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PROCESS OF BUILDING FIBROUS SHEETS

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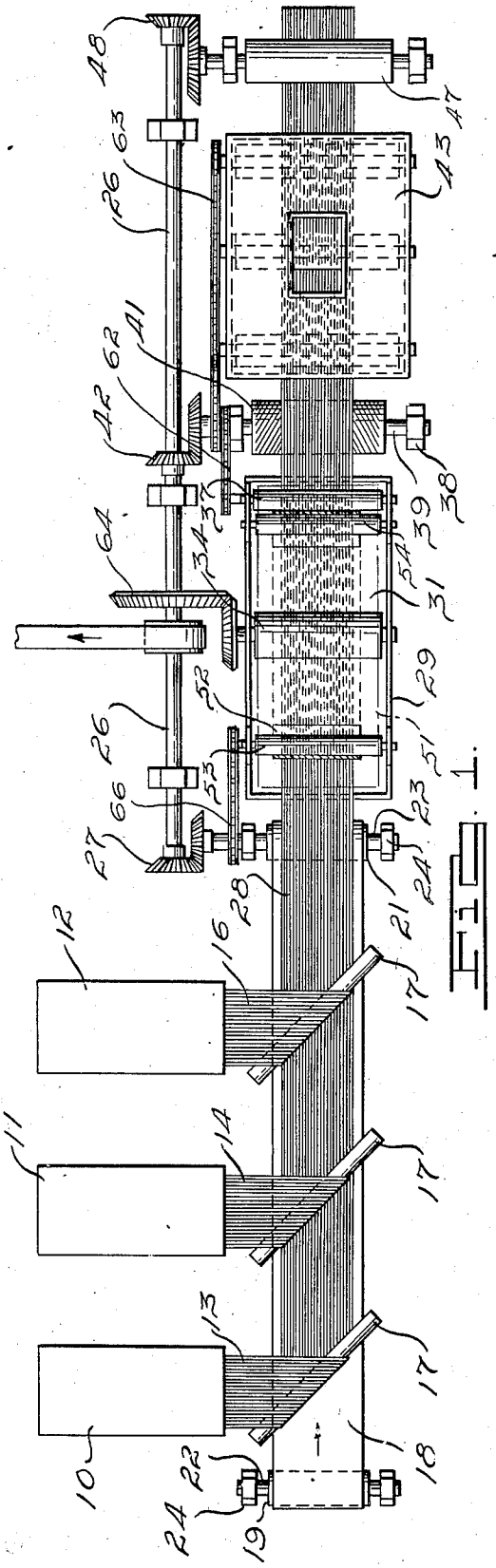


Fig. 1.

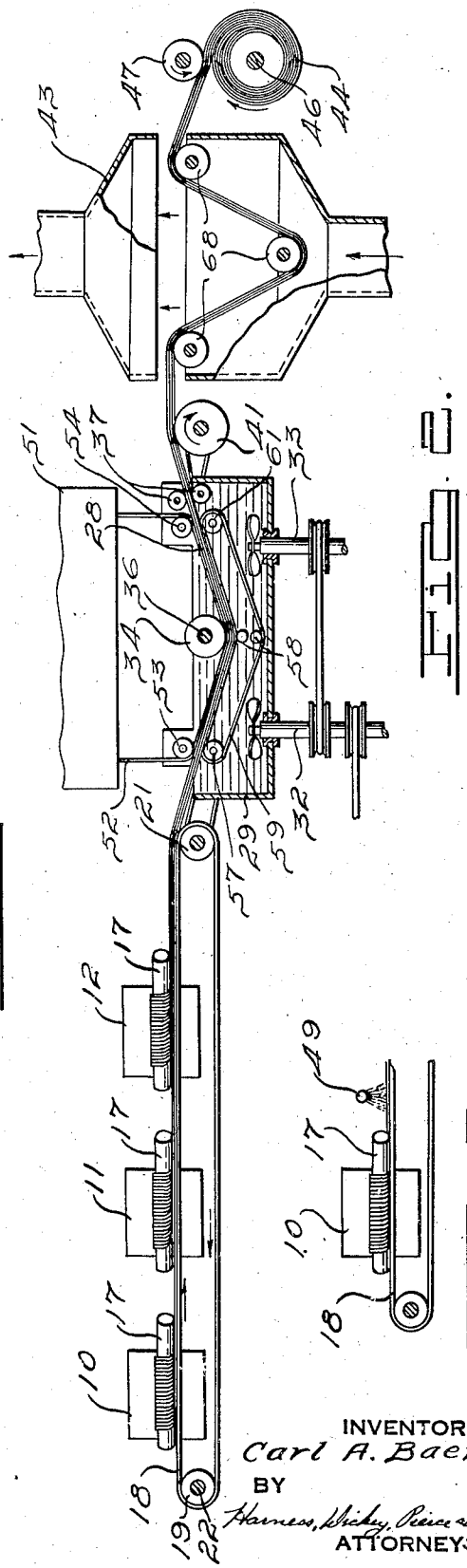


Fig. 2.

Fig. 3.

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PROCESS OF BUILDING FIBROUS SHEETS

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12 Claims. (Cl. 154—2)

This invention relates to a process of manufacturing fibrous sheets and a product produced by the practice of such process.

An object of the invention is to provide a strong, flexible and inexpensive material capable of being employed as a substitute for woven fabric or other similar material.

Another object of the invention is to provide a simple and practicable method of forming fibrous material into strong and flexible sheets without the necessity for spinning, weaving, knitting or any of the numerous manufacturing processes now required to accomplish this result to obtain an equivalent article, after the usual steps of textile preparations are completed.

Another object of the invention is to dispense with the spinning operation now ordinarily involved in the manufacture of textile materials by employing a resilient bonding agent for holding together the fibers coming from machines employed for cleansing and arranging them in any desired order.

Another object of the invention is to provide a single and continuous process for converting loose fibers into a continuous strand or sheet by first arranging them in the desired order and then applying a bonding agent thereto which will hold the fibers permanently in interlocking relation.

Another object of the invention is to form loose and unfabricated fibers into a finished product by an additional step in the process of textile preparation.

Another object of the invention is to provide a process by which certain fibrous materials having very smooth exterior surfaces can be fabricated to form relatively strong material whereas if the tenacity of the fibers alone were relied upon the product would have a much lower tensile strength.

Another object of the invention is to fabricate the loosely arranged fibers delivered in sheet form by a carding or other similar machine into a product having great longitudinal tensile strength and a sufficiently high transverse tensile strength to be suitable for forming the plies employed in the construction of pneumatic tires.

Another object of the invention is to provide a relatively strong fabric composed of a mixture of cotton and asbestos fibers and formed directly into fabricated sheets from a mixture of the loose fibers of such materials.

The invention generally contemplates the collection of loose fibers in any desired form, as for example in a continuous sheet, and then emersing or otherwise impregnating them with a latex solution capable of coagulation upon the fibers to hold them permanently together to form a strong, fabricated material. In the illustrated embodiment of the invention the fibers are delivered upon a moving conveyor from carding or other suitable fiber arranging machines, where the fibrous webs or sheets thus delivered are superposed one upon another to form a composite fibrous sheet. Such composite sheet is discharged from the end of the conveyor into a tank containing a solution of latex or other similar substance which binds the fibers together in whatever relation they are in when the bonding agent coagulates. A dryer or heater of any suitable character may be employed to assist in coagulating the bonding agent. While any kind of fibers may be employed in broadly practicing the process, as a matter of illustration in the present instance the fibers will be considered as being of an asbestos and cotton mixture capable of forming a sheet of material the tensile strength of which is not so injuriously affected by the high operating temperatures encountered in fabrics employed in the manufacture of pneumatic tires, as fabrics now conventionally used for this purpose.

In the drawing:

Fig. 1 is a diagrammatical plan view of an apparatus which may be employed for practicing the process herein disclosed and with the fabricated fibrous sheet resulting from the practice of the product illustrated therein.

Fig. 2 is a longitudinal sectional view through the apparatus and product illustrated by Fig. 1.

Fig. 3 is a view illustrating a slightly different form of apparatus for practicing the process embracing the principles of the invention.

Referring particularly to the drawing there is employed in practicing the invention one or more carding or other machines such as 10, 11 and 12, adapted to form and to deliver one or more fibrous sheets or webs 13, 14 and 16 respectively. These sheets as delivered from the carding machines consist of loose and independent fibers arranged in any desired order depending upon the manner in which they are treated within the machines. In the present instance cotton and asbestos fibers in any desired proportion are uniformly distributed upon supporting surfaces within the machines with the fibers lying generally in parallel relation longitudinally of the sheets but preferably overlapping one another to an appreciable extent. These are discharged over angularly disposed glass bars 17, or other suitable devices, upon a continuously moving

conveyor 18 supported at the opposite ends thereof on rollers 19 and 21. Shafts 22 and 23 extending through the rollers for supporting the latter are rotatably mounted in bearings 24 and the shaft 23 is driven in any suitable manner as by a driving shaft 26 and gears 27.

The sheets 13, 14 and 16 are superposed upon the conveyor to provide a composite sheet 28 which is discharged beyond the end of the conveyor 18 into a tank 29 containing a solution 31 of latex having therein all the ingredients necessary for its coagulation, or any other solution suitable for providing a bonding agent between the fibers of the composite sheet. The tank 29 preferably has stirring or agitating devices 32 and 33 projecting therein for circulating the solution contained therein to prevent the separation of its ingredients where such is likely to occur. The solution is kept at a proper consistency by adding thereto in proper proportions the ingredients adhering to the sheet in its passage therethrough.

In order to hold the composite sheet in a uniform position within the tank there is provided a roller 34 engaging the upper surface thereof and rotatably mounted below the level of the solution 31 therein upon a shaft 36 journaled in the sides of the tank. From the tank 29 the sheet 28 is withdrawn through a resiliently mounted pair of pressing rollers 37 which are adapted to squeeze out of the sheets any surplus liquid adhering thereto. Just beyond the tank a shaft 39 is rotatably mounted in bearings 38 and on which is supported a spreading roller 41, the exterior surface of which is spirally corrugated in opposite directions from the center thereof. The shaft 39 of the roller 41 is driven from the drive shaft 26 through gears 42 in such manner that the peripheral speed of the spreading roller is somewhat greater than the rate of movement of the composite sheet 28 thereacross. Under such circumstances the spirally formed surface of the roller tends to pull the edges of the sheet in opposite directions and consequently to remove from the sheet any wrinkles or contraction therein.

Beyond this roller the sheet is passed through any suitable heater or drier indicated at 43 where the rate of coagulation of the ingredients of the solution, or the drying of the liquid, is materially accelerated. Beyond the heater 43 the sheet is spirally wound in the form of a roll 44 upon a shaft 46 which is driven by frictional contact between the exterior surface of the roll 44 and a roller 47 in turn driven from the shaft 26 through gears 48.

In addition to the roller 34 for holding the composite sheet 28 in a uniform position within the tank 29, the sheet also may be held in position in such region by upper and lower endless belts 52 and 59 respectively, and which are preferably of the same width as the conveyor belt 18. These belts may be formed of any material as, for example, rubber or other felting material or of wires or screen suitably arranged for this purpose. For positively driving the composite sheet through the tank 29, the roller 34 may be driven by bevel gears indicated at 64 and this roller may be employed for driving the belt 52 by reason of its frictional engagement therewith. Rollers 53 and 54 mounted in the sides of the tank 29 are employed for holding the belt 52 in engagement with the composite sheet 29 in the region where the composite sheet enters and leaves the liquid contained within the tank. The upper portion of the belt 52 may be housed within a cleaner and drier 51 which may be additionally employed, if desired, for scrubbing or scraping the coagulated latex solution from the belt and for returning it to the composite fibrous sheet in a clean and dry condition. The lower belt 59 is mounted for operation in any suitable manner within the tank as, for example, upon end rollers 57 and 61 rotatably mounted within the tank and an intermediate pair of rollers 58 mounted in the tank beneath the roller 34. Either one or both of the rollers 57 and 61 may be driven in any suitable manner as, for example, by a chain and sprocket mechanism 66 driven from the shaft 23. Either or both of the pressing rollers 37 may be driven by a chain and sprocket mechanism 63 driven by the same shaft also may be employed for driving any number of the rollers 68 employed in the heater or drier 43 for supporting the composite sheet therein. It is to be understood, of course, that the above described mechanism is merely illustrative of the principles of the invention and that any other suitable mechanism may be employed for conveying the fibrous material during the various steps in practice of the process to which the invention principally relates.

The coagulated latex upon the sheet forming the roll 44 tends to condense the fibers into a relatively compact form wherein they adhere to one another tenaciously by reason of the irregular formation thereof and the coagulated substance thereon.

In this form the sheet constitutes a finished produce which may be employed for whatever purpose desired, an illustration of one use of which is in the formation of plies for pneumatic tire construction. When so employed it is apparent that the material will have great strength in a direction parallel to the fibers and by reason of the interlocking relation of the fibers will be considerably stronger in a direction perpendicular to the fibers than materials now employed.

The asbestos fibers when employed will not be appreciably affected by the temperatures encountered in the operation of pneumatic tires and consequently will not deteriorate in tensile strength at such a rapid rate as do the cotton fibers now employed.

It is to be understood that any kind of fibers may be employed in constructing a fabric embracing the principles of this invention and that any kind of machine for arranging the fibers in the order desired likewise may be employed.

In Fig. 3 there is disclosed an apparatus by which a solution of latex with suitable ingredients therein may be sprayed or otherwise deposited upon the sheets either separately or in composite form as such sheets are delivered upon the conveyor 18 from the carding machines, one of which is indicated by the numeral 10. Any suitable spraying or depositing device such as a perforated pipe indicated at 49 may be employed for this purpose. The fibrous sheets so impregnated with the solution may be heated or dried as hereinbefore described to increase the rate of coagulation of the solution and then may be wound in rolls for shipment.

While the process and product herein disclosed constitutes a preferred form and application of the invention, it should be understood that there are numerous modified and equivalent ways of practicing the principles of the invention within the scope of the appended claims.

I claim:—

1. The process of fabricating fibrous materials

which comprises assembling loose and independent dry fibres into a composite homogeneous sheet comprised of multiple film-like layers of undrawn carded fibres with the fibres in each film longitudinally arranged and in natural tension and subsequently to the formation of the homogeneous multiple film-like fibre sheet, applying to said sheet a bonding agent for holding the fibres together to form a compressed and interlocking mass, and allowing the bonding agent to set with the fibres maintained in their normal lengthwise position and under normal tension during bonding and subsequent setting of the bonding agent.

2. The method of forming fabricated sheets which comprises uniformly distributing loose and independent dry fibres upon a supporting surface to form a web of overlapping fibres which comprises a plurality of carded fibrous films superimposed upon each other with the fibres in each film longitudinally arranged and in natural tension and while the web of fibres is carried by the supporting surface and thereafter subsequently to the complete formation of the web of multiple films upon said surface impregnating said web with a coagulative bonding agent to provide a composite fabric.

3. The method of forming fabricated fibrous sheets which comprises uniformly distributing loose and independent dry fibres upon a movable supporting surface to form a web of overlapping fibres comprised of a plurality of carded fibrous films superimposed upon each other with the fibres in each film longitudinally arranged and in natural tension, and while the web of fibres is carried by the supporting surface and subsequently to the complete formation of the web of multiple films upon the movable surface impregnating the fibrous structure with a coagulative bonding agent to provide an interlocking fibrous mass.

4. The method of forming loose and independent dry fibres into a composite product which comprises arranging said fibres under natural tension in overlapping relation and in a plurality of superimposed carded films with the fibres in each film longitudinally arranged upon a supporting surface and in thereafter applying a coagulative bonding agent to said fibres, compressing said fibres together to expel the excess bonding agent and to assemble the fibres in more compact relation and thereafter with the fibres left in their previously arranged lengthwise position heating said product to increase the rate of coagulation of said bonding agent.

5. The process of forming a fabricated product which comprises uniformly distributing loose and independent dry fibres upon a supporting surface to form a web of overlapping fibres comprised of a plurality of carded fibrous films superimposed upon each other with the fibres of each film longitudinally arranged and in natural tension and subsequently to the complete formation of the web of multiple films upon the supporting surface applying a coagulative bonding agent to said fibres, thereafter compressing said fibres to eliminate the excess bonding agent therefrom and to assemble the fibres in more compact and interlocking relation, and then effecting setting of the product while the fibres remain in their previously arranged lengthwise position and in their subsequently compacted condition.

6. A process of forming a fabricated fibrous product which comprises uniformly distributing loose and independent dry fibres upon a supporting surface to form a web of overlapping fibres comprised of a plurality of carded fibrous films superimposed upon each other with the fibres in each film longitudinally arranged and in natural tension and subsequently to the complete formation of the web of multiple films and while said web is supported upon the surface immersing the web in a latex solution containing suitable coagulating ingredients, and thereafter heat treating said web to increase the rate of coagulation of the substance adhering to said fibres and causing setting of the bonding agent with the fibres under the natural tension which they had when arranged upon the supporting surface.

7. The process of forming fabricated fibrous sheets which comprises carding loose and independent dry fibres to provide a uniform and continuous web of undrawn carded fibres with the fibres in each web longitudinally arranged, superposing a plurality of such webs one upon another to provide a continuous composite homogeneous sheet, thereafter after the complete formation of the fibrous sheet immersing said composite sheet in a coagulative latex solution, and in effecting setting of the latex solution with the fibres under natural tension no greater than normal carding tension.

8. The method of forming fabricated sheets which comprises successively superposing dry carded fibrous laps upon a continuously moving fibre supporting conveyor, with the fibres in each lap longitudinally arranged with respect to each other and under natural tension, and thereafter subsequently to the superposition of the fibrous laps impregnating said laps with a coagulative solution providing a bonding agent between fibrous elements thereof, and in effecting setting of the bonding agent while the fibrous elements of the laps are maintained under no greater lengthwise tension than that of the lengthwise tension of the fibrous elements of the laps upon impregnation with the bonding agent.

9. A fabricated product comprising a carded but undrawn fibrous web having the fibrous thereof secured together by a coagulative bonding agent with the fibres secured together under no greater lengthwise tension than the lengthwise carding tension of the fibres and with the fibres arranged lengthwise of the web and generally parallel with one another and in relatively straight condition.

10. A fabricated product comprising a plurality of fibrous sheets of undrawn carded fibres secured together by a coagulative bonding agent with the fibrous sheets under natural tension and with the fibres arranged lengthwise of the web and generally parallel to each other, relatively straight and longitudinally arranged in the sheet.

11. The invention set forth in claim 10 in which the fibres comprise carded asbestos fibres.

12. The invention set forth in claim 10 in which the fibres comprise carded cotton and asbestos fibres.

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