Jan. 19, 1932. F. L. BRYANT 1,841,785

METHOD OF MAKING LAYERS OF DISTENDED FIBROUS MATERIALS

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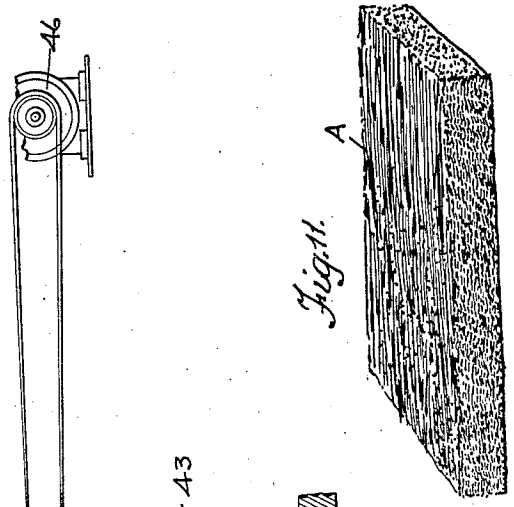


Fig. 11.

Fig 1

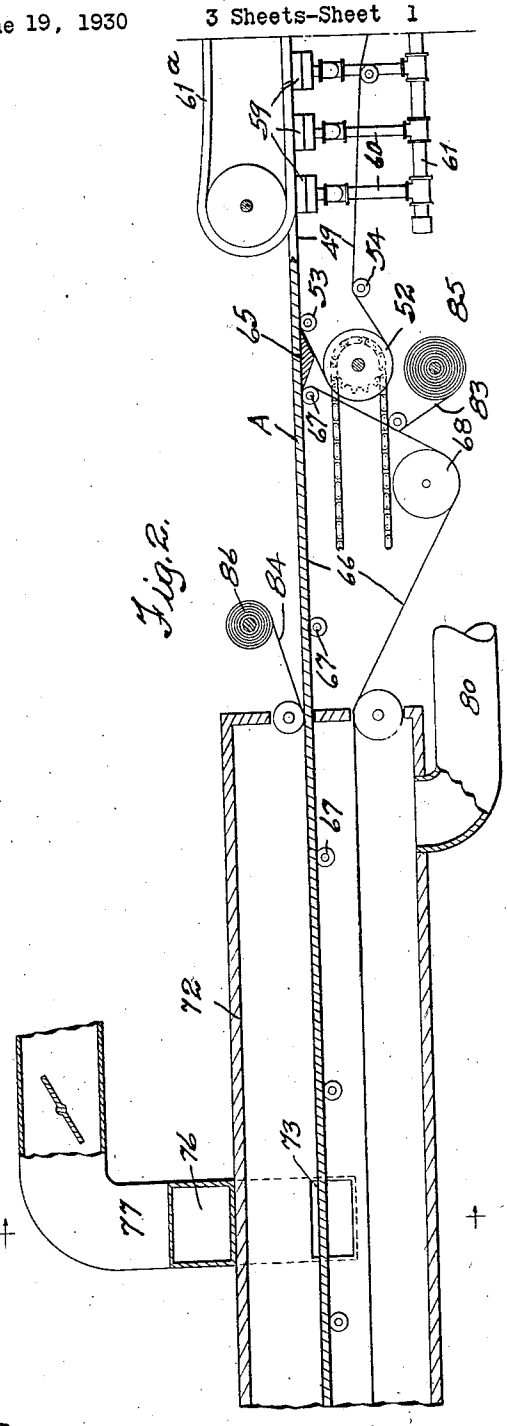


Fig. 2.

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Fig. 3.

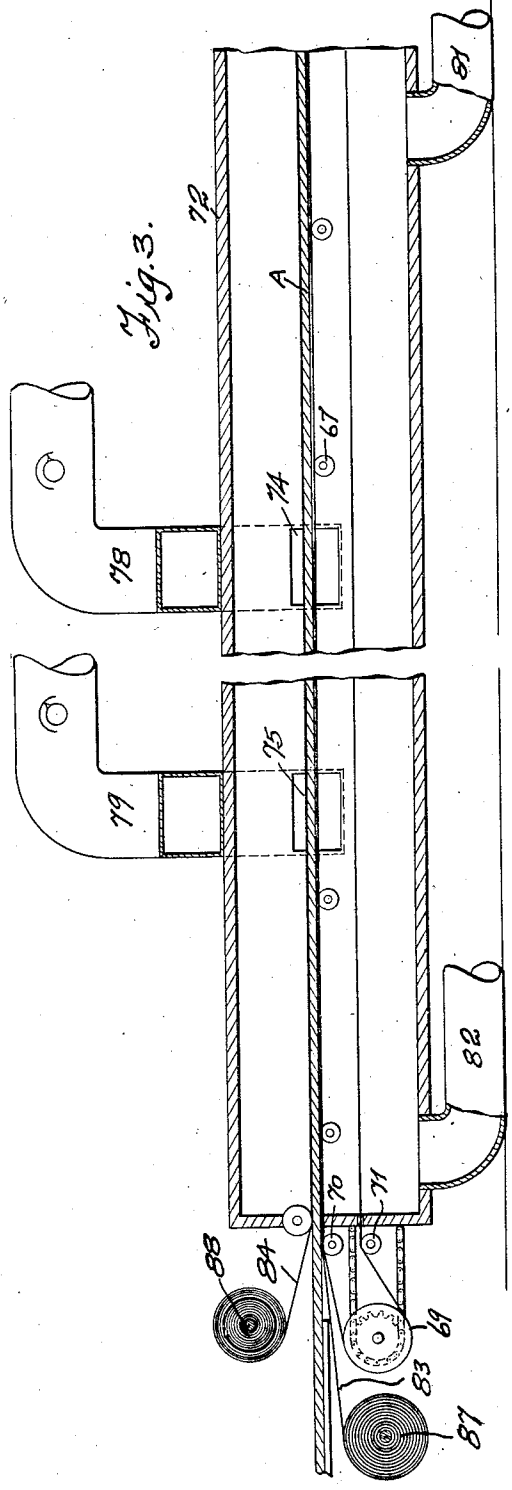


Fig. 7.

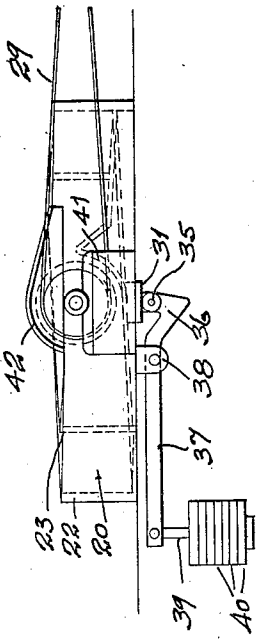
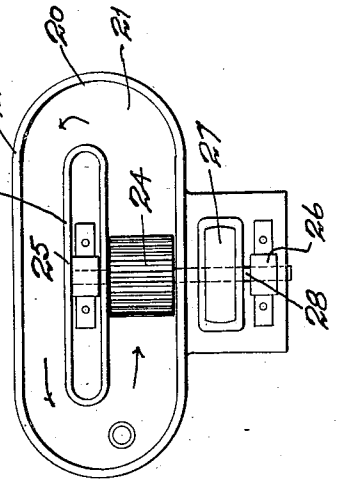


Fig 6



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Fig. 8.

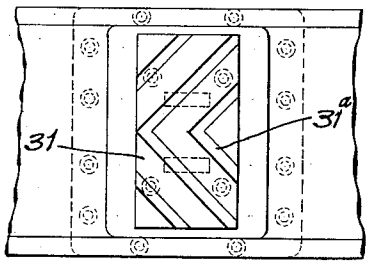


Fig. 4.

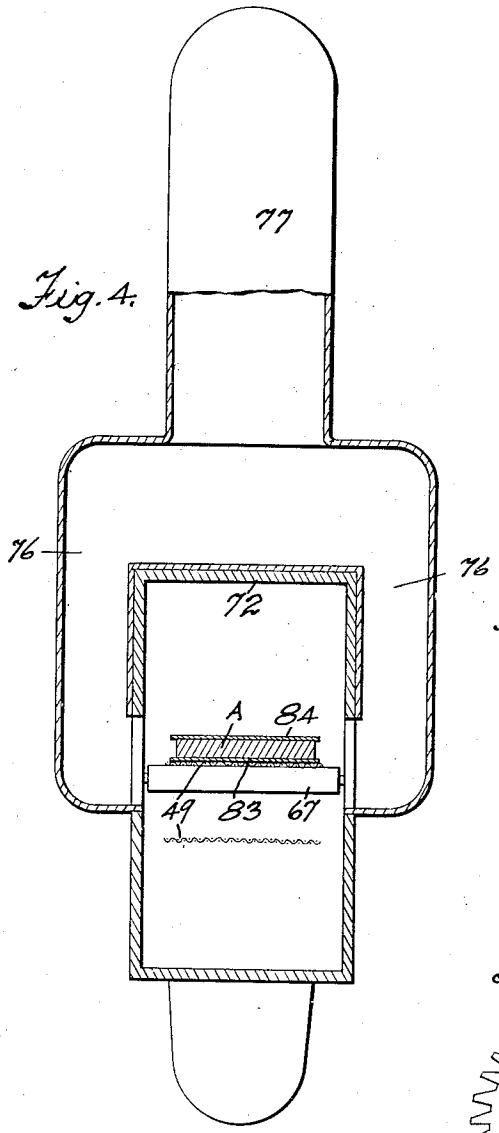


Fig. 5.

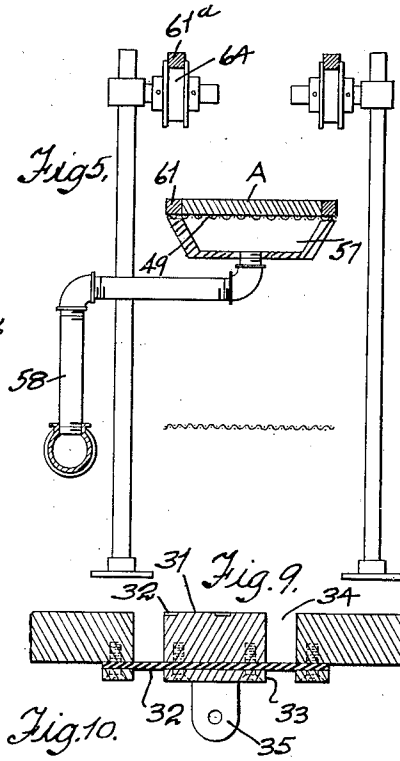
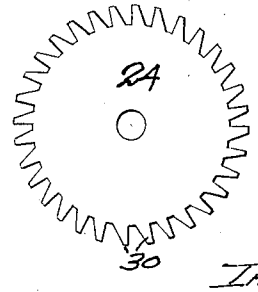


Fig. 9.

Fig. 10.



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UNITED STATES PATENT OFFICE

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METHOD OF MAKING LAYERS OF DISTENDED FIBROUS MATERIALS

Application filed June 19, 1930. Serial No. 462,218.

This invention relates to method of making layers of distended fibrous materials.

The present invention has reference to a method of continuously manufacturing in somewhat modified form the distended fibrous material which forms the subject matter of Patent No. 1,740,280, issued December 17, 1929.

The material in question is formed of cellulose fibres, which are impregnated with a bubble forming or foam forming ingredient which when agitated causes the fibrous mass to distend by the formation of minute bubbles throughout the mass, so that its volume becomes greatly augmented, with the result that when fed forward in the form of a layer and dried under conditions which prevent it from being crushed down or compressed, it assumes the form of a light fluffy layer adapted to subserve numerous purposes for which a material of this character having absorptive properties is fitted, and is also adapted in coarser form for use as a packing for furniture or fragile articles.

The product of the present method possesses the above characteristics, but in addition thereto, and as a result of the special operations embodied in the present invention, the layer is provided on one side with a somewhat tough, coherent and paper-like skin, which is formed out of the mass of material itself during the process of its manufacture, and which serves to better maintain the layer in the form of a coherent body of substantially uniform thickness, thereby better adapting it for use as a packing or padding of the character commonly employed in the making of pads for stair carpeting, although the material is adapted for numerous uses in which the cushioning or protective effect is desired.

The texture of the layer can be modified in considerable degree by a preliminary beating which may constitute one of the steps of the present method, and which beating serves to shorten or break down the fibres to the desired extent, depending, however, upon the purpose for which the layer is intended. The beating period will also vary with regard to the constituents of the stock employed and the speed of operation and the adjustment of the beater, but in most cases it is desirable to avoid a beating action unduly prolonged, which tends to shorten the fibres to such an extent that the resulting product will not be sufficiently resistant to compressive action. In general, it may be said that for most purposes a beating action of about an hour is desirable, which produces a mass which when subjected to the treatment hereinafter described will emerge in the form of a layer having a somewhat cellular texture, but with the fibres of sufficient length to afford the necessary cohesion and resistance to crushing pressure. In short, the product will have a certain resiliency which enables it to serve as a pad where a cushioning or like effect is desired.

Where the preliminary beating is continued for several hours, the fibres become so shortened that in the ultimate product the texture will be rather of a spongy or cellular character but without a great deal of resiliency, although for some purposes a product of the last mentioned character may be desirable.

Where the product is not subjected to the preliminary beating, the fibres will be long, and there will be little of the cellular or spongy quality in the product, which for most purposes is considered to be a desirable characteristic.

It is of the utmost importance that after the preliminary beating the mass of fibrous material, which may be cellulose or the like, or cellulose in combination with other fluffy or fibrous material, such as hair, be thoroughly impregnated with the bubble forming ingredients and distended, while in semi-liquid form, and subjected to agitation by agitating blades designed to give to the mass a swift vertical movement having a centrifugal component and a downwardly directed component, and of so directing these movements with respect to the tank or container within which the mass is held that there will also be imparted to the mass a surging in and out movement which more fully tends to impregnate the fibre forming ingredients and to cause the necessary froth-

ing and distension, and this agitating process is continued until the mass assumes a creamy consistency and becomes distended to two or three times its original volume, at which time the mass is in condition to permit it to be discharged from the agitating receptacle in the form of a thick sheet or layer, which as discharged is preferably of quite substantial depth or thickness. Suitable results are obtained by the discharge of a layer of from one inch to an inch and half in thickness, although, of course, the thickness of the layer will depend in considerable measure on the purpose for which the layer is intended and the degree to which it has been distended by the bubble forming or foam forming ingredients contained in the mixture.

After the material has been thoroughly agitated, it is discharged onto the moving foraminous bed of a Fourdrinier machine, which carries the material forward in the form of a continuous layer of uniform thickness, and in order to create upon the under surface of the layer a somewhat tough coherent skin of paper-like consistency, the layer, immediately after it is discharged upon the bed of the Fourdrinier machine, is subjected momentarily to a vacuum, preferably above five inches, which has the effect of suddenly exhausting most of the moisture from the under surface of the mass, contiguous to the vacuum box, without, however, imparting the suction deeply into the mass, so that the under surface only will be thus subjected to the compacting influence of the somewhat heavy suction, which results in the formation on the under surface of a skin layer, without, however, subjecting the remainder of the mass to any substantial degree of compressive action, so that above the skin layer the mass will retain its fluffy or spongy consistency, which gives to it the cushioning properties which the layer of the present invention is primarily intended to retain.

After the layer of material has traveled beyond what may be termed the heavy suction, it is thereafter subjected to a lesser vacuum of about three inches, which serves to abstract a large portion of the moisture, without, however, breaking down or compacting the fibrous body of the layer, so that as it is discharged from the Fourdrinier machine it will display the characteristics of a fibrous or spongy pad, with a paper-like surface skin of considerable toughness. In this condition the layer is fed onwardly without compressive contact and without being subjected to disrupting or disturbing influences, into an elongated drying chamber, through which it passes and within which it becomes thoroughly dry, so that at the point of discharge from the drying chamber it may be cut into sections of the desired dimensions and stored or packed for shipment.

If it is desired to prevent staining of the surfaces by the evaporation of the chemicals employed to expand the mass, the layer, during its progress through the drying chamber, may be brought into surface contact upon its upper and lower surfaces with thin sheets of absorptive material, such as paper or fabric, which serve by contact and capillary action to draw the liquid chemicals from the surfaces of the layer and effect the ultimate evaporation of the liquid constituents upon the surfaces of the protective strips, rather than the surfaces of the layer of material itself, thus preventing staining of the material; and the present process includes this protective step in the drying operation, although where the material is used for packing or padding, and where a slight surface discoloration is unobjectionable, this step in the process may be omitted.

Throughout the entire progress of the layer of distended material, from its discharge from the agitating receptacle until its final delivery at the far end of the drying chamber, the layer will be adequately supported in an undisturbed condition and without subjection to the pressure of rolls or the like which are commonly employed in the paper making industry, since save for the momentary subjection of the layer to a relatively high vacuum in order to provide a paper-like surface skin to the layer surface, the object sought in the present case is directly the reverse of the compacting effect which is required in the making of paper to give it the desired strength and toughness.

In order to more fully elucidate the details of the present process as practiced upon mechanisms of a character particularly designed for the present purpose, reference may be had to the accompanying drawings, wherein,—

Figures 1, 2 and 3 comprise longitudinal sectional views of successive portions of one and the same machine designed to continuously produce the layers of distended material;

Fig. 4 is an enlarged sectional elevation through the drying chamber;

Fig. 5 is a section through one of the suction boxes;

Fig. 6 is a plan view of the beater;

Fig. 7 is a side elevation of the beater;

Fig. 8 is an enlarged plan view of the bed block of the beater;

Fig. 9 is a longitudinal section through the bed block;

Fig. 10 is an end elevation of the beater roll; and

Fig. 11 is a perspective view of a small section of the material, showing by heavy line the paperlike skin on the under surface thereof.

The mass of cellulose or other fibrous material in its original state is first liquefied by the addition of water to give a liquid mixture containing about two and a half percent by weight of solids, and in this condition is flowed into the beater, which is in the form of a tank 20, provided with a circuitous channel 21 afforded by an outer continuous wall 22 and an inner continuous wall 23, as illustrated in Fig. 6. Across the channel thus formed extends a beater roll 24 which is journalled at its inner end within a journal mounting 25, and at its outer end within a journal mounting 26, and adjacent to the mounting 26 is a pulley 27 upon the beater roll shaft 28, which pulley mounts a belt 29 adapted to impart rotation to the roll.

As illustrated in Fig. 7, the roller turns in an anti-clockwise direction, and the flow of the material follows the arrows as indicated in Fig. 6. The roll is provided with teeth or serrations 30 extending from end to end of the roll, and having a slight forward projection toward the direction of rotation. Below the roll is located an adjustable bed block 31, which as shown in Fig. 8 is provided on its surface with obliquely arranged inset metallic strips 31ª which coact with the teeth of the roll in disintegrating the fibres and reducing them to the desired length. The bed block 31 contacts a rubber diaphragm 32 to which it is clamped by an outer plate 33, and the diaphragm bridges across a gap or orifice 34 in the floor of the beater tank so as to prevent the escape of liquids and at the same time permit the bed block to be vertically adjusted to bring it to the desired distance from the surface of the beater roll.

In order to impart an upward or lifting pressure to the bed block against the tension of the diaphragm 32, the bed block is provided with ears 35 between which is pivoted the upwardly extending end 36 of a lever 37 which is fulcrumed between ears 38 and provided on its end with a depending rod 39 adapted to receive weight disks 40 in the number requisite to impart the desired lifting effect to the bed block.

The floor of the beater tank, at a point beyond the beater roll as regards the direction of travel of the material, is provided with a curved plate 41 which stands in spaced relation to the surface of the roll and affords a narrow or restricted channel through which the material is forced upwardly and caused to overflow when subjected to the impulsion of the beater roll, and in order to prevent an outflow of the liquid, a curved shield 42 is provided above the roll.

With the beater in operation, the mixture of fibrous material and water will be subjected to the agitating and disintegrating action of the roll in coaction with the bed block, so that a swift current will be maintained around the circuit of the tank and the fibres reduced to the desired length and degree of fineness, which will depend upon the length of time the material is subjected to the beating action and upon the speed of the roll and the adjustment of the bed block. For most purposes, a beating of approximately an hour will reduce the fibrous material to the desired condition of fineness, after which it is necessary to incorporate with the liquid mixture a suitable quantity of bubble forming or foam foaming ingredients of the general character set forth and described in Patent No. 1,740,280, of December 17, 1929. It may also at this stage be desirable to incorporate with the mass a quantity of hair or other fibrous material which it is desired to introduce into the completed layer. Experience has shown that the incorporation into the mass of an amount of hair equal in weight to fifty percent of the cellulose or other fibrous material contained in the liquid mixture will produce a highly desirable product, although it will be understood that the introduction of such materials as hair or the like is optional. When introduced they serve to strengthen and improve the cushioning properties of the resulting product, and to produce a product which may successfully compete with pads or the like composed entirely of hair or similar materials.

After the bubble-forming ingredients have been added to the liquid mass, with or without the addition of hair or the like, the mass is poured into a tank 43 within which the material is agitated and distended by the action of propeller blades 44—44 mounted upon a vertical shaft 45, which is driven from a motor 46 or other source of power.

The shaft 45 is preferably located off center with respect to the tank 43, which is preferably circular, so that as the material is driven outwardly by the action of the propeller blades it will sweep around the wall of the tank and be alternately directed inwardly toward the propeller blades and outwardy and away therefrom during its circuit around the tank. While the tank, as shown, is of cylindrical or circular formation, similar results may be obtained by the use of a barrel-shaped tank or one otherwise configured.

The blades of the propeller are preferably formed with downwardly turned tips 47, while the body of each blade is turned upwardly, with the result that when rotating, the blades will have the effect of imparting a combined downward and outward thrust to the material, which gives the vortical motion, and which, combined with the surging action caused by the eccentric relation to the blades to the tank, serves to thoroughly agitate the material without any tendency to additionally break up the minute fibres. The con-

struction and arrangement of the blades themselves are fully set forth and described in co-pending application Serial No. 452,901, filed May 16, 1930.

After the material has been thus agitated for a sufficient period to cause it to distend through the action of the bubble-forming or foam-forming ingredients, to about two and a half times its original liquid volume, and after the hair or other material, if any, has been added and becomes thoroughly impregnated with and distributed evenly throughout the mass, and while the material is in a creamy state due to the presence of the minute bubbles formed therein, it is discharged in the form of a layer from a spout 48 located near the bottom of the tank and onto the traveling or foraminous bed or carrier 49 of a Fourdrinier machine.

The bed is preferably formed of fine mesh wire screening, and is carried upon supporting rollers 50 and passes around a front idle roller 51 and a rear power driven roller 52. Immediately in advance of the power driven roller, the belt or carrier passes downwardly over a supporting roller 53, and the lower turn of the belt or carrier passes over a rear roller 54, a forward guide roller 55, and under a tension roller 56.

Near the forward end of the Fourdrinier machine is located what may be termed a heavy suction box 57 connected by a suction pipe 58 with a suitable source of vacuum adapted to maintain a relatively heavy vacuum of approximately five inches in the heavy suction box, the purpose of which is to momentarily subject the layer of material, immediately after its delivery onto the bed of the Fourdrinier machine, to a sufficiently heavy suction to draw down and compact the under surface of the layer of material, thereby causing the fibres to cohere and compact together in the formation of a tough paperlike under skin.

Near the rear end of the Fourdrinier machine are located a series of relatively light suction boxes 59 connected by pipes 60 with a suitable source of vacuum 61 adapted to maintain a light suction of approximately three inches of vacuum in the suction boxes, which is a much less degree of vacuum than is commonly employed in the paper making art, and less than the vacuum in the vacuum box 57, the light vacuum boxes being relied upon to withdraw moisture, without, however, additionally compacting the body of the layer of material.

In order to give proper definition to the width of the layer, gauge belts 61^a of rubber or suitable composition are employed, one on each side of the bed or carrier, and these beds are properly held and supported to rest upon and travel with the carrier and constitute side walls or flanges for gauging the depth of the layer of material and for affording a sharp or clean cut edge to the layer.

In order to insure a proper depth of material, which should ordinarily be flush with the lower turns of the gauge belts, a scraper bar 62 is provided immediately to the rear of the spout 48, which serves to level down the layer to the level of the gauge belts, after which the layer is not again subjected to any compressive or deformative action save and except the suction previously described.

The gauge belts are mounted upon grooved rollers 63 at the forward and rear ends thereof, and the upper turn of each belt is supported by an intermediate roller 64 which allows the lower turn of each belt to rest bodily upon the moving carrier of the Fourdrinier machine and to travel therewith by friction without the necessity of providing means for positively feeding the gauge belts.

The layer of material A passes from the traveling conveyor of the Fourdrinier machine over a stationary shoe 65 and onto the surface of an endless carrier belt 66, the upper turn of which lies flush with the surfaces of the carrier 49 and the shoe 65. The carrier belt 66 is carried upon supporting rollers 67 and passes under a forward roller 68 suitably spaced to distend the forward end of the belt and thereby cause the lower turn to move upwardly in oblique relation to the forward roller 67, as indicated in Fig. 2. The carrier belt 66 passes a rear power driven roller 69, and the upper and lower turns in proximity to the power driven roller are supported on guide rollers 70 and 71, respectively. The upper and lower turns of the endless carrier 66 both pass through an elongated drying chamber 72 of boxlike formation, which as shown is supplied with heated air through forward, intermediate and rear ports 73, 74 and 75, respectively. The first port is located near the forward end of the drying chamber while the last occupies a position near the discharge end thereof.

Each of the ports, as shown in Fig. 4, is in duplicate, and discharges from each side into the drying chamber at a level with the carrier therein, so that the hot air will be discharged above and below the layer of material being dried, and the duplicate ports in each instance communicate with side ducts 76 which pass upwardly around opposite sides of the drying chamber and receive heated air from an air delivery duct 77. Similar delivery ducts 78 and 79 deliver the heated air to the intermediate and rear discharge ports 74 and 75, respectively. The hot air ducts receive heated air from a furnace or other suitable source of supply, and it is preferred that the hot air delivered to the forward discharge ports 73 be at a higher temperature than that delivered to the intermediate and rear discharge ports, since in the wetter condition in which the material enters the drying cham-

ber it will stand a higher drying temperature than is desirable at subsequent stages in its progression toward the point of delivery. The air is withdrawn from the bottom of the drying chamber through return ducts 80, 81 and 82, which communicate with an exhaust fan not shown, for the purpose of maintaining a circuit flow of heated air through the drying chamber.

Where it is desired to contact the upper and/or lower surfaces of the layer of material with an absorbent sheet or strip, in order to prevent discoloration of the surface in drying, the following mechanism is provided:

A lower strip 83 of absorbent paper or the like and a similar upper strip 84 are fed over rolls 85 and 86 in position to contact respectively the lower and upper surfaces of the layer of material during its progress through the drying chamber. As shown, the strip 83 is wound up on a roll 87, and the upper strip 84 is wound up on a roll 88, although other arrangements for feeding one or more absorbent strips of the character mentioned might be employed in lieu of the arrangement shown.

The foregoing mechanism serves by way of exemplification to illustrate the process of the present invention, but it will be understood that the process can be otherwise carried out on mechanisms of different descriptions without departing from the spirit of the invention. The arrangement shown, however, is one which permits a continuous and undisturbed feeding of the material from the agitating tank to the point of final delivery, and after the layer has once begun to travel along the bed of the Fourdrinier machine, the process can be continued uninterruptedly for an indefinite period of time until the supply of material in the agitating tank has been exhausted.

The product produced by the method of the present invention is one which possesses a relatively thick, cushionlike resilient body, which is protected and held against disintegration by the formation, on one of its surfaces, of a thin relatively tough and coherent skin formed from the same body fibres and adhering thereto sufficiently to prevent easy removal, which skin surface is highly desirable, in that it tends to conserve the form of the layer as a whole and protects the layer against abrasion, so that it may be more readily used as pads for stair carpeting, or elsewhere.

Although for most purposes the formation of a single surface skin is adequate to afford the desired protection, nevertheless, it is within the contemplation of the present invention, if desired, to duplicate the suction to produce a similar skin on the upper surface of the layer, which may be desirable where additional protection against abrasion or disruption of the body of the layer is desired.

Although the expanded fibrous material of the present invention may be produced by the methods specifically described in Patent No. 1,740,280, it is not the intention, unless expressly so stated in the claims, to limit the present invention to the use of particular methods for expanding the fibrous material, since the present invention relates in the main to the method of treating fibrous material distended by any suitable method, in such a way as to produce a layer having thereon a skin formed by the compacting of the surface fibres.

I claim:

1. The method of producing a layer of distended fibrous material, which consists in incorporating into the material a substance adapted to produce foaming when subjected to agitation, agitating the material to produce a distension thereof by the formation of minute bubbles throughout the mass, discharging the material in the form of a thick fluffy layer, and subjecting the surface of the layer to suction in sufficient degree and during a period of time adequate to compact the fibrous ingredients of the surface subjected to suction to produce a paperlike skin thereon without compacting the body of the layer.

2. The method of producing a layer of distended fibrous material, which consists in incorporating into the material a substance adapted to produce foaming when subjected to agitation, agitating the material to produce a distension thereof by the formation of minute bubbles throughout the mass, discharging the material in the form of a thick fluffy layer, and subjecting the surface of the layer to suction in sufficient degree and during a period of time adequate to compact the fibrous ingredients of the surface subjected to suction to produce a paperlike skin thereon without compacting the body of the layer, and thereafter subjecting the layer to drying operation without compacting the distended body of the layer.

3. The method of producing a layer of distended fibrous material, which consists in incorporating into the material a substance adapted to produce foaming when subjected to agitation, agitating the material to produce a distension thereof by the formation of minute bubbles throughout the mass, discharging the material in the form of a thick fluffy layer, and subjecting the surface of the layer to suction in sufficient degree and during a period of time adequate to compact the fibrous ingredients of the surface subjected to suction to produce a paperlike skin thereon without compacting the body of the layer, and thereafter subjecting the layer to a lesser degree of suction to extract moisture without compacting the body of the layer.

4. The method of producing a layer of distended fibrous material, which consists in incorporating into the material a substance adapted to produce foaming when subjected to agitation, agitating the material to produce a distension thereof by the formation of minute bubbles throughout the mass, discharging the material in the form of a thick fluffy layer, and subjecting the surface of the layer to suction in sufficient degree and during a period of time adequate to compact the fibrous ingredients of the surface subjected to suction to produce a paperlike skin thereon without compacting the body of the layer, thereafter subjecting the layer to a lesser degree of suction to extract moisture without compacting the body of the layer, and finally subjecting the layer of material to drying temperature.

5. The method of producing a layer of distended fibrous material, which consists in subjecting a liquid mixture of said fibrous material to a beating action to disintegrate and shorten the fibres to the desired degree, incorporating into the liquid mixture an ingredient adapted under agitation to produce distension due to foaming, agitating the material to produce a distension thereof by the formation of minute bubbles throughout the mass, discharging the material in the form of a thick fluffy layer, and subjecting the surface of the layer to suction in sufficient degree and during a period of time adequate to compact the fibrous ingredients of the surface subjected to suction to produce a paperlike skin thereon without compacting the body of the layer.

6. The method of producing a layer of distended fibrous material, which consists in subjecting a liquid mixture of said fibrous material to a beating action to disintegrate and shorten the fibres to the desired degree, incorporating into the liquid mixture an ingredient adapted under agitation to produce distension due to foaming, agitating the material to produce a distension thereof by the formation of minute bubbles throughout the mass, discharging the material in the form of a thick fluffy layer, subjecting the surface of the layer to suction in sufficient degree and during a period of time adequate to compact the fibrous ingredients of the surface subjected to suction to produce a paperlike skin thereon without compacting the body of the layer, and thereafter subjecting the layer to drying operation without compacting the distended body of the layer.

7. The method of producing a layer of distended fibrous material, which consists in subjecting a liquid mixture of said fibrous material to a beating action to disintegrate and shorten the fibres to the desired degree, incorporating into the liquid mixture an ingredient adapted under agitation to produce distension due to foaming, agitating the material to produce a distension thereof by the formation of minute bubbles throughout the mass, discharging the material in the form of a thick fluffy layer, subjecting the surface of the layer to suction in sufficient degree and during a period of time adequate to compact the fibrous ingredients of the surface subjected to suction to produce a paperlike skin thereon without compacting the body of the layer, and thereafter subjecting the layer to a lesser degree of suction to extract moisture without compacting the body of the layer.

8. The method of producing a layer of distended fibrous material, which consists in subjecting a liquid mixture of said fibrous material to a beating action to disintegrate and shorten the fibres to the desired degree, incorporating into the liquid mixture an ingredient adapted under agitation to produce distension due to foaming, agitating the material to produce a distension thereof by the formation of minute bubbles throughout the mass, discharging the material in the form of a thick fluffy layer, subjecting the surface of the layer to suction in sufficient degree and during a period of time adequate to compact the fibrous ingredients of the surface subjected to suction to produce a paperlike skin thereon without compacting the body of the layer, thereafter subjecting the layer to a lesser degree of suction to extract moisture without compacting the body of the layer, and finally subjecting the layer of material to drying temperature.

9. The method of producing a layer of distended fibrous material, which consists in subjecting a liquid mixture of said fibrous material to a beating action to disintegrate and shorten the fibres to the desired degree, introducing into the mixture a quantity of long fibred hairlike material adapted to increase the cushioning properties of the completed product, incorporating into the liquid mixture an ingredient adapted under agitation to produce distension due to foaming, agitating the material to produce distension thereof by the formation of minute bubbles throughout the mass, discharging the material in the form of a thick fluffy layer, and subjecting the surface of the layer to suction in sufficient degree and during a period of time adequate to compact the fibrous ingredients of the surface subjected to suction to produce a paper-like skin thereon without compacting the body of the layer.

10. The method of producing a layer of distended fibrous material, which consists in subjecting a liquid mixture of said fibrous material to a beating action to disintegrate and shorten the fibres to the desired degree, introducing into the mixture a quantity of long fibred hairlike material adapted to increase the cushioning properties of the completed product, incorporating into the liquid mixture an ingredient adapted under agita-

tion to produce distension due to foaming, agitating the material to produce distension thereof by the formation of minute bubbles throughout the mass, discharging the material in the form of a thick fluffy layer, subjecting the surface of the layer to suction in sufficient degree and during a period of time adequate to compact the fibrous ingredients of the surface subjected to suction to produce a paperlike skin thereon without compacting the body of the layer, and thereafter subjecting the layer to drying operation without compacting the distended body of the layer.

11. The method of producing a layer of distended fibrous material, which consists in subjecting a liquid mixture of said fibrous material to a beating action to disintegrate and shorten the fibres to the desired degree, introducing into the mixture a quantity of long fibred hairlike material adapted to increase the cushioning properties of the completed product, incorporating into the liquid mixture an ingredient adapted under agitation to produce distension due to foaming, agitating the material to produce distension thereof by the formation of minute bubbles throughout the mass, discharging the material in the form of a thick fluffy layer, subjecting the surface of the layer to suction in sufficient degree and during a period of time adequate to compact the fibrous ingredients of the surface subjected to suction to produce a paperlike skin thereon without compacting the body of the layer, and thereafter subjecting the layer to a lesser degree of suction to extract moisture without compacting the body of the layer.

12. The method of producing a layer of distended fibrous material, which consists in subjecting a liquid mixture of said fibrous material to a beating action to disintegrate and shorten the fibres to the desired degree, introducing into the mixture a quantity of long fibred hairlike material adapted to increase the cushioning properties of the completed product, incorporating into the liquid mixture an ingredient adapted under agitation to produce distension due to foaming, agitating the material to produce distension thereof by the formation of minute bubbles throughout the mass, discharging the material in the form of a thick fluffy layer, subjecting the surface of the layer to suction in sufficient degree and during a period of time adequate to compact the fibrous ingredients of the surface subjected to suction to produce a paperlike skin thereon without compacting the body of the layer, thereafter subjecting the layer to a lesser degree of suction to extract moisture without compacting the body of the layer, and finally subjecting the layer of material to drying temperature.

13. The method of producing a distended layer of fibrous material, which consists in subjecting the fibres in mixture with a liquid to a beating action to disintegrate the fibres and reduce them to the desired degree of fineness, incorporating into the semi-liquid mass an ingredient adapted under agitation to produce distension by foaming, agitating the material to cause distension by the formation of bubbles throughout the mass, feeding the thick fluffy layer of material to a continuously moving surface, momentarily subjecting the surface of the material to a relatively high suction sufficient to cause the formation by compacting of the fibres of a paperlike skin without compacting the body of the layer, continuously moving the layer of material away from the point of suction, subjecting the moving material to a lesser degree of suction to reduce the liquid content without materially compac' ng the distended body of the layer.

14. The method of producing a distended layer of fibrous material, which consists in subjecting the fibres in mixture with a liquid to a beating action to disintegrate the fibres and reduce them to the desired degree of fineness, incorporating into the semi-liquid mass an ingredient adapted under agitation to produce distension by foaming, agitating the material to cause distension by the formation of bubbles throughout the mass, feeding a thick fluffy layer of material to a continuously moving surface, momentarily subjecting the surface of the material to a relatively high suction sufficient to cause the formation, by compacting of the fibres, of a paperlike skin without compacting the body of the layer, continuously moving the layer of material away from the point of suction, and subjecting the moving material to a lesser degree of suction to reduce the liquid content without materially compacting the distended body of the layer, and continuously moving the material through a heated zone to completely extract the moisture.

15. The method of producing a distended layer of fibrous material, which consists in incorporating into a liquefied mixture of fibres an ingredient adapted under agitation to produce distension by foaming, agitating the material to cause distension by the formation of bubbles throughout the mass, feeding a thick fluffy layer of material to a continuously moving surface, momentarily subjecting the surface of the material to a relatively high suction sufficient to cause the formation by compacting of the fibres of a paperlike skin without compacting the body of the layer, continuously moving the layer of material away from the point of suction, and subjecting the moving material to a lesser degree of suction to reduce the liquid content without materially compacting the distended body of the layer.

16. As a new article of manufacture, a layer of material having a cushion-like body of distended fibres and having the body

fibres of one of the surfaces compacted in the form of a thin relatively tough and paper-like skin.

17. As a new article of manufacture, a layer having a body of fibres distended by the formation therethrough of bubbles, and having the body fibres of one of its surfaces compacted in the form of a thin relatively tough and coherent paper-like skin.

18. The method of producing a layer of distended fibrous material which consists in subjecting the material while in semi-liquid condition to a treatment to cause distension of the mass, discharging the material in the form of a thick fluffy layer, and subjecting the surface of the layer to suction in sufficient degree and during a period of time adequate to compact the fibrous ingredients of the surface subjected to suction to produce a paper-like skin thereon without compacting the body of the layer.

19. The method of producing a layer of distended fibrous material which consists in subjecting the material while in semi-liquid condition to a treatment to cause distension of the mass, discharging the material in the form of a thick fluffy layer, and subjecting the surface of the layer to suction in sufficient degree and during a period of time adequate to compact the fibrous ingredients of the surface subjected to suction to produce a paperlike skin thereon without compacting the body of the layer, and thereafter subjecting the layer to drying operation without compacting the distended body of the layer.

In witness that I claim the foregoing I have hereunto subscribed my name this 12th day of June, 1930.

FRANK L. BRYANT.