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WATER-LAID FELT.

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To all whom it may concern:

Be it known that I, HENRY P. SHOPNECK, a citizen of the United States, residing at Dorchester, county of Suffolk, Commonwealth of Massachusetts, have invented certain new and useful Improvements in Water-Laid Felts, of which the following is a specification.

The usual commercial paper felt is generally composed of textile rags, or textile rags to which has been added a small percentage of old newspapers or wood pulp. The usual method of preparing this sheet material consists in beating the rags until the mass has been reduced to a smooth pulp, which is then refined in a jordanning engine, so-called, and which is finally sheeted out by means of a papermaking machine.

In order to be capable of running successfully on a papermaking machine, the fibres of the pulp must of necessity be fairly short—at a maximum approaching 10 millimeters. Such a felt is therefore composed of very short fibres as compared to those found in a woven fabric.

Attempts have been made to prepare paper felt having longer fibres than are usually found in ordinary rag paper felts. Such felts would find utility in holding the stitches of a sewing machine, and in greatly strengthening a felt which would later be impregnated with various materials or substances, as asphalt for instance.

In all of these attempts the material generally relied upon to hold the stitches and impart strength to the processed felts, was tannery hair.

In the absence of better felts, hair felts and felts composed of rags and hair have been used. These, however, have been found unsatisfactory for a number of reasons; first, the cost of hair is very high, being about three times the price of common textile rags; second, in the manufacture of asphalt saturated felt, it is necessary to saturate at a high temperature (400° F.) as the greater the temperature the quicker the felt will be saturated, due to increased penetration of the saturant, and hence the greater the speed of production. At this temperature and really much below it, hair becomes brittle and may carbonize and instead of strengthening the felt, either weakens it or makes it very brittle. Third, the incorporation of hair weakens the plain untreated felt. This is due to the fact that hair cannot be reduced to a pulp and felt, in the same sense that rags or wood pulp can, and hence it acts as a long fibred filler which reduces the tensile and bursting strength of the felt. Fourth, commercial hair is subject to great variation in properties, depending as it does upon the kind of animal, condition of the animal, the season of the year; climatic conditions, the conditions under which the hair is removed from the animal hide. Hair, therefore, is not constant in physical properties. Fifth, ordinary commercial hair generally carries a considerable percentage of lime which has become associated with the hair during the depilatory process. The presence of lime is very objectionable due to the fact that it introduces an alkaline substance on the paper machine and hardens the water, and also because the lime which finds its way into the finished felt makes the felt slightly alkaline, and this greatly retards saturation. Sixth, hair is not an individualized substance as it comes from the animal, and it always lumps up in small wads in the paper maker's beater. Since it is desired to keep the fibre long, it is not permissable to beat the hair hard, and this results in the necessity of giving the stock a prolonged smoothing out operation, greatly increasing the time of preparing the stock for the papermaking machine, and hence decreasing production. Seventh, commercial animal or tannery hair is of limited length by nature. This operates to disadvantage as it is impossible to obtain very long soft hair averaging 2 inches long. Also, what hair is available varies greatly in length and a genuinely uniform felt with hair cannot be obtained except at prohibitive cost.

My present invention has for its object the preparation of a paper felt which contains long fibres other than hair and which overcomes or surmounts all of the present objectionable features of paper felt containing hair, and also the preparation of a felt having properties heretofore nonobtainable.

My present invention contemplates the use of various vegetable fibres which I have found are capable of being incorporated in paper felt as long fibres in a felted or un-

felted condition. In the preparation of such vegetable fibres for my felt, the fibres may be brought to any desired length and can be relied upon for great uniformity in its properties in marked distinction to hair.

I may use for such vegetable fibres jute, manila, hemp, sisal or other long vegetable fibre of similar nature. I may use these fibres in conjunction with rags, wood pulp, newspapers, asbestos or suitable mixtures of them.

The ability to run an all vegetable fibre felt is peculiar to this class of felt as all hair stock cannot be run on an ordinary paper machine. I may beat out some of the vegetable fibre such as jute, to hydration, and then add other fibre which has been kept long and run this combined pulp on the paper or cylinder machine, resulting in an all vegetable fibre felt which is extremely strong. Such vegetable fibres when previously cut to the desired length as on a rag cutter or shredder may be added to the beater along with the rest of the furnish, and run off on the machine without either lumping in the beater or clogging the machine, as hair usually does.

As an illustration of the method I prefer to use in manufacturing this felt, I give the following example; the textile rags or other stock, such as wood pulp, newspapers or mixtures of them, are loaded into the beater and smoothed out to a mere pulp. The beater roll is raised and the cut up jute or other long vegetable fibre is added. Care must be taken not to cut the stock with the beater roll. After the stock is smoothed out, it is run off on the paper machine, or if desired, it may be previously passed through a refining engine and then run off on a paper machine to the desired thickness.

Such a felt finds uses to which woven or steam-felted felts are readily put. It may be used to hold the stitches of a sewing machine, such as when used as a part of an insole in shoes made by the McKay process. It may be saturated with pitch, asphalt or other thermo-plastic binder, and used as a roofing base, flooring base or linoleum backing. When saturated with a thermo-plastic binder it may be used as a box toe material. It is also capable of receiving alcohol or aqueous impregnating solutions without disintegrating. In these uses it has a great number of advantages over hair felt, or paper felt containing hair, and the usual temperature of asphalt saturation may be employed, it being as inert as the textile rags or wood pulp with which it is associated. Such a felt does not carbonize in the asphalt bath nor become brittle. Not having any lime associated with it it does not make the beater water hard, nor does it cause the felt to become brittle when it is dried on the paper machine, nor does it decrease the speed of saturation in asphalt or pitch. These vegetable fibres only cost about a fourth as much as hair.

Hair cannot be hydrated in the sense that that term is used to describe the change which ordinary wood pulp undergoes when beaten in the beater in the presence of water. Hair when kept long is inert as far as being capable of affecting the density of the felt and its hardness. However, vegetable fibre when in the beater may be gradually slightly hydrated, so as to cause the felt to become harder and denser and very much stronger. Vegetable fibres when added to the beater do not lump up, but separate generally, being entirely free from the glutinous and calcareous substance so commonly found associated with animal hair.

In producing this felt it is preferable to treat the stock with reference to two features. The shorter the fibre and the longer the hydration, the greater felting effect is attained. On the other hand, the presence of unhydrated long fibres greatly increased the porosity and softness of the felt, and increases absorbent power. It is therefore desirable in most instances to beat out a certain percentage of fibrous material as a base, as rags, wood pulp, asbestos or suitable mixtures of the same, to a length say of 10 millimeters, or slightly more or less, and add thereto a suitable portion of long vegetable fibres, i. e. jute having an average length of say an inch or inch and a half. A suitable formula is made of 70% rags, 30% jute. As stated above, my invention is capable of practice in great variety and proportions and combinations, and in fact this is one of the great advantages of my felt in that it is capable of being produced with a great variety of characteristics which make it adaptable to a great variety of industries. It is to be understood that what is meant by long vegetable fibres are the elongated fibres composed of a plurality of bundles of fibres which owe their adhesion to the encrusting effect of the ligneous constituents on the intercellular substances.

All such variants are to be considered as within the purview of my invention as defined in the appended claims.

What I therefore claim and desire to secure by Letters Patent is:—

1. A box toe material, consisting of a fibrous pulp and a relatively longer vegetable fibre of the class described distributed throughout the mass in felted relation therewith and impregnated with a thermo-plastic binder.

2. A box toe material, consisting of a fibrous pulp and relatively longer jute fibres distributed throughout the mass in felted relation therewith and impregnated with a thermo-plastic binder.

3. A box toe material, consisting of a fi-

brous pulp and relatively longer vegetable fibres of the class described distributed throughout the same in felted relation therewith and impregnated with a thermo-plastic binder, the proportion of vegetable fibres being substantially less than that of the fibrous pulp.

4. A box toe material, comprising a water-laid felt, consisting of rag pulp and much longer vegetable fibre distributed therethrough and in felted relation therewith, and impregnated with a thermo-plastic binder.

5. A water-laid felt consisting of a rag pulp, and much longer vegetable fibre distributed throughout the mass in felted relation therewith, and capable of being impregnated with a thermo-plastic binder.

6. A water-laid felt, consisting of a rag pulp and relatively longer ligno-cellulosic fibre of the class described, uniformly distributed therethrough.

In testimony whereof I affix my signature.

HENRY PHILIP SHOPNECK.