Jan. 26, 1960 E. KIEFER 2,922,229

APPARATUS FOR DRYING LOOSE FIBROUS MATERIALS AND THE LIKE

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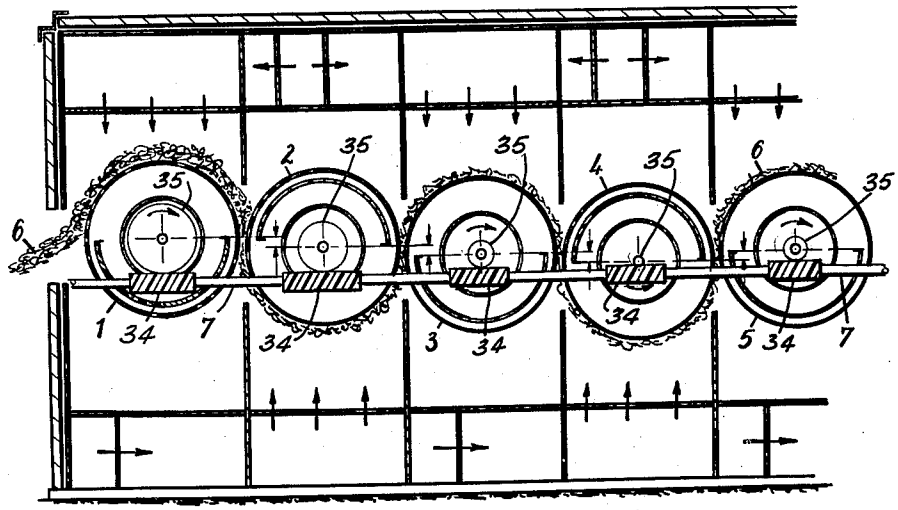


Fig. 1

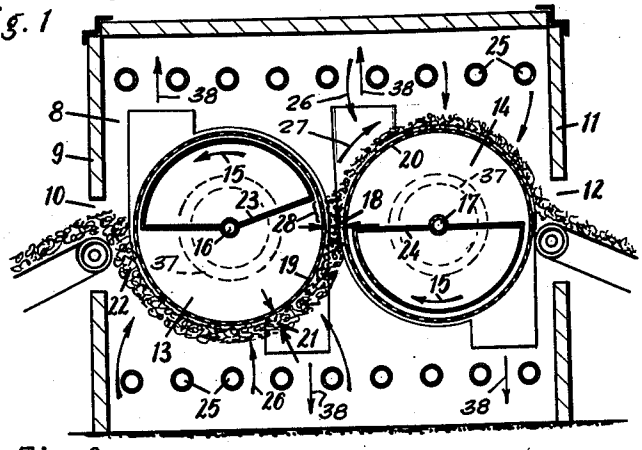


Fig. 2

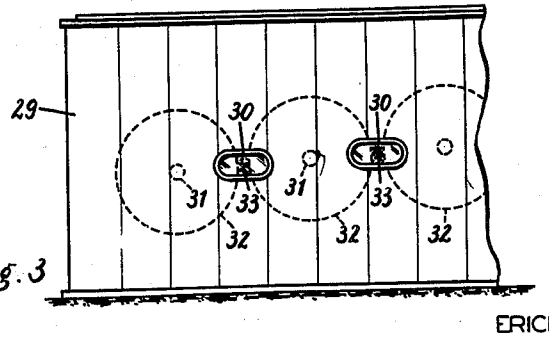


Fig. 3

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APPARATUS FOR DRYING LOOSE FIBROUS MATERIALS AND THE LIKE

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2 Claims. (Cl. 34—115)

The present invention relates to an apparatus for drying loose fibrous material, card slivers, fiber bats, or the like.

In the manufacture and treatment of fiber bats which are passed over the perforated drums of a drying apparatus it has been found advisable in order to dry the fibers as uniformly as possible to bring as many new surfaces of the fibers into contact with the drum surfaces as possible by shifting the position of the fibers within the bat so that the drying air current will act uniformly upon all the layers thereof. Such relocation of the fibers within the bat must be carried out very carefully, and this is a procedure which in actual practice is rather difficult. It has now been found, according to the invention, that such relocation may be carried out quite easily if the successive drying drums are rotated at different peripheral speeds so that the bat will thereby be distorted and the relative position of the fibers therein be shifted.

It is therefore an object of the present invention to provide a drying apparatus in which at least some of the successive drying drums may be rotated at different peripheral speeds so that the fibrous bat in passing from one drum to the next will be so distorted that the relative position of the fibers within the bat will be changed.

Another object of the present invention is to provide a drum drier in which some or all of the drying drums are driven at different peripheral speeds by means of a single drive shaft.

This object of the invention is attained by mounting some or all of the drying drums at different levels, by mounting a horizontal drive shaft alongside all of the drums, and by positively connecting the drive shaft to the various drums by suitable power-transmitting means, such as bevel gears, worm gears, or the like of different sizes and with a different number of gear teeth.

Another object of the invention is to provide suitable adjusting means for varying the respective level of distance of the individual drying drums from the common drive shaft so as to permit the power-transmitting means to be exchanged for others of a different size if the relative speed between two adjacent drums is to be changed in accordance with different fibrous materials or a different consistency or thickness of the fibrous bat.

According to the invention, the individual drying drums may, for example, be disposed relative to each other so that the peripheral speed of the drums will at first increase from one drum to the other and thereafter decrease in the following drums, or vice versa, or so that the speed of the successive drums will alternately increase and decrease. It is thus possible to drive the various drums with a common drive shaft rotating at a uniform speed and by providing gears of different sizes and with a different number of teeth so that the fibrous bat in passing from one drum to another rotating at different speeds will either be drawn apart or stretched or be pushed together, whereby the relative position of the individual fibers within the bat will be considerably shifted. However, the successive drying drums may also be run at equal differences in speed between adjacent drums so that the drive shafts of the drums themselves may be disposed relative to each other within a straight plane which is either upwardly or downwardly inclined.

A further object of the present invention is to increase

the distorting or dislocating effect which is exerted upon the fibrous bat by rotating the drying drums at different speeds by mounting the shafts of adjacent drums so that the minimum distance between two adjacent drums is smaller than the thickness of the fibrous bat on the first of these drums. Consequently, the material will then be temporarily arrested and compressed at these narrowest points and will then be drawn apart and again loosened by the faster running drum.

Another feature of the invention for loosening up and displacing the fibers in the bat very effectively consists in mounting the cover plates within each drum so that the end of at least one cover plate will be spaced at such a distance from the narrowest point between the adjacent drums, that is, from the point of transfer of the fibrous material from one drum to the other, that behind such narrowest point, as seen in the direction of travel a free suction area will be formed in which the material will be acted upon by the suction of both drums. The faster running drum will thus not be able to pick up the fibers freely from the preceding drum but must actually pull them out of the bunch of fibers which is temporarily held arrested at the narrowed point between the drums.

Another feature of the invention designed for regulating the displacement of the fibers as above described consists in making the cover plates within the perforated drums to be adjustable from the outside of the drier. This may be done, for example, by mounting each cover plate on a shaft which extends out of one side of the respective drum, preferably through a hollow shaft driving the drum, and by connecting such shaft to a suitable adjusting device which is provided on the outside of the drier.

Still another feature of the invention consists in the provision of inspection windows or the like in the side walls of the drier through which the drying process and the displacement of the fibrous material may be easily observed. These windows are preferably provided at the level of the center of the drums at the point of transfer of the material from one drum to the other, and of a shape in accordance with the points to be inspected.

Further objects, features, and advantages of the present invention will be apparent from the following detailed description thereof, particularly when read with reference to the accompanying drawings, in which—

Fig. 1 shows a diagrammatic longitudinal section through the first part of a drum drier according to the invention with a series of consecutive drums, five of which are shown;

Fig. 2 shows a diagrammatic longitudinal section through a drum drier with only two perforated drums; while

Fig. 3 shows the outside of a drum drier with inspection windows mounted in its outer wall for observing the drying procedure.

Referring to the drawings, Fig. 1 shows a series of five consecutive drying drums 1 to 5 with perforate cylindrical surfaces, over which the fibrous material 6 to be dried is wound so as to contact the drums alternately along the upper and lower sides. The drums 1 to 5 are rotatably mounted, in close spaced relationship to each other, and with the respective axes of rotation substantially parallel to each other. A drive shaft 7 extends underneath all of the rotary axes of the individual drums 1 to 5 and, as diagrammatically shown in Figure 1, is drivingly connected to the respective drums by successive meshing pairs of gears 34, 35 of differing ratios. The rotary axis of drum 1 is disposed at a greater distance from drive shaft 7 than the axis of adjacent drum 2. The gear ratio of the gears connecting drive shaft 7 to the shaft of drum 1 is larger than that of the gears driving drum 2 so that the latter rotates at a greater speed

than drum 1. Drums 3 and 4 are mounted still more closely to the axis of drive shaft 7 and due to the relatively reduced ratio of their driving gears 34, 35 rotate at still greater speeds. The next drum 5 is mounted at a greater distance from shaft 7 than the preceding and adjacent drum 4 and due to the relatively larger gear ratio of its driving gears 34, 35 runs more slowly than the latter. Additional drums (not shown) rotating at still lower speeds may follow drum 5. While the fibrous material is drawn apart by the first drums 1 to 4, those following thereafter will push the material in the bat together.

In the embodiment of the invention as illustrated in Fig. 1, the distance of the adjacent drums from the axis of the common drive shaft 7 preferably differs by about 10 to 20 mm.

In the modification of the drier according to Fig. 2, the drier itself is formed of a drying chamber 8 with an inlet opening 10 in one end wall 9 and an outlet opening 12 in its other end wall 11, and a pair of perforated drums 13 and 14 mounted in chamber 8 and driven in a direction as indicated by the arrows 15. Drum 14 is driven at a greater speed than drum 13, and the rotary axes of the drums extend transversely to the longitudinal direction of the drier. These axes may also be disposed at slightly different levels similarly as shown in Fig. 1 and should be spaced from each other so that at the narrowest point between the drums the distance 18 between the outer wall 19 of drum 13 and the outer wall 20 of drum 14 is smaller than the thickness 21 of the fibrous material 22 before it reaches this narrowest point. Each of the perforated drums 13 and 14 contains an inner cover plate 23 and 24, respectively, which covers those points of each drum where the suction produced by the suction fans 36 and 37 should not become effective. The drying air current which is preferably drawn out of the drums in the axial direction thereof is blown by the fans in the directions indicated by arrows 38 past the heating elements 25 and then in the direction shown by arrows 26 upon the bat of fibrous material 22, and is then drawn through the material as well as through the perforations in the outer wall of each drum toward the inside thereof. The meanderlike transfer of the fibrous bat 22 from drum 13 to drum 14 occurs at the narrowest point between the drums. The distortion of the fibrous bat and the dislocation of the individual fibers therein caused by the drawing action upon the bat resulting from the higher speed of drum 14 and the compression of the bat 21 to the thickness 18 will be further increased by the position of cover plates 23 and 24 relative to each other and to the narrowest point 18. By the provision of suitable adjusting means which may be controlled from the outside of the drums, at least cover plate 23 may be adjusted so that the edge thereof will be spaced from the narrowest point 18 so as to form an uncovered area 28 behind this point, as seen in the direction of travel 27 of the bat. Within this area 28, the fibrous material will be acted upon simultaneously by the suction of both drums. The faster running drum 14 can therefore not pick up and draw the fibers freely from the preceding drum 13, but must draw them out of the bunch of material which is temporarily arrested at the narrowest point 18 after the suction of this drum 14 overcomes the suction of drum 13. Thus, after the material is first compressed by the two drums at point 18 so that the fibers within the bat will thereby be dislocated, it is again loosened and thus displaced first by the drawing action of both drums 13 and 14 and then by that of drum 14 alone within and toward the end of area 28.

Although this alternate compression and drawing procedure for the purpose of relocating the fibers in the bat and thus subjecting them more effectively and uniformly to the drying action has been illustrated in Fig. 2 only by means of two drying drums, it will be understood that this procedure may also be carried out repeatedly by a larger number of drums arranged one behind the other as illustrated, for example, in Fig. 1.

Fig. 3 illustrates a drier according to the invention mounted in a housing with a side wall 29 in which inspection windows 30, preferably of an oval shape, are provided substantially at the level of the shafts 31 of drums 32 and near the narrowest point between two adjacent drums. Such windows being approximately equi-distant from the axes of the two adjacent drums to permit a close observation from the outside of the transfer of the fibrous material 33 from one drum to the other and of the drying procedure as above described so that, if necessary, the cover plate within one or another drum may be properly adjusted from the outside, or so that it may be determined from the outside whether the speed of the different drums relative to each other should be changed either by adjusting the speed of the individual driving means of the drums or, if the drums are driven by a common shaft, as shown in Fig. 1, by adjusting the vertical position of the bearings of the respective drum by suitable means and by then changing the respective gear on the shaft of the drum for one of a different size.

Although my invention has been illustrated and described with reference to the preferred embodiments thereof, I wish to have it understood that it is in no way limited to the details of such embodiments, but is capable of numerous modifications within the scope of the appended claims.

Having thus fully disclosed my invention, what I claim is:

1. An apparatus for drying bats or bands of loose fibrous material comprising a plurality of perforated drying drums, fan means for drawing an air current through said drums from the outside toward the inside thereof, a common drive shaft mounted substantially horizontally alongside said drums, said drums being rotatably mounted in close spaced relationship to each other and with the respective axes in rotation substantially parallel to each other, the drums being at different levels relative said drive shaft, and gear means of different sizes for connecting said drive shaft to each of said drums so as to rotate said drums at different speeds, the successive drums being mounted at such levels with respect to said drive shaft and being connected thereto by gear means of such size that in a first group of the successive drums the peripheral speed of each drum is greater than a preceding adjacent drum and in a second group of the successive drums the peripheral speed of at least one drum is less than the speed of a preceding adjacent drum.

2. An apparatus for drying bats or bands of loose fibrous material comprising a plurality of perforated drying drums, fan means for drawing an air current through said drums from the outside toward the inside thereof, a common drive shaft mounted substantially horizontally alongside said drums, said drums being rotatably mounted in close spaced relationship to each other and with the respective axes in rotation substantially parallel to each other, the drums being at different levels relative said drive shaft, and gear means of different sizes for connecting said drive shaft to each of said drums so as to rotate said drums at different speeds, the successive drums being mounted at such levels with respect to said drive shaft and being connected thereto by gear means of such size that in progressing along successive drums the peripheral speed of each of the successive drums is alternately greater than or less than the speed of the preceding adjacent drum.

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