Jan. 26, 1965 J. J. BERNARD 3,166,823

METHOD OF MAKING FELT-LIKE STRUCTURE

Filed Aug. 29, 1963

FIG. 1

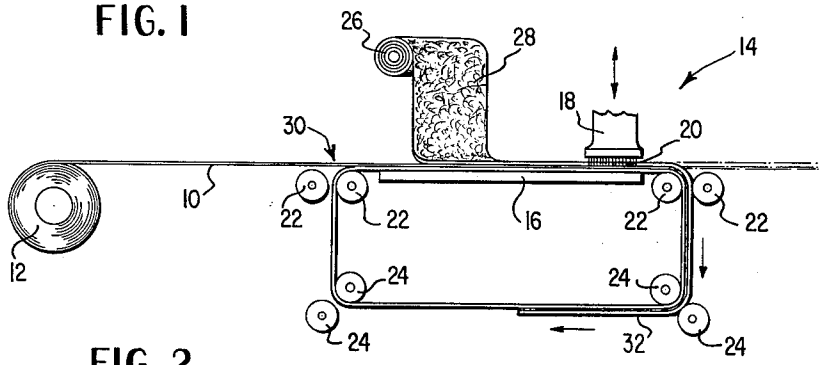


FIG. 2

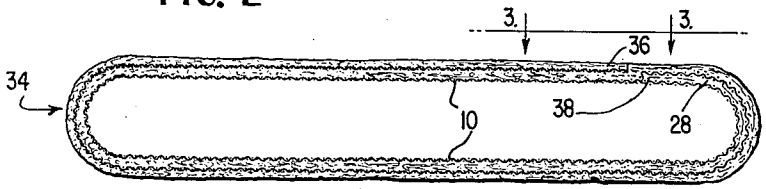


FIG. 3

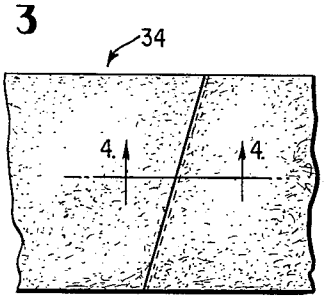


FIG. 4

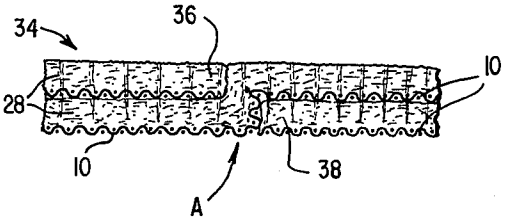
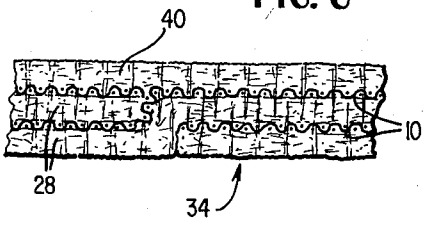


FIG. 6



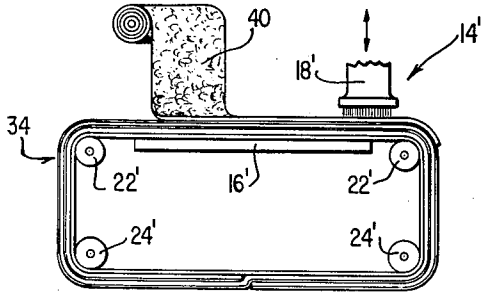


FIG. 5

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METHOD OF MAKING FELT-LIKE STRUCTURE

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3 Claims. (Cl. 28—72.2)

This invention relates to improved felt-like structures and methods of making same.

It is a particular object of the present invention to provide an improved felt-like structure having particular utility in the papermaking art.

Papermakers' felts are employed in the manufacture of paper to pick up a freshly laid web of wet paper after it leaves the forming wire or cylinder; to conduct the web through the paper finishing presses; and to remove water from the paper in press sections and the like.

A papermakers' felt must have a high degree of dimensional stability, properties permitting the felt to pick up and retain the fibers of the paper during the processing thereof and the felt must be of sufficient porosity to permit rapid removal of water from the freshly laid paper sheet. These properties of the felt must be substantially uniform throughout the felt if the paper produced and finished thereon is to be uniform in quality.

Felts as conventionally constructed and finished are generally woven from wool or wool-synthetic blend yarns and thereafter subjected to conventional fulling procedures to provide the necessary closeness of weave desirable in papermakers' felts. Further, papermakers' felts are extremely large ranging from about 100 inches to about 350 inches across and having lengths from about 25 feet to about 250 feet. The large size and the necessity that each papermakers' felt fit a particular papermaking machine has necessitated custom designing, construction and finishing of each felt, thereby materially increasing the cost of production.

It is a primary object of the present invention to provide a method of making felt-like structures which materially reduces both the lead time and the time of production of belt-type papermakers' felts and which compare favorably with the best grade woven and fulled felts as to dimensional stability, water removal properties and the like.

A further object is to provide a method of making felt-like structures in belt form from a stock fabric which may be prefabricated and stored until needed, thereby eliminating time consuming endless weaving and splicing operations which presently burden the papermaking felt manufacturing industry.

These and other objects and advantages are provided by a method of making endless belt-like fabrics comprising needling a batt of fibers to at least one surface of a web-like base material to provide a stock fabric, needling said stock fabric into an endless belt consisting of at least two convoluted layers of stock fabric, and needling a final batt of fibers to at least one surface of said endless belt and by an improved papermakers' felt comprising an endless belt constructed of a plurality of superposed convoluted layers of a base material having needled thereto batts or fibers and a final batt of fibers needled to at least the outer surface of said convoluted belt-like structure.

The invention will be more particularly described with reference to the accompanying drawings wherein:

FIG. 1 is a diagrammatic view illustrating the formation of a stock fabric from a base fabric and a source of batt of fibers;

FIG. 2 diagrammatically illustrates a stock fabric which has been converted into an endless belt composed of convoluted layers of said stock fabric;

FIG. 3 is a section substantially on line 3—3 of FIG. 2;

FIG. 4 is a section substantially on line 4—4 of FIG. 3;

FIG. 5 is a diagrammatic illustration of means for converting the belt illustrated, for example, in FIG. 2 into an endless fabric having a final batt of fibers needled thereto; and

FIG. 6 is a greatly enlarged fragmentary sectional view similar to that illustrated in FIG. 4 of a felt-like fabric constructed in accordance with the teachings of the present invention.

Referring to the drawings and, in particular, to FIG. 1 thereof, 10 generally designates a base material. The base material 10 may comprise a woven fabric, a sheet-like film, a non-woven fabric, a bonded web, or the like. The base material may be constructed or formed from natural or synthetic materials or combinations thereof. For example, if the base material is composed of a woven fabric, the warp yarns may comprise a natural fiber such as wool or blends of wool and synthetic fibers such as nylon, Dacron, Orlon and the like and the filling yarns may comprise the same materials or comprise different materials and the warp and filling yarns need not be of the same tensile strength or denier.

The base material provides a web to which a batt or batts of fibers are needled to form a stock fabric and the base material assists in providing dimensional stability to the formed felt-like structure. The thickness of the base material or the denier of the yarns forming the base material may be varied over a substantial range depending on the ultimate end use. The selected base material would be determined by the felt classification which is determined by the position of the felt on a paper machine and the grade of paper being manufactured. Very satisfactory results have been provided by a base material composed of a woven fabric having about 20 warp ends per inch and about 20 filling picks per inch; the yarns in both the warp and the filling comprising about 840 denier, high tenacity nylon. This fabric combines strength and openness of weave to provide the necessary substantial dimensional stability and good water removal properties.

The selected base material is illustrated as being fed from a bolt 12 into a needling apparatus generally designated 14. The needling apparatus includes a bed 16 and a reciprocating needle beam 18 which support a plurality of felting needles 20. The illustrated needling machine 14 is of the type which permits the construction of endless belts and includes a plurality of rolls 22 for directing and supporting the passage of the base material 10 through the needling apparatus and a plurality of cooperating rolls 24 which permit the return run of the base fabric for plural passes beneath the reciprocating needle beam 18. The assembly illustrated in FIG. 1 also includes a source 26 of batt fiber 28 which is laid upon the base fabric preceding the passage of the material below the reciprocating head 18 of the needle loom. The means for applying the batt of fibers 28 to the base material 10 is not specifically illustrated in the drawings and may comprise any of the plurality of batt laying devices known in the art. Further, the batt of fibers may be laid at an angle to or parallel with the direction of movement of the base material 10 through the needle loom.

At this stage in the process, the source of base material 12 may be passed through the needle loom 14 and collected on a suitable take-up roll not illustrated in FIG. 1, thus providing a single layer of base fabric with a batt or batts of fibers needled thereto.

As indicated hereinabove, the base material may be formed into an endless belt directly on the apparatus illustrated in FIG. 1 by returning the end of the base material with the layer or layers of batt material 28 needled thereto

to the lead end 30 of the needling machine 14 as illustrated by the fabric 32 whereby on the second pass a convoluted needled felt-like structure as illustrated in FIGS. 2, 3 and 4 is formed. During the formation of the belt-like convoluted fabric 34, successive layers of base material 10 and batt material 28 are needled to each other or plural layers of batt material may be needled to successive layers of base material 10. Preferably, in forming the convoluted belt-like needled fabric 34, the lead edge 36, of base fabric 10 and batt 28, is cut to provide a diagonal edge. Similarly, the trailing edge 38, of batt material 28 and base fabric 10, is cut along a line which coincides with the cut diagonal 36 so that the final needled product has substantially uniform thickness throughout including the zone indicated at A in FIG. 4 where the leading and trailing edges of base material 10 and batt 28 are joined. With this form of construction, substantially uniform physical properties are provided for the entire belt-like fabric and any differences in thickness caused by the splice will be minimized as only small portions of the spliced zone will pass between roll nips in the press sections of papermaking machinery at the same time.

After completion of the belt from the stock fabric, a further layer or layers of batt fiber 40 is needled to at least one surface of the belt-like structure.

Referring particularly to FIGS. 5 and 6, a needle loom generally designated 14', which may comprise the same machine illustrated at 14 in FIG. 1, is utilized to apply the final batt or batts of fibers to the belt-like structure 34. The needle loom 14' includes a bed 16', a reciprocating needle head 18' and fabric control roll 22' and 24'. In applying and needling the final batt or batts of material 40 to the surface of the belt-like fabric 34 to provide the structure as illustrated in FIG. 6, it is preferable to turn the belt-like structure 34 so that the inside surface composed predominantly of the base material 10 is positioned on the outside of the belt whereby when the batt or batts of fibers 40 are needled to said surface, both the inner and outer surfaces of the fabric are provided with a layer of batt fiber. In applying the batt of fibers 40 to the convoluted fabric 34, care should be exercised so that the final batt or batts of fibers 40 meet in edge-to-edge alignment as hereinabove discussed with relation to edges 36 and 38 of the convoluted belt to create a smooth surface for the felt-like structure.

The batts of fibers 28 and 40 may be the same or different in compositions. Further, the batts of fibers may comprise wool or synthetic materials or mixtures or blends thereof.

Example

A papermakers' felt was constructed employing a base material composed of a woven fabric wherein both the warp and filling yarns comprised 840 denier high tenacity nylon yarns. The fabric had a plain weave and there were 20 warp ends and about 20 filling picks per inch of fabric. Needled to the base fabric was a carded web of fibers comprising 70% wool fibers and 30% nylon fibers. The carded web of fibers was applied to the base fabric by means of a single pass through a conventional needle loom having approximately 3 needles per square inch. This material was then wrapped to form an endless belt consisting of two thicknesses of batt and base material which was joined by passing the convoluted fabric through a needle loom. A further layer of batt material consisting of a carded web comprising 70% wool fibers and 30% nylon fibers was securely attached to the belt-like structure by passing the belt and the web of batt material through the bank of needles three times.

The finished product was found to have a soft-cushiony layer very satisfactory for carrying paper sheets on papermaking machines and the finished product was found to have good dimensional stability and water removal properties.

In general, the number of layers of base fabric and batt material, in manufacturing papermakers' felts, has been found to be from two to about eight and preferably between two and four. Further, it has been found that very satisfactory papermakers' felts are provided when the weight of the batt material applied to the base material is from about two to about fifteen oz./sq. yd. of final felt with the preferred range being from about three to about six ounces of batt material per square yard of final felt.

I claim:

1. A method of making endless belt-like fabrics comprising needling a batt of fibers to at least one surface of a web-like base material to provide a stock fabric, needling said stock fabric into an endless belt consisting of at least two convoluted layers of said stock fabric, and needling a final batt of fibers to at least one surface of said endless belt.

2. A method of making endless belt-like fabrics comprising needling a batt of fibers to at least one surface of a web-like woven base fabric to provide a stock fabric, needling said stock fabric into an endless belt consisting of at least two convoluted layers of said stock fabric, and needling a final batt of fibers to at least one surface of said endless belt.

3. A method of making endless belt-like fabrics comprising needling a batt of fibers to at least one surface of a web-like base material to provide a stock fabric, needling said stock fabric into an endless belt consisting of at least two convoluted layers of the stock fabric with the ends of the convoluted stock fabric joining in parallel alignment on a diagonal to the width of the fabric, and thereafter needling a final batt of fibers to at least one surface of said endless belt.

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