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[54] **EXTRUDED ASBESTOS YARN FOR PAPER DRYER FELTS**

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Related U.S. Application Data

[63] Continuation of Ser. No. 780,284, Nov. 29, 1968, abandoned.

[52] **U.S. Cl.** ..... **57/140 BY,** 57/139, 57/153, 57/164, 264/103, 264/183

[51] **Int. Cl.** **D02g 3/04,** D02g 3/20

[58] **Field of Search** ..... 57/35, 140 BY, 140 R, 57/144, 1 CY, 58.89–58.95, 157 R, 139, 153; 264/103, 183, 184

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[57] **ABSTRACT**

A process, a fabric, and a use thereof, the process including preferably uniformly weaving interlocked asbestos fibers into the fabric porous to a gas suitable for use as a felt in an apparatus for carrying wet paper and for drying the paper by passing the gas through the porous felt.

13 Claims, No Drawings

EXTRUDED ASBESTOS YARN FOR PAPER DRYER FELTS

CROSS REFERENCE TO RELATED APPLICATION

This application is a continuation of application Ser. No. 780,234, filed Nov. 29, 1968, and now abandoned.

This invention relates to a felt of the type normally used as a carrier belt in the drying step during the production of paper, for example.

BACKGROUND

Over a period of many years, in the production of particular grades of paper, it has been necessary to employ a supporting felt in the nature of a carrying belt as a support for wet paper prior to and during the drying operation as the result of that paper having insufficient wet strength to be independently self-supporting without tearing or stretching, for example, when being passed over and through calendering and/or drying rolls.

In past years, it was the standard practice to employ any suitable fabric as the belt or felt as the suppor for the paper during the passing over the rolls. In order to decrease the cost per unit volume of output of paper, felts of various fibrous components were employed in efforts to obtain longer life of such felts.

Gradually, responsive to economic demands for greater and more rapid production, in order to speed up the drying of the paper while employing the same equipment basically, i.e., in order to avoid having to merely increase the number of drying rolls over which the paper is passed in order to more rapidly dry the paper, the temperature of drying for the respective drying rolls was increased thereby subjecting the felts to higher and more detrimental temperatures which served to reduce the life of the various felts employed. Different types of felts were thereafter developed in order to meet the more stringent conditions, such as the employment of asbestos fibers in the making of a felt, the asbestos fibers normally being employed with other textile materials such as cotton, but for the more stringent heat conditions being employed for example as asbestos filler with a warp of a suitable high temperature synthetic. A particularly suitable synthetic for combination with the asbestos fibers was found to be the polyester synthetic fibers which advantageously exhibited a tolerance and resistance both to heat and to the relatively acidic wet paper normally having a pH for example as low as about 4 or 5.

As the economic pressures continued to require even more rapid drying in order to obtain greater production during a unit period of time, the concept was developed of employing hot air directed up and through the felt in order to more rapidly dry the paper, in conjunction with the heated rolls normally employed at the higher temperatures. Such a concept required a felt of a different construction, in other words a felt having a high degree of porosity through which the hot air could pass in order to effectively dry the paper. In the switch from the concept of using felt merely as a carrier for the paper to a concept in which the felt served to permit hot air to pass, there was also an additional change in the method of drying. That change related to the original felts which had been employed for years having an additional function of serving as a blotting means for facilitating the withdrawal of moisture from the paper

being carried thereon, and as the felts revolved around to a return position, the moisture evaporated from the felt. In the new concept of producing porous felts as a carrier for the paper, the "blotting" action of the felts was thereby substantially abandoned for the improved, more rapid drying obtained as a result of the passing of hot air through the felts to dry the paper.

Accordingly, asbestos fibers were employed as filler for typically polyester warp but of a fabric construction in which there was a substantial and desired degree of porosity, sufficient to obtain desired drying effectiveness. However, it was found that because of the nature of the normally and conventionally employed fibers made from the asbestos, the porosity was not uniform throughout a felt of porous construction. As the result of the lack of uniformity of porosity, there was no uniformity of hot air passage through the felt, and the lack of uniformity of hot air passage through the felt resulted in a fluttering of the wet paper, a production of stretched paper where there is greater porosity as compared to less stressed paper where there was a lack of porosity, and also a routine accidental tearing of the paper by the action of the uneven passing of the hot air through the felt, for example.

Accordingly, it appeared that the use of asbestos fibers for the production of felts designed to have effective porosity for the rapid drying of paper by use of hot air, had experienced at least a substantial loss of its original utility for use in the production of felts required for the paper industry.

Throughout the history of the making of felts which incorporated asbestos fibers, the fibers employed for this purpose were uniformly produced by conventional carding methods.

THE OBJECTS

An object of this invention is a fabric including asbestos fibers and having a uniform porosity sufficient for ventilation through the pores.

Another object is a felt suitable for use on drying rolls of a paper production apparatus, and having a substantially uniform degree of sufficient porosity to be effective for such a utility.

Another object is a process of employment of such a fabric for use as a drying felt having a sufficient degree of porosity for such a utility.

Other objects become apparent from the preceding and following disclosure.

SUMMARY OF THE INVENTION

The above objects are obtained by the manufacture of a felt for use as a support in a paper manufacturing process and apparatus therefor, in which the fabric has a substantial and major degree of substantially uniform porosity to a gas sufficiently for an effective amount of drying ventilation for wet paper carried thereon, and including a major amount of extruded asbestos fibers as the fibers from which the fabric is produced, i.e., woven yarn. The extruded asbestos fibers may be used either as warp or as the filler, or both as the warp and the filler. In various other embodiments, the extruded yarn may include also synthetic fibers, for example, or alternatively a purely extruded asbestos fiber yarn may be used for example as solely the warp and a synthetic fiber such as a polyester or a "NOMEX" (trademark) nylon, may be used as the filler or alternatively the polyester or a "NOMEX" nylon may be used as the

warp and the yarn produced from the extruded asbestos fibers used as the filler. Various other combinations of the nature of these typical embodiments are also contemplated.

BROAD DESCRIPTION

In particular, the heart of the invention lies in a process employing a fabric of the nature described above, as a felt in an apparatus for carrying wet paper and for drying the paper by passing a gas from beneath the felt through pores of the felt sufficiently to ventilate the wet paper. Preferably the felt would be heat-resistant to withstand heated gas. Thus the process comprises passing a gas through the pores of the felt comprising a fabric of the nature described above, the passing being sufficient to ventilate the wet paper supportable on the felt.

It was unexpectedly discovered that a fabric of the type described above when produced by the substitution of extruded asbestos fibers for the previously conventionally employed asbestos fibers produced by conventional prior arts carding methods, resulted in a felt which did not impair uniform and effective ventilation through the felt fabric. As discussed above, the felt produced by yarn made from fibers subjected to the carding processes of producing yarn proved to be unacceptable because of the uncontrollable variable of random extensions of a plurality of asbestos fibers extending from various portions of the twisted asbestos yarn of the carding method which thereby resulted in a substantial plugging of or stoppage of a substantial number of pores randomly throughout the felt.

Accordingly, the invention also includes a process comprising weaving extruded asbestos fibers into a fabric having substantially uniform porosity and having sufficient porosity to a gas for a substantial amount of ventilation therethrough. It is within the scope of the invention to employ any suitable gas which is not reactive with the felt material or with the paper being dried. However, normally merely air, preferably heated air, would be employed. Obvious substitutes would typically include nitrogen gas, carbon dioxide gas, and other inert gases, for example.

It is within the scope of this invention to employ yarn comprising any suitable extruded asbestos fibers. One variety of extruded asbestos fibers which is a preferred embodiment of this invention is the extruded asbestos fiber described and claimed in the copending, commonly assigned U. S. application Ser. No. 641,757 filed on May 29, 1967, now abandoned; as stated in that Application, support strands such as of wire, asbestos, or the like, may be employed to support extruded and interlocked asbestos fibers. Another typical extruded asbestos fiber employable, although not preferred, in the process and fabric of this invention is the extruded asbestos fibers of Turner Brothers Asbestos, Ltd. of Turner-Newall, Great Britain.

The extruded asbestos fibers of the preferred embodiment of this invention of the copending application Ser. No. 641,757 referred to above, are typically produced by a process comprising the steps of extruding a supply of discontinuous asbestos fibers dispersed in a liquid medium containing a gelable agent, to form (optionally either alone or around a support such as wire) a strand when introduced into a coagulating bath, which bath converts the gelable agent into a binder, and twisting the formed strand to mechanically interlock the asbestos fibers of the strand. Preferably the method includes extracting the binder while simultaneously maintaining the integrity of the formed strand, preferably employing a solution of sodium alginate as the liquid medium, preferably employing at least 10 percent of the asbestos fibers of the length of at least one-fourth inch, and preferably preparing the gelling bath by mixing acetic acid and calcium carbonate, subsequently immersing the twisted strand in an aqueous solution of sodium carbonate sufficiently to convert the calcium alginate to sodium alginate and to leave the residue of fibers in strand form, extracting the sodium alginate, and rinsing and drying the residue sufficiently to form the strand of extruded asbestos fiber employable in this invention. The binder preferably is hydrophilic, capable of being elongated, and capable of being extracted, such as thermally extracted or chemically extracted, from the strand while the continuity of the strand form is substantially reserved or maintained. Typical binders include a water soluble gun such as polysaccharide or sodium alginate, for example, a binder formed of a natural vegetable colloid, or a binder formed of a synthetic colloid, for example.

The asbestos fibers are formed into a thickened dispersion and are thereafter extruded through an orifice into a coagulating bath, where the thickening agent is continuously converted into a congealed substantially water insoluble, coherent reversible binder for the fibers, which fibers are extended substantially in parallel alignment with each other as a result of the extrusion. The formed roving of fibers, binder, and wetting agent is collected as a continuous strand described above. At this stage the fibers may be described as being in relatively spaced-apart relation entrained within the binder gel. The strand is then advanced between pressure rolls, where the water content is substantially reduced and adjacent fibers are squeezed within the strand into closer relationship with each other, to a winding means where the strand is collected into package form.

It is within the scope of this invention to employ various weaves of the yarn, and mats made therefrom having the required physical property of a porosity between the yarn making up the warp and/or between the yarn making up the filler of the fabric. As noted above, it also is within the scope of the invention to employ extruded asbestos yarn either as the filler or as the warp or as the filler and the warp, and when used solely as either the warp or the filler, to employ a suitable synthetic fiber and/or yarn as the other of the filler and warp. Also as noted above, in the extrusion process of this invention, it is within the scope of this invention to employ either natural organic or synthetic fibers in the making of the extruded yarn and/or alternatively during the twisting of the extruded fiber.

However, as stated above, the preferred fabric of this invention is produced by the preferred process described above, the subject matter of the copending U. S. application Ser. No. 641,757.

It is within the scope of the invention to employ any one or more substitutes of steps and/or elements that would be mere equivalents obvious to a person skilled in this art.

I claim:

1. A method of producing yarn comprising:

a. dispersing asbestos fiber in a liquid medium containing a gelable binder;

b. extruding the said dispersion of asbestos fiber and liquid medium containing gelable binder into a coagulating bath to align the asbestos fibers generally parallel to each other and gel the gelable binder;

c. twisting into twisted strand form the extruded asbestos fibers and gel binder within which they are aligned generally parallel to each other, and also employing synthetic fibers during the twisting of the extruded fibers; and

d. removing the gel binder while substantially maintaining the integrity of the formed strand.

2. The method of claim **1** wherein the gelable binder is a water soluble gum.

3. The method of claim **1** wherein the gelable binder comprises sodium alginate and the coagulated gel binder comprises calcium alginate.

4. The method of claim **1** wherein the yarn is woven into a fabric.

5. The method of claim **1** wherein the yarn is woven into a porous fabric of substantially uniform porosity.

6. The porous fabric of the method of claim **5.**

7. The yarn produced by the method of claim **1.**

8. A method of producing yarn comprising:

a. dispersing asbestos fiber in a liquid medium containing a gelable binder;

b. extruding the said dispersion of asbestos fiber and liquid medium containing gelable binder into a coagulating bath to align the asbestos fiber generally parallel to each other and gel the gelable binder;

c. twisting into twisted strand form the extruded asbestos fiber and gel binder within which they are aligned generally parallel to each other and also including therewith fiber selected from the group consisting of natural organic fibers and synthetic fiber during the twisting of the extruded asbestos fibers; and

d. removing the gel binder while simultaneously maintaining the integrity of the formed strand of asbestos fibers and included fibers twisted therewith.

9. The method of claim **8** wherein the gelable binder comprises sodium algenate and the coagulated gel binder comprises calcium algenate.

10. The method of claim **8** wherein the yarn of twisted extruded asbestos fibers including fibers selected from the group consisting of natural organic fiber and synthetic fiber is woven into a fabric.

11. The yarn product of the method of claim **10.**

12. The method of claim **8** wherein the yarn of twisted extruded asbestos fiber including fibers selected from the group consisting of organic fibers and synthetic fiber is woven into a porous fabric of substantially uniform porosity.

13. The porous fabric of the method of claim **12.**

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