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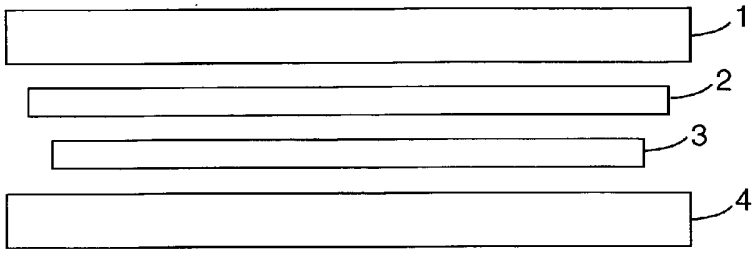
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(54) **Title:** METHOD OF PRINTING A MAT THROUGH THE PROCESS OF IMAGE TRANSFER



(57) **Abstract:** The present invention refers to the method of printing a mat (3) through the process of transferring an image. The method relates to transfer an image using a paper web (2) with dye sublimation combined with the controlling of pressure, time and temperature.

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METHOD OF PRINTING A MAT THROUGH THE PROCESS OF IMAGE TRANSFER

Background of the Invention

This invention refers to the method of printing a mat through the process of Transferring an image by controlling specific conditions of time, temperature, and pressure. The image is transferred using a paper transfer sheet with dye sublimation combined with the controlling of pressure, time, and temperature.

The smooth side of the web provides better contact with the contact surface and is especially useful in guaranteeing a good bonding with mastic or with the adhesive compositions applied to it. The crush-resistant larger diameter crinkled filaments provide a safe, pleasant, and wear-resistant walking surface. The extremely open nature of the transfer sheet and the smooth surface of the filaments allow easy cleaning and washing as well as quick drying as described in US Pat. No. 4.351.683 given to Minnesota Mining Manufacturing Company.

Description Of the Prior Art

Ribbon-like mats have been prepared by extruding polymeric material into filaments onto a surface, flattening the extrusions together with a roller, and then quenching the resulting ribbon-like structure, e.g., as described in French Pat. No. 1.459.929. This ribbon-like product is flat, and it lacks the highly expanded lofty open structure of the transfer sheet as described in US Pat. No. 4.351.683 given to Minnesota Mining Manufacturing Company.

Other web products have been prepared by extruding polymeric materials into filaments and allowing the filaments to fall upon a collecting surface to be cooled thereon without the benefit of a quench bath. Such products will not have a lofty open structure, but they will be flattened or compacted on the collecting surface unless permitted to pre-cool and rigidify in the air. If the filaments cool in air, however, they

will not have the crinkling or inter-engagement of the filaments such as obtained in the present invention, US Pat. No. 4.351.683 given to Minnesota Mining Manufacturing Company.

WO 01/25524 describes a process of manufacturing and printing mats, rugs, etc. in which the mats consist of a primary layer bonded to a rubbery backing layer. This present invention refers also to a mat, made of PVC in this example, while the related art describes primarily a rubber layer of support connected to a primary cloth layer, though the primary layer can also be made of a blend of PVC/nitrile rubber Another significant difference of the cited patent refers to the time necessary for the printing. While in the present invention it is between 20 – 40 seconds, in the related art it is 20 minutes.

Summary Of the Invention

A ribbon-like mat was prepared by extruding or melt-spinning a molten polymer in the form of a bundle of free-flowing thick filaments which progresses vertically downwardly into glancing contact with a contact surface of a smooth plate or roll and into a quench bath as described in US Pat. No. 4.351.683 given to Minnesota Mining Manufacturing Company.

The contact surface is maintained just above the surface of the quench bath so that filaments making glancing contact with it will thereafter fall into the quench bath. The filament bundle is aligned to permit some of the outer filaments to make such contact with the contacting surface and the remaining filaments in the bundle to fall directly into the quench bath, thereby providing differential quenching which imparts unique structural properties to the web of the invention. The filaments are continuously withdrawn through the liquid cooling medium of the quench bath in a path that diverges from the vertical direction of the melt spinning. The point at which the direction of withdrawal of filaments diverges from the vertical direction is located in a zone extending from about the surface of the bath to a distance below the surface. The web is advanced at a slower rate of speed than the extrusion rate causing the quenched

portion of the bundle to continuously support the incoming portion. As a result there is produced a novel filamentous web having a fattened surface and a highly expanded lofty open structure.

As polymeric materials may be used polycarbonate, polyalkylene, polyester, polyvinyl, polyamide, ionomer and other resins, which are extrudable at elevated temperatures in the form of soft flexible continuous filaments and which at lower temperatures have the required stiffness, toughness and other required physical and chemical characteristics to permit cohesion of the filaments. Particular polymers may, if desired, contain plasticizers or softeners and may be otherwise modified by the addition of coloring agents, fibrous or non-fibrous reinforcing agents, stabilizers, fillers and other additives. This process can also be used to print art on carpet rugs made of nylon, polyester, etc.

The products of loosely- connected, open, and smooth-surface filaments of this invention has a number of areas or uses as previously noted in that its flexibility, wear-resistance, low density, soft surface filaments and other properties combined with its improved surface characteristics offer important advantages. The products are also useful in the field of decoration and as such can be produced in a variety of colors and in various patterns.

Brief Description Of the Illustrations

The many advantages and features of the present invention can best be understood and appreciated by reference to the accompanying drawing and wherein:

Fig. 1 is a cross sectional view illustrating the process using a hydraulic or manual press.

Fig. 2 is a schematic illustration of the process of using a calendar.

Fig. 3 illustrates a non-woven blanket of PVC formed by filaments that can have optionally PVC base.

Detailed Description Of the Invention

The present invention refers to the method of printing a mat through the process of transferring an image by controlling specific conditions of time, temperature, and pressure. The image is transferred using a paper transfer sheet 2 with dye sublimation combined with control of pressure through movable support 4 or not and through pressure roll 6, time and temperature conditions as shown in Fig. 1 and Fig. 2.

It is preferred that the base of the mat 3 be made of PVC material (polyvinyl) or Others polymeric materials such as polycarbonate, polyalkylene, polyester, polyamide, ionomer and other resins that are extrudable at elevated temperatures in the form of Soft, flexible 10, continuous filaments and that at lower temperatures have the required Stiffness, toughness, and other required physical and chemical characteristics to permit cohesion of the filaments as shown in US Pat. No. 4.351.683 given to Minnesota Mining Manufacturing Company.

The transfer sheet 2 is made of dyes that are sublimed when applied to the same adequate conditions of temperature, time, and pressure.

In Fig. 3, a non-woven blanket of PVC 12 formed by filaments 10 that, optionally, can have a PVC base 11 is illustrated in further detail. This blanket illustrates the three dimensional arrangement of filaments 10 in a narrow segment of a typical mat. The open structured mat can receive impression by thermal transfer by using two processes:

1. By means of a hydraulic or manual press in which it is necessary that one of the plates are heated in order to transfer the art to the mat. This process is meant for individual production (as shown in Fig. 1).

2. By means of a heated calendar, using similar conditions as the hydraulic or manual press, the art may be transferred onto the mat, but this calendar process is only necessary when larger quantities of mats are produced and imprinted with rollers (as shown in Fig. 2).

In both processes, controlling the temperature, pressure – by either mobile support or pressure roll – and the time of contact are very important factors in the correct transfer and perfect image.

Process For Using a Hydraulic or Manual Press

The process with the hydraulic or manual press is shown in Fig. 1. The heat emitted through the heated plate 1 and the pressure by support 4 of the plate will cause the evaporation of the dyes when in contact with the transfer sheet 2.

The transferred art on mat 3 may vary based on the conditions of the temperate, pressure and time. The variation can be: no transfer of the art, little transfer or melting of the filaments 10.

In the process with the hydraulic press, the pressure control is easier than that of the manual process, because it depends only on adjustments made to the equipment.

In the process with the hydraulic press, the support plate 4 is movable and the heated plate 1 is fixed, while in the process of manual press the heated plate 1 is movable and the support plate is fixed 4.

Table 1 shows various conditions that may be used to obtain the imprinted PVC mat 3.

Table 1. Conditions of the Process

Temperature (°C)	Time (seconds)	Pressure (bar)
150	60	3 – 6
155	60	3 – 6
160	40 – 55	3 – 6
165	25 – 35	3 – 6
170	15 – 25	3 – 6
175	15 – 25	3 – 6
180	10 – 20	3 – 6
185	10 – 15	3 – 6
Above 185	Up to 10	3 – 6

Difficulties in working with temperatures under 160 C have been observed for the mats of PVC 3 due to lower transfer of the art onto a PVC mat. In temperatures above 170 °C, the PVC material will quickly fuse, in this manner transferring the art perfectly. At this temperature, however, the mat may become deformed. Temperatures between 160 and 170 °C are recommended. Mats made using these temperatures show excellent transfer and no deformities. Therefore, the best process occurs within this range of temperatures and with a pressure of 3 to 6 bar.

Process For Using Calendaring machine

The process for using a calendar to produce the printed mat 3 is shown in Fig. 2. A hot roll 5 in contact with the transfer sheet 2 allows the evaporation of the dye while the pressure from a second roll (cold roll) 6 will aid in the sublimation process, resulting in the transfer of dye to mat 3.

The calendaring process is advantageous in comparison to the hydraulic or manual press process because it is a continuous process that functions in fixed support 8.

Table 2 shows the conditions of the process that may be used to transfer the art from transferring web 2 to mat 3.

Table 2. Conditions of the Process

Temperature (°C)	Time (seconds)	Pressure (Bar)
150	60	3 – 6
155	60	3 – 6
160	40 – 55	3 – 6
165	25 – 35	3 – 6
170	15 – 25	3 – 6
175	15 – 25	3 – 6
180	10 – 20	3 – 6
185	10 – 15	3 – 6
Above 185	Up to 10	3 - 6

In relation to temperature, the same results for the process of calendar occur as those results of using the hydraulic or manual process: optimum temperatures are from 160 to 170° C.

The time of contact between the calendar and the mat may be regulated by adjusting the speed of rolls 5 and 6, which may vary by 1 to 15 meters per second. Other than this adjustment, the optimal conditions of the process are the same as those for using the hydraulic or manual press.

CLAIMS

1. Method of printing a mat through the process of transferring an image by controlling specific conditions of time, temperature, and pressure, characterized by the fact that the image is transferred by using a paper transfer sheet (2) with dye sublimation combined with the controlling of pressure, time, and temperature.

2. Method according to claim 1, characterized by the fact that the mat is made of polymeric material.

3. Method according to claim 2, characterized by the fact that the polymeric material includes polycarbonate, polyalkylene, polyester, polyvinyl, polyamide, ionomer and other resins, which are extrudable at elevated temperatures in the form of soft flexible continuous filaments (10) and which at lower temperatures have the required stiffness, toughness and other required physical and chemical characteristics to permit cohesion of the filaments (10).

4. Method according to claim 2, characterized by the fact that the polymeric material is a PVC.

5. Method according to claim 1, characterized by the fact that the image is transferred using manual or hydraulic press machine.

6. Method according to claim 4, characterized by the fact that in the hydraulic press, the support plate (4) is movable and the heated plate (1) is fixed.

7. Method according to claim 4, characterized by the fact that in the manual press, the heated plate (1) is movable and the support plate (4) is fixed.

8. Method according to claim 1, characterized by the fact that the process is done between 160 to 170 °C temperature approximately.

9. Method according to claim 1, characterized by the fact that the necessary time for the printing is approximately between 20 to 40 seconds.

10. Method according to claim 1, characterized by the fact that the pressure is in the range of 3 to 6 bar.

11. Method according to claim 1, characterized by the fact that the time of contact between the calendar and the mat (3) is regulated by adjusting the speed of the rolls, which may vary from 1 to 15 meters per second.

12. Method according to claim 1, characterized by the fact that the mat (3) is a floor mat.

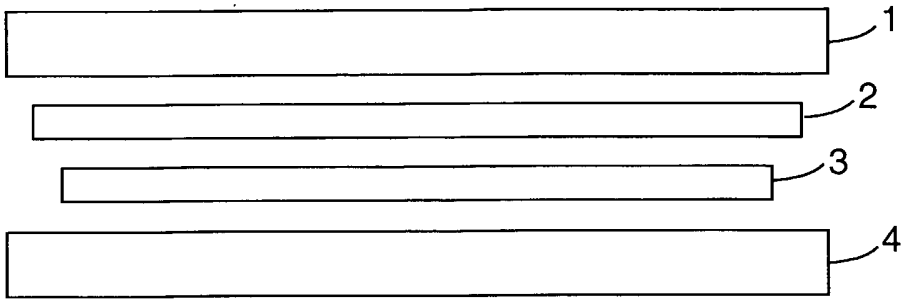


FIG. 1

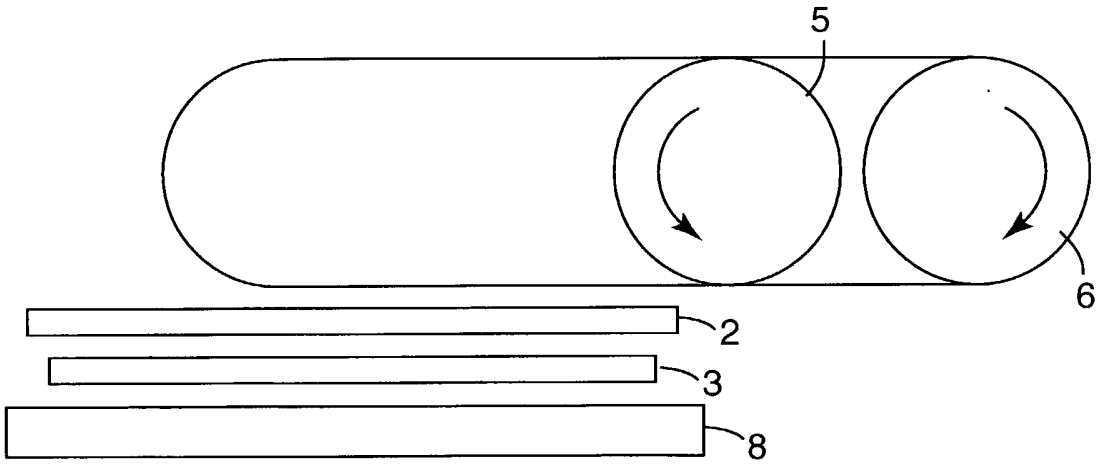


FIG. 2

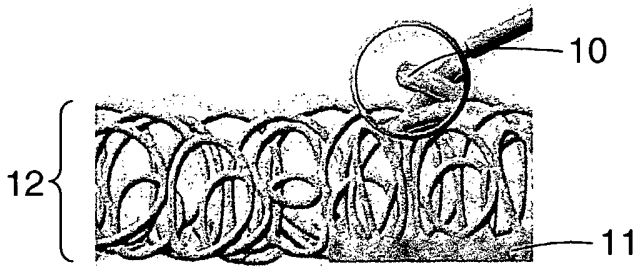


FIG. 3

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US2005/032582

A. CLASSIFICATION OF SUBJECT MATTER
D06P5/00 B41M5/035

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)
D06P B41M

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 practical, search terms used)
EPO-Internal, PAJ, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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

[X] Patent family members are listed in annex.

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"A" document defining the general state of the art which is not considered to be of particular relevance

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Date of the actual completion of the international search	Date of mailing of the international search report
19 December 2005	10/01/2006

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Patosuo, S

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INTERNATIONAL SEARCH REPORT

International Application No
PCT/US2005/032582

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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