

Dec. 20, 1960

E. KIEFER ET AL
PERFORATED DRUM DRIER

2,964,854

Filed July 3, 1957

2 Sheets-Sheet 1

Fig. 1

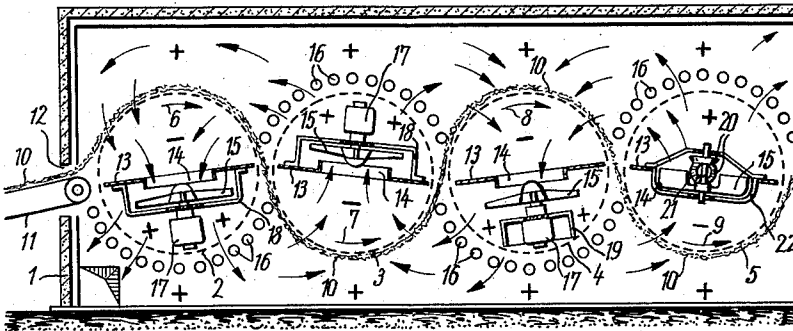
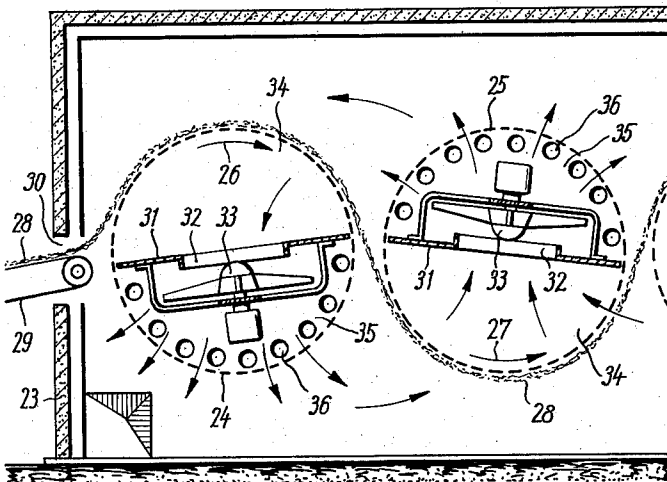


Fig. 2



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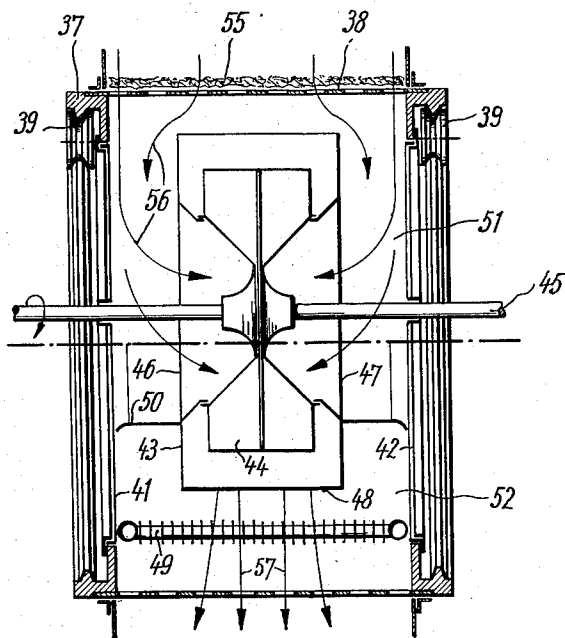


Fig. 3

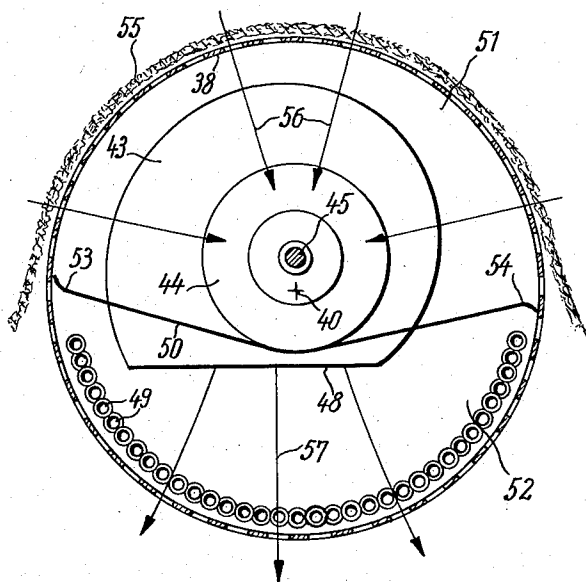


Fig. 4

1

2,964,854

PERFORATED DRUM DRIER

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9 Claims. (Cl. 34—115)

The present invention relates to a perforated drum drier for drying textile material, such as woven and knitted fabrics, loose fibers, or the like, consisting of rotating, perforated drums located side by side parallel to each other, so that the said material in passing from one drum to the next, as seen in cross section, is carried through the drier meanderlike, and provided with fans to produce air currents which dry the said textile material and hold it in position on the perforated drums.

In previously known perforated drum driers the perforated drums are supported in axial bearings on which throughout the most varied modifications thereof special air screens are suspended to cover the holes in the perforated drums at the points where the material to be dried is not expected to be held by the air currents and is not held so, respectively. Depending on the arrangement of the perforated drums in relation to each other the air screens are shaped such that they cover a portion of the periphery of each perforated drum. The air drawn through the material to be dried in the previously known perforated drum driers flows axially to the fans located next to, above or below the perforated drums, or to exhaust holes, and is either recirculated or evacuated from the drier. In other types of perforated drum driers the air is distributed to the other perforated drums through connecting passages in quantities considered essential for the drying process. The air quantity may be regulated by means of flaps. Such a design has the general disadvantage that in certain areas, for example under the perforated drums, there are no air currents at all or only irregular ones.

It is the object of the present invention to provide a considerable simplification in the design of perforated drum driers and to further provide improved control of air currents. The invention is therefore characterized by fans mounted inside the perforated drums, which draw the drying air from the section of the perforated drum surface on which the textile material lies, blowing it to the opposite section of the cylinder surface of the perforated drum. These sections constitute the outer surfaces of perforated wall portions of the drums. According to another characteristic of the present invention each perforated drum may carry but one fan, for example a radial or an axial fan. In long drums, however, several fans could be mounted, distributed along the length of the drum. To obtain outstanding efficiency, partitioning walls with through holes may be mounted inside the perforated drums, dividing the inner space of each drum into a drawing or suction section and a pressure section, thus aiding in eliminating irregular air currents.

The fans may be suitably mounted inside the pressure sections of the perforated drums close to the perforations in the partitioning walls.

According to another characteristic of the invention the fans may be driven electrically and mounted inside the perforated drums together with their driving motors. But the fans may also be operated mechanically by means of drive shafts and bevel gears axially entering the per-

2

forated drums. This type of construction seems to be of particular advantage, for example, in perforated drums which are supported cantilever-like at only one end of their side walls, thus providing space to introduce a driving shaft for a fan from the direction of a face end of the perforated drum.

If, according to another characteristic of the invention, a number of heating elements are arranged along the pressure section of the perforated drums, the drier may be constructed in such a simplified way that no lateral channels at all are required, so that the width of the drum practically corresponds with the length of the drum.

The elements heating the drying air may also be mounted inside the perforated drums of the pressure section. In addition to purely structural improvements and reductions in cost there is the additional advantage that all troubles caused by fibres sticking to heating elements mounted outside the perforated drums are eliminated from the start.

The heating elements may suitably consist of heating tubes arranged longitudinally inside the perforated drums close to the inner walls.

A further modification of the invention serves the purpose of guiding the drying air in relation to its speed and quantity in such a manner that delicate materials such as chemicals, for example, will not be destroyed, with the modification substantially characterized by the fact that the shafts of the fans coincide with the shafts of the perforated drums, or run parallel to these shafts of the said perforated drums. For the purpose the fans may be preferentially centrifugal fans mounted in a special housing.

For such a modification of the invention the fans are best designed for double end suction, while the shafts of the said fans are preferentially driven from outside the perforated drums, for example by belt drives.

According to still further characteristics of the present invention the drum sections facing the outlet holes of the fans may be covered by rigidly attached air screens in relation to the other drum sections, and the fans with their housings and air screens may be rigidly attached to the stationary lateral disks of the perforated drums.

In the drawings the invention is shown in several modifications.

Fig. 1 shows a longitudinal section of a perforated drum drier.

Fig. 2 also shows a longitudinal section of a perforated drum drier in another modification,

Fig. 3 shows a longitudinal section of a perforated drum, with centrifugal fan mounted inside drum,

Fig. 4 shows a cross section of perforated drum shown in Fig. 3.

Arranged inside perforated drum drier 1 are perforated drums 2 to 5. Perforated drum 2 is driven in the direction of arrow 6, perforated drum 3 in the direction of arrow 7, perforated drum 4 in the direction of arrow 8 and perforated drum 5 in the direction of arrow 9. The textile material to be dried arrives at inlet 12 on a conveying means 11, and is carried by the perforated drums meanderlike through the drier to an outlet, not shown in the drawing. Arranged inside the said perforated drums axially along a diameter of the drum are partitioning walls 13 with through holes or air passages 14, separating the inside space of the perforated drums into drawing sections (—) and pressure sections (+) comprising the perforated peripheral wall portions before referred to. The partitioning walls are supported at one or two face ends of the drum outside the said drum. The partitioning walls together with these face ends or walls and with the peripheral wall portions of the drum thus form suction chambers and pressure chambers in the interiors of the drums.

3

Fans 15 are arranged in front of through holes 14 in the pressure section (+) and draw the drying air, indicated by arrows, from the drying space into the drawing or suction section (-), simultaneously pressing the textile material 10 against the outer surface of the perforated drums and blowing the drying air through the pressure section (+) again outside the perforated drums into the drier. Around the pressure section (+) of the perforated drums heating elements 16 are arranged in axial direction of the drums, serving the purpose of heating the drying air. As shown clearly in the drawing the paths of the drying air while circulating from one perforated drum to the next are very short; neither is the drying air much deflected, thus permitting a perforated drum drier according to the invention to be operated at a very good degree of efficiency.

Fans 15 in the perforated drums 2, 3 and 4 shown in the example are directly driven by electric motors 17, located inside the pressure section (+) of the perforated drums. As shown in perforated drums 2 and 3, the electric motors may be attached by fastening means 18, linked to partitioning walls 13, or, as shown in perforated drum 4, by fastening means 19, taken past a face end of the perforated drum and held outside the said drum.

In another modification of the possible driving means of the fans, fan 15 of perforated drum 5 is driven by means of bevel drive 20 and shaft 21, passing axially through the perforated drum. The fan is held in position by bearing means 22, in turn connected with partitioning wall 13.

In the embodiment according to Fig. 2 perforated drums 24 and 25 are arranged inside perforated drum drier 23. Perforated drum 24 is driven in the direction of arrow 26, perforated drum 25 in the direction of arrow 27. For drying, the textile material 28 enters the perforated drum drier on conveying device 29 at inlet 30 and is carried meanderlike through the drier, by the perforated drums. Axially arranged inside these perforated drums along a diameter of the said drums are partitioning walls 31 with through holes 32 and fans 33, which draw the drying air from the drawing or suction section 34 into the blowing section 35. In longitudinal direction of the perforated drums in the blowing or pressure sections 35 along the inside walls of the perforated drums are the heating tubes 36, by means of which the drying air passing out of the perforated drums may be reheated. The heating tubes 36 inside the perforated drums are arranged in such a manner that any contact with the textile material or sections thereof is eliminated.

In the modification according to Figs. 3 and 4 the perforated drum 37 with its cylinder sheet 38, arranged inside a perforated drum drier housing not shown in the drawing, is supported along its circumference by means of two inner rings on rollers 39 and driven around rotary axis 40, also not shown. Perforated drum 37 may, for example, be driven by an outer ring gear opposing an inner gear. Side disks 41 and 42 of the perforated drum are rigidly fastened inside the perforated drum drier and do not rotate with the other parts. Suitable seals are used to seal the stationary lateral disks against the rotating parts of the perforated drum. As shown particularly also in Fig. 4 housing 43 of a centrifugal fan 44 is mounted inside the perforated drum, of which driving shaft 45, projecting from the housing and the lateral disks, lies above the rotary axis 40 of the perforated drums. Lateral draw or suction holes 46 and 47 in housing 43 point towards lateral disks 41 and 42. The outlet opening 48 points towards the bottom half of the perforated drum, with heating elements 49 rigidly attached to said drum. Draw or suction holes 46 and 47 and the outlet opening 48 are separated from each other by a stationary air screen or partition plate 50, which divides the inside area of the perforated drum

4

into drawing section or suction chamber 51 and pressure section or pressure chamber 52. Ends 53 and 54 (Fig. 4) of the air screen or partition plate facing cylinder sheet 38 are provided with seals which glide along the inner walls of cylinder sheet 38, performing a sealing action during the rotation of the drum. The material to be dried, 55, chemicals, for example, is held on cylinder sheet 38 by air drawn from outside the perforated drum in the direction of arrow 56 into drawing section 51 in response to the action of the centrifugal fan. The air flows on from drawing section 51 through the lateral drawing holes 46 and 47 to the inside of housing 43 and flows under pressure from outlet opening 48 into the pressure section 52 of the perforated drum (direction of arrow 57). There, the drying air is heated by heating elements 49 and leaves the perforated drum through the bottom part of the cylinder sheet to repeat its cycle.

By constructing the fan as a centrifugal fan, the flow of air, that is, the air velocity, may be guided and controlled in comparison with other types of fans in such a manner that delicate materials such as chemicals will not be destroyed in the drying process. The reason for this is that the axes of the fans are disposed parallel to the axes of the drums and that the fans are arranged within a spiral casing or housing.

Fan 44, for example, may be driven through shaft 45 by means of a belt or gear drive not shown in the drawing. But it is also possible to use an electric motor to drive shaft 45, attached directly to a lateral disk of the perforated drum, and if required, alternatively attached inside the said drum.

Having thus fully disclosed our invention, what we claim is:

1. A perforated drum dryer adapted for the passage therethrough of textile or fibrous material to be dried thereby, comprising rotating drums disposed side by side parallel to each other, each of said drums comprising perforated peripheral wall means, each of said perforated peripheral wall means comprising a wall portion in contact with said material and a further wall portion out of contact with said material at any given instant during the rotation of said drums, means for drawing drying air into said drums through each said first-named wall portion and expelling said air from said drums through each said further wall portion, said means including fans, wall means defining chambers in the interior of each of said drums receiving said drying air, the wall means defining one of said chambers including said first-named wall portion, the wall means defining another of said chambers including said said further wall portion, said wall means defining said chambers comprising a partitioning wall common to each of said chambers and extending axially of said each of said drums, air passage means in said partitioning wall interconnecting said chambers, means supporting said fans in positions operatively adjacent each said air passage means, and means for driving said fans.

2. A drying apparatus for textile material such as woven or knitted goods, loose fibrous material or the like comprising a plurality of drying drums mounted for rotation side by side and parallel to each other, each of said drums further comprising a perforated cylindrical peripheral wall, wall means supported transversely within said cylindrical wall and extending substantially thereacross to define with the cylindrical wall a first chamber and a second chamber, air passage means in said wall means, fan means including fans communicating with said air passage means for drawing air from said first chamber and discharging it into said second chamber, means closing the ends of said first chamber, means for driving said fans, and means for passing the material to be dried into contact with the peripheral wall of each drum only on that portion which is adjacent said first chamber.

5

3. A drying apparatus according to claim 2, wherein said wall means extends axially of each of said drums.

4. A perforated drum dryer as defined in claim 1, wherein said another of said chambers constitutes a pressure chamber, said means supporting said fans includes means for supporting one each of said fans in each said pressure chamber.

5. A perforated drum dryer as defined in claim 1, wherein heating elements are disposed adjacent each said further wall portion.

6. A drying apparatus according to claim 2, wherein said fans have axes parallel to the axes of said drums.

7. A drying apparatus according to claim 2, wherein said fans are of the centrifugal type and include spiral housings, said housings having inlet and outlet openings, said outlet openings being located adjacent said air passage means.

6

8. A drying apparatus according to claim 6, further including supporting means for said drums, said supporting means comprising ring means on the inner peripheries of said drums and roller means engaging said ring means.

9. A perforated drum drier as defined in claim 1, wherein said one of said chambers is a suction chamber and said another of said chambers is a pressure chamber, heating elements for heating the drying air being disposed in each said pressure chamber.

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