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MANUFACTURE OF SHEETED FIBER BINDER PRODUCTS

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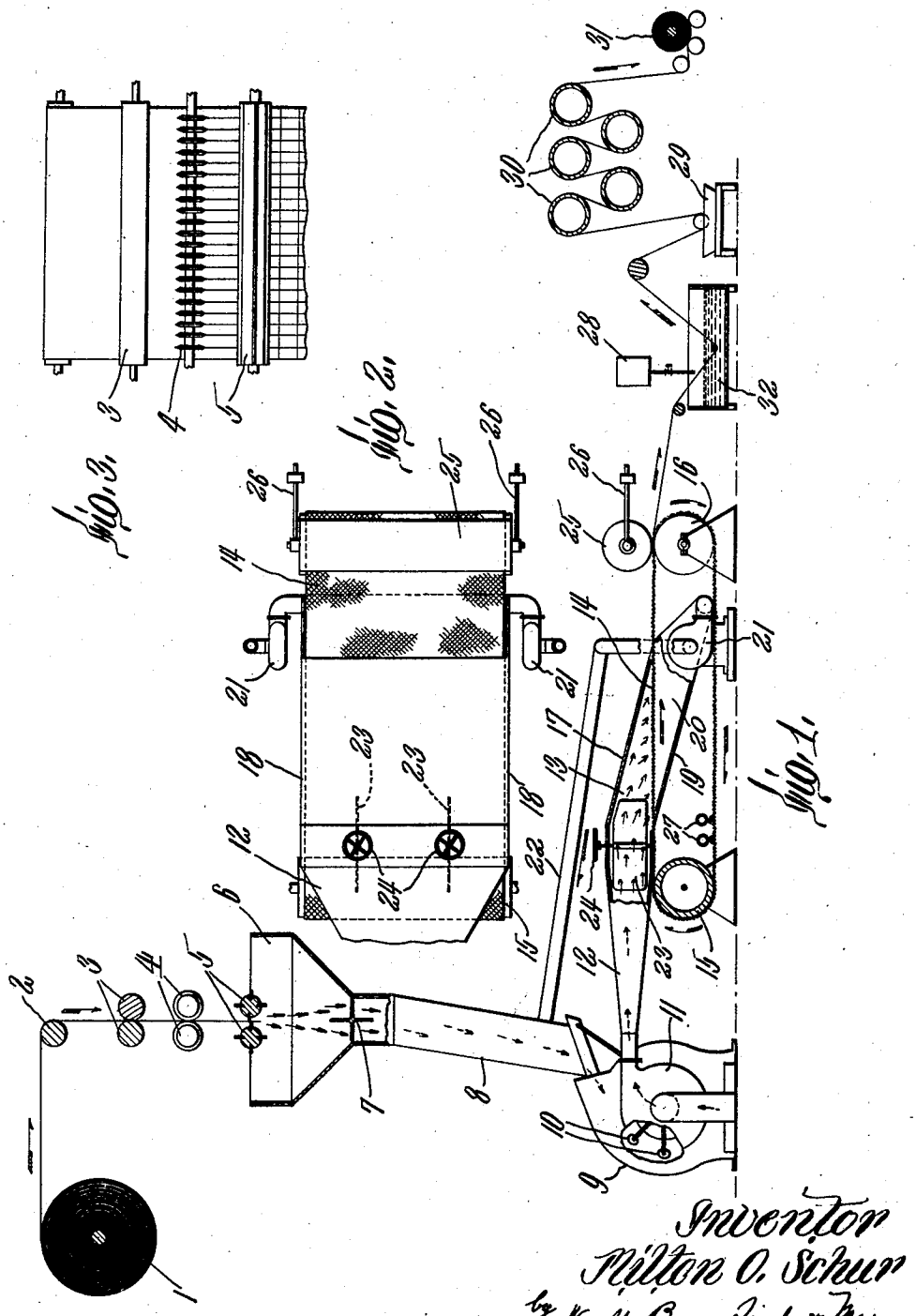

Fig. 3.

Fig. 2.

Fig. 1.

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## MANUFACTURE OF SHEETED FIBER-BINDER PRODUCTS

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2 Claims. (Cl. 154—2)

The subject of this invention is sheet fiber products combined with impregnating media which impart certain desired characteristics thereto. This invention further deals with a method of making such products.

In making webs or foundations of fibrous material adapted to undergo impregnation with asphalt, latex, rubber solutions, viscose, glue-glycerine solutions, or other liquid media which after drying or setting in the web impart thereto such characteristics as strength and water resistance, it is frequently the practice to start with fibrous material as an aqueous pulp suspension and to run off the suspension on machinery of the papermaking type. The usual types of paper machines, e. g., a cylinder or Fourdrinier machine, deliver a more or less compact web or felt, especially when the pulp has been beaten or hydrated to a substantial degree prior to its sheeting. It has been a matter of difficulty and considerable expense to depart from standard papermaking practice in the direction of producing on machinery of the paper making type a web of loosely interfelted, substantially unpressed fibers. For instance, when a lightly beaten pulp is used as a raw material and such pulp is deposited from aqueous suspension on an endless foraminous carrier or wire gauze as a layer or web to be dewatered to dry condition without undergoing much compacting, it is found necessary to evaporate large quantities of water from the web, and sometimes to support the web on the carrier during the drying operation. This means either slow running of the machine or equipping it with exceedingly long driers. In either case, drying of the web is expensive and its handling difficult,—increasing with the fluffiness or looseness of structure of the finished web. Again, one cannot, under the best conditions, avoid the action of surface tension during the drying of the web in drawing together the fibers.

In accordance with the present invention, I can produce at low expense an exceedingly loose and fluffy web by using dry cellulose fiber and forming a web directly therefrom. More especially, it is within the contemplation of my invention to be able to use comparatively inexpensive short fibers, such as wood pulp, as the raw material. In this connection, it should be mentioned that when wet wood pulp is dried, the fibers tend to aggregate into hard clumps. Ordinarily, the manufacturer of wood pulp stores and markets his product as so-called drier sheet, which is made by forming the pulp and drying it as sheet material on large-capacity pulp driers. Such drier sheet is not unlike heavypaper board in its density or compactness, but may be readily disintegrated into small pieces. Ordinarily, the drier sheets are broken up and slushed with water in a beater engine, wherein beating or hydration of the fibers is effected as previously described, prior to the delivery of the aqueous pulp suspension to a machine of the papermaking type. The initial step of my process, on the other hand, is the conversion of the fiber, whatever be its origin or form, into a fluffy, dry mass from which individual fibers or flocks of fibers may be lifted and blown readily by a gaseous medium, such as air, to a web-forming machine. In the case of wood pulp, dense aggregates of fiber, such as pieces of drier sheet, may be readily and inexpensively converted into the desired kind of fluffy mass by passage through a hammer mill. I have found that fiber may be lifted from the hammered mass by a blast of air, and then deposited on a foraminous backing or wire gauze, against which the blast is directed, as a uniform layer or web of interfelted fibers. Such a web is characterized by a random arrangement of fibers, by which I mean that there is no marked lay of the fibers in any one direction. So, too, its structure is far more loose and fluffy than a waterlaid web produced under conditions conducive to maximum looseness and fluffiness. The process of the present invention comprehends the foregoing practice of forming a loose and fluffy web whose compactness and strength may be increased at will by mere pressing. It is thus seen that I am enabled to realize webs of a wide variety of compactnesses or densities and strengths. A web formed by what may be termed a dry deposition of fluffed fibers may be impregnated with media such as asphalt, latex, and the like, to produce products useful in many arts. These impregnated products are characterized by uniformity and strength, because of the random entanglement of the fibers as opposed to the marked lay or predominance of direction given the fibers on carding or other textile machines, and the appreciable lay effected even on paper machines. In some cases, liquid binding media, such as asphalt or latex, may be sprayed onto the fibers while they are suspended in air and immediately before their deposition as a layer, although, as indicated, the preformed web may be treated with such media for the first time. Such treatment may be performed while the web is being supported by a suitable foraminous backing, for instance by the same backing on which it was formed, especially when the web is weak and is to undergo the stress of

being drawn continuously through a bath of the impregnating medium, under which conditions it is apt to be ruptured, if permitted to sustain itself. The web produced by my process may be a composite one in the sense that it is made up of layers of different classes of fibers possessing different characteristics. For instance, the foraminous backing or carrier on which the web is formed may initially receive a blast of air carrying chemical wood pulp fibers of high alpha cellulose content, then a blast of air carrying unrefined chemical wood pulp fibers such as kraft or sulphite pulp fibers, and finally a blast of air again carrying chemical wood pulp fibers of high alpha cellulose content. Such a composite web may be of some advantage as a base in a rubber-impregnated product intended for use as power belting, as the outer layers being composed of a more highly absorptive fiber of superior physical and chemical characteristics, are able to absorb more rubber at their surface portions and better to withstand wear at these portions.

With the foregoing and other features and objects in view, I shall now describe my invention in conjunction with the accompanying drawing, wherein

Figure 1 represents diagrammatically and conventionally a machine for producing sheet fiber products embodying the priniciples of my invention.

Figure 2 is a plan view of one portion of the machine.

Figure 3 is a front view of another portion of the machine.

Before describing the machine illustrated, the steps or operations to be performed thereby will be briefly described. Sheeted pulp, for instance refined wood pulp of high alpha cellulose content, is chopped into pieces and fed into a hammer mill which fluffs the pulp into a mass of fibers or fiber flocks capable of being lifted and kept in suspension in a blast or current of air impinging against the mass. The air current is caused to pass through a circuitously moving wire screen on which the fibers deposit or separate out as a layer of loosely entangled fibers, which, after suitable compacting, if desired, may be progressively removed from the screen and wound into a roll, or first put through an impregnating treatment and then accumulated.

Referring to the drawing in detail, 1 indicates a rolled drier sheet of wood pulp which may be progressively unwound, passed over a guide roll 2, then between feed rolls 3, and then between pairs of rotary slitters 4. The series of longitudinal strips coming from the slitters (best shown in Figure 3) pass between a pair of rotary cutters or choppers 5, which serve to divide the strips into relatively small pieces falling into a hopper 6 having a rotating gate 7 at its exit. As the gate rotates, uniform addition of stock is made by way of the chute 8 to a hammer mill of the usual type indicated conventionally at 9, with its casing partly broken away to show a series of hammers 10 mounted radially therein. The hammers act to break up the closely compacted fibers of the sheeted stock into a fluffy mass of fibers or fiber flocks which can be sucked from the bottom of the mill through coarse screens (not shown) by a fan or blower 11. The fiber or fiber flocks become suspended in the blast of air acting upon the fluffed fibers; and this blast of air discharges through a gradually expanding nozzle 12 into a chamber 13, which, as shown, is partly above and partly below a stretch of an endless wire gauze 14 moving circuitously between end rolls 15 and 16, which may be driven by suitable means (not shown). The chamber 13 is defined or enclosed by a sloping top partition 17 and upper side walls 18 terminating just short of the wire gauze, and a sloping bottom partition 19 and side walls 20 also just clearing the wire gauze. As the current of air passes through the traveling wire gauze, the fiber or fiber flocks are deposited or retained thereon as a uniform, coherent layer of loosely entangled fibers. The deposition and entanglement of the fibers on the gauze may be promoted by suction fans 21 communicating through each of the lower side walls 20 of the chamber with the interior of the chamber, and thus creating a suction on the under side of the gauze. The fans 21 may, as shown, exhaust into a pipe 22 leading to the chute 8 so as to effect a recovery and reuse of such fiber or fiber dust as may work its way through the wire gauze. At the entrance into the chamber 13 is shown a pair of gates or dampers 23, whose extent of opening or closing may be controlled by hand-wheels 24. The gates may thus be positioned to deflect the air and fibers carried thereby to certain areas of the gauze when such deflection is necessary to the maintenance of uniform thickness of the web across the gauze. The web is carried from the chamber 13 under a roll 25 pressing down on the web against the end roll 16 and thus serving to compact it. The pressure applied to the web may be determined by counterbalancing the roll as at 26. The web issuing from between the rolls 25 and 16 may be removed from the gauze and accumulated as a roll, before, as shown, it undergoes further treatment as a continuous, self-sustaining sheet in a bath of impregnating medium or binder of the character hereinafter described. The gauze, before completing its cycle to the web-forming station, may undergo the cleaning action of air jets issuing from one or more manifolds 27, which, as shown, are arranged above and transversely of the lower horizontal stretch of gauze.

The treatment of the continuous web may involve guiding it through a bath or pool 32 of suitable impregnating medium, such as latex, supplied from a tank 28. When latex is the impregnating medium, the impregnated web may then be guided through a bath 29 of suitable coagulant, such as acetic acid, to set the rubber in the sheet, whereupon the sheet may be led over a bank of drier drums 30, and the dried sheet finally accumulated as a roll 31. The latex-impregnated sheet may, of course, be dried directly, that is, without undergoing the action of the coagulant, but the use of a coagulant does away with the otherwise prevalent tendency for rubber particles to migrate to the surface of the sheet during the drying operation.

A rubber-impregnated sheet material made pursuant to my invention possesses many important leather-like qualities, including toughness, body, feel, resistance to tear, flexibility, etc. The foundation of the product may be made so fluffy and absorbent that it is capable of absorbing rubber in amount many times its own weight to form a substantially continuous phase of rubber binder in which the foundation is embedded. The rubber coats the fibers and bonds them together without necessarily destroying the porosity possessed by the foundation. In fact, the finished product may be possessed of sufficient residual porosity to permit it to be breathed through like natural leather. As already indicated, the foundation may be impregnated with the other

media hereinbefore mentioned, which impart thereto characteristics similar to or different from those furnished by rubber. Thus, the impregnation of the web with asphalt, as hereinbefore described, results in a bituminized sheet which is an excellent roofing, flooring, and building material.

What I claim is:

1. In the production of fiber-reinforced binder materials, a method which comprises progressively suspending short-fibered, substantially individualized, dry cellulose fibers of the nature of wood pulp in a gaseous vehicle, progressively depositing the fibers from said suspension as a coherent, continuous web, wherein the fibers exist in loose, random state, progressively compacting the web to a self-sustaining condition, progressively passing the compacted web in self-sustaining condition through a bath of liquid impregnant while permitting said impregnant to contact substantially unobstructedly with substantially all of both surfaces of the web and thus to enter the body of the web substantially uniformly and to embed the web in a substantially continuous phase of said impregnant, and causing said impregnant to set in said web.

2. In the production of fiber-reinforced rubber products, a method which comprises suspending short-fibered, substantially individualized, dry cellulose fibers of the nature of wood pulp in a gaseous vehicle, progressively depositing the fibers from said suspension as a coherent, continuous web, wherein the fibers exist in a loose, random, substantially unbonded state, progressively compacting the web to a self-sustaining condition, progressively passing the compacted web in self-sustaining condition through a bath of rubber latex while permitting said latex to contact substantially unobstructedly with substantially all of both surfaces of the web and thus to enter the body of the web substantially uniformly and to impregnate the web with a substantially continuous phase of said latex, and drying the latex-impregnated web.

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