



(51) International Patent Classification:

D03D 1/00 (2006.01) D04B 21/16 (2006.01)

D03D 9/00 (2006.01) D04H 3/005 (2012.01)

D03D 15/00 (2006.01) D04H 3/04 (2012.01)

D04B 21/10 (2006.01)

(21) International Application Number:

PCT/US2020/035917

(22) International Filing Date:

03 June 2020 (03.06.2020)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

62/857,078 04 June 2019 (04.06.2019) US

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(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

- with international search report (Art. 21(3))
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))

(54) Title: MAGNETIC FABRIC FOR MOLDING APPLICATIONS

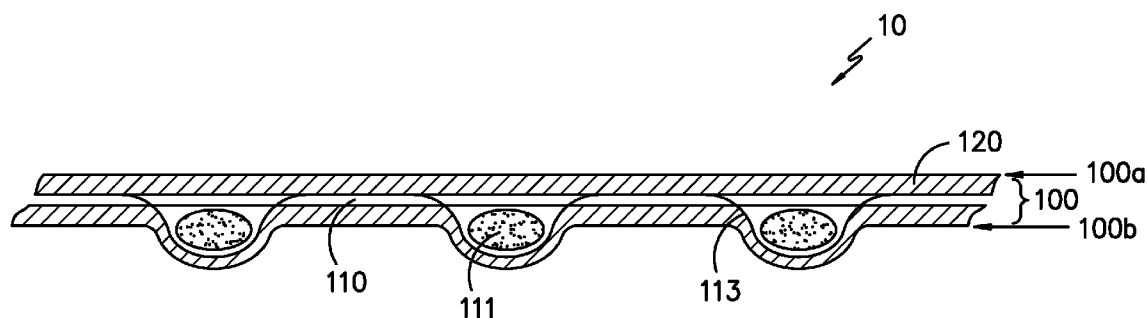


FIG. -1-

(57) Abstract: The invention relates to a magnetic scrim containing a scrim which contains a plurality of yarns and a magnetic coating covering at least a portion of the yarns of the scrim. The magnetic coating contains magnetic elements and a binder, where the magnetic coating is at least about 40% by weight magnetic elements, and where the magnetic coating has an areal density of at least twice the areal density of the scrim.

MAGNETIC FABRIC FOR MOLDING APPLICATIONS

FIELD OF THE INVENTION

5 [0001] The present invention generally relates to creating magnetic scrims for easier processing for molding applications.

BACKGROUND

10 [0002] In some molding applications, foams such as polyurethanes are combined with other textile layers such as scrims during the molding process. The scrims can give the polyurethane additional strength and other characteristics such as fire resistance. There is a need for a scrim that is more easily inserted and positioned within the mold to reduce incorrect molding location and operator time to position the scrim.

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BRIEF SUMMARY

20 The invention relates to a magnetic scrim containing a scrim which contains a plurality of yarns and a magnetic coating covering at least a portion of the yarns of the scrim. The magnetic coating, which contains magnetic elements dispersed in a binder, where the magnetic coating is at least about 40% by weight magnetic elements, and where the magnetic coating has an areal density of at least twice the areal density of the scrim.

25 BRIEF DESCRIPTION OF THE DRAWINGS

 [0003] Figure 1 illustrates one embodiment of a magnetic scrim.

 [0004] Figure 2 is a photograph of one embodiment of the scrim (before being coated with the magnetic coating).

DETAILED DESCRIPTION

[0005] Referring now to Figure 1, there is shown one embodiment of the magnetic scrim 10. The magnetic scrim 10 contains a scrim 100 having a first side 100a and a second side 100b. The scrim 100 contains a plurality of yarns. The magnetic scrim 10 also contains a magnetic coating 120 that covers at least a portion of the yarns of the scrim 100.

[0006] This magnetic scrim 10 would be placed in a mold with at least one magnet to hold the scrim in place while the mold is prepared and polyurethane (or other moldable material) is introduced and then cured in the mold.

[0007] As used herein, the term "scrim" shall mean a fabric having an open construction used as a base fabric or a reinforcing fabric, which may be manufactured as laid scrim, a woven scrim, a knit scrim, a weft-inserted warp knit scrim, a multi-axial warp knit scrim, a stitch-bonded scrim, or a cross-plyed scrim. The scrim contains a plurality of yarns and the yarns may be adhesively or thermally bonded or may be unbonded to each other.

[0008] The scrim 100 may be any suitable scrim including any suitable light-weight woven, knit, or nonwoven fabric. Preferably, the scrim layer is a weft inserted warp knit scrim. A weft inserted warp knit scrim 100 contains a plurality of warp yarns 110, weft yarns 111, and stitching yarns 113. The stitching yarns 113 may have any suitable stitching pattern, including tricot stitches or pillar stitches, or other stitches. The weft yarns 111 can be laid in every course (every row of stitches from the stitching yarn), every second course (every second row of stitches from the stitching yarn), every third course (every third row of stitches from the stitching yarn) or more. How open or closed (how close together the yarns are within the scrim 100, is determined by the types and sizes of the yarns and the desired properties of the scrim 100 and magnetic scrim 10. One suitable scrim, not coated with the magnetic coating yet, is shown in Figure 2.

[0009] In one embodiment the scrim 100 comprises a plurality of yarns in a warp direction and a plurality of yarns in a weft direction defined to be

approximately perpendicular to the warp direction. In another embodiment, at least a portion of the plurality of yarns in a weft direction are polyester texturized polyester yarns.

[0010] The yarns of the scrim can be any suitable yarns, include any
5 suitable materials, structure, and thickness. The yarns making up the strip-shaped textile forming the strip-shaped substrate 200 may be any suitable yarn. "Yarn", in this application, as used herein includes a monofilament elongated body, a multifilament elongated body, ribbon, strip, fiber, tape, and the like. The term yarn includes a plurality of any one or combination of the above. The yarns
10 may be of any suitable form such as spun staple yarn, monofilament, or multifilament, single component, bi-component, or multi-component, and have any suitable cross-section shape such as circular, multi-lobal, square or rectangular (tape), and oval. In one embodiment, the yarns are monofilament. In another embodiment, the yarns are multifilament. In another embodiment, the
15 yarns contain mono and multifilaments. In one preferred embodiment, at least a portion of the yarns are texturized as this has been found to be beneficial in the coating process. In one embodiment, the weft yarns of the weft inserted warp yarn knit scrim are texturized.

[0011] Some suitable materials for the yarns include polyamide, aramid
20 (including meta and para forms), rayon, PVA (polyvinyl alcohol), polyester, polyolefin, polyvinyl, nylon (including nylon 6, nylon 6,6, and nylon 4,6), polyethylene naphthalate (PEN), cotton, steel, carbon, fiberglass, steel, polyacrylic, polytrimethylene terephthalate (PTT), polycyclohexane dimethylene terephthalate (PCT), polybutylene terephthalate (PBT), PET modified with
25 polyethylene glycol (PEG), polylactic acid (PLA), polytrimethylene terephthalate, nylons (including nylon 6 and nylon 6,6); regenerated cellulose (such as rayon or Tencel); elastomeric materials such as spandex; high-performance fibers such as the polyaramids, and polyimides natural fibers such as cotton, linen, ramie, and hemp, proteinaceous materials such as silk, wool, and other animal hairs such as
30 angora, alpaca, and vicuna, fiber reinforced polymers, thermosetting polymers,

blends thereof, and mixtures thereof. In a preferred embodiment, the yarns comprise polyester yarns. In another embodiment, the yarns of the magnetic scrim 10 consist essentially of polyester yarns (defined to be mean at least 98% of the yarns are polyester yarns).

5 [0012] Referring back to Figure 1, the magnetic scrim 10 contains a magnetic coating 120. The magnetic coating 120 preferably covers at least a portion of yarns of the scrim 100. More preferably, the magnetic coating 120 covers essentially all of the surface area of the yarns in the scrim (defined as covering at least 95% of the surface area of the yarns). The magnetic coating 120
10 contains magnetic elements and a binder.

 [0013] The magnetic elements 120 have a persistent magnetic field. As utilized herein, the term “persistent magnetic field” refers to a magnetic field that persists for an extended period of time, such as the magnetic field of a traditional permanent magnet. As is explained in detail below, the magnetic elements and
15 magnetically responsive elements (such as some metals forming the inner walls of the mold) are magnetically attracted when in close proximity to each other. This magnetic attraction produces a force that draws and reversibly holds together the magnetic scrim 10 and the mold. The magnetic elements can be any suitable material that has a persistent magnetic field. For example, the magnetic elements
20 can be permanent magnets made from materials such as iron, nickel, neodymium, cobalt, alloys of such metals (e.g., BaFe_3O_4 , SrFe_3O_4 , AlNiCo) and alloys of rare earth metals, such as NdFeB and CoSm .

 [0014] The magnetic elements can have any suitable magnetic flux density. The magnetic flux density of the magnetic elements is one factor that will
25 determine the strength of the attraction between the magnetic elements and the magnetically receptive elements. Therefore, the desired magnetic flux density of the magnetic elements will depend, at least in part, on the desired attractive force between the elements (and substrates attached to those elements). Preferably, the magnetic elements exhibit a magnetic flux density of about 50 gauss (G) or
30 more (about 5 millitesla (mT) or more), about 100 G or more (about 10 mT or

more), about 150 G or more (about 15 mT or more), or about 200 G or more (about 20 mT or more).

[0015] In a preferred embodiment, the magnetic coating preferably comprises a binder and magnetic elements. The binder can be any suitable binder that will adhere to the scrim and bind together the magnetic elements. Suitable binders include, but are not limited to, urethane binders, acrylic binders, silicone binders, thermoplastic binders, thermoset binders, cements, rubber, and geopolymers. The binder preferably remains flexible after curing. Thus, in a preferred embodiment, the binder preferably is selected from the group consisting of urethane binders, acrylic binders, silicone binders, and mixtures thereof.

[0016] The magnetic elements can have any suitable particle size. Preferably, the magnetic elements have a particle size of about 100 microns or less. More preferably, the magnetic elements have a particle size of about 50 microns or less. The particle size of the material can affect the magnetic characteristics exhibited by the magnetic elements.

[0017] The magnetic elements can be present in the magnetic coating in any suitable amount. The amount of magnetic elements present in the magnetic coating may depend upon several factors, such as the desired strength of the magnetic response and the type of magnetic elements used in the magnetic coating. Generally, in order to achieve a sufficiently strong magnetic response, the magnetic elements (which may be one type of element or mixtures of multiple types of elements) generally account for an appreciable percentage of the overall magnetic coating. Preferably, the magnetic elements are present in the magnetic coating in an amount of about 20 wt.% or more, about 30 wt.% or more, about 40 wt.% or more, about 50 wt.% or more, or about 60 wt.% or more of the coating. In another preferred embodiment, the magnetic elements are present in the magnetic coating in an amount of about 90 wt.% or less. In a more preferred embodiment, the magnetic elements is present in the magnetic coating in an amount of about 20 wt.% to about 90 wt.% (e.g., about 30 wt.% to about 90 wt.%, about 40 wt.% to about 90 wt.%, about 50 wt.% to about 90 wt.%, or about 60 wt.% to about 90

wt.%), about 30 wt.% to about 80 wt.%, about 30 wt.% to about 70 wt.%, or about 40 wt.% to about 60 wt.% of the coating. In another embodiment, the magnetic elements are present in the magnetic coating in an amount of at least about 40 wt. %, more preferably at least about 60 wt. %.

5 [0018] The magnetic coating can be applied to the scrim in any suitable amount. The amount of coating applied to the substrate will depend upon several factors, such as the magnetic strength of the magnetic elements, the amount of magnetic elements in the coating, and the desired magnetic flux density to be exhibited by the coating 120. Due to the amount of coating 120 applied to the
10 scrim 100 and the high content of magnetic elements in the coating, the coating has a high areal density (weight per area). In one embodiment, the magnetic coating has an areal weight of at least about twice that of the areal density of the scrim. In another embodiment, the magnetic coating has an areal weight of at least about 2.5 times that of the areal density of the untreated scrim. In one
15 embodiment, the magnetic coating has an areal weight of at least about 40 g/m². In another embodiment, the magnetic coating has an areal weight of between about 40 and 110 g/m².

 [0019] The magnetic coating 120 is applied to the scrim 100 in any suitable manner. Preferably, the coating 120 is applied from an aqueous solution (or
20 mixture or emulsion). An aqueous based system is preferred for environmental reasons. In other embodiments, the coating is solvent based. In one embodiment, the coating 120 is coated by gravure coating, knife coating, curtain coating, printing, and transfer coating.

 [0020] Through deliberate design of the scrim construction, deliberate
25 placement of the coating via a controlled coating process, or using both of these routes, a patterned deposition of the magnetic coating is possible. This patterned specificity can give a reduced final weight of the coated scrim, reduced cost, and/or design motifs that lend greater functionality to the final article.

[0021] The pattern, if employed, could be in any suitable pattern. The pattern may be continuous or discontinuous, regular and repeating or random. "Continuous" in this application means that from one edge of the textile to the other edge there is a path that contains the pattern and that at least some of the pattern areas are connected. Examples of continuous patterns include straight lines and a grid. "Discontinuous" in this application means that the areas of the pattern are discontinuous and not touching one another. In a discontinuous pattern, there is no path from one edge of the fabric to the other that contains the pattern. Examples of discontinuous patterns include dots. Regular or repeating patterns mean that the pattern has a repeating structure to it. The pattern may also be a random pattern where there is no repeat to the pattern. In a random pattern, it is preferred that the random pattern is also discontinuous, not continuous. The pattern may take any patterned form including but not limited to indicia, geometric shapes or patterns, lines (straight and curved), grids, and text.

[0022] The scrim 100 may be coated with additional layers before or after the magnetic coating 120 is applied. In one embodiment, the scrim 100 is coated with PVC (polyvinyl chloride) before being coated with the magnetic coating 120. The PVC pre-coating step may provide stability to the loose knit, giving it a structure that may be easily handled without creating any distortion in the arrangement of the warp and weft yarns. The PVC coating may also keep the warp yarns tightly bundled and the textured weft yarns fixed in a bloomed, high surface-area form.

[0023] The tightness of the warp yarns compared to the open receptiveness of the weft yarns makes this scrim substrate highly biased towards the addition of any further chemical treatment being concentrated almost exclusively in and on the weft yarns. After the magnetic coating is applied, this pronounced difference may be quantified by bisecting the fabric into separate warp and weft components. An elemental analysis of these separated yarns, detecting and quantifying the elemental signature of the magnetic elements, shows >95% by weight of the magnetic elements localized on the weft yarns.

[0024] The mold is being magnetizable so that the magnetic scrim will be attracted and attach to the mold. In one embodiment, the interior surface of the mold contains iron, nickel, cobalt, an alloys of certain rare earth metals, or mixtures thereof. Preferably, the attraction between the magnetic scrim and mold is strong enough to hold the scrim in place until other materials are introduced into the mold.

[0025] All references, including publications, patent applications, and patents, cited herein are hereby incorporated by reference to the same extent as if each reference were individually and specifically indicated to be incorporated by reference and were set forth in its entirety herein.

[0026] The use of the terms “a” and “an” and “the” and similar referents in the context of describing the invention (especially in the context of the following claims) are to be construed to cover both the singular and the plural, unless otherwise indicated herein or clearly contradicted by context. The terms “comprising,” “having,” “including,” and “containing” are to be construed as open-ended terms (i.e., meaning “including, but not limited to,”) unless otherwise noted. Recitation of ranges of values herein are merely intended to serve as a shorthand method of referring individually to each separate value falling within the range, unless otherwise indicated herein, and each separate value is incorporated into the specification as if it were individually recited herein. All methods described herein can be performed in any suitable order unless otherwise indicated herein or otherwise clearly contradicted by context. The use of any and all examples, or exemplary language (e.g., “such as”) provided herein, is intended merely to better illuminate the invention and does not pose a limitation on the scope of the invention unless otherwise claimed. No language in the specification should be construed as indicating any non-claimed element as essential to the practice of the invention.

[0027] Preferred embodiments of this invention are described herein, including the best mode known to the inventors for carrying out the invention. Variations of those preferred embodiments may become apparent to those of

ordinary skill in the art upon reading the foregoing description. The inventors expect skilled artisans to employ such variations as appropriate, and the inventors intend for the invention to be practiced otherwise than as specifically described herein. Accordingly, this invention includes all modifications and equivalents of the
5 subject matter recited in the claims appended hereto as permitted by applicable law. Moreover, any combination of the above-described elements in all possible variations thereof is encompassed by the invention unless otherwise indicated herein or otherwise clearly contradicted by context.

WHAT IS CLAIMED IS:

1. A magnetic scrim comprising:

a scrim comprising a plurality of yarns;

a magnetic coating covering at least a portion of the yarns of the scrim,
wherein the magnetic coating comprises magnetic elements and a binder, wherein
the magnetic coating is at least about 40% by weight magnetic elements, and
wherein the magnetic coating has an areal density of at least twice the areal
density of the scrim.

2. The magnetic scrim of claim 1, wherein the scrim is a laid scrim.

3. The magnetic scrim of claim 1, wherein the scrim is a woven scrim.

4. The magnetic scrim of claim 1, wherein the scrim is a knit scrim.

5. The magnetic scrim of claim 4, wherein the scrim is a weft inserted warp knit
scrim.

6. The magnetic scrim of claim 1, wherein the yarns of the scrim comprise
polyester yarns.

7. The magnetic scrim of claim 6, wherein at least a portion of the polyester yarns
are texturized polyester yarns.

8. The magnetic scrim of claim 1, wherein the scrim comprises a plurality of yarns
in a warp direction and a plurality of yarns in a weft direction defined to be
approximately perpendicular to the warp direction.

9. The magnetic scrim of claim 8, wherein at least a portion of the plurality of yarns in a weft direction are polyester texturized polyester yarns.

10. The magnetic scrim of claim 8, further comprises a plurality of stitching yarns in the warp direction.

11. The magnetic scrim of claim 1, wherein the magnetic elements comprise a material selected from the group consisting of iron, nickel, neodymium, and cobalt.

12. The magnetic scrim of claim 1, wherein the magnetic coating has an areal density of at least 2.5 times the areal density of the scrim.

13. The magnetic scrim of claim 1, wherein the magnetic coating is at least about 70% by weight magnetic elements.

14. The magnetic scrim of claim 1, wherein the magnetic coating is applied onto the scrim from an aqueous mixture.

15. The magnetic scrim of claim 14, wherein magnetic coating is applied by coating.

16. The magnetic scrim of claim 14, wherein magnetic coating is applied by padding.

17. The magnetic scrim of claim 1, wherein the magnetic scrim further comprises a layer of PVC between the yarns and the magnetic coating.

18. The magnetic scrim of claim 1, wherein the magnetic coating is in a pattern.

19. The magnetic scrim of claim 1, wherein the magnetic elements have an average particle size range of between about 50 nm to 50 microns.

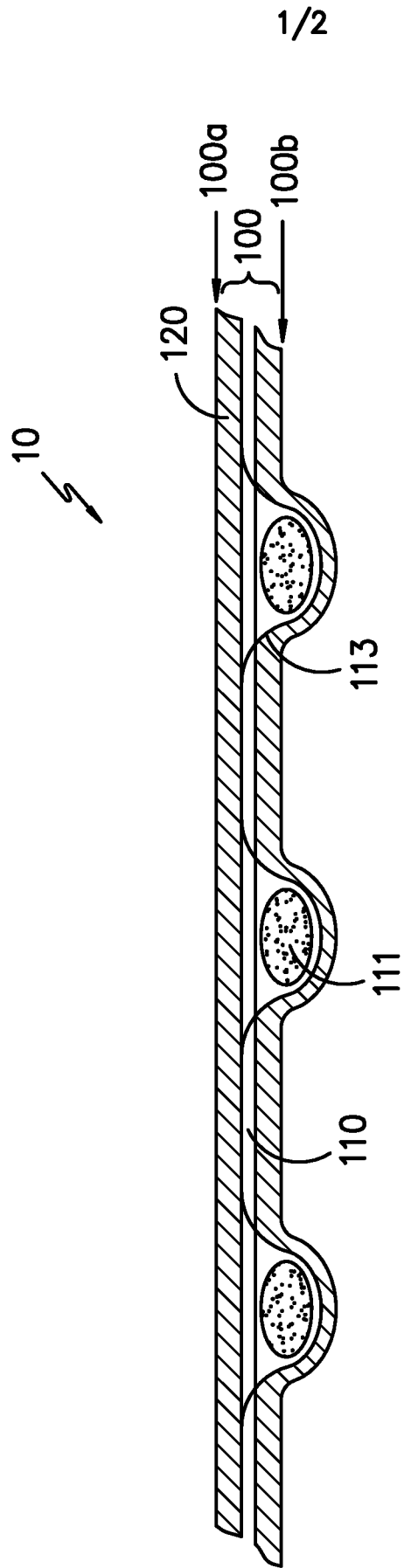


FIG. -1-

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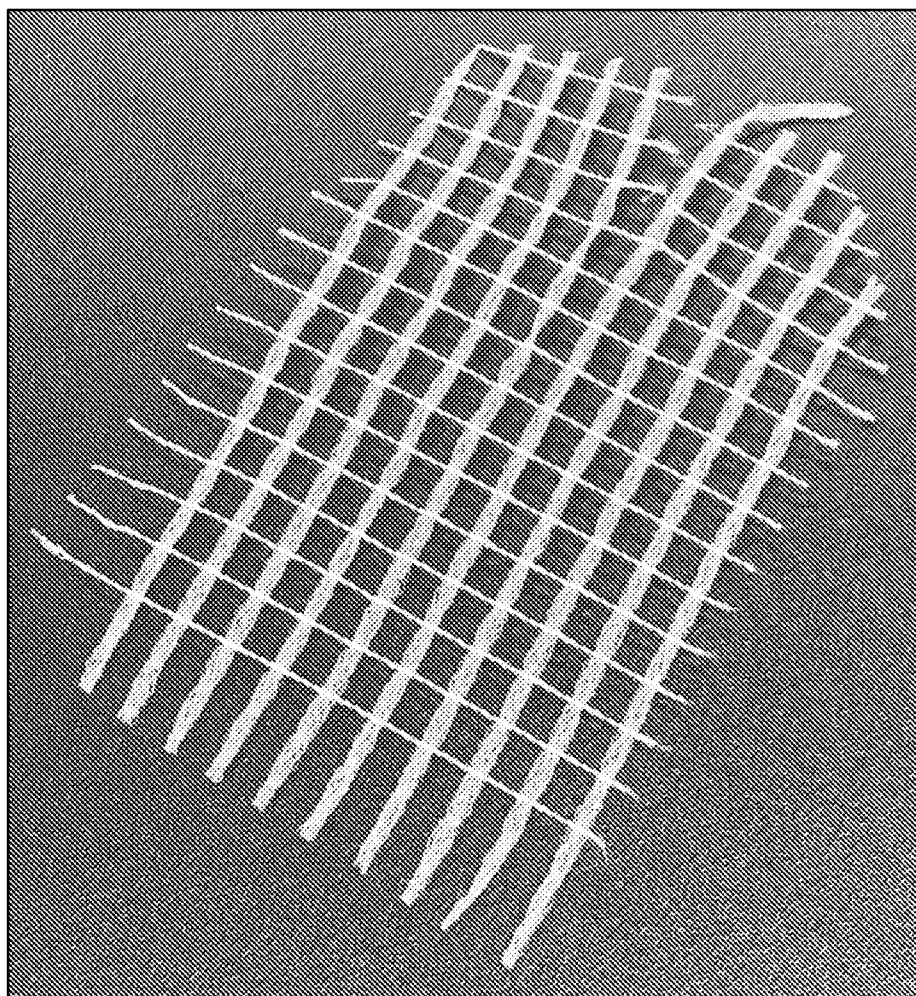


FIG. -2-

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2020/035917

A. CLASSIFICATION OF SUBJECT MATTER INV. D03D1/00 D03D9/00 D03D15/00 D04B21/10 D04B21/16 D04H3/005 D04H3/04		
ADD. 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) D03D D04B D04H		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) EPO-Internal, WPI Data		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP S61 245372 A (MITSUBISHI PLASTICS IND; ASUTAA INTERNATL KK ET AL.) 31 October 1986 (1986-10-31) the whole document -----	1-19
A	EP 1 413 660 A1 (SCHUMACHER ROLF [DE]; ZIEGELE MARK [DE]; STING OLIVER [DE]) 28 April 2004 (2004-04-28) paragraph [0021] - paragraph [0048] figure 1 -----	1-19
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☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.		
* Special categories of cited documents : "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search 8 September 2020		Date of mailing of the international search report 01/10/2020
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016		Authorized officer Hausding, Jan

INTERNATIONAL SEARCH REPORT

International application No

PCT/US2020/035917

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
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Information on patent family members

International application No

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