plurality of compartments, each adapted to be opened from end to end for the free passage therethrough of containers supporting the material to be dried, a transverse passage way communicating with each of said compartments, means for selectively delivering containers from said passage way to said compartments; a blower, a heating chamber for supplying heated air to the inlet of said blower; a distributing chamber receiving the hot air discharged by said blower and adapted to feed such air to any of said compartments; means for individually controlling the feed of air from said distributing chamber to any one of said compartments; and means for equalizing the flow through each of said compartments; substantially as specified.

5. In a drying apparatus, in combination: a drying chamber divided into a plurality of compartments, each adapted to be opened from end to end for the free passage therethrough of containers supporting the material to be dried; a transverse delivery passage way communicating with said compartments; means for optionally supplying an air blast to any one or all of said compartments; and means for selectively delivering said containers from said transverse delivery passage way to said compartments; substantially as specified.

6. In a drying apparatus, in combination: a drying compartment opened from end to end for the free passage therethrough of containers supporting the material to be dried; a transverse delivery passage way adjacent to said compartment; means for controlling communication between said delivery passage way and said compartment; means for supplying an air blast to said compartment; means for heating said air blast; and means for optionally recirculating the discharge from said compartment back to said heating means, or into the atmosphere; substantially as specified.

7. In a drying apparatus, in combination: an elongated drying compartment provided with a reticulated floor located above the bottom of said compartment; a plurality of individually adjustable dampers located in the top of said compartment; a plurality of individually adjustable baffles depending from the reticulated floor of the compartment; and means for supplying a gaseous drying medium to the bottom of said compartment; substantially as specified.

8. In a drying apparatus, in combination: an elongated drying compartment provided with a reticulated floor located above the bottom of said compartment; a plurality of individually adjustable dampers of varying lengths depending from the reticulated floor of said compartment; and means for supplying a gaseous drying medium to the bottom of said compartment; substantially as specified.

9. In a drying apparatus, in combination: an elongated drying compartment having an outlet in its top and a reticulated floor located above its bottom; an inlet located at one end of and at the bottom of said compartment; and a plurality of baffles depending at intervals from the reticulated floor of said compartment and of progressively increasing lengths from the inlet end to the far end of said compartment; substantially as specified.

10. In a drying apparatus, in combination: an elongated drying compartment having an outlet in its top and a reticulated floor located above its bottom; an inlet located at one end of and at the bottom of said compartment; a plurality of baffles depending at intervals from the reticulated floor of said compartment and of progressively increasing lengths from the inlet end to the far end of said compartment; and means for individually adjusting the angular inclination of the individual baffles; substantially as specified.

11. A drying apparatus, having a plurality of parallel drying compartments, each adapted to be opened from end to end for the free passage therethrough of containers supporting the material to be dried, combined with a delivery passageway intersecting all of said compartments for permitting said containers to be distributed at will into any of them, substantially as specified.

12. In a drying apparatus, in combination: a plurality of parallel compartments,

each adapted to be opened from end to end for the free passage therethrough of containers supporting the material to be dried; a delivery passageway intersecting all of said compartments for permitting the containers to be distributed at will into any of them; a hot air channel extending along each said compartment and communicably connected therewith; a common source of hot air supply; and means for permitting the heated air to flow at will individually into each of said hot air channels; substantially as specified.

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