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[54] PAPERMAKERS FABRICS

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[56] **References Cited**

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3,313,645 4/1967 Wagner et al. .....117/126 GB

3,030,690 4/1962 Mizell .....139/383 A

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[57] **ABSTRACT**

This invention relates to papermakers fabrics for use in the dryer section of papermaking machinery characterized by having bulky, resin impregnated cross-machine direction yarns.

8 Claims, No Drawings

PAPERMAKERS FABRICS

BACKGROUND OF THE INVENTION

In the manufacture of paper and paper-like materials, such as writing paper, newsprint, board, corrugating paper, and the like, typically the final portion of the process of removing water from the paper web is carried out in the dryer section of the papermaking machine. In a typical fourdrinier papermaking machine, the dryer section comprises upper and lower parallel arrays of large, steam-heated rolls or "cans," in combination with endless textile conveyor belts usually referred to as "dryer felts" and/or "dryer fabrics." Usually, upper and lower dryer felts or fabrics are used and perform the function of pressing the web of paper against the outer periphery of the dryer rolls in intimate contact as the web travels seriatum from roll to roll and between arrays of rolls through the dryer section. Thus, these dryer felts or fabrics are exposed to extremely severe conditions of high heat, high moisture concentrations, and (frequently) chemically active environments. Thus, there is a tendency for them to degrade physically and chemically very rapidly and for this degradation to be manifested in the form of such things as dimensional variations, tearing or other destruction of the fabrics, and losses in tensile strength. Since the replacement of a papermakers fabric normally consumes considerable amounts of downtime on the machine, which are very costly in terms of loss of production in addition to the cost of the replacement materials, it has been a long-sought objective in the papermaking art to extend the life of papermakers fabrics as much as possible.

In the papermaking art, the endless textile belting used in the dryer section of the papermaking machine, as noted above, is referred to variously as "dryer felts" or "dryer fabrics." Technically, the term "dryer felt" is a misnomer since, as noted in the publication Modern Pulp and Papermaking (by John P. Calkin, Reinhold Publishing Co. 1957, at Page 349), "The dryer felt is actually not a felt, but a heavy duck made essentially of cotton. By papermakers' usage it is termed a 'felt'." Historically, such "felts" have been made from cotton, or cotton and asbestos, although in some cases, material such as wool has also been used. More recently, "dryer fabrics" have come into widespread use in the dryer sections of papermaking machines. Dryer fabrics are usually made from synthetic materials, such as polyesters and/or polyamides, in the form of monofilaments or multifilaments that are woven into open-weave structures. Although in the ambient conditions normally encountered in dryer sections of papermaking machines such dryer fabrics exhibit a significiantly longer life than did the previously used dryer felts, there are, nevertheless, continuing efforts to increase the useful life of such dryer fabrics even beyond that previously achieved.

Thus, it is an object of the present invention to produce a dryer fabric which will have a significantly longer useful life than that attainable with prior art dryer clothing.

It is another object of this invention to provide a dryer fabric that will have improved strength and dimension-retaining characteristics.

Yet another object of this invention is to provide a dryer fabric less susceptible to degradation than prior art structures.

Another object is to provide a dryer fabric with improved heat, moisture, and/or chemical stability.

SUMMARY OF THE INVENTION

These and other objects, which will be readily apparent to those skilled in the art, are attainable through practice of the present invention, one embodiment of which comprises a dryer fabric for use in a papermaking machine comprising bulky resin impregnated yarns in the cross-machine direction.

DESCRIPTION OF PREFERRED EMBODIMENTS

For purposes of this patent application and, more particularly, the claims set forth herein, the following terms and their variants are intended to have the meanings indicated below:

"Yarn" means any continuous structure useful as a constituent member in the weaving of fabrics, whether a monofilament, a multifilament, a plurality of multifilaments bundled together, or a plurality of spun staple fibers.

"Filament" means a single thread, or a thin flexible thread-like object.

"Crinkled" means having many short bends or turns.

"Bulky" (as applied to yarns) means having a relatively large percentage of its cross-sectional area unoccupied by constituent filament material, whereby impregnation of the yarn by treating resins and consequent substantial entire encapsulation of the constituent filament material may be facilitated.

"Textured" (as applied to yarns) means having rendered bulky a yarn comprising a plurality of filaments made from man-made materials which are not originally or inherently "crinkled" by causing said filaments to become crinkled; said plurality of filaments being, or being comprised of, a group of more than one substantially continuous filaments or a plurality of such groups of filaments (such yarns are also sometimes referred to in the textile arts as "textured"yarns).

"Machine direction" means the normal direction of travel of the dryer fabric when it is in use on the papermaking machine. "Cross-machine direction" means a direction substantially normal to the machine direction.

It has been known for some time that materials, such as glass, are available having qualities of chemical and/or thermal resistance that would appear to make them highly desirable for use in ambient environments which may be encountered in the dryer sections of papermaking machines. However, characteristically, such materials also tend to be hard and brittle and therefore to exhibit poor mechanical characteristics. Thus, for example, although it has been suggested in the prior art to use fiberglass as a constituent in the manufacturing of a papermakers dryer fabric (e.g., see Wagner, U.S. Pat. No. 3,279,504), such prior art does not disclose how such materials might be utilized practically in a fabric which is sufficiently supple and flexible to be used in the dryer section of a papermaking machine without those materials being so hard as to mark the paper or to prematurely cause abrasion of the other constituent yarns with which it is associated or to cause the fiberglass yarn itself to deteriorate through fracturing derived from its inherent brittleness and poor resistance to mutual abrasion. It is also known in the textile making arts that the self-destructive tendencies of a fiberglass yarn can be improved somewhat by treating the individual constituent filaments with resin, but even these treatments have not proved satisfactory to produce yarns for use in papermakers dryer fabrics because the process is much too costly and will not produce yarns of satisfactory bulkiness to impart the selective degree of flexibility desirable and/or necessary to the successful operation of such fabrics. Although it is also known from the prior art (e.g., Barrell U.S. Pat. No. 2,098,993) that through use of bulked, cross-direction, asbestos fiber-bearing filling members, dimensional stability may be imparted to papermakers dryer felts, and that preservation of the mechanical and structural integrity of the machine direction yarns of such papermakers dryer felts may be enhanced, the prior art does not teach how these advantages may be imparted to open weave dryer fabrics. Furthermore, this art is not of use to produce an improved papermakers dryer fabric because the inherent low strength of asbestos yarns makes it necessary to supplement the asbestos with some strength imparting material such as cotton (as the Barrell patent shows) which inherently imposes limitations on the strength, thermal, and chemical resistances of the resulting structure. Neither does the prior art teach how dryer fabrics may be made with bulky cross-machine direction filling yarns that are made from fiberglass or other materials having comparable thermal and chemical resistance qualities without simultaneously rendering those yarns susceptible to rapid mechanical degradation in use.

But in no prior art of which I am aware has it ever been proposed to make clothing for the dryer section of a papermaking machine utilizing bulky fiberglass filling yarns.

I have found that fiberglass may be incorporated into a papermakers dryer fabric and rendered suitable for the intended use by using, and subsequently resin impregnating, fiberglass yarns which have been rendered bulky (as defined above) by any of a variety of methods, including "texturizing" (methods for achieving which are disclosed in Cobb et al., U.S. Pat. No. 3,262,177 and the publication Textile World for December, 1969, (Vol.119, No. 12) at Pages 60 through 63).

EXAMPLE

A papermakers dryer fabric was made 162 feet long by 165 inches in width. For warp yarns it had 36 ends per inch of 1,200 denier, 600 filament NOMEX, high temperature polyamide yarns, as manufactured by E.I. duPont de Nemours & Co. For filling yarns, it had Owens-Corning textured fiberglass type No. 401, DE75 5/3 (which is a code to indicate that the yarns consisted of filaments comprising 7,500 yards per pound, 5 ends of which were plied, and 3 such plies being themselves plied together). Obviously, other materials having the requisite characteristics of suppleness, strength, and heat, moisture, and chemical resistance, suitable for use in the dryer section of a papermaking machine, could have been used in place of the aforesaid warp yarns. So also with respect to the filling yarns provided they are susceptible to being rendered bulky, and had been rendered bulky. These filling yarns, at a density of 20 picks per inch, were woven together with the warp yarns at 36 ends per inch in a four harness double satin weave. In this instance the fabric was woven so that the warp yarns did not extend above the flat surfaces of the fabric. This was done in the interests of removing the load-bearing warp yarns from an abrasive exposure. The fabric was also rendered less susceptible to machine direction stretch with attendant cross-machine direction narrowing through crimp interchange. The fabric was treated with a resin according to a known technique substantially in accordance with Wagner U.S. Pat. No. 3,192,599, such that the fabric was rendered sufficiently limber to permit it to be used in the papermaking process, while keeping the constituent members of the fiberglass yarns from abrading each other. Before this fabric was supplied to the papermaker for installation in the dryer section of a papermaking machine, it was tested and found to have a machine direction tensile strength of 402 lbs. per lineal inch and a cross machine tensile strength of 254 lbs. per lineal inch. The fabric was operated on the papermaking machine for 8 months, at which time it was removed, but not for reason of any failure of the fabric, and inspection after removal indicated it would have operated for several more months. This 8-month period was the longest that any conventional dryer fabric had operated up to that time on this papermachine position. When the fabric was removed, it was subjected to various measurements an and found to have a length of 159 feet, a width of 164½ inches, a machine-direction tensile strength of 257.89 lbs. per inch, and a cross-machine direction tensile strength of 284 lbs./in. Thus, it is apparent that, as evidenced by the degree to which it retained its dimensional and strength characteristics, this fabric was more highly resistant to the derogatory effects of high heat, high tension, and the chemical environment to which it was exposed throughout its useful life on the papermaking machine than were any of the conventional clothing previously used on this papermachine position.

Without intending to be bound by any theory, it is believed that this increase in useful life is due, at least in substantial part, to the use of the bulked filling yarns. Apparently, the effect of these yarns having been bulked is to provide a means by which the load-bearing machine direction yarns may be significantly imbedded and protected from abrasion, thereby enhancing preservation of the machine direction and cross-machine dimensional stability of the fabric, as well as the machine direction tensile strength. At the same time, because of having used fiberglass cross-direction yarns which were bulky, it became possible to utilize the desirable characteristics of the fiberglass while, at the same time, being able to impregnate the glass yarns after the fabric had been made with sufficient quantities of resin to preclude substantially self-destruction of the fiberglass yarns through mutual abrasion of their constituent members.

In this connection, it should be noted that the present invention is limited to papermakers dryer fabrics having bulky cross-direction yarns, regardless of the exact means by which they were rendered bulky.

It will also be apparent to those skilled in the art that the present invention may be practiced in a wide variety of embodiments without materially departing from the spirit and scope of the present invention.

It is to be understood that in the foregoing specification the specific embodiments and components thereof which have been illustrated and discussed are by way of illustration and not of limitation and that this invention may be practiced by those skilled in the art utilizing a wide variety of materials and configurations without department from the true spirit and scope of this invention.

I claim:

1. A woven dryer fabric for use in a papermaking machine comprising bulky, resin impregnated yarns in the cross-machine direction, said yarns, prior to impregnation, comprising fibers which have poor resistance to mutual abrasion.

2. The dryer fabric described in claim 1 wherein said cross-direction yarns are made from fiberglass.

3. The dryer fabric described in claim 2 comprising machine direction yarns made from manmade material characterized by being substantially stable, physically and chemically over a long period of time to the ambient conditions to which the fabric is exposed when in use.

4. The dryer fabric described in claim 3 wherein said cross-machine direction yarns are textured.

5. The dryer fabric described in claim 1 in which said cross-machine direction yarns are textured fiberglass.

6. The dryer fabric described in claim 3 wherein said machine direction yarns do not extend substantially above the flat surfaces of said fabric.

7. The dryer fabric described in claim 6 wherein said machine direction yarns are made from high temperature tolerant polyamide.

8. The dryer fabric described in claim 4 in which the machine direction yarns are made from high temperature tolerant polyamide material.

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