

UNITED STATES PATENT OFFICE.

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VELLUMOID PAPER CO., A CORPORATION OF WEST VIRGINIA.

TWINE, CORD, &c.

No. 830,221.

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To all whom it may concern:

Be it known that I, CHARLES I. GOESSMANN, a citizen of the United States of America, and a resident of Amherst, in the county of Hampshire and State of Massachusetts, have invented new and useful Improvements in Twine, Cord, &c., of which the following is a specification.

The object of my invention is to produce a twine or cord, &c., of paper or paper-like material which shall be strong, lasting, and flexible, and which will not be injuriously affected by moisture, acids, or alkalies.

A further object of my invention is to produce, when desired, a twine or cord that not only possesses the above-mentioned qualities or characteristics, but is also free from acidity, taste, and odor.

While twine has heretofore been made of paper, it has not had sufficient strength for many practical uses, has not been adapted as binding-twine for binding grain, stalks, &c., and has not been adapted to withstand the effects of moisture.

My invention consists in the method or process and product, all as set forth herein, whereby the objects of my invention are attained.

To enable others skilled in the art to which this invention appertains to understand the same and enable them to carry out the process and produce the product, I herein set forth the methods of procedure that are deemed by me to be the best; but various of the details may be altered to provide for varying conditions of the material being treated to produce the complete product and to produce twine of varying strength, size, &c.

The paper-like material is preferably treated in a continuous sheet, then cut into the desired widths, and then formed into a strand by twisting, braiding, or some analogous operation. The treatment to strengthen and render the material impervious may be applied while the pulp is being formed into paper, or the finished paper may be treated without materially affecting the nature of my invention. If the material is to be treated during the process of formation into paper, the treatment begins, by preference, when the web of pulpy material leaves the Fourdrinier wire or the cylinders, it then being in a damp condition, but with the larger percentage of moisture removed. From this

point the treatment of the fabric is the same, whether it be pulp in a sheet, as above stated, or the finished product of the paper-making machine.

The treatment consists, first, in immersing the fabric in a bath of glutinous material, preferably animal glue, and, by preference, this bath of glutinous material should be hot to effect the more rapid absorption by and more perfect permeation and deposit of the glutinous material in and throughout all the microscopic interstices of the fabric being treated.

By preference a suitable tank is provided in which the solution of glutinous material is contained and in which it may be kept heated to a constant temperature while the fabric is passing through the solution. I prefer that the material being treated be kept in motion or passed continuously through the bath in an unbroken sheet in order to save time. I find that the requisite permeation of the fabric with glutinous matter or the incorporation of the glutinous matter with the fiber will, with some papers—for instance, lightly-sized manila hemp—require but a few seconds' immersion. As the fabric passes from the glutinous bath the surplus material is removed, preferably by compression.

The strength and consistency of the glutinous bath may be varied, depending upon the material or fabric to be treated and the uses for which it is designed. It may be stated, however, that in a majority of cases when designed for treatment for twine or cord a hot solution of about one part animal glue to about fifteen parts water, by weight, gives the best results. A weaker solution of glue is used when the fabric is to be made into twine or cord than when intended for some other purposes in order to provide for the formation of minute openings in the glutinous material, required to make room for the oil, as hereinafter explained, such openings resulting from the action of the heat and moisture medium to which the fabric is subjected after the application of the formaldehyde solution which follows the glutinous bath.

After leaving the bath of glutinous material the fabric is passed into and through a solution of formaldehyde and water. The strength of this solution may also be variable, dependent upon the fabric and the

uses for which the same is intended, as heretofore stated. In a majority of cases, however, a solution of one part of formaldehyde thirty-five-per-cent. solution to five parts of water, by weight, gives the best results, and the best effect is attained if this bath is cool or cold, though any particular temperature is not essentially necessary to give good results; but the cool or cold temperature facilitates the rapidity of treatment. The effect of the formaldehyde solution upon the glutinous-saturated fabric is to precipitate the glutinous matter and render it insoluble. As the fabric comes from the formaldehyde bath, by preference, the surplus adhering to the surface is removed by rolls or other convenient means. The fabric is then dried in any convenient manner; but the quickest result is attained by the air-blast method of drying—i. e., projecting blasts of air against both surfaces of the fabric, hot-air blasts being preferred as most rapid and effective. The drying removes all of the watery constituents and leaves the fabric in a toughened or greatly-strengthened condition, but not in practical condition for commercial uses, as it is brittle, horny, and stiff.

To temper and render the fabric sufficiently soft and pliable to manufacture into twine or cord for commercial uses, I subject it to moisture, thus producing both mechanical and chemical action. The mechanical action is the temporary absorption of water analogous to the absorption of water by a dry sponge, and chemical action is the permanent union or combination of water with the glutinous-treated fabric, analogous to the union of water and tapioca, causing swelling, or like the chemical combination of water with lime or cement. To obtain these effects, I prefer to pass the fabric into a bath of hot water, saturated steam, or equivalent heat and moisture medium, thus causing the fibers and the non-soluble glutinous material filling the interstices to expand in all directions and producing a commingling or thorough incorporation of the fibers and glutinous compound, and at the same time a chemical action (hydration) takes place, whereby the hardened mass of fiber, glutinous material, and formaldehyde becomes tempered and softened and the strength imparted by the previous treatment is increased. While the glutinous material and the fibers are thoroughly united, as stated above, microscopic pores or openings are left in the fabric, into which the oil of a subsequent step is received and held by surface attraction. To heighten the tempering and softening effect, I prefer in some instances to introduce glycerin into the tempering-bath, and in most cases one-half of one per cent. in volume of glycerin gives the best result. After hydrating, the fabric is dried in any convenient manner.

If it is desired to render the material free from all traces of acidity, taste, and odor, I pass it through a bath of hot water and a volatile alkali, (ammonium hydrate,) the proportion by preference in a majority of cases being one per cent. of ammonium hydrate to ninety-nine per cent. of water, by volume, and to hasten the drying out I may add a small percentage of wood alcohol. This bath is preferably warm; but a variation in its temperature will not to a serious extent interfere with its operation. The fabric, if subjected to this bath, is so subjected before being treated with oil. After hydration, or after the alkali bath, the sheet is dried in any convenient manner and then led into a tank of oil, preferably hot. The oil may be of either vegetable, mineral, or animal origin. It penetrates the minute openings in the fabric, hereinbefore described, and its effect is to render the fabric flexible to a high degree. The fabric is now ready to have the surplus oil removed in any convenient manner and to be cut into strips and twisted or braided into twine, cord, &c., either immediately or at a future time.

It will readily be seen that the respective baths may be varied in strength and made applicable to fabrics of different density or porosity, and also applicable to the treatment of different fibrous structures, being modified, as before stated, to suit the conditions required of the manufactured product or in its use. The treatment by a volatile alkali is not essential except where it is desired to remove all traces of acid, &c., and in most instances I omit this step, as a hygienic condition of twine, &c., is not generally required for binding purposes.

The process or method of manufacturing twine, cord, &c., herein set out, may be modified in several ways without departing from my invention, one of such modifications consisting in winding the fabric into rolls after being subjected to the oil treatment, and subsequently removing the excess of oil, if any excess exists, cutting the material into strips, and twisting, braiding, or otherwise forming the material into a strand, which strand when finished would ordinarily be substantially circular in cross-section, although, of course, the same may be formed in other shapes by pressing or otherwise. Another modification would consist in winding into rolls after coming from the second drier, and later treating with oil as the fabric comes from the roll, removing any excess of oil, and cutting into strips of suitable width, and then forming the same into strands by twisting, braiding, or otherwise. Another modification may consist in forming into a strand before subjecting the material to any part of the herein-described treatments, or at any intermediate point in the process. It will therefore be seen that the order of procedure in forming

the material into a strand of the proper shape for practical use may be immaterial with reference to the other steps in the process and may be varied to suit the circumstances and conditions of manufacture, and the beneficial result of my invention thus attained.

Having therefore described my invention, what I claim is—

1. As an improved article of manufacture, 10 twine consisting of paper formed into a strand impregnated with softened insoluble glutinous material and oiled.

2. The improvement in the art of manufacturing twine from paper or other like material, consisting of saturating the material 15 with a glutinous compound, rendering said compound insoluble, tempering the material, treating with oil and forming into a strand.

3. The improvement in the art of manufacturing twine, &c., from paper and other

like material, consisting of saturating with a glutinous compound, rendering said compound insoluble, tempering, and forming into a strand and treating with oil.

4. The improvement in the manufacture 25 of twine, &c., from a strip of insoluble glutinous-saturated tempered fabric, consisting of subjecting the same to the action of heated oil and forming into a strand.

5. The improvement in the art of manufacturing twine, &c., from paper or other 30 like material, consisting of saturating the material with a glutinous compound, rendering the said compound insoluble, tempering, treating with a volatile alkali, treating 35 with oil, and forming into a strand.

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Witnesses:

ALLEN WEBSTER,
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