

Dec. 25, 1962

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3,069,786

CONTINUOUS DRIER FOR FIBROUS MATERIALS

Filed Nov. 3, 1959

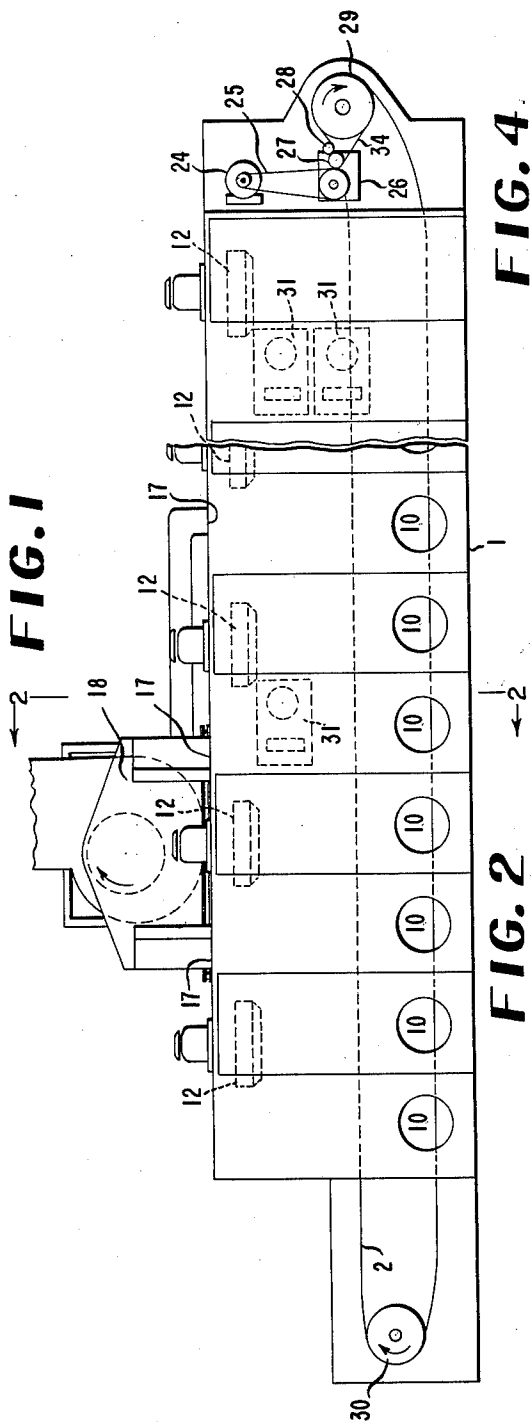


FIG. 4

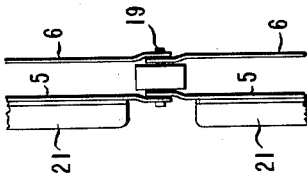


FIG. 3

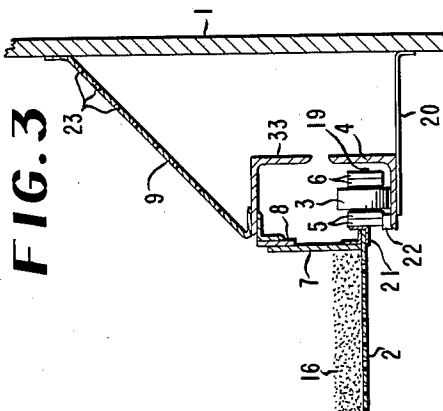
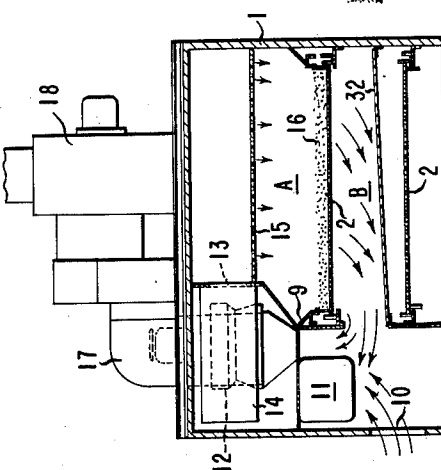


FIG. 2



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CONTINUOUS DRIER FOR FIBROUS MATERIALS
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Filed Nov. 3, 1959, Ser. No. 850,684
3 Claims. (Cl. 34-225)

The present invention relates to an improved continuous dryer for fibrous materials.

In the preparation and processing of staple fibers, drying is an essential step. For reasons of efficiency and continuity of operation as well as uniformity of product, drying is most frequently carried out as a continuous process. A bed of staple fibers is laid on one end of a continuous perforated belt which then carries the fibers through a drying zone in which the heated air is continually passed through the bed. The drying process can be readily controlled; however, certain problems of a mechanical nature have caused considerable difficulty. The loose fibers are readily carried by air streams and because of their shape have a great tendency to become lodged in moving parts of the equipment making continuous operation difficult. In existing apparatus, the fibers are sometimes blown from the belt into other parts of the dryer. They may come in contact with the heating coils which are used to raise the temperature of the circulating air to the point where it has a drying effect on the fibers. This sometimes causes carbonization or other discoloration of these fibers. If the discolored fibers are blown back onto the drying belt they become intermingled with the fibers on the belt and thus lower the quality of the dry product.

Of even greater significance from the standpoint of continuous operation is the tendency for fibers blown from the surface of the bed on the moving belt to become entangled in the supporting members for the belt, e.g., with the rollers on which the belt travels. This results in very sluggish operation of the moving belt, and requires frequent shutdowns in order that these fibers may be removed. Attempts to shield the supporting means as well as attempts to seal the supporting means from the drying zone have failed to eliminate this problem.

It is, therefore, an object of this invention to provide improved apparatus for drying fibrous materials. It is a particular object of this invention to provide continuous drying apparatus in which the fibrous material is prevented from coming in contact with the supporting members for the conveyor. Other objects will appear hereinafter.

The objects of this invention are accomplished by providing improved drying apparatus having an elongated housing with a continuous perforated conveyor mounted therein for moving fibrous material through the housing. At least one inlet duct is provided for introducing a drying medium, such as air, into the housing, and at least one circulating fan is used to draw the drying medium over a heater and thereafter circulate the drying medium from a drying zone above the upper reach of the conveyor into a second zone beneath the upper reach of the conveyor. Exhaust ducts may be utilized for withdrawing a portion of the circulating drying medium from the housing. The improvement provided by this invention comprises a chamber extending along each edge of the upper reach of the conveyor which encloses the supporting means for the conveyor. The chamber is in communication with the drying zone at a position remote from the conveyor but is otherwise essentially sealed by imperforate sealing members to prevent passage of the drying medium to the zone beneath the conveyor.

The objects of this invention will become more ap-

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parent from a study of the following detailed description and accompanying drawings in which:

FIGURE 1 is a side view of a continuous dryer for fibrous material according to this invention;

FIGURE 2 is a sectional view of the dryer taken along the lines 2-2 of FIGURE 1;

FIGURE 3 is an enlarged sectional view of a portion of the conveyor supporting means; and

FIGURE 4 is a top view of a portion of the conveyor supporting means illustrating the roller and link assembly shown in FIGURE 3.

Referring now to the drawings, the drying apparatus comprises an elongated housing 1. Fibrous material enters the housing 1 through an opening (not illustrated) near supporting end roller 30 and is deposited on the upper reach of continuous conveyor belt 2 by feed means, not shown. Conveyor belt 2 is comprised of a series of interconnected, flat, porous or perforated plates which are supported at the edges by rollers 3 which ride on tracks 4. Tracks 4 are supported by vertical members not shown. Rollers 3 are interconnected by linking members 5 and 6, and pins 19. Linking members 5 are in turn attached to angle members 21 which are secured to the edges of belt 2. A sealing bar 22 is attached to tracks 4 maintaining contact with linking members 5, thereby providing an essentially air-tight seal. An imperforate vertical guard 7 is positioned along the edge of belt 2 to aid in retaining the fibrous material on the belt. Guard 7 comprises a plurality of sections, each end of which overlaps an adjoining section to provide a substantially air-tight seal. A sealing strip 8 is attached to a supporting member 33 in a manner to maintain contact with guard 7. Apron 9, which contains a plurality of perforations 23, is positioned in sloping relationship to the edge of belt 2.

The air which is used in drying the fibrous material enters housing 1 through a series of openings 10. Preferably the air is drawn into housing 1 at a position near the end of the dryer at which the dried material is removed. The openings 10 are equipped with dampers (not shown) for regulating the supply of air for different drying loads. The air drawn in through openings 10 is caused to pass upward through heating coils 11 by circulating fans 12. The temperature of the air in the drying zone is continuously monitored by temperature transmitting means 31. The heated air is forced by fans 12 through openings 13 in fan housing 14 through a perforated distributing plate 15 into a drying zone A which runs the length of the dryer. Plate 15 causes the heated air to be uniformly distributed over the bed of staple fibers 16 on belt 2. The heated air is forced by the action of fans 12 through the staple fibers 16 into a zone B beneath the upper reach of conveyor belt 2. The air is directed from zone B along imperforate plate 32. A portion of the air is withdrawn from zone B through exhaust ducts 17 which are connected to exhaust fan 18. The exhaust ducts are located near the end of the dryer at which the wet fibers are fed to belt 2. The individual exhaust ducts 17 connected to the exhaust fan 18 are equipped with dampers (not shown) to permit adjustment of the location of removal of the moisture-laden air. The remaining air is recirculated through heating coils 11.

In the normal operation of the apparatus of this invention, wet staple fibers are fed onto conveyor belt 2 which is driven at a constant speed by motor 24 through chain 25 and gear box 26, which in turn drives the drive roller 29 by means of gear 27 and chain 34. Tension on chain 34 is adjusted by means of idler 28. The fibers travel through the housing and are removed by means, not shown, as the conveyor belt passes over driving roller 29. Fresh air is continuously drawn through housing 1 from

the area surrounding the dryer. By locating the air intake openings 10 near the end of the dryer at which the staple fibers are removed, and the exhaust ducts near the end of the dryer where the wet fibers are fed onto conveyor belt 2, the air is caused to travel through housing 1 counter- 5 current to the direction of travel of conveyor belt 2 in a generally spiraling fashion.

As previously described, the fresh air, before contacting the fibers, must pass upwardly through heating coils 11 and is then driven downwardly through the fibers by fans 12. The circulating air always passes through heating coils 11 before reaching circulating fans 12. After its spiraling passage through the dryer, the moisture-laden air leaves the dryer through exhaust ducts 17.

As illustrated in FIGS. 2 and 3, an essentially closed 15 chamber surrounds the supporting members for the upper reach of belt 2. The chamber is in communication with drying zone A through perforations 23 which are located in the upper portion of apron 9. By using a sufficient number of perforations, the pressure in the chamber will be maintained at essentially the same pressure as in the drying zone A even though some leakage may occur between links 5 and sealing bar 22. The chamber is substantially sealed from zone B by links 5, sealing bar 22, and sealing member 20. Although a pressure differential 25 exists between zone A and zone B, due to essentially equal pressure in the drying zone A and the chamber surrounding the supporting members, the tendency for loose fibers, which are picked up by the air from the surface of the fiber bed, to be drawn into the area surrounding rollers 30 is substantially eliminated. When using existing apparatus it has heretofore been practically impossible to prevent fibers from passing into this area and becoming entangled in the supporting mechanism.

The following data illustrates the advantages of the apparatus of the present invention over known drying apparatus in which the supporting means were essentially sealed from the drying zone. In a mechanism of the type previously known, the dryer was operated at a belt speed of 65 inches per minute. Wet staple fiber, having an average length of about four inches, was continuously fed onto the moving belt. It was necessary to shut down the dryer approximately four times each month to remove fibers from the supporting means. Frequent instances of contaminated product were noted, the contamination generally being staple which was discolored and damaged, due to the passage between the rollers and the roller tracks, followed by travel through the recirculating fans and back onto the dryer belt.

Using the dryer of the present invention, with similar staple fibers, at the speed indicated above, continuous operation was accomplished for a period of more than eight months. No evidence of product contamination or of staple becomes entangled in the moving parts was noted.

The apparatus of this invention as shown in the drawings may be modified in various ways. For example, a sealing strip which contacts the lower edge of conveyor belt 2 and is attached to track 4 may be substituted for sealing bar 22. In addition, sealing strip 8 may be made integral with apron 9, thus eliminating supporting member 33. Other modifications may be made provided that the chamber surrounding the supporting mechanism for the upper reach of conveyor belt 2 is essentially sealed from the zone beneath the belt and is in communication with the drying zone above the belt.

Many advantages accrue from the apparatus of the present invention. It may be used in drying all types of fibrous materials. One of the primary advantages lies in the high quality, i.e., freedom from contamination of the material dried in this equipment. In addition, the high productivity due to the absence of shutdowns for cleaning is important. Maintenance for repairs is also eliminated, due to the absence of fibrous material entering the moving parts. Distortion of the sealing surfaces as well as unusual wear on the rollers and tracks, due to

entangled fibers, is also prevented. Stress on the conveyor belt sections is also relieved.

As many widely different embodiments of this invention may be made without departing from the spirit and scope thereof, it is to be understood that this invention is not to be limited to the specific embodiments thereof except as defined in the appended claims.

I claim:

1. Apparatus for drying fibrous material comprising a housing, a continuous perforated conveyor belt for moving said material through said housing, said belt having an upper reach for supporting said fibrous material and an idle lower reach, said belt having imperforate vertical guards extending along its edges, means for supporting said belt including a track and a plurality of rollers attached to the edges of said belt, means for feeding a drying medium into said housing, circulating means for forcing said drying medium from a drying zone above said belt through a layer of said material on the upper reach of said belt into a second zone beneath said upper reach; the improvement which comprises a chamber in communication with said drying zone enclosing said supporting means, said chamber having an apron positioned in sloping relationship toward said vertical guard above said supporting means and imperforate members conjoint with said apron and said vertical guard which substantially seal said chamber from said second zone, said apron having a depending extension in abutting relationship with said vertical guard and a multiplicity of perforations remotely spaced from said vertical guard providing said communication between said chamber and said drying zone.

2. In apparatus for drying fibrous material having a housing, a continuous perforated conveyor belt for moving said material through said housing, supporting means for said belt, a drying zone above said belt, means for feeding a preheated drying medium into said drying zone and forcing said drying medium into a second zone beneath said belt, and exhaust means for discharging a portion of the drying medium passing into said second zone from said housing: a chamber enclosing said supporting means in communication with said drying zone, said chamber having a perforated apron providing said communication between said chamber and said drying zone positioned in sloping relationship toward said belt above said supporting means and imperforate members conjoint with said apron which substantially seal said chamber from said second zone.

3. In apparatus for drying fibrous material including a housing, a continuous perforated conveyor extending lengthwise in said housing having an upper reach for supporting fibrous material deposited thereon and an idle lower reach, means for supporting said conveyor along each of its edges, means for feeding a drying medium into a zone in said housing above the upper reach of said conveyor, and means for forcing said drying medium from said zone above the upper reach through said fibrous material into a second zone beneath said upper reach, the improvement which comprises a chamber enclosing said supporting means along each edge of the upper reach of said conveyor, said chamber having openings therein spaced laterally from the edge of said conveyor and above said supporting means thereby providing communication with the zone above said conveyor, and imperforate sealing members conjoint with said supporting means for substantially sealing said chamber from said second zone.

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