

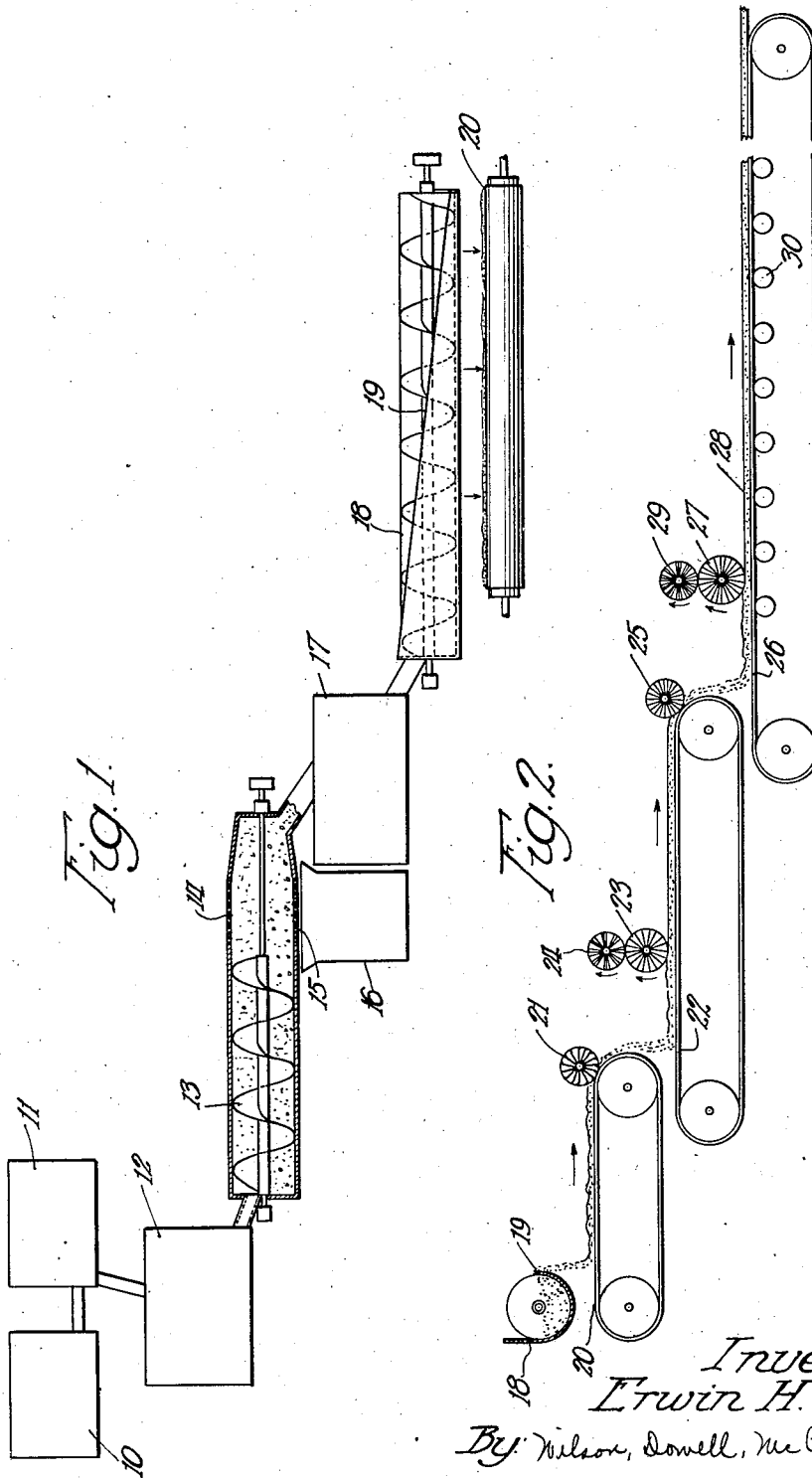
March 27, 1934.

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1,952,208

FIBER SHEET AND ITS MANUFACTURE

Filed May 18, 1931



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UNITED STATES PATENT OFFICE

1,952,208

FIBER SHEET AND ITS MANUFACTURE

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Application May 18, 1931, Serial No. 538,088

9 Claims. (Cl. 154—23)

This invention relates to the manufacture of thick fibrous sheets and, among other objects, aims to provide an efficient and economical process for making thick fibrous sheets in which the fibers are interconnected without impairing the insulating qualities of the sheet.

The nature of the invention may be readily understood by reference to one illustrative embodiment thereof shown in the accompanying drawing.

In said drawing,

Fig. 1 is a more or less diagrammatic view showing an elevation of the devices for initially forming the sheet; and

Fig. 2 is a similar elevation of apparatus forming a continuation of the apparatus shown in Fig. 1.

In the illustrative process, the mass of fibers are interconnected by an adhesive, as distinguished from connecting by felting the fibers together, in order to provide a sheet of looser character than a felted sheet wherein compression or an intimate association of fibers is necessary to effect a felting and interlocking of the fibers. The latter form of sheet is of course much denser in character and does not possess the insulating characteristics of the more porous sheet.

To provide a porous or loose sheet of this character, treatments which tend to compact the fibers are avoided. To this end, the formation of the sheet by the use of a water pulp is avoided because in the latter process the draining of the water away from the pulp layer inevitably produces a rather close and undesirable (from the insulating standpoint) compacting of the fibers. Instead, the fibers are used without a water vehicle and are interconnected by the use of an adhesive which is applied to the fibers. In the present instance, the adhesive is applied and excess adhesive removed, before any sheet forming operations, in order to avoid the disturbance of the loose layer of fibers by any subsequent operation of this character.

To secure a uniformly thick layer of fibers, the initially deposited layer of fiber is repeatedly levelled by removal of fibers forming high spots in the layer, and then the levelled layer is picked apart and uniformly redeposited in another layer. The successive levelings and redepositing operations eventually produce a fibrous layer quite as loose as the original layer, and in which the fibers are uniformly distributed and which is of uniform thickness. The sheet is then dried to set the adhesive and preferably very slightly com-

pressed in order to hold down projecting bits of fiber and provide a smoother surface.

In the drawing is illustrated diagrammatically one procedure for performing the inventive process. The fiber, which may be of vegetable, wood or mineral character or a mixture of these, is employed in dry form, that is, with only about 10 to 15% moisture, which is approximately the natural moisture content of the fiber. It is first subjected to a coarse shredding operation in a hammer machine or hog, diagrammatically indicated at 10, and then later to a fine shredding operation in apparatus such as a single disk fibrator which may be purchased on the market. A fine shredding device is here indicated at 11 receiving the coarse shredded fibers from the device 10.

The finely shredded fibers are then screened to remove dirt and so-called "fines" and are then delivered to a device, represented at 12, for mixing the fiber with an appropriate adhesive. For this purpose, a mixing device, such as is used for mixing cattle feed with molasses, may advantageously be employed. Mixers of this character may be purchased on the open market. A great variety of adhesives may be used, such as starch and dextrine adhesives, glue or rosin, or for some purposes, such as where it is desired fully to water and weather-proof the fibers, a high melting point asphalt may be employed. Adhesive somewhat in excess of that necessary to coat the fibers is introduced into the mixer and the excess adhesive is later expressed from the fibers by the subsequent operations, thereby insuring an adequate coating of the fibers. The excess adhesive may conveniently be expressed from the fibers by delivering the mass of fibers from the adhesive mixer 12 to an enclosed screw conveyor 13 which carries the mass of fiber along and forces it through a confined passage 14 not provided with any screw conveyor. The friction of the passage coupled with the action of the conveyor in attempting to advance the mass of fibers places them under substantial compression and expresses the excess adhesive which may pass through the perforations 15 in the walls of the passage 14 from which it is collected in a receptacle 16 for re-use. The compressed fiber is then delivered to agitating apparatus, indicated diagrammatically at 17, which generally loosens the compressed fibers and delivers the loosened mass of adhesive coated fibers to a distributing device 18 in the form of a worm conveyor having an inclined delivery edge 19. This device with its inclined delivery edge serves

to deliver the fiber fairly uniformly across a belt conveyor 20 (shown in Fig. 1 as travelling perpendicularly to the plane of the drawing and in Fig. 2 as travelling parallel therewith. The layer of fibers deposited on the belt 20, while fairly uniform as regards to the rate of feed and distribution across the sheet, is not uniform in thickness, as indicated in Fig. 2.

To improve the uniformity of the sheet, the layer of fibers is picked apart by a rotating picker roll 21 which serves not only to loosen the fibers but to distribute inequalities in the supply of fiber. From the picker roll the fibers fall upon a continuously travelling conveyor 22, the layer on this conveyor being somewhat more uniform both in character and thickness than on the conveyor 20. Inequalities in the thickness of the sheet are removed by a rotating brush roll 23 whose direction of travel is opposite that of the conveyor 22 and which serves to remove the fiber in the high spots on the sheet and throw it back toward the point of delivery where it is more or less uniformly scattered in the layer of fiber.

A cleaning brush roll 24 rotating in a direction opposed to the roll 23, serves to remove fiber adhering to the brush roll. The levelled layer of fibers is then advanced to another picker roll 25 which serves again to loosen the layer of fibers and further to redistribute any inequalities in distribution of fiber throughout the layer and to deposit the fibers upon another continuously travelled conveyor 26. The slight inequalities in thickness in this layer are removed by another rotating brush roll 27 similar to the roll 23 leaving a levelled loose fibrous layer 28 which is not only uniform in thickness, but in which the fibers are uniformly distributed. If desired the thickness of the fibrous sheet may be varied by regulating the relative speeds between conveyors 20 and 22 and between 22 and 26.

A cleaning brush roll 29, similar to the roll 24, is provided for the brush roll 27. The fibrous layer 28 is then carried by the conveyor 26 or successive conveyors which are advantageously supported level by the usual rolls 30 through the necessary drying operations, during which the adhesive sets. Preferably, the sheet is given an initial drying operation sufficient to permit it to be cut transversely into sections for convenient handling in the cutting operations in which the sheet is cut into desired commercial sizes. Preferably, during the drying operations or until the adhesive has set, slight pressure by means of a smooth belt or otherwise is applied to the surface of the sheet to hold down any resilient fiber ends which may project above the true surface of the layer, thus providing a fibrous sheet which has a relatively smooth surface. This belt or other compressing means may also serve to gauge the sheet to standard or accurate thickness.

It will be understood from the foregoing that the sheet is very porous and loose in character and that the fibers are held together or interconnected by the adhesive with sufficient firmness to preserve the integrity of the sheet.

If it be desired to provide a sheet in which the surface is formed of finer fibers, this can be advantageously done by first depositing upon the final conveyor 26, a thin layer of fine fiber in the manner previously described. Then a layer of coarse fiber is deposited upon the fine fiber layer. The coarse fiber layer may be levelled or not, depending upon the character of its surface and then, if desired, a top layer of fine fiber may be deposited on the layer of coarse fiber and the whole sheet

levelled by the brush roll 27, as above described, after which, the sheet is subjected, as aforesaid, to drying and other subsequent operations.

Obviously, the invention is not limited to the details of the illustrative embodiment herein illustrated and described. Moreover, it is not indispensable that all features of the invention be used conjointly, since various features may advantageously be employed in different combinations and sub-combinations.

Having described my invention, I claim:

1. The method of making sheet material of the character described which is characterized by covering a mass of fiber with a liquid adhesive so as to coat the individual fibers, agitating said mass to loosen and separate the coated fibers and depositing the same in a sheet like layer in loose and unfelted condition, passing said sheet under a rotary levelling brush to remove high spots in said sheet, and then drying said sheet to permit the adhesive to set.

2. The method of making sheet material of the character described which is characterized by mechanically agitating a mass of fibers coated with liquid adhesive to loosen and separate them, depositing them in loose condition in a layer, and picking said layer apart and redistributing the fiber in another layer to secure more even distribution of the fiber in the layer and to produce a more uniform layer thickness without the use of substantial pressure.

3. The method of making thick fibrous sheet insulating material which is characterized by mixing disintegrated fiber with an adhesive, forcing the mass through a confined passage to compress it and discharge excess adhesive, loosening the fibrous mass and depositing it in a layer on a continuously travelling carrier, continuously tearing said layer apart to loosen the fiber and re-depositing it in a layer on a continuously travelling carrier to improve the uniformity of the layer, passing said layer under a rotating leveller to remove the fibers in the high spots in said layer, and then drying the sheet.

4. The method of making thick sheet insulating material which is characterized by mechanically agitating a mass of fibers coated with a liquid adhesive to loosen and separate them, depositing them in loose condition to form a layer without the use of compression, feeding said layer to a picker roll which pulls the fiber apart and continuously discharges it in a layer upon a continuously travelling carrier, and then passing the layer under a rotating brush roll to remove the fiber in high spots on said layer.

5. The method of making thick sheet insulating material which is characterized by mechanically agitating a mass of fibers coated with a liquid adhesive to loosen and separate them, delivering said fibers, in loose condition, to a continuously travelling carrier and allowing them to form a loose unfelted layer; repeatedly mechanically separating the fibers in the layer and then depositing them again upon a travelling carrier; and, following each deposit of the fibers in layer form, passing the same under a rotating brush roll to level the sheet by removing the fiber in the high spots in the layer.

6. The method of making thick porous fibrous sheets which is characterized by mechanically agitating a mass of fibers thoroughly coated with liquid adhesive to loosen and separate them, repeatedly depositing said fiber in loose condition on a continuously travelling carrier followed by a repeated levelling of the sheet by removing the

fiber in the high spots in said layer, thereby forming a loose sheet-like layer of substantially uniform thickness and condition, and then drying said sheet and permitting the adhesive to set.

5 7. The method of making thick, loose fibrous sheets of the character described which is characterized by covering a mass of fiber with a liquid adhesive so as thoroughly to coat the individual fibers, compressing said mass to express excess
10 adhesive, agitating said mass to loosen and separate the coated fibers and depositing the same in a sheet like layer in loose and unfelted condition, passing said sheet under a rotary levelling brush
15 to remove high spots in said sheet, and then drying said sheet to permit the adhesive to set.

8. The method of making thick fibrous material of the character described which is characterized by mechanically agitating a mass of fibers coated

with liquid adhesive to loosen and separate them, depositing them in loose condition to form a layer without the use of substantial compression, levelling said layer by removing the fiber forming high spots in said layer, and then drying said layer to permit the adhesive to set. 80

9. The method of making thick fibrous sheet material of the character described which is characterized by covering a mass of fiber with a liquid adhesive so as thoroughly to coat the individual fibers, separating the excess adhesive, mechanically agitating the coated fibers to separate and loosen them, depositing them in loose condition in the form of a thick layer in substantially unfelted condition, and then drying said layer to permit the adhesive to set. 85 90

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