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METHOD AND APPARATUS FOR WILLOW DRYING

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Fig. 1

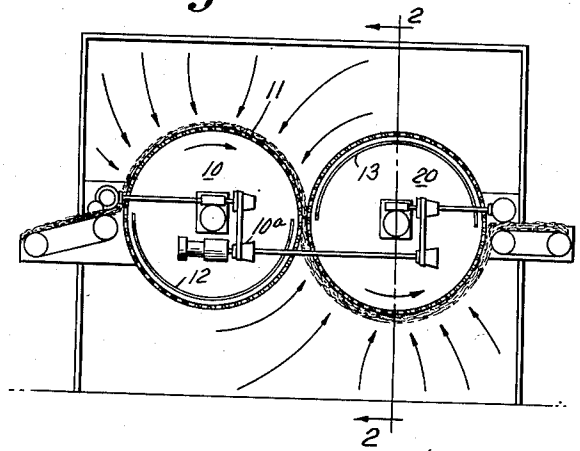


Fig. 2

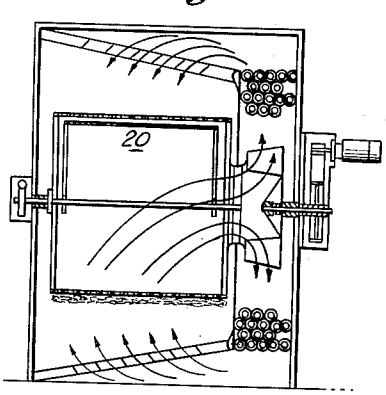


Fig. 3

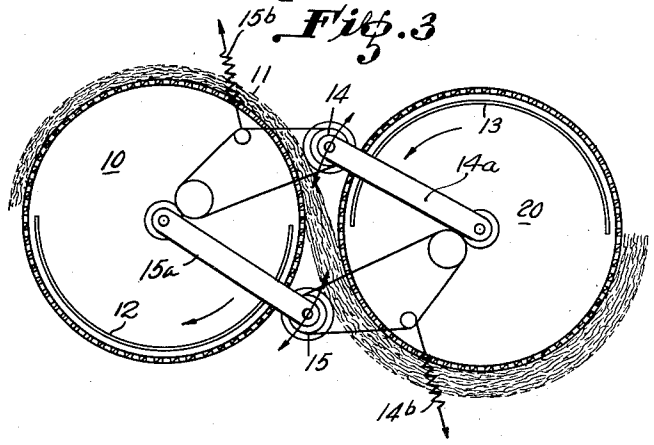
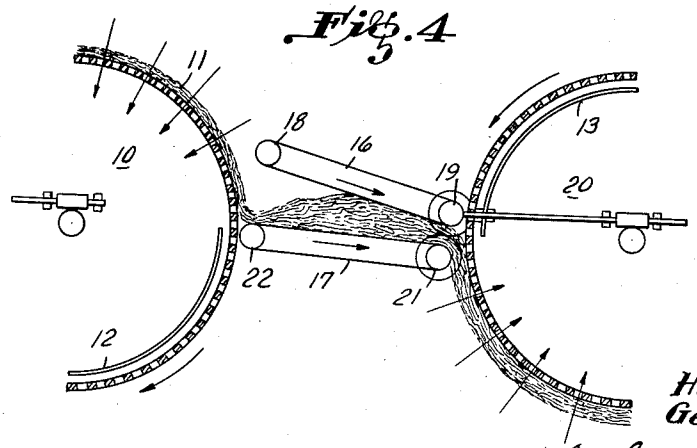


Fig. 4



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METHOD AND APPARATUS FOR WILLOW DRYING

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9 Claims. (Cl. 34—25)

The present invention relates to improvements in willow or sieve drum driers for drying fiber laps, bats, webs, or the like.

In driers of this type the loose fibrous material to be dried is held attached to the peripheral surface of the individual drums by means of the suction of the heated air which is passed therethrough. The fiber mass is originally very wet and only a very thin layer may at first be applied to the drying surface. If the layer is too thick, the suction will not be sufficiently strong and the outer fibers will no longer be held attached but may fall off. Also, in such a case, the drying air can no longer pass through the fiber layer as freely as desired, in order that an effective drying action may be exerted thereon. Not until the material has been dried to some extent will it become lighter, thereby allowing the air to pass through it more easily. For this reason, the fiber laps applied to willow or sieve drum driers as known and used prior to this invention were always rather thin, and they were looped around the drums and progressively and increasingly dried by a succession of such drums until they finally passed out of the drier in a completely dry condition.

It is one of the objects of the present invention to provide a method and apparatus for drying thicker fiber laps or layers as the drying progresses, and it is accordingly another object of the invention to increase the thickness of the fiber lap within the willow or sieve drum drier as the drying of the lap progresses.

Another object of the invention is to provide a willow or sieve drum drier which is of considerably smaller dimensions and may be built at a considerably lower cost than previous driers of this type, requires much less floor space, and may be operated more easily and economically than such previous driers.

The new method according to the invention offers considerable advantages over the previous methods. Thus, for instance, the new method permits the lap or bat to be increased to 1.5 or twice its thickness, or even to three to six and more times the original thickness. This, in turn, results in the advantage that the entire drier may be made considerably shorter than a machine in which the thickness of the lap is the same from beginning to end. Thus, the machines which were known prior to the invention had to be about 1.5 to 2 or even 3 to 6 times as long as a machine according to the invention in which the fiber lap is increased in bulk and thickness during the drying operation.

The method according to the invention for increasing the thickness of the fiber lap may be carried out in different manners. Thus, for example, the rotational speed of the drums may be progressively decreased from drum to drum whereby the fiber layer will be bunched up and thus increased in thickness. At such reduced rotational speed the increase in thickness of the fiber lap progresses in relation to the difference in speed of the next following drum to that of the preceding drum. For varying and controlling the rotational speed of the individual drums, the present invention provides for the use of infinitely variable gears. It is thus possible to adapt the degree of bunching up or thickening of the fiber lap to the requirements in each particular case. Furthermore, two rotating rollers may, according to the invention, be provided at the point of transition from one drum to the other. One of these rollers is preferably mounted at a distance from the first drum which is equal to the thickness of the fiber layer on this drum and has a peripheral speed similar to that of the drum, while the second roller is preferably mounted at a distance from the second drum which is equal to the thickness of the compressed fiber layer on the second drum and is driven at a peripheral speed corresponding to the peripheral speed of the second drum. These rollers additionally serve to maintain the fiber lap in its respective different thickness on each of the two drums which run at different rotational speeds.

Additional features of the invention consist in a pendulum suspension of the rollers so as to be able to rock relative to their associated drums, and in either pressing them resiliently against the fiber lap or securing them at a certain distance therefrom.

In the treatment of textile fibers there are, however, also certain procedures in which the fiber lap or bat has to remain a considerable time in the drying chamber. Rather than make the machine three to six or more times its normal length, as was previously required, it is a further object of the invention to increase the thickness of the fiber lap three to six times. Since this requires the individual drums to rotate at successively lower speeds, the length of time during which the material remains in the drying chamber will be increased accordingly. Such a proceeding may be required, for example, when the wool is being carbonized and treated with sulphuric acid for a longer period of time in order to carbonize the vegetable impurities, such as burrs, seed pods, grasses, and the like, the remains of which will be subsequently removed by knocking. However, such increase in density or thickness of the wool fleece will then no longer be possible merely by reducing the succession of the different speeds of the drums.

It is therefore a further object of the invention to bunch up the fiber layer by transporting the same from one sieve drum to the adjacent sieve drum between two conveyor belts which are driven either at a speed corresponding to the peripheral speed of the following drums or at a speed intermediate the two peripheral speeds of the successive drums. Whether or not it may be for the purpose described above or for any other purpose, such a mechanism and procedure may be used to obtain fiber layers of almost any desired thickness.

Further objects, features, and advantages of the present invention will appear from the following detailed description thereof, as well as from the accompanying drawings, in which—

Fig. 1 shows a diagrammatic side view of a first embodiment of the invention;

Fig. 2 is a cross-sectional view on the line 2—2, Fig. 1;

Fig. 3 shows a similar view of a modification thereof; while

Fig. 4 shows another modification of the invention.

Referring to the drawings, Fig. 1 shows two willows or sieve drums 10 and 20 of a willow or sieve drum drier over which a fiber lap 11 is passed. The drums are enclosed in a housing through which the fleece passes on a conveyor belt to the feed wheels adjacent drum 10. A stationary cover plate 12 is preferably provided on the inside of the lower part of drum 10 to cover the inside of that part of drum 10 which is left free of fiber lap 11, while another cover plate 13 covers the inside of the corresponding upper part of drum 20. The dry-

ing air is drawn off from the inside of the drums in the usual manner and passes through the fibrous layers on the drums.

Drum **10** is rotated by gearing **10***a* at a higher peripheral speed than drum **20**, for example, at a speed which is 1.5 times higher than the peripheral speed of drum **20**. Lap **11** will therefore be held back as soon as it reaches drum **20**, and thus be bunched up and increased in thickness on drum **20** to 1.5 times its previous thickness on drum **10**. Since the fibrous layer on drum **10** has already been dried to a certain extent, the air will be able to penetrate through it on drum **20** just as easily although it will be 1½ times as thick, and despite such greater thickness it will not be considerably heavier than the layer on drum **10**. If additional drums are provided for drying the material, the speed of those drums may be further decreased in their order of succession. Thus, the size of the drying chamber, as well as of the entire machine, will be considerably reduced, less floor space will be required and the cost of construction of the machine will be materially reduced.

The peripheral speed of the individual drums may be controlled, for example, by infinitely variable gears. The degree which the fiber layer may be strengthened or thickened at each individual drum stage may thus be easily controlled so as to comply with the prevailing conditions so that the drying process may be carried out as quickly and uniformly as possible.

Fig. 3 illustrates a willow drier similar to that shown in Fig. 1 in which, however, the two sieve drums **10** and **20** are mounted farther apart, and two rollers **14** and **15** are rotatably mounted at the point of transition of the fiber layer from drum **10** to drum **20**. Roller **14** is operatively associated with drum **10** and rotates at a peripheral speed corresponding to that of drum **10**. Also, roller **14** is mounted at a distance from drum **10** which corresponds to the thickness of the fiber layer **11** on drum **10**, and may be either suspended like a pendulum on arm **14***a*, as shown, or clamped in a fixed position at the mentioned distance from drum **10**. Roller **14** is resiliently mounted by means of spring **15***b*.

Roller **15**, on the other hand, is operatively associated with drum **20** and rotates at the same peripheral speed and in the same direction as drum **20**. Roller **15** is mounted at a point so that the distance between its peripheral surface and the surface of drum **20** corresponds to the thickness of the fiber layer **11** on drum **20**. Roller **15** may likewise be suspended like a pendulum on arm **15***a* or clamped in a fixed position at the mentioned distance from drum **20**. Spring **14***b* resiliently holds roller **15**. The two rollers **14** and **15** insure a proper position of the fiber layer on drums **10** and **20**, and roller **15** in cooperation with drum **20** will either increase the density of the layer by compression, or the thickness thereof.

If the thickness of the fiber layer or lap is to be increased three to six times or more, a mechanism is preferably applied as shown diagrammatically in Fig. 4. The two drums **10** and **20** are still further drawn apart and a pair of conveyer belts **16** and **17** which run on rollers **18** and **19** and **21** and **22**, respectively, are interposed between drums **10** and **20**. Conveyer belts **16** and **17** may run, for example, at a speed which corresponds to the highly reduced peripheral speed of drum **20** or at a speed intermediate the peripheral speeds of drums **10** and **20**. The two conveyer belts **16** and **17** will thus be used to bunch up and then gradually increase the density of the fiber layer three to six times, and, if desired, even more.

Although our invention has been illustrated and described with reference to willow or sieve drum driers and to the preferred embodiments thereof, we wish to have it understood that it is in no way limited thereto or to the details of such embodiments, but is capable of numerous modifications within the scope of the appended claims.

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

1. A method of treating a layer of fibrous material comprising the steps of applying a layer of fibers upon a rotating sieve drum, retaining said layer on said drum by suction, withdrawing said layer from said drum and passing it around a second drum, retaining said layer on said second drum by suction, and rotating said second drum at a speed lower than said first drum so as to bunch up and thus increase the thickness of said layer intermediate said drums.

2. A method of treating a layer of fibrous material comprising the steps of applying a layer of fibers upon a rotating sieve drum, retaining said layer on said drum by suction, withdrawing said layer from said first drum and conveying the same intermediate a pair of moving surfaces to a second drum at a speed lower than the peripheral speed of said first drum, thereby bunching up and increasing the thickness of said layer, passing said bunched up layer around said second drum and retaining it thereon by suction, and rotating said second drum at a speed lower than said first drum.

3. A method of treating a layer of fibrous material comprising the steps of applying a layer of fibers upon a rotating sieve drum, retaining said layer on said drum by suction, withdrawing said layer from said first drum and conveying the same intermediate a pair of moving surfaces to a second drum at a speed lower than the peripheral speed of said first drum, thereby bunching up and increasing the thickness of said layer intermediate said drums, then compressing said layer intermediate said moving surfaces, passing said compressed layer around said second drum and retaining it thereon by suction, and rotating said second drum at a speed lower than said first drum.

4. An apparatus for treating a layer of fibrous material comprising a plurality of suction drums arranged adjacent and parallel to each other for transporting the layer of material from one drum to the adjacent drum, means for rotating the first of said drums at a certain speed, means for rotating the second drum at a speed lower than the speed of said first drum, whereby when said layer is looped around said drums, said material will be bunched up intermediate said drums and said layer will be increased in thickness, and roller means for compressing said bunched up layer on said second drum.

5. An apparatus for treating a layer of fibrous material comprising a plurality of suction drums, means for rotating the first of said drums at a certain speed, means for rotating the second drum at a speed lower than the speed of said first drum whereby when said layer is looped around said drums, said material will be bunched up intermediate said drums and said layer will be increased in thickness, a pair of rollers intermediate said drums, one of said rollers being spaced from said first drum at a distance corresponding to the thickness of said layer on said first drum, means for rotating said first roller at a peripheral speed substantially equal to the peripheral speed of said first drum, the second roller being adapted to engage said layer and spaced from said second drum at a distance larger than the thickness of said layer on said first drum, and means for rotating said second drum at a peripheral speed substantially equal to the peripheral speed of said second drum.

6. An apparatus for treating a layer of fibrous material comprising a plurality of suction drums, means for rotating the first of said drums at a certain speed, means for withdrawing said layer from said first drum and conveying the same to the second drum, said conveying means comprising a pair of endless surfaces adapted to engage said layer at opposite sides thereof, means for moving said surfaces in a direction toward said second drum and at a speed lower than the peripheral speed of

said first drum, whereby when said layer is looped around said first drum, passed between said movable surfaces, and then looped around said second drum, said material will be bunched up intermediate said surfaces and said layer increased in thickness, and means for rotating said second drum at a speed lower than said first drum.

7. An apparatus for treating a layer of fibrous material comprising a plurality of suction drums, means for rotating the first of said drums at a certain speed, means for withdrawing said layer from said first drum and conveying the same to the second drum, said conveying means comprising a pair of endless surfaces adapted to engage said layer at opposite sides thereof, means for moving said surfaces in a direction toward said second drum and at a speed lower than the peripheral speed of said first drum, whereby when said layer is looped around said first drum, passed between said movable surfaces, and then looped around said second drum, said material

will be bunched up intermediate said surfaces and said layer increased in thickness, means for gradually narrowing the distance between said surfaces toward said second drum for compressing said bunched up layer, and means for rotating said second drum at a peripheral speed at least as low as the speed of said surfaces.

8. An apparatus as defined in claim 5, further comprising means for mounting at least one of said rollers on a pendulum suspension.

9. An apparatus as defined in claim 5, further comprising means for resiliently mounting at least one of said rollers.

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