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J. R. WAGNER

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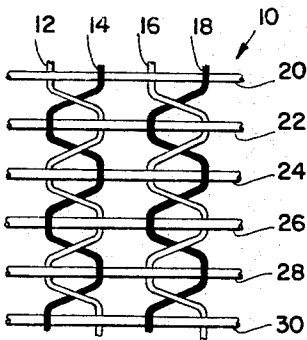


FIG. 1

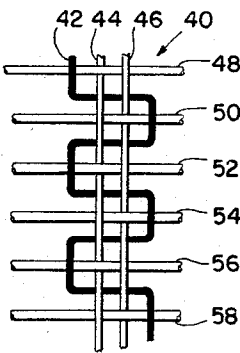


FIG. 2

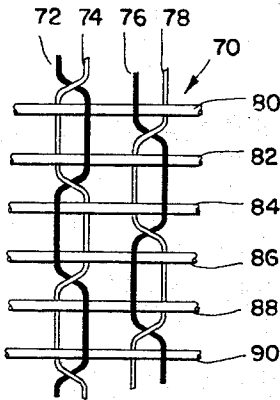


FIG. 3

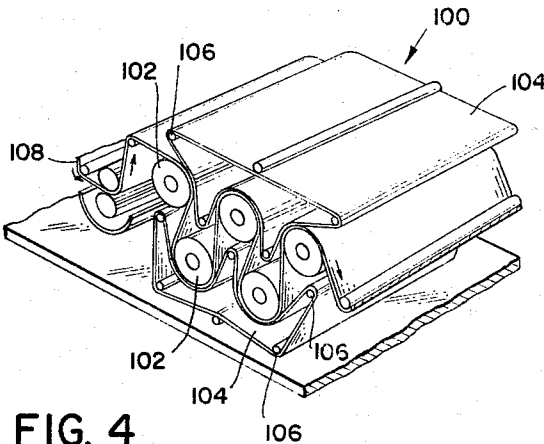


FIG. 4

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This invention relates to papermakers' dryer fabrics and more particularly relates to such fabrics constructed with a type of weave adapted to improve dimensional stability. While the invention is of special utility in relation to dryer fabrics, it may also be used advantageously in connection with inside press fabrics for paper machines.

This invention is particularly useful in connection with a fabric woven from yarns of synthetic material in continuous filament form, used as a multi-filament or a mono-filament. Spun fibers of various types may be used in some instances to produce the yarns, but in general it will be found advantageous to use continuous filaments. The yarns may be either spun, continuous filament or mono-filament yarns. By the selection of particular yarns or combinations thereof, and as a result of the particular weaving style utilized in this invention, the fabric is provided with highly desirable characteristics for the indicated purposes.

It is preferred that fabrics to be used for inside press fabric purposes in papermaking machines be woven in endless form to avoid the need for joining or splicing. Such endless weaving can also be used for the production of dryer fabrics, but for this purpose it has been found preferable to weave the fabric in flat, continuous form with the warps extending in the machine direction on the paper machine.

Papermakers' fabrics have been made from wool, cotton, asbestos, synthetics and similar materials. In recent years, the best results have been obtained with synthetic materials, such as nylon, polyester resins, and the like. However, greige fabrics of synthetic yarns, being normally smooth in surface have a tendency to slip or shove and therefore lack dimensional stability. That is, the synthetic yarns comprising the fabrics tend to move differentially, thereby producing interstices of non-uniform dimensions. Dimensional instability is disadvantageous because the space between yarns must be maintained substantially constant in order to have the fabrics function properly on a papermaking machine. In order to overcome the deficiencies of synthetic materials, it has become the practice to treat the dryer fabrics with resin in order to improve dimensional stability.

It is an object of this invention to provide non-metallic papermakers' fabric having improved dimensional stability, shove resistance, stiffness and like properties due to the type of weave employed in making such fabrics.

It is a further object of this invention to provide an open mesh dryer fabric having improved dimensional stability.

It is another object of this invention to provide a dimensionally stable dryer fabric which is capable of distorting slightly to conform to machine non-uniformity.

It is still another object of this invention to provide a dryer fabric woven in a leno weave.

Other objects will be apparent to those skilled in the art from reading the present disclosure taken in conjunction with the drawings, in which:

FIGURE 1 is a schematic view of one embodiment of a leno weave employed in the practice of this invention;

FIGURE 2 is a schematic view of another embodiment of a leno weave employed in the practice of this invention;

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FIGURE 3 is a schematic view of still another embodiment of a leno weave employed in the practice of this invention; and

FIGURE 4 is a schematic view of a dryer section of a papermaking machine in which the fabrics of this invention may be employed.

The objects of this invention may be achieved by weaving a dryer fabric in a leno weave construction. A leno weave is a weave in which certain warp threads, termed doup or crossing threads, are passed from side to side of one or more ends, termed "standard threads," and are bound in by the filling in this position. Where the crossed interlacing occurs an open, perforated structure may be formed, or the crossing ends may be interwoven in zig-zag form on the surface of a more or less compact ground texture. This is sometimes referred to as a gauze weave. A leno weave results in an open fabric in which pairs of warp yarns cross one another and thereby lock the filling yarns in position while simultaneously locking each other in position.

The leno weave provides an open mesh and yet has dimensional stability and freedom from sleaziness. This is believed to be due to the filling yarns being locked into position by the warp yarns. Due to the nature of the weave, it is possible to have an open mesh dryer fabric or inside press fabric which still performs satisfactorily on a paper making machine. The leno weave prevents the yarns from shoving and yet permits the production of an open mesh fabric. Also, the leno weave permits the fabric to distort slightly to conform to machine non-uniformity which is a desirable characteristic for runability. By forming fabrics using the leno weave, it is possible to make satisfactory dryer fabrics that do not have to be treated with resins or other material to bond the yarn in order to make the fabric dimensionally stable. If desired, however, other desirable characteristics may be obtained by treating the fabric with resins or other material, for instance, those described in U.S. Patent 3,032,441, issued May 1, 1962.

Although spun yarns and yarns made of asbestos, cellulosic and protein material may be used in the preparation of the fabrics of this invention, it is preferred that the warp and filling yarns be constructed from continuous filament synthetic yarns. The synthetic yarns utilizable in this invention include polyester resins, (such as Dacron), polyamide resins (such as HT-1 or type 300 nylon), fiber glass (such as Owens-Corning "Beta" type) and acrylic. The yarns to be useful in the invention must have good rot resistance, abrasion resistance, flex resistance and low shrinkage or growth upon wetting or drying. In addition to the requirements just mentioned, dryer fabrics should have heat resistance and hydrolysis resistance. Advantageously, the yarns have a 2 to 4 ply construction, preferably 3 ply.

Various thicknesses or weights of the yarns may be used depending upon the characteristics desired to be imparted to the fabric. The total warp and filling yarn denier may be between about 200 to 8000 depending upon the particular synthetic material of which the yarn is constructed. The diameter of mono-filament yarns is preferably between about 7 and 60 mils. The preferred single ply polyester denier is 440 denier in a continuous filament; however, 1100 denier polyester resin may also be used. Nylon is preferably used in 840 denier. However, HT-1 nylon is presently available only in 100 and 200 denier yarn sizes, and it is necessary to ply such yarns to a sufficient size for dryer fabrics. The preferred single ply range for fiber glass is between about 500 and 2000 denier and up to 8000 denier for multiple plies. The warp yarns are preferably woven to have between about 12 to 50 ends per inch. The weft yarns are pref-

erably woven so that there are about 12 to 40 filling yarns per inch.

Various types of leno weaves are illustrated in FIGURES 1, 2, and 3. However, these are to be understood to be typical embodiments only, and other leno weave constructions are also utilizable in the practice of this invention.

In FIGURE 1, a leno woven fabric 10 is made up of warp yarns 12, 14, 16 and 18 which are woven with filling yarns 20, 22, 24, 26, 28 and 30. As shown in the drawing warp yarns 12 and 16 cross on one side of the filling yarns. Warp yarns 14 and 18 cross on the other side of the filling yarns. The warp yarns are interwoven by crossing each other on the side opposite from which they cross the filling yarns. The resultant fabric has an open mesh, and the filling yarns are locked in place by the interweaving of the warp yarns.

In FIGURE 2, fabric 40 is woven from warp yarns 42, 44 and 46 and filling yarns 48, 50, 52, 54, 56 and 58. Warp yarns 44 and 46 are woven in a plain weave passing successively over and under successive filling yarns, warp thread 44 passing over each thread that is passed under by warp thread 46 and vice versa. The filling yarns and warp yarns are locked in place by warp thread 42 which passes over each of the filling yarns but passes under both of the warp yarns. The resultant fabric has an open mesh in which the filling yarns are locked in place and resist shoving, etc.

Fabric 70 is woven from warp threads 72, 74, 76 and 78 and filling yarns 80, 82, 84, 86, 88 and 90. The warp threads 74 and 78 pass under all of the filling yarns, while the warp yarns 72 and 76 pass over all of the filling yarns. Warp yarns 72 and 74 cross each other on the side opposite from which they cross the filling yarns after every two filling yarns. Warp yarns 76 and 78 are similarly interwoven but their intersections are spaced between the filling yarns alternately with the intersections of warp yarns 72 and 74.

In FIGURE 4 is shown a typical dryer section of a papermaking machine. The dryer section 100 is made up of drying rolls 102 and drying fabrics 104 which are disposed in operative relation to the dryer rollers by the use of idler rollers 106. As is shown in FIGURE 4 a wet paper web 108 passes successively over each of the drying rolls and is held in contact with the periphery of the drying roll by the drying fabrics. The wet web as it enters the drying roll in the direction indicated by the arrows contains moisture which is substantially removed before the web passes completely through the dryer.

As will be apparent from the drawings, the dryer fabric is subjected to extreme temperatures and alternately moist and dry conditions. Moreover, the dryer fabric must be sufficiently flexible to pass readily around the rollers, yet must be sufficiently firm to maintain the web in contact with the drying rolls.

The terms and expressions which have been employed are used as terms of description and not of limitation, and there is no intention in the use of such terms and expressions of excluding any equivalents of the features shown and described or portions thereof, but it is recognized that various modifications are possible within the scope of the invention claimed.

What is claimed is:

1. A papermakers' fabric for use in conveying wet paper webs in a papermaking machine comprising filling yarns, first warp yarns, and second warp yarns, said second warp yarns being doup warps and being passed from side to side of at least one of said first warp yarns and binding the filling yarns in position, the fabric having dimensional stability and firmness of texture as well as an open mesh which permits the passage of water and steam through the fabric while adequately supporting the web.

2. A papermakers' fabric comprising a dryer fabric for supporting and draining wet paper webs in a papermaking machine, said fabric comprising a belt-like leno woven

structure further comprising first and second warp and filling yarns forming an open mesh, said second warp yarns being doup warps, said filling yarns being locked in place by said second warp yarns whereby the fabric has dimensional stability and firmness of texture.

3. A fabric as described in claim 1 which is woven from synthetic yarn.

4. A fabric as described in claim 1 which is woven from yarns comprised of at least one member of the class consisting of polyester resins, acrylic resins, polyamides, glass fibers, asbestos, cellulosic fibers, and protein fibers.

5. A fabric as described in claim 1 which is woven from yarns having a denier between about 200 to 8000.

6. A fabric as described in claim 1 having between about 12 and 50 ends per inch and between about 12 and 40 filling yarns per inch.

7. A fabric as described in claim 1 which is woven from polyester resin having a denier between about 440 and 1100.

8. A fabric as described in claim 1 which is woven from nylon yarns having a denier of about 840.

9. A fabric as described in claim 1 which is woven from synthetic mono-filaments between about 7 and 60 mils in diameter.

10. A fabric as described in claim 1 which is woven from nylon filaments having a single filament denier between 100 and 200.

11. A fabric as described in claim 1 which is woven from nylon filaments having a total yarn denier between 200 to 8000.

12. A fabric as described in claim 1 which is woven from glass yarns having a denier between about 500 and 8000.

13. A papermakers' fabric for use in conveying wet paper webs in a papermaking machine comprising filler yarns, doup warp yarns crossing said filling yarns on one side, second warp yarns crossing said filling yarns on the other side, said doup and second warp yarns crossing each other on the side opposite from which they cross said filling yarn, said crossing occurring between each pair of filling yarns.

14. A papermakers' fabric for use in conveying wet paper webs in a papermaking machine comprising filling yarns, first and second warp yarns woven in a plain weave with said filling yarns, and a doup warp yarn crossing all of said filling yarns on one side and said first and second warp yarns on the other side, said doup warp yarns crossing said first and second warp yarns between each pair of filling yarns, whereby the first and second warp yarns and said filling yarns are locked in place by said doup warp yarn producing an open mesh in which the yarns are locked in place and resist shoving.

15. A papermakers' fabric for use in conveying wet paper webs in a papermaking machine comprising filling yarns, first and second warp yarns being doup yarns and passing on one side of said filling yarns, third and fourth warp yarns passing on the other side of said filling yarns, said first and third warp yarns crossing each other on the side opposite from which they cross the filling yarns between every second pair of filling yarns, said second and fourth warp yarns crossing each other on the side opposite from which they cross said filling yarns between each second pair of filling yarns, the crossing of said first and third warp yarns and the crossing of said second and fourth warp yarns occurring between alternate pairs of filling yarns.

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