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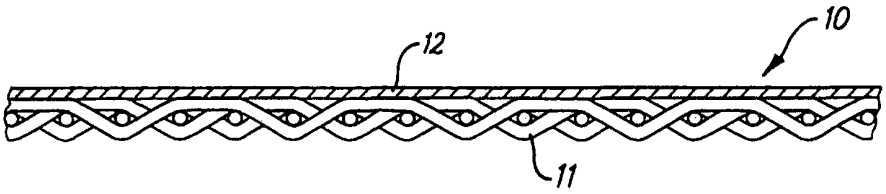

(57) Abstract

A porous belt or filter cloth comprises a woven or nonwoven textile substrate (11), which is coated on at least one surface with a coagulated polymer layer (12). The layer (12) preferably substantially impregnates the substrate, and the textile substrate, if nonwoven, may be supported on a mesh membrane (23), or a spiral link fabric (32). Alternatively, a layer of sintered particles (42) may be incorporated over the substrate which is covered by and impregnated by the coagulated polymer layer.

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POROUS BELTS OR FILTER CLOTHS

This invention relates to porous belts, for example filter belts, filter press cloths and/or filter presses, for example for use in vertical automatic pressure filter machines, and also suitable for use as a forming fabric, press felt, dryer fabric or transfer belt in a papermachine, or as a corrugator belt.

Known filter belts may use the yarns or fibres of a woven or nonwoven fabric, e.g. felt, sintered structure or spiral link fabric as the primary filter medium. With such filters, the lower size limit of retained particles is determined by the void sizes, or compaction, of the fabric. A fabric substrate may be coated with a polymer film which is formed with reticular pores (GB-A-2285935). While these retain fine particles down to submicron sizes, the low ratio of pore aperture to land area does not permit high volume filtration, such as required in pressure filtration and papermachine belt uses.

Fine filtrates such as pigments and dyestuffs, such as titania, cannot at present be filtered by belt filters, because of the extreme fineness of the particles. It is however desirable to use belt filters on account of their high filtration efficiency, and ease of installation of the fabrics.

An object of this invention is to provide a porous belt structure which is suitable for use as a filter belt or filter press, or papermachine belt for example, where extremely fine particles have to be retained, with high liquid phase throughput.

According to this invention, a porous belt comprises a woven or nonwoven textile substrate, coated on at least one surface of said substrate with a coagulated polymer material.

Preferably a relatively low viscosity material, e.g. about 500 cP or less, and relatively high solids content material are used. The low viscosity enables the polymer to penetrate substantially into the fabric structure, whilst the relatively high solids content prevents bleed through of the polymer. The resulting polymer treatment of the base fabric substrate creates a relatively durable depth filtration structure which is capable of operating at high pressures such as 10-20 bar, without collapse of the microporous structure. As the polymer layer penetrates into the fabric structure, it is also robust in that it is less likely to separate from the substrate due to abrasion, or back-pressure surges.

The belt fabric is preferably partially impregnated with the coagulated polymer, in addition to the formation of a layer on the or each coated surface.

The polymer used may be a polyester; a polyamide; a polyolefin such as polypropylene; or PAN.

The coating and partially impregnating layer may be applied to the textile substrate as it is coagulating, for example using DMF, in a 10 to 20% solids solution. The coagulated polymer is preferably coated straight onto the substrate and is washed using water baths with reduced levels on DMF,

thus creating the pores. The coagulant can be foamed, said foaming occurring during or immediately after coagulation. Foaming may be achieved either by physical means, or using a chemical foaming agent . The foaming agent preferably comprises a low boiling point water insoluble halogenated, hydrocarbon, and the latter preferably has a boiling point in the range from 10°-50°C, e.g. in the range 20°-30°C. Preferred foaming agents include 1,2-dibromo-1,1,2,2-tetrafluoroethane and trichlorofluoroethane.

Coagulation, and possibly also foaming, of the polymer may be achieved by heating the impregnated coated textile substrate in the presence of a heat coagulant. Suitable heat coagulants include vinyl alkyl ether and derivatives thereof, polyacetals, polythio ethers, poly(ethylene oxide) and derivatives thereof, and poly(propylene/ethylene oxide) and derivatives thereof. The heat coagulant may be built into the back bone of the polymer. Usually heating to a temperature of about 70°C results solely in coagulation. Heating above this temperature will generally also result in foaming, provided that a foaming agent is present.

Coagulation may also be achieved by means of adding a suitable electrolyte and/or varying the pH of the polymer latex. For example, with cationic polymers, coagulation may occur at an alkaline pH and for anionic polymers coagulation occurs at an acidic pH. This may be followed by heating to achieve satisfactory foaming.

The coating may be applied by any coating technique such as knife coating, dip coating, lick coating, screen printing or spraying. Reverse roller techniques may be employed.

Coagulation produces polymer particles which adhere to the fibres or yarns of the textile substrate, entering into the interstices between the yarns or fibres, and producing a finer pore structure than is attained by the fibres or yarns alone. Foaming of the polymer produces even finer porous structure within the polymer particles, so that the resulting coagulated and foamed partially impregnating coating can retain very fine particles, to micron sizes, such as the aforementioned dyes and pigments, and China clay.

Mechanical or chemical foaming techniques may be used in combination with, or in place of coagulation.

Preferred embodiments of filter belt or papermachine belt according to the invention will now be described by way of example, with reference to the accompanying drawings, wherein:-

Figure 1 Is a sectional view of a woven belt according to the invention;

Figure 2 is a sectional view of a nonwoven belt according to the invention;

Figure 3 is a sectional view of a non-woven fabric supported on a spiral link belt; and

Figure 4 is a similar view of a belt comprising a sintered layer reinforced

by a textile fabric.

In Fig. 1, a fragmentary sectional view is shown of a first filter belt 10, which comprises a woven textile substrate 11. The textile substrate is coated on and at least partially impregnated from one side by a layer 12 of coagulated and foamed polymer, as indicated by cross-hatching in the drawing. The layer is applied by a method such as one described hereinbefore, and has a fine porous structure achieved by the non-compacted nature of the coagulated mass, including that which has entered the interstices between the yarns of the fabric, and further by the foaming of the polymer.

In Fig. 2, a fragmentary sectional view is shown of a second filter belt 20. This comprises a non-woven textile substrate 21, of e.g. a staple fibre batt, or a needled felt, coated on one surface with a layer 22 of coagulated and foamed polymer which penetrates at least partially into and at least partially impregnates the substrate 21, as indicated e.g. by cross-hatching on the drawing. The layer 22 is applied similarly to that of Fig. 1 and achieves a similar microporous structure due to the non compacted coagulated structure, and the foaming of the polymer. The batt layer 21 is supported by a mesh membrane 23.

In Fig. 3, a non-woven fibrous layer 31 is supported on a spiral link fabric 32, and is coated and substantially impregnated with a layer 33 of coagulated and foamed polymer. Substantially impregnated means that the

polymer penetrates to a significant extent into the layer 31 and preferably penetrates into at least half the thickness of the layer, or even substantially throughout the fibrous layer 31.

In Fig. 4, a coagulated and foamed polymer layer 41 is supported on a layer 42 of sintered particles, the polymer of layer 41 penetrating into the interstices between the sintered particles. The sintered layer 42 is reinforced by or carried on a textile fabric layer 43, which is shown diagrammatically as being a woven fabric, but can be a non-woven. The sintered particles may be beads of polymer material, or metal.

In the embodiments described, the coagulated polymer may be coagulated with water, steam or super-heated steam, and may be polyurethane, or to improve resistance to hydrolytic degradation, may be selected from, for example, polyisoprene, polybutadiene, polyvinylidene dichloride, PVC, polychloroprene and styrene-butadiene polymers or mixtures thereof. Foaming of the coagulated polymer may occur during or immediately after coagulation and may be achieved by physical means or using a chemical foaming agent, such as, for example, a low boiling water insoluble halogenated hydrocarbon, with a boiling point, e.g. in the range -40°C to +50°C. Examples are 1, 2-dibromo-1,1,2,2-tetrafluoroethane and trichlorofluoroethane.

The foaming and coagulation of the polymer may be achieved by heating the impregnated coated material, preferably in the presence of a

heat coagulant. Suitable heat coagulants include vinyl alkyl ether and derivatives thereof, polyacetals, polythio ethers, poly(ethylene oxide) and derivatives thereof, and poly(propylene/ethylene oxide) and derivatives thereof. The heat coagulant may be built into the backbone of the polymer. Usually heating to a temperature of about 70°C results solely in coagulation. Heating above this temperature will generally also result in foaming provided a foaming agent is present.

Coagulation may also be achieved by means of adding a suitable electrolyte and/or varying the pH of the polymer latex. For example, with cationic polymers coagulation may occur at an alkaline pH and for anionic polymers coagulation occurs at an acid pH. This may be followed by heating to achieve satisfactory foaming.

The coagulated coatings may be particle-reinforced or fibre-reinforced. The strength of the individual cells in the coagulated cellular polymer network can be improved by the addition of finely-chopped fibres such as RYTON fibres and/or finely dispersed particles such as PTFE particles. These particles and/or fibres should ideally have a chemical inertness, heat stability and acid and/or alkali resistance at least similar to that of the coagulated polymer. The particles and fibres would be incorporated into the polymer emulsion prior to coagulation.

Preferably the filter cloths have a coating thickness in the range from 0.5 to 2.0mm, corresponding to 50 to 250 (preferably 120 to 180) g/m^2

addition by weight of polymer.

Although particularly described as filter belts, for example for use in retaining ultra fine particles such as pigments, titania, dyes or China clay, the invention also includes papermachine belts, such as forming fabrics, press felts, filter cloths, drum covers, dryer fabrics or transfer belts, where retention of fine fibres is required, with a high aqueous phase throughput.

CLAIMS

1. A porous belt and/or filter cloth comprising a woven or nonwoven textile substrate, coated on at least one surface of said substrate with a coagulated polymer layer.

2. A belt or cloth according to claim 1, wherein said coagulated polymer material is a relatively low viscosity material of up to about 200 cp, with a relatively high solids content.

3. A belt or cloth according to claim 1 wherein the textile substrate is at least partially impregnated with the coagulated polymer which is coated directly onto the substrate and is washed using water baths with reduced levels of DMF, thus creating pores in the layer in addition to the formation of a layer on the or each coated surface.

4. A belt or cloth according to claim 1, wherein the polymer of the coagulated polymer layer is or includes any one of a polyester; a polyamide; a polyolefin; a urethane polymer or PAN.

5. A belt or cloth according to claim 1, wherein the coating and partially impregnating layer is applied to the textile substrate as the layer is coagulating, using DMF in a 10 to 20% solids solution.

6. A belt or cloth according to claim 1 wherein the coagulating polymer is foamed, said foaming occurring during or immediately after coagulation.

7. A belt or cloth according to claim 6 wherein a foaming agent is used

and comprises a low boiling point water insoluble halogenated hydrocarbon with a boiling point in the range 10-50°C.

8. A belt or cloth according to claim 7 the foaming agent is 1,2-dibromo-1,1,2,2-tetrafluoroethane and trichlorofluoroethane.

9. A belt or cloth according to claim 5 wherein coagulation is achieved by heating the textile substrate after coating, in the presence of a heat coagulant which is any one of:- vinyl alkyl ether or a derivative thereof, a polyacetal; a polythio ether; poly (ethylene oxide), or poly (propylene/ethylene oxide) or a derivative thereof.

10. A belt or cloth according to claim 9 wherein the heat coagulant is built into the coating polymer.

11. A belt or cloth according to claim 9 wherein coagulation is achieved by adding an electrolyte and/or varying the pH of the polymer latex.

12. A belt or cloth according to claim 1, wherein the coating is applied by any one of knife coating, dip coating, lick coating, screen printing and spraying.

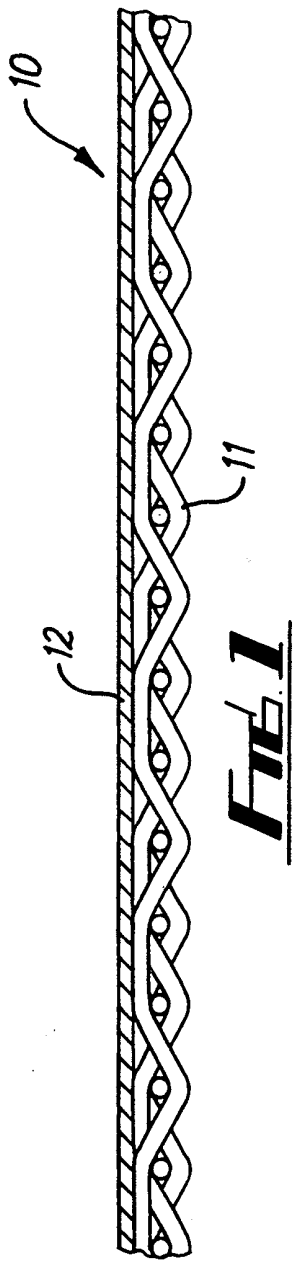

Fig. 1

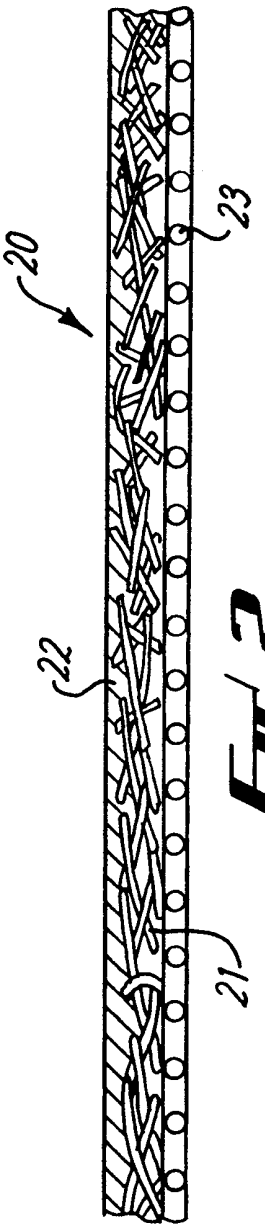

Fig. 2

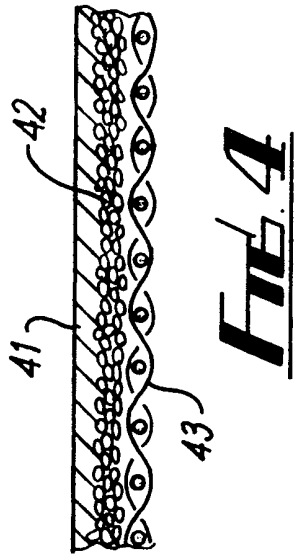

Fig. 4

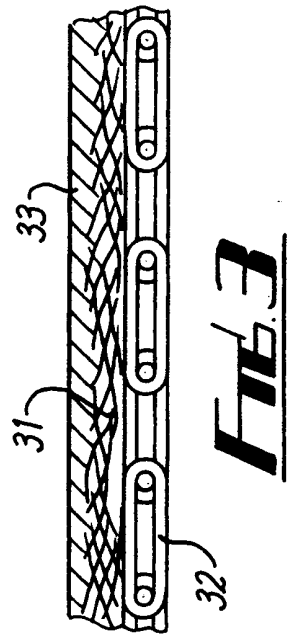

Fig. 3

INTERNATIONAL SEARCH REPORT

Inte .onal Application No
PCT/GB 99/00429

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 D06N3/14 D06N3/12 D06N3/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 D06N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 197 32 994 A (SCAPA GROUP PLC) 12 February 1998 see column 2, line 19 - column 3, line 57 ---	1-12
X	GB 2 288 755 A (SCAPA GROUP PLC) 1 November 1995 see page 2, line 14 - line 16; claims see page 4, line 1 - last line ---	1,4,6-12
X	DATABASE WPI Section Ch, Week 8516 Derwent Publications Ltd., London, GB; Class A88, AN 85-096115 XP002105173 & JP 60 044012 A (SHIKISHIMA CANVAS KK) , 8 March 1985 see abstract --- -/--	1,4

[X] Further documents are listed in the continuation of box C.

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P,X	GB 2 316 015 A (SCAPA GROUP PLC) 18 February 1998 see page 2, last line - page 5, last line	1-12

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Information on patent family members

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 19732994 A	12-02-1998	FR 2752173 A	13-02-1998
GB 2288755 A	01-11-1995	AU 690673 B	30-04-1998
		AU 2314895 A	16-11-1995
		CA 2188780 A	02-11-1995
		EP 0757730 A	12-02-1997
		WO 9529285 A	02-11-1995
GB 2316015 A	18-02-1998	NONE	