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PAPERMAKER'S FELT

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FIG. 1

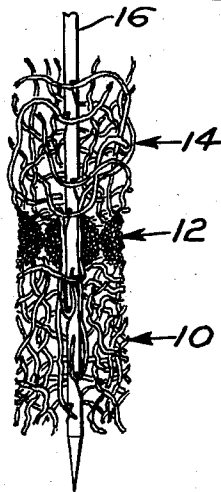


FIG. 2



FIG. 3

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PAPERMAKER'S FELT

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This invention relates to improvements in papermaker's felt constructions and the like, such as are used for example in the manufacture of paper, paper board, pulp, asbestos shingles, transite pipes, and like products; and more particularly to an improved, highly oriented fibrous, non-woven type fabric for such purposes.

It is a primary object of the present invention to provide specifically for the papermaker's felt art in improved "felt" type fabric constructed without use of conventional knitting, braiding or weaving operations on fibers such as the conventionally used grades of wool, cotton, and other natural and synthetic fibres.

It is another object to provide a felt as aforesaid by means of a manufacturing technique novel in this art, so as to provide an improved papermaker's felt of many advantages.

A more specific object of the invention is to provide a felt as aforesaid which is of improved efficiency as a drainage filter in its intended use.

Another object is to provide a felt construction as aforesaid which may be readily produced by presently standard type textile equipment, and at decreased cost.

Still another object is to provide a felt as aforesaid having a pulp supporting surface of improved smoothness and levelness and resilience.

Still another object of the invention is to provide a felt as aforesaid which when incorporated in a felt of endless belt form is of improved resistance to tension loads and is less subject to internal heat generation tendencies when training around press rolls and the like; being thereby better resistant to the rigors of paper making operations, resulting in longer useful life of the felt and lower ultimate cost to the user.

Other objects and advantages of the invention will appear from the specification hereinafter.

It is well known in the papermaker's felt art that it is a primary object to provide a fabric structure which is basically strong and dimensionally stable, while at the same time comprising an efficient water-drainage or filter membrane the surfaces of which are resilient masses in which the individual fibres are so entangled and commingled and blended as to present to the pulp being treated a uniformly smooth and level yet resilient surface. The present invention provides the desired results in combination with a substantial reduction in manufacturing cost and increased tensile strength, as illustrated by way of example in the accompanying drawings wherein:

Fig. 1 is a diagrammatic edge or sectional view illustrating an initial step in the manufacture of the felt of the present invention;

Fig. 2 is an enlarged scale diagrammatic view corresponding to Fig. 1 illustrating a second step in the manufacture of the product; and

Fig. 3 is a diagrammatic fragmentary sectional view corresponding to Fig. 2 but of the finished fabric.

The invention generally contemplates substantial economies in manufacture of "felts" for the aforesaid purposes by provision of a novel "non-woven" fabric as will

now be described in detail. The fabric is made from yarns and batting of any suitable fibres as stated hereinabove; and the yarns so employed may be produced by either the so-called woolen systems or any of the so-called worsted systems. Presently conventional non-woven fabrics are commonly manufactured from many or all of the common textile fibres, either randomly distributed or in the form of an oriented web as for example a card web. Such textile fabrics are then commonly bonded together either by use of a heat-fusible textile fibre such as cellulose acetate, or by use of an exterior latex system such as one of synthetic rubbers, or partially polymerized synthetic resins with subsequent curing. Such impregnation produces fabric of fairly good strength for most applications, particularly where said fabrics are to be used in substantially dry condition. However, peculiarities of the art of papermaking require that the web of partially formed but wet paper be cushioned on the surface of a papermaker's felt, which felt is customarily a woven textile fabric appropriately milled and finished to produce thereon the surface desired.

The life of a papermaker's felt is rigorous because of high and fluctuating longitudinal tensions or tensile stresses therein when the felt is employed in the form of an endless belt in a papermaking machine. An undesirable corollary of these longitudinal stresses is the tendency of a woven felt to become narrow as the longitudinal stresses thereon increase. This "narrowing in" undoubtedly stems from the action of the warp or longitudinal yarns on the filling or transverse yarns through a "parallelogram of force" system induced by skewing of the filling yarns due to mechanical imbalances in the press rolls, felt guides, etc. Thus, with such prior art fabrics preservation of dimensional stability in an operating felt is rather difficult to attain. The present invention overcomes the aforesaid objections and shortcomings of the prior art; and at lower cost of manufacture makes possible the production of a felt having superior qualities including enhanced dimensional stability.

In accord with the present invention, a batt as indicated at 10 (Fig. 1) of any suitable textile fibres or mixtures thereof is laid down on the feed apron of a conventional needling machine; and a parallel array 12 of yarns of any suitable fibres is then superposed on the batt; the yarns being laid in the direction of the longer axis of the felt belt to be manufactured. The yarns of this array are held in proper spatial relationships by reeds, or the like, and then another batt 14 of suitable textile fibres is then placed on top of the array 12. Fibres such as may be used for these purposes include the natural cellulosic fibres, such as cotton, jute, etc.; natural proteinaceous fibres such as wool, including garnetted wool; polyamide fibres such as nylon or Perlon; the polyacrylic fibres such as Orlon, Acrilan, Creslan, Darvan, Zephiran; the polyacrylic polyvinyl chloride copolymer dynel; and the polyester fibres such as Dacron or Terylene. The list above is not intended to be a limitation on the scope of this invention or a deliberate exclusion of any particular fibre but is given only by way of an illustration.

The longitudinal yarn system or web may also be composed of any of the above fibres in either filament or spun staple form. The fibres selected for the batt or batts and the yarn components may include such fibres as are generally termed "crimped"; meaning crimped, crinkled, curled, spiraled, serrated or the like; and are so selected as to have the ability to take a permanent set when heated to a temperature substantially greater than any temperature encountered in the operation of the paper machine. Thus, these fibres will possess felting characteristics somewhat similar to that of natural wool after being heat-set. Thus, fabrics made from such staple fibres will possess substantially the same bulk and springi-

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ness of wool. This makes such material highly desirable as a substitute for wool in this field where the shrinkage and progressive wear characteristics of wool would be detrimental.

The "sandwich" composed of batting and yarn is then passed one or more times through any suitable needling machine whereby, as illustrated in Fig. 2 herewith, the needles 16 of the machine penetrate all of the layers of the "sandwich" with reciprocating motions, thereby drawing the batt fibres severally into and through the yarns of the longitudinal array 12, first in one direction and then in the opposite direction (Fig. 3). Hence, fibres from opposite sides of the yarn array are punched through in such manner as to compact the fibres as shown in Fig. 3 and to simultaneously bridge or interconnect adjacent yarns and the batt masses thereto.

Thus, by means of the punching and fibre inserting operations performed by the needling machine there is produced a fabric as schematically illustrated by Fig. 3, comprising a core of parallel yarns extending longitudinally of the length of the fabric in the direction of the longitudinal extent of the belt to be manufactured. Hence, the longitudinally extending yarns, together with the batt fibres cooperate to mutually sustain the tensile stresses imposed upon the belt during its operation on a papermaking machine. The fibre cross ties between the batts and the yarns provide sufficient lateral bonding of the fabric to develop the requisite fabric coherence to withstand handling and usage of the belt without requiring inclusion of conventional type filling threads or yarns such as are commonly employed in woven fabrics for similar purposes.

The batt masses at opposite sides of the fabric constituting the actual filtering membrane, are cohered in such manner as to provide uniform smoothness and resilience at the surfaces contacting the paper web in course of manufacture. Because of the absence of transverse yarn structures as in conventional woven fabrics for similar purposes, the felt fabric of the present invention is of improved drainage characteristics and minimizes bending stresses such as are developed in conventionally woven type fabrics when passing over and around press rolls and the like. Thus, fibre-to-fibre friction is minimized and yarn-to-yarn interactions are eliminated in the case of the present invention; and intra fibre fatigue and mechanical degradations due to flexing of the components of the individual fibres are likewise minimized. Subsequent to assembly of the fabric as explained hereinabove, it may be subjected to any customary finishing operations if desired, such as a thermal shrinkage process while being subsequently dried and stretched to specified dimensions.

I claim:

1. A new article of manufacture comprising a paper-maker's felt for supporting and draining paper making material, said felt comprising a belt-like non-woven fibrous structure having only one array of substantially parallel yarns extending longitudinally of the structure and having mechanically felted fibre batts disposed at opposite sides of said array and compacted thereagainst and needled thereto by a needling operation driving fibres of said batts through said yarns thereby interlocking the assembly in fabric form.

2. A papermaker's felt belt for supporting and draining paper making material, said felt belt comprising essentially only one array of substantially parallel yarns ex-

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tending longitudinally of the structure and having felted fibre batts disposed at opposite sides of said array and needled thereto with fibres of said batts punched through said yarns thereby laterally interlocking the assembly in fabric form.

3. A new article of manufacture comprising a paper-maker's felt for supporting and draining paper making material, said felt comprising a belt-like non-woven fibrous structure having only one array of substantially parallel yarns extending longitudinally of the structure and having felted batts of different fibrous materials disposed at opposite sides of said array and compacted thereagainst and needled thereto by a needling operation driving fibres of said batts through said yarns thereby laterally interlocking the assembly in fabric form.

4. A new article of manufacture comprising a paper-maker's felt for supporting and draining paper making material, said felt comprising a belt-like non-woven fibrous structure having only one array of substantially parallel yarns extending longitudinally of the structure and with felted fibre batts disposed at opposite sides of said array and compacted thereagainst and needled thereto so that fibres of said batts are punched through said yarns thereby laterally interlocking the assembly in fabric form, said fabric being subsequently thermally shrunken.

5. A new article of manufacture comprising a paper-maker's felt for supporting and draining paper making material, said felt comprising a belt-like non-woven fibrous structure having a core portion consisting of only one array of substantially parallel wool yarns extending laterally of the structure and having felted wool batts disposed at opposite sides of said array and compacted thereagainst and needled thereto by a needling operation driving fibres of said batts through said yarns thereby interlocking the assembly in fabric form.

6. A new article of manufacture comprising a paper-maker's felt for supporting and draining paper making material, said felt comprising a belt-like non-woven synthetic fibrous structure having only one array of substantially parallel yarns extending longitudinally of the structure and with felted synthetic fibre batts disposed at opposite sides of said array and compacted thereagainst and needled thereto so that fibres of said batts are punched through said yarns thereby laterally interlocking the assembly in fabric form, said fabric being subsequently thermally shrunken.

7. A new article of manufacture comprising a paper-maker's felt for supporting and draining paper making material, said felt comprising a belt-like non-woven fibrous structure having a core portion consisting of only one array of substantially parallel wool yarns extending longitudinally of the structure and having felted fibre batts disposed at opposite sides of said array and compacted thereagainst and needled thereto by a needling operation driving fibres of said batts through said yarns thereby interlocking the assembly in fabric form, the fibres of said yarns and of said batts being severally of different fibre mixtures.

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