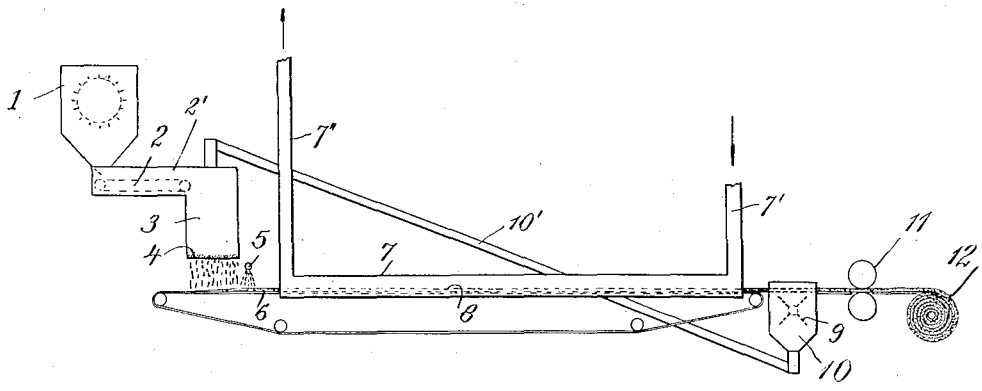
H. F. WEISS.

PRODUCTION OF MATS OF FIBROUS MATERIAL.

APPLICATION FILED MAY 31, 1918.

1,336,402. **Patented Apr. 6, 1920.**



Inventor
Howard F. Weiss
By his Attorneys
Fennie, Davis, Marvin & Edmonds

UNITED STATES PATENT OFFICE.

HOWARD F. WEISS, OF MADISON, WISCONSIN, ASSIGNOR TO C. F. BURGESS LABORATORIES, OF MADISON, WISCONSIN, A CORPORATION OF WISCONSIN.

PRODUCTION OF MATS OF FIBROUS MATERIAL.

1,336,402. Specification of Letters Patent. Patented Apr. 6, 1920.

Application filed May 31, 1918. Serial No. 237,446.

To all whom it may concern:

Be it known that I, HOWARD F. WEISS, a citizen of the United States, residing at Madison, in the county of Dane, State of Wisconsin, have invented certain new and useful Improvements in the Production of Mats of Fibrous Material; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

The present invention relates to the production of resilient masses or bodies of fibrous material in the form of sheets, layers or batting, and more particularly to the treatment of wood to produce such bodies. The invention is especially applicable to the manufacture of the so-called "wood cotton," which is a porous and highly absorbent cellulosic product derived from wood pulp and is eminently suitable, as regards its absorptive properties, for use in the preparation of surgical dressings. Owing to the speed with which the absorption takes place, it can be made in this respect superior to the finest grades of plant cotton.

This wood cotton, at present on the market, however, is open to the objection that its manufacture is extremely tedious and expensive, the ordinary method consisting in first chemically digesting the wood by the sulfite or other known process, then successively bleaching, beating and screening the pulp, and then carrying the sheet-like filament thus formed over a paper machine, a number of the sheets being finally folded upon one another to produce the finished product. The extreme thinness of the sheet, which gives it its open, porous structure, very appreciably cuts down the output of the paper machine and, consequently, is responsible for the high price which must be charged for the product, a machine running on the wood cotton product producing only about one-third as much tonnage as when running on other light weight grades of paper, and the product itself is somewhat less soft than cotton. Furthermore, the beating in water has a tendency to hydrate the product. In present methods of manufacturing wood cotton all of the fibers are pressed together in one plane and their adhesion is due almost entirely to the partial hydration of the fibers and to the pressure applied to them. The resultant product, therefore, looks like paper and possesses little patches of fibers cemented together in the form of "shives." It also is characterized by having slits or holes of various sizes which tend to give it the open, porous and resilient structure desired in absorbent cotton.

According to the present invention, these and other objections as well are avoided. The hydration of the fiber is reduced to a minimum as the fiber is not beaten or separated in water but is separated into a flocculent mass by air shredding. Then, instead of depositing the fibers in a thin layer on a paper machine, in which case the fibers are all in one plane substantially parallel to the surface of the paper, they are deposited in air upon a belt or other suitable member, so that they arrange themselves in a loose, soft, and resilient heterogeneous mass, with the fibers extending in all three cubical dimensions and are treated with an adhesive to bind them together, the character of the adhesive depending upon the use to which the fibers are to be ultimately put, as well as upon the material from which the fibers are obtained. The mass of fibers is next dried and may thereafter be gently beaten to remove the uncemented fibers and produce a less "dusty" mat and finally smoothed out, the last two steps being omitted when desired.

This process of manufacture produces an article of entirely different structure from that prepared by forming the fibers into thin sheets of porous crimped tissure and is much superior in appearance and uniformity, possessing characteristics which are entirely lacking in the so-called "wood cottons" now on the market. It is this heterogeneous arrangement of the fibers; that is, the fibers extending in all directions and planes, that gives the extreme porosity, resiliency, and uniformity to the products made by this process and which are not obtained when the fibers are formed into thin sheets of paper, no matter how much they may be crimped.

While the invention is designed primarily for the treatment of wood fiber and the preparation of an absorbent product therefrom as a substitute for that obtained from plant cotton, it is obviously not limited to the manufacture of this absorbent product, nor, for that matter, to the treatment of

wood fibers; but is to be considered as covering the treatment of fibers or fibrous material obtained from other and different sources, for example, waste paper and utilized for other and different purposes, the mode of procedure being generally the same in all cases. Thus, instead of employing an adhesive having absorbent properties, one having water-resisting properties may be made use of, whether wood fibers or fibers of a different character be used for the body of the mat or batting; and in the latter instance, the finished product may be employed in the manufacture of cushions, upholstery, quilts, bedding, protective wrappers, heat insulating material and a variety of other purposes of more or less similar nature. The adhesive solution may also be treated with a substance or substances which will render it antiseptic, aseptic, or fire resistant. Consequently, while the main object of the invention relates definitely to the treatment of wood fiber and to the manufacture of an absorbent product therefrom which may be put to a certain or particular use, as has already been set forth, yet in its broadest aspect the invention is to be considered as comprehending the treatment of fibrous material in general in the manner above indicated, and the resultant products obtained from such treatment.

The accompanying drawing shows one form of apparatus for carrying out the invention; but the showing is purely diagrammatic, and is given merely to facilitate a complete understanding of the invention. For that reason, the precise structural details of the apparatus are omitted, as forming no part whatever of the present invention.

Referring to said drawing, 1 indicates, generally, a shredder of any desired form wherein the pulp is shredded, preferably in air and in a rather moist condition to enable the fibers to separate more readily and to obtain fibers of greater length, the pulp itself having been obtained previous to this step by cooking the coniferous or other wood chips in a digester by the soda, sulfite, sulfate, or other suitable chemical process. The cooking step is carried out in such a way that a minimum of hydration is produced in the digester, while the pulp possesses a high percentage of cellulose; and at the completion of the pulping operation, the pulp is blown from the digester, thoroughly washed, and, if desired, bleached. The shredded pulp or other fibrous material (for the shredding step is carried out irrespective of the particular material being worked) falls from the bottom of the shredder into a conduit 2′, from which it is delivered to a storage bin 3 by means of a fan, conveyor or equivalent device 2. At the bottom of the bin there is arranged a screen 4 (or a plurality of screens connected in series, if preferred) which acts to sift the fibers onto an endless belt conveyor 6, the latter being driven in any suitable manner and having its stretches arranged horizontally, so that the fibers falling through the meshes of the screen will be deposited in a layer upon the upper stretch of the belt. Between the screen or screens 4 and the aforesaid upper stretch of the belt, there is arranged a sprayer 5, (or, if more than one screen be employed, a sprayer individual to each screen), such sprayer or sprayers serving to discharge an adhesive either directly upon the fibers deposited upon the belt or outwardly in the form of a spray or mist through which the fibers fall. These sprays may be placed directly under the sifting screens or to one side, either arrangement proving satisfactory. Sprays of water and adhesive or steam and adhesive give excellent results. In either case, the adhesive will serve to bind the fibers together, but experiments have shown that when the fibers fall through the mist or spray of adhesive, a somewhat firmer mat or felt containing fewer loose fibers is produced; and it has also been found advisable to deposit a very thin layer of dry fibers upon the belt before the application of the adhesive solution, to provide a cushion which will act to prevent the fibers from sticking to the belt. Where a plurality of screens and sprayers is provided, a relatively-thick mat will be formed; and if such mat is to be utilized for absorbent purposes, the adhesive may consist of a solution containing one-half of one per cent. of soluble starch, though other adhesives and other proportions of starch can be used if preferred. Solutions containing casein and lime, or sodium silicate may be substituted to impart the other properties mentioned. After the mass of fibers 8 has been deposited to the required thickness upon the belt and treated with the adhesive, it is subjected to the drying action of a current of heated air. According to the present disclosure, this drying action is carried out by leading the upper stretch of the belt through a chamber 7 of suitable construction, having an air inlet 7′ at one end and an air outlet 7″ at the other end. Other methods of air circulation can, of course, be used, the main object being the rapid drying of the fiber in clean air. In fact, the drier can be completely closed to outside air and the moisture removed by passing the warm moist air over cold water condensing pipes. On leaving the drier, the mass or mat is caused to pass through a case or chamber 10 containing a rotary beater 9 which gently beats it so as to remove the loose or uncemented fibers and thereby render the mat less "dusty," as previously stated, the fibers thus removed being returned in some suitable manner through a

conduit 10' to the bin or hopper 3. The mat is then passed between a pair of smoothing rolls 11, after which it can be wound upon a reel as indicated at 12, or be otherwise suitably handled. Either the beating step or the rolling step, or both, can be omitted, if desired.

The shredding operation to which the fibers are subjected prior to their deposition on the support, is designed to separate the fibers into individual particles, and I have throughout the specification and appended claims employed the term "shredding" and its derivatives, in a generic sense, to describe the operation of so treating the fibers that each fiber is substantially free from any other fiber. The shredding operation should be conducted with the view of cutting the fibers as little as possible, and only to the extent necessary to secure satisfactory deposition of the fibers in a loose and flocculent layer with the individual fibers extending in all three cubical dimensions.

As will be understood from the foregoing, the process above outlined is applicable to various shredded fibrous materials, while still producing a product of the same general characteristics. Further description and explanation are believed to be unnecessary, and are, accordingly, omitted.

The product made by the above described and hereinafter claimed method is made the subject-matter of a divisional application, Serial No. 292,678, filed April 25, 1919.

I claim as my invention:

1. The herein-described process, which comprises the steps of shredding fibrous material, forming a loose and flocculent layer of the shredded fibers in air, and treating the layer with an adhesive to cement the fibers together.

2. The herein-described process, which comprises the steps of shredding fibrous material, depositing the fibers on a support to form a loose and flocculent layer of the required thickness, and treating the fibers with an adhesive spray to cement them together.

3. The herein-described process, which comprises the steps of shredding fibrous material, depositing the fibers upon a support to form a loose and flocculent layer of the desired thickness, and cementing the fibers together with an adhesive having absorbent properties.

4. The herein-described process, which comprises the steps of shredding fibrous material, depositing the fibers upon a support in air to form a loose and flocculent layer of the desired thickness, cementing the fibers together with an adhesive, and drying the mat thus produced.

5. The herein-described process, which comprises the steps of shredding fibrous material, depositing the fibers upon a support to form a loose and flocculent layer of the desired thickness, treating the fibers with an adhesive to cement them together, drying the mat thus produced, and then beating the mat to remove the loose or uncemented fibers.

6. The herein-described process, which comprises the steps of shredding fibrous material, depositing the fibers on a support to form a loose and flocculent layer of the desired thickness, treating the fibers with an adhesive to cement them together, drying the mat thus produced, beating the mat to remove loose or uncemented fibers, and smoothing the mat.

7. The herein-described process, which comprises the steps of shredding fibrous material, depositing the fibers on a support to form a loose and flocculent layer of the required thickness, and treating the fibers with a water-resisting adhesive to cement them together.

8. The herein-described process, which comprises the steps of producing a clean, dry, wood-cellulose pulp, shredding the pulp to reduce it to a fine, flocculent and absorbent mass suitable for use is surgical dressings, and treating the mass with an adhesive to cement the fibers together.

9. The herein-described process for producing from wood fiber a highly-absorbent product, which comprises the steps of reducing the wood to a cellulose pulp, washing and drying said pulp, mechanically shredding it in air into a uniform, porous and fibrous mass, and treating the mass with a spray containing adhesive material to cement the fibers together.

10. The herein-described process, which comprises the steps of producing a clean and bleached mass of relatively dry wood-cellulose pulp, shredding it in air to produce a fine, loose, flocculent mass suitable for use in surgical dressings, and treating the mass with an adhesive to cement the fibers together.

11. The herein-described process, which comprises the steps of shredding wood-cellulose into a flocculent mass, and treating the mass with an adhesive solution to cement the fibers together.

12. The herein-described process, which comprises the steps of shredding wood-cellulose, depositing the shredded fibers upon a support to form a loose and flocculent layer of the desired thickness, and treating the fibers with an adhesive solution to cement them together.

13. The herein-described process, which comprises the steps of shredding wood-cellulose into a flocculent mass, and treating the mass with a solution containing an adhesive having absorbent properties.

14. The process of manufacturing of a fiber fabric which consists in shredding

wood pulp in a substantially dry condition, then moistening the shredded product while in loose and flocculent condition with a mist of water containing an adhesive material, and then evaporating the water from the fibrous material until it is substantially dry.

15. The process of manufacturing of a fiber fabric which consists in shredding a wood pulp containing not more than 30% of its weight of water, then moistening the shredded product while in a loose and flocculent condition with a mist of water containing an adhesive material, and then evaporating the water from the fibrous material until the total moisture content is less than 15% of the total weight.

16. The process of manufacturing of a fiber fabric which consists in shredding a wood pulp in a substantially dry condition, then moistening the shredded product with a spray or mist of water containing an adhesive material, depositing the sprayed shredded material on a support to form a loose and flocculent layer of the required thickness, and then drying the mat thus produced.

In testimony whereof I affix my signature.

HOWARD F. WEISS.